

UNIVERSITY OF SZEGED
DOCTORAL SCHOOL OF EARTH SCIENCES

**Micromorphological analysis of selected paleosol samples of
variable genetics on loessy bedrock in the Carpathian Basin**

THESIS OF DISSERTATION

DÁVID GERGELY PÁLL

CONSULTANT:

DSc Habil. Sümegi Pál

tanszékvezető egyetemi tanár



DEPARTMENT OF GEOLOGY AND PALAEONTOLOGY

SZEGED

2012

INTRODUCTION AND AIMS

The development of science and technology has also received a new impetus in science research. As a result of the modernization of the loose sediments and soils opportunity to analyze multiple testing. The macroscopic observations, laboratory studies, the analysis of microscopic samples have begun to run. The foundation of the twentieth century soil micromorphology, can be made, when it produced the first soil thin section (Szendrei, 2000). The new method could be approached using different increments in the soil, loose sediments changes that occurred. The method, which was developed by other related disciplines have also started to use that differ from each other. In addition to research in soil science and archeology sites have begun to make use of the method of analysis, and the archaeological soil micromorphology formed by the second half of the XX. (Kovács, 2011). The method of archeology was used primarily in the disturbed soil zone detection, archaeological derived materials - plant and animal remains (fitolitok, seeds, csigahéjak, bones, etc), human products (ceramic, patics etc) - capture and agricultural activities, the signals of the detection (Szendrei , 2000). Archaeology, other disciplines - Quaternary research, engineering, geomorphology, environmental protection, etc. - have also started to apply the tried and tested method.

Various places of Hungary - Tokaj, Kunmadaras, Madaras, Zanat - micromorphological analysis of samples has been my goal and originating from fields to supplement the results of previous studies, comparison with my data in my doctoral dissertation. In addition, I wish to present the data in the light of the loess was formed, was a different environment soils and the resulting environmental history image. The soils and loose sediments thin

sections prepared the historical research on several well-known domestic environmental research carried out, such as Füleky György, Horvath Zoltan and Kovacs Gabriella in our country.

METHODS

My doctoral research task of the field sampling, each of the four cases which I did. The samples taken during the monoliths have carried out from the sediment. In addition, my research was one of the main tasks made thin section, the development of a series of embedding procedure in the Geography and Geology, University of Szeged Department. International Laboratory (Murphy, 1985) according to the methods in all cases, samples were prepared - were dried -, impregnated, sectioned, fixed, and then slide the corresponding thick polished. After the samples prepared, I were performed microscopic analysis simultaneously with the work, process of the digital image processing sections were also analyzed. The micromorphological studies in addition to four profiles – Veres Zsolt PhD student carried out the measurements in Madaras - featured samples of organic matter and carbonate content (Dean, 1954) also carried out.

STUDY AREAS

I described and presented thin section from four site, two of them archeological objects and two of them loess profile. The Tokay High Hill samples are from the valley from Csörgökút. The accumulation of loess began in the Lower Wechsilian and lasted up to the top-Wechsilian, the accumulation of a number of cases affected by environmental factors

(Sümeg, 2005). In light of the data can be stated, that is one of my oldest analyzed profile. We sampled the section of the literature according to the middle part of the profile in part soil formation. We were prepared total of 35 thin sections, and I was processed by 15.

The samples from the southern part of the village of Madaras Brickyard were created sampling. The literature in the light of the profile is a little bit younger ($26\ 300 \pm 501$ Cal BP), than Tokaj profile (Hupucz-Sümeg, 2011). we took the samples about field observations and literature according to the middle and lower parts of the profile, therefore, which soil formation (Hupucz-Sümeg, 2010) or soil-like (Krolopp-Molnar, 1978). We were prepared total of 26 profiles thin sections, each of which has been processed.

The third section was in the Hortobágy National Park, border of Kunmadaras. In light of previous data we can conclude that the formation of early Copper Age, the end can be made (BC. 3000) (MRE, 2003). We were prepared 8 thin sections for micromorphological studies, both of which have been processed.

