

## ***Interactive comment on “Size-dependent response of foraminiferal calcification to seawater carbonate chemistry” by Michael J. Henehan et al.***

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The paper of Henehan and coauthors on ‘Size-dependent response of foraminiferal calcification to seawater carbonate chemistry’ presents a nice new approach to better understand the formation of planktic foraminifer shell calcite, its use as a proxy in paleoclimate research, and possible feedbacks to rising atmospheric and surface ocean carbon dioxide concentration. In general, the manuscript is written in a clear way, and statements are unequivocal. In the following, I comment on three points, meant to enhance intelligibility of the paper.

First point: On page 8, lines 9-11, Henehan et al. ‘Note that logarithmic regression models were used because modelled CI through ontogeny approximates to a logarithmic relationship across the size range of our cultures (see Fig. 1b).’ It should

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be made clear whether 'cultures' only include the size-to-calcite mass relationships of entire individuals or assemblages, or if data on the ontogenetic development (from cross-sections, or CT) of single specimens were also included here.

Second point When comparing their data to the published data of others, Hennehan et al. seem to have struggled with the classification of *G. ruber* morphotypes, and a general confusion concerning taxonomy of *G. ruber* as presented in the literature. To my knowledge, Wang (2000) first described different water depth habitats of *G. ruber* s.s. and s.l. from the South China Sea (SCS). Wang (2000) knew all about the difference between the different morphotypes (*elongatus* and *pyramidalis*), but finally only used differentiated between the types with spherical final chambers (s.s.) and compressed final chambers. From Wang (2000): 'Initially, the *Globigerinoides ruber* s.l. group was differentiated into tests with low and high trochospires. However, as these two sub-groups did not show significant differences in their isotopic signal, they were lumped again into one group.' The morphotype with the compressed final chamber is referred to as *platys* by some colleagues (see Numberger et al. 2009), and may just represent specimens with a *kummerform* final chamber. The concept of Wang (2000) was then largely adopted by Steinke et al. (2005) also working on the SCS and Indo-Pacific waters. Beer, Schiebel, Wilson (2009) did certainly distinguish between the different morphotypes, and did only use *G. ruber* (white), i.e. *G. ruber* s.s., in their analyses. *G. ruber*, *G. elongatus*, and *G. pyramidalis* were considered different species. However, tests with normal formed and *kummerform* final chamber were not distinguished, because the size-to-weight ratio of these tests was not significantly different in the samples from the Arabian Sea. Please note: The ecological significance of different morphotypes, i.e. *G. ruber* s.l. in warmer waters, and *G. elongatus* and *G. pyramidalis* in colder waters as found by Steinke et al. (2005) may differ at the regional scale. Water temperature may just be one among many (more relevant?) parameters, which determine the ecological niche of a species. To conclude, the statement on p. 10, lines 23-25, is wrong, and should be corrected: 'Beer et al. did not differentiate between species, but it is likely they would have sampled an increasing proportion of

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higher-SNW sensu lato species (i.e. *G. elongatus* and *G. pyramidalis*) in lower-pH upwelling waters, given these species preference for colder waters (Steinke et al., 2005). I would have happily discussed this point with the authors before submission of your manuscript, and I might have even provided you with the original samples.

Third point: In Figure 5, Henehan et al. show present a schematic view of the factors affecting shell thickness, by comparing large modern planktic foraminifers and small Paleocene-Eocene benthic foraminifers. To my consideration, this is comparing apples and oranges, and is hence insignificant. Calcification in benthic foraminifers is possibly related to the nature and chemistry of the bulk sediment, and follow an entirely different systematics than in planktic foraminifers. Natural and cultured specimens "pH reaction" may just reflect the general health of individuals, which might be related to alimentation. In addition, production and preservation may both affect wall thickness: Pores in the images (Fig. 5) of *G. ruber* are funnel shaped, which may indicate dissolution. I would suggest to change Fig. 5 and text on page 9 and 10. By the way: The expression 'Larger Foraminifera' signifies an informal group of large benthic foraminifers, and should not be used for planktic foraminifers and other benthic foraminifers, to avoid confusion.

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