



EGUsphere, referee comment RC2
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Comment on egusphere-2022-1144

Adrian Immenhauser (Referee)

Referee comment on "Multi-proxy assessment of brachiopod shell calcite as a potential archive of seawater temperature and oxygen isotope composition" by Thomas Letulle et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-1144-RC2>, 2022

Dear Editor, Dear Authors,

Thank you for allowing me to read this scholarly MS. Letulle and colleagues submit an MS documenting an in-depth analysis of different palaeothermometers making use of the brachiopod shell carbonate archive and discuss strengths and weaknesses of the different methods aiming to reconstruct seawater palaeotemperatures and oxygen isotope signatures. The authors propose a new fractionation equation between brachiopod shell calcite and seawater. I want to emphasise that I am, at best, a learnt amateur in clumped isotope geochemistry; hence, I approach the MS from the viewpoint of carbonate archive research, biomineralisation, geochemistry and palaeo-oceanography.

I like the concepts presented and think this paper should be useful for the community. The science seems mostly fine, and I did not recognise many significant technical problems. I list a limited number of scientific comments below.

From a more critical perspective, the writing ranges from good to less-than-acceptable for a paper submitted to an international journal. The paper is inconsistently written, both in its style and the quality of the technical English. In any case, many grammatical and spelling mistakes should be fixed. I sympathise with all non-native speakers (I am one), but there are now several sophisticated language editing software packages that we can easily download for free. These are very useful for those among us struggling with a foreign language. I will use some examples in the abstract to document why I think the authors must significantly improve portions of the MS concerning language, logic and clarity.

I also found the MS partly convoluted and often long-winded. This feature limited my ability to extract science and information. Some of the text must be shortened and focussed.

My review is not a word-by-word cookbook job but focuses on points that caught my attention while reading the text and are listed in the order in which they appear.

Abstract:

Poorly written. Many deficits in the logic and precision of the language. I list several points that caught my attention; there are others.

Ln 13. Please use 'seawater' rather than 'ocean'. Delta¹⁸O measurements. That is jargon. A 'measurement' is the analytical step(s) we perform to generate the data, the analysis so to speak. The reconstruction of past seawater properties is based on oxygen isotope data (not the measurement thereof).

Ln. 18. Missing word: commonly used 'archives' in studies....

Ln. 20. Unclear wording: ...resistant to diagenetic alteration for decades. Do you mean brachiopod shells do not alter over the time span of several decades? Or do you mean that over the past decades, scientists have considered brachiopod shells to be resistant to diagenetic alteration?

Ln. 20. I am not sure what a 'growing temperature' is (also referred to as 'living temperature' elsewhere)? I did google the term to make sure I did not miss something. The only paper that matched is yours (this discussion version) on the EGU sphere webpage. Do you mean the ambient seawater's temperature during the brachiopod's lifetime? Use 'ambient seawater temperature', I suggest. Other than that, please use proper terminology: seawater d¹⁸O 'values' or similar.

Ln. 21. Again, I can only guess what a 'supposed' carbonate-based palaeothermometre is. Do you mean 'novel' or 'less well established'? Moreover, the palaeothermometre is NOT based on carbonate but uses the archive data (geochemical properties) recorded in carbonate (note the difference between the terms archive and proxy).

Ln. 33. Missing word: ...with 'seawater' temperatures...

Ln. 34. What do you mean by 'relatively good'. In agreement with the measured temperatures within xy degree Celsius?

Introduction:

Much better written, but still some language deficits similar to those listed for the case of the abstract. Please consider.

Ln. 42. What are past seas, and what is the difference to oceans? Do you mean epeiric seas as opposed to genuine oceanic bluewater?

Ln. 52. Many inconsistencies concerning technicalities of cited references. See, for example, In. 52. Brand et al., (2013) should read Brand et al. (2013).

