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Biogeosciences Discussions

Interactive comment on "Regulation of anaerobic methane oxidation in sediments of the Black Sea" *by* N. J. Knab et al.

Anonymous Referee #1

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Knab et al. present a very nice, comprehensive dataset that expands our knowledge about the sulfate-methane transition zone, especially with respect to rates of carbon and sulfur turnover measured using radiotracer techniques. They show an interesting relationship between the thickness of the SMTZ and the curvature of the methane concentration curve above the SMTZ. As the SMTZ spreads out (thickens) the methane concentration profile acquires a concave upward shape. Although this study falls short in adequately explaining how the expanded thickness of the SMTZ is generated in two of the three cores, their hypothesis that lithology plays an important role is intriguing. The major deficiency of this large geochemical dataset is the lack of organic carbon data, including %Corg, d13C, d15N, and C/N. The authors speculate about the role the change from limnic to marine sediments plays in locating the SMTZ and its thick-

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ness, but organic carbon data and a graphical depiction of the lithologic changes would strengthen their argument and show how the transition from terrestrial to marine carbon sources controls the carbon isotope system. In revising this manuscript, I suggest the authors place a simple stratigraphic section next to each chemistry-depth plot in Figure 2.

This is a quite capable group of geochemists, however they should report estimates of errors and the accuracy/precision of the chemical and radiotracer measurements. It is especially important to understand the detection limits to the radiotracer methods in their hands. As previous studies have demonstrated, the rates of methane oxidation are often at or below detection limit (e.g., Hoehler et al. for the Blake Ridge). The radiotracer rate data is a key contribution of the paper. I note that there are no error bars on the radiotracer rate data plots, although these measurements were run in triplicate. Are the errors smaller than the symbol size? This is one way to portray the errors and not clutter the plot.

Detailed Comments

Abstract – in the last sentence, reference is made to the d13C-signal. I believe methane is implied, but please add methane to this to make it more specific.

p. 2308 lines 5-6: This statement makes intuitive sense if the labile organic carbon content of the sediment is high and sulfate reduction of organic matter is the primary sink for sulfate. But, no Corg data has been presented. This is a deficiency. Also, if SR of Corg is this important, then why are the sulfate profiles linear? The studies by Borowski et al. 1996, 1997, and 1999 argue that when linear sulfate gradients are found in methane-rich deep sea sediments, their linear nature is a consequence of focused methane consumption at the SMTZ (formerly termed the SMI). Can the authors provide some clarification of this dilemma?

p. 2314 line 15: replace ‘furnaced’ with ‘was preserved in serum vials combusted in an oven at xx °C, containing…’

BGD

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p. 2315 line 12: I would prefer using a geometrical description of the methane profile ‘concave upward’ rather than ‘tailing towards the sediment surface’

p. 2316 line 17 & 18: I believe the units are incorrect. mmol should be nmol (cf. p. 2315 lines 27 & 28).

p. 2317 line 29: The AOM rates obtained in this study are very reasonable. I suggest comparing then with the recent compilation in Ussler and Paull 2008, EPSL.

p. 2318 line 19: Replace ‘depletion’ by ‘consumption’.

p. 2319 line 17: Replace ‘loss’ by oxidation’.

p. 2329 lines 4 & 8: Replace ‘In contrary’ by ‘In contrast’.

Figures 2, 4, 5, 6, & 7: Add a horizontal line at the same depth in each of the core plots that indicates either the depth of sulfate depletion or the depth where the sulfate and methane curves cross. This would guide the reader’s eye in comparing each set of plot and make it easier to follow the narrative in the text.

Interactive comment on Biogeosciences Discuss., 5, 2305, 2008.