SERBIAN ACADEMY OF SCIENCES AND ARTS

INQUA LOESS FOCUS GROUP

University of Novi Sad | Faculty of Sciences
DEPARTMENT OF GEOGRAPHY, TOURISM AND HOTEL MANAGEMENT

Loess2M

modelling & mapping

ABSTRACT BOOK

Novi Sad, 2016

SERBIAN ACADEMY OF SCIENCES AND ARTS

INQUA LOESS FOCUS GROUP

University of Novi Sad | Faculty of Sciences
DEPARTMENT OF GEOGRAPHY, TOURISM AND HOTEL MANAGEMENT

Loess2M

modelling & mapping

ABSTRACT BOOK

ISBN 978-86-7031-408-5

Printed by
Futura, Petrovaradin

Circulation
100

The Conference has been supported by
Provincial Secretariat for Science and Technological Development

City of Novi Sad – Urban Heart of Vojvodina

Novi Sad is the capital of the Autonomous Province of Vojvodina and the second largest city in Serbia. It is the industrial, cultural, scientific, educational, and administrative centre of Vojvodina.

Seen from above, City of Novi Sad reveals itself as a city located in a vast plain, spacious and open to all directions. Fortress of Petrovaradin, a historical site, is situated on the right bank of the River Danube, whereas a tall building of Central Post Office, massive construction of Spens Sports Centre, immense headquarter of Petroleum Industry of Serbia and elegant oval edifice of Banovina (a seat of Executive Council of Autonomous Province of Vojvodina) are situated on the left. What eyes could also perceive are green oases embodied in City parks, with labyrinth of streets and alleys meandering around them and cut across with wide and straight boulevards.

Moreover, there is the Danube as an unsymmetrical, potent axe of the City, embraced with long quay and Štrand, the most beautiful city beach along the Danube.

Nowadays, a widely recognizable symbol of the City is Exit Festival, while in the past, and even so today that place has been reserved for the Serbian cultural institutions: Matica srpska - the oldest cultural-scientific institution of Serbia, Serbian National Theatre, Sterijino pozorje Theatre Festival...

Furthermore, our City, in contrast to many other European destinations, has the reputation, by full right, of a multinational, multicultural and multi-confessional metropolis in which all differences are seen as advantages.

Department of Geography, Tourism and Hotel Management

Department of Geography, Tourism and Hotel Management was established 1962 by academician Branislav Bukurov. During previous almost half century, the Department has grown and developed, which brings it today amongst the most respectable Institutes of Geography in South-East Europe.

The main professional activities of the Department are educational/teaching, scientific/research and publishing. Educational activity is provided through bachelor, master and PhD studying programmes.

Long lasting scientific researches have been conducted through several projects funded by governmental bodies, such as "Geographic research of municipalities in Vojvodina ", "Geomorphological map of Yugoslavia", "Condition and developing directions of Vojvodina", "Loess-palaesol sequences in Serbia", "Demographic transition in Serbia" and "Regional Water Resources Investigations In The Scope Of Sustainable Development" (funded by UN).

The Department quarterly publishes two scientific journals: *Geographica Pannonica* and *Turizam*, and also the *Department's Researchers review* with the longest tradition. Besides geoscience, multydisciplinary activities of the Department also involve research in tourism, sustainable development, marketing, management, etc.

Consequently, quality lectures, adequacy and eminence of the professors and assistants result with prosper and competitive students successfully employed worldwide.

International conference on loess research | 26-29th August 2016

Loess2M - modelling & mapping

Serbian Academy of Sciences and Arts & INQUA Loess Focus Group

About conference

This conference is dedicated to two main topics: Loess modelling and loess mapping. The conference will be held as a part of celebrating the 175th anniversary of the Serbian Academy of Sciences and Arts and they will be co-organizing the conference along with INQUA loess focus group. Two days of presentations. One day workshops related to Loess Mapping and Modeling methodology improvements and establishing preliminary networks for potential forthcoming project proposals applications and one day excursion.

Local Organizing Committee

- **Academician Stevan Pilipović**, President, President of Branch of the Serbian Academy of Sciences and Arts in Novi Sad
- **Academician Teodor Atanacković**, General Secretary of Branch of the Serbian Academy of Sciences and Arts in Novi Sad
- **Prof. Milica Pavkov Hrvojević**, Dean of Faculty of Sciences, University of Novi Sad
- **Prof. Lazar Lazić**, Director of Department for Geography, Tourism and Hotel Management
- **Prof. Slobodan B. Marković**, Corresponding member of Serbian Academy of Sciences and Arts
- **Prof. Milivoj B. Gavrilov**
- **Dr Mlađen Jovanović**, Vice Director of Department for Geography, Tourism and Hotel Management
- **Dr Nemanja Tomić**, General Secretary of the conference
- **Dr Djordjije Vasiljević**
- **Katarina Barajevac**
- **Milan Mrazović**
- **Milica Radaković**

International Scientific Board

- **Pierre Antoine**, Meudon, France
- **Andriano Banak**, Zagreb, Croatia
- **André Berger**, Belgium
- **Bjoern Buggle**, Bayreuth, Germany
- **Jan-Pieter Buylaert**, Aarhus, Denmark
- **Wei Chu**, Cologne, Germany
- **Vladica Cvetković**, Beograd, Serbia
- **Zhongli Ding**, Beijing, China
- **Manfred Frechen**, Hannover, Germany
- **Milivoj B. Gavrilov**, Novi Sad, Serbia
- **Zhengtang Guo**, Beijing, China, Vice President of INQUA
- **Qingzhen Hao**, Beijing, China
- **Christine Hatté**, Gif-sur-Yvette, France
- **Ulrich Hambach**, Bayreuth, Germany
- **Ken O'Hara-Dhand**, Leicester, UK
- **Paul Hesse**, Sidney, Australia, Vice President of INQUA Loess Focus Group
- **Erszebeth Horvath**, Budapest, Hungary
- **Thomas A. Hose**, Bristol, UK
- **Zdzislaw Jary**, Wroclaw, Poland
- **Vidojko Jović**, Beograd, Serbia
- **Frank Lehmkuhl**, Aachen, Germany
- **Xiuming Liu**, Fuzhou, China/Sidney, Australia
- **Huayu Lu**, Nanjing, China
- **Janos Kovacs**, Pecs, Hungary
- **Slobodan B. Marković**, Novi Sad, Serbia,
  President of INQUA Loess Focus Group
- **Jordana Ninkov**, Novi Sad, Serbia
- **Igor Obreht**, Aachen, Germany
- **Eric Oches**, Bentley, USA, Vice President of INQUA Loess Focus Group
- **Ashok Singhvi**, India, Vice President of INQUA
- **Pal Sumegi**, Szeged, Hungary
- **Randall Schaetzl**, East Lansing, USA
- **Ashok K. Singhvi**, Ahmedabad, India
- **Ian Smalley**, Leicester, UK
- **Thomas Stevens**, Uppsala, Sweden
- **Zorica Svirčev**, Novi Sad, Serbia
- **Denis-Didier Rousseau**, Paris, France
- **Gyorgy Sipos**, Szeged, Hungary
- **Jan-Berend Stuut**, NIOZ, The Netherlands/Bremen, Germany
- **Anders Svensson**, Copenhagen, Denmark
- **Alida Timar-Gabor**, Cluj, Romania
- **Gabor Ujvari**, Sopron, Hungary
- **Jef Vandenberghe**, Amsterdam, The Netherlands
- **Đorđije Vasiljević**, Novi Sad, Serbia

- **Nemanja Tomić**, Novi Sad, Serbia
- **Jovica Vasin**, Novi Sad, Serbia
- **Daniel Veres**, Cluj, Romania
- **Shiling Yang**, Beijing, China, Vice President of INQUA Loess Focus Group
- **Qiuzhen Yin**, Louvain-la-Neuve, Belgium
- **Ludwig Zoeller**, Bayreuth, Germany
- **Christian Zeeden**, Aachen, Germany

Conference program

26th August

Ice Breaker party and registration
17:00-22:00
Building of Branch of the Serbian Academy of Sciences and Arts in Novi Sad

27th August

REGISTRATION

8:00-9:00

OPENING CEREMONY

9:00-9:30

Building of Branch of the Serbian Academy of Sciences and Arts in Novi Sad

- **Prof. Lazar Lazić**, Director of Department for Geography, Tourism and Hotel Management
- **Prof. Milica Pavkov Hrvojević**, Dean of Faculty of Sciences
- **Prof. Stevan Pilipović**, President of Branch of the Serbian Academy of Sciences and Arts in Novi Sad

PLENARY SESSION

Chairmans: Ian J. Smalley and Slobodan B. Marković

9:30-11:00

- **Ulrich Hambach** – Towards multi-proxy based millennial time scales in Lower Danube Late Pleistocene Loess-Palaeosol Sequences: evidence for persistent North Atlantic sea surfacetemperature control
- **Qingzhen Hao** – Extra-long interglacial in Northern Hemisphere during MISs 15-13 arising from limited extent of Arctic ice sheets in glacial MIS 14
- **Zdzislaw Jary** – Palaeoenvironmental conditions recorded in loess of SW Poland

Coffee break 11:00-11:30

PLENARY SESSION

Chairmans: Qingzhen Hao and Zdzislaw Jary

11:30-12:30

- **Thomas Stevens** – Dust mass accumulation rates from high sampling resolution luminescencedating of Chinese loess
- **Jordana Ninkov** – Distribution of Mercury in soil according to the geomorphological units of Vojvodina Province

Lunch 12:30-13:30

LOESS PROVENANCE AND GRAIN SIZE

Chairman: Anna Bird and Kaja Fenn

13:30-15:30

1. **Anna Bird** – Constant Chinese Loess Plateau dust source since the Pliocene using Sr, Nd and Hf isotopes
2. **Kaja Fenn** – Reanalysis of the zircon single grain approaches to loess provenance on the Chinese Loess Plateau

3. **Rastko Marković** – The fate of dust in semi-arid regions – can it be controlled?
4. **Marcin Krawczyk** – The granulometric variability of upper younger loess (L1L1) in the loess-soil sequences in Złota near Sandomierz, Poland
5. **György Varga** – Granulometric properties of aeolian dust deposits: what are we measuring?

Coffee break 15:30-16:00

LOESS CHRONOLOGY

Chairman: Grzegorz Poręba and Piotr Moska

16:00-18:00

1. **György Sipos** – Loess accumulation at the centre of the Bačka Loess Field, preliminary results based on the Novo Orahovo loess section
2. **Grzegorz Poręba** – An application of the OSL method and soil properties measurements to dating Holocene soil erosion in South Poland
3. **Piotr Moska** – Upper Pleistocene OSL chronostratigraphy for loess deposits in Poland
4. **Zoran Perić** - Luminescence characteristics of quartz grains from the Titel Loess Plateau
5. **Piotr Moska** – High resolution dating of loess profile from Strzyżów, poster
6. **Piotr Moska** – OSL chronostratigraphy for the loess deposits in Złota, Poland, poster
7. **Grzegorz Poręba** – Simultaneously using dendrochronology study and radioisotopes measurement to study soil erosion in loess gully near Poręba village (Soult Poland), poster
8. **Grzegorz Poręba** – Simultaneously using Cs-137, Pb-210 and soil properties for the assessment of soil redistribution on an agricultural loess slope, poster
9. **Alida Timar Gabor** – Optically stimulated luminescence dating techniques and multi-proxyanalysis to quantify the timing of the last two major climatic transitions, as recorded by loess palaeosol sequences, poster
10. **Lara Wacha** – Preliminary results on incision rates in the area of Bilogora (NE Croatia) as implied by post-IR IRSL dating, poster

Novi Sad – City walking tour 18:30-20:30

28th August

PLENARY SESSION
Chairmans: György Varga and Igor Obreht
9:30-11:00

- **György Varga** – North African dust addition to interglacial soils in the Carpathian Basin
- **Christian Zeeden** – Modelling causes of loess-paleosol formation in the Carpathian Basin
- **Igor Obreht** – Tracing the influence of Mediterranean climate on Southeast Europe during the past 350,000 years

Coffee break 11:00-11:30

PLENARY SESSION
Chairmans: Ulrich Hambach and Nemanja Tomić
11:30-13:00

- **Milivoj B. Gavrilov** – Prevailing winds in Northern Serbia: recent data, geomorphological evidences and numerical simulations
- **Nemanja Tomić** – Exploring the geotourism potential of mammoth fossils in the Drmno area (Kostolac, Serbia)
- **Ian J. Smalley** – An enthusiasm for loess: Leonard Horner in Bonn, Liu Tung sheng in Beijing.

Lunch 13:00-14:30

LOESS AS A CLIMATIC AND ENVIRONMENTAL RECORD
Chairmans: Mlađen Jovanović and Tin Lukić
14:30-16:30

1. **Nikola Bačević** – Middle and Late Pleistocene loess sequences at Stalać (Central Serbia) at the southern limit of the European loess belt: Initial results
2. **Dragan Govedarica** – Heavy metals in loess deposits: A case study from Beška, Serbia
3. **Milica G. Radaković** – Quantitative relationship between climate and magnetic properties of soil in Bačka Loess Plateau (Vojvodina, Serbia)
4. **Slobodan B. Marković** – The Crvenka loess-paleosol sequence (Vojvodina, Northern Serbia)- a record of continuous domination of the Late Pleistocene grasslands
5. **Natalija Janc** – Correspondence between academicians Milutin Milanković and Vojislav Mišković about the theory of Ice Age
6. **Bojan Gavrilović** – Malacological analysis of loess section in Zemun (Belgrade, Serbia)
7. **Tamara Dulić** – Mid-chain and branched mid-chain alkanes of cyanobacteria – overseen biomarkers in the field of loess research, poster

8. **Peter Fischer** – Terrestrial system response to North Atlantic climate oscillations during the Last Glacial Cycle – evidence based on high resolution geochemical analyses of a new core from the Schwalbenberg site (Middle Rhine Valley, Germany), poster
9. **Jacek Skurzyński** – Geochemical characterization of the Tyszowce loess-paleosol sequence and the importance of the high-resolution sampling, poster
10. **Tin Lukić** – A joined rock magnetic and colorimetric perspective on the Middle Pleistocene climate recorded in Dukatar pedocomplex S5 – Titel loess plateau (North Serbia), poster
11. **Dijana Pantelić** – Cyanobacteria-Specific compounds as biomarkers in loess research, poster
12. **Mlađen Jovanović** – Palaeoenvironmental importance of Zemun loess section (Srem Loess Plateau, Serbia), poster

Coffee break 16:30-17:00

LOESS MAPPING AND MODELING

Chairmans: Ken O'Hara-Dhand, Christian Zeeden and Janine Börker

17:00-19:00

1. **Janine Börker** – Compilation of a new global loess map
2. **Arya Assadi-Langroudi** – Stiffness degradation patterns in loess: lessons for building the High Speed rail 2 on Undisturbed Devensian loams
3. **Ian J. Smalley** – The John Bruce (1978) map of loess in the South Island, New Zealand
4. **Heiko Lindner** – Loess distribution map for the eastern part of the Carpathian Basin: A new approach using different geoscientific maps and data
5. **Piotr Demczuk** – Changes of loess relief caused by catastrophic heavy rain (July 26/27, 2011) in Sandomierz (Poland) based on field mapping and GIS analysis, poster
6. **Sue McLaren** – Loess in New Zealand & Japan, poster
7. **Kamila Ryzner** – Lithological indicators of loess sedimentation of SW Poland, poster

CONFERENCE DINNER AND SHORT BUSINESS MEETING

19:30-21:30

29th August

EXCURSION

8:30-21:00

- Titel loess plateau
- Batajnica loess section
- Surduk loess section
- Stari Slankamen

Abstract Book

Stiffness degradation patterns in loess: lessons for building the High Speed rail 2 on Undisturbed Devensian loams

Arya Assadi-Langroudi[1], Kenneth O'Hara-Dhand[2], Ian Smalley[2], Mihaela Anca Ciupala[1], Elizabeth Theron[3]

[1] *School of Architecture, Computing & Engineering, University of East London, London, United Kingdom, Email: a.assadilangroudi@uel.ac.uk*
[2] *Giotto Loess Research Group School of Geography, University of Leicester, Leicester, United Kingdom*
[3] *Department of Civil Engineering, Central University of Technology, Free State, South Africa*

As the need to exploit shallow Quaternary drift deposits as mediums for bearing dynamic actions of fast moving vehicles grow – one recent case being the High Speed 2 to be built on Devensian silty loams – so too does the uncertainty in determination of long-term strains in those subgrade soils, which are by nature sediments of cemented open packing. A common solution to combat this problem has been to build structures on rigid bases resting on over-consolidated Tertiary substratum. This comes at the cost of considerable earthworks and haulage, high carbon footprint and unattractive ecological implications. Of previously published attempts – to re-engineer the calcareous loess into subgrade - including implementation of enhanced energy compaction or putting a control on the matric suction, few have been proved to be pragmatic and effective in the long-term.

