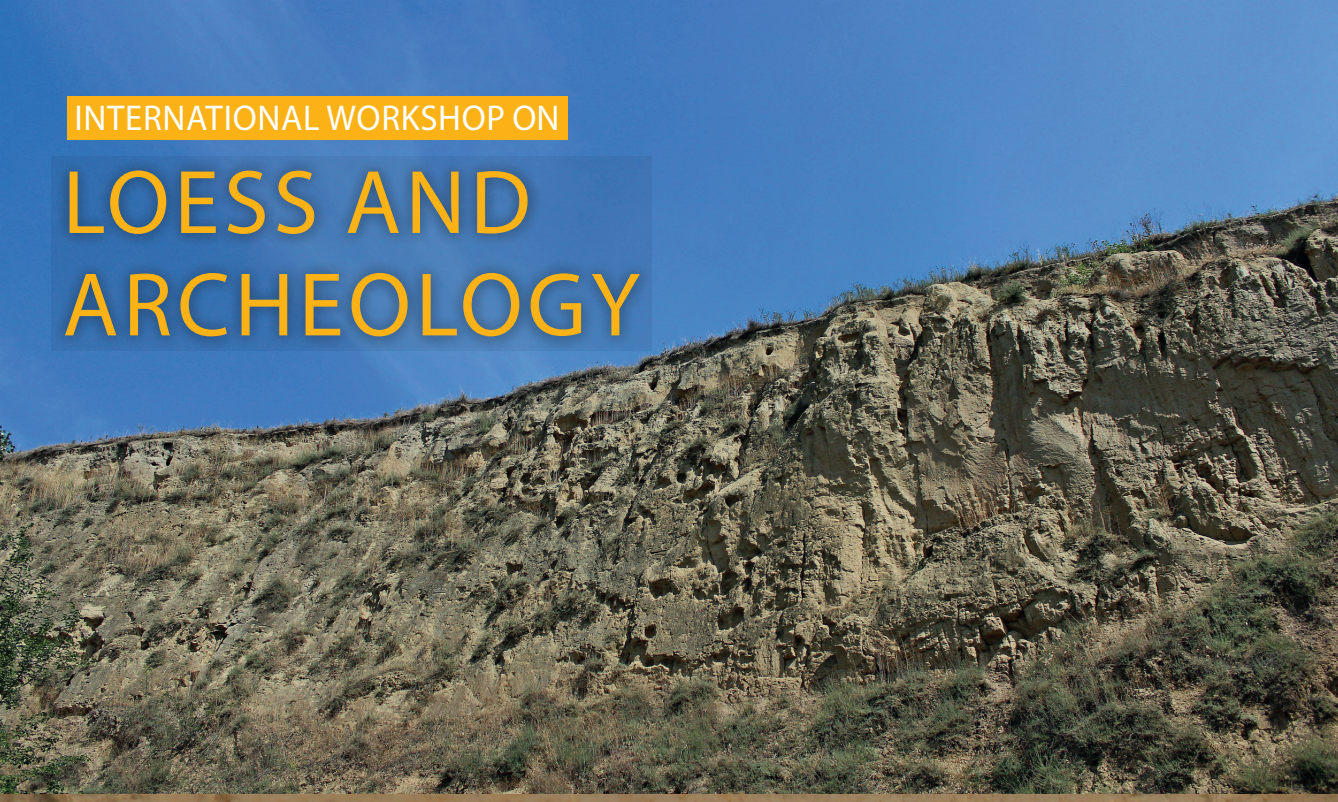
INTERNATIONAL WORKSHOP ON

LOESS AND ARCHEOLOGY



Geoarcheological & paleoenvironmental research in European loess-scapes

Abstract Book

27th - 29th November 2019
Guesthouse Könighügel, Aachen

Edited by J. Bösken, J. Richter and F. Lehmkuhl

University of Cologne
Physical Geography and Geoecology
RWTH AACHEN UNIVERSITY

International Workshop on Loess and Archeology

Geoarcheological and paleoenvironmental research in European loess-scapes

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Titel: *International Workshop on Loess and Archeology*
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Abstract Book
WLA 2019, Aachen, 27-29 November 2019

Herausgeber: *Prof. Dr. Frank Lehmkuhl*

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Einband: Alina Blume, Mirjam Utz

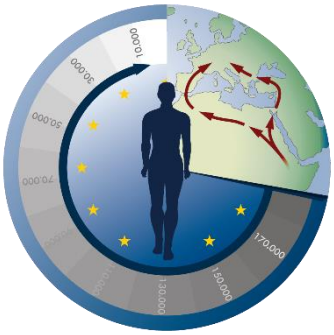
Foto: Shutterstock.com, Bildtitel: „Vertical loess cliffs on Titel hill in Vojvodina province, Serbia“

Der Volltext steht auf dem Publikationsserver der RWTH Aachen zur Verfügung:
DOI: 10.18154/RWTH-2019-10166

Sponsors

Funded by DFG Deutsche Forschungsgemeinschaft German Research Foundation

A B C / J geoverbund aachen bonn cologne jülich



Content

Editorial

We are happy to organize the International Workshop on Loess and Archeology in Aachen in November 2019 and welcome you all to our beautiful city. This meeting follows up on a successful workshop about 'Last glacial paleogeography and archeology in the Eastern Mediterranean and Eastern European loess belt' held in 2012. Since then, many activities have been undertaken within geoarcheological research in loess and other sedimentary landscapes. In the frame of the CRC 806 "Our Way to Europe" project our departments continued and extended research further in Europe, especially in Germany, Belgium, Austria, Hungary, Serbia and Romania. With this workshop we aim to further strengthen collaborations, update each other on current research developments and plan how geoarcheological research in loess-scapes[1] will be continued addressing all diachronic levels and scales. With seven keynotes, 22 oral presentations and several poster presentations we hope to promote active discussions and exchanges. We especially wish to stimulate interdisciplinary work within European loess-scapes.

With 54 participants from 14 countries, we split our meeting into six major topics: (1) Archeology of the Middle Paleolithic, (2) loess and archeology of the Lower Danube Basin, (3) geoarcheological research in the Middle Danube Basin, (4) geoarcheological research in western and central European loess, (5) methodological developments in loess research, and (6) supra-regional paleoclimatic research.

We thank all participants for visiting our workshop in Aachen and we hope that everybody can contribute to a successful meeting. As an outcome of this workshop, we plan a volume in an international peer reviewed journal and invite you to participate with a contribution.

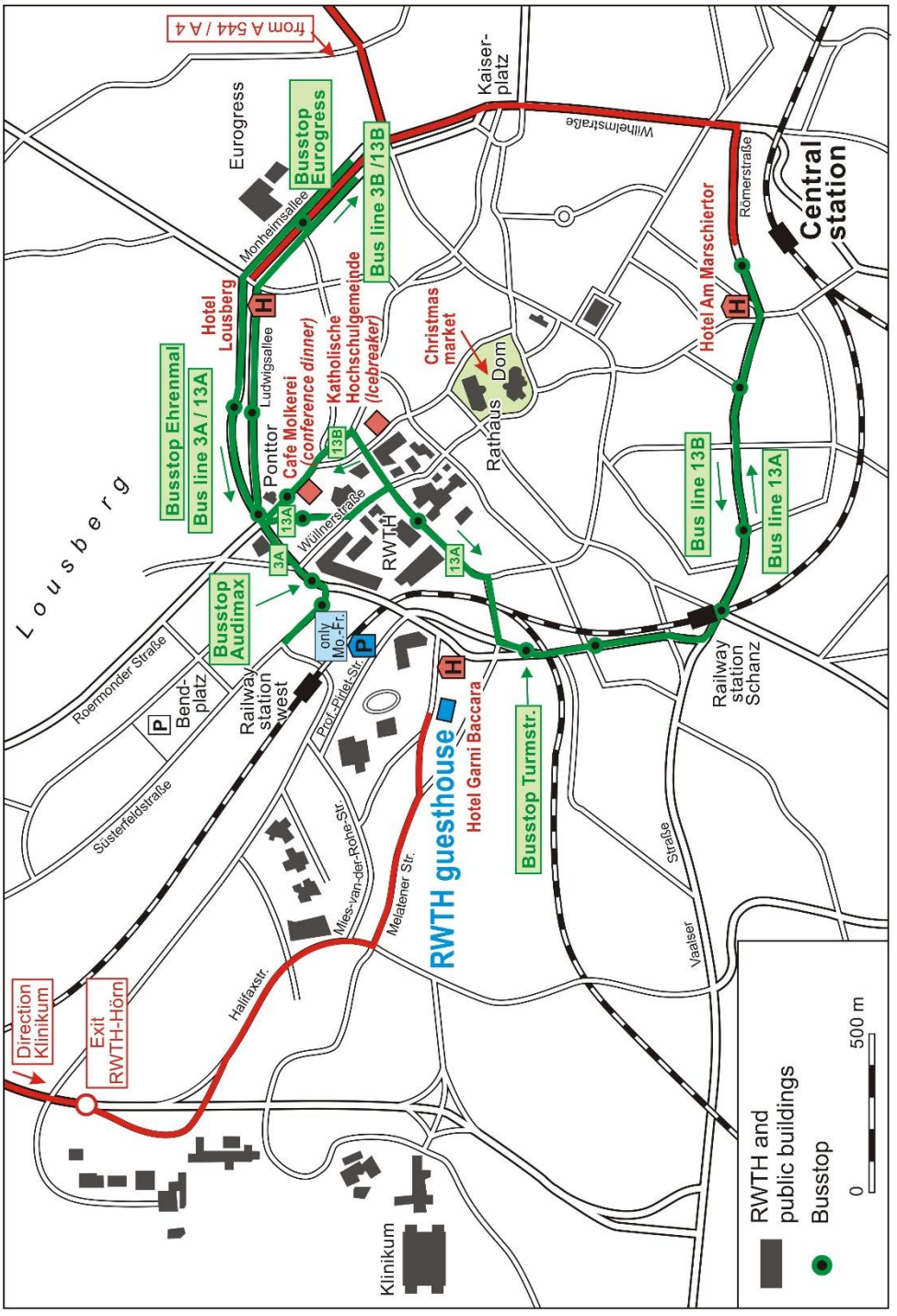
[1] The term loess-scape was first used by Romanescu et al. (2018): Romanescu, G., Lóczy, D., Dezső, J., Carboni, D., 2018. Loess-Scape in the Dobrudja Plateau (Romania). Landforms and Updated Typology. Present Environment and Sustainable Development 12, 95–114.

