

## ***Interactive comment on “Tephrostratigraphic studies on a sediment core from Lake Prespa in the Balkans” by M. Damaschke et al.***

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The manuscript “Tephrostratigraphic studies on a sediment core from Lake Prespa in the Balkans” by Damaschke et al. is an important contribution to both the dating of lake sediment records and the knowledge of tephra dispersal in the Eastern Mediterranean. The paper nicely demonstrates the application of different chronological methods (radiocarbon dating, OSL dating, tephrochronology, stratigraphical information and proxy-data) in order to develop an independently dated age model for the sediment sequence. The Lake Prespa (as well as Lake Ohrid) sedimentary records are indeed valuable archives for tephra studies particularly due to their distal downwind position to major explosive Italian volcanoes and the tephra archive of Lago Grande di Monticchio. The tephra results of Lake Prespa are therefore interesting in terms of the reconstruc-

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tion of tephra dispersal patterns and therewith past wind patterns in the Mediterranean. This should be also more highlighted in the discussion section of the manuscript. In overall, the manuscript is well structured and well written and after minor revisions listed below I strongly recommend a publication in the Journal “Climate of the Past”.

General comments:

1) Since this is a tephra paper, it would be appropriate to include a table in the text showing the average glass composition of individual Prespa tephtras (normalized data including a 2 sigma standard deviation). Most of the Harker diagrams (figure 4, 6, 7 and 8) include only plots of alkalis versus silica oxides, which are not completely representative. Sodium values, for example, are very prone to a loss during measurements and strongly depend on the analytical setup of the instruments, both SEM-EDS and EPMA. It is therefore important to visualize the data as a whole in, for instance, an additional table. The supplementary table 4, in turn, shall provide the original, non-normalized data including oxide totals.

2) Please provide a more detailed description of tephtras in chapter 4.2 including, for example, more concrete values for tephra thicknesses and maximum grain sizes of tephra components. If possible, please provide also information on the mineral assemblage and or lithic content. The information on the sediment depths of the cryptotephtras indicates thicknesses up to 2 cm, which are unrealistic for “cryptotephtras”. Please provide more detailed depths or explain the large range of depth.

3) Chronology discussion: You state in Chapter 2 that the catchment area of Lake Prespa is partly composed of carbonate rocks. Since these rocks may bring in “old” carbon into the lake, it is therefore necessary to discuss any possible hard water effect on the radiocarbon ages, particularly on those obtained on aquatic plants and bulk sediments. Please include this information either in chapter 3 “Material and methods” or in the discussion in chapter 6 “Core chronology and sedimentation rates”.

4) I agree with most of the tephra correlations proposed in the manuscript. However,

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there arise two issues that need further clarification:

a) Cryptotephra PT0915-3 and PT0915-4: I totally agree that those tephras are related to pre-NYT activities of the Phlegrean Fields and that those eruptions are difficult to distinguish just on the basis of major element glass composition. I also agree with a correlation of those two tephras with the marine LN1-LN2 layers interpreted as the Tufi Biancastri deposits by Siani et al. (2004). However, the relationship with the Monticchio tephra record should be discussed in more detail. You have shown in figures 4 and 8 that the Prespa tephras do not match tephra TM-9 which was related to the Tufi Biancastri by Wulf et al. (2004). This might indicate a miscorrelation of either the Monticchio tephra or the marine tephras with proximal deposits, which needs to be discussed at this point. In addition, I recommend to also compare the Prespa data with major element glass data of tephras TM-10a to TM-10d (original individual data available upon request) that were correlated by Wulf et al. (2004) with the proximal Lago Amendolare deposits. Here in particular, tephra TM-10c seems to match the composition of one of the Prespa tephras. I furthermore agree with a potential correlation of the Monticchio tephra deposited after TM-9 (labeled as “TM-9 upper” in the manuscript: PLEASE re-label as “TM-8-1 (Wulf, pers. comment, 2012)”). Both tephras TM-8-1 and TM-10c show in addition similar ages as the marine LN1-LN2 tephras (14,460 and 15,500 calendar years BP). Please add this information in your discussion.

b) Tephra PT0915-6: I don't think that such a detailed discussion about a possible correlation with unknown Vulcano tephras is necessary, since I think that tephra PT0915-6 can be clearly associated with the Codola eruption based on the following argument: Your individual glass data shows in most cases extremely high Al<sub>2</sub>O<sub>3</sub> and CaO values that indicate a strong contamination of glass shards with plagioclase microcrysts. This effect has also been observed for Monticchio tephra TM-16a (30,240 calendar years BP, Wulf et al., 2006). The residual data is quite in agreement with the thick Monticchio tephra TM-16b (31,120 calendar years BP, Wulf et al., 2006) (individual glass data available upon request) and shall therefore relate to the Codola eruption. I therefore

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strongly recommend re-evaluating the Prespa glass data and simplify the discussion section.

5) It is very interesting that Campanian tephras documented in Lake Prespa (and also Lake Ohrid) can be also found in Lago Grande di Monticchio, but that those from Pantelleria and Mount Etna are recorded in either one of those archives. For example, the Y-1/Biancavilla tephra (17 ka) and Ante-Green Ignimbrite (89 ka) tephra is found in Monticchio but not in Prespa, while Y-6 (45 ka) and an unknown 60 ka Etnean tephra are only deposited in Prespa. This distribution pattern gives valuable information about a complex tephra dispersal resulting from interplay of different wind patterns, i.e. the Westerlies and the Scirocco winds from the South. This kind of information should be included in a different discussion chapter or in Chapter 7 “Conclusions”.