This paper surveys the implications of building light-weight fast moving traffic convening structures on undisturbed calcareous loess i.e. cemented open-packed loam. In particular, this paper looks at the durability of mobilised small tensile strength – stemmed from carbonate bonds – as a function of matric suction and stress state, packing collapse threshold, and too often observed rebound volume change following an early constant volume suction decrease. A conceptual Provenance – Transportation – Deposition framework is developed and adopted to extend the captured small strain stiffness degradation patterns among sediments of identical whole-sequence diagenesis.

Small strain stiffness in cemented loams increase with depth, implying that with appropriate risk assessment and monitoring, cemented loams can safely underpin embankments with no punching shear risk. Small compressibility and persistence of maximum shear modulus on dry loading lends further evidence to the suitability of calcareous loams as subgrades. Further proof comes with increasing stiffness at constant void ratio upon unloading and the marginal rebound volume change on wetting at minimal stiffness loss – which compensates with surcharge net pressure. Benefits of building on/into cemented loams however comes with the risk of collapsibility for when shear strains grow beyond a critical value and on post-wetting re-loading. The latter can tentatively be mitigated by implementing rigorous drainage into the cemented layers.

Middle and Late Pleistocene loess sequences at Stalać (Central Serbia) at the southern limit of the European loess belt: Initial results

Nikola Bačević[a,b], Igor Obreht[c], Slobodan B. Marković[b], Ulrich Hambach[d], Christian Zeeden[c], Janina Bösken[c], Milivoj B. Gavrilov[b], Nemanja Tomić[b], Frank Lehmkuhl[c]

[a] *Department of Geography, Faculty of Sciences, University of Priština, nikola.bacevic@pr.ac.rs Serbia*
[b] *Chair of Physical Geography, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia*
[c] *Department of Geography, RWTH Aachen University, Templergraben 55, D-52056, Aachen, Germany*
[d] *Chair of Geomorphology, Laboratory for Palaeo- and Enviro-Magnetism, University of Bayreuth, D-94450 Bayreuth, Germany*

The palaeoclimate record preserved in loess deposits in Central Serbia is poorly understood. This is in strong contrast to the situation in the north of the country (Vojvodina region), where similar deposits have been intensively investigated in recent years.

This study presents a first detailed description, initial proxy analysis (magnetic susceptibility, color) and preliminary luminescence chronology of a loess-palaeosol sequence that is exposed in brickyard at Stalać. The sequence is about 35 m thick and preserves six loess units and six fossil pedocomplex. The rock magnetic signal at Stalać generally resembles the pattern of the enviromagnetic records determined from other Eurasian loess sites. However, significant shifts in magnetic susceptibility values indicate potential changes in dust provenance. The paleo-pedological interpretations, color and rock magnetic record at Batajnica yield valuable data for the reconstruction of paleoclimatic fluctuations for the last 6 glacial–interglacial cycles at least.

Although its potential remains to be fully tapped, the preliminary results demonstrate that the sequence offers a unique record of climate and environmental change during the Middle and Late Pleistocene at the transition area between Mediterranean and Continental Europe.

Constant Chinese Loess Plateau dust source since the Pliocene using Sr, Nd and Hf isotopes

Anna Bird[1,2], Ian Millar[3], Tanja Rodenburg[2], Thomas Stevens[2,4], Martin Rittner[5], Pieter Vermeesch[5], Huayu Lu[6]

[1] *Department of Geography, Environment and Earth Sciences, University of Hull, Hull, HU6 7RX, UK. a.bird@hull.ac.uk*
[2] *Department of Geography, Royal Holloway University of London, Egham, Surrey, TW20 0EX, UK*
[3] *NERC Isotope Geosciences Laboratories, British Geological Survey, Keyworth, UK*
[4] *Department of Earth Sciences, Uppsala University, Geocentrum, Villav. 16, 752 36 Uppsala, Sweden*
[5] *Department of Earth Sciences, University College London, London, WC1E 6BT, UK*
[6] *School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing 210093, China*

Mio-Quaternary wind-blown Chinese loess records past aridification, monsoon and dust cycle history. Previous work on the source of dust on the Chinese Loess Plateau implies changes in source at the Quaternary-Pliocene boundary or at 1.2 Ma, coinciding with a major shift in monsoon dynamics (Sun 2005; Nie et al. 2014)the provenance of the underlying upper Miocene\u2013Pliocene Red Clay sequence is largely unknown. Here we present the first provenance history of the Red Clay sequence based on zircon U\u2013Pb ages from the central CLP. Visual and statistical analyses of the U\u2013Pb age populations and comparison with results from potential source regions reveals that (1. Here we present detailed Sr, Nd and novel Hf isotopic data from multiple sites that show dust source remains the same across these boundaries. The use of established and novel isotopic tracers from multiple sites allows us to demonstrate that sediment geochemistry shifts can be solely explained by weathering changes. Nd and Hf isotopes show the dust was dominantly sourced from the Tibetan Plateau with some input from Alxa and the North China Craton. This shows that a major established and constant dust source on the northern Tibetan Plateau has been active and unchanged since the late Miocene.

Nie, J., Peng, W., et al., 2014. Provenance of the upper Miocene–Pliocene Red Clay deposits of the Chinese loess plateau. *Earth and Planetary Science Letters*, 407, pp.35–47. Available at: http://www.sciencedirect.com/science/article/pii/S0012821X14005810 [Accessed March 2, 2015].

Sun, J., 2005. Nd and Sr isotopic variations in Chinese eolian deposits during the past 8 Ma: Implications for provenance change. *Earth and Planetary Science Letters*, 240(2), pp.454–466. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0012821X05005960 [Accessed August 14, 2014].

Compilation of a new global loess map

J. Börker, J. Hartmann, G. Romero-Mujalli

Institute for Geology, CEN (Center for Earth System Research and Sustainability), University of Hamburg, Bundesstraße 55, 20146 Hamburg, Germany.
e-mail: janine.boerker@univeristät-hamburg.de

The detailed geographic distribution and types of loess sediments are globally sparsely documented. Therefore a new global loess map considering different classes of loess, ages and thicknesses is in development. The loess map is based on the new Global Quaternary Sediments Map (GQMAP), which is currently being compiled, while using diverse resources of information as the geologic maps of the GLIM (Global Lithological Map), the Quaternary Sediments Maps of National Geological Surveys and regional literature.

Regarding the classification of loess for a global map there remain decisions to be made of how to properly classify loess classes, not only for the presentation on a map, but also for representing secondary information being available in the database for further use. Unified definitions of loess considering regional aspects based on the origin are needed to make sure that the global map becomes more homogeneous, but still represents relevant regional information or information of genesis and history. For example, the loess types in the map can be described as mapped loess, estimated loess distributions, regions of eolian sediments, which consist of both eolian sands and loess, and regions of quaternary sediments, where it is known that loess is part of the sediments. Some special previously proposed loess classes have to be defined regarding their origin, for example tropical loess, volcanic loess, alluvial loess or colluvial loess.

Due to heterogeneous input data the loess map has not a uniform coverage and high resolution information exist only for few regions. For these reason detailed studies of specific regions are required to obtain an improved global loess map of today's distribution. Having such a uniform map it would be very interesting to do investigations on the transition and development of loess sediments considering the Quaternary Age period. To accomplish a high quality global map we would like to discuss with regional specialists, which further data are available in the digital format or as maps.

Changes of loess relief caused by catastrophic heavy rain (July 26/27, 2011) in Sandomierz (Poland) based on field mapping and GIS analysis

Piotr Demczuk[1], Tymoteusz Zydroń[2], Przemysław Mroczek[1], Zdzisław Jary[3]

[1] *Faculty of Earth Sciences and Spatial Management, Maria Curie-Skłodowska University, Lublin, Poland, piotr.demczuk@umcs.pl, przemyslaw.mroczek@umcs.pl*

[2] *Department of Hydraulic Engineering and Geotechnics, Agricultural University, Kraków, Poland, tzydron@ar.krakow.pl*

[3] *Department of Physical Geography, University of Wrocław, 1 Uniwersytecki Sqr., 50-137 Wroclaw, Poland, zdzislaw.jary@uwr.edu.pl*

The picturesque Renaissance town of Sandomierz is located on the eastern edge of loess plateau on the left slope of the Vistula River valley. The highest thickness of loess on the area of Old Town is ca. 10 metres and relative heights exceed 40 m. In historical times, the marginal part of town was repeatedly destroyed by landslides caused by improper land use.

Extremely heavy rainfall occurred over the Old Town Hill and the Castle Hill in Sandomierz during the night 26/27 June, 2011. It was torrential rainfall, which started at 8 pm and lasted for approx. 3 hours. The amount of precipitation was 140.5 mm. As a result several sections of roads and slopes around the hills were damaged, the bridges were undermined and also ca. 140 public and residential buildings were flooded.

To characterize the extreme event, we used geomorphological mapping, laboratory (particle size distribution, cohesion, internal friction angle, permeability) and GIS analysis.

The results of stability calculations have shown that a significant part of potential landslide areas covered with the location of landslides registered in the neighbouring areas of hills. However, in general the generated models overestimate the size of the area threatened by mass movements.

In turn, the integrated calculation of filtration and stability (Iverson's model) confirmed the observational data, which showed a small depth range of mass movements. These calculations also showed that the changes in stability were violent in nature, and the critical values of rain have been obtained in the final stage of rain storm. This result indicates the confluence of several factors in a given place and time, which led to the intensification of mass movement in Sandomierz.

The erosivity results calculated for Sandomierz and adjacent area (USPED application) showed that the places of potential intensive erosion are very much in line with the areas selected as the places exposed to mass movements. This application, however, pointed out additional areas which were overflowing watercourse beds and a staircase on the Old Town Hill slopes as the places with particularly high susceptibility to erosion processes. Finally, the field observations have shown that the slope processes were active in places with surface runoff, covered by low-cut grassy vegetation,

and the areas covered with bushy and luxuriantly-developed herbaceous vegetation has not undergone the relief transformations.

Mid-chain and branched mid-chain alkanes of cyanobacteria – overseen biomarkers in the field of loess research

Dulić Tamara[1], Vuković Nikola[2], Orčić Snežana[3], Meriluoto Jussi[1,4], Svirčev Zorica[1,4]

[1] *Laboratory for Paleoenvironmental reconstruction, Faculty of Sciences, University of Novi Sad, Serbia*
[2] *Faculty of Chemistry, University of Belgrade, Serbia*
[3] *Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Serbia*
[4] *Biochemistry, Faculty of Science and Engineering, Åbo Akademi University, Turku, Finland*

Long-chain n-alkanes (>C25) have been widely used in geochemical studies of loess sediment to reconstruct paleoenvironments. Most of the studies concerntheir ratios (eg. C27/C31, C29/C31, (C27 + C29)/(C31 + C33)) which reflect the structure of past higher-plant communities. Short-chain and mid-chain n-alkanes were observed in these studies but not given much attentionsince being regarded as biomarkers of soil microbiota or degradation residues of long-chain alkanes. With the introduction of the BLOCDUST hypothesis, the role of a microbiological component in the formation of loess was emphasized, with a special reference on community type. The need for a better understanding of mid-chain and branched mid-chain alkanes arose, which became a novel means to test the proposed cyanobacterial biocrust model for loess sediment formation.

In this study we analysed mid-chain and branched mid-chain alkanes extracted from cyanobacteria-dominated Biological Loess Crusts (BLCs), cyanobacteria BLC isolates and loess sediment L1 layer (Titel Loess Plateau (TLP)). According to the BLOCDUST hypothesis, the S1 layer does not contain BLC residuals and for this reason a sample from the S1 layer (TLP) was used as a negative control. The results obtained in the analysis of BLCs and cyanobacterial BLC isolates showedthepresenceof C15, C16, C17, C18, and monomethyl-heptadecane.

The analysis of the L1 loess sediment sample showed the presence of both mid-chain (C15-C19) and long-chain (C27-C33) n-alkanes with a significant dominance ofthe mid-chain group. Strong signals for the branched forms of alkanes, especially monomethyl-heptadecane and monomethyl-hexadecane, were also recorded. No signal for the mid-chain n-alkane group was recorded in the reference S1 sample.

This study shows a clear correlation in the n-alkane composition between analysed cyanobacterial samples and the L1 loess sample, indicating the past presence of cyanobacterial communities and corroborating

their role in loess sediment formation. A great need for further research on mid-chain and branched mid-chain alkanes in loess sediment studies is evident.

Reanalysis of the zircon single grain approaches to loess provenance on the Chinese Loess Plateau

Kaja Fenn[1], Thomas Stevens[2], Anna Bird[3], Martin Rittner[4], Pieter Vermeesch[4], Andrew Carter[4], Mara Limonta[5], Sergio Andó[5], Eduardo Garzanti[5], Huayu Lu[6]

[1] *Kaja.Fenn@ouce.ox.ac.uk, School of Geography, Oxford University, Oxford, OX1 3QY, UK,*
[2] *Department of Earth Sciences, Uppsala University, Uppsala 752 36, Sweden,*
[3] *Department of Geography, Earth and Environmental Sciences, University of Hull, Hull, HU6 7RX, UK,*
[4] *School of Earth Sciences, Birkbeck College, University of London, London, WC1E 7HX, UK,*
[5] *Dipartimento di Scienze Geologiche e Geotecnologie, Università di Milano-Bicocca, Piazza della Scienza 4, 20126 Milano, Italy,*
[6] *School of Geographic and Oceanographic Sciences, Institute for Climate and Global Change Research, Nanjing University, Nanjing 210093, China*

The influence and response of dust in past climates is currently unclear, and is best resolved by detailed investigations of past dust emissions and transport through geological dust archives. The Chinese Loess Plateau is the largest (over 440,000km2), most detailed and important terrestrial aeolian archive. However, a lack of consensus over its specific sediment sources prevents understanding of the controls on past dust emissions, determination of transport pathways, and interpretation of preserved proxies. Recent single grain techniques developments, especially U-Pb zircon dating, have brought a new perspective to the provenance debate. Continued research has suggested the Northern Tibetan Plateau as the Loess Plateau's main source, rather than the Northern deserts as had been commonly accepted, with the Yellow River playing a major role in sediment delivery and distribution. However, there have been many inconsistencies across the zircon U-Pb field including varying sampling, laboratory, and statistical approaches. Commonly one or two samples are taken from extensive sedimentary units and accepted as representative of that unit, often with few grains analysed. Further, the statistically representative minimum number of grains in a sample in a mixed sedimentary body such as loess is still contested. Consequently published datasets vary in terms of the number of grains used to discriminate between loess units and sources. Therefore a statistically significant representation of the zircon U-Pb ages from units and sites is not often achieved, and the extent to which samples represent the true variability of zircon ages in samples is unclear. In an attempt to address this, we present new "big data" detrital zircon data-

sets, created from all available published datasets, in combination with a novel use of Raman analysis of detrital garnets. This approach enabled re-analysis of the big questions of source, and temporal and spatial variability on the Chinese Loess Plateau. We note potentially significant dust provenance changes within units and between sites, suggesting some source variability. Finally, we show that the current detrital zircons approach may have reached the limits of its application as a provenance tool and suggest other methods, e.g. detrital garnets geochemistry as a complementary tool to the zircon technique.

Terrestrial system response to North Atlantic climate oscillations during the Last Glacial Cycle – evidence based on high resolution geochemical analyses of a new core from the Schwalbenberg site (Middle Rhine Valley, Germany)

Peter Fischer[1], Mathias Vinnepand[1], Olaf Jöris[2], Andreas Vött[1]

[1] *Institute of Geography, Johannes Gutenberg-Universität Mainz, Johann-Joachim-Becher-Weg 21, 55099 Mainz, Germany*
[2] *MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution, Schloss Monrepos, 56567 Neuwied, Germany*

The Schwalbenberg site in the Middle Rhine Valley, Germany, is well known for a Loess-Paleosol-Sequence particularly covering Isotope Stage 3 in high resolution. So far, studies concentrate on the so called Schwalbenberg II section (e.g. Frechen and Schirmer, 2011; Schirmer, 2012; Schirmer et al., 2012) with a sequence of approx. 13 m on top of the Lower Middle Terrace, and on core REM 1 (Klasen et al., 2015) that is 21 m long.

