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Biogeosciences Discussions

Interactive comment on "Temperate carbonate cycling and water mass properties from intertidal to bathyal depths (Azores, N-Atlantic)" *by* M. Wisshak et al.

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Reply to Referee #2 (Anonymous)

We are grateful to anonymous referee #2 (R2) for the thorough positive review and the valuable specific criticism.

R2 suggests adding the more specific locality "Faial Channel" to the title in order to emphasise that the experimental results are not necessarily representative for the Azores region as a whole. We will follow this recommendation (even though we would not go as far as assuming that it is likely not representative) and we will also clarify in the discussion that the nutrient data is based on water samples taken during the months

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of September and October and thus reflect the autumn trophic regime.

We thank R2 for bringing our attention to the recent PhD thesis by Fernando Tempera, which we will add as a reference to the introduction section.

R2 asks for a more detailed methodological specification with respect to the general habitat characterisation we provide in section 3.1. We will specify, accordingly, that these observations are based on direct seafloor observations and photo + video documentation undertaken during a total of 15 submersible expeditions and 8 SCUBA dives in the Southern Faial Channel (plus the insight gained during many dozen previous submersible and SCUBA dives undertaken by the Rebikoff-Niggeler Foundation in the area prior to the experimental study). During these dives, many samples of selected calcareous epibenthos were taken complementing the wealth of epiliths that were found settling on the experimental frames and form the basis for the proper taxonomic identification undertaken by the authors and experts in the respective fields (as partly identified in the acknowledgements).

We'll follow the suggestion to specify the aim of the embedded mollusc shells and pieces of Iceland spar that were mounted on the experimental frames for later analysis of the microbioerosion ichnocoenoses and biological identity of corresponding euendoliths, respectively. This detailed characterisation of bioerosion patterns is intended to be presented in a separate publication (in prep.).

R2 asks for a specification of the weather conditions during which the light measurements were carried out. This is already specified in figure 4.

R2 points out that section 2.6 would profit from some clarification with respect to the actual weight differences the carbonate accretion and carbonate bioerosion rates are based upon. We will add an according sentence to section 2.1 stating that the PVC and limestone plates were dried and precision weighed before mounting them on the experimental frames. In addition we'll rephrase the mistakable sentence in section 2.6 (page 3303, line 24-27) to say that bioerosion rates were calculated via the weight loss

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of the limestone plates, determined after careful removal of all encrusting calcareous epibionts. The removed carbonate accretion in turn was weighed in order to directly determine the carbonate accretion rate on the limestone plates.

We'll adopt the hypothesis that the pronounced offset from the seasonal temperature amplitudes reported by Lafon et al. (2004) could reflect a considerable inter-annual variability.

R2 asks for a proper statistical backup for the interpretation of the carbonate accretion and bioerosion rates. We do provide descriptive statistics (arithmetic mean $\pm$ standard deviation, minimum and maximum values) for all exposure times, depth stations, substrate types, and substrate orientations. When comparing the results of these statistics, as plotted and partially given as numerical data in figure 6, the bathymetrical trend, temporal pattern, substrate type independency, and substrate orientation dependency are reasonably clear and span a large range of up to three orders in magnitude (logarithmic scaling of the x-axis), justifying to stand alone without the support of multivariate statistics. Considering that the overall length of the manuscript is already substantial, we would opt for not including further statistical tables and paragraphs, unless the handling editor recommends us to do so. Nevertheless, we agree that we should avoid the mathematical term "exponential" in favour of the purely descriptive "rapidly decrease" when addressing the bathymetrical pattern, and we can add the standard deviation where numerical data is given in the text.

What we address with "stronger relative methodological error" is that in case of substrate plates with no or only very little carbonate accretion or bioerosion, the relative error that is potentially introduced by accidental weight loss or gain due to the handling of the plates and platforms is larger, whereas this factor can be neglected where more carbonate was accreted and/or bioeroded.

With respect to the factors influencing the settlement of epibiota on up-facing versus down-facing substrata we can add two factors, namely shading and negative phototac-

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tic larval behaviour, and supporting references dealing with substrate orientation are for instance Crisp 1974, Harris and Irons 1986, Wendt et al. 1989, Connell 1999, and Glasby 2000. This factor is intended to be further elaborated on in more depth in a forthcoming publication (in prep.).

R2 suggests moving the mathematical model for evaluating the carbonate budget to the material and methods section. We do not think that this would be a more appropriate solution, since it is not an experimental or analytical method but a mathematical model that is based upon and derived from results of the present study. For our understanding it would be odd to establish a concluding model in a material and methods section.

Finally R2 raises the question, whether the applied micritic limestone substrate is comparable to the available natural substrates and whether one needs to consider a linked over- or underestimation of the determined bioerosion rates. Generally spoken, in the Azores there is a wide variety of available calcareous substrates with different mineralogy, porosity, organic content, and so forth, and there is an equally wide variety of different bioerosion agents with different modes of penetration, whose individual bioerosion rates are influenced in different ways by the substrate composition. It is thus not surprising that previous studies on the influence of substrate type on bioerosion rates of microborers, polychaetes, sponges, bivalves, grazers, etc. led to different and partly contradicting results (see Wisshak 2006, pp. 137-138 for a review). Based on the present knowledge, we consider the micritic limestone substrate as an “average”, calcitic, homogenous substrate, with high suitability for the applied gravimetrical quantification approach. Apart from that, for the present study, it was most important to apply the same substrate as in the previous north Atlantic experiments the results are tied into with respect to the latitudinal gradient.

We’ll consider all of the valuable technical corrections marked in the supplemented manuscript.

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