Microbial Reduction of Methane Emissions on a Passively Vented Landfill

German Federal Ministry for Education and Research

Microbial Reduction of Methane Emissions

01.04.1999 – 28.02.2003

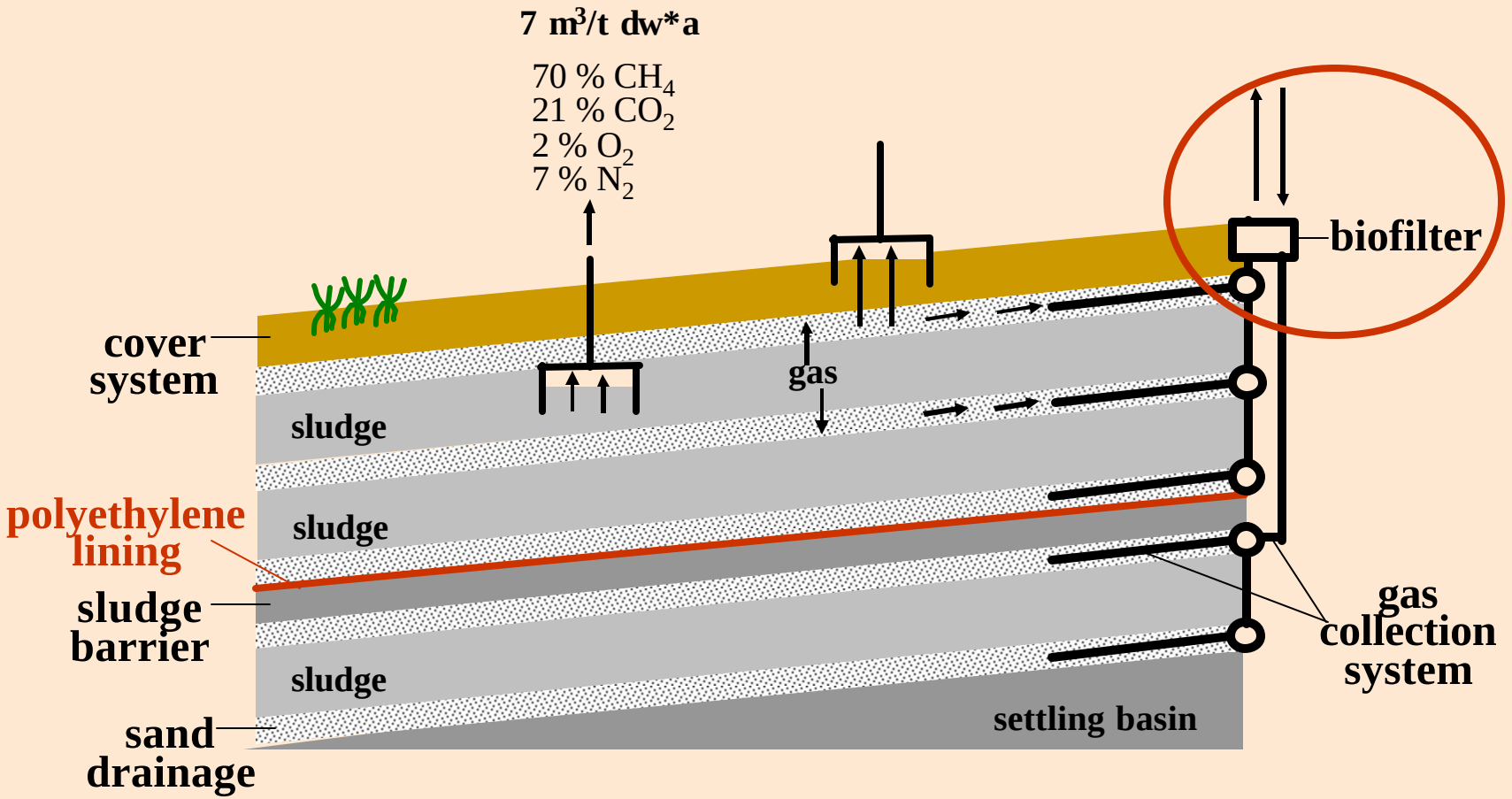
Partners

Technical University Hamburg-Harburg

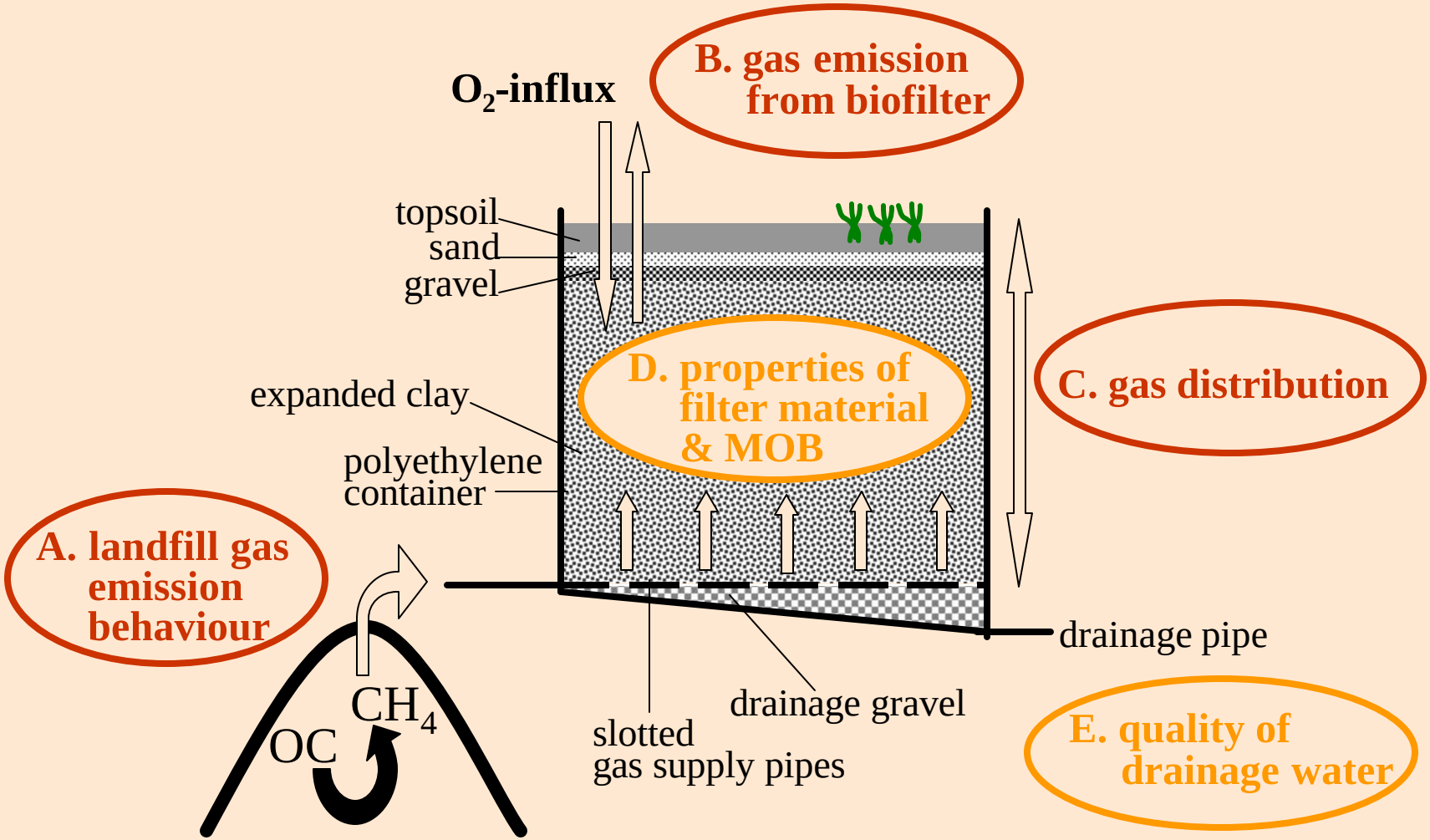
Wessel Umwelttechnik Ltd.

