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Integrating microbial community analysis in lacustrine sediments to paleoclimatic studies

Camille Thomas (1), Aurèle Vuillemin (2), and Daniel Ariztegui (1)

(1) Department of Earth Sciences, University of Geneva, Geneva, Switzerland (camille.thomas@unige.ch), (2) Department of Earth and Environmental Sciences, Ludwig-Maximilians-University of Munich, Munich, Germany (a.vuillemin@lrz.uni-muenchen.de)

Because lacustrine systems are very sensitive to climatic variations, they have long been used as prime targets for paleoclimatic and paleoenvironmental reconstructions. However, the presence of active microbial communities in sediments used for these studies has been recognized as a main factor of post-depositional processes. For instance after burial, microbial communities play a critical role in the precipitation-dissolution of minerals , remineralization of organic matter and isotopic fractionation of the corresponding elements. Hence, combining the analysis of past and present microbial activities in the sediment to limnogeological studies allows to gain access on how microbial turnover and biogeochemical cycling may influence commonly used proxies. State-of-the art techniques in the field of molecular biology provide evermore-precise means to trace the taxonomy, functions and activities of subsurface microbial populations with the prospect to shed light on the much-discussed deep biosphere composition. Approaches including environmental DNA, lipid biomarkers, isotopic fingerprints and organic/inorganic mineralization traces have been implemented in several lake studies, generally involving deep drilling operations and the sponsor of the International Continental Scientific Drilling Program. Here we propose an overview of these projects, encompassing a wide variety of lake systems and limnological regimes. When available, results show a marked influence of past environmental conditions on the development of microbial communities within sediments but variable diagenetic imprint on sedimentary archives, which calls for a generalized effort to integrate microbial ecology to paleoenvironmental reconstructions in order to resolve interdependent biological and geological processes.