Geophysical Research Abstracts
Vol. 13, EGU2011-2961, 2011
EGU General Assembly 2011

Rhizoliths in loess: evidence for the heterotrophic lifestyle of branched GDGT-producing bacteria

Arnaud Huguet (1), Guido L.B. Wiesenberg (2), Martina Gocke (2), Céline Fosse (3), and Sylvie Derenne (1)

(1) BioEMCo, CNRS/UPMC UMR 7618, Paris, France (arnaud.huguet@upmc.fr), (2) Department of Agroecosystem Research, BayCEER, University of Bayreuth, Bayreuth, Germany, (3) Chimie ParisTech (ENSCP), Laboratoire de Spectrométrie de Masse, Paris, France

Over the last years, an increasing number of studies have focused on glycerol dialkyl glycerol tetraethers (GDGTs), which are complex lipids of high molecular weight (>1000 Da) present in membranes of archaea and some bacteria. Isoprenoid GDGTs with acyclic or ring containing dibiphytanyl chains are known to be synthesized by archaea. In soil, another type of GDGTs, which can be distinguished from tetraethers of archaeal origin by way of the branched nature of the alkyl chain, was discovered recently. Branched GDGTs were subsequently detected in a large variety of environments (peats and soils, hot springs, lacustrine and marine sediments) and are synthesized by still unknown bacteria. The relative distribution of branched GDGTs can be related mainly to mean annual air temperature (MAAT) and soil pH. The cyclisation ratio of branched tetraethers (CBT), quantifying the relative abundance of cyclopentyl rings of branched GDGTs, correlates rather well with soil pH, whereas the methylation index of branched tetraethers (MBT), expressing the degree of methylation of branched GDGTs, depends on MAAT and, to a lesser extent, on soil pH. The MBT and CBT can be used as proxies for paleotemperatures and paleo soil pH. The aim of the present work was to examine the distribution and abundance of GDGTs in rhizoliths (calcified roots) and surrounding loess collected from a loess-palaeosol sequence in Nussloch (SW Germany). For two rhizoliths from a depth between 2.2 m and 2.6 m below present surface, loess transects were sampled from the former root towards root-free loess at distances of 0-2.5 cm and 2.5-5 cm (rhizoloess samples). Two reference loess samples without visible root remains were taken at a distance of 50-70 cm from the rhizoliths.
Branched GDGTs were much more abundant in the rhizoliths than in the rhizoloess and almost absent in reference loess samples. The very high abundance of branched GDGTs in the rhizoliths suggests that branched GDGT source organisms feed on root remains. In larger distances to root surfaces, nutrient and energy supply decreases, likely leading to the lower abundance of branched GDGT source microorganisms observed in the rhizoloess and reference loess compared to the rhizoliths. Branched GDGT distribution patterns were different for individual sample types. The MBT was lower in the rhizoliths (0.23-0.26) than in the rhizoloess (0.37-0.47) and loess samples (0.39-0.41). The differences in MBT values between the rhizoliths and rhizoloess samples might be related to the higher variability in microbial activity and community along the former rhizosphere. The reconstructed pH values determined via CBT were similar for the rhizosphere and rhizoloess (7.7-8.1) and close to that of the reference loess (8.1). To the best of our knowledge, this is the first time that the heterotrophic lifestyle of branched GDGT-producing bacteria is evidenced solely based on GDGT abundance.