Finally, we thank the CRC 806 and the German Science Foundation DFG for funding this workshop. In addition, we also thank the German Quaternary Association DEUQUA for advertising our workshop and supporting early career scientists to participate. Finally, we are grateful for the Geoverbund ABC/J for supplying us with conference materials.

Aachen and Cologne, 14.11.2019

Janina Bösken, Frank Lehmkuhl & Jürgen Richter

Conference locations



Conference program

Wednesday, 27th November 2019

19:00 – 21:00 The icebreaker party will take place in the 'Gruppenraum' of the Katholische Hochschulgemeinde, Pontstr. 74-76, Aachen.

Thursday, 28th November 2019

08:30 – 08:45	*Registration*	RWTH Gästehaus, Melatener Str. 31-35, Aachen
08:45 – 09:00	Welcome	
	Archeology of the Middle Paleolithic Convener: Jürgen Richter	
09:00 – 09:30	**Keynote 1: Philip Nigst**	Neanderthal occupation of the East European Plain: New data from the Middle Dniester valley (Ukraine)
09:30 – 09:50	Rudenc Ruka	Middle Paleolithic lithic variability in southern Albania: A good time to raise questions
09:50 – 10:10	András Markó	Three Middle Paleolithic open-air sites from the Cserhát Mountains (Northern Hungary): new excavations, new results, new questions
10:10 – 10:30	Jean-Luc Locht	The Middle Paleolithic in loessic context in Northern France
10:30 – 11:00	*Break*	

Loess and archeology of the Lower Danube Basin
Convener: Philip Nigst

11:00 – 11:30	**Keynote 2: Mircea Anghelinu**	Tracking technological changes across the last glacial maximum: a diachronic perspective on the Gravettian-Epigravettian archeological record from the Eastern Carpathians (northeastern Romania)
11:30 – 11:50	Larissa Koulakovska	The Paleolithic sites Korman' IV & 9 (Middle Dniester, Ukraine)
11:50 – 12:10	Cristina Cordoş	Reassessing site formation processes at several Upper Paleolithic settlements in the Ceahlău Basin (NE Romania): Some chrono-cultural implications.
12:10 – 12:30	Pierre Noiret	40 Years of excavations at Mitoc-Malu Galben (Romania): Exploring the archeology of a high-resolution loess-paleosol sequence
12:30 – 12:50	Adrian Doboș	Current issues in Romanian Paleolithic chronology
12:50 – 14:00	*Lunchbreak*	

Geoarcheological research in the Middle Danube Basin Convener: Christian Zeeden		
14:00 – 14:30	**Keynote 3: Wei Chu**	A geoarcheological investigation of a Middle-Upper Paleolithic transition site in Central Eastern Europe
14:30 – 14:50	Slobodan B. Marković	How warm were summers during the LGM in the southeastern Carpathian Basin?
14:50 – 15:10	Dávid Molnár	Paleoecological background of the famous Gravettian site of Ságvár, Hungary: Radiocarbon-dated malacological and sedimentological results of the Late Pleistocene environment
15:10 – 15:30	Igor Obreht	A critical reevaluation of paleoclimate proxy records from loess in the Carpathian Basin
15:30 – 17:00	*Poster session & drinks*	
17:00 – 17:45	*General discussion*	
19:00	**Conference dinner**	1st floor of the restaurant '**Molkerei**' in Pontstraße 141-149, Aachen.

Friday, 29th November 2019

Geoarcheological research in Western and Central European Loess 1 Convener: Frank Lehmkuhl		
09:00 – 09:30	**Keynote 4: Pierre Antoine**	The last 400 ka in loess-paleosol records from Northern France: Environmental background and dating of the Paleolithic
09:30 – 09:50	Héloïse Koehler	New archaeological research in Alsatian loess (France) and its implications on the dynamics of Palaeolithic populations
09:50 – 10:10	Olivier Moine	Millennial-timescale paleoenvironmental changes and human occupation in Northern France during the Last Glacial: The case of Amiens-Renancourt 1
10:10 – 10:30	David Hérisson	Etricourt-Manancourt (Somme, France) : A reference loess sequence and archaeological site for the last 350 ka
10:30 – 11:00	*Break*	

Methodological developments in loess research Convener: Igor Obreht		
11:00 – 11:30	**Keynote 5: Alida Timar-Gabor**	Dating and provenance of loess by luminescence and ESR
11:30 – 11:50	Daniela Constantin	Luminescence age constraints on the Pleistocene-Holocene transition recorded in loess sequences
11:50 – 12:10	Tobias Sprafke	Color-based stratigraphy of loess - application for paleoenvironmental reconstructions from Krems-Wachtberg (MIS3/2)
12:10 – 13:10	*Lunchbreak*	
Geoarcheological research in Western and Central European Loess 2 Convener: Tobias Sprafke		
13:10 – 13:40	**Keynote 6: Peter Fischer**	Refined stratigraphy of loess-paleosol sequences from the Schwalbenberg near Remagen (Middle Rhine valley, Germany) - paleoenvironmental and archeological implications
13:40 – 14:00	Stéphane Pirson	Loess and archeology in Belgium: An overview
14:00 – 14:20	Petr Škrdla	Loess and archeological cultures in Moravia

14:20 – 14:40	Marc Händel	Using refittings of lithic artefacts to test a site formation model for the Gravettian site of Krems-Wachtberg
14:40 – 15:00	F. Lehmkuhl & J. Richter	Loess chronology and archaeology in loess in Western Central Europe
15:00 – 15:30	*Break*	
	Supra-regional paleoclimatic research Convener: Peter Fischer	
15:30 – 16:00	**Keynote 7: Ulrich Hambach**	Interglacial, Holocene and recent dust accretion in the Danube Basin and beyond – evidence for uninterrupted dust accumulation in Eurasian dry steppe regions
16:00 – 16:20	Patrick Ludwig	Model based dust cycle over Europe during the Last Glacial Maximum
16:20 – 16:40	Stephan Pötter	Last glacial loess records from the Lower Danube Basin – a comparative study of the key sites Vlasca and Balta Alba Kurgan
16:40 – 17:00	Christian Zeeden	A European loess stack and its timing (in progress) in the context of human evolution
17:00 – 17:30	*Discussion & closing*	

After the workshop, everybody interested can join us for a good-bye chat at the Christmas Market.

Abstracts of oral presentations

Tracking technological changes across the Last Glacial Maximum: a diachronic perspective on the Gravettian-Epigravettian archaeological record from the Eastern Carpathians (northeastern Romania)

M. Anghelinu[1], L. Niță[1], E.-C. Cordoș[2]

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DOI: 10.18154/RWTH-2019-10533

Archaeological research over the last decade at several sites from the Bistrița Valley (northeastern Romania) have considerably redefined the chronological and cultural framework of the regional Upper Palaeolithic sequence. The archaeological record from six recently reassessed sites (Bistricioara-Lutărie I, III, Mal, Poiana Cireșului, Buda and Lespezi) documents the Gravettian-Epigravettian succession between 28 and 16 kyr cal BP.

The archaeological layers from the six selected sites provided consistent lithic assemblages of 1,000 to 6,000 artifacts, illustrate important differences in terms of technological and typological variability raw material selection, flake and laminar blank production and formal tools. While the lithic material variability alone offers only a glimpse of the cultural background as a whole, it nevertheless manages to both support and nuance the chronologically-secure continuity of human presence in the area during the peak of the LGM.

The last 400 ka in loess-palaeosol records from Northern France: Environmental background and dating of the Palaeolithic

P. Antoine[1], S. Coutard[2,1], J.-L. Locht[2,1], E. Goval[3], D. Hérisson[4], O. Moine[1], J.-J. Bahain[5]

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DOI: 10.18154/RWTH-2019-10416

In Northern France, Quaternary loess-palaeosol sequences represent the main deposits in which Palaeolithic sites are generally recovered. The oldest loess deposits, dating from the Middle Pleistocene, are generally preserved in sedimentary traps formed by the junction between the chalky slopes and the alluvial formations of the Somme River fluvial terrace system or by deep sinkholes (3-5 m) resulting from the dissolution of the chalky substratum on the plateaus. They are mainly resulting from local deflation processes reworking the top of sandy fluvial deposits. A large extension of typical calcareous loess over the whole landscape is only observed from the end of the Saalian (≈ 150-135 ka). The heavy mineral content of these aeolian deposits testifies to a distant transport from the polar desert areas of the dried Eastern Channel (≥ 100 km). Following the last Interglacial (Eemian), the Last glacial (Weichselian) is represented by a sub-continuous loess cover rising up to 7-8 m in thickness in the best locations as leeward slopes. In this large area, pedostratigraphic sequences from the last Interglacial-glacial cycle have been intensely studied, especially in the frame of rescue archaeological programs that have provided hundreds of individual sequences from test-pits or excavations and numerous archaeological layers.

