

# ***Interactive comment on “Ostracods as ecological and isotopic indicators of lake water salinity changes: The Lake Van example” by Jeremy McCormack et al.***

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This is really nice study which combines some detailed and critical evaluation of their data sets (e.g. sampling sizes, potential biases due to vital effects, etc) with evaluation in terms of wider issues of Quaternary climate reconstruction.

I am not an ostracod specialist so cannot comment in any detail on this aspect of the paper, and instead will focus my comments on the stable isotopes, carbonate mineralogy and climate stratigraphy.

The stable isotope record of the PALEOVAN core record has been a bit of a puzzle.

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The pre-PALEOVAN core record from Lake Van, covering the last  $\sim 15$  ka and based on bulk carbonates, showed good overall correspondence to other lake isotope records from SW Asia (Roberts et al., Quat Sci Rev, 2008). However the bulk carbonate isotope data for the PALEOVAN cores, older than  $\sim 15$  ka BP, made no real sense, either in comparison with other proxies from the same cores (e.g. XRF Ca/K ratio) or with other sequences from the same climate region. Potential explanations for this discrepancy included isotopically-light glacial meltwater or inwash of detrital carbonate. The authors here focus on an alternative explanation, namely fractionation effect due to changes in carbonate mineralogy. They show, 1) that  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  measurements on ostracod shells do not correlate with equivalent stable isotope measurements on bulk carbonate, 2) that instead they correlate well with other proxies from the same core, 3) that there have been important shifts in carbonate mineralogy through the core sequence. The resulting hydro-climate reconstruction makes a lot more sense, with more positive isotope values (and low lake levels) during the last glacial stage (70-15 ka BP).

The effect of carbonate mineralogy on isotope values is most marked for dolomite, whose fractionation factor is substantially different from either calcite or aragonite. The authors might want to cite other studies where this has also been demonstrated (e.g. Nar lake, also in Turkey – Dean et al., Quat Sci Rev 2015). In contrast, the difference in the mineral-water fractionation factors of calcite and aragonite is small ( $\delta^{18}\text{O}$  of aragonite is  $\sim 0.7\%$  more positive than  $\delta^{18}\text{O}$  of calcite formed in the same  $\delta^{18}\text{O}$  lakewater and temperatures; Grossman and Ku, 1986; Kim et al., 2007), so seems unlikely to explain the much bigger offset between  $\delta^{18}\text{O}_{\text{ostr}}$  and  $\delta^{18}\text{O}_{\text{bulk}}$  in Lake Van.

Although, in general, the new isotope, carbonate mineralogy and ostracod data match other data sets well, I think it would be worth highlighting those time periods when they do not match so well. For example, the end of MIS6 in L Van shows high % Candona and a low ACE index, both suggesting relatively high lake levels, in contrast to previous interpretations, and also in contrast to the last glacial period (MIS 2 and 4). MIS 5a

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also seems a bit mixed, with some indicators showing high lake levels (e.g.  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$ ) but others indicating low water levels (e.g. ACE index).

Overall, though, I don't see much here that needs changing before full publication.

Neil Roberts, 18 Feb 2019

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