The youngest section is Zanat, we were sampling within an archeological excavation between Nemesböd, Zanat, a special geomorphology area, Csepregekúti-völgyre-dűlő. The works will result revealed a much younger age profile based on the literature (Sümeg et al. 2011c) than the other sites. The buried soil formation ages are BP. levels after the first and early in the fourth century (roman hidromorphic soil) and AD 900-1526 (medieval ceramics containing meadow soil) (Sümegi et al 2011c). We were prepared 15 thin sections, each one of which morphological investigations were carried out.

THE SUMMARY OF THE RESULTS

1. The thin sections of Csorgókút-valley micromorphological datas can be stated that the upper part of Mende Upper Ground Complex (MF1) is not only the level of chernozem soils developed character (based on the exploration of more profiles), but other than soils can be detected in this cycle. Podzol kind of soil formation has developed. The thins section micromorphological studies of Csorgókút-valley compare with the literature data's the fossil Mende Upper ground (MF1) and the top end of the development of loess accumulation at the beginning, 32 and 25 thousand years cal BP for climatic change.
2. The thin sections of Madaras Brickyard confrim, that the Carpathian Basin in the ice age the loess accumulation have changed environmental parameters and soil formation processes started.
3. The micromorphological studies of Kunmadaras-Ecse-halom can be clearly demonstrated that the levels of accumulation of the original habitat are not present, it deposited different conditions.
4. The thins sections from the lower parts of the profile the buried soil is different soil levels – meadow chernozem - about the micromorpholigical studies the recent soil from the immediate surroundings (meadow solonetz).
5. The micromorphological studies of the Zanat section the known layers are multiple levels of thinner split. The accumulation of

sediments deposited was not continuous, but in different fluvial processes and anthropogenic influence from time to time. There were stable environmental condition, therefore soil formation processes started. The two soil formation – meadow soil - was similar facies, which reworked fluvial sediments were deposited down.

6. At the same time and formed several types of sediment deposited in the Carpatian Basin at the end of the quarter, which is the development of local and regional formations influenced by both effects. In accordance to the environmental factors in the location - independently - that changed soil formation processes started. These local and regional changes formed different sediments.

PUBLISHED ARTICLES IN THE SUBJECT OF THE DISSERTATION

Páll, D. G., Persaits, G., Náfrádi, K., Sümegi, P. 2012. Egy középső würm végi fosszilis talaj- és löszréteg átmeneti szintjének komplex paleoökológiai vizsgálata a tokaji Kopasz-hegyen. Földtani Közlöny, in press.

Páll, D. G., Hupuczi, J., Gulyás, S., Veres, Zs., Sümegi, P. 2012. Micromorphological investigations on two paleosol horizons of the loess/paleosol sequence of Madaras. Central European Geology, in press.

Sümegi, P., Persaits, G., **Páll, D. G.** 2011. The geomorphological and geological analyses of the rescue excavation sites along Main Road No. 86 between Szombathely and Vát. In: Kvassay, J. (eds.): The late urnfield period cemetery from Szombathely-Zanat supplemented by an assessment of prehistoric and medieval settlement features and interdisciplinary analyses. VIA - Monographia Minor In Cultural Heritage, Budapest, pp. 214-222.

Sümegi, P., Persaits, G., **Páll, D. G.**, Töröcsik, T. 2011. Results of analysis carried out on the alluvium of Borzó Creek and at the Zanat archaeological site. In: Kvassay, J. (eds.): The late urnfield period cemetery from Szombathely-Zanat supplemented by an assessment of prehistoric and medieval settlement features and interdisciplinary analyses. VIA - Monographia Minor In Cultural Heritage, Budapest, pp. 224-243.

Sümegi, P., Persaits, G., **Páll, D. G.**, Töröcsik, T. 2011. The results of analysis carried out on the alluvium of the Surány Creek and at the archaeological sites of Nemesbőd-Csepregi-völgyre-dűlő I-II. In: Kvassay,

J. (eds.): The late urnfield period cemetery from Szombathely-Zanat supplemented by an assessment of prehistoric and medieval settlement features and interdisciplinary analyses. *VIA - Monographia Minor In Cultural Heritage*, Budapest, pp. 247-265.

Sümegei, P., Persaits, G., **Páll, D. G.**, Töröcsik, T. 2011. The results of evaluations conducted on the soil section of the archaeological site at Nemesbőd-Csepregi-völgyre-dűlő I. In: Kvassay, J. (eds.): The late urnfield period cemetery from Szombathely-Zanat supplemented by an assessment of prehistoric and medieval settlement features and interdisciplinary analyses. *VIA - Monographia Minor In Cultural Heritage*, Budapest, pp. 270-279.