Ln. 91. That is a scientific criticism. The authors argue about the question of whether shell carbon (DIC) and oxygen isotope values are in equilibrium with the seawater from which the shell carbonate precipitated or not. Please allow me to clarify that brachiopod biominerals are secreted from bodily fluids, NOT seawater. The problem is threefold: (i) What is the isotopic value of the bodily fluid relative to that of the ambient seawater? (ii) Does the isotopic value of the bodily fluid change during active versus passive cycles in the brachiopod metabolism cycle and during the brachiopods life span? Juvenile brachiopods grow rapidly, mature slow down. (iii) What is the fractionation factor between bodily fluid and brachiopod biomineral, and is it constant during the lifetime of a brachiopod? In some cases, brachiopod bodily fluids are isotopically close to the ambient seawater; in others not. In short, it is complicated. The authors provide text about thermodynamics and kinetics but less so about these metabolic effects and biomineralization pathways. In my opinion, that is a weakness of the paper. Please see the discussion and references cited in:

Immenhauser, A., Schöne, B., Hoffmann, R. and Niedermayr, A. (2016) Mollusc and brachiopod skeletal hard parts: Intricate archives of their marine environment. *Sedimentology* 63, 1-59.

I emphasise that you do not need to cite my paper! That is entirely up to you. It simply saves the reviewer time when being able to refer to the text and the cited references in a published paper. Please consider.

Material and Methods:

No major comments, looks o.k. One exception, please avoid acronyms in titles (2.3) and please refer to 'values'. $\delta^{13}\text{C}$ of modern brachiopods is jargon. Please use carbon isotope

values of modern....

Results:

Header chapter 3.1. Please do not use 'stable' as a synonym for carbon and oxygen isotope values; science knows about 120 stable isotopes.

Ln. 210. I always wonder, what is the meaning of the second decimal in a range of isotope values resulting from bulk samples? What is the meaning of -2.24 permil in this context? My opinion, the second decimal is meaningless. You analyse a bulk sample from a brachiopod shell, and I would refer to that as pseudo-precision. I suggest providing one-decimal values. Bulk samples and second decimals do not match. Particularly as you mix bulk sample data and data from the inner and outer shells (see Table 2).

Discussion:

General comment: This chapter is longwinded and, in part, difficult to follow. I advise streamlining the text and shortening it by at least 20%.

I wonder if the 'holy trilogy' of scientific writing consisting of Data Presentation, Data Interpretation and Discussion is applied here? If so, where is the discussion? Consider rephrasing the header as 'Interpretation and Discussion'.

Ln. 282. What are 'independent' brachiopods? Please explain.

Chapter 4.1.2 is poorly written. Quite some problems regarding grammar and formalities (citations etc.). Please clean up.

Chapter 4.1.4 All good science but very longwinded. Could you streamline that? This is not easy to follow and this is not something you want to hear from the readers.

Chapter 4.2 Here, we need much more emphasis on metabolism and biomineral secretion from bodily fluids. The authors deal with the topic as if brachiopod biomineralization pathways were an inorganic precipitation experiment. These are super complicated little 'bio-machines', and they are fascinating since each individual is a case on its own. Please see papers from the marine biology community (mainly aquaria monitoring experiments

but also field observations).

Conclusion(s):

Please use the plural, I suggest that you list more than one conclusion here.

This chapter is very much written in a discussion style. Please consider coming up with genuine conclusions style text rather than a short (renewed) discussion. The last statement is an anti-climax. First, you present all of these data and text. Then you tell the reader that you advise considering the variability in brachiopod live habitats, environmental conditions, metabolic effects, seasonal effects etc.? I must admit, have read very similar concluding statement in many papers published a decade or more years ago. Please consider.

The figures are reasonably well done.

As I said, I generally like the paper and the concepts and the data. I listed some of the numerous problems regarding syntax, grammar, and logic in an exemplary manner and indicated several scientific issues that require the authors' attention.

I look forward to reading (and citing) this article in its final incarnation.

Sincerely,

Adrian Immenhauser