University of Hamburg
Faculty of Earth Sciences
Institute of Soil Science

Landfill Design



Biofilter Design & Investigation Concept



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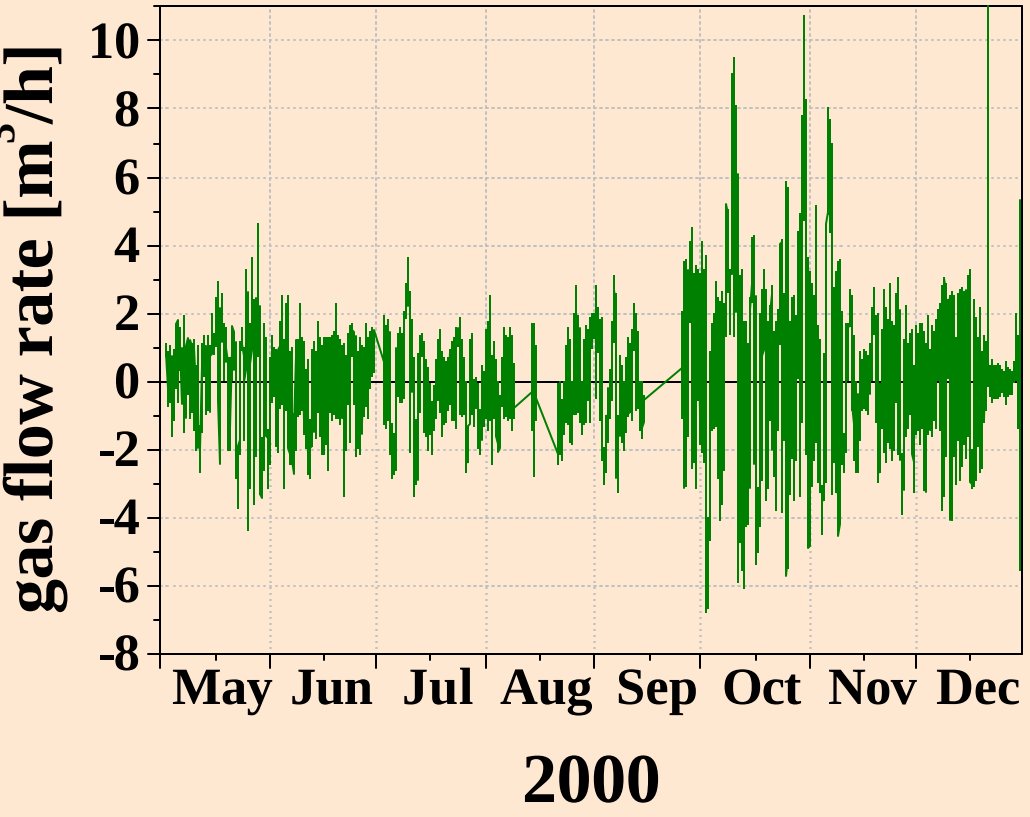
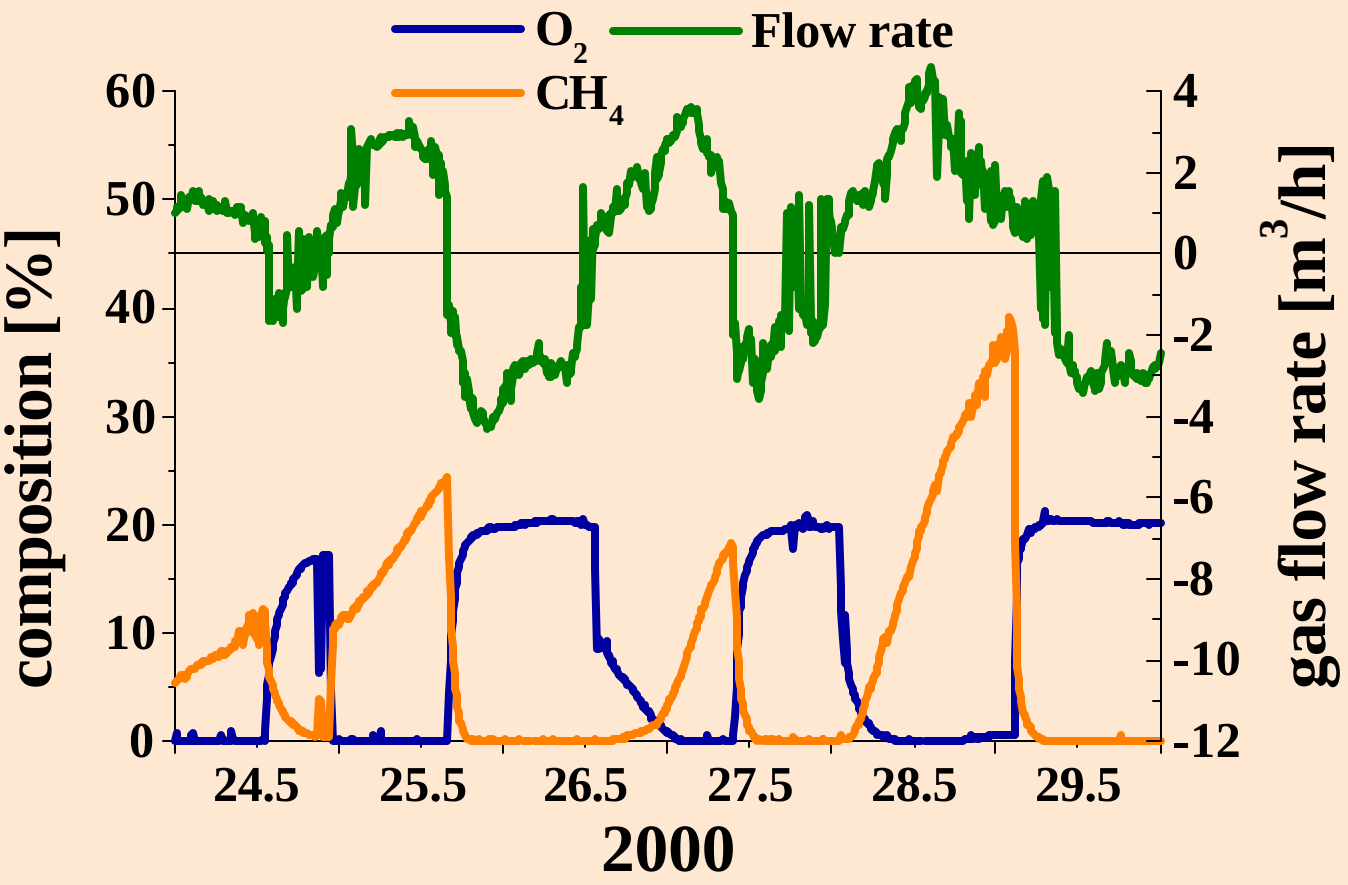
Landfill Gasemission I



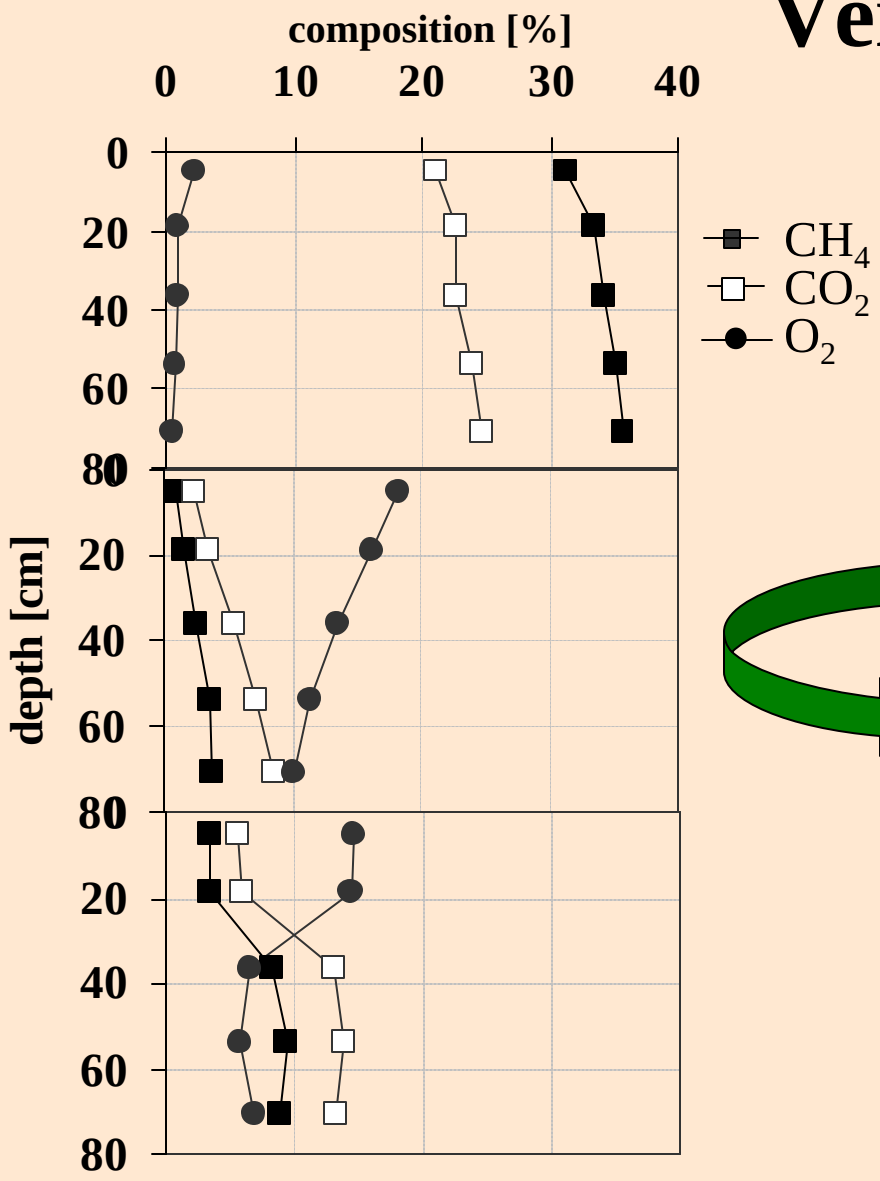
Caused by **changes in atmospheric** pressure due to

