

## ***Interactive comment on “Assessment of hydrothermal alteration on micro- and nanostructures of biocarbonates: quantitative statistical grain-area analysis of diagenetic overprint” by Laura A. Casella et al.***

**Anonymous Referee #1**

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The manuscript “Assessment of hydrothermal alteration on micro- and nanostructures of biocarbonates: quantitative statistical grain-area analysis of diagenetic overprint” by Casella et al. represents a substantial contribution to scientific progress in the field of biomineralization and addresses a very important scientific question, the alteration of biogenic hard tissues, which is within the scope of Biogeosciences. The applied methods are valid and clearly outlined and the interpretation and conclusions are strongly supported by the results. The references are appropriate. The conclusions are fundamental as the authors prove the different steps which ultimately lead to calcite re-

C1

placement of biogenic carbonates, the possible occurrence of overprinted aragonite and importance of grain size, intergrain surfaces and porosity in controlling timing and extent of alteration.

However, the overall presentation is not very clear and the language is not always fluent and precise, so I think that the manuscript would benefit of moderate revisions, as discussed below.

General comments

In the Introduction, the authors should describe in more details the mineralogy of selected material (i.e. anticipate what it is written at p. 5).

In paragraph 3.1, the authors should describe in greater details the microstructural characteristics of modern bivalve, gastropod and coral skeletons, which at the moment is only briefly addressed. For instance, *A. islandica* is known to have an outer homogenous/crossed lamellar/crossed acicular layer, an inner fine complex crossed lamellar layer and an irregular simple prismatic pallial myostracum. The brief description reported in 3.1 does not adequately inform the reader about the fabric and does not correspond to what subsequently written at p. 6 line 30 (aragonite prisms, but the microstructure of *A. islandica* is not prismatic see Dunca et 2009; Schone et al 2013).

I do not think that the microstructure of *M. edulis* can be described as consisting of calcite fibres. What shown in Fig. A2B are calcite prisms not fibers. Other figures may be more questionable, but the microstructures of *M. edulis* is foliated and prismatic (see for instance Brom & Szopa 2016; Carter et al. 2013). Eventually it is described as fibrous prismatic (Brom & Szopa 2016), a term which I do not agree with, but which is used (Carter et al. 1990) and it is distinct from the typical fibrous fabric of brachiopods.

An important issue is the time of decay of organic sheaths around the basic mineral units, which is not clearly indicated but just discussed as short.

Some important concepts (porosity) are not described enough clearly.

C2

In paragraph 4.3, the authors should add the stratigraphic age of the described fossil material in order to support their conclusions.

In the conclusions, the authors should report and give more emphasis to the important statement: “even though nacreous aragonite is still preserved as aragonite, it is an overprinted aragonite that, most probably, holds little of the original microstructural or geochemical signature”.

Technical corrections

p. 1 line 34: sentence unclear

p. 2 line 9-10: long and complex sentence

p. 2 line 16 (and below in the text): sp. not italics

p. 2 line 25-30: I would describe before all the molluscs and only after the corals or viceversa.

p.3 line 2: correct *M s edulis* to *M edulis* test material: it would be better to indicate the dimension for the size (length, width, height?)

p. 4, line 24: the critical misorientation value. Sentence not finished

p.5 line 19: correct *H s ovina* to *H ovina*

p. 5 line 20: add the type of fabric for *A. islandica*.

p. 6 line 5: I do not think that the shell of *M. edulis* can be described as consisting of fibres, but prisms. Please check carefully also in the literature (Carter et al. 1990).

p. 6 line 13-14: explain better this statement. The examples that follows are not strictly related to it.

p. 6 line 29: How long does it take for organic fibrils to be destroyed? What is the relationship between this processdecay and the “dormant” interval reported at p. 7?

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p. 6 line 30 and p. 14: the microstructure of *A islandica* is not prismatic (Dunca et 2009; Schone et al 2013)

p. 7 line 25: again it is very important for this statement that the microstructure of the two taxa is described in great details, which is not at the moment.

p. 8 line 13: “for both microstructures”, is it true also for both mineralogical phases in *M edulis*?

p. 8 line 22-25: the description of the “rise in porosity” is very important but it is not described enough clearly. It should be stated more clearly that pores are present in the biogenic carbonates.

p. 9 line 12-14. Sentence not clear.

p. 12, lines 3-4 and p. 15, line 3-4. Prismatic and nacre microstructures are among the shell microstructures, the ones having the higher amount of organic content, more than the homogeneous/fine complex crossed lamellar fabric in *A. islandica*. Having a high organic content they should have also a high primary porosity. Or is it a matter of pore size?

p. 12, line 11 Regenberget al. 2007, comma missing after et al.

p. 12, line 29-35. This part is not very clear and not very well fitted into the paragraph. Also should not it be placed in the results?

p. 14 line 5-13. Very important process, to be described more clearly. It is nor clear why “Carbonate phase alteration kinetics in *A. islandica* shell is sluggish at first” and why porosity “explains the little difference in mineral grain area”.

p. 14 line 22-23. “the increased prevalence of the nacreous shell layer of *M. edulis* relative to calcitic shell layers in seashore sediments”. This statement should be better explained and supported.

p. 15 line 5-6: sentence not clear

C4

p. 15, "It has been further demonstrated that in Palaeozoic marine faunae taxa with calcitic skeletons prevail". The authors have to add fossil before marine fauna

p. 16 line 26: tissue forms or tissues form

p. 17 line 10-13: sentence long and not clear

p. 17 line 26: "Thus, in the case of aragonitic tissue the survival of biogenic aragonite" better to correct into "Thus, in the case of aragonitic tissue the survival of biogenic aragonite"?

References: Crippa & Raineri (2015) is in the text but it missing from the ref list

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