

Interactive comment on “The effects of environment on *Arctica islandica* shell formation and architecture” by Stefania Milano et al.

Anonymous Referee #1

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In the paper “The effects of environment on *Arctica islandica* shell formation and architecture” Milano and co-authors investigate the structural properties of *A. islandica* shells as new environmental proxies. Despite its potential for future (palaeo-)oceanographic studies, the orientation of microstructural units in relation to environmental changes in shells has not yet received much attention. Therefore I consider this paper of high scientific quality and importance. The usage of the English language is excellent and the paper should definitely be published within BG.

However, in the following, I have some minor remarks on the draft, which should be addressed before publishing:

For the food experiments both the food and the temperature setting/conditions have been recorded. For the temperature experiment however, to my understanding, only

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the temperature has been measured. It is stated that throughout the experiment the shells were fed by/with ambient water. Please clarify what this mean exactly. What if during the first half of the experiment there was an algal bloom, ie plenty of food? Would you have known? Can this possibility really be ruled out with this setup? It would have been good to keep a control group at 10°C for the second half of the experiment to rule out any influence of the food availability.

Line 345: "Altered crystallographic organization may derive from the animal exposure to suboptimal conditions." In this study different temperature settings and food compositions have been chosen but I would like to know a bit more about the "why". Why exactly have those settings been chosen? What temperature does *A. islandica* tolerate? When would we expect the animals to be stressed? Why 10° and 15°C?

Pigment distribution is mentioned throughout the manuscript and has been measured. I would like to know why. Why are those pigments important? What are they good for within the shells. Why bother about them? I am sure there are good reasons for that. Please clarify early in the text.

Line 299 "All treatments showed a slightly thicker pigmented layer formed during the experiment than during the acclimation phase": Is there an (hypothetical) explanation for it given later on in the discussion? Why is that? Maybe I missed it. If so, disregard this comment please.

Line 802: How and where exactly has the pigment thickness been measured? And what does it tell us? Does it occur in identical parts of the shell in different ontogenetic years?

For the water temperature experiment it seems that the shells have been kept in a lab for about 1.5 years after collection. What happened to the shells during that time? If it was other experiments, how certain is it that they still "behaved naturally"?

The transfer of the shells from AWI to NIOZ happened in January, if I read that correctly.

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It is said that this transport created a stress line. However, January is usually not part of the growing season in *A. islandica*. How can the authors be certain that this line was built at that time/during the transport?

Line 287 "the shell portion deposited before the experiment": what time period is that exactly here? Acclimation? What happened to the shell at that time? How long before the experiment? "Before the experiment" does mean it has been under controlled conditions? Please clarify.

Line 326 and following: "As a consequence..." is that really true? I honestly don't know this myself but thinking of *Tridacna* and *Spondylus* with thick shells for warm water and *Serripes* with thin shells for cold water I am a bit in doubt if this is really such a general trend. Maybe it is the phrasing? It sounds to me as if that is always the case. Maybe relativize?

Line 754-756: why do polyene peaks occur exactly where aragonite peaks are? Has this to do with the aragonitic crystal lattice?

TECHNICAL CORRECTIONS Line 38: maybe consider changing "shells" to specimens? It is living animals and not just the shells.

Line 39 and following: no space between number and unit (°C).

Line 89: $\delta^{18}\text{O}$ shell should be followed by "value" (or "ratio"?) and not stand alone.

Line 94: "cite Schone et al 2010 papers here" clearly has not been done yet.

Line 202: "Polarized Raman microscopy"? "Confocal" maybe?

Line 314: "pigmentationreact" two words.

Line 352: "Hedegaard et al., (2006)" no comma here.

Line 359: "specie-specific" here an "s" is missing.

Line 389 and following: "...and many other bivalves - is linked to environmental vari-

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ables (e.g., Witbaard et al., 1997, 1999; Schöne et al., 2004; Butler et al., 2010; Mette et al., 2016)." Citations are all on *A. islandica*. What about "many other bivalves"?

Line 434: "sewater" here an "a" is missing.

Line 750: adult shell? It was 4 or 5 years old. That is not adult for *A. islandica*, or is it?

Line 751: "where" must be "were".

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