

Report on the dissertation thesis „ Steppe or woodland? Ecological Conditions of Formation and Evolution of Chernozems in Central Europe” presented by Barbora Vysloužilová

This dissertation thesis presents the results of several years of research carried out by the applicant during postgraduate studies at the University of Strasbourg and the Charles University in Prague. The work represents a detailed and systematic regional study on the evidence for Chernozems development in variable natural conditions through the Late Quaternary. This study is focused on one of the key-points necessary for the better understanding of complex relations (and feedbacks) between large-scale or regional changes of climatic conditions and variability of pedogenetic processes in Central Europe. The investigations involved the critical analysis of publications, examination of the nature, sampling and characterisation of the environmental conditions of selected areas and localities, laboratory and other experimental analysis of studied soils. All these parts of regional pedological and/or pedogeographical research were combined and interpreted to express suggestions about variability of the origin, development and degradation of Chernozems as a consequence of dynamic paleogeographical changes. These investigations are placed into their broad European setting.

Editorial aspects of the reviewed dissertation paper show a very good sense of the author to methodological organization of the long-term research project as well as stylistic and graphical expression of analytic data and complex results. Substantial parts of the paper (which has 400 pages as a whole!?) are definition of the topics, well organized reviews of the specialized literature with related references, analytic chapters (examinations in nature, laboratory methods, etc.) and also (incredibly) extensive set of annexes (pp. 281 – 400). In general, complex bibliographical characteristics, methodological and analytic chapters or paragraphs are the best parts of the paper. The modern physical geography uses many geological, geophysical, geoecological and other techniques to reveal details that are relevant to a range of environmental topics. The research presented applies a series of methods used to reconstruct regional or local natural conditions and environmental characteristics of Chernozem-type soils in Central Europe. Overall the research is of a high standard and has been very competently carried out. The dissertation thesis is also supported by recent research publications of the author with co-operating colleagues.

The 1st question of reviewer to the author: I should greatly appreciate your more detailed explanation of co-operation procedures of the research group(s) (e.g. during analytic processes in laboratories, experimental work in nature, etc.) to emphasize a share of your own creative work in the topics.

The 3th part of the study (chapters 6 – 9) with regional and related results and their discussion is extremely stimulating, which is strengthened by definition of the aims of dissertation paper (cit.): “to contribute to discussion about genesis of Chernozems by restoring the environmental conditions prevailing during the formation of Chernozem soils in Central Europe.” (The topics of thesis are much better described at pages 27 – 29.) Therefore, it has been expected that interpretations of the new analytic as well as complex regional results will be evaluated and also (at minimum briefly) integrated to a systematic conceptual model of the ecological and environmental conditions of the origin and evolution of Chernozems in Central Europe (compare also main title of the thesis !!?) during the late Quaternary. It is a pity that presented dissertation paper is not completed in this creative way.

Allow me to explain the heart of the matter by emphasizing the following points. It is very well known that the soil development and properties depend on the parent material and on the climatic and related environmental conditions in which soils have formed. Paleosols or polygenetic soils are valuable archives of the past environments. These archives can be interpreted in order to obtain reconstructions of palaeo-environments. Paleosols include specific characteristics in macro- and micro-morphology, geochemistry, fossil assemblages, mineralogy and clay mineralogy and other parameters. The critical zone for records of the paleo-environment characteristics is complex of soil, sediments, and weathered rock, as well as the ecosystems they support. Understanding the evolution of the near-surface zone of landforms and its sensitivity to perturbations requires an understanding of the processes that produce its architecture. A briefly described state of the art is substantial consequence of rapid progress in natural sciences. (From this point of view the question “Steppe or woodland?” can be accepted only as an attractive (and in a popular sense “romantic”) question, but not decisive in research aspects.) Integrated approach to research of the Late Quaternary (paleo-) environments is a strong motivation to the 2nd question of reviewer to the author.

The 2nd question of reviewer to the author: Will you be so kind to take advantage of your reports, observations and their interpretations (described in the thesis) for determination and presentation of 1) specific environmental conditions necessary to the

onset of Chernozem development?; 2) natural conditions which probably prevailed during optimal stages of the Chernozem evolution?; 3) main characteristics of Chernozem degradation processes during the late Holocene environmental changes (inclusive anthropogenic influences) in central Europe?

Many other possible questions and notes are not so important. For example, it is substantial difference between a concept of development (or evolution) of soils and their (“passive”) preservation in (new, later) variable environmental and ecological conditions and to mix up these situations during discussions is not suitable. The term “Pleistocene” is often used without explanation what it means in the context of the site / locality, process or period of time. Why is not the influence of permafrost even mentioned? It existed in large regions of Europe during the Upper Pleistocene. The author also often writes in the style “I agree (or, on the contrary, I do not agree) with somebody”, however, what is her own opinion about e.g. natural / ecological / environmental processes and phenomena expressed by more precise physical and biological terms and/or points of view? For example, what exactly is behind expressions such as are “more humid environment” or “higher temperature”, etc.? (By the way, so called “Autoreferát disertační práce” (in Czech and English, it is required in the Czech Republic), which is usually defined and accepted as a compulsory summary of dissertation thesis, has a low quality in many paragraphs. It is in striking (negative) contrast with a careful editorial and stylistic work of the author presented in the main book of dissertation thesis.)

Recent progress in Earth Sciences became evident that a considerable number of palaeo-environmental reconstructions, based on various terrestrial archives, have been elaborated. There is a great potential for integrated reconstruction, combining results from archives and proxies that are connected and can be highly synergetic. These archives include a multitude of proxies: vegetal proxies (e.g. pollen, diatoms, vegetal lipids, isotopy of soil organic compounds, macro plant remains), faunal proxies (particularly molluscs and beetles), and abiotic proxies (e.g. sedimentology, paleosol macro- and micromorphology, geomorphology, geochemistry, environmental magnetism, isotopes). Moreover, stratigraphical control can be obtained from sedimentological analyses, palaeomagnetism, palynostratigraphy, and from chronometric methods such as radiocarbon dating, luminescence, electron-spin resonance, uranium series, and others. Presented thesis is based on detailed field examinations, well selected and progressive laboratory methods. It follows above described progress in

ecological and environmental studies of soils. Key parts of the reviewed paper are remarkable especially by 1) new knowledge in selected localities and/or sites of Chernozems documented by extensive collection of data, and 2) systematic discussion of the complex of natural and anthropogenic conditions existed during variable processes of development and degradation of Chernozems in Central Europe which is supported by original observations. Moreover, the author of the paper demonstrated necessary capability and talent to perform responsible and specialized work as a member of research team.

Conclusion: Dissertation thesis of the applicant, RNDr. Barbora Vysloužílová, is very well arranged, original and creative research paper, and, therefore, it is recommended as appropriate for successful defence and consequently for the award of the title PhD.

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Professor RNDr. Jan Kalvoda, DrSc.

Prague, 8th September 2014