In the last two years, systematic Electrical Resistivity Tomography (ERT) was carried out to determine the maximum overall thickness of the cover sediments on top of the fluvial gravel. Based on our ERT results, a new sediment core (REM 3) was recovered from the Remagen-Schwalbenberg area. This core, 26 m long, exhibits one of the most complete terrestrial archives of the Last Glacial Cycle within the Western European Loess Belt. It was analyzed in high resolution by means of XRF, ICP-OES and GC-IRMS measurements.

The litho- and pedostratigraphical structure in combination with calculated weathering indices and organic carbon contents as well as the $\delta^{13}C$-isotopic composition allow reconstructing palaeoenvironmental changes in high resolution. Based on data from core REM 3, we achieve a first estimation of terrestrial system response to North Atlantic climate oscillations.

Preliminary results indicate that core REM 3 covers not only Isotope Stage 3 but also the early Glacial (late OIS 5 and OIS 4) and Upper Pleniglacial succession (OIS 2) including the Eltville Tephra layer.

Frechen, M. and W. Schirmer (2011): Luminescence Chronology of the Schwalbenberg II Loess in the Middle Rhine Valley. Quaternary Science Journal (Eiszeitalter und Gegenwart) 60 (1): 78–89. DOI 10.3285/eg.60.1.05.

Klasen, N., P. Fischer, F. Lehmkuhl and A. Hilgers (2015): Luminescence Dating of Loess Deposits from the Remagen-Schwalbenberg Site. Geochronometria 42: 67–77. DOI 10.1515/geochr-2015-0008.

Schirmer, W. (2012): Rhine Loess at Schwalbenberg II – MIS 4 and 3. Quaternary Science Journal (Eiszeitalter und Gegenwart) 61 (1): 32–47. DOI: 10.3285/eg.61.1.03.

Schirmer, W., A. Ikinger and F. Nehring (2012): Die terrestrischen Böden im Profil Schwalbenberg/ Mittelrhein. Mainzer geowissenschaftliche Mitteilungen 40: 53–78.

Prevailing winds in Northern Serbia: recent data, geomorphological evidences and numerical simulations

Milivoj B. Gavrilov[1], Slobodan B. Marković[1], Randall J. Schaetzl[2], Ivana Tošić[3], Christian Zeeden[4], Kathrin Emunds[4], György Sipos[5], Albert Ruman[6], Suzana Putniković[3], Igor Obreht[4], Zoran Perić[1], Frank Lehmkuhl[4]

[1] *University of Novi Sad, Faculty of Sciences, Chair of Physical Geography, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia*
[2] *Department of Geography, Michigan State University, 128 Geography Building, East Lansing, MI 48824, USA*
[3] *University of Belgrade, Faculty of Physics, Institute of Meteorology, Dobračina 16, 11000 Belgrade, Serbia*
[4] *Department of Geography, RWTH Aachen University, Templergaben 55, 52056 Aachen, Germany*
[5] *Department of Physical Geography and Geoinformatics, University of Szeged, Szeged, Hungary*
[6] *Republic Hydrometeorological Service of Serbia, Belgrade, Kneza Višeslava 66, Serbia*

The prevailing winds are explored in Northern Serbia, examining the aeolian processes, especially in the southeastern part of the Carpathian (Pannonian) Basin in the area in and around the Banatska Peščara (Deliblato Sands). In this study, four different methodological approaches were used. The first two approaches are based on the identification of prevailing winds using climatological data on winds and synoptic data on atmospheric circulations from the recent period. Geomorphologi-

cal records and numerical simulation were used as the second two approaches to determine prevailing winds in the past. Recent prevailing winds in Northern Serbia have been encountered mainly in the fourth (270°-360°/00°) and second (90°-180°) quadrants with frequencies of 113.5 and 102.2 days a year, while their frequencies within the area of Banatska Peščara are 106.0 and 121.0 days per year, respectively. The crest directions of the Banatska Peščara dune field confirms that of about 1300 dunes, the vast majority of parabolic dunes (approximately 1200 dunes) show direction of the second quadrant, which is dated to the Early Holocene, while the remaining ones, the so-called, transversal dunes have shifted their direction to the third quadrant. The grain size analyses of loess deposits around the Banatska Peščara shows a main accumulation of aeolian particles from south-east to north-west (prevailing winds from the second quadrant) and probably represent the period between the Last Glacial Maximum (LGM) and the Holocene. Modern wind measurements and geomorphological results showed that the prevailing winds in the recent and past periods were from the same, second, quadrant in and around the Banatska Peščara. These results were confirmed with an explicit numerical simulation of atmospheric circulation that created prevailing winds from the second quadrant in the LGM period.

The phenomenon of prevailing winds in Northern Serbia is the result of the interaction of atmospheric circulation of different scales over the European continent, especially in Southeastern Europe. The main carrier of this interaction is the undulation of the Polar front, which, due to the constant change of form and position, creates distinctive types of weather. Thus, the winds from the second quadrant are most often dry and usually cause weather conditions without precipitation, while winds from the fourth quadrant usually create advection of moist air and precipitation. This alternation of dry and wet winds show a great similarity with the shift of dry and wet monsoons in Asia, but with one difference. Monsoons are replaced every six months, while the dry and moist winds in Northern Serbia alternate many times a year and their total duration amounts to 227.0 days a year in the area of Banatska Peščara.

Malacological analysis of loess section in Zemun (Belgrade, Serbia)

Bojan Gavrilović[1], Miloš Ćirić[2], Slobodan B. Marković[3]

[1] *Serbian Academy of Sciences and Arts, Geographical Institute "Jovan Cvijić", Department of Physical Geography, Djure Jakšića 9, Belgrade, Serbia.*
[2] *University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Department of Ecology and Technoeconomics, Njegoševa 12, Belgrade, Serbia.*
[3] *University of Novi Sad, Faculty of Sciences, Department of Geography, Tourism and Hotel Management, Trg Dositeja Obradovića 3, Novi Sad, Serbia.*

The aim of our study was to describe the succession of malacological assemblages along the exposed loess profile located in Belgrade, along the Danube river bank (municipality of Zemun). The thickness of the section was 440 cm and samples were taken at every 20 cm. Analyzed section covers the period between the last approximately 10,000–30,000 years which corresponds to (Marine Isotope Stage) MIS 2 and the latest part of MIS 3. Detailed chronological investigations are in progress in the Laboratory for Luminescence Dating at the University of Cluj, Romania. For Optically Stimulated Luminescence (OSL) dating more than 20 samples were collected. A total of 17 taxa were recorded including one subterranean species – *Cecilioides acicula*, which was omitted from analyses. When it comes to temperature and humidity preferences the mesophilous and subhygrophilous species prevailed in the section. Out of the 16 analyzed taxa nine were mesophilous, four were thermophilous, two were cold resistant, while one was eurytherm. According to humidity preferences six taxa were characterized as subhygrophilous, four as mesophilous, four as aridity tolerant and two were hygrophilous. The abundance of mollusks ranged between 166 and 1108 individuals per sample. *Vallonia pulchella* had the highest percentage in total abundance – between 14% and 77%. In the group of thermophilous and aridity tolerant species *Pupilla triplicata* dominated, with 16–54 % in assemblages. Based on ecological preferences of molluscan assemblages the upper part of the section (0–100 cm) is characterized by the presence of thermophilous and aridity tolerant species (*P. triplicata, Granaria frumentum* and *Chondrula tridens*). The portion of the loess profile between 100–180 cm and the lower layers of the section 240–440 cm were populated by mesophilous and subhygrophilous species (mostly *V. pulchella*). Reoccurrence of thermophilous species was recorded in the part of the profile between 180–240 cm.

Heavy metals in loess deposits: A case study from Beška, Serbia

Dragan Govedarica[1], Slobodan B. Marković[2], Tijana Zeremski[3], Nemanja Tomić[2], Ivana Sentić[4], Olga Govedarica[1]

[1] *Faculty of Technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia*
[2] *Faculty of Sciences, University of Novi Sad, Department of Geography, Trg Dositeja Obradovica 3, 21000 Novi Sad, Serbia*
[3] *Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia*
[4] *Faculty of Agriculture, University of Novi Sad, Department of fruit science, viticulture, horticulture and landscape architecture, Trg Dositeja Obradovica 8, 21000 Novi Sad, Serbia*

We sampled loess sediments in sections located right next to the highway Novi Sad – Belgrade, with the intention to evaluate the potential pollution preserved in loess deposits. Loess samples were collected from two loess profiles in broad ranges of vertical depth (0.15-4.5m at 0.05m intervals) and horizontal depth (0.01, 0.05 and 0.1m). Both loess profiles were located in the vicinity of a highway in a rural area where there is an intense frequency of motor vehicles. Heavy metal content (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, and Zn), hydrocarbon content, and magnetic susceptibility were measured in 45 loess samples. Statistical analysis was applied in order to classify samples. For all loess samples the content of heavy metals, except Mn and Zn, were lower than 45 mg/kg. The developed methodology based on physical and chemical properties of loess can be used to investigate persistence of heavy metals released into the environment by anthropogenic activities. In order to improve the accuracy of the developed statistical approach, more extensive analysis of wash load and loess properties needs to be assessed.

Towards multi-proxy based millennial time scales in Lower Danube Late Pleistocene Loess-Palaeosol Sequences: evidence for persistent North Atlantic sea surface temperature control

Ulrich Hambach[1,5], Christian Zeeden[2], Daniel Veres[3,4], Igor Obreht[2], Slobodan B. Marković[5] and Frank Lehmkuhl[2]

[1] *BayCEER & Chair of Geomorphology, University of Bayreuth, Germany, ulrich.hambach@uni-bayreuth.de*
[2] *Department of Geography, RWTH Aachen University, Germany*
[3] *Institute of Speleology, Romanian Academy, Cluj-Napoca, Romania*
[4] *Interdisciplinary Research Institute on Bio-Nano-Science of Babes-Bolyai University, Cluj-Napoca, Romania*
[5] *Laboratory for Palaeoenvironmental Reconstruction, Faculty of Sciences, University of Novi Sad, Serbia*

Late Pleistocene palaeoclimatic records for south-eastern Europe rely largely on loess-palaeosol sequences (LPSS). The general spatial scarcity and often limited temporal range of other sedimentary archives assign the LPSS of the region a key role even in millennial scale temporal reconstructions of the Late Pleistocene terrestrial environmental dynamics. The Eurasian loess-belt has its western end in the Middle Danube (Carpathian) and the Lower Danube Basin. Similar to the Chinese Loess Plateau (CLP) and to the steppe areas of Central Asia one can find true loess plateaus in this area dating back more than one million years and comprising a semi-continuous record of the Quaternary palaeoclimate.

The LPSS of the Lower Danube and the Carpathian Basin allow inter-regional and trans-regional correlation and, even more importantly, the analysis of temporal and spatial trends in Pleistocene palaeoclimate, even on hemispheric scales. However, the general temporal resolution of the LPSS seems mostly limited to deca-millennial (orbital) scales enabling the correlation of their well documented palaeoclimate record to the marine isotope stages (MIS) and thus to the course of the global or northern hemisphere ice volume with time.

Magnetic susceptibility (χ, χ_{fd}) and grain size (GS) are highly sensitive proxies for the environmental conditions during loess accumulation. Recent studies on GS trends across the CLP reveal Late Pleistocene palaeoclimatic fluctuations on millennial scale which correlate to the Dansgaard-Oeschger (D-O) events known from the Greenland Ice Cores. Such millennial scale variations were up to date not observed in Late Pleistocene Danube LPSS.

Here, we present new high resolution environmental proxy data from Late Pleistocene LPSS of the eastern Lower Danube Basin (Dobrogea). The stratigraphic variability of palaeoclimatic proxy parameters reveals detailed information on the temporal environmental dynamics. Based on these records we can draw the following conclusions:

- χ_{fd} largely resembles the O-isotope record from Greenland Ice providing a multi-millennial time scale.
- On this time scale, the GS-trend correlates surprisingly well to the Greenland dust proxy record suggesting a persistent North Atlantic sea surface temperature control of western Eurasian climate.
- Estimated dust accumulation rates are relatively homogeneous (10-15 cm/ka).

Extra-long interglacial in Northern Hemisphere during MISs 15-13 arising from limited extent of Arctic ice sheets in glacial MIS 14

Qingzhen Hao[1], Luo Wang[1], Frank Oldfield[2], Zhengtang Guo[1]

[1] *Key Laboratory of Cenozoic Geology and Environment, Institute of Geology and Geophysics, Chinese Academy of sciences, P.O. Box 9825, Beijing 100029, China; e-mail: haoqz@mail.iggcas.ac.cn; wangluo@mail.iggcas.ac.cn*

[2] *School of Environmental Sciences, University of Liverpool, Liverpool L69 7ZT, UK.*

The marine $\delta^{18}O$ records of benthic foraminifera show that the growth and reduction of global ice volume exhibited dominant quasi-periods of 100 kyr since the Mid-Pleistocene transitions of 1200–700 kyr ago. Normal interglacials generally span two or three precession cycles with a maximum durations of 60 kyr, and normal glacials, two precession cycles, over the recent 700 kyrs. In the MIS sequence, MIS 14 (563–533 kyr BP) stands out as a short and mild glacial epoch in many records. Confirming the extent of Northern Hemisphere (NH) ice sheets during MIS 14 can provide new insight into the 100-kyr climate cycles and improve our understanding of the forcing mechanism of the Pleistocene glacial and interglacial cycles.

Here, based on the demonstrable link between changes in Chinese loess grain-size and NH ice-sheet extent, we use loess grain-size records to confirm that northern ice-sheets were restricted during MIS 14. This is in accordance with the marine and continental records in the NH. Thus, an unusually long NH interglacial climate of over 100 kyr persisted during MISs 15–13, much longer than expected from marine oxygen isotope records. However, the evidence from many middle-high latitude records from the Southern Hemisphere suggests typical glacial-like climate conditions in middle-high southern latitudes, and we tentatively attribute the cooing of MIS 14 as indicated by the marine $\delta^{18}O$ record to South Pole processes.

The extra-long and warm, predominantly interglacial style climate in the Northern Hemisphere during MISs 15–13 may have had a profound influence on the migration of early humans within the context of alter-

nating glacial and interglacial climates. The evidence from genetic analysis and archaeological investigations suggest that hominins of African origin dispersed, and similar forms of hominins and Acheulean bifacial handaxes occurred in regions on both sides of the Mediterranean about 600 kyrs ago. Therefore, we propose that the extra-long duration of interglacial/mild stadial climates during MIS 15–13 may have provided favorable conditions over 100 kyr for the second major dispersal of African hominins into the Eurasia region during the middle Pleistocene.

Hao QZ, Wang L, Oldfield F et al. 2012. Delayed build-up of Arctic ice sheets during 400,000-year minima in insolation variability. *Nature*, 490, 393–396.

Hao QZ, Wang L, Oldfield F et al. 2015. Extra-long interglacial in Northern Hemisphere during MISs 15-13 arising from limited extent of Arctic ice sheets in glacial MIS 14. *Scientific Reports*, 5: 12103, http://dx.doi.org/10.1038/srep12103.

Correspondence between academicians Milutin Milanković and Vojislav Mišković about the theory of Ice Age

Natalija Janc[1], Milivoj B. Gavrilov[2], Slobodan B. Marković[2], Vojislava Protić Benišek[3], Vladimir Benišek[3], Luka Č. Popović[3]

[1] *Baltimore, USA;*
[2] *University of Novi Sad, Faculty of Sciences, Novi Sad, Serbia,*
[3] *Astronomical Observatory, Belgrade, Serbia*
Corresponding author: Natalija Janc, natalijanc@earthlink.net

A part of the unpublished correspondence between Milutin Milanković and Vojislav Mišković from 1924 until 1930 is presented in this paper. At first, Mišković worked at the Astronomical Observatory in Nice, France, while Milanković taught at the Belgrade University, Serbia. This correspondence covers their collaboration, as well as Milanković's research, the publication of his papers, his acceptance speech at the Serbian Academy of Science, his encounters and exchanges with other scientists like Alfred Wegener, and other related topics. An analysis of the letters' content gives us additional information about the life and work of these two Serbian scientists, particularly regarding Milutin Milanković. Milanković was very interested in the publications of the Astronomical Observatory in Belgrade, where he found useful data for his research. Numerical calculations he needed for his research were carried out using pinwheel desktop mechanical calculators. Two such machines are now on display at the Astronomical Observatory's library in Belgrade, Serbia: the *Original Odhner Göteborg* and the *„Brunsviga" System Trinks.* These aforemen-

tioned calculations provided Milutin Milanković with a foundation for his now well-known mathematical theory of ice ages (the succession of ice ages and warmer periods) on Earth. This theory, historically and at present, is indispensable reading in the world of science.

