THE BIOCHEMISTRY OF EPS FROM THE CYANOBACTERIAL STRAIN SYNECHOCOCCUS PCC 7942 IN THE CONTEXT OF CALCIUM CARBONATE PRECIPITATION

I.A BUNDELEVA[1]*, I. ZEIGLER-DEVIN[2], N. BROSSE[2], F. MARIN[1]

[1] Biogéosciences, Univ. Bourgogne Franche-Comté, Dijon, France (*correspondence : irina.bundeleva@u-bourgogne.fr)

[2] ENSIC LERMAB, INRA, Univ. Lorraine, Vandoeuvre-lès-Nancy, France

The contribution of microorganisms, particularly bacteria, in carbonate mineral formation, the main natural processes controlling CO_2 level in the atmosphere, has played an important role since the Archean Eon. There are several specific features that make bacteria highly suitable templates for mineral nucleation: (*i*) small size, (*ii*) surface charge, (*iii*) metabolic activity inducing environmental changes, and (*iv*) production of extracellular polymeric substances (EPS). EPS are chiefly composed of polysaccharides (including uronic acids) but may also comprise proteins. They are capable of both promoting and inhibiting carbonate precipitation.

In this study, 3 EPS fractions of the cyanobacterial strain *Synechococcus* PCC 7942 were used for comparative investigation : REPS (released into the medium), LEPS (loosely bound to cells surface) and TEPS (tightly bound). Their monosaccharide compositions were obtained by HPAE-PAD (High Performance Anion Exchange - Pulsed Amperometric Detection), and their lectin affinity profiles, by ELLA (Enzyme-Linked Lectin Assay). Their molecular mass distribution was visualized by 1D electrophoresis. These approaches demonstrated the similar composition of the three fractions, while they differed by their quantitative distribution of monosaccharides. In parallel, *in vitro* assays were performed, aiming at checking the effect of various EPS concentration on the crystallization of $CaCO_3$. A wide range of EPS concentrations (16 - 256 μg/ml) was tested for each fraction. The results show the progressive change of $CaCO_3$ crystal shape from rhomboedral to polycrystalline and more rounded with the increase of EPS concentration. Other effects are a decrease of the crystal size and distribution per surface unit. The three fractions do not exhibit the same reactivity: the LEPS are more effective on the shape and size modification and $CaCO_3$ crystals distribution per surface unit. Our results underline the relationship between the biochemical properties of bacterial EPS and their influence on $CaCO_3$ precipitation process. They contribute to understand better the molecular basis of $CaCO_3$ precipitation in natural systems.