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Arsenic in living microbial mats: distribution, redox state and (bio)geochemical implications

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

In this work, we studied a microbial mat from laguna La Brava, a hypersaline lake in the Atacama Desert (Chile). This environment represents a potential living analogue of the ancient Earth (e.g. high UV, lack of O_2 in sediments). Laguna La Brava receives a groundwater input containing leached volcanic material, in which high concentrations of arsenic and sulfide are carried where microbial mats develop. Hence, these mats are possibly driven by anoxygenic photosynthesis using reduced sulfur and arsenic compounds. Oxidative processes in these mats could include fermentation, methanogenesis, sulfate and likely arsenate reduction. The diversity in these mats is dominated by *archaea* and sequences for *Haloarchea*, which have preserved As metabolims for a very long time, linking this to ancestral matabolisms that prevailed on ancient Earth [1]. Our study focuses on identifying geochemical proxies of the As-based metabolisms within the La Brava mats. To do so, we have combined scanning X-ray micro-fluorescence (μXRF) with X-ray Absorption Near Edge Structure (XANES) imaging and punctual XANES analyses [2], and performed Principal Component Analysis (PCA).

[1]Rascovan, Maldonado, Vazquez & Farías (2016), *ISME,* **10**, 299-309; [2] Somogyi, Medjoubi, Baranton, Le Roux, Ribbens, Polack, Philippot & Samama (2015), *J. Synchrotron Radiat*. **22**, 1118-1129.