Palaeoenvironmental conditions recorded in loess of SW Poland

Zdzisław Jary[1], Piotr Moska[2], Jerzy Raczyk[1], Marcin Krawczyk[1], Jacek Skurzyński[1], Dariusz Ciszek[3]

[1] *Department of Physical Geography, University of Wrocław, 1 Uniwersytecki Sqr., 50-137 Wroclaw, Poland, zdzislaw.jary@uwr.edu.pl*
[2] *Department of Radioisotopes, Institute of Physics, Silesian University of Technology, 44-100 Gliwice, Poland*
[3] *Polish Geological Institute-Research Geological Institute, Lower Silesian Branch, al. Jaworowa 19, 50-122 Wrocław*

To reconstruct local and regional palaeoenvironmental conditions in SW Poland, several loess-soil sequences have been investigated. All sections were sampled in vertical continuous profiles at close intervals (5 cm). The following analyses were conducted: grain-size distribution (laser diffraction method), magnetic susceptibility, contents of $CaCO_3$ and organic carbon. OSL and ^{14}C dating have been also performed.

The best developed Late Pleistocene loess-soil sequence on this area consists of four units: two polygenetic pedocomplexes (S1 and LiSS1) and two loess units (LiLL2 and LiLL1). In the top of younger loess unit recent soil (S0) has developed.

The most spectacular grain-size changes occur in the lower part of LiLL2 loess and in the lower part of LiLL1 loess. These layers frequently show cryogenic deformation and evidence of redeposition by gelifluction and other slope processes. It proofs, that they were formed contemporaneously with the most important, climate induced, environmental changes of the Last Glacial period on the investigated loess areas.

Grain-size analyses performed for LiLL1 loess usually demonstrate systematic increase of coarse silt fraction percentage towards the top of the sequences. It can be interpreted as evidence for growing rate of loess accumulation, which can be associated with availability and decreasing distance to the main loess alimentation areas.

Spatial variations of loess lithologic properties appear in longitudinal N-S section. Mean grain-size diameter usually decreases from north to south. This phenomenon is probably connected with variations of latitudinal climate zones, showing indirectly the position of major primary source areas for loess particles.

During the warm periods of the Late Pleistocene (MIS 5 and MIS 3) loess sedimentation processes were reduced almost to zero. Results of high resolution dating indicate a short but very intense processes of loess deposition which occurred in harsh climatic conditions. The high rate of deposition is confirmed by structure of loess dominated by primary lamination.

One of the most spectacular features of loess sequences in SW Poland is the occurrence of well-preserved relicts of periglacial structures. Despite of the local and regional differentiation, periglacial record indicates the occurrence of four main cold stages during Last Glacial period.

Palaeoenvironmental importance of Zemun loess section (Srem loess plateau, Serbia)

Mlađen Jovanović[1], Tivadar Gaudenyi[2], Ljupko Rundić[3], Ulrich Hambach[4], Slobodan Marković[1]

[1] *Department of Geography, Tourism and Hotel Management, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, mladjenov@gmail.com*

[2] *Geographical Institute "Jovan Cvijic" of the Serbian Academy of Sciences and Arts, Đure Jakšića 9, 11000, Belgrade, Serbia*

[3] *Department of Regional Geology, Faculty of Mining and Geology, University of Belgrade, Kamenička 6, 11000 Belgrade*

[4] *BayCEER & Chair of Geomorphology, University of Bayreuth, D-95440 Bayreuth, Germany*

Loess sequences of northern Serbia reveals a continuous record of paleoclimatic variations during the Middle- and Late Pleistocene. The most detailed stratigraphic information comes from remarkable exposures on the cliffs of the right Danube banks from Vukovar to Belgrade.

The Zemun loess section is the southernmost investigated section on Srem Loess Plateau. It is situated 4 km upstream from the Danube and Sava confluence, on altitude from 102 to 72 m a.s.l.

Despite the fact that the section is known almost 100 years ago, up to present days detailed studies have not been conducted. According to its importance as a valuable geological heritage, the loess section of Zemun is officially protected since 2013.

About 30 m thick section represents clear succession between polycyclic fluvial sediments in bottom part of the section and eolian deposits in the upper part. Based on the to stratigraphic data of other investigated sections on Srem Loess Plateau, such as Stari Slankamen, Batajnica, Surduk and Ruma, the loess-paleosol sequences of Zemun sections were formed since MIS 10 and covers the period from younger part of Middle Pleistocene to the end of the Upper Pleistocene. The identified tephra layer in the L2 horizon stresses

importance of Zemun loess section for intersection correlations within Srem Loess Plateau and to the Mostiştea section on the east.

Unlike the wellknown stratigraphy of loess series, the time frame of formation of polycyclic fluvial sediments at the bottom of the section is much less clear. Observed Pleistocene *Corbicula* beds at the base of the section could represents the temperate fluvial stages of the younger part of Lower Pleistocene to Middle Pleistocene. Position of these beds on the section and its surroundings, can be connected with a strong neotectonic movements in the area of the Sava fault. Red clays in the last 3 m of exposed section are potentially an excellent benchmark for reconstruction of paleoenvironmental conditions at the bottom of the Pannonian Basin.

The granulometric variability of upper younger loess (L1L1) in the loess-soil sequences in Złota near Sandomierz.

Marcin Krawczyk, Zdzisław Jary, Jacek Skurzyński, Kamila Ryzner

Department of Physical Geography, University of Wrocław, 1 Uniwersytecki Sqr., 50-137 Wroclaw, Poland; marcin.krawczyk@uwr.edu.pl

Loess sedimentation during the last loess formation phase was not continuous. Intensity of this process was differentiated. The evidence is recorded in the granulometric composition of upper younger loess (L1L1) which show significant variations. Granulometric research have high importance in the paleogeographical interpretation. The samples for grain size analysis were taken from upper younger loess (L1L1) in two neighbouring loess-soil sequences in Złota near Sandomierz.

The Złota profiles are situated in the eastern part of the Sandomierz Upland. They are located in the upper part of the left slope of the Vistula River valley at the height of 172 m.a.s.l., about 20 m above the modern valley bottom. The loess-soil sequences in Złota consists of five units: two polygenetic pedocomplexes (S1, L1S1) and two calcareous loess units developed in the Late Pleistocene (L1L1, L1L2), and recent soil S0 developed in the top of the younger loess, reworked by agricultural activity.

For detailed analyses 300 samples have been used, which were taken at close intervals (5 cm). These samples were subjected to detailed preparation, then the grain size distribution were measured by laser diffraction method using Mastersizer 2000 particle size analyser. Four main fractions have been distinguished: clay (<4 μm), fine silt (4-16 μm), coarse silt (16-63 μm) and sand (>63 μm).

For a more complete analysis the most commonly cited grain size indicators were calculated. The first is GSI (Grain Size Index) expressed as

the ratio of coarse silt and fine silt plus clay (16-63/<16 μm) and the U-ratio index as a ratio of coarse silt (16-63 μm) and fine silt (4-16 μm).

Analysing the distributions of the percentage content of the individual fractions and the curves of the grain size indexes sudden changes in their course were observed. This is probably a record of short, rapid changes in the sedimentation conditions connected with abrupt climate oscillations. On the basis of granulometric indicators and content of clay (<4 μm) and sand (>63 μm) the depositional cycles in both studied sequences were also recognized.

Loess distribution map for the eastern part of the Carpathian Basin: A new approach using different geoscientific maps and data

Heiko Lindner, Frank Lehmkuhl, Christian Zeeden

Department of Geography, RWTH Aachen University, Aachen, Germany

Geo- and paleo-ecological studies in the Carpathian Basin require a detailed knowledge of the distribution of aeolian sediments. Existing and often cited maps, such as Haase et al. (2007), are in not detailed enough and faulty as a result of the basic input data and due to the used scale. To create a map showing the detailed distribution of loess sediments in the Carpathian Basin at the border of Hungary and Romania several different cross-border spatial data were used. Particularly some problems occurred because of the thematically content of the underlying international geodata, but also due to geodetical basics such as projections and linguistic barriers, respectively. To solve the identified problems some approaches were made, e.g. by following the terms of the EU-INSPIRE-directive. However, the most important approach was the unification of both areas by blending spatial data generated from scanned medium scale paper maps with topographical surface properties using a Geographic Information System. Therefore the geological map of Hungary (scale 1 : 300,000) has been vectorized, statistically analyzed and classified to an actual classification system. Due to the lack of useable geological data for Romania the Romanian pedological map (scale 1 : 500,000) was vectorized. The pedological data (soil type and texture) could be transferred into the German Soil Taxonomy first. In a second step the identified soils were interpreted by type and texture to make conclusions back to their parental substrate, especially loess sediments. Also remote sensing data and a Digital Elevation Model were taken to validate the results or to solve single problems of classification of the generated model considering geomorphological properties, respectively.

Finally the Hungarian and the Romanian data set were combined and transferred into a common loess sediment classification system resulting in a seamless cross-border map showing the loess distribution in the Carpathian Basin at a scale of about 1:500,000.

A joined rock magnetic and colorimetric perspective on the Middle Pleistocene climate recorded in Dukatar pedocomplex S5 – Titel loess plateau (North Serbia)

Tin Lukić[1*], Biljana Basarin[1], Björn Buggle[2,3], Slobodan B. Marković[1], Vladimir M. Tomović[4], Jovanka Popov-Raljić[1], Ulrich Hambach[2], Milivoj B. Gavrilov[1], Miško M. Milanović[5], Nemanja Tomić[1], Mladjen Jovanović[1], Dušan Sakulski[6], Matija Zorn[7], Blaž Komac[7], Kristina Kalkan[1]

[1] *Department of Geography, Tourism and Hotel Management, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia*
[2] *BayCEER & Chair of Geomorphology, University of Bayreuth, D-95440 Bayreuth, Germany*
[3] *Geological Institute, ETH Zürich, Sonneggstr. 5, 8092 Zürich, Switzerland*
[4] *Faculty of Technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia*
[5] *Department of Geospatial Bases of Environment, Faculty of Geography, University of Belgrade, Studentski trg 3/III, 11000 Belgrade, Serbia*
[6] *Disaster Management Training and Education Centre (DiMTEC), University of the Free State, 205 Nelson Mandela Drive, Park West, Bloemfontein, South Africa/ BioSens Institute, University of Novi Sad, Zorana Đinđića 1, 21000 Novi Sad, Serbia*
[7] *Research Centre of the Slovenian Academy of Sciences and Arts, Anton Melik Geographical Institute, Gosposka ulica 13, SI 1000 Ljubljana, Slovenia*
[*] *Corresponding author e-mail addresses: tin.lukic@dgt.uns.ac.rs, lukic021@gmail.com*

Loess-palaeosol sequences in Vojvodina (North Serbia) represent a significant terrestrial sedimentary archives of climate and environmental changes during Pleistocene. The investigated sequence, Dukatar pedocomplex S_5 on Titel loess plateau is formed due to global paleoclimatic changes during the Middle Pleistocene. Obvious color changes in loess and intercalated paleosols can be interpreted as a consequence of different climate conditions under which pedocomplexes were formed. Goethite and hematite are the main iron oxides in loess and paleosols that strongly influence color differences. Presence of this ferrimagnetica represent proxy of climatic and ecological changes. Soils containing only, or almost exclusively, goethite are yellow. When hematite is present, the color usually becomes reddish because the red hematite is very effective in masking the yellow goethite. Sampling and laboratory investigation of the mentioned pedocomplex provided rock magnetic and colorimetric perspective on the Middle Plistocene climate presented in this study. Wet and dry colors were determined using a Munsell soil color chart. Then,

the dry samples were ground using mortar and pestle and color reflectance of loess and paleosol samples was determined colorimetrically using a chromameter. Color values as determined by the chromameter are given in the CIE L*, a*, b* color space. Wet and dry colors, determined by Munsell soil color chart were used for calculation of Rubification (RI) and Melanization (MI) Indices. As an alternative proxy for soil reddening and changes in the hematite content, the Redness Index (RI1) was determined as well. The Redness Rating (RR) was calculated as average from moist and dry Munsell colors for strongly rubified pedocomplex S5. Rock magnetic measurements were carried out as well, since this parameter is generally applied as proxy for the exclusively pedogenetically formed fraction of ferrimagnetica. Rock magnetic and colorimetric results of the Dukatar pedocomplex shows that investigated paleosol was formed during MIS 13-15, a period characterized by increase in summer temperature and/or duration of summer dryness. Due to paleopedological interpretations and measured colorimetric and soil development index values, it can be highlited that investigated sequence, presented in this study indicate a succession of interglacial environmental changes from semi-humid subtropical environments (S_5) towards landscapes with typical steppe soils (S_1).

Acknowledgement

This research was supported by the Project 114-451-2080/2016 of Provincial Secretariat for science and technological development, ECAP Vojvodina.

The Crvenka loess-paleosol sequence (Vojvodina, Northern Serbia) - a record of continuous domination of the Late Pleistocene grasslands

Slobodan B. Marković[1], Pál Sümegi[2], Thomas Stevens[3], Igor Obreht[4], Wei Chu[5], Björn Buggle[6], Michael Zech[7], Roland Zech[8], Ulrich Hambach[9], Frank Lehmkuhl[4], Christian Zeeden[4], Milivoj Gavrilov[1], and Zorica Svirčev[10]

[1] *University of Novi Sad, Physical Geography, Novi Sad, Serbia; slobodan.markovic@dgt.uns.ac.rs,*
[2] *Department of Geology and Paleontology, University of Szeged, Egyetem u. 2-6, H-6722 Szeged, Hungary,*
[3] *Department of Earth Sciences, Uppsala University, Villavägen 16, 75236 Uppsala, Sweden,*
[4] *Department of Geography, RWTH Aachen University, Templergraben 55, D-52056, Aachen, Germany,*
[5] *Institute of Prehistoric Archaeology, University of Cologne, Bernhard-Feilchelfeld-Str.11, D-50969, Cologne, Germany,*
[6] *Geological Institute, ETH Zurich, CH-8092 Zurich,Switzerland,*
[7] *Geographical Institute Faculty of Environmental Sciences Technical University of Dresden, Helmholtzstr. 10, 01062 Dresden, Germany,*
[8] *Geographical Instiute University of Bern Hallerstrasse 12 CH-3012 Bern, Switzerland,*
[9] *Bay CEER & Chair of Geomorphology, University of Bayreuth, D-95440 Bayreuth, Germany,*
[10] *LAPER, Faculty of sciences, University of Novi Sad, Trg Dositeja Obradovica 2, 21000 Novi Sad, Serbia*

In this study we present a comparison of two independent paleo-environmental evidences: novel n-alkane biomarkers and traditional land snails assemblages, associated with widely used proxy records such as the low field magnetic susceptibility, grain size and various isotopic and geochemical indices. These paleo-environmental proxy records provide evidence for the continued predominance of the different grassland vegetation types during the entire Late Pleistocene. The results presented in this study highlight the spatial differences in the environmental conditions during the Late Pleistocene across the European loess belt. Contrary to other European loess provinces characterized by high diversity of the Late Pleistocene environments (ranging from tundra-like to deciduous forest habitats), our investigations indicate a continued dominance of grassland-dominated ecosystems in the southeastern Carpathian Basin. This uninterrupted presence of Late Pleistocene grassland zone in the southeastern part of the Carpathian Basin may have played an important role in the preservation of exceptional biodiversity of the Balkan region, as well as in the migration of anatomically modern humans into Europe.

The fate of dust in semi-arid regions – can it be controlled?

Rastko S. Marković[1], Zorica Svirčev[2], Igor Obreht[3], Slobodan B. Marković[1]

[1] *Chair of Physical Geography, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia*
[2] *Laboratory for Paleoenvironmental reconstruction, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia*
[3] *Department of Geography, RWTH Aachen University, Templergraben 55, D-52056, Aachen, Germany*

The origin and distribution of dust are well known in the environment. The fate of dust is still problematic from the environmental, hygienic and management perspective. For instance, the importance of dust in increasing the total capacity of water ecosystems and contributing to air pollution is often underestimated when assessing the consequences of dust formation-distribution in semi-arid regions. In this presentation we focus on the role of biological loess crusts (BLC) in (re)directing and (re)distributing dust particles in loess, water and air. The differences between BLC and physical crusts in the process of loess formation, accumulation and preservation are discussed. We describe the geo-microbiology of BLC with special attention to cyanobacteria in the processes of capturing, selection and sedimentation of dust, together with their role in protecting the sediments against wind and water erosion. The role of cyanobacteria and their polysaccharides in loess formation has only recently been recognized, and the biogenic nature of loessification is underestimated as compared to the aeolian nature. Primary and secondary metabolites of cyanobacteria have been evaluated, and new biomarkers are proposed for paleoclimate reconstruction. The new BLOCDUST hypothesis is discussed together with possible human activities for the restoration and recultivation of the geological cover in semi-arid regions.

