Lipid biomarkers and microbial diversity associated with aphotic euxinic chemoclines in a saline lake

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The shallow-water lake Dziani Dzaha located on Petite Terre, Mayotte Island (Indian Ocean) has recently been identified, based on its microbial and biogeochemical features, as one of the best contemporary analogues of Proterozoic oceans candidates. This lake exhibits a strong prokaryotic dominance (cyanobacteria)[1], permanent anoxia under 1.5m, and seasonal stratification and bottom layer euxinia (H_2S>3mM) .

The molecular composition of the suspended organic matter was characterized along with the structure, abundance and diversity of the microbial communities in the different layers of the water column. Two contrasted conditions were studied: a stratified period (rainy season) when strong euxinic conditions prevail in most of the water column, and a mixed period (dry season) when euxinia is limited to the deepest part of the lake (18 m). We showed that the depth of the chemocline (at the sub-surface and/or at the bottom), although always located below the photic zone, played a prime role in structuring microbial communities throughout the water column, and recycling of cyanobacterial organic matter. Bacterial and archaeal biomass together with lipid biomarker concentrations suggest the existence of specific anaerobic halophilic microbial populations of involved in the sulfur cycle and systematically associated with the aphotic euxinic chemocline(s). The biological origin of several biomarkers (wax esters, tetrahymanol, etc.) associated with the aphotic limit and euxinic chemoclines is questioned. Our data highlight the complexity and dynamism of such highly productive and anoxic aquatic ecosystems, that deserve to be further investigated in order to better characterize the origin and fate of organic matter under conditions resembling those of the Proterozoic Oceans.

[1] Leboulanger et al. 2017, PLoS One 12(1), e0168879.