

Interactive comment on “The role of ocean acidification in *Emiliana huxleyi* coccolith thinning in the Mediterranean Sea” by K. J. S. Meier et al.

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We thank reviewer 1 for the valuable comments. The points brought up will be addressed as follows:

Comment 1

Firstly, the slope of the weight decrease is unexpectedly steep. By this I mean the slope of the weight versus e.g. CO₂ curve. With increasing CO₂ coccolith weight decreases. The overall slope, i.e. linear regression using the highest and lowest weight, is by two orders of magnitude steeper than the slope reported in the experimental study by Bach et al. 2012. For the calculation I used data in Table 1, specifically the TA constant set

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from 288-1004 CO₂ (Bach et al. 2012). Why should the slope in the Mediterranean field data-set be so steep by comparison? This question deserves a paragraph of discussion.

Answer

It seems to be a general pattern, that natural community changes in coccolith weight are much larger than those recorded in single strain experiments in the laboratory. This could be due to the ecophenotypic and/or genotypic variation in natural assemblages that may include many different types with different responses of calcification to OA. This gives two possible explanations for the observed discrepancy between field and laboratory studies:

(1) The strain tested in culture is unusual in its response to OA and only displays small changes in calcification compared to the majority of types in natural populations. There are, however, also other types that have been tested in cultured, and while the response is variable, it is still within a similar order of magnitude.

(2) Therefore, the observed weight decrease in the natural assemblage is probably due to a change in relative abundance of types, i.e. lightly calcifying types become more abundant over time. This may also explain the periods of extremely low weights that occur over the record. These occur after strong mixing events, when the phytoplankton community is dominated diatoms. Only few coccolithophores are found during these periods, and probably they represent lightly calcifying types.

We will include a discussion about these aspects in the manuscript.

Comment 2

Secondly, the decrease in coccolith weight is clearly comprised of two slopes. A shallow one from 1996-2004, and a steep one from 2004-2006. The latter is by a factor of 5 steeper than the former. The alleged cause, i.e. CO₂, pH, or... change, is linear with a single slope. How can that be explained? This question, too, deserves a paragraph

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of discussion.

Answer

The answer to this question may be the same as for comment 1. After 2004, there are more deep mixing events, which has affected the phytoplankton community structure. If these events favour lightly calcifying *E. huxleyi* types, this may explain the steepening of the slope. Still, there is also an effect of the carbonate chemistry, as the deep mixing brings deep water that originated in the Eastern Mediterranean into the surface waters. The carbonate chemistry signature has been found from 2004 onwards, and this may further lead to the decrease in coccolith weight.

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