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Biogeosciences Discussions

Interactive comment on "Anatomical structure overrides temperature controls on magnesium uptake – calcification in the Arctic/subarctic coralline algae *Leptophytum laeve* and *Kvaleya epilaeve* (Rhodophyta; Corallinales)" *by* Merinda C. Nash and Walter Adey

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The manuscript submitted by Nash and Adey and entitled "Anatomical structure overrides temperature controls on magnesium uptake – calcification in the Arctic/subarctic coralline algae Leptophytum laeve and Kvaleya epilaeve (Rhodophyta; Corallinales)" is an interesting study in biomineralization of coralline algae. The authors investigate important aspects of calcification in two genera of coralline algae (order Hapalidiales),

such as structural aspects of biomineralization, as well as the control by the plant vs. temperature in the magnesium uptake. I think that in the recent scenario of climate global change and of growing use of these organism as climate proxies we need more studies to improve our understanding of mechanism that lead mineralization in these plants. Nevertheless, I would underline some observations and suggestions arose during the careful reading of the manuscript.

The authors should enhance the literature cited. For example L75-78, are not there other published studies after the 1975 on coralline growth rates under different range of temperature and light conditions? Cabioch and Giraud (1986 In: Biomineralization in lower plants and animals [Ed. B.S.C. Leadbeater R. Reading], Clarendon Press, Oxford) reported a chapter entitled: Structural aspects of biomineralization in the coralline algae (calcified Rhodophyceae). The authors investigate the cytophysiological features of biomineralization in several examples of coralline algae from the different types of organization (crustose (M. lichenoides; L. lenormandii; L. sonderi; L. incrustans), branching and articulated (Jania rubens)). They found that calcification is a two-step phenomenon: 1) "In the outer zone the general envelope contains thin needles arranged tangential to the cells and parallel to the polysaccharide fibrils. Towards the base of the outer cells needles change progressively into plates. Among the epithallial cells, in the youngest parts, only tangential crystals can be observed and they are regularly arranged in the lateral walls." 2) "Inwards, from the perithallial meristem and directly under the epithallus, calcification increases and a second phase can be observed in the form of crystallization perpendicular to the cell wall. These secondary crystals are very closely juxtaposed and form in contact with the plasmalemma. After gentle decalcification they appear to be inserted between the radial polysaccharide fibrils. . .. . .. The wall of each cell is made of a primary part, with tangential fibrils and crystallization, and of a secondary part with radial fibrils and crystallization. These observation show that biomineralization is controlled by the cells and that radial crystallization is a secondary process. . .. .".

The authors should replace the words epithallium, perithallium and hypotallium with epithallum, perithallum and hypotallum respectively. Indeed, the terms epithallus, perithallus and hypothallus are respectively formed with the prefix epi- (form the Greek áijŘπÎŕ âĂŐ= on top of), peri- (from the Greek περὶ âĂŐ= around, close to), hypo- (from the Greek á¡ŚπÎ£- = below) and the word thallus (from the Greek ΪŚαλλΪŇς (offshoot, from thallein = to sprout), becoming thallum in Latin). Instead thallium is the chemical element.

Despite the interest in the topic of this study, one of my uncertainty concerns the resolution of EDS beam for measuring the Mg content in parts of the cell wall that range between 0.5μm to 2μm in thickness. The same authors raise the problem, and they write that the values measured for cell wall and interfilament may include small amount of the other. Moreover, although the authors could not know time and temperature of formation for each algal component (L403-404), they suggest that the magnesium offsets in different parts of the crust are clearly aligned to anatomical features and not controlled by temperature on base of a calibration value obtained on different species of CCA in experimental treatments (L410-417). I think that, although it could be possible, with these approximations the affirmation is not well supported.

L79: In the references there are two articles for Adey et al. 2015. Here, is it Adey et al 2015a?

L183: L. laeve (in italic)

L265-267: I think that for comparing the calcified cell structure of K. epilaeve with the one of L. laeve, the cells should be oriented in the same way. I suggest to embed the sample into epoxy resin for driving the cut.

L281-283: should it be moved in discussion.

L288: the authors reported that the lowest values of Mg content were for the K. epilaeve PIF and PCW. Could it due because the thallus was in a earlier stage of calcification

than the perithallial cells of L. laeve (Cabioch Giraud 1986; see also L329-331)?

L347: remove space

Figures:

In some case, there is not conformity between the text and the figures:

L129: It should be Figs 1A and B

L134: It should be Figs 1C and D

L247: Fig. 2D?

L249: Fig. 3B?

L251-263: Should it be Fig. 3?

L269: in figure 3A is not possible to see the areas of interfilament.

L271: should it be Fig. 3B?

L272: should it be Fig. 4A, B?

L368: Maybe figure 1C?

L377: figure 1B do not show any layering

The figures should be cited in the text in order of the presentation, though figure 5 is taken from other articles (L211 the figure 5 is cited after figure 1 and before figure 2). I think that the authors should show the figures in the same order in the composed figures. For example in Fig. 1 the figures are ordered from left to right, on contrary in Fig. 2 they are ordered from the top to bellow.

All the Best,

AC

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