

Interactive
Comment

Interactive comment on “Carbon mineralization and carbonate preservation in modern cold-water coral reef sediments on the Norwegian shelf” by L. M. Wehrmann et al.

Anonymous Referee #2

Received and published: 2 February 2009

General comments: The topic of the work by Wehrmann et al. is suitable for the journal and worthy of publication in Biogeosciences with moderate corrections. This work is dealing with the impact of cold-water coral ecosystems on biogeochemical processes and carbonate preservation in associated sediments, which they studied at Rost Reef and Traenadjupet Reef of the Norwegian Shelf. The paper provides interesting novel data of early diagenetic processes in coral reef sediments and gives further evidence that there is no linkage between the distribution of cold-water coral reefs and the presence of hydrocarbon seepage, a hypothesis which was controversially discussed in the scientific community during the past years.

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The paper is generally well-written and well structured. The figures are overall of good quality (one exception: Figure 1, see specific comments). The reference list is complete (although some additional referencing is needed, see specific comments) and almost correct with one exception: Titschack et al. is already in press since 2009 (Marine Geology).

Specific comments

1 Introduction

(1) The authors represent a brief overview about the state-of-the-art of the research of cold-water coral ecosystems and their role on the global carbonate cycle, although for the latter still not much is known! Reasons for this might be (1) the high diversity of the appearance of cold-water coral ecosystems as they occur as patches, reefs or giant carbonate mounds, and (2) the variety in their temporal distribution in particular along the NE Atlantic, e.g. off Norway only reefs of post-glacial age are known whereas along the Irish margin cold-water coral carbonate mounds existed already for millions of years! For this reason, the authors should be careful in comparing Norwegian coral reefs with carbonate mounds (e.g. Challenger mound) of the Irish margin.

(2) The aim of the study is clearly stated.

2 Study area

(1) The study areas Rost Reef and Traenadjupet Reef are shortly introduced with respect to their morphology, sediment composition and coral coverage as well as the prevailing current system.

3 Material and methods

(1) p. 4951, lines 5-6: As the data of only seven gravity cores are presented in this paper (see Table 1, chapter 4), the ranges of core length and water depth for these cores should be stated instead of the ranges of all collected cores of cruise ARK XXII/1a! (2) The numerous geochemical methods applied for the study are described in very detail.

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Check if the methods can be introduced in a more condensed way.

4 Results

(1) For the core description (p. 4956), revise past tense to present tense.

(2) p. 4956, lines 2, 20: Revise *Lophelia pertusa* and *Madrepora oculata* to *L. pertusa* and *M. oculata*. These species are already mentioned with full name in chapter 1.

(3) p. 4957, lines 6-13: Who did the microscopic analyses? This method is not mentioned in chapter 3. It becomes not clear, if these are the results of the authors or if they refer to other publications. Is the biogenic composition of the sediments based on qualitative or quantitative data? For the latter case, give the proportions of forams, coccos, diatoms and sponge spiculae in percentage.

(4) For what reasons are some data/proxies are just shown for specific cores? Why there are almost no data presented for the off-mound cores (one exception: sulfate reduction rates)? The manuscript would benefit from an overview of which methods/measurements were applied for which cores.

5 Discussion

(1) The discussion is lacking in a comparison between the two studied reef complexes as well as in a comparison between the on-mound and off-mound cores. Although the authors stated that the aim of the study is to investigate the impact of cold-water corals on biochemical processes in reef sediments, this relationship is not really emphasized in the discussion.

(2) There is almost no linkage between the discussed matters and the figures showing the data.

(3) p. 4964, line 8 and the following: This paragraph needs to be moved to chapter 1 as it constitutes a summary of the most important discussion within the cold-water coral research: which factors influence or control the development of cold-water coral

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ecosystems. (4) p. 4964, lines 9-10: There is a need for additional referencing as indicated:

Henriet, J.-P., De Mol, B., Pillen, S., Vanneste, M., Van Rooij, D., Versteeg, W., Croker, P.F., Shannon, P.M., Unnithan, V., Bouriak, S., Chachkine, P., 1998. Gas hydrate crystals may help build reefs. *Nature* 391, 647-649.

(5)p. 4964, lines 22-23: There is a need for additional referencing as indicated:

Dorschel, B., Hebbeln, D., Foubert, A., White, M., Wheeler, A.J., 2007b. Hydrodynamics and cold-water coral facies distribution related to recent sedimentary processes at Galway Mound west of Ireland. *Marine Geology* 244, 184-195.

Mienis, F., de Stigter, H.C., White, M., Duineveld, G., de Haas, H., van Weering, T.C.E., 2007. Hydrodynamic controls on cold-water coral growth and carbonate-mound development at the SW and SE Rockall Trough Margin, NE Atlantic Ocean. *Deep Sea Research I* 54, 1655-1674.

White, M., Mohn, C., de Stigter, H., Mottram, G., 2005. Deep-water coral development as a function of hydrodynamics and surface productivity around the submarine banks of the Rockall Trough, NE Atlantic. In: Freiwald, A., Roberts, J.M. (Eds), *Cold-Water Corals and Ecosystems*, Springer, Heidelberg, pp. 503-514.

White, M., Roberts, J.M., van Weering, T.C.E., 2007. Do bottom-intensified diurnal tidal currents shape the alignment of carbonate mounds in the NE Atlantic? *Geo-Marine Letters* 27, 391-397.

(6) p. 4964, lines 27-29: Remove Kenyon et al. (1986) from the reference list, this paper is not dealing with cold-water corals. There is a need for additional referencing as indicated:

Freiwald, A., 2002. Reef-forming cold-water corals. In: Wefer, G., Billett, D., Hebbeln, D., Jorgensen, B.B., Schlüter, M., van Weering, T.C.E. (Eds), *Ocean Margin Systems*, Springer, Berlin, Heidelberg, pp. 365-385.

Roberts, J.M., Wheeler, A.J., Freiwald, A., 2006. Reefs of the deep: The biology and geology of cold-water coral ecosystems. *Science* 312, 543-547.

Roberts, J.M., Wheeler, A.J., Freiwald, A., Cairns, S.D., 2009. Cold-water corals. The biology and geology of deep-sea coral habitats. Cambridge University Press, 336 p.

Wheeler, A.J., Beyer, A., Freiwald, A., de Haas, H., Huvenne, V., Kozachenko, M., Olu-Le Roy, K., Opderbecke, J., 2007. Morphology and environment of cold-water coral carbonate mounds on the NW European margin. *International Journal of Earth Sciences* 96, 37-56.

6 Conclusions

(1) p. 4970. lines 18-19: The authors should be careful in comparing Norwegian coral reefs with carbonate mounds of the Irish margin (see also Introduction comment (1)).

Table 1

(1) Add column with core length.

Figure 1

(1) 1a: The gray arrows indicating the water circulation cover the indication of the study areas. The flow direction of the currents is hardly to see.

(2) 1b c: The coordinates and water depth numbers are much too small and are not readable. Overall, the maps are of low resolution.

(3) 1b: The location of core 7-1 GC is not indicated on the map.

Interactive comment on *Biogeosciences Discuss.*, 5, 4945, 2008.

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