Loess in New Zealand & Japan

Sue McLaren, Ken O'Hara-Dhand, Ian Smalley

Geography Department, Leicester University, Leicester LE1 7RH, UK (sjm11@le.ac.uk)

Julius von Haast took the idea of loess from the Austro-Hungarian Empire to New Zealand in the Nineteenth Century. He recognized loess in his new country, and drew attention to the interesting deposits in the South Island. Loess has been studied in New Zealand for over a hundred years; attention has focussed on loess in the South Island, and particularly in South Canterbury. The boundaries of South Canterbury are set by

the Southern Alps to the north-west, by the rivers Rangitata and Waitaki, and by the Southern Pacific Ocean in the sout-east. In this region it is possible to describe a realistic sequence of events to describe the formation of loess deposits; the so-called deterministic approach to loess formation appears to apply very effectively in this region. Identify all the key factors; if these apply then a loess deposit *should* form.

As John Hardcastle recognized the Southern Alps are a good source of loess particles. These are high, cold mountains (Aoraki Mount Cook is on the border of South Canterbury) and in glacial cold phases there were abundant glaciers. Production of loess material by glacial grinding in a mountain glacier landscape was very effective and the first stage of loess deposit formation was easily accomplished. This is the P phase of the sequence; in 2015 the recognized fundamental phases are P- production of loess material; T- transportation of loess material; D- deposition of loess material; C- changes occurring after the aeolian deposition phase.

T- transportation contains two important aspects; transportation is remarkably significant in the formation of a loess deposit. Rivers move loess material into position in the landscape, then aeolian transportation lifts the material into final position, and confers on the loess deposit many of its characteristic properties. The role of aeolian transportation has long been recognized (via the work of Obruchev & Richthofen) but it is only recently that the critical role of rivers has been appreciated. D is the deposition phase, and then there might be post-depositional changes. In New Zealand the most significant C action could be the formation of fragipan horizons.

Japan is like New Zealand in many ways; each country is roughly 40˚from the equator- similar latitudes. There are volcanoes and earthquakes and some similar mountainous terrains and some long and steep rivers; shared geomorphologies. But Japan seems to lack loess deposits; at least significant loess deposits have not been reported. There is an in-balance; large loess in New Zealand, little loess in Japan. Is it the case that NZ is over-supplied, or that Japan is under-supplied? Why the distinctive difference between the two countries in terms of loess deposition?

Speculative loess deposit formation might be considered. The Shinano River flows north from the central Alpine region of Honshu. It flows into the Sea of Japan at Niigata, where there should be a loess deposit if the deterministic template can be fitted. From the same mountainous region the river Tone flows to the south-east and enters the Pacific Ocean- again local loess might be expected. If the loess deposits in Japan are much smaller than those in New Zealand there could be various reasons. It may be that all the conditions in the deterministic model operate but in each case to a less intense degree- so that more modest mountains produce a smaller output of loess material, which is carried by more modest rivers, It seems likely that it is the critical P1 phase that makes the difference. There are over 20 mountains in Japan with elevations of over

2500m but they do not compare to the great range of the Southern Alps in New Zealand. It might be that the situation in Japan is like it was in England and India where loess was present but the conditions for its discovery and description did not exist. Because the South Island mountains in New Zealand were so dominant it was not until recently that the considerable loess in the North Island was noticed and appreciated. A better comparison might be to relate the situation in the North Island to the situation in Japan. In fact if 'tephric' loess is taken into consideration the comparison looks very reasonable.

Smalley, I.J., O'Hara-Dhand, K., Wint, J., Machalett, B., Jary, Z., Jefferson, I.F. 2009. Rivers and loess: The significance of long river transportation in the complex event-sequence approach to loess deposit formation. Quaternary International 198, 7-18.

Smalley, I.J., Fagg, R. 2014. John Hardcastle looks at the Timaru loess: Climatic signals are observed, and fragipans. Quaternary International doi.10.1016/j.quaint.2014.06.042.

Milne, J.D.G., Smalley, I.J. 1979. Loess deposits in the southern part of the North Island of New Zealand: An outline stratigraphy. Acta Geologica Acad.Sci.Hungar. 22, 197-204.

Upper Pleistocene OSL chronostratigraphy for loess deposits in Poland

P. Moska[1], Z. Jary[2], G. Adamiec[1] and A. Bluszcz[1]

[1] *Department of Radioisotopes, Institute of Physics, Silesian University of Technology, 44-100 Gliwice, Poland*

[2] *Institute of Geography and Regional Development, University of Wroclaw, 50-137 Wroclaw, Poland*

Corresponding author: P. Moska (Piotr.Moska@polsl.pl)

Loess formations in Poland display a close relationship with cooling and warming periods of the Northern Hemisphere during the Pleistocene. Loess sequences sensitively record regional palaeoclimatic changes. In Central Europe, loess/palaeosol sequences provide excellent high-resolution terrestrial archives of climate and environment change for the past 130 ka, the time span of the Upper Pleistocene. In general, loess is typical for cold and dry, periglacial climate and environment. The intercalated palaeosols are indicators of warmer and more humid climate representing interstadials or interglacials. The silty and sandy aeolian material originates mainly from weathered rock surfaces affected by frost shattering or from glaciofluvial/fluvial deposits of river flood plains. In Poland, loess and loess-like formations occur in the southern part of the country, mostly in

the south polish uplands, i.e. in the Lublin, Sandomierz, and Cracow Uplands. In addition, such deposits are found in the forelands and foothills of the Carpathians and Sudetes. At present, luminescence dating provides the greatest number of chronostratigraphic data concerning loess deposits. According to our project we report luminescence ages of loess from the last glacial cycle in SE Poland (up to about 100 ka), obtained in the Gliwice Luminescence Laboratory. Four different loess profiles from different regions in SE Poland were chosen for this investigation. For each profile (Biały Kościół, Złota, Tyszowce, Strzyżów) about 20 samples for luminescence dating and six for radiocarbon dating were collected. Two different fractions were investigated, the polymineral fine grains fraction (4-11μm) and medium quartz grains (45-63μm). For the fine fraction equivalent doses were determined using post-IR $IRSL_{290}$ and for medium quartz SAR OSL was used. Obtained OSL chronostratigraphy for the last 40k years was also confirmed by radiocarbon dating. Ages obtained for different fractions differ, especially for the oldest part of the loess profiles medium sized quartz yields younger ages than polimineral fine grains and what would be expected from the geological point of view. In addition for all loess profiles samples were collected in a vertical section at close intervals of ca. 5 cm and documented in respect of their sedimentology, palaeopedology and stratigraphy. In addition to high resolution OSL dating, grain-size distribution, carbonate and organic carbon contents, geochemical composition and magnetic susceptibility were determined.

All presented result were obtained with support of Polish National Science Centre, contract number 2011/01/D/ST10/06049

High resolution dating of loess profile from Strzyżów

Piotr Moska[1], Zdzisław Jary[2], Grzegorz Adamiec[1], Andrzej Bluszcz[1]

[1] *Silesian University of Technology, Institute of Physics - Center for Science and Education, ul. Konarskiego 22B, 44-100 Gliwice, Poland*

[2] *Institute of Geography and Regional Development, University of Wrocław, 50-137 Wrocław, Poland*

Corresponding author: P. Moska (Piotr.Moska@polsl.pl)

The Strzyżów loess profile is located close to the Polish-Ukrainian border in the northern part of the Sokal Plateau-Ridge, which is a latitudinal cretaceous hump with thick (10-30 m) loess cover. From the north and south the region is limited by distinct morphological edges to over 10 meter high. The loess sequence at Strzyżów is located at the height of 216 m above sea level in the northern margin of the loess cover, close to the Bug River about 40 m above the modern valley bottom. The Strzyżów

loess profile has not been investigated so far because it was discovered at the end of 2013 and in our investigations it was proved that it does not contain all the units characteristic for loess-soil sequence. Above the palaeosol S1 we can only distinguish about 12 m of L1L1 loess deposits and about 1 m of modern soil. There are no remains of the L1S1 soil and L1L2 loess deposits. Nineteen samples were collected from the almost 14m loess profile in Strzyżów (λ = 24°0'E, φ = 50°51'N). Combined infrared (post-IR IRSL for the deepest part of the profile) and blue light stimulated luminescence dating were applied to the polimineral fine grains (4-11μm) and medium grained quartz fraction (45-63μm). The obtained OSL chronostratigraphy was also confirmed by radiocarbon dating. Ages obtained for different fractions are very similar and only the result from one sample from the S1 soil is different. For a more complete picture of the changes in this profile, dating results have been complemented by grain-size distribution, carbonate and organic carbon contents, geochemical composition and magnetic susceptibility determinations.

All presented results were obtained with the support of the Polish National Science Centre, contract number 2011/01/D/ST10/06049

OSL chronostratigraphy for the loess deposits in Złota, Poland

Piotr Moska[1], Grzegorz Adamiec[1], Zdzisław Jary[2], Andrzej Bluszcz[1], Grzegorz Poręba[1], Natalia Piotrowska[1], Marcin Krawczyk[2], Jacek Skurzyński[2]

[1] *Silesian University of Technology, Institute of Physics – Center for Science and Education, ul. Konarskiego 22B, 44-100 Gliwice, Poland*

[2] *Institute of Geography and Regional Development, University of Wrocław, 50-137 Wrocław, Poland*

Corresponding author: P. Moska (Piotr.Moska@polsl.pl)

Loess formations in Poland display a close relationship with cooling and warming trends of the Northern Hemisphere during the Pleistocene. Loess sequences sensitively record regional palaeoclimatic and palaeoecological changes. The Złota loess profile (21°39'E, 50°39'N; Moska et al., 2015) provides a unique opportunity to reconstruct climate conditions in the past in this part of Poland. This continuous sequence of loess and palaeosol deposits allows to distinguish between warmer and more humid climate which is favourable for soil development and much colder and dry periods which are conducive to loess accumulation. The silty and sandy aeolian material originates mainly from weathered rock surfaces affected by frost shattering or from glaciofluvial/fluvial deposits of river flood plains. In Poland, loess and loess-like formations occur in the southern part of the country, mostly in the south polish uplands, i.e. in the Lublin, Sandomierz,

and Cracow Uplands. We used different techniques to establish a chronological framework for this site. 21 samples for luminescence dating were collected from the investigated loess profile in Złota. Combined infrared (post-IR IRSL for the deepest part of the profile) and blue light stimulated luminescence (OSL) dating were applied to the polymineral fine grains (4-11μm) and medium grained quartz fraction (45-63μm), respectively. Radiocarbon dating was performed for snail shells and humid acid extracted from loess and palaeosol deposits. The dating results are accompanies by detailed analyses of the grain-size distribution, carbonate and organic carbon content, geochemical composition and magnetic susceptibility. Based on such a large stratigraphic dataset OxCal (Ramsey and Lee, 2013) age-depth model has also been constructed for this site.

Moska, P., Jary, Z., Adamiec, G., Bluszcz A., 2015. OSL chronostratigraphy of a loess-paleosol sequence in Złota using quartz and polymineral fine grains. Radiation Measutements. 81, 23-31.

Bronk Ramsey, C., Lee, S. (2013). Recent and Planned Developments of the Program OxCal. Radiocarbon, 55(2-3), 720-730.

All presented result were obtained with support of Polish National Science Centre, contract number 2011/01/D/ST10/06049

Distribution of mercury in soil according to the geomorphological units of Vojvodina province

Jordana Ninkov[1], Slobodan Marković[2], Dušana Banjac[1], Jovica Vasin[1], Jelena Marinković[1], Milica Vučinić Vasić[3], Aleksandra Mihailović[3]

[1] *Institute of Field and Vegetable Crops, Maksim Gorki St. 30, Novi Sad, R. Serbia, jordana.ninkov@nsseme.com;*

[2] *University of Novi Sad, Faculty of Science and Mathematics, Dositej Obradovic Sq. 3, Novi Sad, R. Serbia*

[3] *University of Novi Sad, Faculty of Technical Sciences, Dositej Obradovic Sq. 6, Novi Sad, R. Serbia*

Establishing Hg background levels in various soils is problematic. The main problem is distinguishing human input (pollution) from natural Hg input. Geostatistical methods and Geographic Information System (GIS) mapping have been used in numerous studies to determine spatial distribution and behavior of heavy metals in soils and to identify their sorces. A grid superimposed on Vojvodina land by means of a GIS tool (GIS ArcView 10) has divided land into 4x4 km units, each representing an area of 16 km^2. Total number of 1,370 bulked soil samples were taken (0-30 cm depth) from agricultural land and analysed for total mercury content

THg. The samples were analysed using Direct Mercury Analyzer DMA 80 Milestone. Quality control was carried out with IRMM BCR reference materials 143R. The aim of this study was to determine the total content of Hg in agricultural soils, its spatial distributions in different parts of Vojvodina Province. It was indicated that the content of Hg coincides with main geomorphological units of Vojvodina Province. Hg spatial distribution indicated that most of Vojvodina Province area has geochemical origin of Hg. Average values of Hg concentrations for soils formatted on different geomorphological units were: 0.031 for sandy area with dune fields, 0.048 for alluvial terraces, 0.055 for upper Pleistocene terraces, 0.058 for loess plateaus, 0.083 for mountains, and 0.092 mg kg^{-1} for alluvial plains. Content increase in soils formed on specific geomorphological units in the following order - sandy area < alluvial terraces < upper Pleistocene terraces < loess plateaus, can be explained by organic matter increase in these soils. However, it is not the case with soils formed on mountains and alluvial plains. Higher concentrations of Hg in top soils are indicated in alluvial plains of the Danube, the Sava, the Tisa and the Tamiš rivers and in the central part of the Fruška gora mountains and southern slopes of the Vršačke mountains. Higher Hg content in mountain region can be explained by specific geological, and thus the pedological basis. Higher concentration of Hg on alluvial plains indicated that the origin of Hg near rivers could be from anthropogenic source. The main rivers in Vojvodina have been dammed more than a century ago. Thus, higher concentrations of Hg in their alluvial plains out of narrow dammed zone around the rivers must be related to natural and anthropogenic sources located in their huge catchments.

Tracing the influence of Mediterranean climate on Southeast Europe during the past 350,000 years

Igor Obreht[1], Christian Zeeden[1], Ulrich Hambach[2,3], Daniel Veres[4], Slobodan B. Marković[3], Janina Bösken[1], Zorica Svirčev[3], Nikola Bačević[5], Milivoj B. Gavrilov[3], Frank Lehmkuhl[1]

[1] *Department of Geography, RWTH Aachen University, Templergraben 55, 52056, Aachen, Germany*
[2] *BayCEER & Chair of Geomorphology, University of Bayreuth, 94450 Bayreuth, Germany*
[3] *Laboratory for Paleoenvironmental Reconstruction, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia*
[4] *Romanian Academy, Institute of Speleology, Clinicilor 5, 400006 Cluj-Napoca, Romania*
[5] *Department of Geography, Faculty of Natural Sciences and Mathematics, University of Kosovska Mitrovica, Lole Ribara 29, 38220, Kosovska Mitrovica, Serbia*

Loess-palaeosol sequences (LPS) are valuable archives of past environmental changes in the Eurasian loess belt. Although regional palaeoclimatic trends and conditions in Southeastern Europe (SEE) have been inferred from LPS, large scale forcing mechanisms responsible for their formation have yet to be determined. SEE is a climatically sensitive region, existing under the strong influence of both Mediterranean and continental climates. Establishment of the spatial and temporal evolution and interaction of these atmospheric systems is essential to understand the mechanisms of LPS formation. Here we present high-resolution grain-size, environmental magnetic, spectrophotometric and geochemical data from the Stalać section in the Central Balkans (Serbia) for the past ~350,000 years. The goal of this study is to determine the influence of the Mediterranean climate during this period. Our data show the Central Balkans being under different atmospheric circulation regimes during the late Middle and Upper Pleistocene.A strong Mediterranean climatic influence dominates in the South and the more continental climate prevails farther north. We observed a general weakening of the Mediterranean climate influence with time. Our data suggest that Marine Isotope Stage 5 was the first interglacial in the Central Balkans that had continental climate characteristics. This prominent shift in climatic conditions resulted in unexpectedly warm and humid conditions during the last glacial in SEE.

