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Biogeosciences Discussions

Interactive comment on "Physiological controls on seawater uptake and calcification in the benthic foraminifer *Ammonia tepida*" *by* L. J. de Nooijer et al.

Anonymous Referee #2

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General comments:

The manuscript entitled "Physiological controls on seawater uptake and calcification in the benthic foraminifer Ammonia tepida" by L.J. de Nooijer et al. describes processes of seawater uptake and calcium pathways in the benthic foraminifer A. tepida. For this study, the authors used various fluorescent tracers (for visualizing membranes, Ca2+ ions, and vacuolization) and Confocal Laser Scanning Microscopy. The results indicate that this species calcifies its test from vacuolized seawater, which is very likely modified in terms of calcium and carbonate ion concentrations. This is not a new finding, but confirms observations that have been earlier reported by e.g. Erez (2003)

and Bentov & Erez (2005). In contrast to earlier studies, the time-lapse recordings of Ca-rich vesicles observed during chamber formation allow for estimating intracellular Ca fluxes. It is shown that the vesicular Ca reservoir is not sufficient to calcify an entire new chamber and that additonal Ca must be delivered from another source, potentially from intracellular ACC (amorphous calcium carbonate). This finding is quite interesting since it confirms an earlier observation described by Bentov & Erez (2005). Nevertheless, the discussion is in part too extensive, especially the section about trace metal partioning, and should be more related to the authors' own results. However, since such studies on benthic species are rare, this work is an interesting contribution to our knowledge of biomineralization mechanisms in foraminifers. I recommend that this manuscript should be published in "Biogeosciences" after minor revisions.

Technical comments:

Abstract

Since there is no summary section, the abstract should contain more conclusions drawn from the observations. It lacks important information described in the discussion, in particular on the Ca budget. On the other hand, the first three sentences can be moved to the introduction. Further, the terms for the different fluorescent dyes can be eliminated. Since the different dyes are (or rather should be) explained in the methods section, it is sufficient to say that "... vesicle membranes, Ca ions and vacuole fluids were traced with various fluorescent tracers. Our results show that...".

Line 7 (page 7085): Analyze or analyse? Use either AE or BE.

Line 7 (page 7085): ... Ca cycling...

Lines 8-9 (page 7085): ... juveniles of the benthic foraminifer Ammonia tepida...

Lines 16-17 (page 7085): ... calcium ion cycling...

Line 17 (page 7085): ... Ca budget...

Introduction

The introduction is a bit too extensive and can be shortened and condensed, particularly the part from the beginning until line 25 (page 7085).

Line 22 (page 7084): Delete “the” before D18O; . . .calcium carbonate. . .

Line 26 (page 7084): Here you need to say that Mg/Ca in benthic foraminifers is also strongly influenced by the carbonate chemistry (e.g., Elderfield et al, 2006;. . .).

Line 6 (page 7085): There are a lot more studies showing the high TE variability within shells. Therefore insert “e.g.” before Hathorne et al.

Line 26 (page 7085): . . . calcium carbonate. . .

Line 27 (page 7085): . . . precipitation. . .

Line 1 (page 7086): . . . Mg content. . .

Line 2 (page 7086): . . . Mg2+ channels. . .

Line 5 (page 7086): Please provide reference for the internal pH increase.

Line 7 (page 7086): better use considerably instead of greatly

Lines 10-13 (page 7086): Change the order: separate pools, crystalline CaCO3, or amorphous CaCO3

Line 29 (page 7086): . . . analyze. . .

Line 3 (page 7087): . . . calcium and carbonate budgets. . .

Methods

Line 14 (page 7087): Can you be more precise in terms of how often reproduction took place? It may be important for further culturing experiments.

Line 16 (page 7087): better use build instead of grow

Line 17 (page 7087): specific instead of several

Line 21 (page 7087): For what is FM1-43 used?

Line 24 (page 7087): Can you briefly explain how Confocal Laser Scanning Microscopy works?

Line 3 (page 7088): Here you need to say that fluorescent beads can’t cross the cell membrane and are therefore used to track vacuolized seawater.

Results

Line 16 (page 7088): . . . In the following hours. . .

Line 24 (page 7088): . . . labeled. . .

Discussion

Line 3 (page 7090): . . . Ca and carbonate pools. . .

Line 4 (page 7090): . . . Ca ions. . .

Line 16 (page 7090): You need to explain earlier that beads can’t cross the cell membrane.

Line 25 (page 7090): . . . Ca budget. . .

Line 4 (page 7091): . . . Ca pool. . .

Line 5 (page 7091): Why do you use a diameter of 100 μm for old chambers and 50 μm for a new chamber? Are these the observed average sizes?

Line 27 (page 7091): . . . Ca pool. . .

Line 28 (page 7091): . . . Ca vesicles. . . Ca pool. . . Ca concentration. . .

Line 1 (page 7092): . . . Ca pool. . .

Line 4 (page 7092): . . . Ca concentration. . . Ca ions. . .

Line 5 (page 7092): . . . Ca gradient. . .

Line 7 (page 7092): . . . Ca pool. . .

Line 8 (page 7092): . . . Ca pool. . . Ca ions. . .

Line 16 (page 7092):. . . Ca transport. . .

Line 19 (page 7092): . . . Ca pool. . . calcium concentration. . .

Lines 21-24 (page 7092): This is an important conclusion that can be included in the abstract.

Line22 (page 7092): . . . calcium carbonate. . .

Line 25 (page 7092): . . . cross-polarized. . .

Line 27 (page 7092): . . . calcium carbonate. . .

Line 28 (page 7092): . . . Contrary to the classical theory. . .

Line 29 (page 7092): .. carbonate ions. . .

Line 3 (page 7093): What is the size of these ACC clusters? Can you provide any information on that?

Line 7 (page 7093): . . . Compared to most other elements. . .

Line 12 (page 7093): . . . Ca reservoir. . .

Line 18 (page 7093): . . . Ca reservoir. . .

Line 26 (page 7093): . . . Ca pool. . .

Line 6 (page 7094): . . . Ca concentration. . .

Lines 8-11 (page 7094): This is an important conclusion that can be included in the abstract.

Line 11 (page 7094): . . . (see last section). . .

Line 25 (page 7094): . . . Ca concentration. . .

Line 27 (page 7094): Insert comma after Nehrke et al.

Figures

Figure 2: It's hard to identify the old chambers and the newly formed one. Can you outline them as in Figure 1? What are the red spheres? Why are the beads clustered there?

Figure 4: This scheme is not very helpful and could contain more information such as organic compounds, ACC, and some mechanisms like the Ca-pump etc. (like in the famous Erez (2003) figure).

Interactive comment on Biogeosciences Discuss., 6, 7083, 2009.