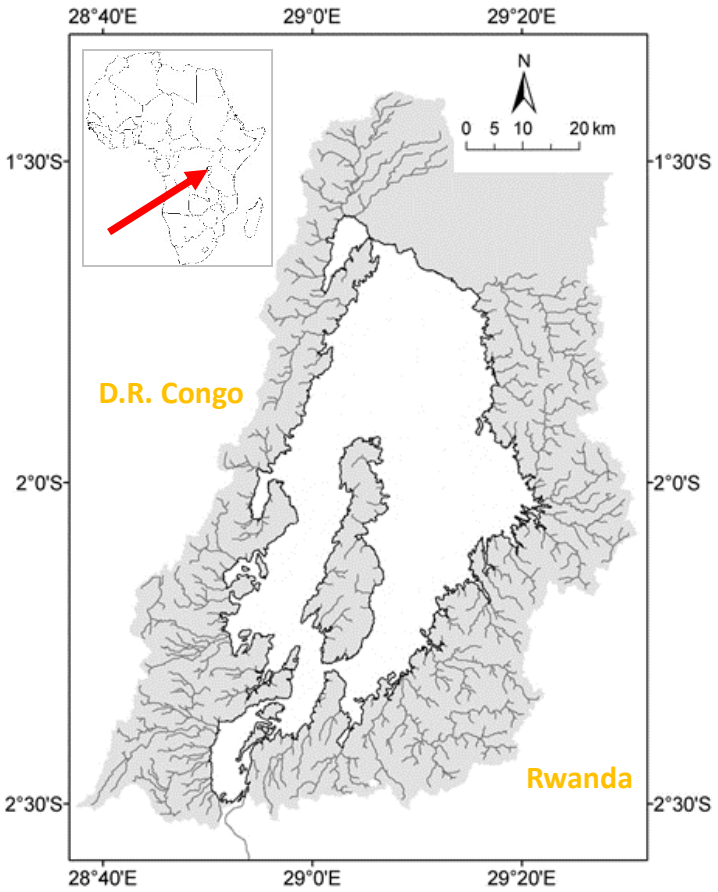
Anaerobic methane oxidation and aerobic methane production in Lake Kivu

FLEUR A. E. ROLAND, CÉDRIC MORANA, FRANÇOIS DARCHAMBEAU, SEAN A. CROWE, BO THAMDRUP, JEAN-PIERRE DESCY AND ALBERTO V. BORGES

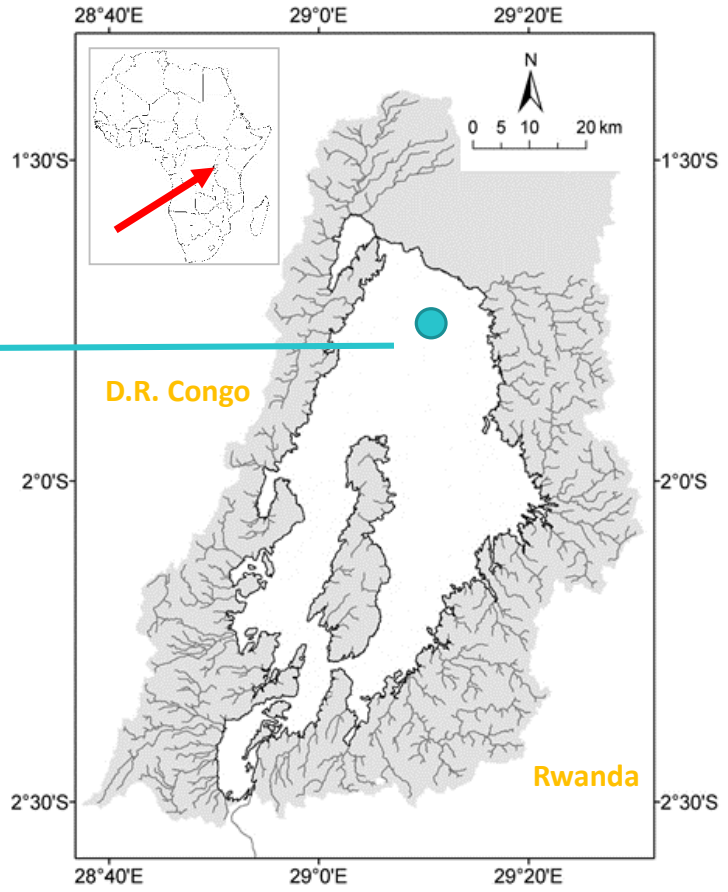
INTRODUCTION

INTRODUCTION: LAKE KIVU



INTRODUCTION: LAKE KIVU

Main basin



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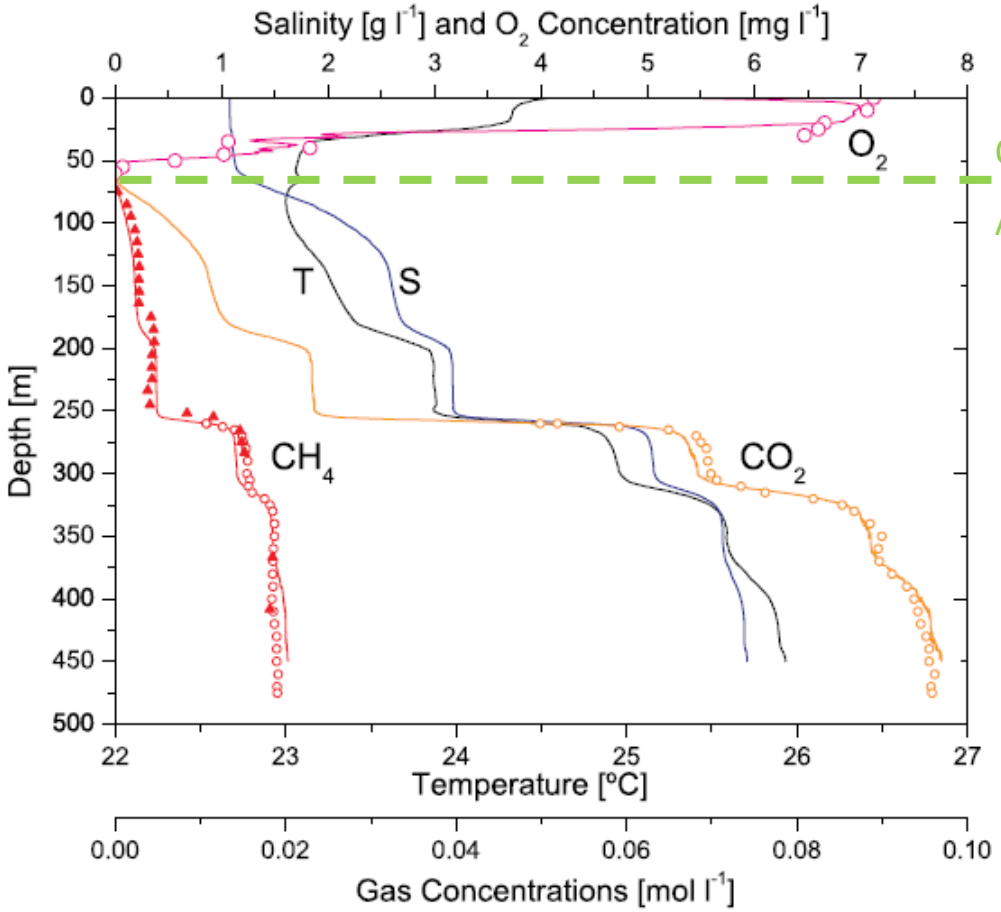

Oxic superficial waters

Anoxic deep waters

Schmid et al. (2005)