OTHER PUBLICATIONS

Sümegei, P., Heinrich-Tamáška, O., Töröcsik, T., Jakab, G., Pomázi, P., Majkut, P., **Páll, D. G.**, Persaits, G., Bodor, E. 2011. Reconstruction of the environmental history of Keszthely-Fenekpuszta. In: Heinrich-Tamáška, O. (eds.): *Keszthely-Fenekpuszta im Kontext spatantiker Kontinuitätsforschung zwischen Noricum und Moesia. Castellum Pannonicum Pelsonense Vol. 2.*, Verlag Marie Leidorh Hof GmbH, Budapest, 541-572. (ISBN 978-3-89646-152-0)

Sümegei, P., Gulyás, S., Persaits, G., **Páll, D. G.**, Molnár, D. 2011. The loess-paleosol sequence of Basaharc (Hungary) revisited: mollusc-based paleoecological results for the Middle and Upper Pleistocene. *Quaternary International* "Loess in Eurasia" in press (**SCI impact: 1,601**)

Sümegei, P., Molnár, M., Jakab, G., Persaits, G., Majkut, P., **Páll, D.G.**, Gulyás, S., Timothy, A. J., Töröcsik, T. 2011. Radiocarbon-dated

paleoenvironmental changes on a lake and peat sediment sequence from the central part of the Great Hungarian Plains (Central Europe) during the last 25,000 years. *Radiocarbon*. Vol 53:1 p. 85-97 (**SCI impact: 1,257**)

Sümegei, P., Persaits, G., Töröcsik, T., Náfrádi, K., **Páll, D. G.**, Hupuczai, J., Molnár, D., Lócskai, T., Mellár, B., Tóth, Cs., Tasnádiné Gábor, Sz. 2011. Maroslele-Pana régészeti lelőhely környezettörténeti vizsgálata. In: Paluch, T.: Maroslele-Pana, Egy középső neolitikus lelőhely a kultúrák határvidékén. *Monographia Archaeologica 2*, Móra Ferenc Múzeum, Szeged, 205-246. (ISBN 978-963-9804-42-5)

Sipos, Gy., Kiss, T., **Páll, D. G.**, Tóth, O., Schubert, G., Tóth, M. 2010. Mintagyűjtés, minta-előkészítés, mintaveszteség TL kormeghatározás során. *Archeometriai Műhely*. 2010/2: p. 131-136

Sümegei, P., Töröcsik, T., Jakab, G., Gulyás, S., Pomázi, P., Majkut, P., **Páll, D. G.**, Persaits, G., Bodor, E. 2009: The environmental history of Fenékpusztá with a special attention to the climate and precipitation of the last 2000 years. *Journal of Environmental Geography* 3-4. in press

Sümegei, P., Bodor, E., Jakab, G., Majkut, P., **Páll, D. G.**, Persaits, G., Pomázi, P., Töröcsik, T. 2009. Fenékpusztá környezetének rekonstrukciója a Kis-Balaton öblözetében lemélyített zavartalan magfúrás komplett környezettörténeti vizsgálata nyomán. *FIRKÁK* in press

Conference abstracts

Páll, D. G., Persaits, G., Sümegei, P. 2011. New investigations at Tokaj-Csörgökút II. loess section, Northeast Hungary. Paleosols as a source of

information about past environments (Siberia, Volodarka). Abstract and field guide book. Novosibirsk. pp. 139.

Páll, D. G., Náfrádi, K., Sümegi, P. 2011. New investigations at Tokaj-Csorgókút II. loess section, Northeast Hungary. Closing the Gap - North Carpathian loess traverse in the Eurasian loess belt. International Workshop, 6th Loess Seminar in Wroclaw (Poland). Abstract and field guide book. Wroclaw, 46. (ISBN 978-83-62673-06-3)

Náfrádi, K., Persaits, G., **Páll, D. G.**, Sümegi, P., Töröcsik, T. 2010. Az Alpokalja negyedidőszaki környezettörténete. In.: Pál-Molnár E. (szerk.): Medencefejlődés és geológiai erőforrások. GeoLitera. SZTE TTIK Földrajzi és Földtani Tanszékcsoport, Szeged, 123. (ISBN 978-963-306-016-2)

