Geophysical Research Abstracts
Vol. 13, EGU2011-6224, 2011
EGU General Assembly 2011

Temperature and methane cycling effects on methanotroph-related biomarkers in peat moss

Julia van Winden (1), Gert-Jan Reichart (1,2), Niall P. McNamara (3), Albert Benthien (2), Jaap S. Sinninghe Damsté (1,4)

(1) Utrecht University, Earth Sciences, Organic Geochemistry, Netherlands (j.vanwinden@geo.uu.nl), (2) Alfred-Wegener-Institut für Polar- und Meeresforschung, Germany, (3) Centre for Ecology and Hydrology, Lancaster Environment Centre, Library Avenue, Bailrigg, Lancaster, United Kingdom, (4) Department of Marine Organic Biogeochemistry, The Royal Netherlands Institute for Sea Research (NIOZ), 't Horntje, The Netherlands

Aerobic methane oxidizing bacteria (methanotrophs) are the largest known terrestrial methane sink and play an important role in the global methane cycle. In peat bogs, aerobic methane oxidizing bacteria (methanotrophs) live in symbiosis with peat moss (*Sphagnum),* strongly reducing methane emissions and providing $CO_2$to *Sphagnum*. Peat cores may be used to reconstruct bacterial methane oxidation in the past in order to assess the influence of changing environmental conditions. This requires, however, an independent proxy for methane cycling in peat cores. Here we investigate the influence of temperature and methane cycling on compound specific carbon isotopes to evaluate their potential as proxies for methanotrophs and methane cycling in ancient bogs. Increasing temperatures lead to increased methane production, but also to enhanced methane oxidation. To resolve the effect of temperature and methane cycling on potential methanotroph proxies, intact peat cores containing actively growing *Sphagnum* were incubated at 5, 10, 15, 20 and 25 $^{\circ}$C for two months. Subsequently, compound specific carbon isotopes were measured for diploptene, a bacterial marker which is produced by, but not exclusive to, methanotrophs. Bacterial diploptene δ^{13}C values decreased with increasing temperature, with compound-specific carbon values of -33,9‰ at 5°C and -40,7‰ at 25°C. This relationship is best explained by a correlation with enhanced methane cycling, caused by increased methanotroph abundance and/or enhanced isotopic fractionation as a result of increased methane availability. Increased uptake of methane-derived CO_2 by *Sphagnum* as a result of enhanced methane cycling could not be confirmed since δ^{13}C values of C_{23} n-alkanes did not vary with temperature or methane availability. The lack of a clear signal in the *Sphagnum* derived biomarkers suggests that the ratio of CO_2 derived from methane oxidation to CO_2 from other sources. Our results, therefore, indicate that diploptene δ^{13}C would be the most appropriate proxy to assess methane cycling in past environments.