Detailed comments:

Page 4443: Change the affiliation of Norbert Nowaczyk to “German Research Centre for Geosciences GFZ, Section 5.2 – Climate dynamics and landscape evolution, Telegrafenberg C321, 14473 Potsdam, Germany”.

Page 4444, line 1: Please be more detailed about the age of the basal sediments, i.e. MIS 5b (ca. 91 ka BP)

Page 4444, line 20: Please provide information about the provenance of cryptotephras PT0915-6 and PT0915-10, i.e. Campanian area.

Page 4445, line 14: Change to “. . . is considered to be a promising region for distal tephrostratigraphic studies. . .”

Page 4445, line 16: Please give information on the distance of Italian volcanoes to Lake Prespa.

Page 4446, line 2: Please change and add “. . . to known eruptions, documented i.e. in proximal and distal deposits, can. . .”, since you are comparing most of your data with the distal Monticchio record.

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Page 4446, chapter 2 “Regional setting”: Since you are mentioning IRDs in the sediments and ice cover in the Prespa area in chapter 6 (discussion), it is appropriate to include this information also in this chapter.

Page 4447, lines 5-7 and page 4448, line 26: Please include information about the location of the XRF scanner and the SEM-EDS analyzer (University of Cologne?).

Page 4447, line 13: Please use a reference other than Nowaczyk et al. 2012 since this paper is still in preparation and therefore is not citable.

Page 4448, line 21: What do you mean with “washing selected sediment sections”? Did you treat the samples with H<sub>2</sub>O<sub>2</sub> or HCl? How large were the sample amounts? Please provide more detailed information.

Page 4453, lines 18-19: Traces of the 12.1 ka Vedde Ash from Iceland were recently found in the Lake Bled sediments (Slovenia) proving a further distribution than supposed (Lane et al., 2011, QSR Vol. 30, 1013-1018). This information needs to be included in the discussion section. You may also cite a newer paper showing the distribution of the LST in Europe (Riede et al., 2011, Quaternary International 246, 134-144). Also add a reference for Massif Central tephra.

Page 4454, lines 26-28: In order to distinguish between the 472 AD and 512 AD events higher sedimentation rates of host sediments would additionally be required. The sedimentation rates in Lake Prespa are much lower than in i.e. Monticchio and therefore may not provide two distinct layers but a mix of both events in one single horizon. You may add this statement in the discussion as a further argument.

Page 4455, lines 7-11: The Mercato tephra was also identified in the sediment cores of the Island of Mljet, where it shows a bimodal composition similar to the Monticchio TM-6a and TM-6b tephra (see Jahns and van den Bogaard, 1998, Vegetation History and Archaeobotany 7, 219-234). Please add this information.

Page 4456, line 11: The reference is Wulf (2001). Please change throughout the text

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and in the list of references.

Page 4457, line 17: Please change reference to “Pappalardo.” instead of “Papparlado”.

Page 4458, line 5: The varve age of Y-3/TM-15 in Monticchio has been revised in Wulf et al. (2006) to 27,260 calendar years BP. Please use that new age.

Page 4460, line 7: The varve age of TM-18 is 36,770 calendar years BP according to Wulf et al. (2006). Please correct.

Page 4460, lines 19-20: Tephra PT0915-8 has an almost identical composition as the Campanian Ignimbrite and tephra PT0915-7. How can you conclude that this tephra has a different origin from Ischia volcano? I suggest changing the source to “Phlegrean Fields” or more general to “Campanian area”.

Page 4459, line 5: Monticchio tephra TM-18-1d is dated at 37,360 calendar years BP (Wulf et al., 2006). Please correct this age. Furthermore, TM-18-1d is directly underlying the Campanian Ignimbrite in the Monticchio record. According to your sedimentation rate chronology, Prespa tephra PT0915-8 is deposited at ca. 42-43 ka BP (please provide age at this point), close to the Y-6 tephra. How do you explain the high sedimentation rates between the CI and tephra PT0915-8 in your core? Can this be explained by a miscorrelation?

Page 4462, line 15: Please provide the interpolated age for tephra PT0915-10 based on the estimation of sedimentation rate. You may mention here that in this time frame there are numerous tephra layers in the Monticchio record with very similar composition as PT0915-10, and that a correlation without additional trace element data is not possible at this point (cite Wulf, pers. comment, 2012).

Page 4463, line 2: Please provide ESR date again in parenthesis.

Page 4464, line 25: Change “cold climate” to “cooler climate”.

Page 4465, line 20: Change “corresponds with” to “corresponds to”.

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Page 4467, line 13: Delete “a” in “The study of a sediment core Co1215. . .”.

References: Delete the reference “Macdonald (1974)” since it does not occur in the text. Replace the reference “Nowaczyk et al. 2012, in prep.” by a different reference. Page 4478, line 29: delete the space character in “V ogel”. Page 4479, line 6: change the year of publication of Wulf from “2000” to “2001” and change throughout the text, figure and table captions.

Figure 1: Please check the scale in figure 1a, since it seems to be too large.

Figure 4: These diagrams are way too small and hard to distinguish. Please provide also references for the correlative data, particularly for those not mentioned in the text. Please make also sure that you cite the detailed figure number in the text, i.e. Fig. 4a instead of just Fig. 4.

Figure caption 6: Please define the “Campanian Zone”. Do you mean the Neapolitan area including the Campi Flegrei and Somma-Vesuvius?

Figure 8: Re-label “TM-9b upper/TM-9 upper” to “TM-8-1”.

Figure 9: Please add the CI location in the Black Sea according to Nowaczyk et al. (2012, EPSL 351-352, 54-69).

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