Sümegi, P., Lócskai, T., Jakab, G., Persaits, G., **Páll, D. G.**, Veres, Zs., Majkut, P., Töröcsik, T. 2010. Radiocarbon-dated malacological and paleoenvironmental changes on a lake and peat sediment sequence from the central part of the Great Hungarian Plains during the last 25000 years. In.: Gaudényi, T. - Sümegi, P. - Molnár, D. (eds.): Conference of the European Quaternary Malacologists - EQMal 2010, Szeged - Novi Sad, 37-38. (ISBN 978-86-86053-09-1)

Sümegi, P., Bodor, E., Jakab, G., Majkut, P., **Páll, D. G.**, Persaits, G., Pomázi, P., Töröcsik, T. 2008. The Imperial Age environmental reconstruction of the Valcum (Keszthely, Hungary). Proceedings of the 3th Conference of the Young Archaeologists' Imperial Age. *in press*

Sümegi, P., Bodor, E., Jakab, G., Majkut, P., **Páll, D. G.**, Persaits, G., Pomázi, P., Töröcsik, T. 2008. The environment of Fenékpusztas as inferred from environmental historical records of a continuous core sequence from the

embayment of Little Balaton. Proceedings of the 3th Conference of the Young Archaeologists'Imparial Age. *in press*

Persaits, G., **Páll, D. G.**, Sümegi, P., Takács, K. 2010. Fitolitelemzéssel kiegészített régészeti geológiai vizsgálatok egy középkori csatornarendszerben (Tóköz, Magyarország). In.: Pál-Molnár E. (szerk.): Medencefejlődés és geológiai erőforrások. GeoLitera. SZTE TTIK Földrajzi és Földtani Tanszékcsoport, Szeged, 124-125. (ISBN 978-963-306-016-2)

Conference participation - presentation

Páll, D. G., Persaits, G., Sümegi, P. 2011. New investigations at Tokaj-Csorgókút II. loess section, Northeast Hungary. (II. International School on Paleopedology for Young Scholars in Siberia, Volodarka)

Náfrádi, K., Sümegi, P., Persaits, G., **Páll, D. G.**, Törőcsik, T. 2010. Holocene Environmental History of Hungarian Subalpine Region. (Workshop on Landscape History, Sopron)

Conference participation - poster

Páll, D. G., Persaits, G., Náfrádi, K., Sümegi, P. 2011. Preliminary micromorphological and phytolith investigations on Northeastern Hungary loess profile (Tokaj-Csorgókút II.). (Climate Change in the Carpathian-Balkan Region During the Last Pleistocene and Holocene, Suceva)

Páll, D. G., Náfrádi, K., Sümegi, P. New investigations at Tokaj-Csorgókút II. loess section, Northeast Hungary (International Workshop, 6th Loess Seminar in Wroclaw, 2011)

Náfrádi, K., Persaits, G., **Páll, D. G.**, Sümegi, P., Töröcsik, T. 2010. Az Alpokalja negyedidőszaki környezettörténete. (Medencefejlődés és geológiai erőforrások. Magyarhoni Földtani Társulat Vándorgyűlése, Szeged)

Sümegi, P., Hupuczi, J., Persaits, G., Gulyás, S., **Páll, D. G.** 2009. New chronological and environmental historical data of the first identified Upper Paleolithic site of the Great Hungarian plain: Szeged - Öthalom. (European Association of Archaeologists 15th Annual Meeting, Riva del Garda, Trento)

Sümegi, P., Molnár, M., Jakab, G., Persaits, G., Majkut, P., **Páll, D.G.**, Gulyás, S., Timothy, A. J., Töröcsik, T. 2009. Radiocarbon-dated paleoenvironmental changes on a lake and peat sediment sequence from the central part of the Great Hungarian Plains (Central Europe) during the last 25,000 years. (20th International Radiocarbon Conference, Big Island, Hawaii)

