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Large CH4 production fueled by autochthonous OC in an anoxic sediment

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River damming and human-induced eutrophication both affect river and lake functioning, increase organic carbon (OC) sedimentation rates and generate anoxic conditions in bottom waters. Under these conditions, OC in sediments is decomposed into CO_2 and CH4, a high potential greenhouse gas. It has been shown that the decomposition of land-derived (allochthonous) OC is inhibited at anoxic conditions, compared to OC internally produced (autochthonous). However, the overall extent and end products (CO_2 or CH4) of anoxic decomposition remain poorly known for different types of OC, making it difficult to judge the effect of river damming and eutrophication on greenhouse gas emissions from inland waters. We incubated different types of allochthonous OC (terrestrial plants) and autochthonous OC (phytoplankton and aquatic vascular plants) in an anoxic sediment during 130 days. We aimed to test 1) if this addition of relatively fresh OC resulted in an increase of CH4 production and 2) if autochthonous OC would produce more CH4 than allochthonous OC. We assessed the contribution to CH4 production of the different OC sources (i.e. sediment or added OC) with stable isotope measurements. We found that the addition of relatively fresh OC greatly increased CH4 production. Autochthonous OC generally produced more CH4 than allochthonous OC, but the overall extent of CH4 production was highly variable between the different autochthonous OC types. The d13C-CH4 measurements indicated that CH4 originated exclusively from the added OC. We conclude that the production of CH4 is likely to to be high in eutrophic as well as in artificial lakes, especially when these systems have anoxic bottom waters and high internal primary productivity and thus a high supply of autochthonous OC to the sediment. The current expansion of reservoir construction in concert with almost globally prevalent anthropogenic eutrophication are therefore likely to increase CH4 production in inland waters.