The pedostratigraphic sequences from the last Interglacial-glacial cycle exhibit a regular pedosedimentary pattern including well identified pedological and periglacial marker horizons that can be followed towards the East, at least in Belgium and Germany. This approach leads to a detailed pedostratigraphic and chronostratigraphic scheme that represents a unique database to discuss the relations between Palaeolithic occupations and environment in Europe. It can be summarised by the succession of four main chrono-climatic phases following

the erosion of the Eemian brown leached soil during MIS 5d: (1) Early-glacial (112-72 ka) including a phase with grey forest soils (Early-glacial A: ≈MIS 5d-5a) and a phase with steppe-like soils (Early-glacial B: end of MIS 5a), (2) Lower Pleniglacial (≈70-58 ka): erosion, colluvial deposits then first typical homogeneous loess deposits marking the first occurrence of typical periglacial conditions, (3) Middle Pleniglacial (≈58-30): intense and short erosive episode (thermokarst) / deposition of bedded colluviums reworking the whole underlying units/development of a brown soil complex and weak aeolian deposition during most of MIS 3, (4) Upper Pleniglacial (≈ 30-15 ka): main network of large ice-wedge casts/drastic increase in loess sedimentation including tundra-gley horizons and large Ice wedge casts. In this context, the data show that Human occupation of Northern France was discontinuous during the Last glacial, with a clear concentration of Palaeolithic remains during the Early-glacial in forest-steppe contexts under continental climate. Only a few occupations were attributed to the Lower Pleniglacial and to the course of the Middle Pleniglacial and a gap is attested between ~ 25 and ~15 ka mainly during the period of maximal loess deposition. It thus appears to be a strong relationship between the intensity of human occupation and the climatic and environmental context. This could be conditioned by the relative abundance of large fauna, itself linked to vegetation density, as indicated by the extremely sparse biomass contemporaneous with the Upper Pleniglacial loess. Even if data are much more scattered for the Middle Pleistocene, a markedly concentration of Palaeolithic occupations is observed during the Early-glacial transitional phases (Early-glacial MIS 11/10, 9/8 and 7/6).

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A geoarchaeological investigation of a Middle-Upper Paleolithic transition site in Central Eastern Europe

W. Chu[1], A. Doboș[2], J. Marreiros[3], A. Ciornei[2], J. Richter[1]

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Luminescence age constraints on the Pleistocene-Holocene transition recorded in loess sequences

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DOI: 10.18154/RWTH-2019-10422

Here we investigate the timing of the last glacial loess (L1) - Holocene soil (S0) transition recorded in loess-paleosol sequences across the Chinese Loess Plateau, the SE European loess belt and the Central Great Plains, Nebraska, USA by applying comparative luminescence dating techniques on quartz and feldspars. Equivalent dose measurements were carried out using the single-aliquot regenerative-dose (SAR) protocol on silt (4–11 μm) and sand-sized (63–90 μm and coarser fraction when available) quartz. Feldspar infrared stimulated luminescence (IRSL) emitted by 4–11 μm polymineral grains was measured using the post IR-$IRSL_{290}$ technique.

The paleoenvironmental transition from the last glacial loess to the current interglacial soil was characterized using magnetic susceptibility and its frequency dependence. SAR-OSL dating of 4–11 μm, 63–90 μm and 90–125 μm quartz provided consistent ages in the loess-paleosol sites investigated, while the post-IR $IRSL_{290}$ protocol proved unreliable for dating such young samples.

Based on the OSL ages and the threshold of the magnetic signal enhancement the onset of soil formation started around Termination 1 (~17 ka in the North Atlantic) as observed in radiocarbon-dated regional benthic $\delta^{18}O$ stacks (Stern

and Lisiecki, 2014) but before the stratigraphic Pleistocene/Holocene transition dated at 11.7 ka in ice core records (Svensson et al., 2008).
No major hiatuses in ages are identified in the investigated sites. The magnetic susceptibility indicates a gradual increase in pedogenesis after Termination 1 (~17 ka in the North Atlantic). Based on this, we infer that the upbuilding soil formation prevail over topdown soil formation during the Pleistocene-Holocene transition in the investigated sites (Roberts, 2008).

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]).

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Reassessing site formation processes at several Upper Paleolithic settlements in the Ceahlău Basin (Northeastern Romania): Some chrono-cultural implications

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DOI: 10.18154/RWTH-2019-10535

The rich open-air record of the Ceahlău Basin (North-Eastern Romania) has been long considered as providing a rather continuous and complete chronicle of the regional Upper Paleolithic cultural succession, allegedly including several Aurignacian, Gravettian and Epigravettian substages. However, most reassessments attempted in the last decade to have questioned this picture drawn between the 1950's and 1990's.

Apart from the obvious theoretical and methodological improvements and the newly gathered empirical data, a crucial aspect of explaining the contrast between the initial and the more recent interpretations is the very understanding of site formation processes. Three-dimensional single find recording with artifact orientations, current topographic recording, core drillings, correlated with accurate litho-stratigraphic descriptions and a reexamination of old documentation in some key sites in the area (Bistricioara-Lutărie I-III, Ceahlău-Dârțu), point to much more complex and locally variable depositional contexts where the local geomorphology and various post-depositional factors (e.g. slope processes, differential erosion/accumulation) played key roles. As a consequence, the integrity, consistency and comparative relevance of many previously defined archeological ‘assemblages’ remains doubtful. At the same time, recent work confirms the paleoenvironmental and paleocultural breadth of some of the local geological archives, pointing to promising future research prospects.

Current issues in Romanian Paleolithic chronology

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DOI: 10.18154/RWTH-2019-10536

In the recent decades, our understanding of the dynamics of Paleolithic occupations in Romania has greatly improved thanks to advances in research methods ranging from excavation techniques to isotope-based analyses. One area where a major improvement has been achieved is the improved absolute ages of the Paleolithic sites.

Traditionally, Romanian scholars employed the Alpine chronology and used the river terrace system to assess the ages of open air sites; this system was subsequently extended to the dating of the loess-paleosol sequences. A misinterpretation in the position of the MIS 5e paleosol in the province of Dobrogea (southeastern Romania) prompted the idea that all of the deposits were much younger.

Radiocarbon ages derived from materials sampled during the 1960s and later, were analyzed through conventional radiocarbon method mostly during the 1980s and 1990s. Because of the method's limitations, unacknowledged at the time, and the likely contamination of samples stored sometimes for decades, the interpretation of the results endorsed a 'short chronology' for the Paleolithic throughout Romania.

New advances in dating methods (AMS radiocarbon, luminescence-based methods, etc.) have revealed that the occupation of the Romania's territory in the Pleistocene is much older than previously estimated.

Refined stratigraphy of loess-paleosol-sequences from the Schwalbenberg near Remagen (Middle Rhine valley, Germany) - paleoenvironmental and archeological implications

P. Fischer[1], O. Jöris[2], A. Vött[1], K. Fitzsimmons[3], M. Vinnepand[1], U. Hambach[4], C. Prud'homme[3], P. Schulte[5], F. Lehmkuhl[5], W. Schirmer[6]

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DOI: 10.18154/RWTH-2019-10423

Loess-paleosol-sequences (LPS) are outstanding terrestrial archives of palaeo-environmental changes and connected to habitats for past human populations also elucidate the nature of interactions between people and their environment. In the frame of the TerraClime-Project, extensive fieldwork has been carried out along a transect from the interfluve position to the foot slope at the Schwalbenberg site near Remagen (Middle Rhine valley, Germany) combining geophysical exploration (electrical resistivity tomography, seismics) with Direct Push borehole geophysical measurements and sediment coring. Multi-proxy analyses are used to detect signals of palaeoenvironmental and palaeoclimatic changes and enable the integration of formerly investigated Schwalbenberg sections, namely a c. 6 m thick profile where an archaeological horizon testifies to Palaeolithic occupation in the area (App et al., 1995) and the c. 13 m thick Schwalbenberg II profile section (e.g. Schirmer, 2012). A new Schwalbenberg age model is based on quartz luminescence and radiocarbon ages from fossil earthworm calcite granules and tephrachronology.

Based on our results we are able to demonstrate that investigated novel Loess-Palaeosol-Sequences from the Schwalbenberg area yield the thickest and most comprehensive terrestrial record of environmental change in Western and Central Europe for the entire Last Glacial Cycle. Furthermore, the combination of direct sensing techniques and geophysical measurements allows for accurate mapping of stratigraphic marker horizons (e.g. soil horizons, tephra layers),

layer boundaries (e.g. transition from loess deposits to fluvial and colluvial sediments) and erosional events along the geomorphological transect.
The Schwalbenberg chronology refines age estimates established earlier for the archaeological horizon (App et al., 1995; Schirmer 2012). The small assemblage, which is interpreted to represent the techno-typological transition between the Middle and Upper Palaeolithic, dates to around 33.500 cal BP, and therefore corresponds to the very beginning of the Mid-Upper Palaeolithic 'Gravettian' period in Central Europe (cf. Jöris et al., 2010). Early Upper Palaeolithic Aurignacian sites in the wider vicinity predate the Schwalbenberg site by several millennia. Against the background of the Schwalbenberg archaeological site, new light is shed on the Middle-Upper Palaeolithic transition in Central Europe, indicating that the underlying socio-cultural changes were far more complex than previously thought.

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Interglacial, Holocene and recent dust accretion in the Danube Basin and beyond - evidence for uninterrupted dust accumulation in Eurasian dry steppe regions

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DOI: 10.18154/RWTH-2019-10413

Lithospheric dust plays a key role in the Earth's system connecting litho- and pedosphere with atmo-, hydro-, cryo- and even biosphere, on the one hand materially via the containing minerals and immaterially via the impact on atmospheric radiation balance and the elevated energy content of gases loaded with dust. Litho- and pedosphere serve as source and sink of dust, which eventually accumulates in the ocean and on continents as environmental archives. These accumulations and the pristine dust consist mainly of common silicates in silty grain sizes and variable contents of carbonates corresponding geochemically to the average continental crust.

Here we discuss spatial and temporal patterns of dust accumulation in the Danube Basin and stratigraphic records of environmental proxy data in recent soils, palaeosols and loess and their implications for palaeoclimate reconstruction, pedogenesis and archaeology in Eurasian steppe environments.

