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The Anaerobic Oxidation of Methane in Freshwater and Terrestrial Habitats

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So far, reports on the presence of sulphate-dependent anaerobic oxidation of methane (AOM) have been restricted to marine habitats, as a consequence of the dependance of this process on high sulphate concentrations. AOM is carried out by yet uncultured methanotrophic archaea (ANME) closely related to methanogenic microorganisms, which often occurr in physical association with sulphate-reducing bacteria (SRB). Recently we were able to show for the first time the presence and activities of AOM-microorganisms in freshwater and terrestrial habitats low in sulphate. Methane concentrations and carbon isotopic signatures in the water column of the eutrophic freshwater lake Plusssee indicated a zone of anaerobic methane oxidation in the anoxic water body, coinciding with a peak in hydrogen sulphide concentration. Furthermore, high cell numbers of single ANME-archaea and SRB were detected by CARD-FISH in this zone, indicating that in this ecosystem aerobic and anaerobic methane oxidation act together in reducing methane emissions. In methane and oil seeping mud volcanoes in the Carpathian Mountains, the combined analysis of lipid biomarkers, stable isotope ratios, and 16S rRNA genes confirmed the presence of ANME and SRB in the mud breccia. Additionally, consistently to the dominance of ANME sequences and 13C-depleted archaeal lipids, a low but significant activity of anaerobic methane oxidation was detected by radiotracer techniques and *in vitro*. In conclusion, the presence of AOM also in non-marine systems puts even more importance on the global rele-

vance of this process for the reduction of the emissions of the important greenhouse gas methane.