Sümegi, P., Lócskai, T., Jakab, G., Persaits, G., **Páll, D. G.**, Veres, Zs., Majkut, P., Töröcsik, T. 2010. Radiocarbon-dated malacological and paleoenvironmental changes on a lake and peat sediment sequence from the central part of the Great Hungarian Plains during the last 25000 years. (EQMal 2010 - Conference of the European Quaternary Malacologists, Szeged)

Sümegi, P., Jakab, G., Töröcsik, T., Molnár, M., Persaits, G., **Páll, D. G.** 2010. Radiocarbon-dated macrobotanical and palynological changes on sediment sequence of Lake Kolon from the central part of Great Hungarian

Plain (Central Europe) during last 25.000 years. (8th European Palaeobotany - Palynology Conference, Budapest)

Persaits, G., **Páll, D. G.**, Sümegi, P., Takács, K. 2010. Preliminary results of Arpadian age channel system survey based on phytolith analysis (Tóköz, NW-Hungary). (8th European Palaeobotany - Palynology Conference, Budapest)

Persaits, G., **Páll, D. G.**, Sümegi, P., Takács, K. 2010. Fitolitelemzéssel kiegészített régészeti geológiai vizsgálatok egy középkori csatornarendszerben (Tóköz, Magyarország). (Medencefejlődés és geológiai erőforrások. Magyarhoni Földtani Társulat Vándorgyűlése, Szeged)

Veres, Zs., **Páll, D. G.**, Sümegi, P., Törőcsik, T. 2010. Geoarcheological examination of Selyemrét (Ócsa). (EQMal 2010 - Conference of the European Quaternary Malacologists, Szeged)

Veres, Zs., **Páll, D. G.**, Sümegi, P., Törőcsik, T. 2011. Geoarcheological examination of Selyemrét (Ócsa). (Climate Change in the Carpathian-Balkan Region During the Last Pleistocene and Holocen, Suceava)

Veres, Zs., **Páll, D. G.**, Sümegi, P., Törőcsik, T. 2011. Az ócsai Selyemrét geoarcheológiai vizsgálata (Krolopp Endre Emlékkonferencia, Budapest)

BIBLIOGRAPHY

Dean, W.E. 1974. Determination of the carbonate and organic matter in calcareous sediments and sedimentary rocks by loss on ignitions: comparison with order methods. *Journal of Sedimentary Petrology*, 44, pp. 242-248.

Hupuczi, J. – Sümegi, P. 2010. The Late Pleistocene paleoenvironment and paleoclimate of the Madaras section (South Hungary), based on preliminary records from mollusks. *Central European Journal of Geosciences*, 2, pp. 64-70.

Hupuczi, J. – Sümegi, P. 2011. A madarasi téglagyári löszszelvény legújabb malakológiai vizsgálatának eredményei. *Archeometriai Műhely*, 2, pp. 157-162.

Kovács, G., 2011. Régészeti talaj-mikromorfológia. Antropogén rétegek talaj- mikromorfológiai vizsgálata, *Matrica Füzetek III*, „Matrica” Múzeum, Százhalombatta, p. 56.

Szendrei, G. 2000. Talaj-mikromorfológia. ELTE-Eötvös Kiadó, p. 220.

Molnár, B., Krolopp E. 1978. Latest Pleistocene geohistory of the Bácska loess area. *Acta Mineralogica – Petrographica*, 23, 2, pp. 245-265.

Murphy, C.P. 1985. Thin Section Preparation of Soils and Sediments. A B Academic Publishers, Berkhamsted, p. 149.

Sümegi, P. 2005. Loess and Upper Paleolithic environment in Hungary. Aurea Kiadó, p. 312.

Sümegei, P., Persaits, G. Páll, D. G., Töröcsik, T. 2011c. Results of analyses carried out on the alluvium of Borzó Creek and at Zanat archaeological site. In: Kvassay, J. (Eds.), The late Urnfield period cemetery from Szombathely-Zanat supplemented by an assessment features and interdisciplinary analyses. VIA-Monographia Minor in Cultural Heritage 2. Hungarian National Museum-Natural Cultural Heritage Protection Centre, Budapest, pp. 224-243.

Visy, Zs., Nagy, M., B. Kiss, Zs. (eds.) 2003. Magyar régészet az ezredfordulón. Nemzeti Kulturális Örökség Minisztériuma Műemléki Főosztálya, Teleki László Alapítvány, Budapest, p. 480.