Cyanobacteria-specific compounds as biomarkers in loess research

Pantelić Dijana[1], Dulić Tamara[1], Tokodi Nada[1], Drobac Damjana[1], Fassen Els[2], Palanački Malešević Tamara[1], Savela Henna[3], Važić Tamara[1], Fan Titan[4], Meriluoto Jussi[1,5], Svirčev Zorica[1,5]

[1] *Laboratory for Paleoenvironmental reconstruction, Faculty of Sciences, University of Novi Sad, Serbia.*
[2] *Aquatic Ecology and Water Quality Management, Environmental Sciences, Wageningen University, Netherlands.*
[3] *Molecular Biotechnology and Diagnostics, Department of Biochemistry, University of Turku, Finland.*
[4] *Beacon Analytical Systems, Inc., Saco, ME, USA.*
[5] *Biochemistry, Faculty of Science and Engineering, ÅboAkademi University, Turku, Finland.*

According to the BLOCDUST hypothesis, biological loess crusts (BLC) with cyanobacteria as their most abundant component play a major role in trapping and accumulation of dust particles, promoting the process of loessification. In order to prove the hypothesis, geochemical evidence of cyanobacteria-specific biomarkers in the sediment is required. In our study structurally different cyanobacteria-specific compounds were examined for their potential to be used as biomarkers. These compounds included cyanotoxins, phycobilins (phycocyanin, allophycocyanin, phycoerythrin), and UV-protective pigments (scytonemin and mycosporine-like amino acids, MAAs).

Cyanotoxin studies of BLC as well as of cyanobacterial BLC isolates from Serbia, China and Iran (20 strains) included analysis of 8 microcystins, saxitoxin, cylindrospermopsin, nodularin and BMAA by applying LC-MS, ELISA and *Artemia salina* toxicity assay tests. The microcystin ELISA test was weakly positive for one cyanobacterial BLC isolate and for one crust sample from Iran. LC-MS and *Artemia salina* toxicity assay tests were negative for all tested samples. Negative results on microcystins were additionally confirmed by PCR and qPCR assays for the detection of potentially toxic cyanobacteria by showing absence of *mcyB* genes. According to these first results, cyanotoxins cannot be considered as biomarkers in loess studies.

Screening of cyanobacterial BLC isolates for the production of phycobilins, scytonemin and MAAs was performed using spectrophotometric techniques. Phycobilins are a characteristic group of pigments of all cyanobacteria and were detected in all strains. Scytonemin was detected in all examined cyanobacterial strains, while MAAs were detected in all loess strains except two strains from China. To determine the biodegradability of these cyanobacterial pigments, we performed a decomposition test with three different bacterial isolates from biological loess crust (biodegradation test of scytonemin, MAAs, and phycobilins) and two soil bacteria strains (biodegradation test of phycobilins). Phycobilins

were degraded during the experiment, which makes them unsuitable to be used as biomarkers. The decomposition test showed that scytonemin and MAAs have stable core structures resistant to bacterial enzymes. This gives them a good potential to be used as biomarkers for paleoclimatic reconstruction.

Luminescence characteristics of quartz grains from the Titel loess plateau

Perić, Z.[1], Stevens, T.[2], Buylaert, J.P.[3], Marković, S.B.[1], Hambach, U.[1,4], Fischer, P.[5], Obreht, I.[6], Zeeden, C.[6], Veres, D.[7], Lehmkuhl, F.[6], Vött, A.[5], Gavrilov, M.B.[1]

[1] *University of Novi Sad, Faculty of Sciences, Chair of Physical Geography, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia (zoranperic.geo@gmail.com)*
[2] *Department of Earth Sciences, University of Uppsala, Geocentrum, Villavägen 16, 75236, Uppsala, Sweden*
[3] *Nordic Laboratory for Luminescence Dating, Department of Geosciences, University of Aarhus, Risø Campus, Denmark*
[4] *BayCEER & Chair of Geomorphology, University of Bayreuth, Germany,*
[5] *Institute for Geography, University of Mainz, Germany*
[6] *Department of Geography, RWTH Aachen University, Germany*
[7] *Institute of Speleology, Romanian Academy, Cluj-Napoca, Romania*

The Titel loess plateau in the Vojvodina region of Serbia is considered to contain the most detailed terrestrial paleoclimatic records in Europe, with a thick and apparently continuous record extending through the middle and late Early Pleistocene. In the past few decades the plateau has been investigated on a fairly large scale and has provided important records of climatic and environmental changes during the Pleistocene in this part of Europe. Regardless the extensive research in the past, high detailed optically stimulated luminescence (OSL) dating of the Titel loess plateau has not yet been conducted on the site, despite having been shown in China to be essential in development of reliable chronologies and in accurate reconstruction of the last two glacial-interglacial cycles. The absence of a detailed independent chronology limits the paleoclimatic interpretations possible from this valuable archive.

In order to obtain detailed stratigraphic, climatic and chronological information from the plateau, two cores were drilled in the northern area of the plateau, near the village of Mošorin (45.296225 N 20.188648 E). The first core (TLP 1) was drilled to a depth of 22.93 m while the second one (TP 1A) was drilled to a depth of 21.42 m. The two cores were drilled side by side, covering about the same stratigraphic depths. Sampling for equivalent dose determination using the Single Aliquot Regeneration (SAR) protocol was undertaken in continuous sections at 13-15 cm resolu-

tion in both cores. Sample for dose rate via laboratorygamma spectrometry was undertaken in 6 cm sections matching the luminescence samples. In core TLP1 114 samples were obtained for both equivalent dose and dose rate measurements, while from TLP 1A 105 samples were obtained. In this study, we present the results from a detailed OSL investigation of the 63-90 μm quartz from the upper part of core TLP 1.

Aliquots for the OSL measurements were obtained from samples 168110 (9.5 cm depth) – 168138 (633 cm depth), corresponding to the L1 loess-paleosol sequence. This fraction proved to have acceptable luminescence properties which were confirmed by conducting preheat plateau, purity check and dose recovery tests.

The purity of the quartz was determined by performing purity checks on each sample before further measurements. In most cases the purity of the quartz was acceptable. There was no significant infrared stimulated luminescence (IRSL) reaction at 60°C to a large regenerative dose and the 110°C TL peaks are clearly defined. The OSL signal is bright and generally dominated by the fast component. The natural and regenerated decay curves show a very close match to each other as well as to the signal from the calibration quartz.

In order to determine an appropriate preheat temperature, a preheat plateau test was performed on 24 aliquots of the sample 168122 (309 cm depth). Temperatures ranging from 160°C to 300°C were engaged for 10 s preheat in combination with 160°C test dose preheat. The De value did not show any significant sensitivity to preheat temperature up to approximately 260°C. The recycling ratios are close to unity and the recuperation is close to 1% in the 160-300°C interval. The dose recovery test was performed on samples 168110, 168111, 168113, 168114, 168115, 168116, 168141, 168143 (L1 unit) and 168158, 168159 (S1 unit). Various preheat temperatures were used ranging from 160°C to 300°C with a fixed 220°C cut heat. The average of measured to given dose ratio for all the samples (n=10; 4 aliquots per sample) was 1.06 ±0.03 which confirmed that neither the De nor the ratio of the measured to given dose are dependent of previous preheat temperature and a known laboratory dose can be recovered. Based on these results, a preheat temperature of 260°C for 10 s and cut heat of 220°C was chosen for all following measurements.

For the determination of the De values a standard single-aliquote regenerative (SAR) protocol with blue stimulation lights was used. For each sample (168110–168138; n=29), a minimum of five replicate measurements were conducted so far, except for samples 168117 and 168129 where no sufficient quartz grains could be extracted .

The dose rates are currently in the process of calculation and no precise estimation of the actual age of the samples can be conducted at this time. Nevertheless, using typical dose rate values from Serbian loess, we were able to determine great consistency of the De values with the last glacial ages.

The calculated De values range from 20 ±1 Gy for the uppermost sample to 154 ±15 Gy for the lowest samples investigated and correspond with the stratigraphic position of the samples. The De value increases consistently to a depth of 345 cm (sample 168124) where it reaches 122 ±18 Gy and where the natural OSL signal was proved to be in saturation. By fitting a single exponential saturating dose response curve, a De value of ~120 Gy was obtained. The De values of the lower samples (168125-168138), showed significant scattering and inconsistence ranging from 92 ±10 Gy for sample 168125 up to 197 Gy for sample 168132. These results confirm our hypothesis that quartz from the Titel loess plateau cannot be reliably used to determine doses larger than ~120 Gy and K-feldspar will be more suitable for the measure of the De values of older samples.

Regardless of the limited OSL characteristics of the quartz grains from the Titel loess plateau, we can deduce that a reliable dose determination up to ~120 Gy is possible, covering roughly the last glacial cycle. We hope that these preliminary results, in addition to the results from the ongoing investigations (dose rate via laboratory gamma spectrometry, K-feldspar luminescence dating) will greatly contribute to the reconstruction of climatic and environmental changes during the Pleistocene in this part of Europe.

Simultaneously using dendrochronology study and radioisotopes measurement to study soil erosion in loess gully near Poręba village (Soult Poland)

Grzegorz Poręba[1], Ireneusz Malik[2], Małgorzata Wistuba[2], Łukasz Ciesielski[2]

[1] *Politechnika Śląska, Instytut Fizyki CND, Zakład Zastosowań Radioizotopów, ul. Akademicka 2A, 44-100 Gliwice, Grzegorz.Poreba@polsl.pl*

[2] *Uniwersytet Śląski, Wydział Nauk o Ziemi, Będzińska 60, 41-200 Sosnowiec*

Loess areas especially agricultural areas are susceptible for soil erosion: rill erosion and gullies formation. Although in the last decades studies on erosion in loess gullies have been carried out by researchers, few studies have specifically addressed the combined use of dendrochronological analysis of tree roots and analysis of Cs-137 and Pb-210 radioisotopes in the same sediment or soil layers.

The use of fallout radionuclides ^{137}Cs and ^{210}Pb provide an effective and valuable tool for studying erosion and deposition within the landscape. Cs-137 technique has now been used to investigate soil erosion and sediment accumulation Compare to Cs-137 there are only little papers bout using Pb-210 to study soil erosion. This isotope is rater used to study lake sediments.

For this work three series of samples from one of the numerous gullies of the Proboszczowicka Plateau (Silesian Upland, Southern Poland) were collected. Using two methods: dendrochronology and radioisotopes Cs-137 and Pb-210 allowed a comprehensive study of soil erosion and sedimentation in a loess gully. In addition we have analysed grain size composition for all collected soil and sediment samples. Sediment samples were collected from the bottom of the gully (8 cores), from the slopes of the gully (11 cores) and from the undisturbed areas of the reference site (4 cores). For all collected samples the activity of Cs-137 and Pb-210 were determined by the semiconductor gamma spectrometry.

Root samples for dendrochronological study were collected from the same study sites at the gully bottom and slopes. Samples were taken from roots of lime (*Tilia cordata*), maple (*Acer platanoides*) and beech (*Fagus sylvatica*) trees growing inside depositional landforms in the gully bottom and roots of beech trees (*Fagus sylvatica*) on eroded slopes of the gully.

In case of roots growing in deposited material we assumed that the age of roots equals the minimum age of particular sediment horizons. In case of roots sampled on eroded slopes of the gully we determined by the time of root exposure from the soil/sediment cover.

Results of the study indicate that analysed landforms developed during the last 50 years. Diverse age of roots growing in sediment horizons allowed to determine at least 3 significant geomorphic events resulting in deposition of material in the gully bottom during the last 50 years. This suggests that relief of gullies could be moulded surprisingly fast, despite the forest cover present in the gully.

Studies confirmed large potential of dendrochronological analysis of root age and date of exposure combined with analyses of 137Cs i 210Pb content in sediment or soil.

The study was funded by the National Science Centre – Poland (grant no. DEC-2011/02D/ST10/05788).

Simultaneously using Cs-137, Pb-210 and soil properties for the assessment of soil redistribution on an agricultural loess slope

G. Poręba[1*], M.Frechen[2], Z. Śnieszko[3]

[1] *Institute of Physics CSE, Department of Radioisotopes, Silesian University of Technology, Akademicka 2A str., 44-100 Gliwice, Poland*
[2] *Leibnitz Institute for Applied Geophysic, Stilleweg 2 Hannover, Deutchalnd*
[3] *Institute of Geography, Kazimerz Wielki University, Mińska 15, Bydgoszcz, Poland*

Soil erosion and associated sediment accumulation is a serious problem especially on agricultural loess areas. The knowledge about the intensity of soil erosion is important. Quite often to study soil erosion are used radioisotopes Cs-137 and Pb-210. The use of radioisotopes to study soil erosion and sedimentation overcomes many of the limitations associated with the traditional methods.

Unfortunately, this method is related to several problems and limitations. In this work were done detailed study of behavior Cs-137 and Pb-210 on a loess slope used as an agricultural field. The study field is located on the South of Poland near Ujazd village. Simultaneously with isotope measurement an additional geochemical analysis were done as well as: grain size distribution, organic matter, Fe_{dith}, Fe_{ox}, Al, Mn and pH value.

From a study field were collected 24 soil cores. Beside this 3 soil cores from undisturbed areas as a reference were collected. A sediment cores were sectioned into 10 cm intervals and activities of ^{137}Cs and $^{210}Pb_{ex}$ were measured. The results obtained for the study area confirm the potential for using ^{137}Cs to study medium term soil erosion on agricultural areas. For longer timescale than last 60 years fallout of ^{210}Pb could be used to study soil erosion . Although ^{210}Pb is widely used for study lake sediment accumulation, its application to the study of soil erosion is rather small.

Detailed geochemical study confirmed that fallout of ^{137}Cs and ^{210}Pb is rapidly and strongly adsorbed by clay minerals on the surface of soil and its redistribution on slope could occur in association with mobilized soil particles. The behavior of isotopes should be included into soil erosion calculation.

The study was funded by the National Science Centre – Poland (grant no. DEC-2011/02D/ST10/05788).

An application of the OSL method and soil properties measurements to dating Holocene soil erosion in South Poland

G. Poręba[1]*, Z. Śnieszko[2], P. Moska[1], P. Mroczek[3]

[1] *Department of Radioisotopes, Institute of Physics CSE, Silesian University of Technology,K onarskiego21B,44-100 Gliwice, Poland*
[2] *Institute of Geography, Kazimerz Wielki University, Mińska 15, Bydgoszcz, Poland*
[3] *Faculty of Earth Sciences and Spatial Management, Maria Curie-Skłodowska University, Kraśnicka 2cd, Lublin, Poland*
* *Corresponding author: Grzegorz.Poreba@polsl.pl*

Soil erosion is a natural process that can be intensified by human activity. After accumulation of the youngest loess, several phases of soil erosion occurred on loess areas. These deposits are located at early Holocene-Late Pleistocene soils and reach a thickness of up to 5-7 m locally. For the first time, soil erosion was visibly intensified when agricultural fields began to be cultivated outside the bottoms of river valleys. This was connected with an intensification of slope processes as a result of deforestation and the development of Neolithic agriculture. The oldest well documented traces of agricultural use of loess areas in Poland have been dated to the period between 5000 and 4000 BP. After the Neolith, between 3500 years BP (Lusitanian) and 1000 AD, it is likely that loess areas in Poland were occupied and used by farmers several times. Slope processes intensified due to mechanical denudation about 1 ka BP. Soil erosion has been intensified drastically since the 17th century due to intensive land use. Establishing the scale and intensity of the prehistoric soil erosion in loess deposits in Poland is a key problem in the investigations of the human-environment relation in prehistoric times.

A precise dating of Holocene colluvial sediment is very important to study an influence of human on environment in the past. In this work the results of detailed study of Holocene loess coluvial sediments on Polish highlands are presented. There were studied samples from three colluvial profiles located on the South of Poland: Biedrzykowice, Szyszczyce and Świerklany. Detailed field studies, SAR OSL dating of colluvial sediments, sedimenthological, pedological and micropedological analysis as well as archeological records were used to obtain high resolution stratigraphy. Moreover the radiocarbon dating results of humus and artifacts found in the sediment were also considered.

In each of the studied profiles a colluvial sediments layers are located on the early Holocene – Late Pleistocene fossil soil but with different luminescence age. Those colluvial sediments correspond to Neolothic sedimentation in Biedrzykowice, Bronze Age in Szyszczyce and Late Medieval Period in Świerklany. The micromorpological study aided in the genetic interpretation of the studied loess-soil deposits.

The study was funded by the National Science Centre – Poland (grant no. DEC-2011/02D/ST10/05788).

