Pre-Examination of Doctoral Dissertation

"Physical Properties of Meteorites and Their Role in Planetology"

of M.Sc. Tomas Kohout, University of Helsinki

1. Doctoral Dissertation of M.Sc. Tomas Kohout consists of 4 published papers, one paper accepted and one submitted. All the papers were published, or will be published in international journals, which meet high standards for peer-reviewing. Therefore, their quality is beyond any doubts. Tomas Kohout is first author in 5 of the 6 papers, in one of them he contributed significantly as a co-author. In all the cases, the teams of co-authors represent international group of researcher. This is clear evidence of leadership and communication skills and competencies of Tomas Kohout. I am firmly convinced that the candidate's contribution to the research is adequate in the entity of the dissertation. I am even confident that it is an above-average dissertation, compared to those I could evaluate in various EU countries.
2. Information, recorded in meteorites, is related to events and processes of the earliest stages of the solar system history, such as formation of the raw material that later formed the solar system. Therefore, knowledge of properties of meteorites is crucial for understanding the origin and early history of Earth and the whole solar system. Research of meteoritic material (and any extraterrestrial material in general) is subject to several severe limitations. First of all, samples of extraterrestrial bodies are very rare, thus very valuable. Therefore, any research method should be primarily nondestructive. This means that any method, providing information on classification, history, parent bodies, etc., is of great value. Several magnetic methods, developed in rock magnetism, fulfill the non-destructive condition. Moreover, most of magnetic parameters can be measured with very high sensitivity and precision. Magnetic parameters provide information on composition, grain-size distribution, structural and textural properties, and in many cases on diagenetic history. Moreover, magnetic properties may decipher magnetic field acting during the formation and whole existence of meteorites (and their parent bodies). Research in the field is very dynamic, what is well demonstrated by the number of papers published in international journals, as well as by topical international sessions and meetings organized worldwide. For example, simple search for keywords "meteorites research properties" in the SOA/NASA Astrophysics Data System (http://adsabs.harvard.edu/cgi-bin/nph-abs_connect) retrieved 200 records, with authors coming from all around the world. From this point of view, the dissertation is highly significant.
3. Scope of the research, represented by 6 papers, 4 of which were published and 1 is accepted for publication in leading international journals dealing with geophysics or astrophysics, ranges from improved classification of meteorites from several European museums through testing the reliability of magnetic record of magnetic field acting during their formation, effect of travel through the Earth's atmosphere and impact-associated shock, to improvements of rock-magnetic methodology, applicable to various applications. In result, the 6 papers are not monothematic, but cover relatively wide scope of interconnected and complementary subjects. Significance of the contents and possible shortcomings are beyond

my evaluation, because the papers underwent standard peer-review process in journals that meet high criteria for publishing scientific articles.

4. The conclusions of the material presented are clearly formulated. Results of the candidate's research, which is of clearly international and team character, contribute to understanding the properties, origin and history of meteorites. In particular, original findings of low-temperature properties of sulfides, present in extraterrestrial material, contribute to better understanding of how minor bodies of solar system interact with the interplanetary magnetic field. Last but not least, improvements made to the rock-magnetic methodology may contribute to higher reliability of paleointensity data acquired in the future research.
5. The dissertation is composed of 6 different published papers. The six papers are introduced by some 40 pages of text, which is self-explanatory, structured into several sections. Abstract and Introduction are followed by 7 sections, practically corresponding to the six published papers, and Conclusions. The text is clear and concise, accompanied by illustrative figures. I found the dissertation enough consistent, with clear and logical structure.
6. In the Introduction, the candidate uses more than 110 references. More references can be found in the 6 papers in concern. I found the references adequate. Therefore, I am convinced that the candidate is well familiar with the literature. The way how literature is used in this dissertation is proper to dissertations at this level.
7. Despite the fact that the candidate is not a native English speaker (nor am I), I found the language clear enough, comprehensible and intelligible to readers not only from the specific field of meteoritic research, but also to generally wider public. Again, the presence of 6 original papers, cooperation with native English speakers, active presentations at international meetings, etc., provide evidence of generally high level of English skills.
8. I would like to raise one issue to be discussed during the defense of the dissertation, related to statement on alignment of magnetic moments (bottom of page 26). Usually, randomly oriented magnetic moments result in behavior softer than in case of aligned moments. Why it should be opposite here?

In spite of the issue #8 raised in my review, and noting that the candidate has made the corrections I asked for in my previous reading review, **I hereby give my permission to the Faculty of Science of the University of Helsinki that this PhD thesis can be printed**.

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