

## ***Interactive comment on “The fate of fixed nitrogen in oligotrophic marine sediments: an in situ study” by Stefano Bonaglia et al.***

### **Anonymous Referee #2**

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The authors present a high-quality dataset on nitrogen cycling in coastal sediments with a low carbon loading. The manuscript is generally well written and based on a high-quality dataset comprising in situ flux measurements, incubations experiments to partitioning nitrogen flows and some basic background data (ladderane lipids as biomarker for Anammox, burial of nitrogen using  $^{210}\text{Pb}$  excess, etc).. The conclusions are largely confirming our existing view of nitrogen biogeochemistry in low carbon coastal sediments and such present a useful addition to the literature. I suggest the authors to articulate their DON flux findings a little more.

Although the writing is generally clear, some fine tuning and precision of wording would improve this very good manuscript further. - insert hyphens for multi-word adjectives: e.g. bottom-water salinity. - one the one and on the other hand always come together - sometimes the logic of sentences needs improvement, e.g. p3, l. 9-10: pore-water

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chemistry is the result of N cycling processes; anammox biomarker reflect cycling processes but do not control it, etc.etc. Another example: p. 12, l. 25: our rates therefore represent in situ conditions. Rate reported are representative for the in situ rates. Rates do not represent conditions.

Oligotrophic marine sediments: is that the right term? Water column ecosystems are considered eutrophic or oligotrophic, but sediments are usually classified as low or high carbon loading systems. Nutrient concentrations are quite high in sediment, including the ones reported here. Moreover, can you use the term oligotrophic for sediments with an oxygen penetration depth of less than 2 cm? Not convincing. > 75% of the seafloor has larger OPD.

The authors emphasize somewhat the peculiarities of low temperature conditions, e.g. p. 2, l. 19, but are all deep-sea systems not cold. Consequently there are quite some studies on DNRA in cold systems along ocean margins. Rewrite the text. Moreover, why should temperature matter so much? A permanently cold system will function well, in the end supply of oxidants and reduced substances set the stage.

The material and methods section is very detailed and sometime too much detailed knowledge is expected from the reader: all the abbreviations, etc. Perhaps a few lines on explaining the principle of the approaches would better guide the reader through the details.

On page 8, it is mentioned that C and N were measured before and after HCL treatment. Two remarks: (1) this is the wrong reference because Verardo et al. used sulfurous acid rather than HCl and (2) communicate to the reader that you report only total nitrogen and organic carbon in this manuscript. You made the right choice of not using Norg because of acidification artifacts.

Burial rates are based on sediment burial rates inferred from  $^{210}\text{Pb}$  excess measurements. Although you touch upon the issue of bioturbation in the material and methods sections and conclude that you can ignore it, lateron you present visual faune observa-

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tions suggesting otherwise. Communicate to the reader that burial rates may be inflated because of bioturbation, in particular at stations.. Even better show the  $^{210}\text{Pb}$ excess profiles in the appendix/supplementary info.

Minor corrections: - p. 1, l. 12: on the global - p. 1, l. 13: most scientific investigations have increased the last few years because the scientific community has grown. Reformulate. - P. 1, l. 17: burial rates were not experimentally determined: they were inferred from  $^{210}\text{Pb}$ excess observations - P. 1, l. 24: clarify here that you mean total dissolved fixed nitrogen. - P. 2, l. 26: southern and central Baltic Sea are among the ... - P. 3, l. 2: but do not report anammox - P. 4, l. 30: control or output? - P. 8, l. 11: an dimensionless linear sorption coefficient - P.10, l. 19: depth-interval weighted average porosities? - P. 12, l. 15: give the most accurate.. - P. 13, l. 17-19: why this role of latitude: is this the cause? I guess that coastal-deep-sea gradient is more important than latitudinal.

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