Especially widespread on the mid-latitude Eurasian continent, dust accumulations are known as loess generally exhibiting a characteristic feature of stratigraphic intercalations of distinct horizons differing mainly in colour and possibly in grain size and chemical composition. Based on analytical evidence,

those horizons are interpreted as the result of dominantly synsedimentary alterations of the pristine minerals not directly controlled by temperature, but indirectly through elevated moisture and the related biome. Such coupled processes, permanently creating a global interface on top of the lithosphere, are known as pedogenesis forming the pedosphere, which in turn hosts an essential part of the continental biosphere. In case of dust accumulations, the intensity of pedogenesis acts on a wide range of amplitudes reflecting temporal hydroclimate variabilities and transforming accumulated lithospheric dust into loess (loessification) and sometimes into pedohorizons, called soils, when prevailing pedogenesis exceeds critical thresholds. Soils become eventually buried forming the characteristic feature of loess-palaeosol sequences (LPS), fossil soils (palaeosols)interbedded with loess. Hence, palaeosols are the dominant metronomes of LPS reflecting the temporal hydroclimatic variations of the geological past.

At least since the early Pleistocene, the western end of the Eurasian steppe belt, notably the Danube Basin and the steppe regions north of the Black Sea, operated as important dust sinks providing decametre thick records of environmental history. We will present results showing that in those steppe environments, synsedimentary pedogenic transformation dominates over translocation processes, in this way preserving primary depositional sedimentary features. Mainly carbonate, sulphate and soil organic matter are widely affected by translocation, whereas the main component of the lithospheric dust deposits, the silicate mineral skeleton, remains largely unaffected yet recording environmental temporal dynamics. Therefore, records of physical properties of LPS as grain size (GS) or magnetic susceptibility (MS) reflect directly synsedimentary environmental conditions as wind speed (GS) or sediment moisture (MS). Under these conditions, pedogenesis is, albeit providing often colourful marker horizons, a rather secondary process operating in steppe LPS more “bottom up than top down” and thus only slightly affecting the primary environmental signal generated by aeolian deposition and early diagenesis (loessification). Hence, palaeosols in LPS primarily record the temporally changeful environment during interglacials and interstadials via their uninterrupted sedimentary nature, and only secondarily the pedogenic overprinting operating top down. Distinctive patterns of environmental proxy records from palaeosols in LPS provide characteristic fingerprints allowing thereby even correlations to sedimentary marine and ice records.

Employing those fingerprints (e.g. MS), we present unambiguous continent-wide correlations of Eurasian LPS giving evidence for a quite similar

accumulation and/or loessification history which in turn reflects the on-site environmental conditions changing with time. Dust accumulation rates seem to be quite constant in plateau loess settings varying from c. 3 to c. 20 cm/ka, at most. Interestingly, in low accumulation sites relatively fine silt dominates (median c. 20-25 micron) pointing to a long-range transported dust. Similar to Greenland ice cores and lacustrine records, dust accumulation in Eurasian steppe LPS varies with changing climate but does not cease during climatically favoured intervals such as interstadials or interglacials. High-resolution dating results of sites across the Danube Basin document precisely the accumulation history of dust at the transition from Pleistocene to Holocene and during Holocene times. These chronologies prove the dominantly sedimentary character of the Holocene soil, in which pedogenesis mainly operates “bottom up” generally playing only a subordinate role.

The continuous nature of dust accumulation in LPS is also proven by the occurrence of numerous volcanic tephra layers and the excellent preservation of delicate archaeologic find horizons, both providing quite short temporal snapshots. Furthermore, geoarchaeological evidence, direct observations and historic records of dust falls supported by numerical models of recent dust deposition in the Danube Basin suggest a significant contribution of aeolian dust to Holocene soils even outside the loess plateaus. Hence, LPS in dry steppe regions of the Eurasian continent are formed by dust accretion representing a unique archive of palaeoenvironmental and human cultural evolution.

Using refittings of lithic artefacts to test a site formation model for the Gravettian site of Krems-Wachtberg

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DOI: 10.18154/RWTH-2019-10537

Given its rich archaeological and sedimentary records, Krems-Wachtberg can be considered a key site in the Middle Danube region. Unquestionably, the site is most renowned for its Mid Upper Palaeolithic infant burials. Of similar significance is, however, the preservation of an occupation surface providing the context for these burials as well as for other anthropogenic structures such as a large multi-phased hearth. The presence of yet another rich archaeological layer characterised by redeposited finds, on top of and truncating the *in situ* occupation layer, is of utmost importance for understanding and modelling the local site formation processes.

Archaeological excavations at Krems-Wachtberg have been conducted from 2005 to 2015 and provided a wealth of material and data. Among these are more than 40,000 lithic artefacts for which orientation and position were recorded three-dimensionally. Post-excavation analyses of this assemblage included both artefact-morphological recording as well as raw material determination for each artefact. The latter provided data for a classification of the assemblage and a basis for refittings. Besides providing crucial technological insights, these refittings represent a most suitable proxy for testing our site formation model.

Etricourt-Manancourt (Somme, France): A reference loess sequence and archaeological site for the last 350 ka

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DOI: 10.18154/RWTH-2019-10539

A new Middle Pleistocene loess-palaeosol sequence was uncovered during a preventive excavation at Étricourt-Manancourt (Somme, France). The full 12-m-thick sequence exhibits five stacked glacial-interglacial cycles and integrates five *in situ* Palaeolithic levels and remarkably, one Acheulean level dated by thermoluminescence on burned flints at about 300–280 ka ago. A detailed field stratigraphic approach has been completed through a high-resolution sedimentological study (grain size, total organic carbon) based on more than 380 5-cm-thick samples collected from continuous sampling of columns covering the entire units, more than 110 micromorphological block samples for thin sections analysis and a set of 37 sub-samples for the study of heavy minerals. Despite specific samples (tubes) having been extracted for future OSL dating, the geochronological control is mainly based on thermoluminescence dating of heated (archaeological) flints, completed by infrared-stimulated luminescence dating on K-feldspars. The study of four reference profiles distributed throughout the excavation and their correlation using well-defined pedological level marks, led to the definition of a ca. 12-m-thick cumulative loess-palaeosols succession including 18 main stratigraphic units. This approach allowed building a global pedosedimentary sequences for the

Étricourt site that presently serves as a reference for northern France, and more broadly the loess belt.
The archaeological excavation, located on the slope of a dry valley, extended over 4500 m². Five *in situ* Palaeolithic occupations have been excavated, dating from 330 to 70 ka ago. The youngest occupation dates from 80 to 70 ka ago (Weichselian) and corresponds to a recent phase of the Middle Palaeolithic. The next two layers belong to the Early Middle Palaeolithic, between 240–190 ka ago (Saalian). Finally, the two oldest layers have dates between 330 and 280 ka ago (Saalian) and belong to the Lower Palaeolithic.
We propose to present the archaeological and chronostratigraphic results of the excavation of Etricourt-Manancourt and its input with high-resolution data to the knowledge of the Saalian and the Weichselian in northern France and in Northwestern Europe.

New archaeological research in Alsatian loess (France) and its implications on the dynamics of Palaeolithic populations

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DOI: 10.18154/RWTH-2019-10544

Despite the existence of several reference sites studied since the beginning of the 19th century, prehistorical research has been poorly developed in Alsace (east of France) owing to the lack of local specialists. Since 2011, a new research team has stimulated the detection and study of Palaeolithic sites and Quaternary sequences in Alsace, especially in loess sequences of the Rhenish Plain. Synthesized within the “PaleoEls” Collective Research Project since 2015, these works, initially focused on the recovery of existing archaeological and geomorphological data, also allowed for the discovery of new sites and Quaternary sequences in loessic context and to the excavation of several of them. This considerably improved the regional knowledge in both domains.
In the framework of this project the review of lithic industries from the famous site of Achenheim-Hangebieten was undertaken. Combined with recent studies carried out on loess sections during (but not exclusively) rescue archaeological operations, this revision allows the discussion of the chronostratigraphical attributions of sequences and the population dynamics during the Palaeolithic. The oldest evidences of human occupation during the Lower Palaeolithic takes place below the loess deposits in Vosgian red sands and Rhenish muds of the upper layers of the terrace. Based on malacology and stratigraphy, they would be contemporaneous with a glacial period dated to at least MIS 12. The absence of Acheulean tools at Achenheim challenges the common idea that the Rhine River blocked the diffusion of the Acheulean culture and technology eastwards into Germany.

Above, younger sequences yielded very early, handsome Mousterian industries in the pedocomplex “Achenheim III” attributed to MIS 9, and are among the oldest ones in northwestern Europe. “Loess series II” yielded industries from the end of the Upper Saalian glaciation. However, they are very few and technologically less accomplished. These characteristics are similar to those of the material found during the excavation of the “Sol 74” in the same loess series at Achenheim, but also in the MIS 7 pedocomplex of Uffheim and in the Saalian loess of Ernolsheim-sur-Bruche. Whereas evidences are rare for the Weichselian Early Glacial in pedocomplex “Achenheim I”, two new sites have been recently excavated at Ernolsheim-sur-Bruche and Pfulgriesheim. Furthermore, new evidences dating from MIS 4 or 3 have recently been collected at Kolbsheim, Ittenheim and Pfulgriesheim. Compared with that from the Mutzig foothill context, the lithic industry from loess sequences thus brings forth new elements to discuss the role of the Rhine River for Neanderthal populations in northwestern Europe.
Finally, early Upper Palaeolithic tools have also been clearly identified in old collections from Achenheim, but also from Holtzheim a few kilometers away, and a nucleus has recently been found northward at Schaffhouse-près-Seltz.

The Paleolithic sites of Korman' IV & 9 (Middle Dniester, Ukraine)

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DOI: 10.18154/RWTH-2019-10546

In 1930/1931, I. Botez and N. Moroshan discovered Palaeolithic site, Korman' IV. On the right bank of the Dniester, two archaeological layers were discovered, marked by lithic artefacts and faunal remains and identified as Upper Palaeolithic. In total there are 16 archaeological layers documented spanning the Middle Palaeolithic to Mesolithic: 12-9 - Mousterian, 8 - 'transition' from Middle to Upper Palaeolithic, 7-1 - Upper Palaeolithic and layers B and A are classified as Mesolithic.

