Geophysical Research Abstracts
Vol. 13, EGU2011-2976, 2011
EGU General Assembly 2011

Effects of in situ artificially increased temperature on the distribution of branched GDGTs in a French peat bog

Sylvie Derenne (1), Arnaud Huguet (1), Céline Fosse (2), and Fatima Laggoun-Défarge (3)

(1) BioEMCo, CNRS, Paris cedex 05, France (sylvie.derenne@upmc.fr), (2) Laboratoire de Spectrométrie de Masse, Chimie ParisTech, Paris cedex 05, France, (3) ISTO, Université d'Orléans-CNRS, Orléans, France

Glycerol dialkyl glycerol tetraethers (GDGTs) are complex lipids of high molecular weight, present in cell membranes of archaea and some bacteria. Archaeal membranes are formed predominantly by isoprenoid GDGTs with acyclic or ring-containing biphytanyl chains. Another type of GDGTs with branched instead of isoprenoid alkyl chains was recently discovered in soils and was suggested to be produced by anaerobic bacteria. The relative distribution of branched GDGTs was shown to be determined primarily by two environmental parameters: mean annual air temperature (MAAT) and soil pH. The degree of methylation, expressed in the methylation index of branched tetraethers (MBT), was shown to depend on MAAT and to a lesser extent on soil pH, whereas the relative abundance of cyclopentyl rings of branched GDGTs, expressed in the cyclisation ratio of branched tetraethers (CBT), was observed to correlate well with soil pH. The MBT and CBT indices have recently been shown to be useful tools for the reconstruction of past continental temperatures. Nevertheless, the MBT and CBT have been empirically established and the direct impact of temperature on these two proxies has been rarely evaluated. The aim of this work was to study the effects of in situ artificially increased temperature on the abundance and distribution of branched GDGTs in a Sphagnum-dominated peatland located in the Jura Mountains (France). In this peatland, temperature was experimentally increased using a warming system consisting of in situ open mini-greenhouses (Open-Top Chamber – OTC). 12 randomised plots have been chosen (6 controls and 6 OTCs). Two years after the installation of the warming system, MAAT was observed to be 1.6°C higher in the OTCs than in the control plots. 3 peat samples (5-7, 7-12 and 12-17 cm depth) were collected from each plot. GDGTs occur under two broad forms: core lipids, presumed to be of fossil origin, and intact polar lipids, derived from recently active microorganisms. Both lipid pools were investigated in this study. Core lipids were observed to represent between 75 and 85% of the total pool of branched GDGTs (i.e. core + intact polar GDGTs), indicating that branched GDGTs are predominantly of fossil origin in Frasne peatland. In addition, the MBT was observed to be systematically higher in the OTCs than in the controls at all depths, implying that the average degree of methylation of branched GDGTs decreased with increasing temperature. This confirms the effect of temperature on branched GDGT distribution previously established in a large range of soils and supports the empirical relationship between MBT and MAAT. Last, the analysis of the MBT and CBT revealed no significant differences in branched GDGT distribution between the core and intact polar lipid pools, suggesting that the fossil pool of branched GDGTs has a very fast turnover (less than the 2 year duration of the experiment) at the peat surface. To the best of our knowledge, these results are the first evidence of a direct influence of temperature on branched GDGT distribution.