Stable isotope probing reveals the preferential growth of branched GDGT source microorganisms under aerobic conditions in peat

A. HUGUET[1*], T.B. MEADOR[2], F. LAGGOUN-DEFARGE[3], M. KÖNNEKE[2], S. DERENNE[1], K.-U. HINRICHS[2]

[1]METIS, CNRS/UPMC/EPHE UMR 7619, Paris, France, arnaud.huguet@upmc.fr (*presenting author)

[2]MARUM Center for Marine Environmental Sciences and Dept. of Geosciences, University of Bremen, Bremen, Germany

[3]ISTO, CNRS/Univ.Orléans/BRGM UMR 7327, Orléans, France

Branched glycerol dialkyl glycerol tetraether (brGDGT) membrane lipids are widely distributed in aquatic and terrestrial environments and are being increasingly used as temperature proxies. Nevertheless, little is known regarding the microorganisms that produce these lipids. Stable isotope probing incubations of peat samples from a *Sphagnum*-dominated peatland (Jura Mountains, France) were initiated to measure the incorporation of (D)-D_2O and ^{13}C-labeled dissolved inorganic carbon into brGDGTs, and thus gauge the activity, growth, and turnover times of their source organisms. Peat samples were collected from two adjacent sites with contrasting humidity levels (hereafter called "fen" and "bog" sites). For each site, samples from the surficial aerobic layer (acrotelm) and deeper anaerobic layer (catotelm) were incubated at 12 °C under both anaerobic and aerobic conditions for the acrotelm samples and only anaerobic conditions for the catotelm. After two months of incubation, there was no incorporation of ^{13}C label in brGDGTs, showing that brGDGT-producing bacteria are heterotrophic microorganisms. Similarly, little to no D incorporation was observed for brGDGTs isolated from anaerobically-incubated samples. In contrast, in the aerobic incubations of acrotelm samples from bog and fen, the δD of brGDGTs significantly increased after two months, indicating that fresh brGDGTs were biosynthesized at the peat surface. In conclusion, our results reveal that brGDGT source microorganisms preferentially grow under oxic to sub-oxic conditions, likely as facultative anaerobes. We show for the first time that these microorganisms are especially active at the peat surface, in contrast to the deeper layers, implying that the high abundance of brGDGTs typically observed in the catotelm should result from the accumulation of the brGDGTs actively produced in the acrotelm.