Biological, mineral and elemental diversity of extant microbialites

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Microbialites, rock- forming microbial assemblages whose existence extends from the Archaean (~3,500 mya) until present days are useful study models to explore the diversity and the mechanisms involved in carbonates and other minerals precipitation. The role of microbes in the precipitation of minerals needs clarification; the use of emergent strategies of biological and chemical analysis contribute to address questions such as the participation of microbes in mineral formation as well as the chemical interactions at micro-scale. High throughput sequencing, XRD, XRF, SEM and S-FTIRS spectro-microscopy were used to assess biological and chemical diversity in a cross-system analysis (Cuba and Mexico sampling locations).

Here, we show preliminary results from the chemical diversity of the substratum (elemental composition of the biomass and the microbialite mineral matrix), and its relationships with the microbial community structure in extant microbialites. Regardless their origin (sampling location), microbial groups such as Cyanobacteria, Proteobacteria, Firmicutes and Bacteroidetes exhibited the strongest correlations with organic carbon (C_{org}), N and particularly with C:S ratio as shown by the presence/abundance of microbial phylotypes closely involved in N and C cycling (e.g., Pseudanabaenales, Pasteurellales, Clostridiales, Bacillales and Flavobacteriales). A diversity of bacterial taxa showed significant (positive and negative) relationships with trace elements (accumulated in microbialite precipitations relatively to their water environments) such as Cd, Co, Cu, Fe, Se and Ni. Significant correlations among phylotypes and chemical signatures are summarized for biogeochemical parameters, organic molecules, mineral - major ions and trace elements.