Mechanisms structuring aerobic methane-oxidizing bacteria within lake oxyclines

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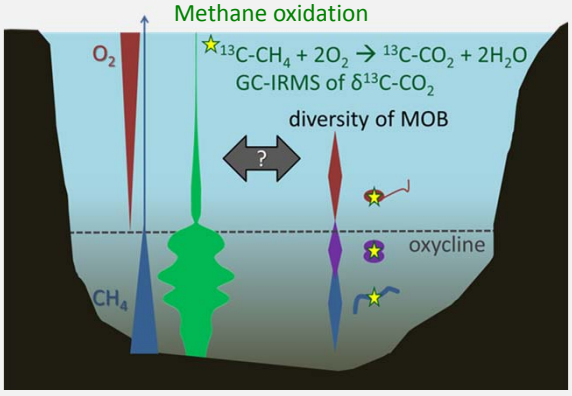
Background

- Globally, lakes contribute 6-16% to the natural CH_4 emission
- 30-99% of the produced CH_4 is oxidized before reaching the atmosphere
- **Aerobic methane-oxidizing bacteria (MOB)** are mainly found within *Gamma-* and *Alphaproteobacteria*
- Hypothesis: MOB form discrete assemblies throughout the water column, structured by vertical environmental gradients acting on species inherent traits.



stratified lake

Objectives

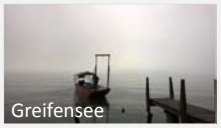
I. Linking structure and activity of MOB taxa across the lake oxyclines to environmental conditions

II. Determining the response of MOB to autumnal lake mixis & consequences for CH_4 emission

III. Enrichment and isolation of pelagic MOB in order to characterize their key traits

Study sites

- Rotsee, monomictic, eutrophic, shallow
- Greifensee, dimictic, eutrophic, shallow
- Luganersee, meromictic, eutrophic, deep
- Zugersee, meromictic, eutrophic, deep

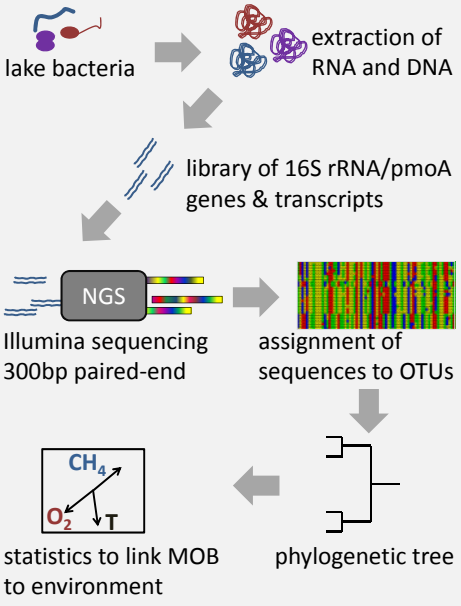


The four lakes have anoxic hypolimnia during stratification.

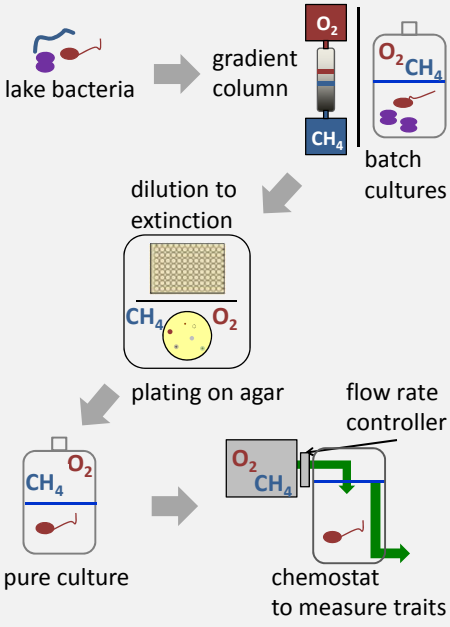
High-resolution profiles across the oxycline were taken to investigate the MOB community and environmental conditions.

Methods

Community structure & activity



Cultivation



Outlook

In the four lakes (Rotsee, Greifensee, Luganersee & Zugersee), potential methane oxidation rates were obtained from incubation experiments with $^{13}C\text{-}CH_4$. Illumina sequencing of the MOB community (DNA and RNA) is under way in order to link methane-oxidation to MOB community structure at a high spatial resolution throughout the oxycline of the four lakes. The four lakes were found to be extremely variable in terms of methane-oxidation patterns.

We expect to find spatially distinct MOB population maxima across the four lake oxyclines. Future experiments with MOB species and consortia from the lakes will reveal the importance of various traits, which will be used to mechanistically explain the observed MOB community patterns. A second PhD student (Matthias Zimmermann) will base a trait-based model of MOB community and activity in stratified lakes on the findings of this project.

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