

Interactive comment on “Marine bivalve geochemistry and shell ultrastructure from modern low pH environments” by S. Hahn et al.

Anonymous Referee #1

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1. Overall quality of paper The paper is both novel and significant, but unfortunately its conclusions are somewhat disappointing as stated in the manuscript. It is a valiant attempt to characterize the influence of increasing dissolved CO₂ levels in seawater on a carbonate secreting marine invertebrate, but with mixed results. Some scientific problems with their isotopic compositions also compromise the outcome of the results and should be rectified in a revised version of this manuscript. 2. Specific comments The paper claims on lines 116-117 “no differences in seawater isotope ratios were noted between test sites” In actuality, the isotope data are from Pierre (1999, table 3) and that publication only lists $\delta^{13}\text{C}$ values for a site far from Ischia and Naples, nothing near Ischia. Did the authors collect and analyse their own???? They used *M. edulis* from Sylt as reference material, why not *M. galloprovincialis* from the harbor of Ischia, the same location of source for transplanted material? Especially a concern, since *M.*

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edulis was collected dead from a shell bed (abraded and worn). Nacre is usually referred to as tablets that form lamellae (Milliman, 1974; Carter 1990) not platelets and laminae. The reference to Fig. 3B is inadequate since no direction is given in caption or figure as to where it is on the photo. Authors claim lack of organic encrustation of outer shell (Fig. 2B, upper), which is difficult to ascertain in the photo. Perhaps a close-up would be better!? Also, they claim that the nacre lacked luster and pitted with holes; again impossible to discern from the figure their observation. The scanning electron – microstructural evaluations are fine, except a figure to show the disorder of fibers (unordered, line 226). A figure showing this disorder is in order and not just ones of ‘patches’ (Fig. 3e , f). Table S1 is critical to the text of the manuscript and should be incorporated into the Main body and not the supplement. The biggest concern is with the stable isotope results. They sampled the periostracum plus calcite, calcite, calcite plus aragonite and aragonite portions of the shell. The first and third are mixtures of unknown proportion and thus offer up meaningless results and should be dropped from the data tables, results, discussion, etc. Furthermore, the third mixture also suffers from differences between carbon and oxygen isotopes in calcite and aragonite (cf. Rubinson, M., Clayton, R.N., 1969. Carbon-13 fractionation between aragonite and calcite. *Geochimica Cosmochimica Acta*, 33: 997-1002. And Tarutani, T., Clayton, R.N., Mayeda, T.K., 1969. The effect of polymorphism and magnesium substitution on oxygen isotope fractionation between calcium carbonate and water. *Geochimica Cosmochimica Acta*, 33: 987-996). So, to compare and plot on the same graph we need to Normalize one set of values. All the discussion about isotope values from the nacreous layer and the calcitic one are mute because NO adjustment for mineralogical fractionation was made or mentioned in the text. Instead, the authors observe remarkable differences (lines 499-501) and it questions the bulk data from bivalve shells. Indeed, what it does is question their results!

The discussion in Section 3.3.3. is a real concern. Line 311 talks about ‘...calcite layer...’, whereas line 324 talks about ‘...bulk...’. Which is it???

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Thus far, the only valid conclusion is that transplantation caused a shock in both chemistry and microstructure, because the post transplant time at the acidified sites was too short. Agree, which in itself is very IMPORTANT! Other conclusions are not supported especially since water isotope compositions are not available, although claimed in table 1.

A major re-write with deletion of the mixed isotope results and normalization of the calcite and aragonite data may show some remarkable trends.

3. Editorial comments The submission is relatively well written, but suffers in places from germanic English. Surely, the co-authors from the UK should have caught these inconsistencies in the language and grammar.

Examples: line 57 until -> by Line 59 sea needed in front of surface Line 63 delete 'lead to a' and ' in the' and 'pattern' Line 84-85 move 'are scarce' to after 'studies' Line 285 (and others) '...nacre layer ...' -> nacre or nacreous layer Figures need improvements: 1. Inset should move down in major figure, also the location should be clearly marked on the eastern side of the island of Ischia (see original figure) 2. (b) needs to zoom in on the specific areas of interest 3. (b) should highlight nacreous layer 4. ok 5. nice 6. arrows to slices are not needed just lines 7. ibid 8. delete all results for MIXED samples, expand and concentrate on investigated interval not whole shell (compresses trends) 9. concentrate on area about shell growth related to transplantation (a-d), also make sure you define the transition between before and after (and not through a sample data point). What is meant by 'outer' and 'inner' layers, calcite, aragonite or mixed layers????

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