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Interactive comment on "Temperature response of denitrification and anammox reveals the adaptation of microbial communities to in situ temperatures in permeable marine sediments that span 50 in latitude" *by* A. Canion et al.

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Review of Canion et al

This was a generally well-written and interesting manuscript. It is important because it adds to a small but growing database of denitrification rates in permeable sediments. I think the key strength of the paper is the temperature gradient work. The intact core incubations run under perfused/diffusive conditions data set is weaker and could benefit greatly from a reconsideration of their data and broader discussion, particularly given

the rates actually seem to be very low.

Specific comments The paragraph starting on pg 14598 line 14 makes the case that permeable sediments are a significant sink for nitrogen through denitrification. Our work has shown the opposite, and I believe (Cardenas et al. 2008) is misquoted. Cardenas et al actually showed that denitrification rates and efficiencies are very low compared to cohesive sediments. The fundamental control over denitrification in permeable sediments is the amount of nitrate reaching the anoxic zone of the sediment where potential denitrification rates are high. I think this is very low for a number of reasons including: 1. Low concentrations of nitrate in the water column, 2. The flow fields around ripples means that a lot of nitrate advected into the sediment transits through the aerobic zone and is not denitrified. 3. Ammonia produced within the sediment is released through anaerobic chimneys in at the ripple crests resulting in very little nitrification and hence denitrification of ammonia produced within the sediment (Kessler et al. 2012). I am not suggesting these points always apply, however, I suggest this paragraph be tempered against these points.

Following on from this point, I see that the rates are actually very low (with the highest rate equating to 14 μmol m-2 h-1) even when you pump nitrate vertically into the core. In these experiments this occurs as a consequence of the low nitrate concentrations in the water column (as acknowledged in the discussion) because the potential rates are very high. I believe the slant of this discussion should be recalibrated to explicitly consider the fact that their results show low integrated rates, but that potential rates are very high.

The potential rates of denitrification and the proportion of anammox are remarkably consistent with rates measured by (Evrard et al. 2013) in a warm temperate embayment (the only other study to report potential denitrification and anammox). Given that these results are from very different environments, I think this is very interesting and worthy of discussion.

The extremely high rates reported by Eyre in oligotrophic reef sediments measured using chamber experiments and direct N2 fluxes are mentioned. These high rates are probably artefacts associated with pumping of N2 out of the sediment, see (Cook et al. 2006). Aside from this, I am not sure how this work is relevant to a discussion on nitrate removal in sands under high nitrate loading (as suggested by the heading). Perhaps this section should be a more general discussion of denitrification rates in sands?

p14601 l13. What time period did you sacrifice the cores over? Did you allow time for the newly perfused (oxic) water to become anoxic? This could be anywhere between 10 mins and 2 h depending on the rates of metabolism.

p14604 l14. The symbol for Vanadium is V, not Vn, It is VCl3.

14609 line 24, I think Sylt is cool temperate?

Section 4.3 Very interesting discussion.

p14613. I disagree that these results support this paradigm, the rates are actually some of the lowest in the literature, unless there is a typo in the units or a miscalculation. See main point above.

Figs 2, 3 and 4 μmol L-1 d-1 and nmol cm-3 d-1 are dimensionally the same, use consistent notation

References cited Cardenas, M. B., P. L. M. Cook, H. S. Jiang, and P. Traykovski. 2008. Constraining denitrification in permeable wave-influenced marine sediment using linked hydrodynamic and biogeochemical modeling. Earth and Planetary Science Letters 275:127-137. Cook, P. L. M., F. Wenzhöfer, S. Rysgaard, O. S. Galaktionov, F. J. R. Meysman, B. D. Eyre, J. C. Cornwell, M. Huettel, and R. N. Glud. 2006. Quantification of denitrification in permeable sediments: Insights from a two dimensional simulation analysis and experimental data. Limnology & Oceanography: Methods 4:294-307. Evrard, V., R. N. Glud, and P. L. M. Cook. 2013. The kinetics of denitrification in permeable sediments. Biogeochemistry 113:563-572. Kessler, A. J., R. N. Glud, M. B.

Cardenas, M. Larsen, M. Bourke, and P. L. M. Cook. 2012. Quantifying denitrification in rippled permeable sands through combined flume experiments and modelling. Limnology & Oceanography 57.

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Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/10/C5392/2013/bgd-10-C5392-2013-supplement.pdf

Interactive comment on Biogeosciences Discuss., 10, 14595, 2013.