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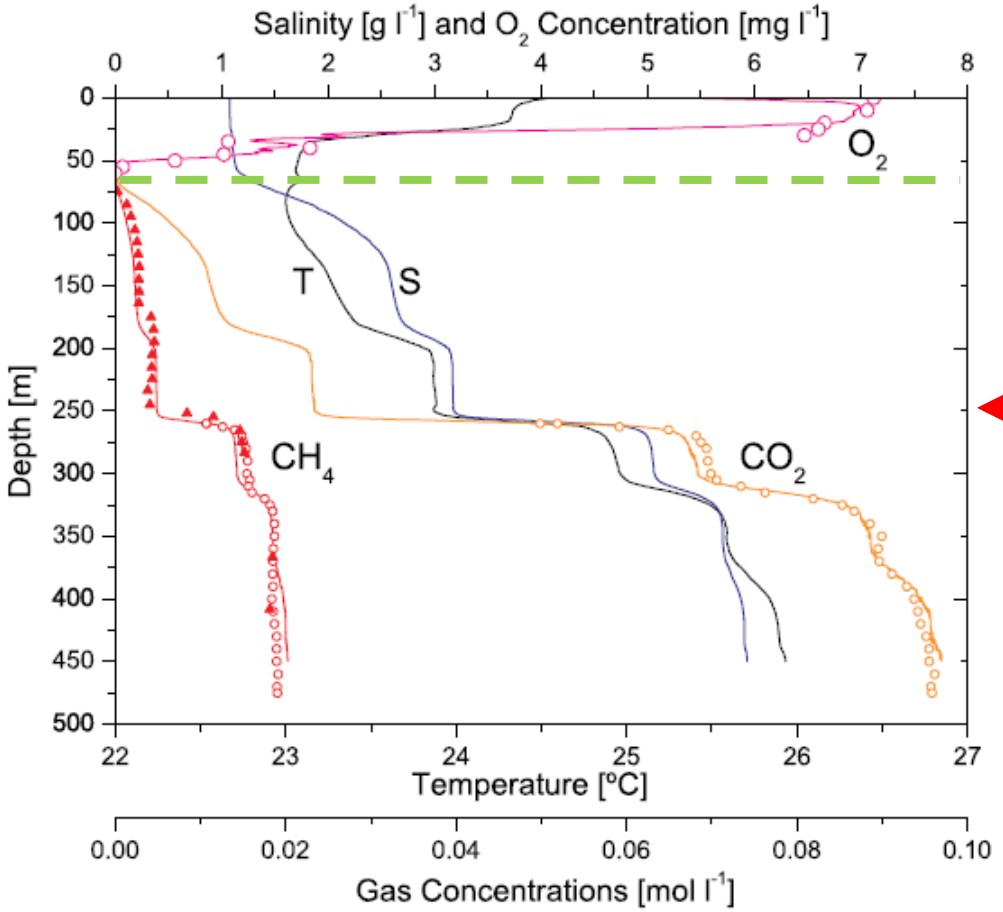

Deep hydrothermal springs

Schmid et al. (2005)

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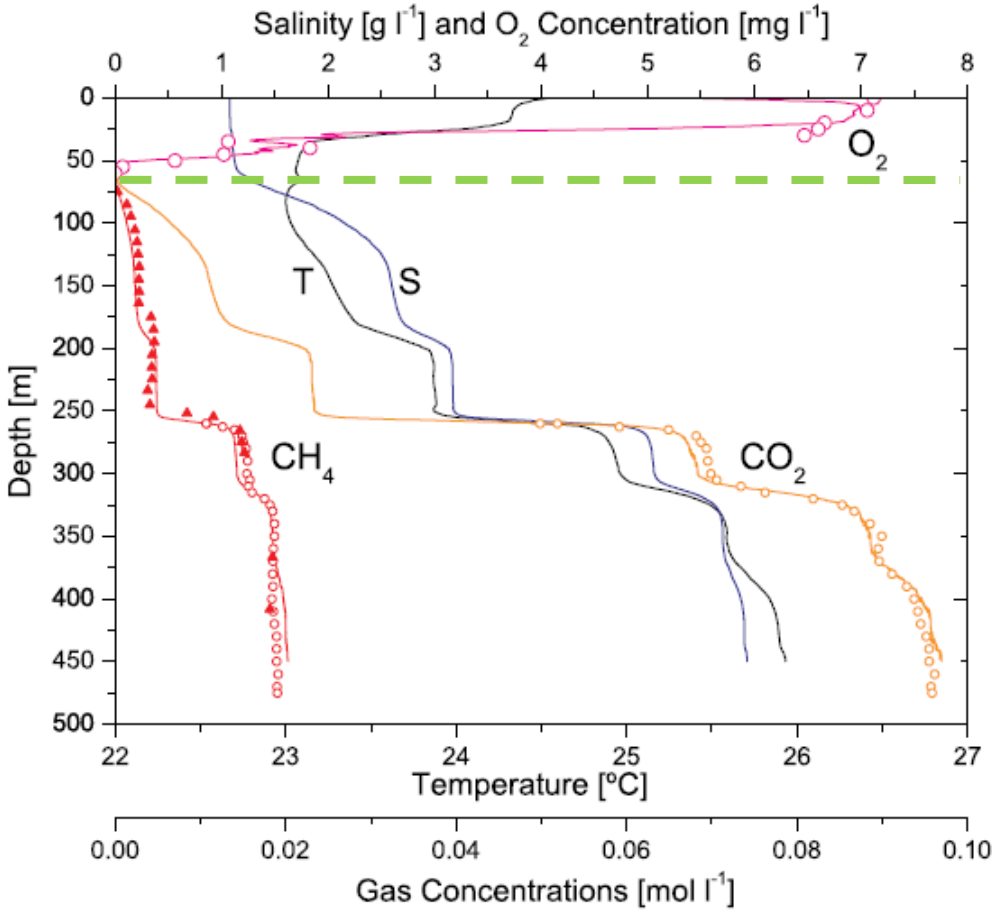

Dry season

Schmid et al. (2005)

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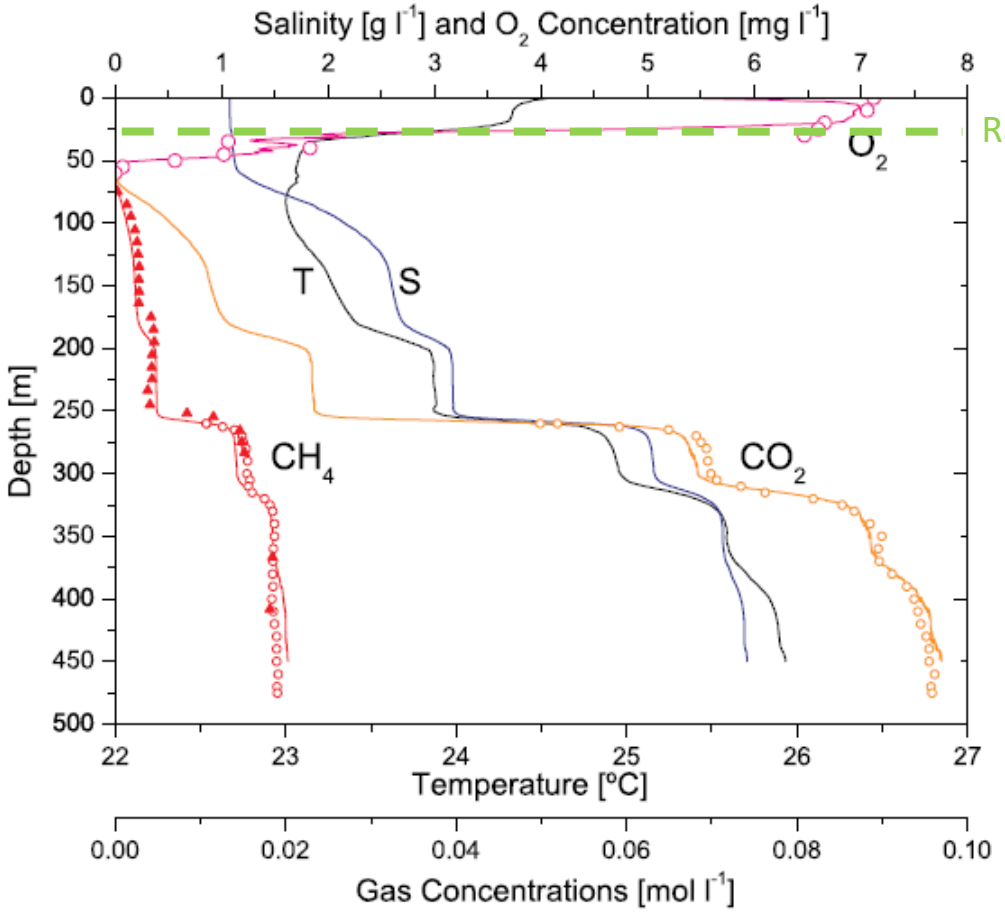

