1-year postdoctoral fellowship in Biomineralization
Materials Science Institute; IMPMC & LCMCP, Paris, France

Study of the intracellular amorphous calcium carbonate (ACC) formed by cyanobacteria for the bioremediation of alkaline earth element pollutions

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The Biomineralogy team of the Institute of Mineralogy, Physics of Matter and Cosmochemistry (IMPMC) together with the SMILES team of the Laboratory of Condensed Matter Chemistry of Paris (LCMCP) are looking for a Postdoc who will study the amorphous calcium carbonate (ACC) biomineralized intracellularly by some bacteria using a diverse set of cutting-edge analytical tools that are detailed thereafter. This job offer represents a unique opportunity for the candidates to achieve a major scientific work in a pluridisciplinary academic environment recognized for its excellence in materials physics and chemistry and geobiology. In particular, a strong and new analytical approach will be pursued coupling the unique expertise of LCMCP in solid state NMR and of IMPMC in TEM.

We recently discovered several species of cyanobacteria forming intracellular amorphous calcium carbonate (iACC) (Couradeau et al., 2012; Benzerara et al., 2014). Cyanobacteria are environmentally important photosynthetic organisms that use solar energy to capture atmospheric CO₂ thereby making up a huge biomass that sustains a large part of the food chain of our planet. Moreover, by forming iACC, some species accumulate very high intracellular amounts of calcium, as well as other alkaline earth elements (AEEs) such as strontium (Sr), barium (Ba) or radium (Ra), which substitute for Ca in the iACC mineral cell reservoir (Cam et al., 2016). We inferred that they are among the highest Sr and Ba-scavenging organisms known (Cam et al., 2016). More recently, we showed that this strong AEEs sequestration by iACC-forming cyanobacteria also works with radioactive ⁹⁰Sr and ²²⁶Ra (Mehta et al., 2019). However, the characterization of the ACC inclusions and other potential intracellular reservoirs in these bacteria sequestering AEEs remain poorly detailed. Yet, understanding the origin of this selective and massive sequestration of AEEs is key to strengthen such bioremediation routes and/or design, in the longer term, biomimetic/biosynthetic systems capable of similar AEE hyperaccumulation. Here, the postdoctorate work will consist in (i) setting up experiments to better determine the efficiency of the AEE sequestration process by these bacteria and (ii) using a combination of ¹³C, ⁴³Ca and ⁸⁷Sr solid state NMR (including DNP) and TEM to characterize the chemical speciation of Ca and Sr within the bacteria. More details are available on demand.

The ideal candidate should have a strong experience in solid-state NMR and/or TEM and/or aqueous chemistry. Expertise in microbiology and/or manipulation of AEE radioisotopes are welcome. She/he should have skills for working in an interdisciplinary team mixing chemists, biologists and geochemists/mineralogists, conducting her/his research autonomously and communicate her/his results in English.
The funding is for 1 year, starting at the soonest in September 2020. It is provided by the Institut des sciences des matériaux at the Sorbonne Université Alliance. Candidates should send a detailed CV with a letter of motivation to both Karim Benzerara (karim.benzerara@sorbonne-universite.fr) and Thierry Azaïs (thierry.azais@sorbonne-universite.fr).


https://www.lcmcp.cnrs.fr/sites/thierry-azais/une-section-de-page-daccueil/

References


