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Biogeosciences Discussions

Interactive comment on "The last glacial-interglacial cycle in Lake Ohrid (Macedonia/Albania): testing diatom response to climate" *by* J. M. Reed et al.

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General comments

This is a well-written, thoughtful and interesting paper that contributes valuable new data on a key site for late Quaternary climate change from this important region. Using diatom morphological and dissolution data provides an extra dimension to investigating environmental change and taphonomic processes, and certainly this paper will be important baseline study for later higher-resolution work from this site. The paper confirms that the diatom record is a sensitive proxy of climate/environmental change, but not without its own challenges and complexities that will richly reward further study. I

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Interactive Discussion

Discussion Paper

have a few, more substantial comments, given below, and a list of typos/minor points.

Specific comments

1) Methodology

a) 4694 L12-16 Why different preparation methods used in UK and Macedonia? Potential effects on diatom representation e.g. smaller (dissolved/weakly silicified) taxa – though preservation not affected (how was this tested?). Might be interesting to see a scatterplot of dissolution indices of UK vs Macedonia, to check dissolution protocol consistency (though differences might be due to preparation method too).

b) Why was parallel counting employed – on same samples? If a smaller calibration set counted in common (to establish taxonomic/preparation consistency), then twice as many samples could be analysed between the 2 teams? Also, some lumping of the Macedonian data to approximate that done in the UK (merged or split) would likely show the same CA patterns (cf. Fig. 2).

c) Diatom samples from Baikal sediments, which are also poorly preserved generally, were prepped using water and overnight settling alone (see Mackay references) – seeing the low TOC% at Ohrid, H2O2 might not be necessary and in future work, this might minimize further valve destruction/loss etc.

d) Perhaps use Battarbee et al., 2001 rather than Battarbee, 1986?

2) Fragilariales are notoriously difficult to interpret – but I think the authors are right that diatom concentration data, and flux data, would be very helpful in determining to what extent planktonic and benthic accumulation rates differ between glacial/interglacial cycles, and their relationship to dissolution indices. Such data would also help interpretations of changes in lake functioning and limnological processes (e.g. ice cover, stratification, water residence time, nutrient enrichment, lake level change etc) that might be the factors to which diatom communities are in fact responding (and this might in turn shed light on the different time lags expected for different limnological factors –

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e.g. rapid response of ice cover for example compared to generally longer changes in nutrient levels mediated via catchment changes in weathering, soils and vegetation, and internal cycling).

3) Dissolution: The pristine category used here equates to the F index of Mackay and others, and does show good correspondence between glacial (generally poor) and interglacial/interstadial (generally good) conditions. It is possible an index involving more dissolved categories (e.g. Ryves et al., 2006) might provide a better summary, as there are 3 categories for C. fottii and C ocellata. But I also noted that in Fig. 4, the correspondence between pristine valves and CA axis 1 scores seems strong – in a constrained ordination (time or depth as co-variable; and perhaps with MIS or cold/warm as co-variable too?...), I wonder how much variation in the diatom data (lumped) would be explained by dissolution? Of course, one can argue that in an assemblage where a handful of taxa dominate, CA axis cores reflect the dominant taxa, which also dominate the F index scores – but perhaps interesting nonetheless to explore!

4) Figures illustrating the main taxa (or just C. fottii and C ocellata), and their dissolution morphologies, would also help and be of interest – the pattern of C. fottii corrosion alluded to is certainly unusual for Cyclotella as observed elsewhere (e.g. ...Battarbee, 1988; Flower, 1993; Ryves et al., 2009).

5a) Differences between present and last interglacial – clearly the appearance of S. galileensis, and importance of C. ocellata (3 ocelli) plus benthic differences are the major contrasts between these two interglacials – more discussion on what these differences are, what they might mean and wider implications would be useful.

b) The discrepancies in location of cores Co1202 and more littoral Lz1120 (plus location closer to major inflow etc?) may explain differences between these records, but potentially so could dissolution (better preservation in Lz1120?). But if there is evidence of ice-rafting in Co1202 (when/how much? Curve of this in Fig. 4 would help),

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this would suggest that conditions here were colder, perhaps into the Holocene, and thus Co1202 might not be as compromised as the authors suggest – but then one would expect to see similar cold conditions at Lz1120 too, only 20km away. How sound is the dating for Co1202 at this time (or indeed Lz1120)? Both cores are on slopes – could there be effects from turbidites or other sedimentological processes affecting the integrity of the records?

Figures

Figure 3. This would be easier to read & interpret if there was a 2^{nd} Y axis with the dates (I see that plotting against age might bunch up the counts too much); and another column with the MIS stages would certainly help. Also, values below about 2% are very hard to discern on this plot – could these low abundances be indicated by a + symbol etc? Another way to do this is to remove the baseline (y axis) for species plots, thus all occurrences can be seen.

A plot of the age-depth model (with sedimentation rate) would be most useful for the reader in evaluating core chronology and integrity.

Typos/other minor Qs

4691 L2 Change important to key? Reads a bit oddly

4692 L14 Heinrich events/stadials also seen further afield in tropical Africa e.g. Tanganyika (e.g. Tierney et al., 2008)

4693 L9-10 This part of sentence reads awkwardly

4693 L3 Why have reference for lake altitude? Surely not debated?

4693 L13 Need reference for water budget/hydrology

4693 L17 Rephrase, e.g.: "it is undergoing [ref] or may undergo a switch. . . "

4696 L13 C2 should have a reference – see suggested reference in C2 manual

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(...(..)Juggins, 2003)

4696 L 14. Linear ordination might be appropriate for gradients <1.5-2; what were the gradients for diatoms?

4697 L16 "...rare" – sentence should be re-phrased?

4697 L21 add "in"

4701 L4 Add "seen"

4701 L19 "respond"

4701 L20-22 Possibly with ostracods etc from a littoral core – though these might of course be rare in a glacial (more chance of finding these with a shallower, littoral core however)

Additional references

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Interactive comment on Biogeosciences Discuss., 7, 4689, 2010.