Re: **Review of Thesis for the Degree of Philosophiae Doctor**

Title: **Details of magnetic reversal and paleosecular variations from sediments**

Author: M.Sc. **Hakan Ucar**

Submission date: **July 2024**

Reviewed by: **Mgr. Martin Chadima, PhD**

Critical comments/questions for author's response are highlighted in blue.

The present doctoral dissertation is a complex scientific study examining, on several case studies, how the recent fluctuations of the Earth's magnetic field are recorded in the remanent magnetization of various types of sedimentary sections. These case studies explore various aspects that must be taken into account while studying recent paleomagetic record including different types of carriers of remanent magnetization, diagenetic changes of paleomagnetics directions caused by sedimentary flattening, influence of authigenic minerals and contribution of their remanent magnetization to the overall paleomagnetic signal. All these studies are focused on the sedimentary records located in central Europe thus creating new valuable master curves of the Earth's magnetic field behavior for this part of the world.

The actual thesis consists of seven chapters (214 pages) and is a compendium of three published high-quality peer-reviewed articles (Mr. Ucar is the main author of 2 of them), and one manuscript intended for later submission. These cornerstone chapters are framed by the following chapters:

1. Chapter 1: **Introduction** – This chapter introduces common principles of the Earth's magnetic field and outlines the problems we may deal with when studying recent paleomagnetic records. (5 pages)

2. Chapter 6: **Summary, discussion and conclusions** – This chapter presents an overall summary combining the results of all four articles/manuscript. (3 pages)

3. Chapter 7: **Outlook** – This chapter points to some unsolved problems and proposes the ways of future research aimed to solve them. (1 page)

In my opinion, these introductory/concluding chapters are too brief; I don't know about the regulations for dissertations, but perhaps I would have liked to see the introduction and common discussion done a bit more thoroughly.

But let's leave that aside, because the main part of the thesis lies in the article/manuscript collection:

1. **Ucar, H.**, Panovska, S., Vondrák, D., Kletetschka, G., Elbra, T., Svecova, E., Kdyr, S., Kouklikova, L., Meszarosova, N., Stastny, M., Kavkova, R., Bazala, R., Pruner, P. The first full-vector paleomagnetic record for the Mid-Holocene period from Central European lake sediments: Toporowy Staw Wyżni, Southern Poland. *Manuscript.*

This manuscript was intended to be published in a Q1 journal, please indicate if there is any progress in manuscript submission.

2. **Ucar, H.**, Kletetschka, G., Kadlec, J. 2021. Evidence of the Matuyama-Brunhes transition in cave sediment in Central Europe. *Quaternary International*, 604, 16–27.

3. **Ucar, H.**, Kletetschka, G., Egli, R., Mach, K., Petronis, M.S., Grison, H., Scheidt, S., Schnabl, P., Kdyr, S. 2024. Enigmatic mixture of magnetite magnetofossils and diagenetic greigite as the magnetic carriers of the Early Miocene lacustrine sediments from the Most Basin in Central Europe. *Physics of the Earth and Planetary Interiors*, 353, 107216.

4. Elbra, T., Skupien, P., Bubík, M., Košťák, M., Matejová, M.M., Pruner, P., Reháková, D., Švábenická, L., Vaňková, L., Cígler, V., Geist, J., Kdýr, Š., Lukeneder, A., Rybová, P., Mazuch, M., Schnabl, P., Svobodová, A., Trubač, J., **Ucar, H.** 2024. Integrated stratigraphy across the Jurassic–Cretaceous boundary in the Rettenbacher section (Northern Calcareous Alps, Salzburg, Austria). *Cretaceous Research*, 158, 105854.

In the individual articles/manuscript, I highly appreciated the respective discussion chapters, the cornerstones of each publication, in which multiple aspects of observed phenomena are commented. Each article/manuscript is accompanied with rather extensive list of citations indicating that the doctoral candidate went through a great deal of literature in order to validate his research results.

As the three already published articles were subjected to a thorough peer-review process, their scientific merit and originality is certainly guaranteed.

Below, there are only several minor issues to be explained, corrected or discussed:

1. Page 23, Introduction chapter, 1st paragraph: It is probably oversimplified to say that the Earth's magnetic field is a vector quantity. I know what the author meant but the correct way to say is, e.g., The Earth's magnetic field is a vector field that can be, at any given location, characterized by a vector.

2. Page 48: Could you describe how the magnetic inclination of the WTS1 core was corrected to bring the average inclination equal to the GAD value? Just by adding a constant?

3. Figure 2.7.: The curves for WTS1 and WTS2 for various rock magnetic parameters are quite different. Could you comment on that?

4. Figure 2.7 d: It shows the relative declination, relative to what?

5. Page 71: While measuring the azimuth using a Bruton geological compass, did you take into account the magnetic declination which was in 2020 for your location (according to WMM-2020) about 5°E? This becomes a non-negligible factor to consider if the goal is to produce high quality master curve data.

6. Figure 3.3: The thermomagnetic curves are not corrected for the respective empty furnace signal thus producing the "false" negative susceptibility values at higher temperatures.
7. Page 76: The main magnetic field in your location in the time of article submission (February 2021) was D: 5.041°, I: 65.966°, see point 5.
8. Figures 3.5 and 3.6; How do you explain that in your section the negative inclination in the Matuyama chron is not accompanied by the opposite declination (i.e., ca. 180°) as seen for other case studies in the cave sediments where the Brunhes/Matuyama switch is indicated by an abrupt change in both inclination (Fig 3.6, f) and declination (fig 3.6 j)?
9. Page 80: Just for your interest, the Chiba section is not an offshore section "near" Japan but a terrestrial outcrop recently declared as the Chibanian stage stratotype located in the Chiba peninsula, Japan.
10. Page 120: If you suspected a presence of GRM, what protocol you applied to AF demagnetize your specimens, 3-axis mode or tumbling specimen mode? I would be very interested to see the Supplementary figure Fig. S4.

In summary, the present dissertation represents a high-quality scientific work. In addition to this thesis, I met Hakan several times during various conferences where he showed a very good ability to present his work to a wide audience. All this combined testifies that Hakan Ucar is able to work as an independent researcher and qualifies him to obtain a doctoral title.

I highly recommend the present doctoral dissertation of Hakan Ucar for defense.

Martin Chadima

Brno, 21st October 2024

Mgr. Martin Chadima, PhD
AGICO, Inc.
Purkyňova 99a
Brno, CZ-612 00
Czech Republic
Email: chadima@agico.cz
Tel: +420 734 644 366