Ocean Science
Discussions

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Interactive comment on "Is coccolithophore distribution in the Mediterranean Sea related to seawater carbonate chemistry?" *by* A. M. Oviedo et al.

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The manuscript by Oviedo and co-authors deals with the question whether the carbonate system is controlling the distribution of coccolithophores in the Mediterranean Sea. I have read the manuscript with great interest, as many studies on the effect of ocean acidification on coccolithophores came to the conclusion, that the effect of the carbonate system on assemblage composition is a crucial point for understanding coccolithophore community responses to ocean acidification. In this study, water samples form a cruise in April 2011 covering a W-E transect in the Mediterranean sea were analysed for their coccolithophore and other phytoplankton content by SEM counts, and

for environmental parameters that were measured on-board. The data was then run through a statistical analysis in order to determine which parameters, or combination of parameters, are the most likely factors controlling coccolithophore distribution. In summary, the authors define three groups of heterococcolithophore species that represent different regions or habitats, i.e. the NAtlantic inflow, the deep photic zone, and the eastern Mediterranean Sea, and claim that statistically the highest support is found for the combination of $[CO_3^{2-}]$, pH, and salinity as the factors controlling coccolithophore distribution.

The manuscript is well written and mostly easy to follow. However, I found a number of typos and grammatical errors, which is why I would like to suggest a thorough language check on the next version of the manuscript. Some sections are slightly repetitive and could be shortened.

I think that the dataset is very interesting and of high quality. I am not completely convinced by the interpretation and the statistical analyses, which need some clarification before the paper can be published.

General comments

(1) Sampling has been carried out over a relatively short time in April 2011. I don't think that this is representative of a whole year, and phytoplankton populations may change during the year. In the study of Knappertsbusch (1993) who studied different seasons, this effect seems to be relatively large. I would like to see short discussion on how the assemblages from the study of Knappertsbusch compare to your results, and how representative the sampling in April 2011 may have been. Also, a comparison with surface sediments may help.

(2) The filter preparation and counting may cause a bias. Filtering and oven-drying will destroy most phytoplankton with an organic covering, so dinoflagellates will be underrepresented on the filters. Furthermore, counting at 3000x magnification a relatively small patch of the filter will lead to an underrepresentation of larger cells, e.g. diatoms

and dinoflagellates. Therefore, the conclusions drawn on the dominance of coccolithophores may be wrong.

(3) The outcome of the statistical analysis feels strange sometimes. When looking at Figure 2, CO32- and temperature look very similar (which they mostly do), but statistically CO32- is highly significant, while temperature seems to be not significant. Can you explain this? Furthermore, why are the species representing the Atlantic inflow, i.e. E. huxleyi type B/C and Gephyrocapsa species negatively correlated with CO32- in Table 3? When comparing Figures 2 and 6, they are found in the region with highest CO32- values.âĂĺAlso, the rho values in Table 1 are not so much lower for combinations of more than 3 variables. Therefore, there may be too much focus on the carbonate system parameters in the discussion.

Minor comments (probably incomplete, please check for more typos and grammar mistakes)

Abstract

P 614

L 5: as marine calcifying organisms

L 6: systems parameters

L 7: physicochemical

L 19: What do you mean by preferentially distributed? Higher abundance?

Introduction

It may be noteworthy, that there are observations of coccolith and calcareous dinoflagellate distributions in the sediment, that show some distinct W-E patterns (see Knappertsbusch 1993; Meier and Willems 2003)

P 615

L 10: check grammar in "being calcification...."

L 15: what is PAR?

P616

L 17: above mentioned

L 18: "Additionally, when a west to east transect was sampled (Knappertsbusch, 1993; Ignatiades et al., 2009) carbonate chemistry parameters were not." This sentence sounds very strange to me. Perhaps something like "Carbonate chemistry parameters were not measured in older studies on the distribution of coccolithophores in the Mediterranean Sea (...)" could be better.

Material and methods

P 617

L 7: Rosette

L12: Filtering and especially oven drying will destroy most of the dinoflagellates, as they have cellulosic walls.

L 19: Counting at 3000x magnification for all groups may cause a bias towards smaller groups.

Results

P 620

L 24: Figure 3 is mentioned before Figure 2.

P 622

Discussion

P 623

L 5: nutrients concentration

L 13: "Even though only reached at the Gibraltar Strait, the highest cell density of coccolithophores was 1–2 orders of magnitude higher than for the other phytoplankton groups." This may be due o the preparation and counting bias mentioned above. Therefore this whole section should be discussed more carefully. If larger numbers of diatoms and dinoflagellates were present (but not recorded due to methodological restrictions), a discussion on competition between these groups could be necessary.

P 624

L 16: Section 4.2 lacks clarity and structure. Especially the discussion about the holococcolithophores is unclear to me. I understand that the different stages of the same organism may have different ecological preferences. The data presented here seems to suggest that all holococcolith phases have similar preferences, while the heterococcolith phases form three groups. However, these groups comprise only 12 out of 70 species. What about the other 58 species? I assume that they do not show a clear regional distribution. Could it be, that the majority of the holococcolith phases are related to these species? It would be good to see the distribution of, e.g. the Syracosphaera pulchra HOL types or other HOL phases of the species that show a eastward distribution. Are they as well evenly distributed over the entire Mediterranean?

L 20: were only recently sampled

L 24: plausible

P 625

L 1: The carbonate species that is used for calcification is more likely HCO_3^- (see Bach et al. 2012).

P 626

L 1: What is the reference for E. huxleyi blooms in the Baltic Sea? Or do you mean the

blooms recorded in the Skagerrak (which is more the North Sea)?

P 627

L 25: The statement "Interestingly, during this haploid life stage the different species seem to behave as a homogeneous group, exploiting a similar ecological niche." is difficult to understand.

Table 1

I assume that temperature is not shown in the first row, as it has a rho value less than 0.2. This seems strange, as the temperature and CO_3^{2-} usually covary, and also when looking at the maps in Figure 2, they show a very similar distribution.

Table 3

Why are the species representing the Atlantic inflow, i.e. E. huxleyi type B/C and Gephyrocapsa species negatively correlated with CO_3^{2-}? When looking at Figure 2, they are found in the region with highest CO_3^{2-} values.

Figures

The figures nicely present the data and analyses. The resolution (dpi) should be improved on the transects for better viewing.

References

Bach, L., Bauke, C., Meier, K. J. S., Riebesell, U. and Schulz K. G.: Influence of changing carbonate chemistry on morphology and weight of coccoliths formed by Emiliania huxleyi, Biogeosciences, 9, 3449-3463, 2012.

Knappertsbusch, M.: Geographic distribution of living and Holocene coccolithophores in the Mediterranean Sea, Mar. Micropaleontol., 21, 219–247, 1993.

Meier, K. J. S. and Willems, H.: Calcareous dinoflagellate cysts in surface sediments from the Mediterranean Sea: distribution patterns and influence of main environmental

gradients, Mar. Micropaleontol., 48, 321-354, 2003.

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