Rainy season

Schmid et al. (2005)

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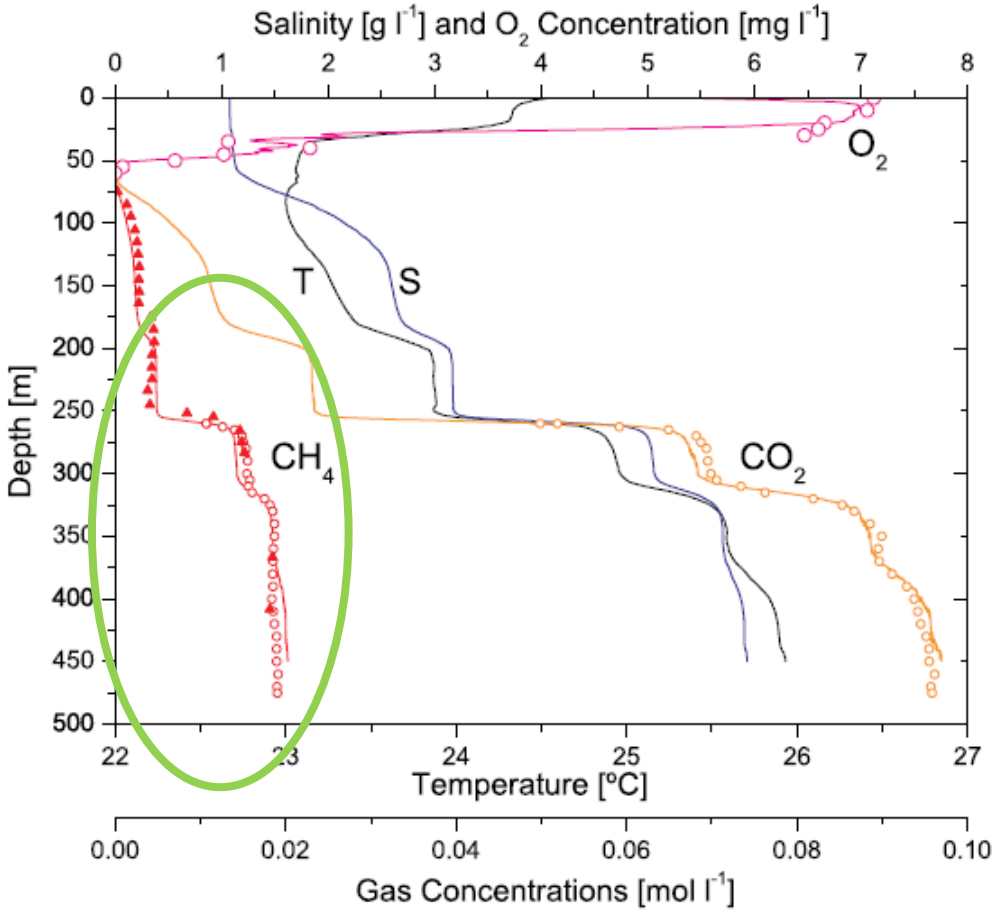

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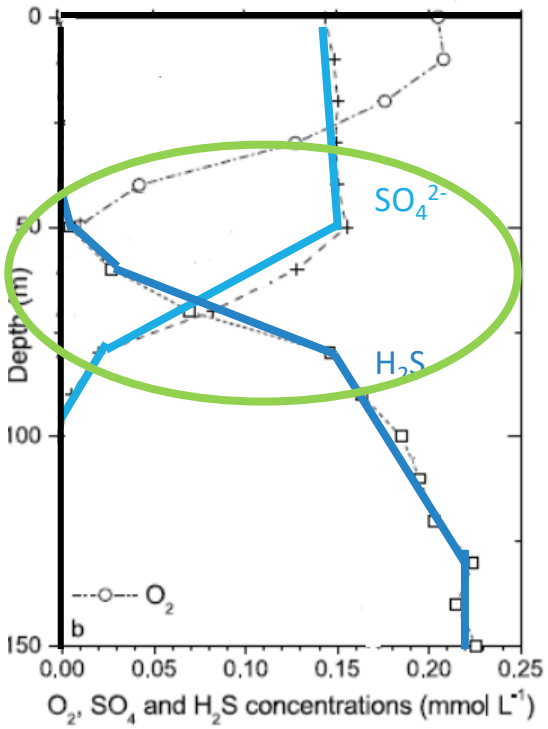

Pasche et al. (2011)

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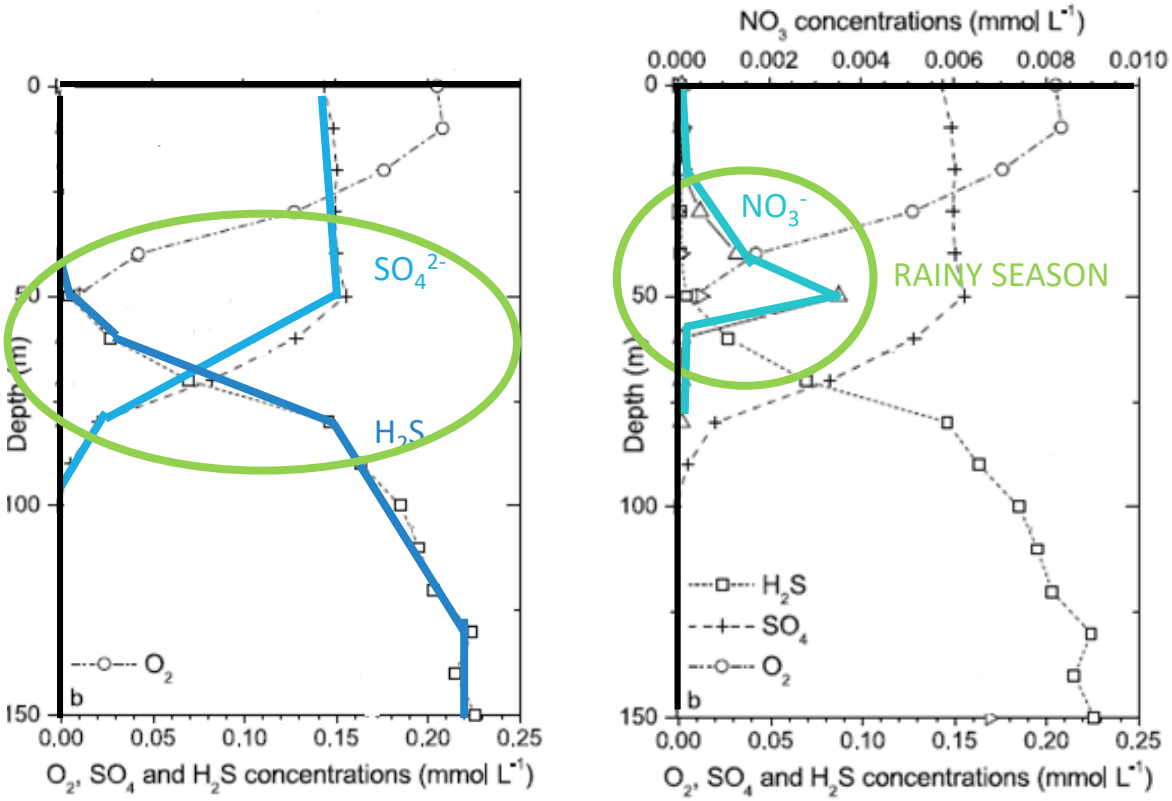

Pasche et al. (2011)

INTRODUCTION: OBJECTIVES

- To put in evidence aerobic methane production and aerobic methane oxidation in the surface waters of Lake Kivu

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- To identify the potential electron acceptors for AOM (NO_3^-, SO_4^{2-})

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- To put in evidence anaerobic methane oxidation (AOM) in the anoxic deep waters of Lake Kivu
- To identify the potential electron acceptors for AOM (NO_3^-, SO_4^{2-})
- To determine the seasonal variations of AOM

