Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-361-AC2, 2020

Biogeosciences
Discussions

Interactive comment on "DISCOL experiment revisited: Assessing the temporal scale of deep-sea mining impacts on sediment biogeochemistry" *by* Laura Haffert et al.

Laura Haffert et al.

lhaffert@geomar.de

Received and published: 21 January 2020

Anonymous Referee #2 Haffert and co-authors present a comprehensive sedimentary geochemical dataset on an experimentally disturbed potential deep-sea mining area, called DISCOL. The paper reports an extensive set of downcore geochemical data (O2, organic C, nutrients) from both short (MUC, box corer) as well as long (GC) cores in the experimental site. Further, the study improves an existing diagenetic reaction-transport model with datadriven process optimisations. The authors then use these new data plus transient early diagenetic simulations to asses the short and long-term impact of sediment removal during (future) mining of polymetallic nodules. They find that the

removal of the surface labile organic carbon along with the nodules is the single most important driver of the establishment of a new geochemical regime in the disturbed areas. The primary strength of this work is a quite convincing set of predictions as to what will happen in the long run when these nodules will be extracted from the seabed. The transient simulations are very useful and well integrated to the data. Supported by an extensive and novel dataset and the improved modelling approach, the integrated methodology could be used in other seafloor resource extraction scenarios as well. There is no significant weakness in the manuscript. It is well laid out and well written. I only have a few suggestions for a minor revision of the existing manuscript:

Overall comment: How does the Fe(II)-rich clay layer can trap nitrate? The redox reaction between the two is not that well established, and wondering if a more complex cycle is present here, involving nitrogen intermediate species and a more complicated Fe(II)-Fe(III) cycle. I would propose that Figure 2 can be improved to clarify this, and both introduction (L84) and discussion parts can be expanded with a more detailed proposition of redox pathways.

- The Fe(II)-rich layer in the Peru basin was discussed in detail in previous publications (König et al., 1997; König et al., 1999; König et al., 2001). Intermediate complexes where not discussed in this context, instead changes in the deposition flux of organic matter has caused a 'redox pump mechanism'. Figure 2 summarizes the findings for the DEA region. It should be kept in mind that the NO3 burn down of the Fe(II)-rich layer, which occurs at present at much greater depth, does not play a role for the research question at hand. We would thus like to avoid a detailed discussion on the Fe(II)-Fe(III) cycle and focus on the shallow sediments directly affected by potential mining activities.

L27: JPI Oceans - with plural 'oceans', I think is the right acronym.

- Yes. We will correct this.

L54: the work 'untypically' can be removed without a significant change in the meaning

of the sentence.

- We will remove ‘untypically’ from the L54.

L58: ’availability positions’ - perhaps could be re-phrased using ’order of the electron acceptors’ or similar.

- The sentence is trying to say that the redox zones are controlled by the availability of the various electron acceptors. To clarify the sentence we will change it to: ‘The reactions utilize different terminal electron acceptors in the order of decreasing free-energy production, namely oxygen, nitrate, manganese oxide, iron oxide and sulphate and their availability controls the position of the various redox zones in the sediment column.’

Section 1.1 - overall I find this section is more like a discussion, rather than introduction. As mentioned above, the introduction of a Fe(II)-NO3 redox pathway is a little bit out of place in this section. Besides, the readers might expect a following section of 1.2, since there is 1.1, bot there is no other subsection of the introduction. Please consider re-organizing the material in 1.1.

- In line with comments from Referee #1, we will restructure the information in the introduction. We will move the section, which intends to justify the introduction of a shallow Fe(II)-O2 reaction layer, to the description of the diagenetic model to Line 180:

L200-205 - interesting - did all cores include such buried nodule layers? I would strongly recommend to indicate the depth of these layers in the Figures 3-6 to be able to see directly in the figure if the nodule is impacting the geochemical profiles.

- About half of the gravity cores included buried nodules. We will add the depth of manganese nodules to the gravity core profiles in Figure 3.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-361, 2019.