ADAM MICKIEWICZ UNIVERSITY, POZNAŃ
Faculty of Geographical and Geological Sciences
Institute of Geoecology and Geoinformation
Climate Change Ecology Research Unit

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PhD **Piotr Kołaczek** (Professor of AMU, Poznań)
Faculty of Geographical and Geological Sciences
ul. Bogumiła Krygowskiego 10,
61-680 Poznań

Mobile phone: +48 516 061 026
E-mail: pkolacz@amu.edu.pl
ORCID: 0000-0003-2552-8269

Review of the PhD thesis entitled "Human impact as reflected in the pollen record, with a focus on the Middle Ages", submitted by Petra Marešová

Thank you for allowing me to be an external reviewer and member of the defence committee for PhD candidate Petra Marešová. I have read PhD thesis with interest and great pleasure. The thesis consists of a general introduction focused on the description of general issues considering the Late Glacial and Holocene vegetation history of Central Europe, palynological and palaeoecological research, and human impact. It includes aims and the most important results of the thesis as well. The second chapter of the PhD thesis provides an overall review of presented papers that includes the most important results and conclusions of the thesis and short reviews of individual publications. Then, in the third chapter, the candidate presents concise conclusions, reasonably combining the outcomes of all the articles. Even though the author does not present a joint discussion for the entire PhD thesis set, the broad discussion of individual papers is very satisfactory. The reference list after the introductory part is long and impressive. The articles presented in the PhD thesis set were published in the period 2014-2019 and present interdisciplinary, mostly palaeoecological/archaeobotanical studies. They involve between five and ten specialists and are published in well-recognised peer-reviewed journals (IF 2.375-5.198). PhD candidate is the first author of 60 % of articles in the entire set. It should be highlighted that article with the highest impact factor, published in Catena, was designed and in prevalence written by the candidate. However, it is somehow out of the scope of the thesis title „human impact as reflected in the pollen record". Pollen is not used there as a proxy in this study. Nonetheless, this article gives a background for interpretations of palaeoecological data regarding medieval and post-medieval settlements. Considering the publishing strategy,

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PhD candidate was not focused on journals more adjusted for (palaeo-) botanists or environmentalists only but also designated for a broad set of physical geographers (e.g. Catena). Personally, I like this because I am a palynologist, similarly to a PhD candidate, who defended my PhD thesis as a botanist, but who made his habilitation as a geographer. Combining views from both of these branches gives me a broader perspective when I interpret data obtained from multi-proxy palaeoecological studies.

In general, I am very positive about the PhD thesis and I recommend it for further procedures of the defence. Judging from this set of publications, and the candidate's input, Mgr. Petra Marešová fully deserves the PhD grade. Moreover, I can say that such a publication set might be a good basis for habilitation in some Polish institutions. Below, I present some of my detailed comments and questions that should be helpful in the preparation of the defence and/or future studies conducted by Petra Marešová.

Even though I should focus more on PhD thesis set, I have some minor comments on the „Introduction":

-The map showing the location of sites presented in the thesis would be helpful for the reader

-Some words read odd, e.g.:

- page 8 - instead of 'chronoblocks', it should be 'chronozones';
- page 24 - you start the sentence with 'E.g.' – 'For instance' would be better;
- page 23 'lycopodium tablet' – Latin name should be written in italics and with a capital letter;
- page 35 and so on 'pollen ratios' – there are no pollen ratios in this article, 'percentage values' would be more appropriate;

-On page 37, it is written „Expansion of grasslands in the area since 5.5 ka BP occurred…". In my opinion, based on the pollen diagram presented in the 2nd article (Figure 3), the increasing trend of Poaceae percentages is rather weak and it starts at ca. 6.5 ka BP.

-In the subchapter „1.6 Aims of the thesis" you start with the general aim „…to obtain pollen data sets from fossil records to access the continuous memory of the Czech landscape since the pre-historic times,…". In my opinion, the aim of any scientific thesis or article should not be obtaining a pollen dataset but answering scientific questions or resolving problems. Pollen data should be applied to solve the problems, not be an aim itself.

I have some questions about the articles, which is why I combined them into blocks:

1. PhD CANDIDATE INPUT

   PhD candidate clearly explained her contribution in each paper. I do not know Czech regulations regarding the assessment of candidate input in percentage values, but I think it is not necessary in case the input is described. I would like to know more about this part of the candidate activity, hence, there is my question: What did you learn during the preparation of each of the articles presented in PhD set? Please, tell us about new skills you learned, also these interpersonal.

