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Interactive comment on “Modelling the impact of Siboglinids on the biogeochemistry of the Captain Arutyunov mud volcano (Gulf of Cadiz)” by K. Soetaert et al.

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Dear authors

Thank you very much for providing a thorough revision of your manuscript. It is now almost ready for being published in BG; however, I still found a few minor points I would like you to consider when preparing the final manuscript. There is no further reviewing round needed, I trust that you can correct the according points directly before submission.

Answers to Ref 1 and further comments

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P1, L2“Sediments overlying gas hydrate deposits or experiencing high organic matter deposition produce a significant amount. . .” This is a confusing statement. Sediments overlaying gas hydrates do not produce methane – it is transported through them. Please correct “A significant amount of methane (75–320 Tgyr⁻¹), is released from marine sediments overlying gas hydrates or experiencing high organic matter deposition (Valentine,2002). P3, L12: “AOM takes place..” (normally when using the abbreviation, the “the” is not used.) P3, L18“Some bacteria, such as Beggiatoa can use use intracellularly stored nitrate for sulfide oxidation, either by dissimilatory nitrate reduction to ammonium (DNRA) \cite{Jorgensen and Nelson 2004} or by chemolithotrophic oxidation of reduced sulfur compounds using nitrate as electron acceptor and concomitant release of N₂ or NO₂ (Cardoso et al., 2006).”

In any instance, the energy derived from sulfide oxidation with nitrate can be shuttled into autotrophic CO₂ fixation.

Please correct: “Many thiotrophic bacteria use oxygen as an electron acceptor. Some bacteria, such as Beggiatoa can use use intracellularly stored nitrate for sulfide oxidation {Jorgensen and Nelson 2004; Cardoso et al., 2006}.”

Van Dover 2000 is not an original reference for the description of aerobic sulfide oxidation.

P3, L25: Please correct this. There are numerous recent papers on the subject (DeBeer et al, Macalady et al, Girth et al., Gruenke et al.), which show that freeliving bacteria may just as well bridge distances. (e.g. L. Nielsen of Aarhus has recently described the bridging of a m distance by bacteria.) “Some freeliving thiotrophic bacteria are adapted to bridge gaps between the supply of oxygen and sulfide for example by vertical migration or electron shuttling (DeBeer et al. .. Nielsen et al. . . .). When sulfide and oxygen are physically separated over decimeters, another strategy is the symbiosis with an animal host such as. . .”

P4, L12. The sentence reads awkward, sulfide is a product of AOM as you describe

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before “In these systems, beyond the energy available from the oxidation of methane, the anaerobic oxidation of methane provides high fluxes of sulfide that are used by sulfide-oxidising bacteria (Levin, 2005).”

P 8 line 5: What do you mean with “amends for the absence of regular diagenetic reactions” ? in your model, or in nature ? please clarify. Normal OM degradation with sulfate as e- is of course happening everywhere in the absence of oxygen and presence of sulfate around the worm, but the rates may not be significant compared to the methane-driven sulfate reduction.

P10 L 27. The most plausible explanation is that there are gas bubbles or hydrate pieces in the sediment. Methane can migrate in dissolved and gaseous form. Where there hydrates below, was the sediment gassy ? This should be clarified.

P12 L 28 – is “fluxes” a verb here ? otherwise the sentence misses a verb.

Answers to Ref. 2

All good, but in addition to answering to the referees questions about sensitivities of the different parameters used, it may be good to simply add also a couple of summary sentences in the MS to state which parameters had low and which had high sensitivities in your model.

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