Quantitative relationship between climate and magnetic properties of soil in Bačka Loess Plateau (Vojvodina, Serbia)

Milica G. Radaković[1], Ivana A. Tošić[2], Milivoj B. Gavrliov[1], Ulrich Hambach[3], Jordana Ninkov[4], Jovica Vasin[4], Miloš Ostojić[1], Mladjen Jovanović[1], Slobodan B. Marković[1]

[1] *Chair for Physical Geography, Faculty of Science and Mathematics, University of Novi Sad, Dositej Obradovića 3, 21000 Novi Sad, Serbia*
[2] *Faculty of Physics, Institute of Meteorology, Dobračina 16, 11000 Belgrade, University of Belgrade*
[3] *Chair of Geomorphology, University of Bayreuth, 95400 Bayreuth, Germany*
[4] *Institute of Field and Vegetable Crops, Maksim Gorki 30, 21000 Novi Sad, Serbia*

The loess plateau in Bačka (BLP) is located in the northern part of the Vojvodina region, Northern Serbia. BLP was studied before, but the correlation between climate and magnetic soil properties remained unresearched. Recent soil on the plateau is represented by 7 different soil types in area of about 2500 km^2. In this paper 178 surface soil samples will be analysed. The network of samples has been distributed equally across the BLP. Climatic variables for BLP were derived form six-decade national meteorological datasets. Low field magnetic susceptibility and Frequency-dependent magnetic susceptibility will be determined for each site and then compared to the mean annual precipitation, mean annual temperature and different aridity indexes. Each parameter will be mapped by interpolation method in ArcMap 10.1 and then analysed. Variations in magnetic properties of the soils contain information about climate of that region. The study will provide new evidence of relationship between climate and magnetic properties of soil.

Lithological indicators of loess sedimentation of SW Poland

Kamila Ryzner, Zdzisław Jary, Marcin Krawczyk, Jacek Skurzyński

Department of Physical Geography, University of Wrocław, 1 Uniwersytecki Sqr., 50-137 Wrocław, Poland, kamila.ryzner@uwr.edu.pl

High-resolution grain-size investigations were carried out within two loess sections located in SW Poland: Biały Kościół (Niemcza-Strzelin Hills) and Zaprężyn (Trzebnica Hills). The Zaprężyn is the northernmost loess profile in this region situated only ca 70 km away from the maximum extent of the last glaciation. The distance between this two profiles is about 60 km.

Both loess-soil sequences are composed of interfluve and slope loess facies and consist of five litho-pedostratigraphic units developed dur-

ing the Late Pleistocene and Holocene: two loess units LiL1, LiL2 and three soil units S0, S1 and LiS1. There are almost no LiL2 loess unit in the Zaprężyn section unlike to the Biały Kościół profile with ca 1,5 m LiL2 unit. Also the difference in development of soil LiS1 can be observed: LiS1 soil unit in Biały Kościół is much better developed than in Zaprężyn. Well-developed periglacial features as well as several distinct erosional levels noted in the Zaprężyn sequence suggest extreme and harsh climate conditions in this area during the loess sedimentation.

Each sequence was sampled using the same methodology and sampling interval of every 5 cm. The particle size distribution was obtained by laser diffraction methods (Mastersizer 2000). The percentage content of all individual fractions was determined as well as selected grain size indicators: Mz - mean grain size, Grain Size Index - ratio between coarse silt (16-63 μm) and fine silt (4-16 μm) plus clay (<4 μm), Kd - loess index, as a ratio between coarse silt and clay were calculated.

Both the grain-size distribution and grain size indicators of loess sediments reflects a variations of the climate conditions at the time of loess sedimentation. There are some markers and similarities which can be used for correlation of these sections. However, generally coarser grain sizes and even sands inserts in the Zaprężyn loess section can be evidence of short episodes of strong winds or even sand storms during the loess sedimentation.

Analysing and comparing those profiles by their lithological properties can be conclude that the gradient of climate changes in SW Poland was much more narrowed during the last glacial maximum.

Loess accumulation at the centre of the Bačka Loess Field, preliminary results based on the Novo Orahovo loess section

György Sipos[1], Slobodan B. Marković[2], Milivoj B. Gavrilov[2], Dávid Filyó[1], Orsolya Tóth[1], Krisztián Sztanoj[1]

[1] *Department of Physical Geography and Geoinformatics, University of Szeged, H-6722 Szeged, Egyetem u. 2-6., Hungary*

[2] *Department of Geography, Tourism and Hotel Management, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia*

The loess of Northern Serbia (Vojvodina) is regarded as one of the thickest and most complete palaeoclimate archives in Europe. However, beside climatic information loess sections also carry abundant palaeoenvironmental and geomorphological evidence as well.

In Vojvodina the the Bačka Loess Field, though not the thickest, has the greatest spatial extension. It has developed on the former alluvial fan of the Danube, and has a direct contact to the sand ridges of the Dan-

ube-Tisza Interfluve, located northwest of the area. Therefore, the transfer of coarser material to the loess field is suggested to be either continuous or periodic.

Although several loess sections have been processed in Vojvodina, one of the key sites, Novo Orahovo has not been investigated yet in detail. The loess section is situated in the axis of the Bačka Loess Field and thus it can be characterised by a relatively high accumulation rate, and offers the possibility of a high resolution environmental and geomorphological reconstruction of its area. In the present study, as a start of the research 10 loess samples were tested and dated by the means of optically stimulated luminescence. Besides, magnetic susceptibility and grain size measurements were also made in order to reveal paleoenvironmental conditions.

Geochemical characterization of the Tyszowce loess-paleosol sequence and the importance of the high-resolution sampling

Jacek Skurzyński, Zdzisław Jary, Jerzy Raczyk, Marcin Krawczyk, Kamila Ryzner

Department of Physical Geography, University of Wrocław, 1 Uniwersytecki Sqr., 50-137 Wroclaw, Poland
jacek.skurzynski@uwr.edu.pl

The Late Pleistocene loess-paleosol section in Tyszowce is located in eastern Poland, in the northern part of the Sokal Plateau-Ridge. The 19 m thick profile, with an age corresponding to 130 ka BP, was sampled with a sampling interval of 5 cm beginning at the surface, and a total of 380 samples were collected. These loess-paleosol sequence consists of five main units: two paleosol complexes (S1 and L1S1), two loess units (L1L2 and L1L1) and a recent soil (S0) at the top. The content of Na, K, Mg, Ca, Fe, Mn, Al, Ti and P for the total number of 85 samples of all units were determined by atomic absorption spectrometry method - the sum of their oxides was presented as weight percentage of components. Chemical determinations were carried at the variable intervals (in the range from 0.05 to 0.4 m) depending on the litho-pedostratigraphical description - sampling was more precise near to the expected boundary between two units. In addition, grain-size, magnetic susceptibility, humus and $CaCO_3$ content was analysed.

The results of elemental composition analyses pretty well confirm former designation of main lithostratigraphic units - non-pretreatment geochemical data curves as well as number of geochemical ratios reveal significant differences between loess and soils in general. Under pedogenic/weathering processes, the chemical composition of a given aeoli-

an dust changes – mobile and soluble elements are depleted and less soluble and immobile elements are enriched. For this reason increase (or decrease) in many elements content and the highest indexes of chemical weathering are characteristic of fossil soil units. It is also possible to separate internal subunits in each main unit itself. In order to characterize them more precisely high-resolution sampling is needed. Investigation based on elemental composition is confirmed in other proxy data analysis. Comparison of geochemical data with macroscopic description of the lithological variability and other proxy data (e.g. grain size, magnetic susceptibility and humus content) indicates that high-resolution elemental record is useful for precise paleoenvironmental analysis.

An enthusiasm for loess: Leonard Horner in Bonn, Liu Tung sheng in Beijing.

Ian Smalley[1], Slobodan B. Marković[2]

[1] *Giotto Loess Research Group, Geography Department, Leicester University, Leicester LE1 7RH, UK*

[2] *Laboratory for Palaeoenvironmental Reconstruction, Faculty of Sciences, University of Novi Sad, Novi Sad 21000, Serbia*

Liu Tung sheng featured on the list of twelve notable loess investigators prepared for the great LoessFest meeting, held in Heidelberg and Bonn in 1999. He fully deserved his position on this list of eminent loess scholars; in fact it might be argued that his was the major contribution. His contribution was a true paradigm shift in the world of loess investigation. Obruchev and Richthofen had produced an earlier paradigm shift when they propagated the idea that loess deposits form by aeolian deposition- a paradigm shift away from the earlier Lyellian idea of lacustrine or fluvial deposition. But that was a fairly simple shift, a tweak of the sedimentological event structure. Liu, and his co-workers in China, produced a new vision, a new way of looking at loess, not so much a paradigm shift as a paradigm enlargement. Post Liu the Quaternary era was a new land, a new place with a real chronology and a landscape of events and amazing happenings.

Liu related to the amazing. We propose that he played a role in promoting and maintaining an enthusiasm for loess. Loess science has become very precise and the scholars are respected for their exact and insightful observations; but Liu offered an extra dimension, we need to recognize the dimension of enthusiasm; the realization that loess is a remarkable material and the need to propagate that fact. And in recognising Liu as the major loess enthusiast of the 20th Century we should ac-

knowledge Leonard Horner, the first loess enthusiast. Karl Caesar von Leonhard named loess and placed it in a scientific context; Charles Lyell took the idea of loess and spread the science world-wide, but it was Horner, in those few years at Bonn (1831-1833), who recognised loess for the marvellous material that it was and gave us permission to be enthusiastic. Liu followed determinedly in these footsteps; a great scholar, and a great enthusiast.

The John Bruce (1978) map of loess in the South Island, New Zealand

Ian Smalley[1], Roger Fagg[2]

[1] *Geography Department, Leicester University, Leicester LE1 7RH, UK*
[2] *34 Balmoral Street, Timaru, South Canterbury, New Zealand*

The Bruce (1978) map of loess in the South Island of New Zealand was produced for the Otago Catchment Board and published as a single sheet at a scale of 1:1,000,000.

We use the data on the southern part of this map to examine the locations of mountain sources for loess particles, the roles of certain rivers in loess material distribution, and the location of eventual loess deposits. Seven rivers are considered: Waimakariri, Rakaia, Rangitata, Opihi, Waitaki, Clutha, Mataura; these are major landscape makers/markers; they can probably be put into two carrying classes: large straight steep rivers which carry much material but leave little trace, and smaller, more winding rivers which deliver loess to the wider landscape. The large steep rivers deliver much material to off-shore deposits; Pegasus Bay, Canterbury Bight etc- deposits within the Raeside 50-fathom contour.

Waimakariri; across the plains from Sheffield to Belfast; this is a plains river but the flow rate is high enough to carry material into the Raeside 50f zone and form Pegasus Bay deposits.

Rakaia; from the Southern Alps to the Pacific Ocean- a direct fluvial route; delivering sediment to the Canterbury Bight, and leaving little loess en route. The Rakaia starts in the high lands by the Ramsey and Lyell glaciers, flows in a south-easterly direction, via Lake Coleridge, leaving a modest loess deposit on the south-western bank near Methven. Large river but small loess.

Rangitata; and Rakaia are the two major NZ rivers that originate from high altitude glacier dominated mountain sources. Material into 50f zone but not much associated loess formation.

Opihi; by far the smallest of the seven rivers; a plains river- into the Pacific just north of Timaru. Bruce shows the Opihi as a loess river. We

think that material was delivered to the plains, and then moved on by rivers like the Opihi. Little offshore material from the Opihi, but considerable inland deposits.

Waitaki; one of the great braided rivers, supplying the Canterbury Bight just to the north of Oamaru. Bruce shows loess to the south, limited in extent by the Kakanui mountains.

Clutha: the great river of the southland. The long river (300+ km) with a high discharge (600+ m^3/s); and moving loess material from the southern end of the Southern Alps. Less dramatic than the Rakaia or the Rangitata and therefore a more effective loess river.

Mataura; was one of the 'Rivers & Loess' rivers, chosen to illustrate the distribution of loess material. This is the Gore river, flowing south.

The rivers and loess story is enacted in New Zealand and the Bruce (1978) map shows the relationship between the high zones and the consequent loess and alluvium. There is a balance between rivers supplying material to the 50f zone and those providing material for inland deposition. The Opihi plays a secondary role, picking up material from the plains and supplying extensive loess deposits. From John Hardcastle (1898) to John Bruce (1978) the deterministic glacial loess story in NZ is consistent.

Dust mass accumulation rates from high sampling resolution luminescence dating of Chinese loess

Thomas Stevens[1*], Jan-Pieter Buylaert[2,3], Christine Thiel[4], Shuangwen Yi[5], Andrew Murray[2], Manfred Frechen[4], Huayu Lu[5]

[1] *Department of Earth Sciences, Uppsala University, 75236 Uppsala, Sweden,*
[2] *Nordic Laboratory for Luminescence Dating, Department of Geosciences, University of Aarhus, Aarhus, Denmark,*
[3] *Centre for Nuclear Technologies, Technical University of Denmark, Risø Campus, Risø, Denmark,*
[4] *Leibniz Institute for Applied Geophysics, s3: Geochronology and Isotope Hydrology, Hannover, Germany, (5) School of Oceanographic and Geographic Sciences, Nanjing University, Nanjing 210023, China*
* *thomas.stevens@geo.uu.se*

Dust mass accumulation rate (MAR) data calculated from loess deposits are a critical component of understanding past atmospheric dust loading and the response and impact of dust in Quaternary climate change. Radiometric chronologies are crucial to the correct interpretation of this sedimentation history, and also in accurate reconstruction of climate signals recorded in loess-palaeosol sequences. However, relatively few loess sites have been independently dated in sufficient detail to uncover rapid changes in dust deposition. Traditionally quartz optically stimulated luminescence (OSL) has been used as an absolute chronometer but the range of this signal is usually limited to <70 ka; feldspar signals have the potential to date much further back in time but were hampered by instability of the traditional infra-red stimulated luminescence (IRSL) signal measured at ambient temperature. However, recent breakthroughs in luminescence dating of feldspar have identified stable feldspar post-IR IRSL signals that can be used for dating. For Chinese loess, numerical feldspar post-IR IRSL chronologies can now be derived back to at least 200 ka, and possibly to ~250 ka (bottom of palaeosol S2). In this project several loess sections located along a N-S transect across the Chinese Loess Plateau were sampled at high resolution (~20 cm for luminescence, 5 cm intervals for grain size distribution and magnetic susceptibility) over the last two glacial interglacial cycles. In this way we present independently dated climate records alongside coupled MAR and grain-size records for loess-palaeosol sequences in China, the latter crucial in the reconstruction of past atmospheric dust activity. Our results allow us to identify the timing and scale of major changes in dust MAR in loess sequences, such as a major dust pulse between 22 and 27 ka, while in some sequences close to the desert margin, our results demonstrate that there are major discontinuities in the sedimentary record, with up to a whole glacial-interglacial cycle missing. Such gaps in the record are of great significance for understanding climate records from loess.

Optically stimulated luminescence dating techniques and multi-proxy analysis to quantify the timing of the last two major climatic transitions, as recorded by loess-palaeosol sequences

A. Timar-Gabor[1,2*], D. Constantin[2], V. Anechitei-Deacu[1,2], D. Veres[2,3], S.M. Groza[1,2], R.C. Begy[1,2], J.P. Buylaert[4,5], S.B. Marković[6], Q. Hao[7], Z.T. Guo[7]

[1] *Faculty of Environmental Sciences and Engineering, Babeş-Bolyai University, Cluj-Napoca, Romania*
[2] *Interdisciplinary Research Institute on Bio-Nano-Science, Babeş-Bolyai University, Cluj-Napoca, Romania*
[3] *Institute of Speleology, Romanian Academy, Cluj-Napoca, Romania*
[4] *Nordic Laboratory for Luminescence Dating, Department of Geoscience, Aarhus University, DTU Risø campus, Roskilde, Denmark*
[5] *Center for Nuclear Technologies, Technical University of Denmark, DTU Risø campus, Roskilde, Denmark*
[6] *University of Novi Sad-Faculty of Sciences, Chair of Physical Geography, Novi Sad, Serbia*
[7] *Key laboratory of Cenozoic Geology and Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China*
* *alida.timar@ubbcluj.ro*

The practice of tuning different climate proxies prevents the observation of regional response times of terrestrial archives to global changes. Thus, it is imperative to develop correlation protocols based on absolute chronologies. Loess-palaeosol (L/S) deposits are continental archives of Quaternary paleoclimates and loess is generally considered an ideal material for the application of luminescence dating.

The agreement previously obtained for 10-20 ka ages using different techniques has given us confidence in using the state of the art measurement protocols for young deposits, as confirmed by comparison with independent age control. Therefore, we propose detailed investigations of loess samples collected in close proximity to the transition to the recent soil, with the purpose of obtaining a temporal quantification of the ending of the Late Tardiglacial and the beginning of the Holocene (i.e. L1/S0 boundary).

