

Physico-chemical and biological controls on microbialite formation: experimental biomineralization in open system.

ELODIE MULLER¹, KARIM BENZERARA², ROBIN HAVAS³, MIGUEL INIESTO⁴, DIDIER JÉZÉQUEL⁵, PURIFICACIÓN LÓPEZ-GARCÍA⁶, DAVID MOREIRA⁶, ROSALUZ TAVERA⁷, DR. CHRISTOPHE THOMAZO⁸, EMMANUELLE VENNIN⁹ AND NINA ZEYEN¹⁰

¹CNRS - IMPMC

²IMPMC CNRS/Sorbonne Université/MNHN

³Université de Bourgogne Franche-Comté

⁴Unité d'Ecologie Systématique et Evolution, CNRS, Université Paris-Saclay, AgroParisTech

⁵Université de Paris-Institut de Physique du Globe de Paris-CNRS, UMR 7154

⁶Unité d'Ecologie, Systématique et Evolution, CNRS UMR 8079, Université Paris Sud

⁷Departamento de Ecología y Recursos Naturales, Universidad Nacional Autónoma de México

⁸Laboratoire Biogéosciences, UMR CNRS 6282, Université de Bourgogne Franche-Comté

⁹University of Bourgogne Franche-Comté

¹⁰University of Alberta - EAS

Presenting Author: elodie.muller@upmc.fr

Microbialites are organo-sedimentary rocks found in modern marine and lacustrine environments, but also in the geological record dated back to 3.5 Ga. They represent the oldest undisputed evidence of life on Earth. These rocks are formed by the mediation of microorganisms in interaction with environmental factors and thus represent a source of information on paleobiology and paleoenvironments. However, our ability to recognize and interpret this information depends on our understanding of the relative role of microorganisms and local environmental conditions that control their formation.

Modern lacustrine microbialites from the Trans-Mexican volcanic belt form under a wide diversity of conditions (*e.g.* alkalinity, Mg/Ca ratio, pH, salinity) and show a broad diversity of mineralogical compositions, including various carbonate phases such as hydromagnesite, aragonite, calcite, and monohydrocalcite as well as authigenic Mg-silicates. The varying intensity of microbialite formation and their mineralogical composition appear strongly dependent on the lake hydrochemistry [1]. Meanwhile, Iniesto *et al.* [2] identified a microbial core of 247 operational taxonomic units (including cyanobacteria and diverse anoxygenic photosynthetic bacteria), which may be involved in microbialite formation and is conserved across lake microbialites, despite their diversity.

Here, in order to better disentangle environmental *vs.* biological controls, we set up a flow-through cell in which we have grown cyanobacterial biofilms under various physico-chemical conditions encompassing the conditions of the Mexican lakes. After critical point drying, the biofilms and associated

(bio)mineralizations were characterized by SEM (Scanning Electron Microscopy), EDX (energy dispersive X-ray spectrometry) and FTIR (Fourier transform infrared) analyses. The present work explores the local biotic and abiotic factors that may control the mineralogy of lacustrine microbialites.

[1] Zeyen *et al.* (2017), *Procedia Earth and Planetary Science* 17, 380-383.

[2] Iniesto *et al.* (2021), *Environmental Microbiology* 23(1), 51-68.