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Biogeosciences Discussions

Interactive comment on "The role of microorganisms on the formation of a stalactite in Botovskaya Cave, Siberia – palaeoenvironmental implications" *by* M. Pacton et al.

S. Verheyden (Referee)

sophie.verheyden@naturalsciences.be

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This paper deals with the still open question of potential active participation of bacteria in the deposition of speleothems. New techniques bring indeed some new and more precise data. Microbial studies in caves may open a different, until now less studied environment, therefore interesting. The fact that the paper combines different methodologies to investigate the minerals as well as the organic material and the combination of observations and experimental work is a rather robust methodological approach and certainly a step further than several former studies done in the cave environment. As previous comment, posted by Dr Bindschedler, my opinion is that the paper can be

much ameliorated by taking the results with some more caution. Especially following points:

Lines 15 to 20. The studied sample is an asymmetric stalactite and authors assume that it is 'likely the result of preferential water flow down one side.' However, the asymmetric forms in stalactites may also be due to a higher CO2 degassing rate at that side (if towards the upstream side of cave airflow) and, in an extreme case, resulting to anemolites (a helictite in which the eccentricity is ascribed to the action of air currents). This has implications on the statement at p. 6579-line1-10 that the Mn-Fe mineralization precipitated where the water flow was minimal, since the water flow would be MAXimal, or at least the water film on the stalactite would be the thickest downstream the airflow. . .. The given reference of Lau and Liu concerns biofilm deposition in open channels, a very different environment and flow velocities than here on the stalactite.

Page 6571, lines 4-6: "The hiatus between layers E and D is the last speleothem surface on which a microbial community was present. Two calcite layers and two hiatuses separate layer B and last period of the microbial activity.' I fully agree with previous comment by Dr Bindschedler that the authors cannot state that microbial activity was not present in the other layers. So I suggest that the authors change it to 'microbial community was observed' and 'last period where microbial occurrence was observed'. I would avoid 'activity' since it supposes activity in the speleothem deposition which is not proven here.

Page6574, lines 22-25. The authors state that 'biofilms seem to help initiate layer formation on the stalactite via organo-mineralization processes characterized by small minerals.'. However, speleothem layers initiate through small crystals towards palisade crystals by competition, as well in a totally inorganic precipitation and do not need 'organo-mineralization processes'; (Kendall and Broughton, 1978).

Chapter 5.3. d18O and d13C : If I understood well, the conclusion linking depleted d13C values and porous layers (putative biogenic) is based on a single stable isotopic

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profile where the d13C is depleted at the proximity of a crack. Replicate profiles should be done to confirm this. Laser-ablation isotopic measurements linking depleted d18O with the 8.2ka cold event was published and the depletion turned out to be due to the crack (See McDermott et al., 2001). Even if not the same methodology, porosity and cracks can probably have some influence on the measurement. I agree with the authors that if the results are confirmed this is an argument for microbial calcite deposition activity.

p. 6575 line 9-12. Concerning the fact that the rosette-like arrangement of the oxides in the stalactite is unexpected, Cañaveras et al.1999 and Cuezva et al., 2009 related rosette- or nest-like aggregates in Altamira cave to bacterial CaCO Âż deposition. They also show the interest of tracking Vaterite in the samples because bacterial activity seems to be necessary to form vaterite spheroid elements, similar to and a possible precursor of the observed CaCO3 spheroid elements (see also; Sanchez-Moral et al., 2003; Rodriguez-Navarro et al., 2007). So, I wonder if the rosette-like structures could be carbonate deposited simultaneously or in alternation with the oxide in the stalactite presented in this paper.

p. 6578, line15 to 18. The authors suppose that the source for the iron and the Manganese in the oxides is a now disappeared peat bog. However, manganese coatings are often encountered on pebbles in cave streams and iron can be present in the form of sulfides in the above lying limestone (see also Peck, 1986). The peat bog is therefore certainly not the only possible source. A more detailed (geochemical) description of the host rock can bring interesting elements to better understand possible sources.

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