MATERIAL AND METHODS

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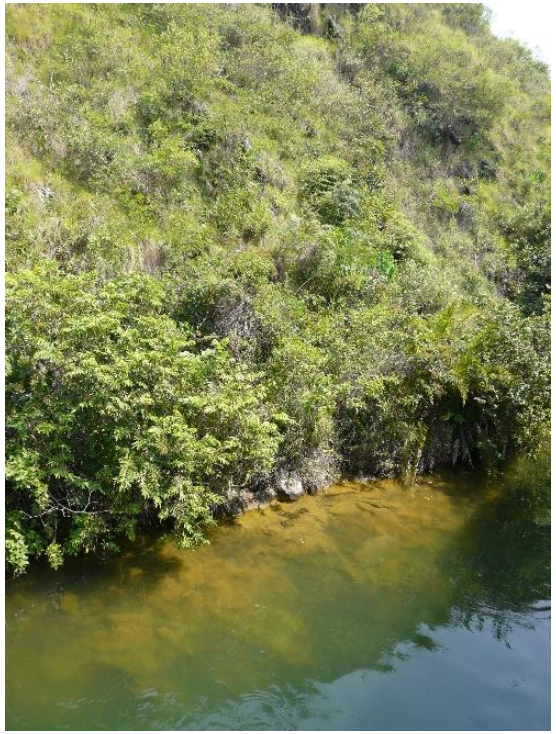
- Aerobic methane production measured by the increase of CH_4 concentrations in incubations, with the addition of picolinic acid, during one field campaign



RESULTS

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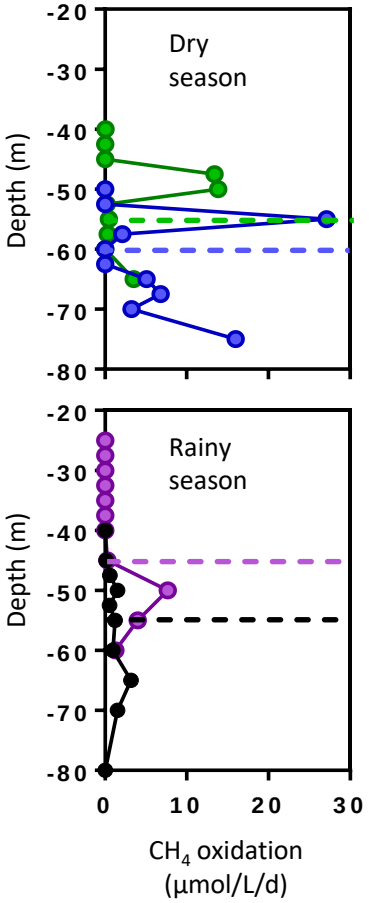

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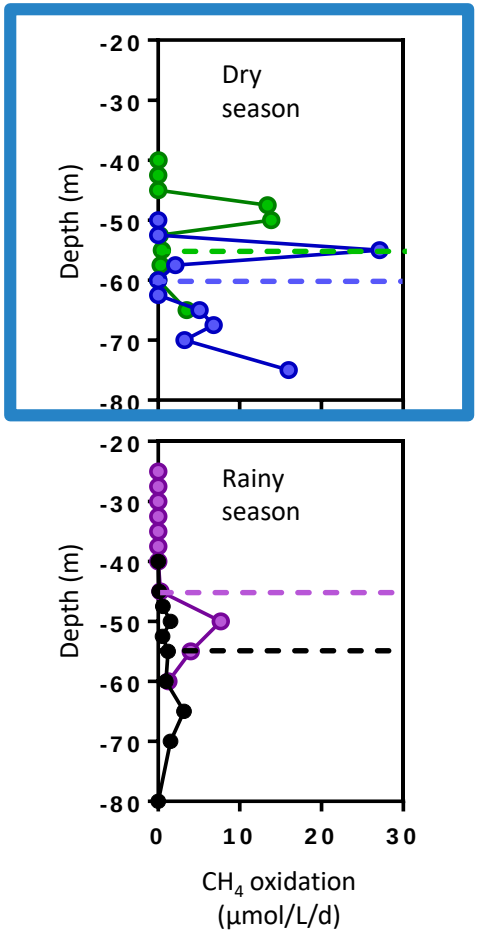

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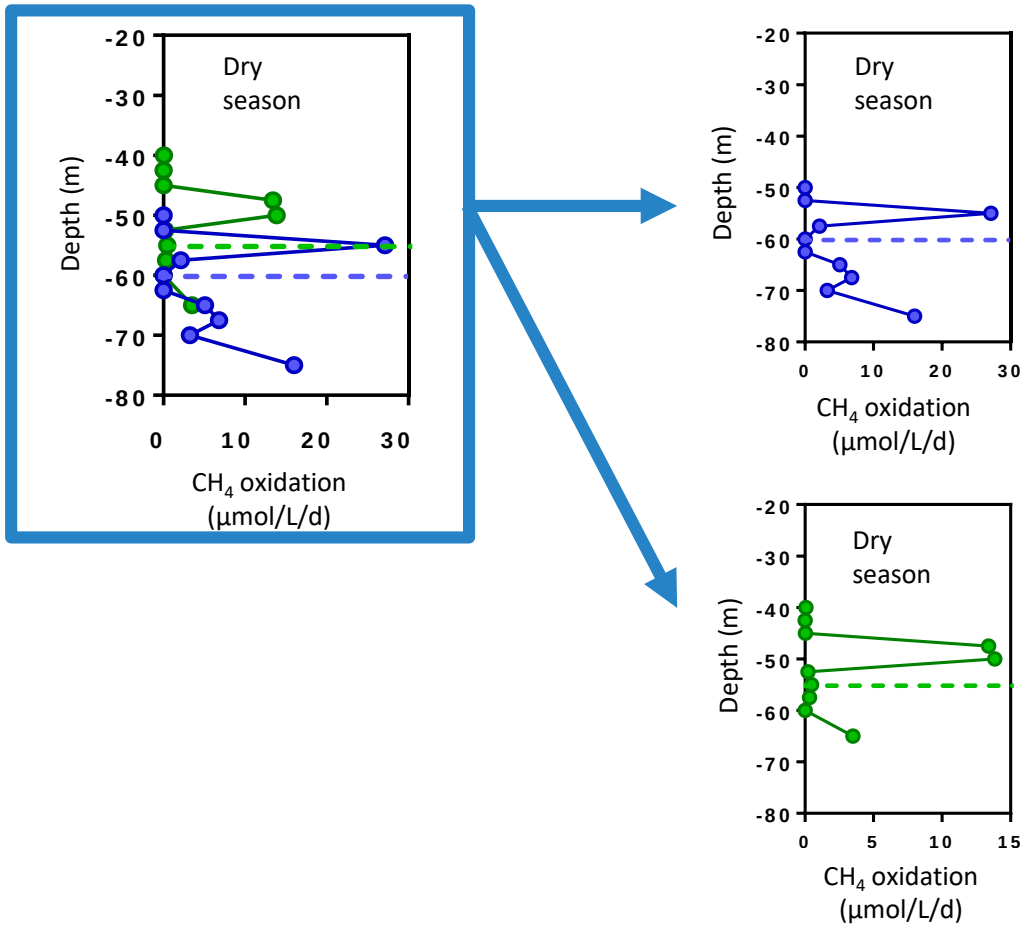

