

Interactive comment on “A new high-resolution pollen sequence at Lake Van, Turkey: Insights into penultimate interglacial-glacial climate change on vegetation history” by Nadine Pickarski and Thomas Litt

Anonymous Referee #2

General comments:

This is an exciting and valuable new data set and a major contribution to the knowledge of past climate and vegetation development in the Middle East.

As you clearly show in your discussion, vegetational development, i.e. transitions from open steppe vegetation to various stages of deciduous and coniferous woodland (and vice versa) are not only driven by temperature, but largely by moisture sources and availability. Thus it is somewhat risky to directly relate the Lake Van pollen and oxygen isotope records to the marine isotope stratigraphy and to use the MIS terminology. I suggest to interpret the Lake Van record with regard to regional climate and vegetational change and use it as a basis for discussing possible correlations to the MIS, insolation etc.

Be careful with the term 'succession'; I think it may not be used in a central European sense. At Lake Van there is a distinct gradient in moisture from south-west to northeast; the 'succession' from open steppe to deciduous oak woodland as described here might rather be a movement of the different vegetation formations from SW to NE than an all-over woodland expansion.

Minor improvements and suggestions:

(Linguistic and grammatical improvements suggested by referee#1 are not repeated here)

Line 114: please provide some additional information on how you did the synchronization

We revised the 'Chronology' section as follows (see also response to Referee #1; comment **7 101** and **7 114**):

'For the climatostratigraphic alignment of the presented Lake Van sequence, the proxy records were visually synchronized to the speleothem-based synthetic Greenland record (GL_{T-syn} from 116 to 400 ka BP; Barker et al., 2011). The identifications of TOC-rich sediments containing high Ca/K intensities and increased AP values at the onset of interstadials/interglacials were aligned to the interstadials/interglacial onsets of the Greenland record by using 'age control points'. Here, the correlation points of the Lake Van sedimentary record have been mainly defined by abiotic proxies (i.e., TOC) caused by a higher time resolution of this data set in comparison to the pollen samples available during that time.' (now line 117-124).

Lines 157 ff.: you may replace 'forest' by 'woodland', '(sparsely) wooded landscape'

We rephrased the sentence (see also comment Referee#1). Now it reads: 'The pollen diagram provides a broad view of alternation between regional open deciduous oak steppe-forest and treeless desert-steppe vegetation.' (now line 177-178).

Line 163: Chenopodiaceae max. 70%

See also comment of Donatella Magri. It should be read: ...(max. ~76)...

Line 217: how did the vegetation change?

We added some additional information about the vegetation change (see also Referee#1). Now it reads: 'Furthermore, the fire activity rose at the beginning of each warm phase when global temperature increased and the vegetation communities changed from warm-productive grasslands to more steppe-forested environments.' (now line 271-273).

Lines 231-234: please give a brief description of this relationship

We revised this section and added some more information about the relationship between erosion and vegetation cover. Now it reads:

‘Furthermore, Kwiecien et al. (2014) described the relation between soil erosion processes and the vegetation cover in the catchment area. They define interglacial conditions related to increased precipitation indicated by higher amount of arboreal pollen and lower detrital input. Our new high-resolution pollen record validates their hypothesis with high authigenic carbonate concentration (high Ca/K ratio; low terrestrial input) along with the increased terrestrial vegetation cover density (high AP percentages above 50%) during the climate optimum (c. 240-237 ka BP).’ (now line 289-294).

Lines 239-241: What is the link from the Lake Van vegetation to the MD01-2447 record based on?
Removed.

Line 315: delayed - relative to what?

...relative to the glacial/interglacial boundary as defined in NGRIP and GL_{T-syn}. We revised this sentence as follows:

‘...the MIS 8/7e, MIS 7d/7c as well as the MIS 6/5e boundary in the continental, semi-arid Lake Van region recognized a delayed expansion of deciduous oak steppe-forest of c. 5,000 to 2,000 years, comparable to the pollen investigations of the marine sediment cores west of Portugal by Sánchez Goñi et al. (2002, 1999). As already shown in high-resolution Lake Van pollen studies by Wick et al. (2003), Litt et al. (2009), and Pickarski et al. (2015a), a delay in temperate oak steppe-forest refer to the Pleistocene/Holocene boundary as defined in the Greenland ice core from NorthGRIP stratotype (for the Pleistocene/Holocene boundary; Walker et al., 2009) as well as from the speleothem-based synthetic Greenland record (GL_{T-syn}; Barker et al., 2011; Stockhecke et al., 2014) can be recognized.’ (see also reply Referee#1).

Line 347: replace ‘during’ by ‘between’
Changed.

Line 379: Do you have any idea, why this evidence is missing at Lake Van?

If you wanted to know why other archives (e.g., Tenaghi Philippon) can recognized another period of abrupt warming between 155 and 150 ka and the Lake Van pollen record not, I can’t give you a satisfactory answer. What we see is that the Ca/K ratio (and also the TOC record of Lake Van, which is not mentioned in the manuscript) documents slight change to lower erosion processes around 150 ka (We have added this fact to the manuscript). I think the vegetation signal is too weak/subdued in an overall cold/dry climate to see any small changes in the record. (see also reply Referee#1).

Line 426: ‘dense’ does not really fit with a steppe-forest - maybe ‘well developed’
Changed.

Lines 441-444: Please add a few words saying what is different / new / special at Lake Van

We rewrote the conclusions and added what is new in our Lake Van record. See also reply to the comment of Donatella Magri.

Fig. 2b: Why is *Thalictrum* in the aquatic group? there are about 30 species in Antolia, most of them adapted to dry conditions, some prefer humid soils, but there is no real aquatic species.
You are completely right. We have grouped the species *Thalictrum* to the herbs.