Biogeosciences Discussions

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Comment on bg-2021-235

Karina Apolinarska (Referee)

Referee comment on "A modern snapshot of the isotopic composition of lacustrine biogenic carbonates – records of seasonal water temperature variability" by Inga Labuhn et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-235-RC2, 2022

The study by Labuhn et al. discusses an interesting issue of applicability of oxygen stable isotope measurements in specific lacustrine carbonates in reconstructions of past water temperatures. The study adds to the already existing knowledge as pointed out by authors.

I found the manuscript well written and interesting. The introduction is informative and points out the key information based on the available literature sources. The data are well presented with high-quality graphics. The authors discuss the possible mechanisms that control the stable isotope composition of the carbonates studied and explain the possible reasons for the differences in the stable isotope composition of encrustations and shells.

The study confirms the established knowledge that due to the differences in stable isotope composition $\delta^{18}O$ measurements should be performed on the specific types of carbonates instead of bulk carbonate samples of unknown and potentially time-variable composition. The most important outcome of the study is showing that by studying selected carbonates it is possible to estimate seasonal water temperature changes.

Despite the overall good quality of the study I suggest considering the specific comments listed below before the manuscript can be accepted for publication.

Specific comments:

Line 4: change ‘on’ to ‘by’

Line 98: delete double ‘the’

Lines 145-148: I would not limit the growth of *Chara* to May-July. What about August and possibly also September? You suggest that charophytes studied are perennial.

Lines 156-157: What was the bottom area (cm2) where each of the surface sediment was sampled?

160-162: Information about the sampling of charophytes is lacking. Were the whole macroalgae taken? Cut at the water-surface sediment interface? How many individuals of each species were sampled?

Lines 168-169: Since I was involved in the studies of the isotopic composition of recent charophytes I have also tried to remove organics with H2O2. I have never managed to remove all. Part of the stem was always resilient and remained after the treatment.

Line 169: Please explain what the ‘fine-grained calcite sticking to the encrustations’ is. Why did you remove it? How do you know that you did not remove a fraction of encrustations at the same time?

Lines 255-257: I guess both living specimens and *Pisidium* shells taken from surface sediments in fact originate from the surface sediments therefore it is better to say: shells of living *Pisidium* specimens and empty *Pisidium* shells

Line 257: probably it would be good to change ‘living and dead samples’ to ‘shells of living and dead mussels’

Lines 263-264 and 380-382: Charophytes – you studied ‘single stalks from an internode or branchlet’. Encrustations at one specimen are not formed at the same time but as charophytes grow. Therefore in the isotopic studies of charophytes, specific fragments were studied, e.g. apical fragments. The variation of stable isotope values of charophyte encrustations studied may result from the fact that different fragments had CaCO3 precipitated at slightly different times, i.e. as the charophyte grew. In my opinion, the larger isotopic range of *Chara hispida* is also due to the gradual seasonal growth and precipitation of encrustations in the changing ambient conditions.

Lines 264-265: Do you have confirmation that *Chara hispida* from the lake studied overwintered? Charophytes are not always perennial. Overwintering can occur but it is not a rule. I have observed this during the field studies I participated in. You can have a look at publications e.g. of Mariusz PeÅ□echaty – an experienced charophyte scientist with extensive field experience, in which the issue is discussed.

Lines 265-266: Whole new and several dozen cm high charophyte can grow within one season –personal field observations.

Line 266: Which internodes and branchlets were sampled? Apical ones or fragments from different parts of charophytes. Also, what were the sizes of charophytes? How tall were the macroalgae studied? This information is important in the context of the discussion. Thick and dense charophyte stands can form a specific microhabitat, they can also limit the extent of water mixing to the bottom.

Lines 279-282: This difference may result from the intensity of photosynthesis and density of charophyte patches.

Lines 283-284: Here 'fine calcite' is mentioned once again, what kind of calcite is that? More explanation is needed.

Lines 317-319: Influence of stratification is mentioned here however, previously in the manuscript it was stated what waters within the epilimnion are well mixed and looking at the data one can see that thermocline is below the deepest site sampled. Also, see lines 345-348 and most important lines 352-357: These fragments confirm my concern about interpreting $\delta^{18}O$ values in *Candona* as related to water stratification.

Lines 324-329: Also, $\delta^{13}C$ of adult ostracods is lowest because of water mixing and return of the ^{13}C-depleted DIC of the waters from below the thermocline

Lines 424-425: Which is an apparent drawback.

437-438: Temperatures absolutely unlikely to occur. In central Europe, even during days with temperatures > 30 during the day, water temperature in the epilimnion reaches 24-25oC.

Fig. 3a: Why don't you present the complete, i.e. whole year precipitation and temperature data for the year of sampling – 2018? This may differ from the long term

data. In fact, the difference is already visible, especially in precipitation values.

Sincerely,

Karina Apolinarska