Geophysical Research Abstracts
Vol. 13, EGU2011-8180, 2011
EGU General Assembly 2011

Bacteriohopanepolyol signatures as markers for methane oxidation and nitrogen-fixation in peat

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Bacteriohopanepolyols (BHPs; membrane components produced by many prokaryotes) are bacterial biomarkers with the potential to identify (past) bacterial communities and associated biogeochemical processes and conditions [1]. To allow investigation of the methanotrophic community in peat bogs, we here report the BHP signatures of the type I and type II methanotrophs isolated from Sphagnum, and an extreme acidophilic verrucomicrobial methanotroph. Many of these organisms were found to contain a more complex BHP distribution than those reported previously for other methanotrophs [2] including novel mono-unsaturated structures and adenosylhopane [1,3].

We have also investigated the BHP distribution in a number of peat cores and here report findings from a 4 m core obtained during the ACCROTELM (Abrupt Climate Change Recorded over the European Land Mass) programme from a site at Bissendorfer Moor (Germany). Up to a total of 23 different BHP structures were identified, including remarkably well preserved signatures in the deepest sections. Compounds observed include structures with a range of biological sources whilst others have more constrained origins including Type I methane oxidising bacteria and cyanobacteria. We also report for the first time the observation of an unusual suite of unsaturated BHPs which are particularly abundant in the oxic, near surface layers and propose an origin from nitrogen-fixing bacteria associated with the Sphagnum plants. Furthermore, comparison with the recent microbiological studies on peat bog communities suggest that nitrogen status likely has a significant controlling influence on the BHP producing community. The overall complexity of the BHP distribution is comparable with recent studies on soils [e.g. 3,4] although there are differences in the relative contribution from some compound groups including the proposed “soil-marker” BHPs (adenosylhopane and related compounds [1,3]).

References

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