

## ***Interactive comment on “Boron incorporation in the foraminifer *Amphistegina lessonii* under a decoupled carbonate chemistry” by K. Kaczmarek et al.***

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Reviewer: 1. Writing can be improved. For example, the first sentence in the Abstract should be deleted/revised, because it has been shown that, even we can get two parameters from  $\delta^{11}\text{B}$  and B/Ca, it is still difficult to define the seawater  $\text{CO}_2$  system. This has been well demonstrated previously by Yu et al. (2010) and Rae et al. (2011) both published in EPSL.

Authors' response: 1. The interpretation of proxy data always has to take into account several interfering processes and is never straight forward. Therefore, we wrote "... can serve as proxies for two parameters ...". Nevertheless, the general potential of B

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based proxies is well demonstrated in many studies. Furthermore, we want to point out that the present study is based on samples from culture experiments and therefore we do not have to deal with unknown "interfering processes". However, the suggestion of the reviewer has been taken into account by adding the following sentence to the abstract: "However, the B incorporation mechanism into marine carbonates is still not fully understood and analyses of field samples show species specific and hydrographic effects on the B proxies complicating their application."

Reviewer: 2. Another issue is that discussions of literature data are mixed for benthic and planktonic forams. It would be nice to make a clear separation of these two. Relevant publications should be cited, but are missing at present.

Authors' response: 2. As requested by the referee we made a clear separation in the discussion between planktonic and benthic foraminifers. Planktonic species are discussed in lines 240 – 284 and benthic species in lines 285 – 291. To the best of our knowledge we cited all relevant publications, but we would be happy to include any paper we might have accidentally omitted.

Reviewer: 3. Line 332-334: the reason is not due to symbionts, it is due to the lower pH in deep waters.

Authors' response: 3. The content of lines 332 – 334 was corrected according to the referee's comment. We added "In benthic foraminifers without symbionts (*Neoglobobulimina dutertrei*, *Cibicides mundulus*, *Cibicides wuellerstorfi*) studied so far a lighter  $\delta^{11}\text{B}$  is observed than for planktonic species (Foster, 2008; Rae et al., 2011) due to a lower pH of the growth habitat of benthic foraminifers in deeper waters" in the lines to 285 – 288.

Reviewer: 4. Figures require some further work. For example, Fig 2b & 5b, the unit for  $\text{CO}_3^{2-}$  should be  $\mu\text{mol/kg}$ ;

Authors' response: 4. Units in figures 2b and 5b are corrected.

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Reviewer: Fig. 4. the positive  $\delta^{11}\text{B}$  for pH of 8.6 demands some explanation;

Authors' response: The following discussion on the possible causes for positive  $\Delta\delta^{11}\text{B}$  values in section 3.2.1. ("The role of  $\text{B}(\text{OH})_3$ ",) was added. "The incorporation of  $\text{B}(\text{OH})_3$  could modify foraminiferal  $\delta^{11}\text{B}$  (Klochko et al., 2009). This B species always has a heavier isotopic composition than  $\text{B}(\text{OH})_4^-$ . Therefore, additional incorporation of  $\text{B}(\text{OH})_3$  would result in heavier  $\delta^{11}\text{B}$  of the foraminifers. Assuming that  $\text{B}(\text{OH})_3$  incorporation is positively correlated to  $\text{B}(\text{OH})_3$  concentration of seawater, the foraminifers from the pH 8.6 treatment should display the lightest  $\delta^{11}\text{B}$ . Contrariwise, this treatment features the heaviest  $\delta^{11}\text{B}$ . Therefore, incorporation of  $\text{B}(\text{OH})_3$  appears to be unlikely", lines 292 – 298.

Reviewer: Fig. 6b, c: add regression lines and R2 values.

Authors' response: Regression lines and R2 are added as requested.

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