- autooscillation
- radiation
- general weather situation

Landfill Gas Emission II



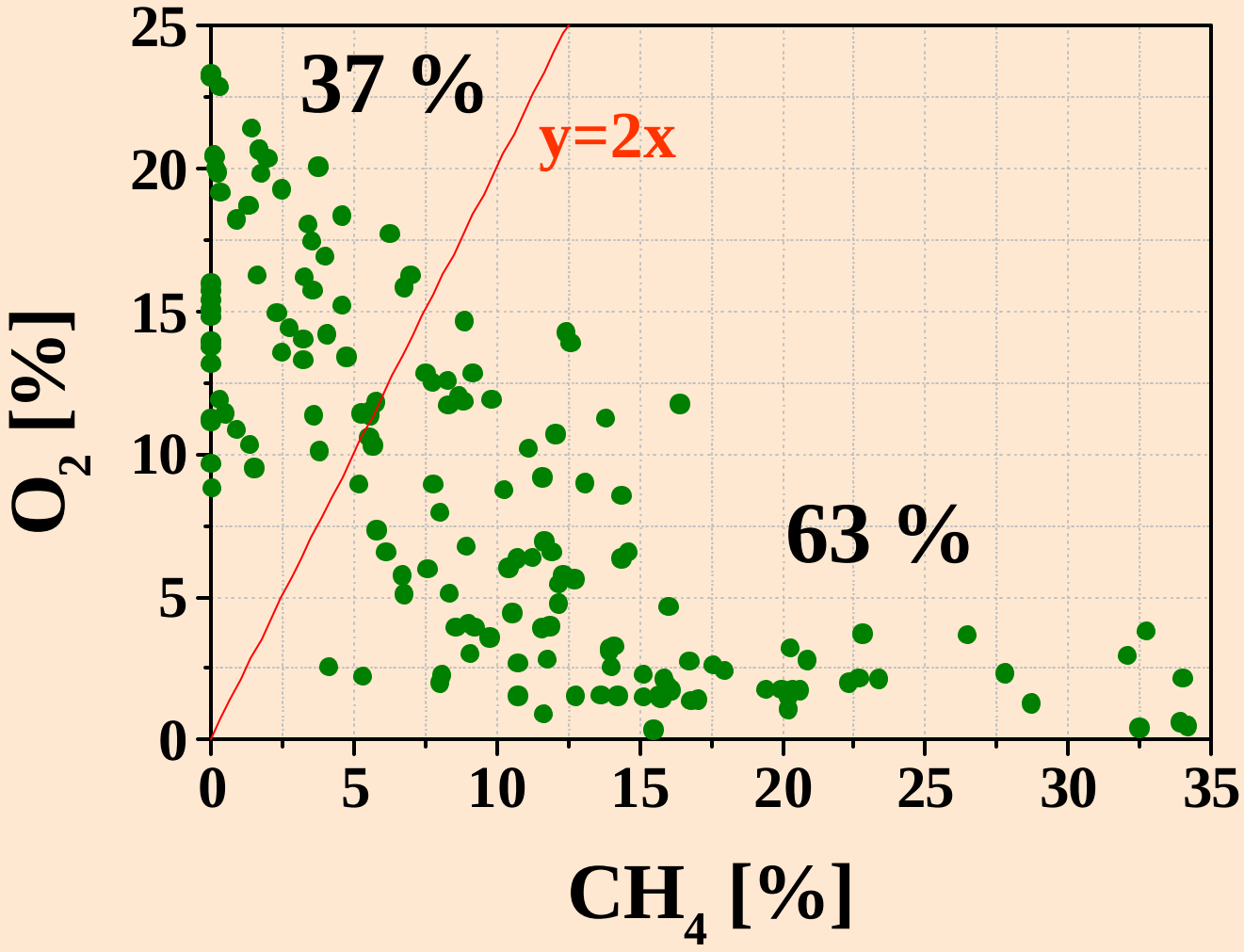
Vertical Gas Distribution



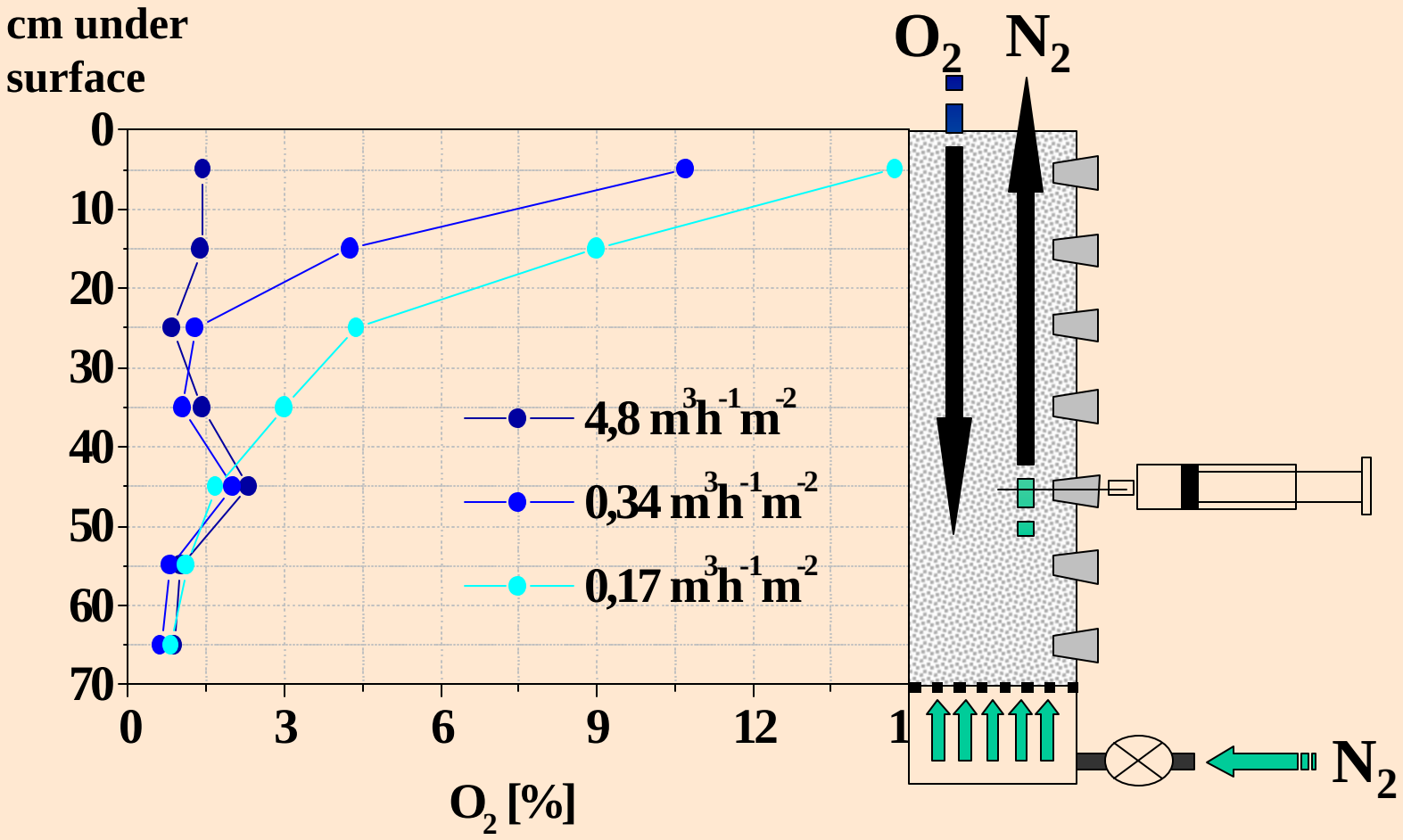
- Direction of flux
- Length of flux period
- Gas composition
- Flow rate
- Methane oxidation rate

Is diffusion via the biofilter surface sufficient to supply O_2 to the site of microbial activity?

