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Biogeosciences Discussions

Interactive comment on "Direct O_2 control on the partitioning between denitrification and dissimilatory nitrate reduction to ammonium in lake sediments" *by* Adeline N. Y. Cojean et al.

Anonymous Referee #1

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The article by Cojean et al deals with the effect of oxygen concentrations on the partitioning between denitrification and dissimilatory nitrate reduction to ammonium in a lake sediment. The study uses stable isotopes in anaerobic slurries amended with increasing concentrations of oxygen to measure potential rates of the different processes.

I have several methodological and interpretation questions. Also I think the data could be used to obtain more information in the processes studied. many of the questions left open are supposed to be in another article in prep (Cojean in prep). Maybe the authors should consider to include these data here.

More details comments can be found below.

L74. "aquatic", you mean limnetic?

L89. "ventilated", waters are oxygenated but not ventilated

L97-99. How do authors explain the presence of nitrate under anoxic conditions?

L102. At which temperature was the profiling made?

L104. How were the cores sectioned ? Under N2 or normal atmosphere? Please add information on time, temperature and xg of centrifugation.

L109. I understand that all manipulations were performed under normal atmosphere.

L111. Can you provide a reference for the artificial lake water?

L115. Flushing and preincubating overnight have an impact on the presence of other gases (N2O, CO2 etc) as well as on the availability of labile organic matter, both dissolved and particulate. A comment on these limitations of sediment slurries should be added in my opinion.

L117. No information on how much nitrate was added is given. How does it compare to the natural concentrations? If the concentrations used are not saturating for the enzymes in question, relative rates can be dependent on the enzymatic kinetics of each process.

L118. Details should be added on how the duration of the experiments and time points were determined. Was it based on the oxygen evolution? On some previous experiments? How did the authors know in advance that the incubation should last approx 10 h?

L121. Any particular reason for the difference in the compensation method? If transfer of liquids was performed under normal atmosphere how did the authors account for any oxygen contamination? How were samples poisoned to prevent microbial activity?

L125. Monitoring of O2 concentrations was possible with the optode spots. It is important to know the degree of the "marked decline" was observed and have an estimate of the possible effect on the rates (by looking at the corresponding N species concentrations).

L132. Gordon reference is missing.

L140. Did the authors measure organic carbon content which is an important factor in the partitioning between DN and DNRA?

L147. Rates were determined based on initial and final data? or regressions over time?

L162. Maybe I missed it somewhere but I did not find any statistical analysis of the data.

L169. The profiles do indeed indicate that the surface sediment of the Figino is less active at the surface than further below. Any reason why? However, the profiles of nitrate do not indicate directly that the sediment acts as a sink given that nitrate and nitrite microprofiles occur same as for oxygen at a mm scale.

L180. A treatment with ATU to block nitrification would have clarified many of the issues mentioned here.

L185 & table 1. Rates of 1.1 umol N g d are very low and probably close to the detection limit of the methods used. Data on detection limits should be added in M&M. This is critical when standard error of 6 replicates is 130% of the mean value.

L192. The authors could take advantage of their data and provide kinetic rate data calculations to allow for easier comparisons with other studies. Also given the big dispersion of the data it would also provide more quantitative information on the differences between sites and processes. Error of percentages should also be provided L196.

L214. reduced should be consumed. There is a strong discrepancy as the authors mention between the budget and the order of N species transformations based on stable isotopes and total rates.

L217 authors claim that biotic immobilization can be an explanation, however, previously they mention that N species exchangeable fraction was insignificant.

L224. Authors should try to put into quantitative perspective their findings given that they have oxygen concentration data for bottom water.

L237. The effect of oxygen concentration on the partitioning between nitrate reduction will only have an impact on a um scale.

L280. Author should show the time evolution of oxygen in the slurries to prove no microniches were created in the slurries. Just mentioning that it is unlikely they were formed is speculation. Where was the spot placed? How many per bottle? Was it always under water? Was any sort of beads were included in the bottles?

L285. This makes no sense as pelagic communities are more easily exposed to high oxygen concentrations and thus should be more tolerant, rather than the opposite.

L292. These sections (4.3-4.5) are purely based on speculations and are not based on any data from this study. Actually these sections just highlight the limitations of the study.

L314. How did the authors ensure lack of H2S in the slurries forming? is is by eliminating SO4 presence or its formation somehow?

L320. Authors have no data to discuss the partitioning between the activity of NAP and NAR enzymes.

L349. Authors could try to quantify the effect. Is it significant?

L412. The data do not differentiate in any way between NAR and NAP.

Fig 2. Are data single measurements or mean of several replicates? Oxygen in water column of panel b is missing. Y axis scale is not "oxygen penetration depth" but just depth, same as in the first y axis. In the fully mixed lake conditions, oxygen concentrations does not increase above 150 uM yet in the microprofiles O2 is 250 uM.

Fig 3. I thin it is better to show the rate data of the same site in the same panel as in Fig 4. Also use different colours to be able to differentiate between thte two.

Fig 4. Mean values can be represented as points with their appropriate error bars plus a statistical analysis to confirm significant differences.

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