We illustrate the application of such an integrated approach on the Mosorin loess-palaeosol site, in the Vojvodina region, Serbia. Optically stimulated luminescence dating method was performed by applying the single aliquot regenerative (SAR) protocol (Murray and Wintle, 2003) to 4-11 μm and 63-90 μm quartz grains extracted from the topmost part of the profile. For the sake of a consistency check and for minimizing the final error on the obtained ages, the post-IR IRSL290 protocol (Buylaert el al., 2012) was applied to 4-11 μm polymineral grains extracted from the same samples. In order to constrain precisely the transition the multi-proxy approach included rock magnetic analysis, grain-size distribution colour indices (proxy for variations of mineral concentrations) of loess-palaeosol were determined as well. The sampling strategy included the collection of

doublet samples for luminescence dating at 15 cm resolution while collection of samples for proxy analyses was at 5 cm apart, in total 13 samples being collected for luminescence dating from the topmost 1 m of the section. The OSL age results obtained on the two quartz extracts agree and are internally consistent, whereas the post-IR IRSL290 ages highly overestimate the quartz data (the equivalent doses generally being 100% higher than the fine quartz equivalent doses), as it has been previously shown at young ages (Buylaert et al., 2011; Schatz et al., 2012). If the maximum rate of change in the magnetic susceptibility record (Dong et al., 2015) is considered, this proxy locates the Pleistocene/Holocene transition at 30 cm. For this depth the luminescence age, (average of coarse and fine quartz ages determined on two samples) is 10.9 ± 0.8 ka, whereas data from the other proxies indicate an earlier transition, at about 45 cm depth (13.4 ± 0.9 ka).

Consequently, obtaining a comprehensive absolute dating of the timing of the most recent glacial/interglacial transition recorded in loess deposits requires a higher resolution for both luminescence as well as proxy analysis that should be ideally applied to soils of greater thickness.

For dating the Termination 2 as recorded in loess-paleosol deposits, we encounter the problem associated with luminescence dating of older loess deposits. A series of recent investigations carried out on quartz of different grain sizes extracted from Romanian and Serbian and loess (Timar-Gabor and Wintle, 2013, Timar-Gabor et al., 2015) yielded intriguing results. The optical ages obtained on coarse quartz (63-90 μm) were reported to be systematically higher than those on fine quartz (4-11 μm) for ages >~40 ka. While the cause of this chronological discrepancy is being hitherto not fully explained, our ongoing studies on loess from China and Israel prove that this is a general effect, potentially affecting deposits worldwide, and raising significant doubts on previously obtained chronologies.

We present explore our on-going studies that aim at unraveling the cause of the observed discrepancy and at the development of an innovative dating protocol that will improve the accuracy of luminescence dating with the ultimate goal of providing a temporal quantification of L1/S1/L2 boundaries.

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme ERC-2015-STG (grant agreement No [678106])

Buylaert J-P., Jain M., Murray A.S., Thomsen K.J., Thiel C., Sohbati R., 2012. A robust feldspar luminescence dating method for Middle and Late Pleistocene sediments. Boreas 41, 435-451.

Buylaert J-P., Jain M., Murray A.S., Thomsen K.J., Thiel C., Sohbati R., 2012. A robust feldspar luminescence dating method for Middle and Late Pleistocene sediments. Boreas 41, 435-451.

Dong Y., Wu N., Li F., Huang L., Wen W., 2015. Time-transgressive nature of the Magnetic susceptibility record across the Chinese Loess Pla-

teau at the Pleistocene/Holocene transition. PLoSONE 10(7): e0133541. doi:10.1371/journal.pone.0133541.
Murray, A.S., Wintle, A.G., 2003. The single aliquot regenerative dose protocol: potential for improvements in reliability. Radiation Measurements 37, 377-381.
Schatz A.K, Buylaert J.-P., Murray A., Stevens T., Scholten T., 2012. Establishing a luminescence chronology for a palaeosol-loess profile at Tokaj (Hungary): A comparison of quartz OSL and polymineral IRSL signals. Quaternary Geochronology 10, 68-74.
Timar-Gabor, A., Wintle, A.G., 2013. On natural and laboratory generated dose response curves for quartz of different grain sizes from Romanian loess. Quaternary Geochronology 18, 34-40.
Timar-Gabor A., Constantin D., Markovic S. B., Jain, M., 2015. Extending the area of investigation of fine versus coarse quartz optical ages from the Lower Danube to the Carpathian Basin. Quaternary International, 388, 168-176.

Exploring the geotourism potential of mammoth fossils in the Drmno area (Kostolac)

Nemanja Tomić, Slobodan B. Marković, Milivoj B. Gavrilov, Djordjije A. Vasiljević

Department of Geography, Tourism and Hotel Management, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, airtomic@gmail.com

The discovery of mammoth fossils in the Drmno mine area in 2009 and 2012 provided an excellent basis for the establishment of the first ever palaeontological park in Serbia. This paper is dedicated to the geotourism potential and conservation values of these palaeontological remains and the surrounding loess geoheritage. We also propose possible interpretation methods and aim to determine the current state and tourism potential of the Drmno mammoth fossils, by using the M-GAM model for geosite assessment and comparing this site with two similar world famous sites, the Mammoth Site of Hot Springs and the La Brea Tar Pits in the USA. Results of the assessment indicate that the fossils from the Drmno open mine have similar scientific and educational values as the fossils from two other analysed sites, whereas scenic and tourist values are much lower in comparison with those sites. This means that the Drmno site possesses great potential and resources which should be used and managed in a better way. In future years, there are some necessary activities and smaller projects which need to be carried out in order to fully complete the tourist offer of the paleontological park. This will hopefully eliminate the currently existing gap between the Drmno fossil site and other similar world famous fossil sites.

North African dust addition to interglacial soils in the Carpathian Basin

György Varga[1,*], Csaba Cserháti[2], János Kovács[3,4], Zoltán Szalai[1,5]

[1] *Geographical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Budaörsi út 45, H-1112 Budapest, Hungary*
[2] *Department of Solid State Physics, University of Debrecen, Bem tér 18/b, H-4026 Debrecen, Hungary*
[3] *Department of Geology & Meteorology, University of Pécs, Ifjúság u. 6, H-7624 Pécs, Hungary*
[4] *Environmental Analytical & Geoanalytical Research Group, Szentágothai Research Centre, University of Pécs, Ifjúság u. 20, H-7624 Pécs, Hungary*
[5] *Department of Environmental and Landscape Geography (Institute of Geography and Earth Sciences, Faculty of Science), Eötvös University, Pázmány Péter sétány 1/c, H-1117 Budapest, Hungary*
* *Corresponding author: varga.gyorgy@csfk.mta.hu*

Huge amount of Saharan dust material is transported every year into Europe. Previous observations, measurements and numerical simulations have revealed that Saharan dust events are fairly frequent also in the Carpathian Basin and North African fine grained mineral material is a significant constituent of the atmosphere of the study area. However, there are very few direct measurements of Saharan dust deposition in Europe. Dust models, however, provide valuable information on dust deposition in Central Europe.

Estimations derived from the BSC DREAM8b v1.0 and v2.0 models (adjusted by in-situ measurements) indicated that the dust flux of North African fine-grained mineral material can be set into the range of 3.2–5.4 g/m²/y. Pleistocene mass accumulation rates calculated from stratigraphic and sedimentary data of loess–paleosol sequences allowed the determination of relative contribution of Saharan dust to interglacial paleosol material. According to these values, Saharan dust material represents 20–30% of the clay and fine silt-sized fractions of interglacial paleosols in the Carpathian Basin. The remaining proportion could be regarded as the product of pedogenesis, dust input from additional sources and individual particles remaining after aggregate-disintegration.

Support of the Hungarian Research Fund OTKA under contract PD108708 (for G. Varga) is gratefully acknowledged. It was additionally supported (for G. Varga) by the Bolyai János Research Scholarship of the Hungarian Academy of Sciences.

Granulometric properties of aeolian dust deposits: what are we measuring?

György Varga[1,*], Gábor Újvári[2], János Kovács[3,4], Zoltán Szalai[1,5]

[1] *Geographical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Budaörsi út 45, H-1112 Budapest, Hungary;*
[2] *Institute for Geological and Geochemical Research, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Budaörsi út 45, H-1112 Budapest, Hungary;*
[3] *Department of Geology & Meteorology, University of Pécs, Ifjúság u. 6, H-7624 Pécs, Hungary;*
[4] *Environmental Analytical & Geoanalytical Research Group, Szentágothai Research Centre, University of Pécs, Ifjúság u. 20, H-7624 Pécs, Hungary;*
[5] *Department of Environmental and Landscape Geography (Institute of Geography and Earth Sciences, Faculty of Science), Eötvös University, Pázmány Péter sétány 1/c, H-1117 Budapest, Hungary*
* *Corresponding author: varga.gyorgy@csfk.mta.hu*

Particle size and shape analyses are of growing interest in the Earth sciences. Granulometry of terrestrial sedimentary deposits provide insights into the physicochemical environment of transport, accumulation and post-depositional alterations of sedimentary particles. Due to fairly narrow grain size range of aeolian dust deposits, various aspects of sedimentation (wind strength, distance to source(s), possible secondary source regions and modes of sedimentation and transport) can be reconstructed only from precise grain size data via a correct sedimentary and paleoclimatic interpretation.

Measurements of particle size have been performed by a variety of instrumental techniques such as sieve and pipette method, laser diffraction and image analysis of pictures taken by optical or scanning electron microscopes. Grain size distribution data obtained from the most widely used particle sizing technique, the laser diffraction measurement provides information on the volumetric amount of particles arranged into ca. 100 size bins ranging from hundreds of nanometers up to several millimeters in size. However, laser diffraction particle size data are indirect information; the signals from the measurements must be transformed by different optical models (Fraunhofer and Mie theories) to attain particle size distribution data.

Not only size, but shape parameters of particles are holding vital information on sedimentary mechanisms (transport and deposition) and post-depositional, environment-related alterations. Automated imaging was applied using Malvern Morphologi G3-ID which provides a unique technique to gather direct information on particle size and shape parameters. Image analysis techniques have been applied widely, however previously published studies were carried out on populations with much smaller number of particles. The average particle number of automated

imaging measurements is ca. 10^4-10^6 particles, which provide us to gain a statistically robust and objective insight into the morphological characteristics of the particles.

Support of the Hungarian Research Fund OTKA under contract PD108708 (for G. Varga) is gratefully acknowledged. It was additionally supported (for G. Varga) by the Bolyai János Research Scholarship of the Hungarian Academy of Sciences.

Preliminary results on incision rates in the area of Bilogora (NE Croatia) as implied by post-IR IRSL dating

Lara Wacha[1,*], Bojan Matoš[2], Jan Alexander Kunz[3]

[1] *Croatian Geological Survey, Department of Geology, Sachsova 2, 10 000 Zagreb, Croatia*
[2] *Faculty of Mining, Geology and Petroleum Geology, Department of Geology and Geological Engineering, University of Zagreb, Pierottijeva 6, 10 000 Zagreb, Croatia*
[3] *National Taiwan University, Department of Geosciences, No. 1, Section 4, Roosevelt Rd., Taipei, 10617 Taiwan (R.O.C.)*
* *corresponding author: lwacha@hgi-cgs.hr*

Bilogora is a low hilly terrain in the SW Pannonian Basin along the SW margin of the Drava Depression in Croatia. Genetically linked to the evolution of the Drava Depression and the *palaeo-Drava* River System, Bilogora initial uplift set on during the Pliocene within the NW-striking Drava Depression Boundary Fault Zone. Bilogora was finally uplifted during Middle to Late Pleistocene and Holocene, within a range of 300 and 550 m. Exposed to recent tectonic activity the area of Bilogora is characterized by near-surface strata deformation and numerous historical and recent instrumental records of moderate seismicity.

In the area of Bilogora Quaternary sediments unconformably overlie Pontian-Lower Pliocene *Rhomboidea beds* and are associated to the Drava River drainage system and its sedimentation. The Quaternary is represented by four aggradational Drava river terraces composed of thick series of gravel beds intercalated by sand, silt and clay. The stratigraphically oldest terraces exposed in the investigated area are unconformably overlain by Pleistocene loess and loess-like deposits, lacustrine-marsh silts and clays.

In order to establish a chronological framework of the Quaternary deposits, luminescence dating was applied on loess and loess-like deposits as well as sand lenses intercalated within the terrace gravel deposits identified at several locations in the investigated area. The dating was performed on separated feldspar coarse-grains from the sand and on polymineral fine-grained material from loess, using the elevated temper-

ature post-IR IRSL dating protocol (pIRIR) with the IR-stimulation temperature of 290°C. The advantage of the pIRIR protocol is its applicability for dating of older deposits (up to the Middle Pleistocene) as well as that it circumvents fading, which causes age underestimation in feldspar due to athermal signal loss.

The luminescence signals of the sand samples are in saturation and therefore very likely imply to a Middle Pleistocene age of the river terrace, whereas the covering loess can be correlated to the Last Glacial, as seen from the pIRIR dating results. The obtained results could indicate the timing of the abandonment of the investigated river terrace and the incision rates calculated from the obtained ages could imply to the relative uplift rates of the area.

Modelling causes of loess-paleosol formation in the Carpathian Basin

Christian Zeeden[1*], Ulrich Hambach[2,3], Joyce Bosmans[4], Slobodan B. Marković[2], Igor Obreht[1], Stefanie Kaboth[4], Frank Lehmkuhl[1]

[1] *Department of Geography, RWTH Aachen University, Aachen, Germany,*
[2] *Laboratory for Palaeoecological Reconstruction, Faculty of Sciences, University of Novi Sad, Serbia,*
[3] *BayCEER & Chair of Geomorphology, University of Bayreuth, Bayreuth, Germany,*
[4] *Faculty of geosciences, Utrecht University, Utrecht, The Netherlands.*
* *c.zeeden@geo.rwth-aachen.de*

The effect of orbital forcing of climate in southeastern Europe can be demonstrated using climate models. Multiple linear regression models (here of the LR04 stack, obliquity and precession; Laskar et al., 2004; Lisiecki and Raymo, 2005) are rather simple models which may be used for the estimation of factors influencing dust deposition resulting in loess formation and pedogenesis in loess. Available data for the last 440 ka from loess is limited to magnetic susceptibility datasets in the area (Basarin et al., 2014; Marković et al., 2012). These data indicate a dominant contribution of global or northern hemisphere climate (here represented by the LR04 benthic isotope stack; (Lisiecki and Raymo, 2005). Depending on using either the Marković 2012 or Basarin 2014 time scale obliquity (M2012) or precession (B2014) are significant orbital contributors, where the other parameter does not contribute significantly at 95% confidence level.

However, such models consistently fail to reach a baseline as observed in proxy data for soil formation in loess. This is due to the lack of such baselines in input data, requiring more sophisticated models clipping input data at least at its base. Applying regression models including an op-

timisation of fit (using the Spearman rank correlation to allow for some nonlinearity) is used to adjust base lines.

Results from such models show clear discrepancies of proxy data on the time scales by Basarin et al. (2014); or Marković et al. (2012), more in the timing of events than in magnitude and patterns and especially for MIS7, suggesting that models may also be used for iterative time scale adjustment.

Basarin, B., Buggle, B., Hambach, U., Marković, S.B., Dhand, K.O., Kovačević, A., Stevens, T., Guo, Z., Lukić, T., 2014. Time-scale and astronomical forcing of serbian loess-palaeosol sequences. Glob. Planet. Change 122, 89–106. doi:10.1016/j.gloplacha.2014.08.007

Bosmans, J.H.C., Drijfhout, S.S., Tuenter, E., Hilgen, F.J., Lourens, L.J., 2014. Response of the North African summer monsoon to precession and obliquity forcings in the EC-Earth GCM. Clim. Dyn. 44, 279–297. doi:10.1007/s00382-014-2260-z

Laskar, J., Robutel, P., Joutel, F., Gastineau, M., Correia, A.C.M., Levrard, B., 2004. A long-term numerical solution for the insolation quantities of the Earth. Astron. Astrophys. 428, 261–285. doi:10.1051/0004-6361:20041335

Lisiecki, L.E., Raymo, M.E., 2005. A Pliocene-Pleistocene stack of 57 globally distributed benthic δ18O records. Paleoceanography 20, PA1003. doi:10.1029/2004PA001071

Marković, S.B., Hambach, U., Stevens, T., Basarin, B., O'Hara-Dhand, K., Gavrilov, M.M., Gavrilov, M.B., Smalley, I., Teofanov, N., 2012. Relating the Astronomical Timescale to the Loess–Paleosol Sequences in Vojvodina, Northern Serbia, in: Berger, A., Mesinger, F., Sijacki, D. (Eds.), Climate Change. Springer Vienna, Vienna, pp. 65–78.