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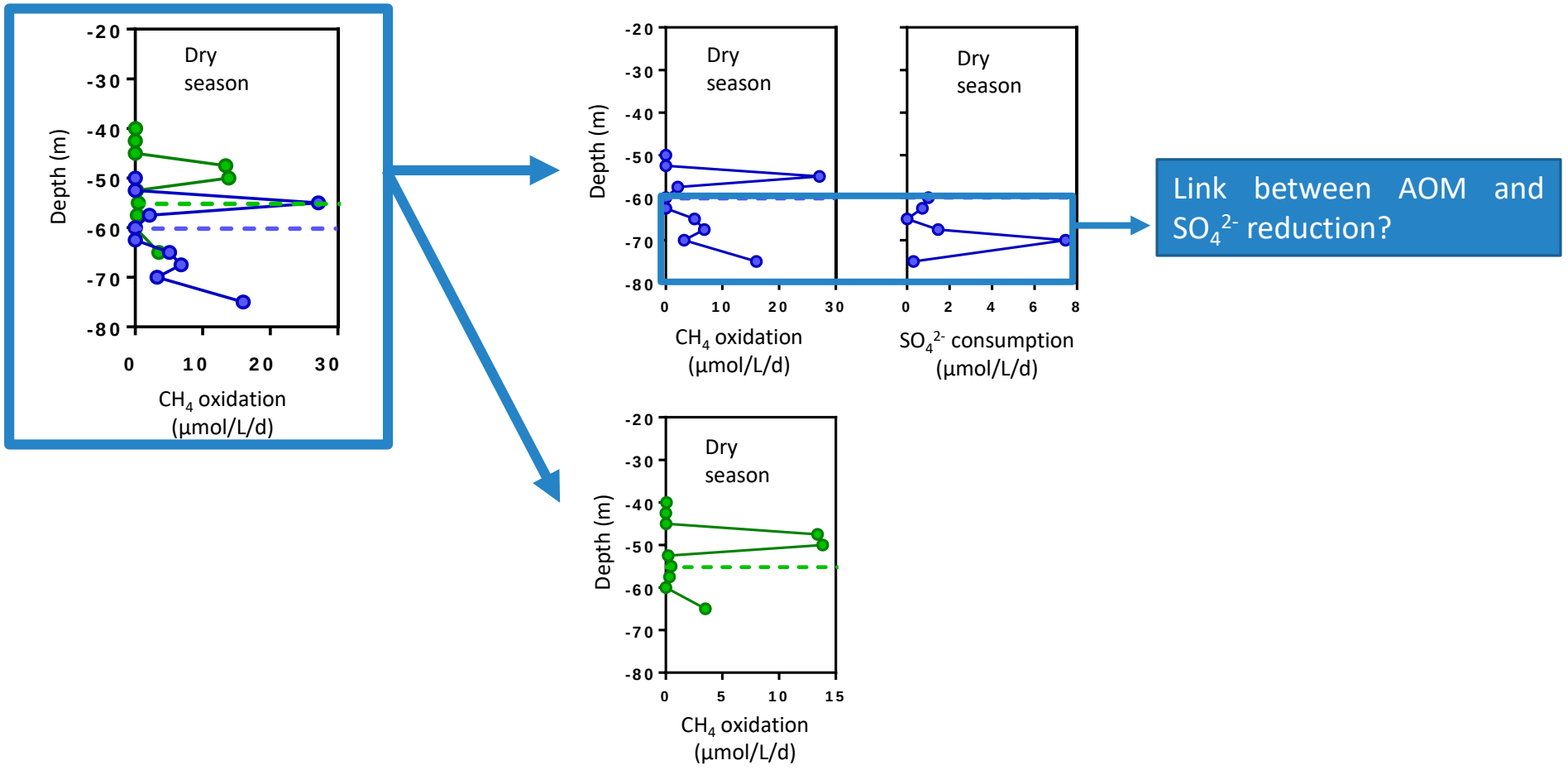

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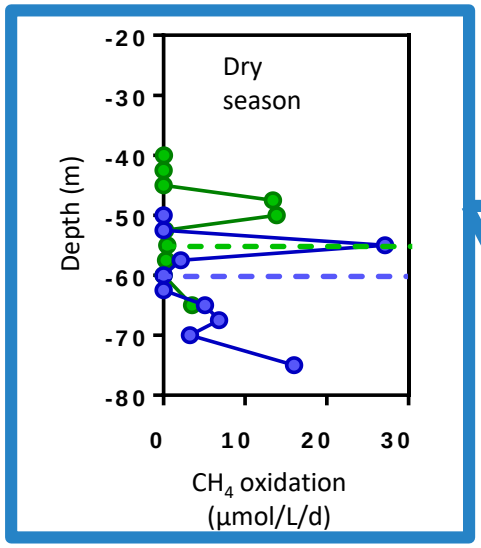
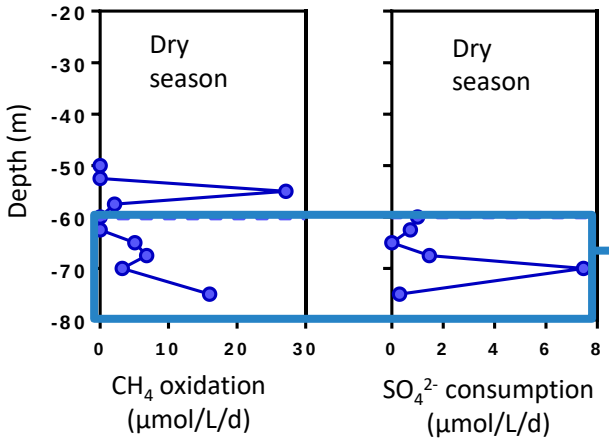
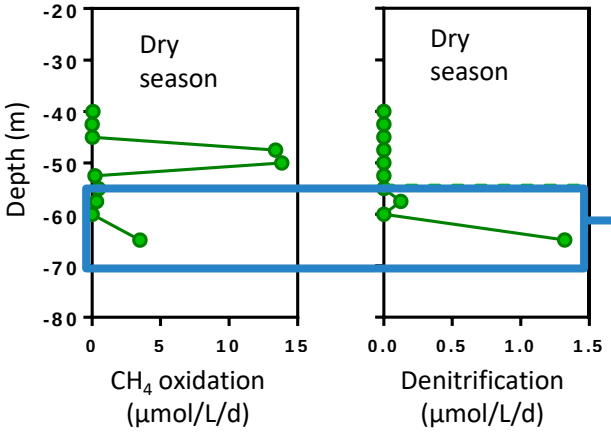




Link between AOM and SO_4^{2-} reduction?



Link between AOM and denitrification?

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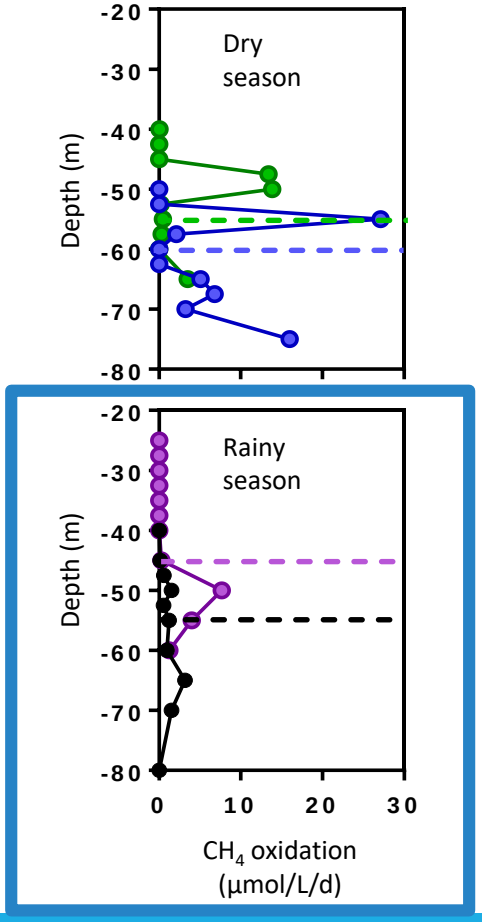