During 1969–1975 Korman' IV was excavated by a team led by O. Chernysh and I.K. Ivanova. This interdisciplinary study and the comparison with the Molodova I, V sites resulted in a cultural and chronological scheme of the development of Upper Palaeolithic cultures in the region. The close cooperation with specialists of the natural sciences lead to a detailed reconstruction of the palaeoecological context of Palaeolithic occupation.

In 2012, the Dniester Palaeolithic expedition of the IA NASU in cooperation with the University of Cambridge discovered a new site, Korman' 9. The preliminary archaeological and geological fieldwork at Korman' 9 allows a first assessment of the stratigraphy, chronological position and archaeology of the new site. Three layers were discovered that were all attributed to the Upper Palaeolithic. All three layers belong to the Late Pleniglacial and human occupation that occurred under cold conditions.

Layer I can be classified as Epi-Gravettian based on typology (microliths) and technology (core for micro blades and bladelets) as well as personal ornaments (shell, amber and tooth). Also, the radiocarbon age (17.950 ± 80 BPGrA-59996) supports this classification. Also, Layer II can be classified as Epi-Gravettian based on the radiocarbon age (18.440 ± 80 BP; GrA-59993)). Due to the scarcity of finds, we cannot base such a classification on lithic typology and technology.

Layer III can be attributed to the Gravettian technocomplex based on morphological criteria (bi-directional prismatic core and rather wide value with evidence for organic (soft) percussion). Currently, Layer III is undated.
The stratigraphy of Korman' 9 connects to the upper part of Korman' IV, but to the low numbers of artefacts at Korman' 9, a detailed comparison is not possible. It is also important to note that in the new Palaeolithic site of the Dniester Valley, Neporotovo 7 (Layer II), an analogue of the industry of the Middle Palaeolithic layer 11 of the Korman IV site was found.
However, we can conclude: The Upper Palaeolithic at Korman' 9 and Korman' IV have the same chronostratigraphic position with near identical radiocarbon ages. Furthermore, the faunal assemblage is very similar; the same is true for technological and typological characteristics of the lithic artefacts.

Loess chronology and archaeology in loess in Western Central Europe

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DOI: 10.18154/RWTH-2019-10562

During the 20th century, comparative loess chronology essentially relied on loess-paleosol sequences (LPS) linking to regional records. Archaeological data – particularly those of Middle Paleolithic (300–40 ka BP) and Upper Paleolithic (43–14.5 ka BP) open-air sites – had been derived from such composed interregional age models of loess deposition. The growing importance of new methods, such as geochemical description of LPS and OSL-dating, led to revisions and corrections, rather than refinement, of the previous loess chronology: as a general tendency. Loess chronology nowadays appears as much more discontinuous and variable than previously thought. This paper discusses possible consequences concerning our knowledge about environmental change during the Middle and Upper Pleistocene and the associated human population history.

The Middle Palaeolithic in loessic context in Northern France

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DOI: 10.18154/RWTH-2019-10547

Northwestern France is at the western end of the Eurasian loess zone characterized by a subcontinuous loess cover. It contains a large amount of Lower and Middle Paleolithic open-air sites. This region, and in particular the Somme Valley, has played an essential role in the history of Prehistory.

The Middle Palaeolithic of northwestern France is characterized by the presence of many Middle Palaeolithic sites, covering the entire period. The Saalian phase is less documented, partly for taphonomic reasons. The lithic industries indicate mastery of all production systems for flakes, blades, points and to a lesser extent, bifaces. During the Upper Pleistocene, the occupation of this territory by Neandertal groups is important. The vast majority of these lithic series cannot be attributed to discrete cultural facies of Mousterian defined by Bordes, due to the low number of retouched tools. Aside from some typical Mousterian of Acheulean tradition bifaces and blade production characteristic of the Early Weichselian, which are stylistic and cultural markers, there is nothing to differentiate Mousterian groups. In an attempt to identify their cultural identities, lithic assemblages were analyzed using the *Chaîne opératoire* method that studies artifacts from the acquisition of raw materials through the final objectives of the different production systems to the ultimate abandonment of tools. The situation is considered from each chronostratigraphic phase to attempt to distinguish the settlement patterns of this region. This renewed approach to technical studies points to a wide diversity of Neandertal adaptive faculties, which can be interpreted in terms of cultural diversity.

Model based dust cycle over Europe during the Last Glacial Maximum

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DOI: 10.18154/RWTH-2019-10427

This modelling study establishes a linkage between the eolian mineral dust cycle during the Last Glacial Maximum (LGM) and the loess deposits in Europe. We simulated the glacial dust cycle at high resolution using a regional climate-dust model. The simulated dust deposition rates are of a comparable order of magnitude with fieldwork-based mass accumulation rates determined from more than 70 loess sites in Europe. The highest simulated dust emissions and deposition occurred during summer, followed by autumn. In contrast to the present-day prevailing westerlies, we found that easterly (36%) and cyclonic (22%) weather patterns prevailed over central Europe during the LGM. Together with the cyclones, the recurring dry easterlies associated with a high-pressure system over the Eurasian ice sheet (EIS) dominated the dust transport from the EIS margins in eastern and central Europe. Coherent with the persistent easterlies, major westwards running dust plumes resulted in high deposition rates in western Poland, northern Czech Republic, Germany, the Netherlands, and in the southern North Sea region.

Three Middle Palaeolithic open-air sites from the Cserhát Mountains (Northern Hungary): new excavations, new results, new questions

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DOI: 10.18154/RWTH-2019-10548

During the last 15 years, three Middle Palaeolithic open-air sites with leaf-shaped implements were excavated in the Cserhát Mountains (Northern Hungary). At each locality, the finds were excavated in reddish or yellowish palaeosols(?) laying at a depth of 50–100 cm below the current surface. Samples for sedimentological and secondary carbonate analysis, as well as OSL-dating were collected at Szécsénke and Galgagyörk. From the Vanyarc site, two radiocarbon dates are known.

From the beginning of the excavations, the emphasis was on the reconstruction of the artefact-bearing layers.

The sites, lying very close to each other (at a distance of 20–25 km at a maximum) on the northern periphery of the Hungarian Plain show several differences in spite of the general stratigraphic and typological uniformity. For instance, one-third of the assemblage of Vanyarc was made of extralocal metarhyolite (felsitic porphyry, the characteristic raw material of the Szeleta Cave), imported from a distance of 100 km. The ratio of the same rock is 14% in the Galgagyörk assemblage and it is represented only by some pieces at Szécsénke. On the other hand, the local andesite and the distant obsidian was used only at Galgagyörk. The dominating raw material in each case is the limnic quartzite having various macroscopic types in the Cserhát area and the adjacent territories.

From a typological point of view, the dominant tool types are end-scrapers at Szécsénke, leaf-shaped implements at Vanyarc and side-scrapers at Galgagyörk.

The observations made on the recently excavated sites raise the question of the variability of the assemblages belonging to the leaf- shaped industry ("*Blattspitzenindustrie*").

How warm were summers during the LGM in the southeastern Carpathian Basin?

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DOI: 10.18154/RWTH-2019-10428

In this study, we compare two independent approaches for the reconstruction of summer air temperatures during the last glacial maximum (LGM) in the southeastern Carpathian Basin. We present results of numerical modeling and July paleo temperatures based on identified land snail assemblages from loess sequences. Those two approaches are, moreover, compared with more widely used proxy data for loess sections, such as environmental magnetism, grain size, and geochemical indices.

The results show that the July malacopaleothermometer provides relatively high July temperatures comparable to present day conditions, indicating consistently higher summer air temperatures than reconstructions based on numerical modeling experiments for the LGM in the Southeastern Carpathian Basin. Numerical modeling experiments related to six different models used in this study show 6.2 ˚C to 2.5 ˚C colder July air temperatures than recently measured equivalent temperatures. From a spatial point of view, our investigations confirmed that LGM conditions in the southeastern Carpathian Basin are indicating a notable increasing Northwestern-Southeastern gradient in temperatures.

Millennial-timescale paleoenvironmental changes and human occupation in Northern France during the Last Glacial: The case of Amiens-Renancourt 1

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Paleoecological background of the famous Gravettian site of Ságvár, Hungary: Radiocarbon-dated malacological and sedimentological results of the Late Pleistocene environment

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DOI: 10.18154/RWTH-2019-10494

Authors represent new paleoecological and sedimentological results of the famous Paleolithic site of Ságvár, Hungary. Simple (abundance and dominance) and advanced (cluster analysis, PCA, correspondence) statistical analyses of malacological results were carried out determining 8 malacological zones (MZs) and the key species of the fauna evolution in the sequence. Furthermore, age-depth models were calculated using new radiocarbon age data. Accumulation rates (AR) were further derived from the age-depth models. The paleoecological reconstruction yielded a cool to cold climate and chiefly steppe environment, which indicated low AR. Not only the vegetation cover but also the geographical setting of the sequence could have favored the low AR values. The settled Gravettian hunters around 22,000 yr cal BP lived in a progressively warming wooded-steppe environment hunting mainly for reindeer. The climate change forced them to migrate away, following the reindeers.

This research was supported by the Ministry of Human Capacities, Hungary grant 20391-3/2018/FEKUSTRAT.

