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Study of modern microbialites in a seasonally euxinic water column

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The oxygenation of the atmosphere (usually referred to as GOE, *Great Oxidation Event*) likely impacted the emergence and diversification of early complex life, *i.e.* eukaryotes, but also the functioning of existing microbial communities, including calcifying ones that formed microbialites. Indeed, the availability of O_2 as a new electron acceptor and the modified availability of dissolved chemical species such as metals sensitive to redox conditions probably changed the functioning of these metabolically diverse communities. Microbialites, in turn, may eventually provide some information about key steps in these changes. However, one difficulty in order to decrypt this information is that we presently lack studies on modern analogues growing under anoxia that would help to better grasp the changes induced by oxygenation.

Here, we will describe modern microbialites experiencing seasonal oxic/euxinic cycles in the monomictic alkaline lakes Alchichica and Atexcac in Mexico, as potential analogues for pre-GOE environmental conditions. Several data suggest that these microbialites are growing: the water column is saturated with amorphous calcium carbonate, a very soluble carbonate phase, and microbialite-associated microbial communities are visibly active. We assessed the microbialite microbial community composition using Nanopore sequencing under anoxia *in situ* and as microbialites acclimate to anoxic conditions, notably their capability to form carbonates under anoxia based on enrichment cultures. In parallel, we characterized the mineralogy and chemistry of field samples. Deep microbialites in Lake Alchichica contained significant amount of huntite, a calcium and magnesium carbonate. The precipitation of this phase is potentially linked to the reworking by diagenesis of the two major carbonates (*i.e.* hydromagnesite and aragonite) in our lakes. Surprisingly, the chemistry of these microbialites does not record an increase in transition metals content or any positive cerium anomaly, two geochemical proxies often used to detect anoxia. In the end, we will compile these different lines of results to discuss how microbialites respond (and eventually record) to variations of oxygenation.