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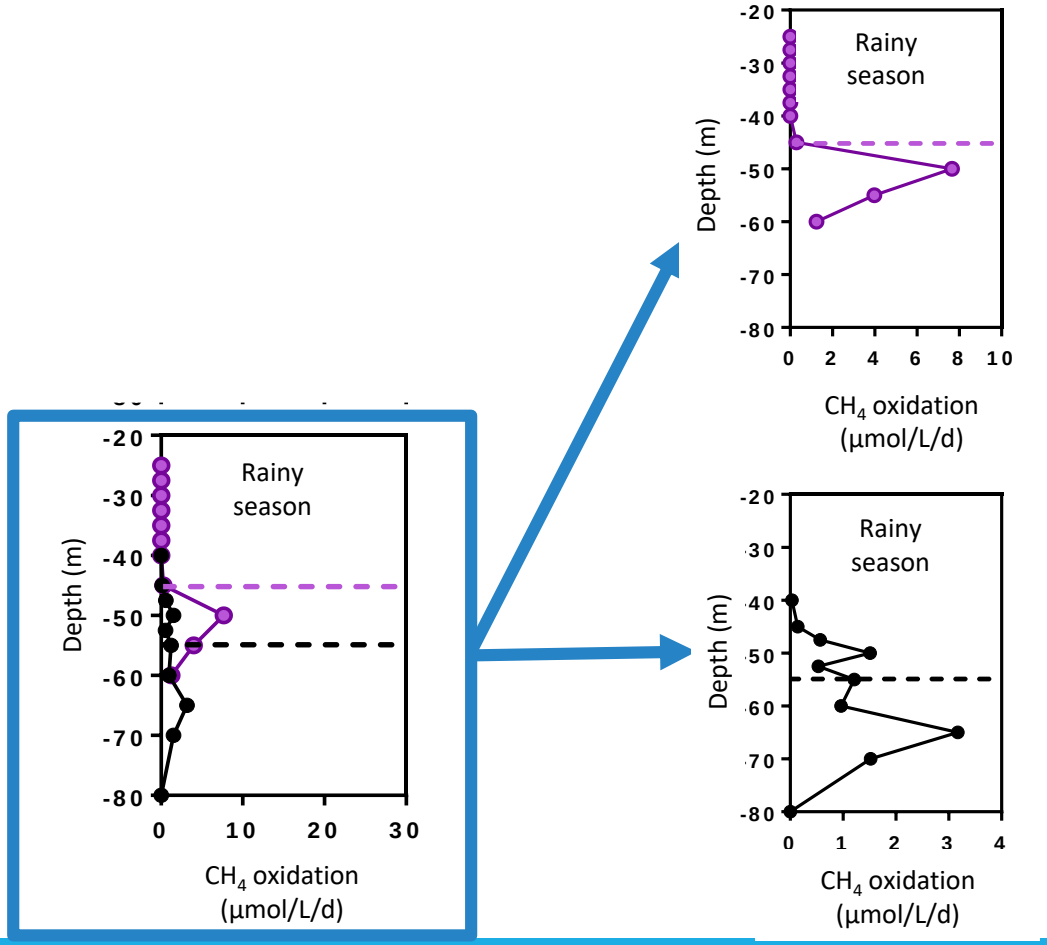

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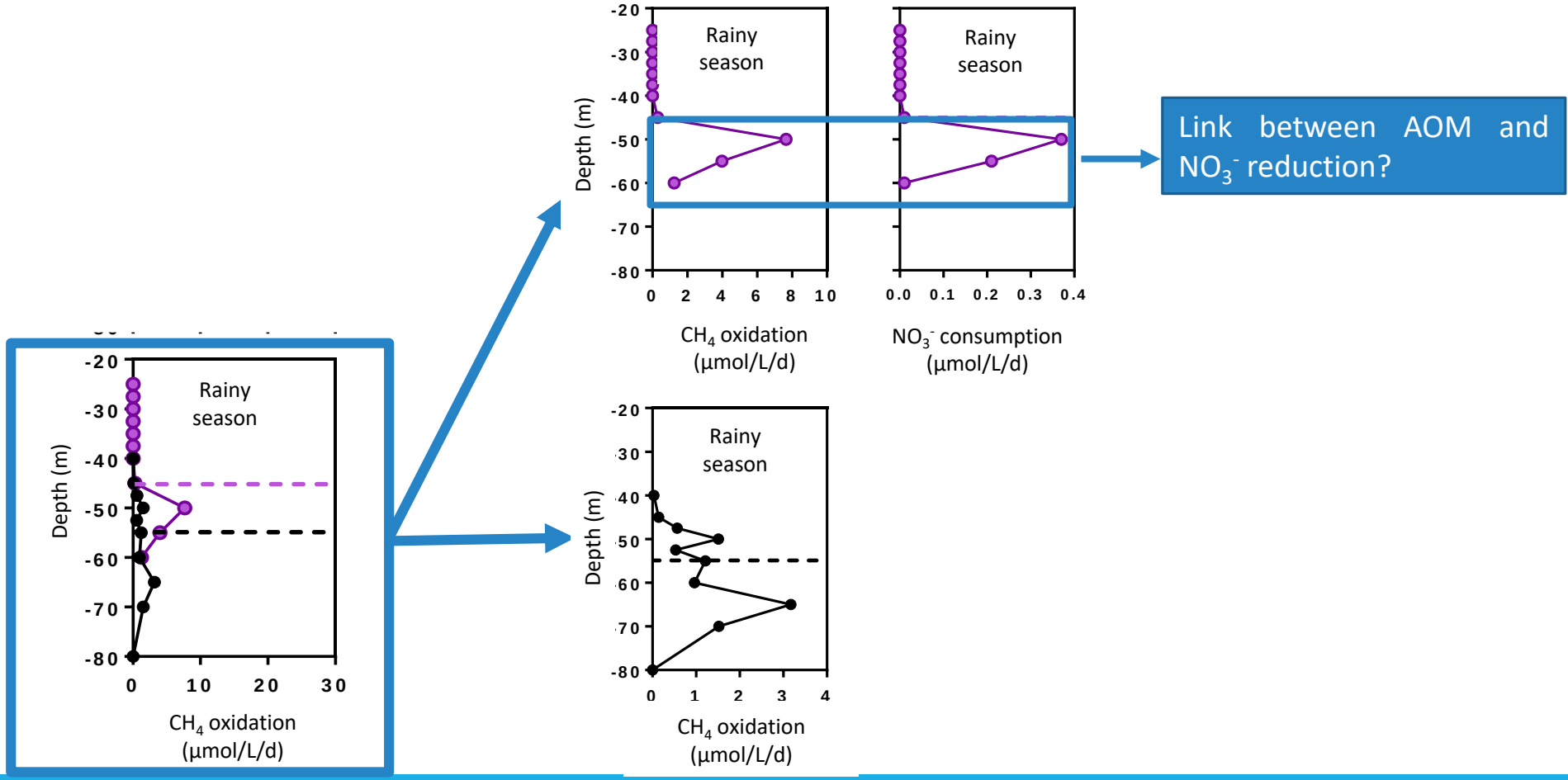

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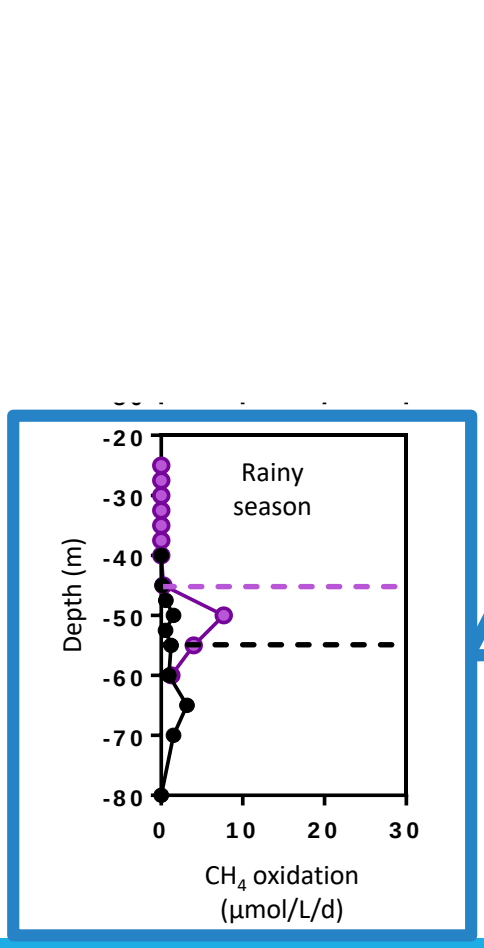
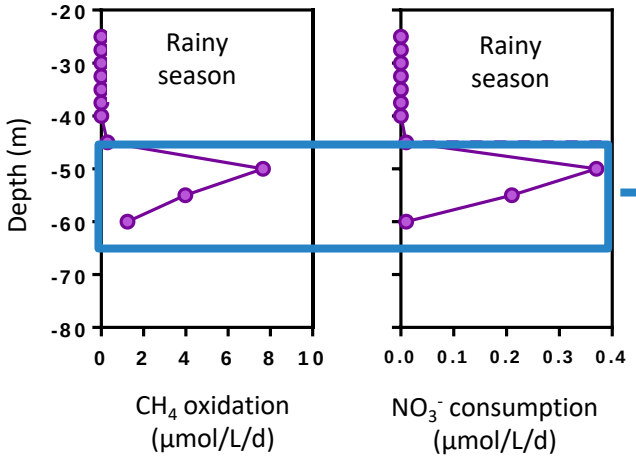
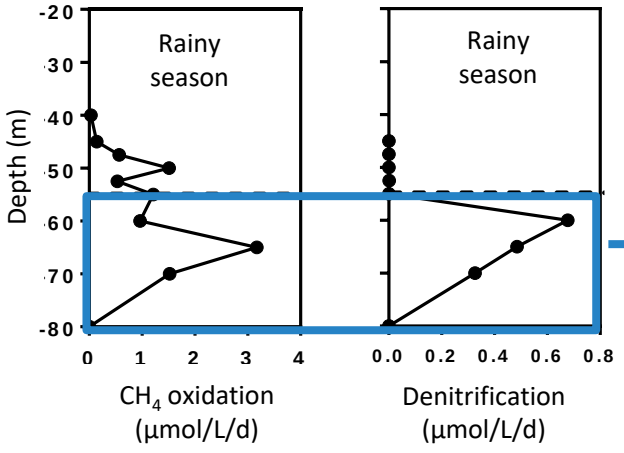