Neanderthal occupation of the East European Plain: New data from the Middle Dniester valley (Ukraine)

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40 Years of excavations at Mitoc–Malu Galben (Romania): Exploring the archeology of a high-resolution loess-paleosol sequence

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DOI: 10.18154/RWTH-2019-10561

Mitoc–Malu Galben, with abundant Upper Palaeolithic archaeological layers embedded in a ~12 meters long loess-palaeosol sequence, is one of the key sites for the Upper Palaeolithic in Europe. The excavations in 1978–1990 yielded rich remains of Aurignacian and Gravettian workshops. From 1992 to 1995, their stratigraphical position, age and typological characteristics were better defined. Since 2013, our team has conducting new fieldwork focusing on: (i) the precise position and orientation of the archaeological remains through 3D recording with total stations, (ii) systematic wet-sieving of all excavated sediment, (iii) an interdisciplinary study of site formation processes, and (iv) a detailed technological study of the lithic artefacts. Our new field and lab research also aimed at integrating data from 40 years of work. Based on fieldnotes and drawings of the old two excavation periods and data from our new fieldwork, we constructed a GIS and database to assess artefact occurrences with reference to stratigraphic units, as well as their spatial distribution. We, thus, present an overview of the current knowledge about the site, with references to questions that remain open.

A critical reevaluation of paleoclimate proxy records from loess in the Carpathian Basin

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DOI: 10.18154/RWTH-2019-10429

In the Carpathian Basin, loess is the most important archive of Quaternary paleoclimate evolution, but only in the past two decades, systematic and high-resolution investigations were conducted. Those studies remarkably improved our knowledge of the regional past environmental change; paleoclimate inferences based on the magnetic susceptibility and grain-size distribution, as the most commonly used paleoenvironmental proxies for the Carpathian Basin loess, indicate colder and drier climatic conditions during glacials when compared to interglacials. With an increasing number of studies using novel proxies in loess research, such a traditional understanding of dry and cold glacials and humid and warm interglacials in the Carpathian Basin has been questioned.

In order to come up with a coherent and consistent interpretation of the existing paleoclimate data from the Carpathian Basin loess, we have reevaluated and reinterpreted the available data. We discuss and propose a coherent interpretation of rock magnetic, grain-size, malacological, stable carbon and nitrogen isotope, n-alkane and bacterial membrane lipid data for the last glacial cycle loess archives from the Carpathian Basin. We show that glacial conditions in the Carpathian Basin led to a notable increasing North-South gradient in temperature and an even stronger expressed decreasing trend in humidity. Most of the biomarker proxy data conducted in loess for the very dry southern part of the Carpathian Basin show a strong bias towards arid conditions. In particular, paleotemperature reconstructions seem to be misleading. Glacial conditions were drier and colder than previously proposed (summer

temperatures likely under 15 °C during glacials), but notably warmer than in other parts of Western, Central, and Eastern Europe. The vegetation consisted mostly of steppic environments during both, glacials and interglacials. The implications of these results for human evolution in this period will be addressed.

Loess and archeology in Belgium: An overview

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DOI: 10.18154/RWTH-2019-10431

The loess belt in Belgium has been studied since the 19th Century, either from stratigraphical, sedimentological, pedological, paleoenvironmental or chronostratigraphical points of view. Recently, the reference sequence for Belgian loess has been revised, including data sets from pedostratigraphy, mineralogy, tephrostratigraphy, radiocarbon and luminescence datings (Haesaerts et al., 2011; Haesaerts et al., 2016; Pirson et al., 2018. Most of the known sequences are related to the Late Pleistocene and were integrated into a high-resolution pedosedimentary sequence encompassing the major part of the Late Pleistocene and reproducible at the scale of the Belgian loess belt. Some Middle Pleistocene sequences are also known, mainly in eastern Belgium. Based on the pedosedimentary and paleoenvironmental signatures of the Belgian sequence, comparisons have been proposed with high-resolution loess sequences from Western and Eastern Europe as well as from Central Siberia.

Paleolithic artifacts have also been recognized as soon as the 19th Century in loess sequences from Belgium. Most of the sites we know today are related to the Middle Paleolithic, but some Lower Paleolithic and Upper Paleolithic sites (Aurignacian, Gravettian and Magdalenian) are also known. In the last 20 years, important advances have been made, both on the field and in the laboratory: a few major sites have been excavated in the studied area (e.g. Op den Schans, Remicourt or Maisières-Canal), while old collections have been reappraised,

mainly for the Middle Paleolithic (Toussaint et al., 2016) and the Gravettian (Touzé et al., 2016).

In this presentation, we will briefly describe the new reference loess sequence from Belgium and discuss the position of the known archeological assemblages in this newly defined sequence, both for Lower, Middle and Upper Palaeolithic. Some additional topics related to loess and archeology will also be briefly addressed, such as 1) the very good connection with the regional caves, rich in Paleolithic sites, thanks to a specific geological context, and 2) the potential for future studies in the Belgian loess belt, focusing on archeological survey and including the role of geotechnics (Delvoie et al., 2016).

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Last glacial loess records from the Lower Danube Basin – a comparative study of the key sites Vlasca and Balta Alba Kurgan

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DOI: 10.18154/RWTH-2019-10435

The Lower Danube Basin hosts vast Pleistocene loess deposits. The thickness and the accumulation rates of the loess-paleosol sequences (LPS) are the results of manifold interplaying factors, e.g. the available detrital material in the source area and the topography of the sink area. The aeolian deposits of the Lower Danube Basin were investigated thoroughly throughout the years, using a variety of geoscientific methods applicable to LPS. Many of the investigated LPS cover several glacial cycles, providing paleoclimatic evidence from the middle to the Late Pleistocene. Some geomorphic situations lead to thicker loess accumulation during the last glacial cycle, enabling the study of high-resolution paleoenvironmental archives for the last 125 ka and beyond. Here, we present two Late Pleistocene LPS from the Bărăgan steppe area in south-eastern Romania: Vlasca (VLA) and Balta Alba Kurgan (BAK). The two sections are approx. 100 km afar and were formed under different geomorphic situations resulting in differing accumulation rates. Vlasca, e.g. is located at the left bank of the Lower Danube and has a thickness of ca. 27 meters, whereas BAK is exposed at a road cut near the Balta Alba alkaline lake ca. 15 km south of the Carpathian bending and covers presumably the last glacial cycle in ca. 15 meters. On that basis, we compare the results of VLA and BAK in order to investigate the differences and commonalities in paleoclimatic dynamics between a riverine site (VLA) and a full steppe setting (BAK). Amidst climatic evolution patterns, the geographic location, as well as the geomorphic situations, are considered to have a significant influence on the sedimentation

dynamics as well as processes such as in-situ weathering or pedogenesis. Against this backdrop, the two sections provide valuable information about the formation of LPS under varying topography, potential dust sources and (recent) climate conditions.

Middle Palaeolithic lithic variability in southern Albania: A good time to raise questions

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DOI: 10.18154/RWTH-2019-10563

In the recent years, a number of studies have emphasised the dynamicity of the Middle Palaeolithic period based on research that has focused mostly in Western Europe. This part of the continent is traditionally better explored, but presently a greater focus is directed toward the geographically key region of the Balkans. It is in this larger context that the Middle Palaeolithic of Albania remains rather unknown to the wider circles of archaeology. However, in the recent years a number of surface collections have increased the amount of lithic finds especially from southern Albania. Even though there is so far no chronological control of each particular assemblage, they show interesting features with regard to their lithic composition. The differences presented by these assemblages, raises the need to explore site function, raw materials, synchronicity, diachronicity as the possible reasons for such local adaptations. In addition, such assemblage particularities could become an important indicator in the future not only for Neanderthal adaptations but also for the *Homo sapiens*. The unexpected early presence of the latter has been recently published in an adjacent area at Apidima Cave. Therefore, the identification and correlation of such cultural traits remains not only a question but also a very important future aim and task for early prehistoric research.

Loess and archaeological cultures in Moravia

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DOI: 10.18154/RWTH-2019-10564

Moravia is geomorphologically diverse with the eastern part of Bohemian Massif in the west and Western Carpathians to the east. In between, the Carpathian Foredeep connects the Danube Valley with the North European Plains through a network of river valleys connected by gates (narrow conduits through geographical barriers) across the Danube – Oder watershed.

Preferences for site location show distinct differences over time. The study of settlement preferences of different cultures allowed us to define three basic settlement strategies during the Upper Paleolithic: 1) elevated positions were preferred during the Initial and Early Upper Paleolithic, 2) mid-slope locations above major rivers were preferred during the mid-Upper Paleolithic, and low terraces (ca. 10-15m above the river) were utilized during the Late Upper Paleolithic. The preservation of archaeological remains at open-air sites is strongly contingent on loess cover. In general, loess cover is often absent on elevated positions, some loess is present on mid-slopes but it is affected by slope processes, and little loess cover is present at Late Upper Paleolithic sites (the very end of loess sedimentation). For this reason, Moravia is well known for its well-preserved Gravettian sites, while earlier occupation is less common and only known from several sites (most of the known sites are surface sites with no intact deposits remaining). In addition, artifacts produced from less durable materials (i.e. bones) are rare. Late Upper Paleolithic sites are known only from caves.

Recently, we have developed a technique for systematic landscape surveys using the settlement strategy approach (i.e. a predictive modeling method combining a current site database with computer modeling) that has resulted in the discovery of new Initial and Early Upper Paleolithic sites at the expected (predicted) positions in the landscape. We are now also applying this technique to Late Upper Paleolithic sites. We conclude that in continuing to apply this survey technique, we are able to find new well-preserved sites (i.e. covered by loess in intact positions) – a basic necessity for progress in cultural chronology and environmental studies.

Color-based stratigraphy of loess – application for paleoenvironmental reconstructions from Krems-Wachtberg (MIS3/2)

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DOI: 10.18154/RWTH-2019-10502

Loess-paleosol sequences (LPS) provide essential information on the paleoenvironmental context of archeological sites preserved therein. These terrestrial records form in the complex interplay of sedimentation, pedogenesis, and in many cases slope processes. Detailed stratigraphic descriptions of LPS are a prerequisite to reconstruct past environments from down-profile parameter variations, often simply referred to as proxies (e.g. [bio-]geochemical, magnetic, granulometric, colorimetric). The classification of LPS units usually depends on the conceptual background of the researcher and there exist no standardized stratigraphic terms, which hampers profile comparison, interpretation, and communication.

