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Interactive comment on "Microbial methanogenesis in the sulfate-reducing zone of surface sediments traversing the Peruvian margin" *by* J. Maltby et al.

Anonymous Referee #2

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The manuscript of Maltby et al. describes rates of sulfate reduction and methanogenesis were measured in various radiotracer incubations. The study highlights the role of methanogenesis in near-surface sediments (here termed shallow methanogenesis) in overall carbon mineralization. Methodologically the study is extremely well designed and the experimental setup is flawless. The only flaw that I see in this paper is in the treatment of the bag incubations in relation to the whole-core incubations. While whole core incubations are next best thing to in-situ experiments with benthic landers (which come with their own set of problems and limitations), bag experiments for rate measurements will definitely give results that are different to measurements on intact sediment cores. Numerous studies have reported the effects of structural disturbance

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on turnover rates. Although the bag experiments were only perfomed in order to study the effect of various substrate additions, especially non-competitive subtrates, the measured rates are presented in a way that the reader might get the impression that these rates are actually comparable to the whole core incubation data. I would therefore suggest to stress the differences between the whole core and bag incubations and discuss the limitations of the different techniques. Minor comments:

p14872, line 26: Why do these conditions favour methanogenesis, anoxia and fresh organic matter are also perfect conditions for sulfate reduction p14873, line 2: As far as I know Limfjorden sediment is permanently anoxic, at least below the upper few mm, only the oxygen concentration in the water column changes over the year. I think this sentence should be rephrased to avoid confusion. p14875 line 8 and 15: Why did you process the samples in two different cold rooms with different temperatures? p14875 line 11: I still think that you paid for the barrel on your corer and did not steal it... p14878, line 21: What do you mean by "transfered completely"? Did you do a quantitative transfer or did you fill the bottle without headspace? p14879, line 27f: Section 2.3 describes porewater sampling, not rate measurements. What do you mean by "according to the above scheme"? Did you use a slurry? How did you get the sediment into the glass syringes? Or do you mean the old Jørgensen glass barrels (Glass tube with syringe plunger)? p14880, line 9f: Why did you do change your technique? I always thought that the old one was just fine? p14887, line 12: Why didn't you use for example the SO4 or DIC PW profile to align the cores? Comparison between the topmost Gravitiy Core sample and the MUC cores should give you a reasonable estimate how much sediment was blown off by the Gravity Core. p14889, line 13-15: Please show the data, this could be important. p14890, line 21: To me the term "transport velocity" implies an active movement, which would only be important in zones with active fluid flow. Here we are talking about purely diffusive systems and I would recommend sticking to those to avoid confusion.

Interactive comment on Biogeosciences Discuss., 12, 14869, 2015.