Biofilter CH_4:O_2

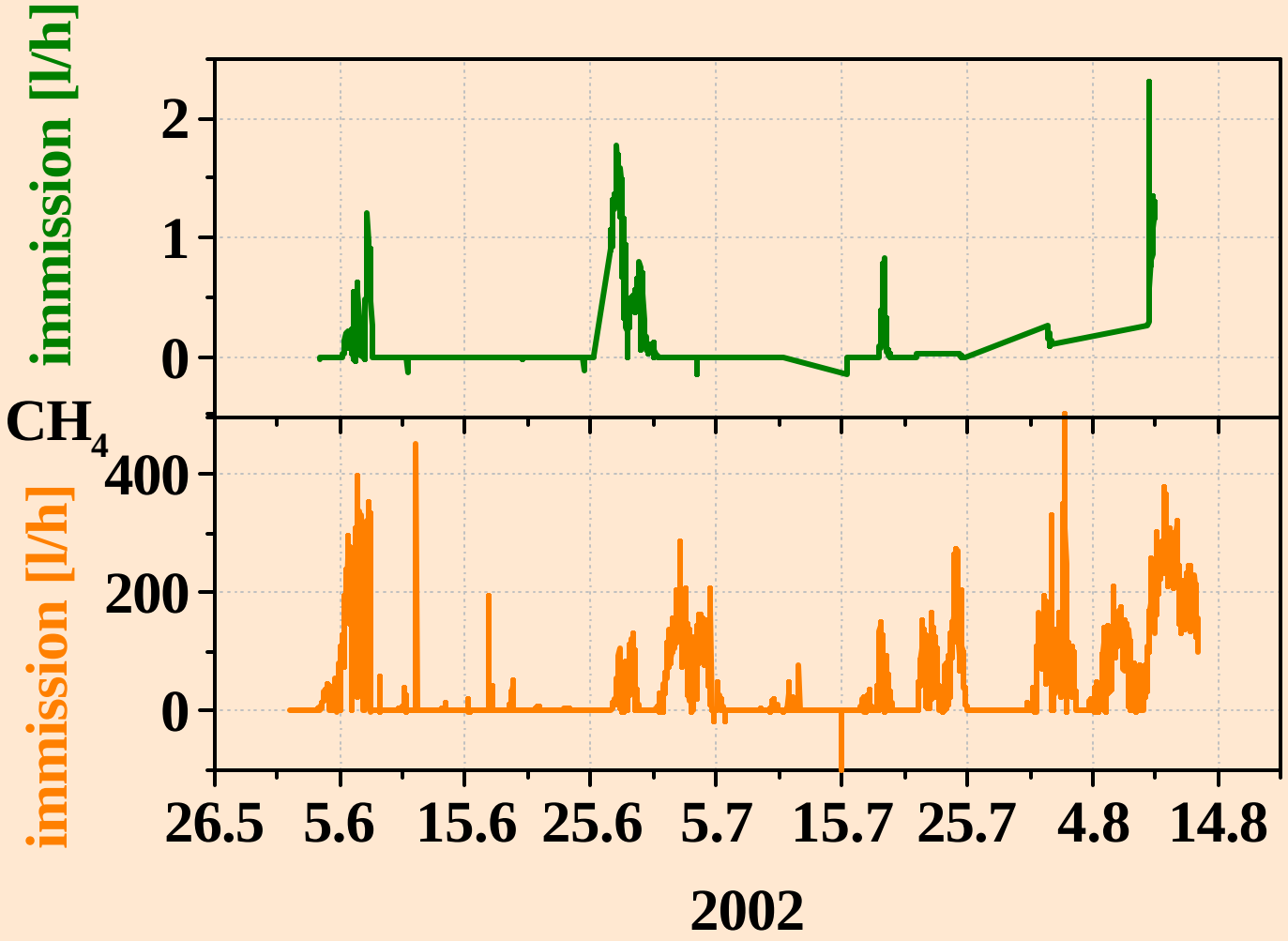


O_2 Diffusion Experiments

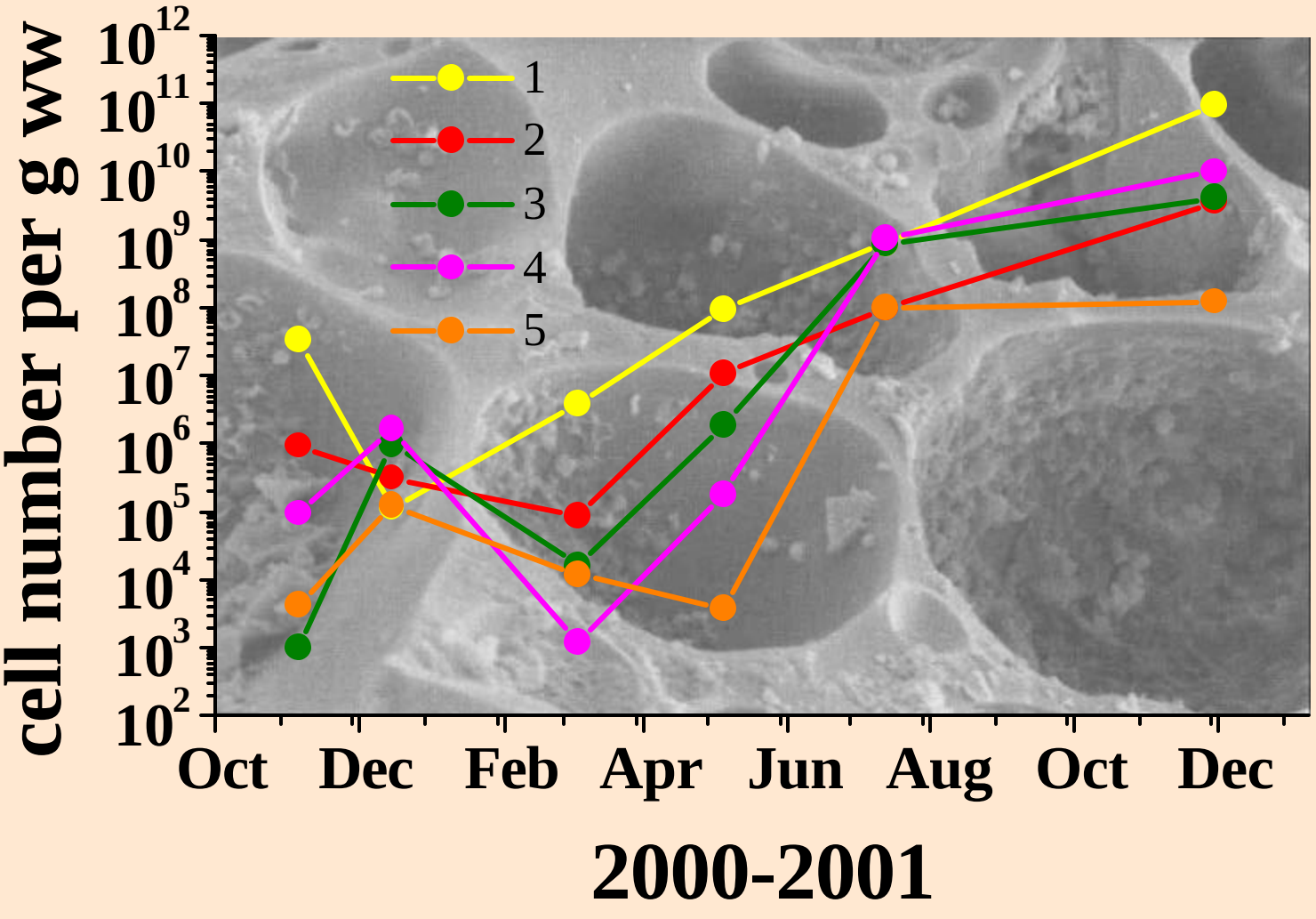


Automated Emission Measurement

Methane Oxidation



Methanotroph Counts



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Conclusions & Open Questions

