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Monitoring Survival and Preservation of Recent Cyanobacterial Mats

Elizabeth Chacon (1), Alicia Negron-Mendoza (2), and Claudia Camargo (2)

(1) Departamento de Geología, Facultad de Ciencias de la Tierra, Universidad Autonoma de Nuevo León (UANL), Linares 67700, Mexico (liz@nucleares.unam.mx, 528212142020), (2) Instituto de Ciencias Nucleares, Universidad Autónoma de México, Circuito Exterior, C. U., México D. F., Coyoacan 04510, México.

Through geobiological evolution cyanobacterial mats have played a fundamental role through the development of early microbial carbonate ecosystems and through the sustainment of major biogeochemical cycling in the biosphere; nonetheless their sedimentary record is relatively modest in comparison with their biological impact; this apparent under-representation in the fossil record may be due to their intrinsic poor preservation potential but also to our inability to recognize some subtle microbial signatures.
Modern studies on cyanobacterial mats involve high-tech molecular approaches to identify, analyze and even quantify the genetic diversity of ancient and modern microbial mats, yet the physical changes of mats, their survival and preservation potential, remain almost unknown and experimentally poorly explored. If we are going to succeed in the astrobiological quest for traces of life we should develop integrated methods and diagnostic features to address biosignatures at both, the phenotypic and genotypic levels when possible. The correct recognition and interpretation of biosignatures in this emerging field needs, aside these fine molecular tools, plain experimental approaches to test microbial resistance, survival and preservation potential of microbial mats after exposure to diagenetic changes.

In this work we study some effects on fresh slices of cyanobacterial mats and cultures of specific external simulated agents that normally occur during diagenesis such as dehydratation, heat, abrasion or pressure among others. Samples from different cyanobacterial communities associated to carbonates collected from different rivers and falls around Mexico were subjected to same lab procedures. Physical and textural changes were monitored through microscopic analysis where cell integrity and mat cohesiveness were analyzed before and after treatment. Preliminary results show that mats enriched in halite and clay sediments were preferentially preserved; however those mats subjected to a rapid dehydration technique retained their original textural characteristics but their overall integrity was lost. Simple and direct observations like these help to get a better idea as to what to expect as biosignatures according to a specific environment, bridging the gap between the observer and the different types and scales of evidences.