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Biogeosciences
Discussions

Interactive comment on "Mn seasonal upwellings recorded in Lake Tanganyika mussels" *by* D. Langlet et al.

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GENERAL COMMENTS This is a very solid paper. The data quality looks good and it is well written. This is a good first step toward the use of Pleiodon for the reconstruction of upwelling history in Lake Tanganyika. This paper is appropriate for the journal in that it describes a new tool for reconstruction of lake history (under the right conditions). Although I have a couple of substantial questions for the authors, I would strongly recommend publication after these issues are addressed. I completely agree that more work needs doing and one of the first methods employed should be carbon and oxygen stable isotopes.

SPECIFIC COMMENTS

Four questions/comments on [Mn] in the lake

1. First, I would very much like to see the [Mn]dissolved data. Why are these not included? The authors say that there is a sustained increase in [Mn]d during upwelling - it would be nice to see the numbers. Having this record may allow the reader to decide if Mn is taken up directly from the water or through the intermediary of food particulates. Even if this data is noisy or does not fit the expected patterns, having this data will help the readers. Is there a clear seasonal contrast in surface water [Mn]? Is it large enough to contribute to the particulate uptake suggested by the authors as the primary control? Is the change large enough to be the cause of the 3 to 4 fold increase in shell [Mn]?

2. There seems to be an opportunity to discuss the quantification of these [Mn]shell signals in the data from MPU-E. In this shell both 2002 and 2003 upwellings seem to be recorded. If we had [Mn]d and [Mn]p data and could compare the area under the [Mn] curves, this may give some hints on how shell data could eventually be quantified.

3. Using Mn/Al in Figure 4 is a nice way to separate runoff-derived Mn from upwelling-sourced Mn, but the bivalves could be taking up Mn from aqueous Mn or digestible food particulates. This is another reason that [Mn]d needs to be shown. The upwelling and [Mn]p does not seem to agree very well (Figure 4) - there is a three month lab between upwelling and the increase in 2002, and in 2003 there is a one month lag and [Mn]p levels stay elevated for a few months after the upwelling. Why were these two years so different? And why does the MPU-E shell return to low [Mn]shell values after a spike in June 2003?

4. I am not convinced that [Mn]d is not taken up by the Pleiodon based on the staining experiment. It seems very possible that the individuals simply failed to grow new shell or take any Mn into the body fluids during 12 hours of handling by the authors. The authors should say how many individuals were used in the staining attempt and give an estimate of their age (based on fig 2?). Were any of the individuals rapidly growing

young individuals?

Five questions/comments about Time in the shell

1. How well is the timing of events in the shell really documented? The authors should try to put a very precise landmark in Figure 5b, since that is the only shell-internal time marker available. If the growth lines are followed back from the margin to the laser transect, when does the [Mn] peak occur? The authors say June-July 02, but this is prior to the peak in [Mn]p - so why would the peak show up in the shell before the strong increase apparent in September 2002? I am also very puzzled by the distance scale in Figure 5b, the text says that there was 2.9 mm of growth between marking and collection, but the transect covers 14 mm. How can this be?

2. I noticed that the secondary [Mn] peaks in Figure 5b and 5d (in the center or to the right of center) are large enough to be mistaken for some of the peaks in shell MPU-V61. They reach values $>$100 ppm. The 94, 95, 99, 00, 03 peaks in MPU-V61 are similar or smaller in size. The authors should point this out and discuss the possibility of multiple [Mn] peaks per year. As they have pointed out, oxygen isotope ratios may eventually help here (e.g. Dettman et al., 2005), although multiple upwelling events would also complicate d18O records.

3. If 1996 was an anomalous year in terms of upwelling, this may help determine if the Mn cycles are truly annual, based on the unusual pattern suggested for 1996 in Figure 6. Although there is probably no directly measured upwelling data, there may be climate factors that could be dug up for 1996 (or 1995 or 1997??).

4. Is there any indication that growth banding is associated with upwelling events (based on a comparison of visible banding and the long records shown in Figure 6)? In Kigoma, near the center of the lake, banding is virtually absent in Pleiodon.

5. As the authors can see from the above, I think that there is still uncertainty about whether the Mn cycle in the shells is truly annual, but this cannot be answered with the

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data we have at present (apparently). Although the authors argue that this is probably an annual record, they have properly qualified their discussion with terms like “probably” and “suggests.” The authors may want to discuss this question in more detail.

Finally, 2 questions about [Mn]shell

1. Can the authors comment on the large difference in [Mn]shell for the two shells in Figure 6? Why are the overall patterns and concentrations so different?

2. Please discuss the consistent offset between the drilled samples in MPU-10 and the laser transect data. This difference seems to be greater than the uncertainty in the measurements. Is there a calibration problem or a matrix effect problem?

TECHNICAL CORRECTIONS

Please consider rewording your title. It should not start with a symbol (Mn). Maybe “Manganese content records seasonal upwelling in Lake Tanganyika mussels"?

Hecky reference is incomplete

A few spelling suggestions: 2-year-long not 2-years-long filtered not filtrated crystallochemic not cristallochemic

Reference cited: Dettman, D.L., M.R. Palacios-Fest, H. Nkotagu, and A.S. Cohen, 2005, Paleolimnological investigations of anthropogenic environmental change in Lake Tanganyika: VII, Carbonate isotope geochemistry as a record of riverine runoff, Journal of Paleolimnology, v. 34, pp. 93-105.

Interactive comment on Biogeosciences Discuss., 3, 1453, 2006.