

Phytoplankton lipid content influences freshwater lake methanogenesis

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SUMMARY

1. Rates of methanogenesis in freshwater sediments have been shown to increase with inputs of phytoplankton biomass. Although many studies have shown the importance of resource quality for decomposition, little is known of the importance of substrate quality on rates of methanogenesis.
2. Here, we studied the effects of lipid content and taxonomic affiliation of phytoplankton biomass on rates of methanogenesis in lake sediment slurries from five lakes differing in trophic status.
3. Substrate quantity had a positive effect on methanogenesis despite differing trophic status. Furthermore, we observed that phytoplankton biomass quality, in terms of lipid content, enhanced methanogenesis rates. However, rates of methanogenesis between lake sediments treated with *Scenedemus obliquus* or *Microcystis aeruginosa* did not differ when lipid content was held constant.
4. Phytoplankton lipid content has been shown to increase when nutrients are limiting, which may result in an increase in substrate quality for methanogenesis with eutrophication. However, our study revealed that responses of substrate quantity to nutrient enrichment likely outpace the effects of resource quality and may result in a net increase in CH₄ emissions from eutrophied lakes. Interestingly, the resource quality feedback may at least partially reduce the potential effect of eutrophication on lake methanogenesis.

Keywords: eutrophication, lakes, lipid, methane, phytoplankton