



Interactive comment on “The environment recording unit in coral skeletons: structural and chemical evidences of a biochemically driven stepping-growth process in coral fibres” by J. P. Cuif and Y. Dauphin

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Dear Anonymous R#3,

authors are very sensible to your clear understanding and exact expression of what they have attempted: “to convince the reader that corals are carbonate minerals whose main features are a direct result of various biological imprints”. Although not paleoclimatologists, we have had various opportunities to meet a number of people that are less familiar than you are with biomineralization and are still following the purely mineral scheme of the coral fibre. To these colleagues, authors hope that their paper could be useful, and they are also grateful for your favourable comment about the method used to present the various scales at which coral fibre must be studied.

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Therefore authors are a little bit disappointed with the second part of your report, in which you seem to think that we do not recognize the value of the environment recording process in coral skeletons. Far from such a standpoint, what we are trying to do is to improve our capacity to read the environmental information in corals, and more generally in any other calcareous biological structure, by a better understanding of the biocalcification process. The sentence you have cited (from p. 639: "application of simple thermodynamical laws cannot provide us with accurate interpretation of environmental signals.") must be strictly understood. By applying to biominerals the thermodynamic rules corresponding to a simple chemical precipitation process, we are not on the right way to improve coral contribution to the paleoclimate global research. Please, note also that this sentence is not own, but a citation of Anne Juillet-Leclerc (LSCE, Gif sur Yvette), who is involved in paleoclimate research since decades and perfectly aware of what is going on in this domain.

To be still more precise, we can even use your own words: "Clearly the corals "feel" the thermodynamic constraints". We fully agree with this sentence, taking into account that the thermodynamic constraints to which crystallization process is submitted result from the complex organic assemblage secreted by the coral ectoderm in the first step of each biomineralization cycle. There is no doubt that the chemical activity of this organic framework is sensible to environmental conditions, and first of all probably, to the temperature. To expose the underlying idea of this paper still more clearly, we hypothesize that the kinetics of the crystallization is first influenced by the well-established differences in the biochemical compositions of the mineralizing matrices, from species to species. Combined to the influence of temperature on the biochemical activity of these matrices, we have a very plausible way to explain the differences that occur in skeletal composition between various species living in the same water pool (and in the different parts of a given coral skeleton as well). These influences are repeated in each biomineralization cycle, the reason why they are the true "environment recording units".

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Thus we all believe in thermodynamics, but the point is to provide thermodynamicians with a complete set of informations about what actually occurs in a biomineralization layer, to develop calculations accordingly. Our paper was made to draw attention on the scale of the “black box”. We have emphasized the importance of the diversity of the biochemical assemblages as a source of the “vital effect”, not only because their presence within the skeleton can alter the isotopical measurements, but mostly because of their chemical activity.

To conclude, authors willingly recognize that “the problem has not been solved”, and there is no doubt that “the definitive model of coral biomineralization lies still in front of us”. They simply found useful to draw attention on the structural level at which the recording process in corals is running and they thank you again for your kind report about the interest of this demarche.

Interactive comment on Biogeosciences Discussions, 1, 625, 2004.

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