

**Proposition of a China Scholarship Council/ Sorbonne University PhD thesis:
Applicability of bacterial membrane lipids as environmental
proxies in lacustrine settings**

Context

Investigating past climatic variations is essential to understand and predict future environmental changes. Paleoclimate studies are chiefly carried out for marine environments because environmental proxies were mainly developed and used for oceanic settings. However, it is essential to develop new proxies also applicable to continental (both terrestrial and aquatic) environments to assess climatic variability over the continents and improve our understanding of both past environment and global climate. Membrane lipids produced by some microorganisms can be used to this aim, as the latter are able to adjust their membrane composition in response to the prevailing environmental conditions. Thus, the structure of glycerol dialkyl glycerol tetraethers (GDGTs) – membrane lipids biosynthesised by archaea and some bacteria – is known to be related to environmental parameters. To date, branched GDGTs (brGDGTs) are the only microbial organic proxies which can be used for temperature reconstructions in both aquatic and terrestrial settings. Nevertheless, paleoenvironmental data derived from brGDGTs have to be interpreted with care, as these compounds may have allochthonous and autochthonous sources in aquatic settings and their source microorganisms are unknown. The development of new environmental proxies, independent and complementary to brGDGTs, is crucial to improve the reliability/accuracy of continental reconstructions. 3-Hydroxy fatty acids (3-OH FAs), membrane lipids predominantly produced by Gram-negative bacteria (GNB), could be used as such a proxy. Significant relationships between 3-OH FA distribution in soils from all over the world and temperature were obtained at the global level. Nevertheless, the influence of environmental parameters on 3-OH FA distribution in lakes and the applicability of 3-OH FAs as temperature/pH proxies in lacustrine settings still deserve investigations.

Aim of the PhD

The main objectives of this work will be to investigate the applicability of 3-OH FAs as new temperature and pH proxies in lakes and to concomitantly compare these new proxies to the existing ones based on GDGTs. To this aim, the source(s) of microbial lipids in lakes will first be assessed. We then envision to develop calibrations between temperature/pH and distribution of microbial lipids in sediments from lacustrine sediments collected worldwide. Last, these calibrations will be applied to long-term paleoenvironmental reconstructions from alpine lacustrine cores.

Supervision

The PhD student to be hired will benefit from the complementary expertise of the two co-PIs of the project, in organic geochemistry (Arnaud Huguët) and paleoenvironment from lake sediment (Pierre Sabatier). The laboratories of the two PIs (METIS and EDYTEM) have all the analytical equipment and material available to make the project successful.

Profile of the applicant

The candidate, compulsorily studying in a Chinese University, will have a MSc degree in geosciences, analytical chemistry or environmental chemistry. Skills in organic geochemistry would be a plus. The candidate should be motivated by laboratory experiments and field campaigns. He/she should have good skills in English.

More information on the China Scholarship Council – Sorbonne University program can be found here: <https://www.sorbonne-universite.fr/en/research-and-innovation/doctorate/doctoral-college/doctoral-programs/international-doctoral>

Application deadline: 15 January 2022

The applicant should send his/her CV and letter of motivation to:

Arnaud Huguet (arnaud.huguet@sorbonne-universite.fr) and Pierre Sabatier (pierre.sabatier@univ-smb.fr)