Oxidation state distribution of arsenic in modern stromatolites: a trace of life evolution

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Arsenic is a notorious toxin, and as such may have exerted a strong selective pressure on the distribution and evolution of life on Earth. Documenting the abundance, distribution, inter-element correlation and speciation of arsenic in living microbial mats would lead to address how arsenic metabolic system works and to evaluate its use as a tracer of life.

Our study focuses on investigating the relationship between arsenic, organic matter and other metal(loid)s of interest, including V, Cr, Fe, Co, Ni, Cu, Zn and Mo in a lithifying modern microbial mat from La Brava, a hypersaline lake in Salar de Atacama, where the extreme conditions resemble to those of primitive Earth [1]. The mats are void of oxygen and driven by anoxygenic photosynthesis using reduced sulfur and arsenic compounds. Oxidative processes in these mats include methanogenesis, sulfate and arsenate reduction. This research is taking a novel approach by targeting microbial arsenic cycling across spatial scales by zooming from mm-scale resolution to a selected area at high (200 nanometers) resolution by a multi-technique scanning imaging that includes scanning X-ray fluorescence spectrometry and transmission contrast modalities, and XANES [2]. We have generated maps displaying areas with different arsenic oxidation states, As(III) and As(V), and its correlation with other trace metal(loid)s.

[1] Farías, Contreras, Rasuk, Kurth, Flores, Poire & Visscher (2013), *PloS one* 8(1), e53497; [2] Somogyi, Medjoubi, Baranton, Le Roux, Ribbens, Polack, Philippot & Samama (2015), *J. Synchrotron Radiat.* 22, 1118-1129.