2. CHRONOLOGY

   The establishment of chronology is a vital part and one of the first steps in each palaeoecological or archaeobotanical study. Hence, it should be treated with care. I have some questions about this issue:

   In article 1 (Tichá et al., 2019), you wrote that bulk samples were dated. Did you consider a reservoir effect that increased the value of the age of at least part of the

deposit's layers? How did you validate the lack of 'reservoir effect'? On the other hand, what do you think about the presence of hiatuses? In the lake Komořany, the period between 16 and 11 k BP is covered by 20 cm thick deposits only (ca. 1 cm / 250 years). However, in this paper, you wrote about a warmer second half of the Younger Dryas. Is it possible to talk about such a narrow period having such a low resolution?

In the case of absolute chronology in paper 3 (Pokorná et al., 2014), what you think might be the cause of age inversion in profile A20?

In article 5 (Houfková et al., 2019) - how did you validate the presence of hiatus at a depth of 30-15 cm when you do not have any date above 30 cm?

What was the agreement index of the age-depth models presented in articles 1, 2 and 5?

3. DATA INTERPRETATION

   In article 1 (Tichá et al., 2019), it is written: „Nevertheless, subtle water-level fluctuations can be inferred from the pollen of macrophytes typical of disturbed wet stands (among others *Sphagnum* or *Elatine*, Fig. 6). I saw numerous *Sphagnum* spores (they produce spores not pollen) in profiles of deposits representing 'healthy' stage of peatland and/or aquatic ecosystems. So why you think that in your case they are indicators of disturbances? How do we know that '*Elatine*-type cf." is an indicator of disturbance? The combination of 'type' and 'cf.' pinpoints rather great taxonomic uncertainty.

   In the case of article 1 (Tichá et al., 2019), in the part of 'Discussion' about 'Driving mechanisms of nutrient availability in LG/Ho transition', I wonder about the potential role of melting permafrost in this 'availability'. Did permafrost occur in lake Komořany vicinity during the Late Glacial?

   In article 2 (Houfková et al., 2017), on page 103, there is written: „Moreover, a local lack of macrophytes growing in the littorals is indicated by the increased count of *Chara* oospores (Figure 5) pointing to transparent water (Hannon and Gaillard, 1997)." Is it possible to draw such a conclusion based on single oospores? Especially, in the light of the time span represented by each sample designated to plant macrofossil analysis. What was the size of samples designated to plant macrofossil analysis in this study?

   In article 2 (Houfková et al., 2017), in 'Conclusions', you wrote about the expansion of grasslands from ca. 5.5 ka BP. What about the influence of marshland vegetation, also consisting of grasses, on pollen signal? You also wrote that it was a shallow lake. The number of plant macrofossils produced by marshland taxa increased later, between 5 and 4.5 k BP, but lake shallowing, indicated by pollen values of e.g. Poaceae, might be detected earlier. Hence, an increase in pollen percentages of Poaceae does not necessarily indicate grassland expansion.

4. TAXONOMY

   In some cases, I have found too precise determinations of pollen taxa dubious. For instance, in paper 2, you recognised *Oenanthe aquatica* to the species level. Is it possible to recognise this pollen type to the species level? If yes, please explain us how you did that. A similar question applies to paper 5 (Figure 3). How did you identify *Ulmus glabra* to the species level?

I have also some minor comments connected with the articles included in the thesis:

-In all articles, tables with radiocarbon dates and calibrations should be supplemented with information about the type of material designated for dating (it should not be dispersed in the article). The full structure of time intervals of calibrated dates should be presented. If a calibrated date is e.g. bimodal, it should be shown in the table. This is also important information about potential age uncertainties for some periods outlined by absolute chronologies.
-The names of pollen taxa should be the same in the text of the article and the pollen diagram. For instance, in article 2, on page 98, in subchapter 'Microfossil analysis', you wrote '*Carpinus* and *Abies* formed stable proportions…' whereas, in the pollen diagram in Figure 3, there are '*Carpinus betulus*' and '*Abies alba*'.

I hope my comments and questions will be helpful to prepare the defence.

Sincerely,

PhD Piotr Kołaczek (Professor of AMU, Poznań)
Adam Mickiewicz University, Poznań