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Interactive comment on "Impact of trace metal concentrations on coccolithophore growth and morphology: laboratory simulations of Cretaceous stress" *by* Giulia Faucher et al.

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We greatly appreciate the valuable comments and critical reading of the manuscript made by L.J. de Nooijer and a second anonymous reviewer which were useful to improve the scientific quality of the manuscript. Please find below our answers to the Reviewers comments.

Dear editor,

After careful assessment of the manuscript BG-2017-138 by Faucher and co-workers on the effect of trace metals on coccolith growth, I recommend it for publication in Bio-

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geosciences after moderate revisions. It is well-written and reports results that will be of interest to the audience of Biogeosciences. Below, I have listed my minor comments that I hope will help improving the manuscript. There is one more serious issue I have with the content, which is the absence of data on the actual metal concentrations in the treatments. Why were those concentrations not determined after preparing the culture media? It may have been that the concentrations did not vary much between treatments due to sorption of ions and this may therefore have important consequences for the interpretation of the data. I suggest that the authors either determine trace metal concentrations from the stock solutions, or explicitly report that the difference between treatments is inferred from the recipe that was used to make the culture media.

Authors reply: We have not analysed the metal concentration in our media. The difference between treatments was insured by adding adequate amounts of EDTA to the culture media to avoid precipitation of metal ions. It is, therefore, safe to consider that the concentrations of metals added to the culture media represent their dissolved ion concentrations. The ratio of EDTA to metals in our “high” treatment, for example, was well within the range of EDTA to the metal ratio used in other studies which test the effect of V (partly in combination with Mo and Fe) concentrations on phytoplankton species (Bellenger et al. 2008a, Bellenger et al. 2008b).

Abstract

Reviewers’ comment: Page 1, line 16: what does ‘phylogenetically linked’ mean?

Authors reply: We improved the text in order to make it clearer. The phylogenetic history of coccolithophores shows that the selected/investigated living species are linked to Mesozoic species showing dwarfism under excess metal concentrations.

Introduction

Reviewers’ comment: Page 2, line 4: are there references to support this statement?

Authors reply: References added

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Reviewers' comment: Page 2, line 5: 'affect' here probably means 'negatively affect', consider replacing by e.g. 'hamper'. Is there a reference that has reported this?

Authors reply: References added and text modified accordingly Reviewers' comment: Page 2, line 31: please add one/ a few references on the evolutionary relation between the studied species. Moreover, it is now suggested that the species themselves have separated from each other in the late Cretaceous, whereas the extant species are likely much younger: the groups to which they belong may have separated in the late Cretaceous. Authors reply: Text revised and references added.

Reviewers' comment: Page 3, line 6: no such studies

Authors reply: Text modified accordingly

Reviewers' comment: Page 3, line 9: metals Authors reply: Text modified accordingly

Methods Reviewers' comment: Page 3, line 30: what was the concentration of the EDTA in the trace metal stock solutions?

Authors reply: The EDTA concentration in our culture media was 11.71 μM. We added this information to table 1.

Reviewers' comment: Page 4, line 3: what is meant by 'experimental conditions'? These are the conditions without the trace metals added, I assume.

Authors reply: Cultures were pre-exposed to the four-experimental conditions (normal, low, medium, high and extreme), considering an acclimation period of some generations. The text was modified accordingly.

Reviewers' comment: Page 4, line 23: for how long were the samples incubated in 0.1 M HCl? Was this sufficient to dissolve all CaCO3?

Authors reply: The samples of the present study were acidified and directly measured (within minutes). The coulter counter measurements evidence the disappearance of all free coccoliths (Fig. 1) after the treatment with acid. Furthermore, samples were

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analyzed with a cross-polarizing microscope and, after the treatment with HCl, no coccoliths were left.

Reviewers' comment: Page 5, line 4: analysis

Authors reply: We made this change

Reviewers' comment: Page 5, line 17: comparison

Authors reply: We made this change

Results Reviewers' comment: Page 6, line 5: although likely true, this is technically speaking an interpretation and should belong in the discussion.

Authors reply: The text was revised and modified following the Reviewer suggestion.

Reviewers' comment: Page 6, line 20: I don't understand the definition of coccosphere volume. Isn't the coccosphere simply the cell volume + the coccolith volume?

Authors reply: We change the name "coccosphere volume" as "volume of the calcitic portion of the coccosphere" (VCP) (see page 4). The volume of the calcitic portion of the coccosphere" (VCP) was estimated as:

Volume of the calcitic portion of the coccosphere (VCP) = coccosphere volume - cell volume The coccosphere volume is the coccolith-bearing cell volume, while the cell volume is the coccolith-free cell volume.

Reviewers' comment: Page 6, line 26: 'cells' should be 'cell'

Authors reply: We made this change

Reviewers' comment: Page 7, line 9: 'the cells' should probably be 'cell volumes'

Authors reply: We made this change

Discussion Reviewers' comment: Page 9, line 15: should be 'trace metals'

Authors reply: We made this change

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Reviewers' comment: Page 9, line 17: should be hand

Authors reply: We made this change

Figures Reviewers' comment: Please add to the caption what the individual dots and error bars represent.

Authors reply: Information added in the captions

Bellenger, J. P., T. Wichard, and A. M. L. Kraepiel. 2008a. Vanadium Requirements and Uptake Kinetics in the Dinitrogen-Fixing Bacterium Azotobacter vinelandii Applied and Environmental Microbiology 74:1478-1484. Bellenger, J. P., T. Wichard, A. B. Kustka, and A. M. L. Kraepiel. 2008b. Uptake of molybdenum and vanadium by a nitrogen-fixing soil bacterium using siderophores. Nature Geoscience 1:243-246.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/bg-2017-138/bg-2017-138-AC1-supplement.pdf

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