

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2021-223

Anonymous Referee #2

Referee comment on "Long-term incubations provide insight into the mechanisms of anaerobic oxidation of methane in methanogenic lake sediments" by Hanni Vigderovich et al., *Biogeosciences Discuss.*, <https://doi.org/10.5194/bg-2021-223-RC2>, 2021

The paper by Vigderovich et al. investigated the pathways of anaerobic methane oxidation in Lake Kinneret sediments by a combination of incubation techniques, lipid and metagenomic analyses.

The authors performed a series of long-term incubations in bottles and semi-bioreactors with an array of added potential electron acceptors and inhibitors for specific metabolic processes in order to track down the dominant processes responsible for AOM. The results obtained from this study were interpreted in combination with results obtained from previous studies on these sediments. All in one, the experimental design was thorough and the use of combinations of electron acceptors/inhibitors feasible for interpretation of possible AOM pathways in these sediments.

The paper is mostly focusing on presentation and interpretation of geochemical data. The authors did perform taxonomic read and metagenomic analyses from several incubations and incubation time points, but I miss the presentation of these results in the paper. The results are briefly mentioned, but I would prefer to see a visual representation of DNA-based results in a separate section in the 'Results' section and a more thorough integration with lipid and geochemical analyses.

It was also a little confusing to see a 'black coffee' treatment, as there was no introduction or reasoning why this rather unusual substrate was used for AOM incubations. Also there was no detailed protocol on how this treatment was prepared (what fraction, concentration etc). Every treatment should be reproducible from the information provided by the paper, but here any details are lacking. So I would suggest to either remove this from the paper completely or to describe the treatments and reasoning thoroughly.

In general, the results presented in this paper are interesting and will benefit the scientific community investigating AOM in natural sediments. The paper will benefit from a more

clear structure and better visual presentation of results.