Passive Ventilation & Oxygen Supply

- O_2-concentration gradient insufficient
  → change of flux direction indispensable

Methane Oxidation

- high counts of MOB
- CH_4-oxidation rate high, max 40 g h^{-1} m^{-3} (at 22 °C)

? Open Questions

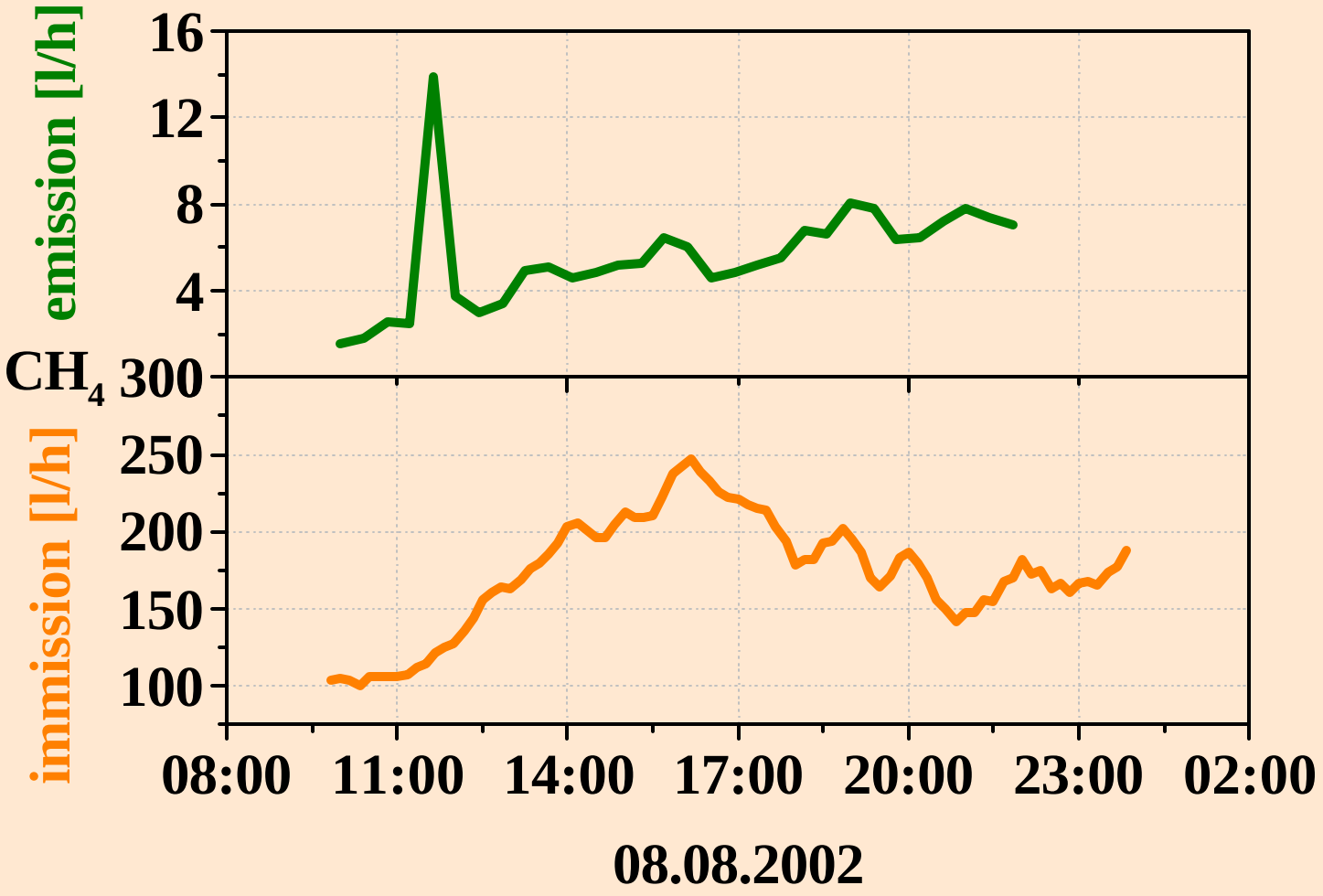
- do CH_4 and O_2 have to be present at the same time
  or is