In the field, colors are the most obvious features of LPS, which suggests their use for stratigraphy. Spectrophotometers quantify color changes objectively and are non-destructive as well as inexpensive. Sprafke (2016) uses quantified color variations to support field documentations, in order to create robust stratigraphic units labelled with pedological designations. This color-based stratigraphy is explicitly descriptive, whereas paleoenvironmental inferences built up on the genetic interpretation of the LPS, which integrates all field and laboratory data.

This approach is applied to the 8 m thick and relatively weakly differentiated LPS Krems-Wachtberg, Lower Austria that formed during 40-20 ka. Infant burials from the main find horizon dating to c. 31 ka make this Late Paleolithic (Gravettien) site unique and well-known. The new color-based stratigraphy uses detailed field documentation and quantitative color data from samples taken in 2.5 cm resolution. The genetic interpretation of all units, supported by published geochronological datasets and further data (partly unpublished) lead to semi-quantitative paleoenvironmental reconstructions and correlations to Central European and Northern hemispheric / global records. The main climatic events of the MIS 3/2 transition recorded in the Greenland ice core records and in the

reference LPS Nussloch are visible in the LPS Krems-Wachtberg, but partly reflect different local effects.

Aknowledgements
Frank Lehmkuhl, Philipp Schulte (both RWTH Aachen), Birgit Terhorst, Simon Meyer-Heintze, Christian Schäfer (all Uni Würzburg), Robert Peticzka (Uni Wien), Thomas Einwögerer, Ulrich Simon, Marc Händel (ÖAW Wien) are thanked for many years of cooperation during this work.

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Dating and provenance of loess by luminescence and ESR

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DOI: 10.18154/RWTH-2019-10425

Natural crystals contain a vast number of point defects, which may be either intrinsic or due to impurities. Some of these defects remain unchanged under ionising radiation bombardment by the omnipresent natural radioactivity, while others are being transformed, generally by charge trapping. Based on the dynamics of these radiation sensitive defects under irradiation, natural minerals such as quartz and feldspars can record the amount of ionising radiation they have been exposed to as a latent signal within their crystal lattice. This signal can be excited and quantified by controlled heating or light exposure, as well as by subjecting the sample to a magnetic and microwave field. As such, quartz or feldspars can be successfully used for dating sediments by thermoluminescence (TL) or optically stimulated luminescence (OSL) well as by electron spin resonance (ESR). As there are many defects available, trapped charge dating methods such as luminescence or ESR are very dynamic research fields, new methodologies being constantly developed. Dating applications rely on the fact that following the deposition and burial of the sediment, when signal resetting occurs, the exposure to natural radioactivity causes a steady increase in luminescence and electron spin resonance signals with time. The assumption on which these methods are based on is that the signal growth in nature can be reproduced by performing controlled laboratory irradiations. The moment to be dated by these methods is the moment of sediment deposition, when the signal used is set to zero by light exposure. As such, loess is an ideal material for the applications of these methods. The time frame of applicability ranges from the recent past to a few hundred ka, depending on the sample, method and measurement protocol used. Moreover, besides dating, these luminescence and electron spin resonance signals have been found recently to be useful for fingerprinting the sources of the sediments and are currently investigated as sediment tracers. In this contribution we will present the basic principles behind these methods and exemplify their use in loess research studies.

A European loess stack and its timing (in progress) in the context of human evolution

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DOI: 10.18154/RWTH-2019-10438

Stacking of paleoclimate and paleoenvironmental data in a stratigraphic framework is a valuable approach for eliminating noise in individual records and extracting a shared pattern. At the same time, stacking may smooth out local differences and features, especially when datasets have a different temporal resolution. Creating a common time scale is prerequisite, although it may not need to be correct in detail (Lisiecki and Raymo, 2005).

For the marine realm (e.g. Karner et al., 2002; Lisiecki and Raymo, 2005) and Asian loess proxies (e.g. Ding et al., 2002; Sun et al., 2006) stacked composite records of paleoclimate evolution exist. These stacks have been very valuable as long, continuous and representative reference datasets. Yet, loess data from continental Europe have been compared only in a qualitative manner (Marković et al., 2015 and references therein).

We aim at placing available magnetic susceptibility data from European loess sites (situated in South-Eastern Europe) on a common stratigraphic age scale and develop a European Loess stack, initially for the past ~500,000 years. In this contribution, we discuss the timescale for the European loess deposits, present results of stacking several datasets, and place this stack in the context of human cultural evolution.

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Abstracts of poster presentations

Just dust? Investigations at the archaeological site of Flintsbach, Lower Bavaria

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DOI: 10.18154/RWTH-2019-10534

Stratified *in situ* sites from Bavaria suggest that leaf points were made by Neanderthals at the very end of the Middle Palaeolithic. However, the majority of the numerous leafpoint sites in southern Germany are only known from surface collections, poorly-documented legacy excavations or are single finds. These circumstances contribute to a poor knowledge concerning the general and internal chronology of the leaf point assemblages and their various accompanying technologies.

The site of Flintsbach, Lower Bavaria, has hitherto only been known as a surface collection. However, current fieldwork at the site by the universities of Cologne and Erlangen revealed the possible preservation of a leaf point bearing find layer within a dense, homogeneous, brownish yellow silt (probably loess). A mandible of *Megaloceros* from the surface collection was dated to a time span between 39506 and 43984 calBP suggesting the possible preservation of organic material within an intact find layer. Still, these dates cannot be connected to the finds unless datable material is found associated with lithic artefacts. Therefore, further fieldwork is planned to reveal datable faunal material within an archaeological context to improve our knowledge on the late Middle Palaeolithic of Southern Germany.

New fieldwork at the open-air loess site Ollersdorf-Heidenberg, Austria

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Luminescence dating challenges in Lower Danubian loess – the Urluia and Vlasca loess-paleosol sequences, Romania

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DOI: 10.18154/RWTH-2019-10418

Paleoenvironmental research often investigates loess-paleosol sequences because they offer presumably quasi-continuous terrestrial records of environmental change. To place the proxy data in a chronological context reliable dating approaches are crucial. Age models can be based on different methods, e.g. correlative approaches or absolute dating approaches. For the Urluia loess-paleosol sequence, which provides a high-resolution record covering the Last Glacial Cycle in the Lower Danube-Black Sea area, correlative and luminescence age models do not agree with each other (Bösken et al., 2018). While the performance of the luminescence data suggests the chronology to be reliable, the radiometric ages for the samples presumably covering the MIS 4-5 interval do not fit the stratigraphic evidence. Ages in the lower half of the section do not increase with depth, which might suggest field saturation. To further explore the possible explanations behind this chronostratigraphic discrepancy, luminescence samples of the Vlasca loess-paleosol sequence, also in the Lower Danube Basin, were investigated. This contribution presents a detailed luminescence dating approach using OSL and pIRIR protocols for quartz, polymineral and feldspar samples. Moreover it will be discussed whether the observed discrepancy between the stratigraphy and the dating results represents a regional pattern or whether intrinsic luminescence properties are responsible.

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Middle Pleniglacial pedogenetic dynamics of the peri-Carpathian zone

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DOI: 10.18154/RWTH-2019-10414

In loess-paleosol sequences (LPSs) the transition from the lower (MIS 4) to the middle Pleniglacial (MIS 3) was accompanied by significant erosion events, as recorded in various terrestrial archives across Central Europe. As a result, potentially existing paleosol horizons of the particular period have been widely erased from the LPSs and only little is known about pedogenesis in this vast area. This study tries to fill this gap in our knowledge through studying three pedo-sedimentary records (Kamenica nad Hronom, Turá and Bíňa) situated along the Hron River in southwest Slovakia, i.e. northwestern edge of the Carpathian Basin. The study sequences represent the most complete pedo-sedimentary record of the MIS 3 within the northern Carpathian Basin, where a high dynamics of erosion during the last Pleniglacial significantly limited sediment accumulation and soil preservation.

The paleoenvironmental development within the studied area is presented and discussed on the basis of soil micromorphology, rock-magnetic and geochemical measurements supported by luminescence dating. Based on the OSL dating of studied profiles, the pedogenesis occurred between 60 and 20 ka (MIS 3 – MIS 2). The most developed paleosol horizons were dated to the early stage of the MIS 3 (60-50 ka) and correlated with the Greenland interstadials GI-17/16, GI-14/13 and/or GI-12 (the northwestern European interstadials Oerel, Glinde and Moershoofd). Another, less intensive phase of pedogenesis occurred ca. 35 ka and probably corresponds to the late MIS 3 intestadials GI-8–5 (Denekamp).

Our observations support the idea that during the middle Pleniglacial the northern rim of the Carpathian Basin was climatically different from the central and southern areas, where the dry to semi-arid conditions prevailing during the

entire MIS 3 resulted in hardly distinguishable differences between loess and initial pedogenic layers. We suggest that the recorded paleosols can be related to the interregional climate differences of the Carpathian Basin: within the northerly located peri-Carpathian zones, a moister climate predominated during the Pleniglacial, in contrast to the drier continental areas to the South. Thus, a sharp climatic transition existed separating a semi-arid steppe region from a climatic zone under the persistent influence of Atlantic air masses.

High resolution paleomagnetic and environmental magnetic data from the last interglacial to glacial transition in a loess-paleosol sequence (LPS) from the Lower Danube (Romania) — Implications for the chronology of the S1 pedocomplex in Eurasian LPSs

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DOI: 10.18154/RWTH-2019-10503

The transition from the last interglacial period (Eemian) to the glacial state (Early Würmian) is well recorded in northern hemispheric continental settings in Greenland Ice Cores (e.g. Dansgaard et al., 1993) and Eurasian lake sediments (e.g. Sirocko et al., 2005). However, from a geographical point of view, these Eurasian lake sediments are unevenly distributed. Nonetheless, in the mid-latitude terrestrial realm loess-paleosol sequences (LPS) represent geographically widespread and occasionally temporally highly resolved archives of Pleistocene paleoclimate and particularly of this paleoclimatically important transition (Zeeden et al., 2018). In order to improve our knowledge about this transition in a region where contrasting ecozones meet, a multi-proxy approach was applied to 216 oriented samples (2 cm spacing, contiguous) covering c. 4 m from the top of the last interglacial paleosol (S1, sensu Marković et al., 2015) into the overlaying loess units. The study site is located in the lower Danube Basin (Romania) on the left bank of the Danube at the village Vlasca in the vicinity of the town of Feteşti. The samples were subjected primarily to paleomagnetic analyses and secondly also to environmental magnetic and colorimetric measurements.

