

2: Roberto Danovaro

I thank Roberto Danovaro for his evaluation and constructive feedback. I repeat the text of the referee in italics and my response follows below in normal font.

This paper is an invited contribution by Prof. Jack J. Middelburg, presenting his acceptance lecture for the Vladimir Ivanovich Vernadsky Medal 2017 of the European Geo- sciences Union. The paper addresses timely and crucially important scientific ques-tions, reconciling different views and providing an unifying vision to the biogeochemical processes involving C cycling at the seafloor. This is a seminal contribution, introducing novel concepts, opening new perspectives in different scientific fields from geology to biogeochemistry, organic chemistry and ecology. The figures are excellent to clarify complex concept and very useful for teaching. This paper is therefore a fantastic contribution to the the knowledge and reflections on the carbon processing at the seafloor.

Thanks for these very kind words.

I have only few and minor suggestion to be eventually considered for the preparation of the final version:P1 L19-22. "It shown [...] time scales." It refers to previously published papers or reflects the personal opinion of the author?P1 L22. "It is hypoth- esized..". It has been hypothesized by other authors? P1 L27. "...is presented..." Similarly, I feel that using the first person here would sound better. P1 L47. Is only car- bon processing involved? P2 L64-72. Is there any reference available in the literature. P2 L84. pls check "eventually is either mineralized into metabolites (carbon dioxide and nutrients)... P2 L90. closely "and positively"? P3 L116-119. Please check the sentence P3 L128. Please delete "is" P4 L150-152. "Chemoautotrophs in sediments [. . .] to the ocean (Middelburg, 2011)". This sentence sounds a bit isolated from the rest of the text, could you add a few words to better link it to the rest of the discussion. P4 L174. "the degraded fraction cannot be studied" could be "the degraded fraction cannot be easily studied" P4 L177-178. "its reverse the" can be deleted. P4 L191. Please avoid repeat- ing "pathways". P4 L194. "microbes and animals and other heterotrophs". Better say "heterotrophic organisms"? P5 L196. ". . .yet is. . .". "it" or "this" is missing in between? P5 L218. The papers by Nomaki et al. (e.g., MEPS, 2006, "Different ingestion patterns of 13C-labeled bacteria and algae by deep-sea benthic foraminifera.") and by Sweet- man and colleagues (e.g., Sweetman & Witte, MEPS, 2008, "Response of an abyssal macrofaunal community to a phytodetrital pulse") could be cited in this paragraph. P5 L199-233. Any suggestion on how to make ecological studies more complete, better harmonized with the other approaches? P6 L285-286. "Microbes usually dominate living biomass but not always". Here you could expand a bit the concept by referring to the increasing relevance of microbial biomass with increasing water depth, referring to Rex et al., MEPS, 2006, "Global bathymetric patterns of standing stock and body size in the deep-sea benthos"). This aspect has been highlighted also in Danovaro et al., TREE, 2014, "Challenging the paradigms of deep-sea ecology". The contribution of the biomass of bacteria, archaea and viruses in surface sediments has been recently summarised in Danovaro et al, AME, 2015, "Towards a better quantitative assessment of the relevance of deep-sea viruses, Bacteria and Archaea in the functioning of the ocean seafloor") in case it can be useful for the discussion. P7 L299. Here "Tissue" could be replaced by "Biomass" ? P7 L301. Selectively "preserved" could be "recycled to bypass de novo synthesis"? or something similar? P7 L327-28. "Degradation of [. . .] relative to carbon." Can add a citation here? P7 L328. Phosphorus? P8 L350. (and, e.g., P1 L18) Instead saying "we present a new.." you could say "here it is pre- sented a new.." if you want to avoid the use of the first person. P9 L416. Build could be built? Figure 1 and 4. Do the red/orange/yellow colours refer to specific compo- nents/processes? Figure 2. Please add legend of the colour used (if useful). Figure 5. Please explain the axes in the central plot.

These corrections and suggestions will improve the paper and will therefore be incorporated. Text will be modified were needed, references will be added and figure captions will be modified to indicate the differences in lability between different organic compounds, etc.