  (1) MMO + CH_4

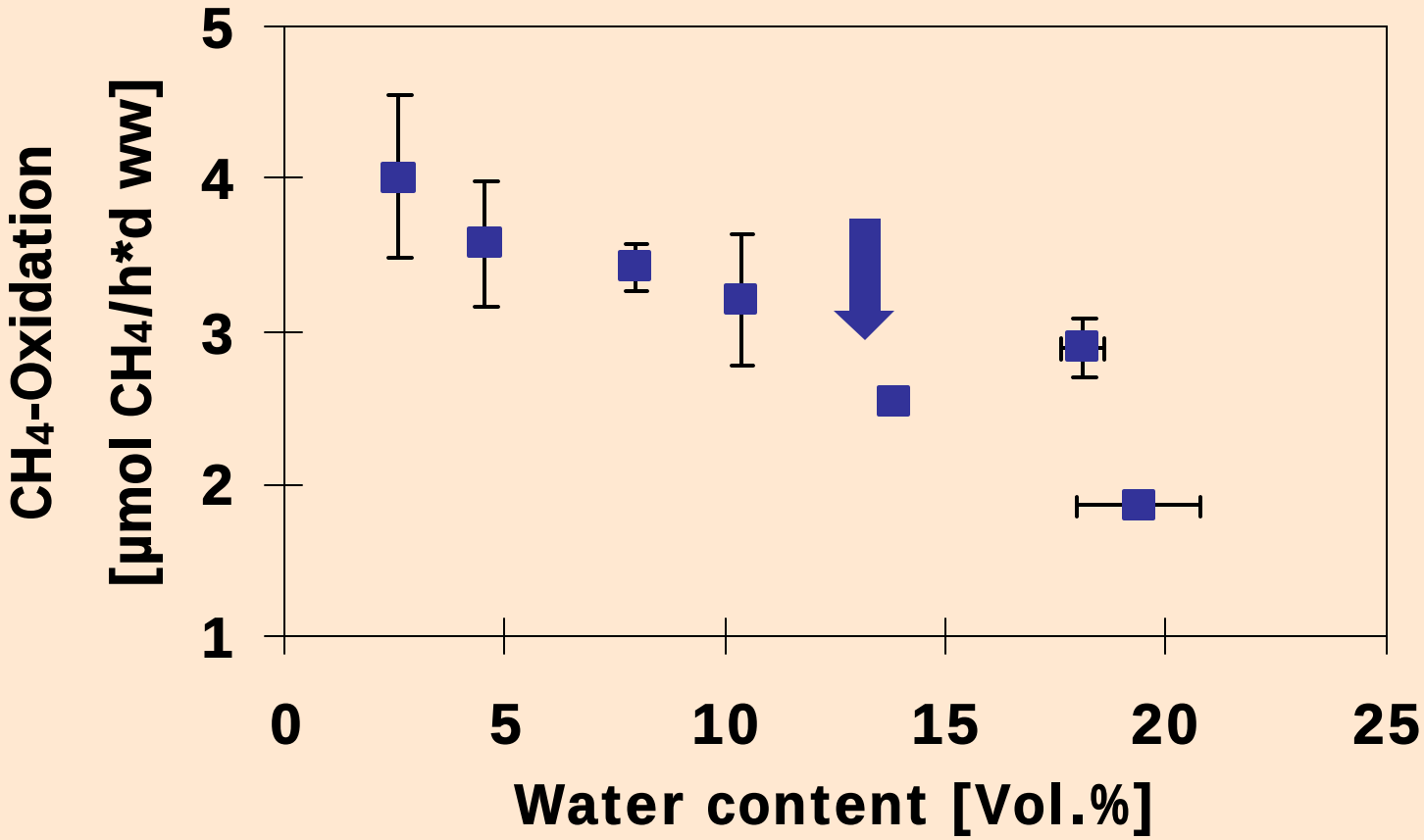
  (2) MMO-CH_4 + O_2 → (3) MMO + CO_2 + H_2O

  possible?

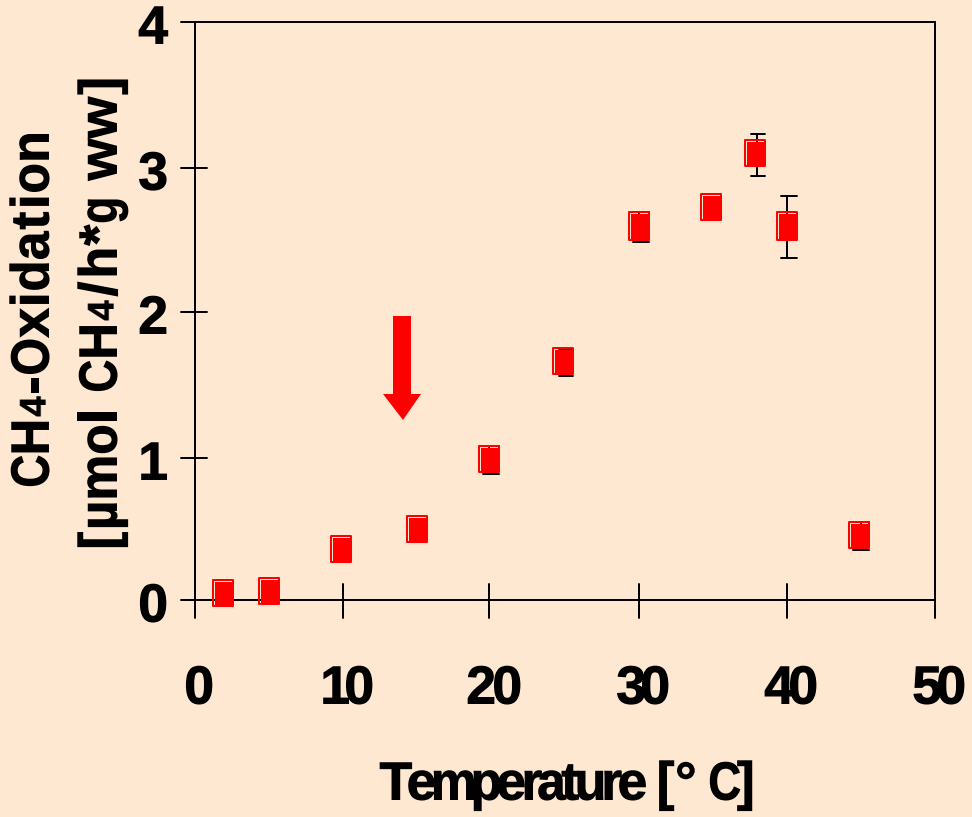
Methane Oxidation I



Methane Oxidation & Water Content



Methane Oxidation & Temperature



Methane Oxidation Kinetics