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Biogeosciences Discussions

Interactive comment on "Acetate turnover and methanogenic pathways in Amazonian lake sediments" *by* Ralf Conrad et al.

Anonymous Referee #2

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The manuscript by Conrad and coauthors describes investigations of acetate turnover, and the relative importance of methanogenic pathways (acetoclastic vs hydrogenotrophic methanogenesis) in Amazonian lake sediments. The data present here using radiotracer approach are compared to a parallel study (Ji et al. 2016) conducted with 13C tracer for the incubations of same sediments. The authors found that a large fraction of acetate was oxidized to CO2 rather than reduced to CH4. This was interpreted as the syntrophic oxidation of acetate coupled to hydrogenotrophic methanogenesis. While this study is interesting and relatively novel, I have several comments that need to be addressed:

1) The comparison between different methods, rates analyses, incubations is confusing, because of the lack of detailed information on the calculations, method descriptions

etc.

2) The authors suggested the oxidation of acetate could be attributed to the presence of organic but not inorganic electron acceptors. It seems the original sediments contain ~mM sulfate (>30 μmol/g at A2) according to Ji et al. 2016. Since acetate can be used by sulfate reducers, I wonder if the authors measured the sulfate concentration after preincubation and if sulfate was completely depleted or not.

3) The turnover of acetate was very fast (Fig. 3C) and RI was much higher than 0.2, suggesting that much of acetate was oxidized to CO2. But this did not necessarily mean the syntrophic oxidation of acetate coupled to hydrogenotrophic methanogenesis. Alternatively, the oxidation of acetate and hydrogenotrophic methanogenesis can be two separate and independent processes. 14CO2 produced from 14C-acetate oxidation could be further converted to 14CH4 via hydrogenotrophic methanogenesis. I think it is possible to estimate the importance of this process based on the turnover of 14C-acetate to 14CO2 and the turnover of 14HCO3- to 14CH4.

Specific comments

Line 4: "aceticlastic" or "acetoclastic"? Both have been used, not sure which one is more often.

Line 107-108: Please specify how fH2 and kac were calculated so that the readers do not need to look for the reference.

Line 135: Should be Fig. 4B. Fig. 4A showed total methane vs methane from acetate.

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2019-411/bg-2019-411-RC2-supplement.pdf

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