

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2021-203

Anonymous Referee #1

Referee comment on "Fractionation of stable carbon isotopes during acetate consumption by methanogenic and sulfidogenic microbial communities in rice paddy soils and lake sediments" by Ralf Conrad et al., Biogeosciences Discuss.,
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The manuscript investigated the acetate consumption under methanogenic or sulfidogenic conditions using carbon isotope fractionation and microbial composition in paddy soils and lake sediments. The main finding is that the magnitude of the isotopic enrichment factors well support the quantification of the methanogenic pathways. However, the microbial compositions could hardly serve for the prediction of the magnitude of enrichment factors. The study system and experimental approach are interesting, the manuscript reads well, the methods are state of the art, and the interpretation of the results are good. It seems little is known about the enrichment factors for acetoclastic methanogenesis and their link between enrichment factors of acetate consumption and methanogenic, sulfidogenic microbial communities in environmental samples. The lack of understanding justifies by the experiments, thus I like the general concept. The detailed comments are as follows:

Materials and methods:

Line 81: the sampling time should be 2016.

Line 119: please revise (iv) 5 ml 50 mM sodium acetate + 4.5 ml CH₃F

Line 135-146: Please add references for the primers used here.

I am a little bit confused about microbial composition analysis. please indicate how many replicates were used for the paddy soil and lake sediments. For the lake sediments, why used the original sediment not the incubated sediment? Maybe it is necessary to explain

why used different temperatures for paddy soil and lake sediments incubation.

Results and discussion:

Line 234: the enrichment factors were calculated from the Mariotti plots. The authors should explain why the enrichment factors for NE- and SW-buffer did not show in Fig. 3

Line 335: the composition of methanogenic community in the absence and presence of sulfate was quite different between the lake sediment and paddy soil. For instance, in the paddy soil, the relative abundance of Methanosaetaceae and Methanocellales increased, while the relative abundance of Methanosarcinaceae decreased in the presence of sulfate. In particular, methanocellales harbored the same trend with Syntrophobacteraceae in the Vercelli soil. These results should be mentioned in the discussion. Any correlations between this phenomenon and enrichment factors?