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Biogeosciences Discussions

Interactive comment on "Biogeochemical processes in sediments of the Manfredonia Gulf (Southern Adriatic Sea): early diagenesis of carbon and nutrient and benthic exchange" *by* F. Spagnoli et al.

Anonymous Referee #2

Received and published: 24 November 2004

The authors report a potentially interesting (but largely under-exploited) data-set at 2 stations in the Manfredonia Gulf in the Southern Adriatic Sea, in October 2002 and March 2003 of porewater profiles of inorganic nutrients, O2, total alkalinity, pH, DIC, Fe and Mn and benthic flux measurements of O2, total alkalinity, pH, DIC, Fe, Mn and SO4.

General comments:

I agree with reviewers 1 and 3 that this manuscript needs profound modifications before being considered for acceptance in Biogeosciences. Discussion of the results is totally missing. Phrasing and syntax need a major improvement.

Major comments:

Most of the major comments for improving the manuscript have already been addressed by reviewers 1 and 3. An additional major comment is that the total alkalinity data are not discussed nor exploited in the manuscript. The combined analysis of total alkalinity and DIC data gives invaluable information on benthic carbon cycling and in particular on CaCO3 precipitation/dissolution dynamics. There is a very large literature available on the subject and for instance the recent paper by Forja et al. (2004) is a starting point on the subject.

If CaCO3 dissolution occurs in these sediments, then DIC must be corrected for this process. Indeed, DIC would contain a mixed signal of organic carbon degradation and CaCO3 dissolution that can be accounted for, using total alkalinity; refer to the classic Jahnke et al. (1997) and the more recent Jahnke & Jahnke (2004) papers for details.

The comparison of the fluxes of DIC, DIC corrected for CaCO3 dissolution/precipitation and O2 (plus estimates of aerobic and anaerobic carbon degradation inferred from Fe, Mn and SO4 data) should provide a further angle for discussing the results (refer to the above mentioned references for details). It is difficult to speculate on this due to exotic scale of fluxes of Figure 6, although the fact that DIC fluxes are 10 times higher than the O2 ones would suggest that CaCO3 dissolution does indeed occur in these sediments (and/or due to an under-estimation of anoxic organic carbon degradation by the O2 chamber measurements due to the trapping in particulate phases of sulfur within the sediment - the paper of Morse & Rowe (1999) is a good starting point on this subject). Finally, a comparison of DIC benthic fluxes in Gulf of Trieste (northern Adriatic) by Cermelj et al. (2001), Ogrinc et al. (2003) and Ogrinc & Faganeli (2003) would be interesting.

Minor comments:

Page 808 Lines 4 to 6 : please specify :

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- The pH scale used (and the buffers used to calibrate the pH electrode).

- The thermodynamic constants used to compute DIC from pH and total alkalinity.

- For the second cruise, specify how consistent were the DIC manometric measurements and DIC computed from pH and total alkalinity. In figures and tables specify for DIC with method is used.

Specify in the Methods section how temperature and salinity were measured in the samples, both in the porewaters and the benthic chambers.

For all variables (or parameters) specify precision and accuracy.

Page 808 Line 3 : reference is missing for the method of inorganic nutrients determination.

Seasons: October corresponds to fall and not summer; march to spring and not winter.

Alkalinity: what the authors measured is total alkalinity. “Alkalinity” is a vague term that leads to confusion between total alkalinity and carbonate alkalinity.

TCO2: this term has been abandoned and DIC is preferred in recent literature

Specify throughout manuscript “inorganic nutrients” and not “nutrients”.

Some of the references are not easily accessible: Bianchi et al. (1984) Brondi & Ferretti (1976) Damiani et al. (1988) Simeoni (1992)

I will not list the other (numerous) minor comments, since a completely re-written version must be provided by the authors for consideration of publication in Biogeosciences.

List of references

Cermelj, B., N. Ogrinc, and J. Faganeli. 2001. Anoxic mineralization of biogenic debris in near-shore marine sediments (Gulf of Trieste, northern Adriatic). The science of the total environment 266(1-3):143-152.

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Forja, J.M., T. Ortega, T.A. DelValls, and A. Gomez-Parra. 2004. Benthic fluxes of inorganic carbon in shallow coastal ecosystems of the Iberian Peninsula. Marine Chemistry 85(3-4):141-156.

Jahnke, R.A., D.B. Craven, D.C. McCorkle, and C.E. Reimers. 1997. CaCO3 dissolution in California continental margin sediments: The influence of organic matter remineralization. Geochimica et cosmochimica acta 61(17):3587-3604.

Jahnke, R.A. and D.B. Jahnke. 2004. Calcium carbonate dissolution in deep sea sediments: reconciling microelectrode, pore water and benthic flux chamber results. Geochimica et cosmochimica acta 68(1):47-59.

Morse, J. W. and G. T. Rowe. 1999. Benthic biogeochemistry beneath the Mississippi River plume. Estuaries 22(2A):206-214.

Ogrinc, N. and J. Faganeli. 2003. Stable carbon isotopes in pore waters of coastal marine sediments (the Gulf of Trieste, N Adriatic). Acta Chim.Slov. 50:645-662.

Ogrinc, N., J. Faganeli, and J. Pezdic. 2003. Determination of organic carbon remineralization in near-shore marine sediments (Gulf of Trieste, Northern Adriatic) using stable carbon isotopes. Organic Geochemistry 34(5):681-692.

Interactive comment on Biogeosciences Discussions, 1, 803, 2004.