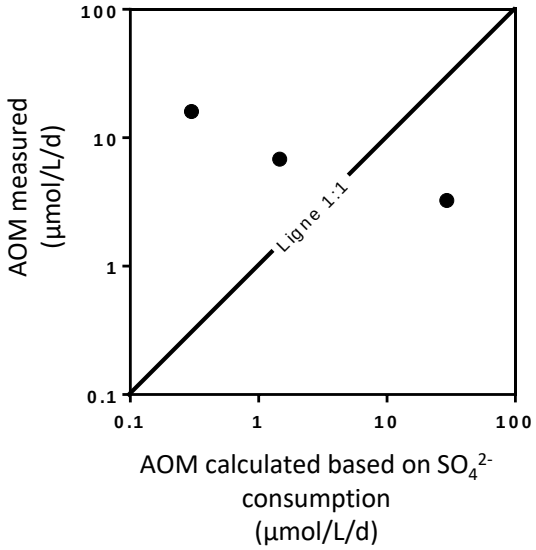




Link between AOM and NO_3^- reduction?

Link AOM and denitrification?

RESULTS: POTENTIAL ELECTRON ACCEPTORS



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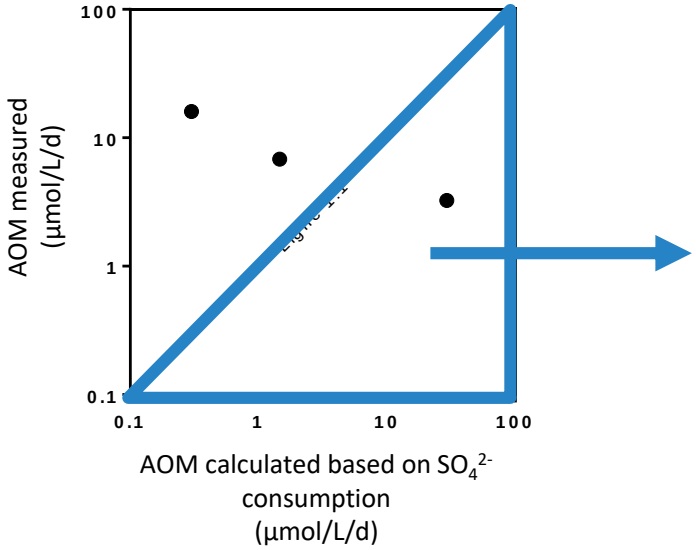

Oxidation rates measured explained by SO_4^{2-} consumption

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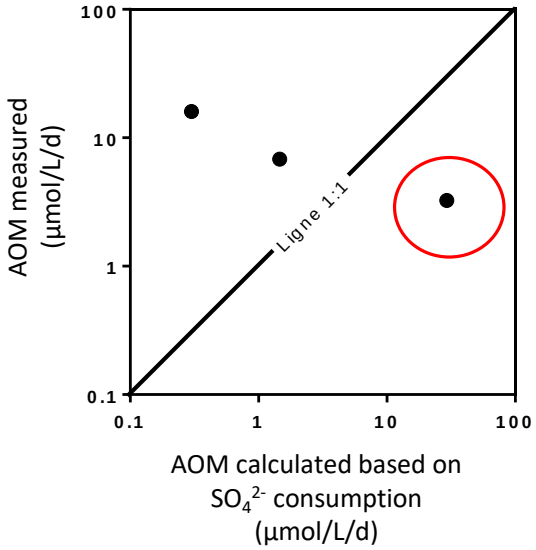

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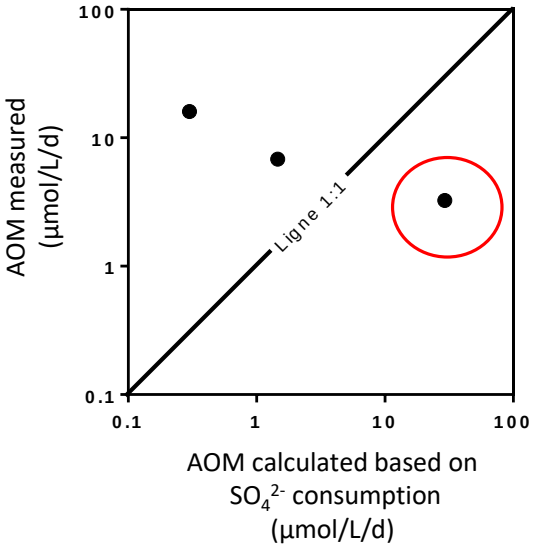

