

Interactive comment on “Occurrence of benthic microbial nitrogen fixation coupled to sulfate reduction in the seasonally hypoxic Eckernförde Bay, Baltic Sea” by V. J. Bertics et al.

Anonymous Referee #2

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The Bertics et al. manuscript addresses the potential simultaneous occurrence of sulfate reduction and N fixation in anaerobic core horizons from the Baltic Sea. This work adds new data to the observations that sulfate-reducing bacteria fix nitrogen. Overall, the technical approach is sound, the conclusions regarding N fixation sound, and the paper is well written. I believe the work to be timely and important and deserved publication in Biogeosciences.

I have some strong reservations about the “denitrification” data used in this paper. The authors correctly identify the measurements as potential rates in the methods, but then treat them as environmentally-relevant rates in the results and discussion. My

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questions about this measurement are not only semantic, but also about the entire relevance of the measurement. The acetylene block approach might be used where NO_x- concentrations are known, but in this application they only tell about the potential for enzyme activity. In highly reducing sediment, sources of oxidized NO_x are minimal because of lack of oxygen for nitrifying bacteria and the potential for sulfide-induced inhibition/death of nitrifiers. The very interesting profile of denitrification shows strong vertical structure, with the highest potential rates >2-3 cm below the sediment-water interface. For these rates to have relevance, the NO_x would need to either be formed at depth (unlikely) or diffuse/bioadvect from surface sediment layers. Moreover, there is a high potential that DNRA would strongly compete for NO_x. The authors should either identify an environmental relevance of these data, or delete them. The paper does not require these data to be a useful and valuable contribution.

Some minor issues with associated page numbers:

6495 Would be nice to mention Br analysis technique and the fact that the coefficient is pore water derived.

6506 Microenvironment referene: Brandes, J.A., Devol, A.H., 1995. Simultaneous nitrate and oxygen respiration in coastal sediments: Evidence for discrete diagenesis. *Journal of Marine Research* 53, 771-797.

6507 Convert the integral of SR to equivalent oxygen units and predict O₂ penetration (Cai, W.-J., Sayles, F.L., 1996. Oxygen penetration depths and fluxes in marine sediments. *Marine Chemistry* 52, 123-131). This whole argument seems poorly set up. High oxygen will not result in deep oxygen penetration in these sulfidic sediments.

6510 The idea of bubble irrigation also in: Roden, E.E., Tuttle, J.H., 1992. Sulfide Release from Estuarine Sediments Underlying Anoxic Bottom Water. *Limnology and Oceanography* 37, 725-738.