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Interactive comment on "Diagenesis and benthic fluxes of nutrients and metals during experimentally induced anoxia in the Gulf of Trieste (northern Adriatic Sea)" *by* N. Koron et al.

Anonymous Referee #2

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Koron et al describe a series of short-term and long-term benthic chamber incubations under different oxygen concentrations in the northern Adriatic Sea. The purpose of the study was to assess the effects of short-term and long-term anoxia and the recovery from anoxic conditions on nutrient fluxes (ammonium and phosphate, and silicate) as well as fluxes of dissolved iron and manganese, calcium, and magnesium. To the extent that I understand the experimental setup chambers were placed on top of sediment for different time periods and anoxia were generated (how this was done is not specified). As I understand, the chamber was then lifted from the sediment and cores were repeatedly taken and analyzed for their porewater constituents and solid-phase composition (C, N, P). The anoxic periods lasted frm 7 days to one year and recovery was also

checked over different periods from one week to one year. A one-dimensional steady state reaction transport model was used to fit the porewater data to calculate benthic fluxes. The results show an initial stimulation of ammonium production under anoxic conditions and short-term increases in dissolved manganese and iron concentrations near the surface of the sediment. Extended anoxic periods lowered both ammonium and phosphate fluxes. Based on a mass balance between phosphate efflux and P burial the authors hypothesize that long-term anoxic conditions induce phosphate precipitation within the sediment. The recovery from anoxic conditions supposedly initially stimulates calcium carbonate dissolution, which abated over longer periods time.

Assessment: This work has serious deficiencies in terms of the experimental design and study setup, which do not make the results generally applicable or useful for the general readership of Biogeosciences. Long-term anoxic isolation experiments cannot reproduce real hypoxic situations since the investigated sediment under the chamber is hydrodynamically and biogeochemically isolated. It should be obvious that porewater ammonium production and phosphate production decrease over a period of a year if new supply of organic matter is cut off by a chamber placed on top of the sediment. This is obvious and does not deserve publication. If the authors could have supplied data on the RATES of recovery or the RATE of flux changes from normoxic to anoxic conditions, the study would have been more relevant. In this regard, macrofauna and meiofauna potentially play an important in the recovery phase, but with the data presented here, their role cannot be assessed adequately, or, if there are such data then the result description of the modeling is insufficient to understand their role. I was also disappointed that the authors did not use the chambers to obtain directly measured benthic fluxes across the sediment surface. When I first looked at the manuscript abstract, I had expected such data. With the present sampling design, lateral sediment heterogeneity must be taken into account in the interpretation. The observed variability may be partly due to sediment heterogeneity. Generally, the data treatment is not sufficiently well described to allow the reader verify the results. In addition, many parts of the discussion contain sweeping statements of processes (e.g., anammox) for which

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there is no hard evidence and which also reveal a misunderstanding of the process itself.For example, tThe sentence in the conclusion section 'The presence of nitrate (no data shown in the paper) in anoxic phases can be explained by the presence of anammox and laterally pumping of oxygenated water by benthic infauna' is not substantiated by any data and the first part is factually incorrect. The graphical data presentation is poor. The graphs are too small to be read clearly and do not convey many hypotheses made in the text. The discussion section also contains parts (e.g., nitrate) for which no data are shown at all, but which are even used in the conclusions. Altogether my assessment of the manuscript is therefore that it should be rejected in its present form.

Interactive comment on Biogeosciences Discuss., 10, 11729, 2013.

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Interactive Discussion

Discussion Paper