

We would like to thank both referees for their critical and constructive comments to our manuscript. Their comments helped to significantly improve the quality and clarity of the manuscript. We hope that our answers and revisions are sufficient to accept this work for publication in Biogeosciences. Please find our responses to each of the individual comments below.

Referee # 1 Dr. Riemann
Received and published 22 September 2015

Review of Gier et al. 2015. The paper concerns N₂ fixation and sulfate reduction (SR) in sediments below OMZ waters off Peru. The work demonstrates an interesting coupling between N₂ fixation and SR, as also suggested by *nifH* gene analyses. Moreover, the study indicates that organic matter load and sulfide are major drivers of N₂ fixation. The paper contributes to the compiling data on factors regulating diazotrophy and specifically to the rather limited number of studies from sediments. The paper is generally well written, clear, and to the point. My points of criticism are overall minor, but should improve the readability and clarity of the paper.

1. The wording should be changed at several places in the abstract. The current version seems to indicate that rates were measured in water, and not just in sediments. For instance line 6: "measured in OMZ mid-waters"; line 8: "Benthic N₂ fixation profiles" etc. Please, make sure the reader cannot be misled to believe that water samples were analyzed.

The wording in the abstract regarding the measurements has been changed according to the referee's suggestions.

2. P1, l. 11. Define *nifH* genes

A definition regarding the *nifH* gene has been added.

3. P1, l14. Delete "various"

"Various" has been deleted.

4. P6, l1. "These bacteria..."

Changed.

5. P6, l10-14. Unclear where this information comes from

The author information (Dale et al., 2015) has been added.

6. P7, l16-22. It would be good to reduce the overall length of the manuscript. This section could be easily reduced. Most readers will know the principle of acetylene reduction.

We thank the reviewer for this suggestion. We reduced the method part regarding the description of the acetylene reduction assay.

7. p8, l5. Specify whether samples were analyzed onboard or stored somehow.

Samples were analyzed onboard and this information has been added.

8. P8, l13. OK, but why were they expressed as NA. Isn't that just confusing? If keeping it as NA, then please explain why.

As both referees pointed out that it is confusing to have nitrogenase activity (NA) and N₂ fixation in the manuscript, values were recalculated for N₂ fixation and all figures, tables and text were changed accordingly and we now only refer to N₂ fixation.

9. P10, l2. Please, specify how many sequences were obtained per sample. Also, describe negative controls and whether they were blank.

The information regarding the sequences and the negative controls has been added.

10. P10, I14. How can you in the description of your sediments cite literature which is published before this sampling was carried out? This is your Results section – you should describe your results, not those of others.

Thanks for noticing. We agree with the referee and deleted this citation from the results part.

11. P10, I18. Redundant, described 3-4 lines higher up.

The sentence has been deleted.

12. P13. It should be evident from the text why the authors are interested in looking at C/N ratios. It is not enough to address that later in the discussion. Likewise, it should be explained why data on DIC flux are reported (Fig. 4), also how this was measured is unclear to me.

Information on why we looked at the C/N ratios and DIC values, as well as how DIC was measured has been added.

13. P14, I8. Rephrase. A novel clade cannot belong to anything. It may be related to something...

The sentence has been rephrased.

14. P15, L5-6. Again, this sounds like water samples. Please, rephrase

Rephrased.

15. P15, I6. "Sometimes both depth profiles revealed similar trends". Clarify what is meant by depth profiles.

Clarified.

16. P15, I8. "were"

Corrected.

17. P15, I21. What does "this study" refer to?

"This study" referred to the citation in the sentence before. The sentence was changed to make this clear.

18. P. 15, I28. "SR bacteria were..."

Corrected.

19. P16, I11-15. Needs work. That samples have a "certain diversity" is not informative. Unclear what "these results" refer to (line 13). Farnelid et al. did not sample an OMZ (line 15).

The paragraph has been rephrased and the citation Farnelid et al. has been removed.

20. P17, I10-11. Weird and unclear sentence. Please, revise or remove.

The sentence has been removed.

21. P17, I20-28. I have not understood the point with the DIC fluxes. Please, make this clearer here as well as earlier in the manuscript.

As stated at comment number 12, information on the DIC fluxes has been added.

22. P20, I7-8. Sentence is out of context. Please, clarify the point or remove.

The sentence has been removed.

23. Figure 1, text. Please, define MUC.

Has been defined.

24. Figure 6, text. Delete “expressed”. Clarify whether the sizes of the triangles are proportional to the number of sequences within each triangle. Moreover, indicate on the figure how many clones the triangles etc represent.

Expressed has been deleted. The sizes of the triangles should not be used for quantification. To make it clearer, all triangles were changed to the same size and the information how many clones each triangle represent has been added inside the triangles.