Geophysical Research Abstracts
Vol. 14, EGU2012-13985, 2012
EGU General Assembly 2012

Micro-scale in situ characterisation of the organic and mineral composition of modern, hypersaline, photosynthetic microbial mats

P. Gautret (1), C. Ramboz (1), R. de Wit (2), F. Delarue (1), F. Orange (1), S. Sorieul (3), and F. Westall (4)

(1) Institut des Sciences de la Terre d'Orléans (ISTO), UMR 6113 CNRS-Université d'Orléans, Campus Géosciences, 1A rue de la Férollerie, 45071 Orléans Cedex 2, France (pascale.gautret@cnrs-orleans.fr), (2) Ecosystèmes lagunaires, UMR 5119 CNRS-Université Montpellier 2-IRD-Ifremer Place Eugène Bataillon, Université Montpellier II, Case 093, 34095 Montpellier Cedex 05, France, (3) Centre d'Etudes Nucléaires de Bordeaux-Gradignan, IN2P3, UMR 5797, Université de Bordeaux 1, Chemin du solarium BP120, 33175 Gradignan Cedex, France. , (4) Centre de Biophysique Moléculaire UPR 4301, CNRS, Rue Charles Sadron, 45071 Orléans Cedex 2, France.

Physico-chemical and biological micro-scale environmental parameters within microbial mats formed in hypersaline conditions favour the precipitation of minerals, such as carbonates. We used optical microscopy and the technique "Fluorescence Induction Relaxation » (FIRe) to differentiate the photosynthetic activity of oxygenic photosynthesisers (cyanobacteria) from anoxygenic photosynthesisers (Chloroflexus-like bacteria, CFB) in samples obtained in 2011. After this preliminary investigation, we characterised the elemental composition of the different species of microorganisms, their extracellular substances (EPS), and the minerals precipitated on their surface. This study was made in-situ by μ-PIXE using the nuclear microprobe of the AIFIRA platform (CEN Bordeaux-Gradignan ; protons of 1.5 or 3MeV). With this microprobe it is possible to map the distribution of elements occurring in quantities down to several ppm, a resolution that is particularly favourable for studying microorganisms. SEM observation of the same zones allowed us to localise exactly the microbial structures (cells, EPS) and minerals analysed by nuclear probe. We were thus able to document the differential S and P concentrations in the different microbial species, the CLB being richer in P. Note that the CLB filaments are < 1 μm in diameter. We were also able to demonstrate the anti-correlation of Ca and Mg in the minerals precipitated directly on the microorganisms and on their EPS.
Thus we have shown the utility of these in situ, nano-scale methods in studying microbial structures consisting of different species with different metabolic activitie, and different functional groups on their cell walls and EPS implicated in the bioprecipitation of different kinds of minerals. Such features in ancient microbial mats could aid their interpretation and possibly the distinction between ancient oxygenic and anoxygenic mats.