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Interactive comment on “Systematics of past changes in ocean ventilation: a comparison of Cretaceous Ocean Anoxic Event 2 and Pleistocene to Holocene Oxygen Minimum Zones” by J. Schönfeld et al.

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Referee comment Holger Gebhardt

General comments

The paper by Schönfeld et al. compares two prominent but separated (time and location) depositional systems characterized by oxygen deficiency: the modern Peruvian shelf and the Cretaceous OAE2 of Morocco. In order to obtain an overview on the intensity of biological activity during the times of deposition (primary productivity, lam-

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ination, burrow-size etc.) the authors reviewed a large number of published data as well as new sources. They also propose a new proxy for paleo-oxygenation from its inverse relation to organic carbon accumulation rates. The paper therefore represents a substantial contribution to the scientific progress and its general scientific significance is rated good.

The paper is mainly a review paper and is based on earlier publications to a large extent. Thus, results are based on a high number of relevant references for the data base as well as on related papers for the concepts applied. I have neither recalculated the computations apparently made by the authors, nor the validity of the formulas presented (e.g. proposed paleo-proxy). The scientific quality of the paper appears to be good to excellent.

The presentation quality is good to excellent. Arguments are given in a clear and concise way and the paper and the figs are easy to read and generally well structured. A few exceptions are mentioned below. For me as a non-native speaker, the English is excellent. Thus, presentation quality is good to excellent.

To my opinion, the paper should be published in BG with minor emendations (see below).

Remark: I would have liked to see a possibility (electronic supplements, link etc.) for an easy access to the complete data set used in this paper. This is possibly beyond the scope of the paper or the journals general policy, at least it will be a huge data set to be stored somewhere. For me as a reviewer it is impossible to check the quality or completeness of the base data within the time frame given and I have to trust information given by the authors.

Specific comments

1. The abstract appears too long to me and might therefore be shortened, but it may be ok for BG.

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2. The point that bewilders me most is that the authors do not compare benthic foraminiferal assemblages. There is a bunch of papers dealing with this issue. Benthic foraminifera have been considered by many authors to be excellent indicators of oxygenation states of ocean waters. There are even indices for the quantification the dissolved oxygen of modern and past habitats (e.g., Kaiho K. 1994 *Geology* 22, 719-722; Kaiho K. 1999 *Marine Micropaleontology* 37, 67-76; and many others). Several concepts are dealing with the organic matter rain as food source for micro-organisms (mainly benthic foraminifera), bottom-water oxygenation, and organic matter accumulation, e.g., the TROX-models of Jorissen et al. (1995, *Marine Micropaleontology* 26, 3-15) and van der Zwaan et al. (1999, *Earth-Science Reviews* 46, 213-236). If there is a good reason, why foraminiferal assemblages should not be considered for the evaluation of ocean ventilation, the authors should at least comment on this.

3. I may be wrong, but can reservoir age be determined as exactly as stated (13348, l. 13)? Instead, I suggest 90 to 340 years, although, this will not affect the calculations substantially.

4. The authors used *Uvigerina* species for stable isotope analyses (13349, l. 7). These semi-infaunal genus might merely reflects pore-water conditions. Therefore, usually epifaunal genera such as *Cibicidoides* is used. The authors should comment on why *Uvigerina* has been used instead.

5. The portion between 13349, l. 26 and 13350, l. 4. should be shifted to the introduction section. Furthermore, the paper of Poulsen (1998) is, according to the ref.-list, on Jurassic dinoflagellates from central Poland, and the paper of Topper et al. (2011) is on the late Miocene of the Mediterranean Sea. The authors should explain why the models of these papers (if there are any) are representative for the mid-Cretaceous Atlantic. I suspect wrong/mixed-up references. ...

6. Chapter 3.1 is not only dealing with the Peruvian OMZ. Pls. change title. The chapter on laminations (3.1.2) contains many general concepts developed in many parts of the

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world, which should be part of the introduction. Only those parts which refer to the modern Peruvian or Cretaceous Moroccan shelf should be part of the results section.

7. I suggest to show (a) location map(s) for all cores analysed (Peru and Morocco) in order to give the reader an idea on the geographic relations and the dimension of the investigations.

Technical corrections

General: The succession of cited papers within the text does not follow an obvious rule. They should be in an order according to the guidelines of the journal (temporal or alphabetic succession?)

13346, l. 12: Expedition in 1965 revealed... in order to distinguish the phrase from a reference.

13351, l. 1: Kuhnt et al. 2001 is missing in the ref.-list.

13351, l. 6ff.: Correct spelling is Savrda (see also ref.-list).

13354, l. 13: Gutierrez et al. 2006 as in ref.-list?

13356, l. 11: bioturbated

13357, l. 18: Gebhardt et al. 2004.

13358, l. 18: Kemp et al. 1990 or Kemp 1996?

13361, l. 13: Martin et al. 1987 is missing in ref.-list.

13362, l. 17: Mallon 2012 as in ref.-list?

13380, Tab A3 Figure caption: Sections with...

13387, Fig. 7: Please arrange the upper and the lower panel in such a way that the ages are in line with each other in order to make a comparison of both panels easy. Correlation of peaks is rather difficult at the present stage.

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11, C5912–C5916, 2014

Interactive
Comment

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Interactive Discussion

Discussion Paper



1. Does the paper address relevant scientific questions within the scope of BG? Yes
2. Does the paper present novel concepts, ideas, tools, or data? Yes
3. Are substantial conclusions reached? Yes
4. Are the scientific methods and assumptions valid and clearly outlined? Yes
5. Are the results sufficient to support the interpretations and conclusions? Yes
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes
7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes
8. Does the title clearly reflect the contents of the paper? partly
9. Does the abstract provide a concise and complete summary? Yes
10. Is the overall presentation well structured and clear? Yes
11. Is the language fluent and precise? Yes
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? yes
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes
14. Are the number and quality of references appropriate? Yes
15. Is the amount and quality of supplementary material appropriate? not applicable

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