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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 #1

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The manuscript 'Carbon mineralization and carbonate preservation in modern cold-water coral reef sediments on the Norwegian shelf' represents an impressive collection of novel data that certainly enhances the knowledge of early diagenetic processes in cold-water coral reef sediments. Methodological approaches are relevant and the applied methods are described in a detailed fashion. The results are well presented. I would however suggest providing (probably as web-based additional information) also the data for the cores that are not included in the figures (especially the off-reef cores). The discussion is unfortunately lengthy including information more suitable for the introduction. It also misses a thorough interpretation of the data and the data are not sufficiently referenced in the discussion thus weakening the basis from which conclu-

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sions were drawn.

But I am confident that the authors, with some moderate revisions, can improve the manuscript in a way that it does the impressive and novel data sets justice.

Specific comments

1 Introduction p. 4947 Line 21 to p. 4948 line 7 Some care should probably be taken when bringing the Norwegian cold-water coral reefs in context with cold-water coral carbonate mounds such as Challenger Mound. The reefs records cover thousands of years (post glacial) while the Challenger mound record spans millions of years.

3. Material and Methods The manuscript presents an impressive amount of new data. The chosen methods appear adequate and relevant to produce data in order to address early diagenetic processes within cold-water coral reef sediments. Material and method descriptions are accurately and detailed and provide the reader with the necessary information in order to appraise the results. Formulas are well expressed and all parameters are mentioned and defined in the text.

For easier comparison with other existing data sets, the amount of total inorganic carbon (TIC) could be also expressed as wt.% CaCO₃ (chapter 3.2; p. 4951; first paragraph).

A break could be introduced into line 15 p. 4953 to indicate the change from analyzed data to modeled results ('calculate' could also be changed to 'model' in line 16).

P. 4955; lines 17&18: Is the assumption that bioturbation and bioirrigation is limited to 10 cm viable? Are stratigraphic data available to support this assumption? Did biologist extract living megafuana from boxcores from the reefs?

4. Results The result section is quite long but nevertheless concise, representing the large amount of data included in the study. The section is well linked in with the figures and the readers' attention is drawn to the relevant information. It only surprises me that no data on pore-water pH are presented. Are pH data not available or are they irrele-

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vant for the study? Further questions that arose while reading the results are: 1) What was the motivation for the selection of the presented data, 2) why are some proxies only presented for some cores and 3) why are none of the off-reef data presented?

Chapter 4.2 (p. 4057 line 15-23) as mentioned before, TIC could be also expressed as wt.% CaCO₃ for easier comparison with other studies.

5. Discussion I would have appreciated a more thorough comparison of the data from the different reef-zones in the Røst as well as in the Traenadjuupet Reef and between the two reefs and off-reef locations. What are the differences - what are the similarities? It does not become clear if the geochemical processes are linked with the coral coverages described in the lithology section and figure 2. Unfortunately the discussion is not as well linked-in with the figures as the result chapter.

In chapter 5.1, the discussion very quickly leaves the data and starts to explain the generally low rates of anaerobic carbon mineralization.

5.1 p. 4961; line 21: Is it possible to explain what 'extremely low rates of anaerobic carbon mineralization' means. Does it make sense to give comparisons from literature?

P. 4963 line 9-22; the hypothesis that the coral frameworks decouple the pelagic system from the sediments is very appealing. It would be however even more convincing if the interpretation would be supported by references to the relevant sections in the data figures. Can differences be detected for different reef zones and what is the influence of the coral cover (coral rubble verse living reef)?

P. 4964 line 8 - p. 4965 line 2; this should be moved into the introduction. This is a long paragraph for data (not shown) that could be shortened to for example: "Low methane concentrations in the reef sediments (values) provide do not provide any evidences for hydrocarbon seepage at the reef sites" - as is true for almost all cold-water corals reefs. Furthermore, the data presented do not necessarily support the hypothesis of an environmental control on coral reef formation it is just the alternative hypothesis.

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Would it make sense to combine the paragraphs p. 4962 line 6-14 and p. 4965 line 4-11 and discuss them together as both metal ion and sulfide concentrations are linked and metal-sulfides precipitate? And again, can that be supported by referring to the data and data figures? P. 4965 line 12 to p. 4966 line 3; provides a lot of background information that could probably form an individual sub-chapter in the introduction.

P. 4966 line 19-27; are XRD data available to further support this interpretation?

P. 4966 line 15; calculated should be changed to modeled

Chapter 5.3; unfortunately, my chemical background and knowledge of the PROFILE program are insufficient in order comment on this chapter. I hope the other reviewers will compensate.

6 Conclusions The last have sentence p. 4970 line 17-19 '...and provide a model for initial...' should probably be deleted as the Norwegian coral reef and Irish coral mounds represent quite different sedimentary systems of different time scales.

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