Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2017-342-AC1, 2017

Biogeosciences Discussions
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EGU

Interactive comment on "Calcification in a marginal sea ndash; influence of seawater [Ca^{2+}] and carbonate chemistry on bivalve shell formation" *by* Jörn Thomsen et al.

Jörn Thomsen et al.

joernthomsen@gmx.de

Received and published: 5 December 2017

This manuscript deals with the effects of concentrations of calcium and dissolved inorganic carbon species on early shell developments in the mussels. The formation of the prodissoconch I are considered in terms of environmental conditions and, importantly in the context of ontogeny. The strength of the manuscript is a precise experimental design, that it deals with this biological process in detail in the environmental, onogenetic and genetic contexts, providing important insight for ocean acidification. The authors present detailed discussion on this phenomenon by way of the chemistry of calcification space indicating thresholds of the calcification responses to carbonate undersatu-

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ration. Thomsen et al. provide important data, serving to motivate more detailed future experiments/monitoring studies.

Response: We like to thank referee 1 for her/his constructive comments on our manuscript, please find our responses below.

Some points: The critical [Ca2+] and saturation thresholds are well characterized from the larval shell length. Is shell morphology likely to relate to tolerance to lowered [Ca2+] and DIC in prodissoconch I? Please provide the relationship between environmental factors, the number and the presence of abnormal individuals.

Response: Malformations are directly related to the inability to form a normal sized shell (ca. 110 μm) thus we only measured shell length but did not quantify numbers of malformed individuals. At shell a size below about 85 μm malformations such as a protruded mantle were observed, similar to the observations reported by the studies of His and co-workers. However, at moderately lowered Ca2+ concentrations this 'malformation' most likely corresponds to a delay of calcification as normal D-shells were observed when larvae continued growth for one more day. Only at Ca2+ concentrations <2 mM larvae did not complete D-shell formation and shells remained malformed/incomplete even after one week.

Line 70: Is there any similar environmental influence on the formation of prodissoconch II? Please provide some information.

Response: So far no longer studies have been run, but as calcification would still be limited by Ca2+ availability the outcome would be similar, as we also observed for settled juvenile mussels >1 mm(Sanders et al. in prep). The effect, however, is most prominent during PD I formation as calcification rates are much higher in this phase compared to later larval and juvenile life stages (Waldbusser et al .2014, Thomsen et al. 2015).

The variation of seawater Mg/Ca are also known to have influence on marine bio-

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logical calcification. Please discuss about the potential impact of varying seawater [Mg2+]/[Ca2+] of this experiments on bivalve shell formation. Suggested reading: Ries, J.B. (2010) Review: geological and experimental evidence for secular variation in seawater Mg/Ca (calcite-aragonite seas) and its effects on marine biological calcification, Biogeosciences, 7, 2795–2849.

Response: We also performed experiments applying Mg2+ manipulations but did not observe a significant effect on PD I formation rates within the tested range. This does not exclude any effects on shell composition which was not tested in this study. We have added a section on this topic to the revised MS.

Upper- and lower-cases in captions and figures should be unified (e.g., 2A, 2a)

Response: corrected

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