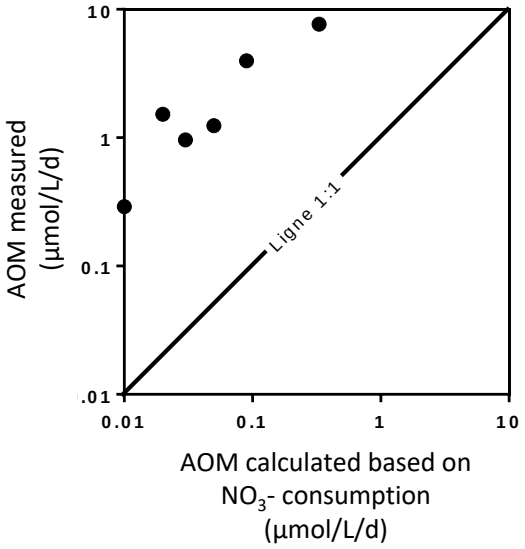

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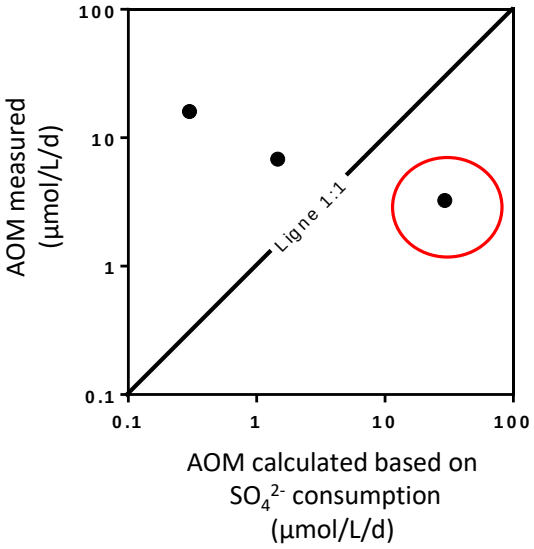
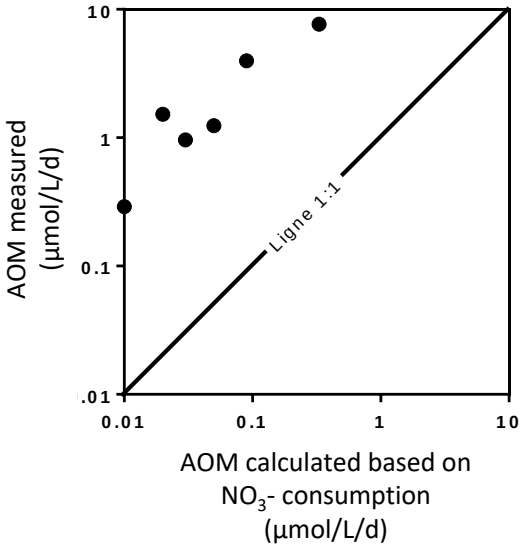
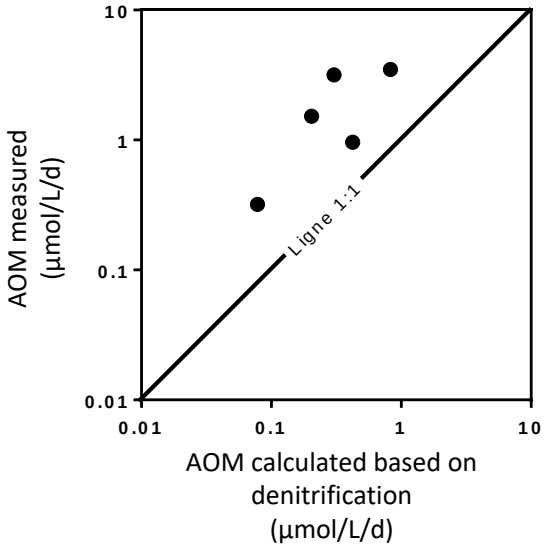
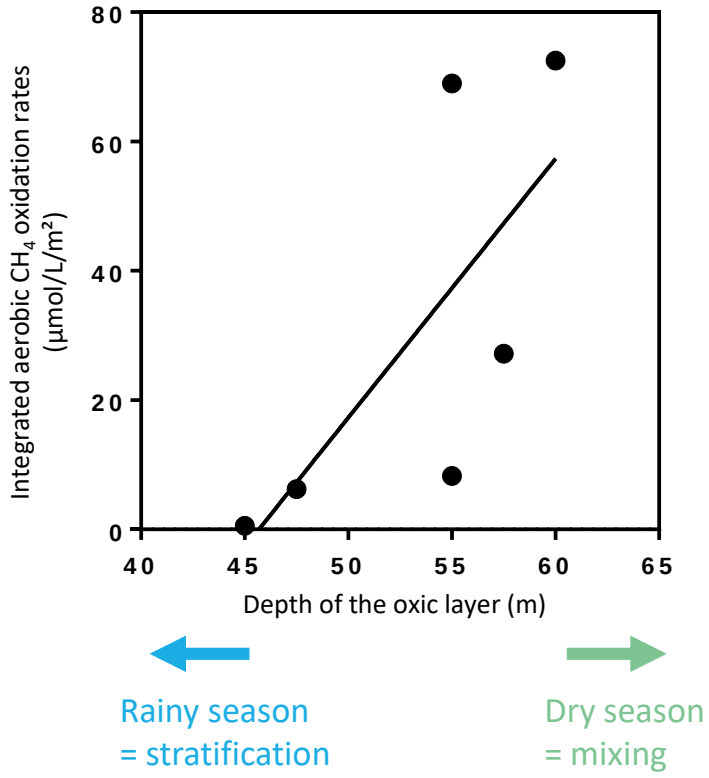






RESULTS: SEASONALITY OF CH_4 OXIDATION

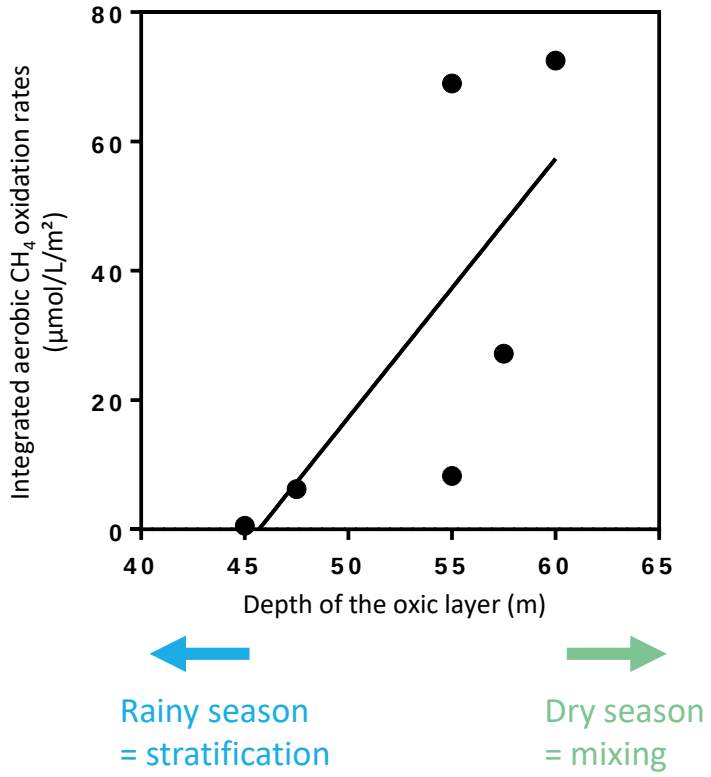


RESULTS: SEASONALITY OF CH_4 OXIDATION

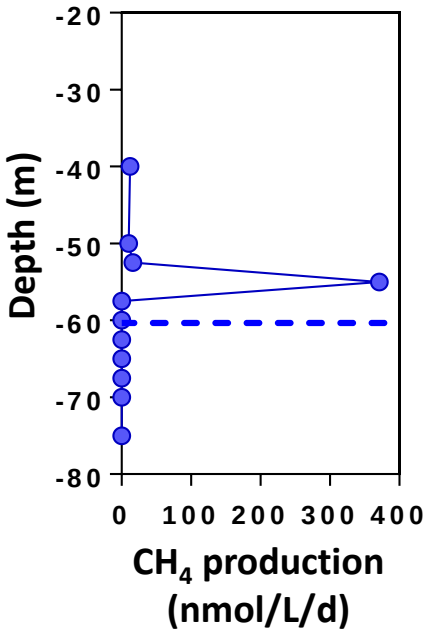
Significance of AOM compared to total CH_4 oxidation

- **Dry season: 25%**
- **Rainy season: 90%**

AOM more significant during the stratification period



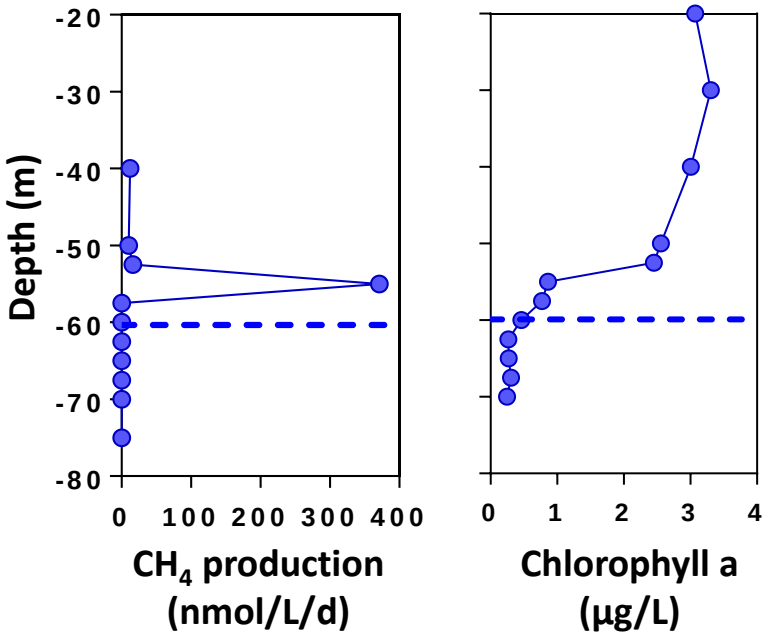
RESULTS: AEROBIC CH_4 PRODUCTION



Context: « CH_4 paradox »

Observation: correlation between production and phytoplanktonic bloom

RESULTS: AEROBIC CH_4 PRODUCTION



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- SO_4^{2-} is probably the main electron acceptor
- NO_3^- can potentially contribute to AOM in a lower extent
- A strong seasonal variability has been demonstrated, with a higher significance of AOM during the rainy season

Thank you for your attention

Study published:

FAE Roland, C. Morana, F. Darchambeau, S.A. Crowe, B. Thamdrup, J-P. Descy and A.V. Borges, *Anaerobic methane oxidation and aerobic methane production in an east African great lake (Lake Kivu)*, 2018, Journal of Great Lakes Research, doi:https://doi.org/10.1016/j.jglr.2018.04.003

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