

Interactive comment on “Sedimentological processes and environmental variability at Lake Ohrid (Macedonia, Albania) between 640 ka and present day” by A. Francke et al.

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I have already made the same comments on the chronology of the Lake Ohrid sequence in my review of the Sadori et al. BGD, but as the derivation of the timescale was undertaken by Francke et al., I think it is appropriate to repeat the them here.

While the 1st-order control points are derived from the chemical fingerprinting of tephra layers to known eruptions providing an independent chronology that is extremely valuable, the 2nd and 3rd order controls are derived by tuning to orbital parameters and the LR04 benthic stack, which is itself tuned to orbital changes.

With respect to the 2nd-order tuning, minima in TOC content and in the TOC/TN ratio
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have been aligned with inflection points of increasing summer insolation on 21 June at 41°N, as suggested by the position of some tephra layers. An explanation involving a balance between summer insolation strength and winter season length leading to low organic matter preservation is presented, which may or may not be correct. In fact, the control points of the 2nd-order are placed at times when perihelion passage occurs in March and it is worth recalling that Magri & Tzedakis (2000, QI), Tzedakis et al. (2003, EPSL) and Tzedakis et al. (2006, QSR) already noted that the most extreme conditions involving tree population crashes that reflect dry and cold episodes occurred at times of perihelion passage in March. Berger et al. (1981) have pointed out that the highest radiative loss through surface albedo in middle and high latitudes occurs in spring. Thus, relative minima in shortwave absorption would occur during intervals when a large part of the annual radiation is delivered at this time (i.e., March perihelion configuration), and this pattern could provide a mechanism for the observed periodic coolings and related impact on ecosystems.

As for the 3rd-order points, aligning terrestrial records to the benthic isotopic stack may have once been considered broadly sufficient (e.g. Tzedakis et al. 1997, EPSL), but is no longer the optimum way for constructing a detailed chronology as more recent work on pollen sequences from deep-sea records has shown that benthic d18O and terrestrial events are not necessarily coeval (e.g. Shackleton et al., 2002 QR; Tzedakis et al., 2004 Science). The climatic explanation for aligning the TIC to the LR04 stack is not tenable on two additional grounds: (i) benthic records contain a signal of changes in the isotopic composition of seawater, deep-water temperature and hydrographic effects and unless these are deconvolved, it is not possible to interpret changes in terms of ice volume only (e.g. Elderfield et al., 2012 Science); and more crucially (ii) even if the ice volume component were isolated, the different response times of ice sheets, ITCZ shifts and local climate means that a simple alignment between the ice volume and TIC is not straightforward. I would therefore recommend that these control points be removed, or replaced by control points derived from alignment with d18O records from Mediterranean planktonic foraminifera or sea-surface temperature records, which
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have been shown to be more in-phase with terrestrial climates. The problem with this, however, is that then one cannot make comparisons with the same records, as this would introduce circularity.

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