Here we report on a high-resolution study of this LPS from the western end of the Eurasian Steppe Belt, providing valuable records of both the Earth's magnetic field and paleoclimate. To analyze the temporal dynamics of climatic changes at a transition from interglacial to glacial conditions, timing is essential and can be provided by paleomagnetic dating. Paleomagnetic methods allow for dating of sedimentary sequences by employing temporal changes of the paleomagnetic field vector in direction and intensity. Obtained individual records are dated by comparison and correlation to independently dated reference

records. Furthermore, rock magnetic parameters reflect environmental conditions during sedimentation (and diagenesis) of sedimentary successions and provide independent age control via comparison to temporally well-defined paleoclimatic archives.

No obvious directional variation of the paleomagnetic vector could be detected, but a characteristic pattern of highs and lows in relative paleo-intensity (RPI) in the lower half of the sequence and a drop towards the top of the section gives evidence for the presence of a recorded geomagnetic excursion, the so-called post-Blake event (Channell et al., 2009). This feature, dated to 99 – 98 ka, serves as an absolute time marker and forms the backbone for the multi-proxy age model combining the results of environmental magnetism, colorimetric analyses and paleomagnetic data. The achieved age model for the Vlasca section reveals a time interval of c. 110 – 95 ka and put the demise of the S1 pedogenesis largely into the Eemian (marine isotope stage (MIS) 5e). This contradicts the assumption of equivalence of the entire MIS 5 with the S1 pedocomplex, which is a key legacy of loess research since 50 years at least (e.g. Marković et al., 2015).

The Vlasca section provides high- and continuous sediment accumulation with a mean resolution of 39 years per cm. Moreover, clearly expressed millennial-scale oscillations in environmental magnetic parameters can be correlated with Dansgaard-Oeschger cycles, based on their internal structure and average duration of ~1470 years (e.g. Bond et al. 1999).

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Geomorphology and (paleo) loess landscapes in Europe during the last glacial cycle at different spatial and temporal scales

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DOI: 10.18154/RWTH-2019-10493

Loess is widely distributed in Europe. It spreads from the southern limits of the Pleistocene Scandinavian ice sheet to the Mediterranean region and from southern England in Western Europe, through northern France and Poland to the Eastern European Plain. The intermontane basins of the central European low mountain ranges, the valleys of large river systems such as Rhine and Danube and the lowlands of the Middle and Lower Danube Basins and the region north of the Black Sea are equally important loess areas.

Throughout Europe, the thickness of loess deposits varies between some decimeters to several tens of meters. These variations/differences are the results of a complex interplay of geomorphology and paleoenvironmental conditions, controlling accumulation, preservation, pedogenesis, and consequent erosional events. For example, the northern European loess belt preserved the most diversified pedo-sedimentary records, nevertheless these sequences were strongly influenced by periglacial environments and thus have a complex stratigraphy including erosional unconformities. However, loess in southeastern Europe is mainly distributed on broad loess plateaus, in particular in the Middle and Lower Danube Basins and north of the Black Sea. Due the absence of periglacial features and their plateau setting, these loess-paleosol sequences have a simpler stratigraphy and are some of the thickest and most complete terrestrial archives of Quaternary paleoclimate in Europe.

Finally, a new map of the distribution of loess in Europe is presented. Spatial data of the geology, geomorphology and the soil properties from 20 different countries were assembled in order to create a seamless map. Additionally, we discuss the depositional settings throughout the European continent, regarding the topography, the distance to potential source areas as well as (paleo-) climatic patterns. Therefore, we also included the fluvial deposits of large rivers from the last glacial cycle as potential dust sources; this area covers about 700.000 km². Further, we examine the influence of (local) topography on sediment deposition using the intersection of loess distribution and elevation data as well as on exemplary loess-paleosol sequences from the Lower Danube using marker horizons such as the Campanian Ignimbrite tephra.

Stable isotopes in loess-paleosol-sequences from the Carpathian Basin – methodological challenges and paleoenvironmental implications

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DOI: 10.18154/RWTH-2019-10432

The loess-paleosol-sequences of the Carpathian basin play a crucial role in understanding the palaeoclimatic evolution of this complex landscape. Among other proxies, stable organic carbon and bulk nitrogen isotopes can be used to interpret past vegetation patterns and qualities of ecosystems, respectively. Here, we present these proxies for two loess-paleosol-sequences from the southern Carpathian Basin, in order to reconstruct the paleoclimatic commonalities and differences between the two sites. To ensure the reliability of our results, we conducted methodological tests concerning the complete decalcification of the samples prior to stable isotope analyses. Since residual carbonate distorts the carbon stable isotope signal of a sample towards enriched values, complete carbonate removal is crucial to obtain the “true” organic carbon stable isotope composition. We tested two different decalcification methods, direct treatment in pre-weighted tin boats and wet chemical acidification, as well as different treatment times for the latter method. Additionally, we performed a reproducibility test on selected samples with low TOC content to estimate the uncertainty of measured organic carbon stable isotope values of those samples. We suggest methodological tests prior to stable isotope studies, in order to obtain reliable results. Besides the methodological advances of our study, the stable carbon isotopes show no indicators for C4-vegetation in the southern Carpathian Basin. Striking conformities in the development of the stable nitrogen isotope records between the investigated sites bear potential for further, more detailed studies.

Reconstruction of dust provenances and environmental conditions from 70-12.5 ka by a combined analysis of geochemical elements and heavy minerals from Dehner dry maar (De3-core; Germany)

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DOI: 10.18154/RWTH-2019-10500

The study presents the results of a combined analysis of heavy minerals, X-ray fluorescence analysis of bulk samples, and grain size analysis from a 84 m long core section of the Dehner dry maar (Eifel, West Eifel Volcanic Field). The core section (De3) ranges from 3 to 87 m depth and encompasses lacustrine sediments which have been supplied by aeolian activity during a period from 12,500 b2k to about 70,000 b2k (Sirocko et al, 2016).
The analysis enabled the distinction of different provenance areas of aeolian material. Local sources are indicated in the content of clinopyroxene and sphene which are supplied mostly from pyroclastic material in the nearer surroundings of the Dehner dry maar. Particularly during the LGM the limestone basins of the Eifeler North-South Zone in the east of the Dehner dry maar represented further local source area (Römer et al., 2016). During this period easterly winds transported carbonate particles to the Dehner dry maar. Zircon, tourmaline and rutile suite minerals (ZRT) indicate regional source areas and were supplied by westerly winds from clastic sedimentary basement rocks of the Eifel, whilst epidote suite minerals and green amphiboles are documenting more remote source areas in the west.
The distribution of heavy minerals (HM) shows a close correspondence particularly to trace elements and heavy metals, not affected by redox transformations. Trace elements such as zirconium are closely associated with HM characterizing regional and more remote dust sources. Heavy metals such as nickel and copper, on the other hand, are mostly associated with clinopyroxene and dark micas (phlogopite, biotite) indicating a supply of pyroclastic material from the nearer surroundings of the Dehner dry maar. The downhole distribution of the heavy minerals (HM) and geochemical elements displays similarities with the “Landscape Evolution Zones” of Sirocko et al.

(2016), with a striking correspondence from the transition of the MIS 3 to the MIS 2 onwards to the LGM. With respect to dust transport, the close parallelism between the Grains Size Index (GSI) after Antoine, et al. (2009), the content of ZRT and epidote and green amphibole group minerals tends to reflect the transporting power of aeolian processes and the availability of deflatable material in the different source areas. This supports the distinction of phases of dust transport/deposition, whilst the increasing degree of mixing of heavy minerals from different source areas during the LGM at times of decreasing GSI suggests the development of a presumably incomplete blanket of
reworked loessic sediments the Eifel. In contrast to the analysis of the HM assemblage geochemical analysis of bulk samples provides further insights on the environmental conditions as several elements reacted on redox conditions in the maar lake. Changes in the concentration of these elements provide a link to environmental and climate reconstruction. The combined analysis of HM, geochemical elements, and grain-size on the other hand, improves the reconstruction of environmental conditions and supports issues related to provenance analyses. The study implies that it may be also possible to determine provenance sensitive geochemical elements. Whilst HM analysis is more sensitive in provenance studies than geochemical element analysis the combined analysis of HM and geochemical elements provides a more comprehensive view on the environmental and climatic conditions.

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Paleoenvironmental analysis of Nowolesie gully sediments (Strzelin Hills, SW Poland)

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DOI: 10.18154/RWTH-2019-10434

Reconstructions of Early Neolithic relief evolution in loess regions in SW Poland are well described only by archeologists and historians. Studies on transformations of the relief under the influence of human activity following neolithization in the Polish territories largely ignore the area of Lower Silesia. Our study aims at complementing research thereby studying special geo-archives: Created landforms and sediments containing fossil soils constitute a spatio-temporal record of the relief transformations due to anthropogenic land use along with local climate changes.

The research was carried out in the loess areas of the Sudeten Foreland where they occur as isolated patches – with particular reference to the Strzelin Hills. This region is characterized by the occurrence of longitudinal stretches of hills whose highest elevations exceed 300 m a.s.l. The bedrock is made of gneisses, quartzite and mica schists, marbles, and amphibolites. However, the most important element of the geological structure in terms of the agricultural settlement is loess and associated fertile soils, which largely cover the slopes and feet of the hills. The study area features a relatively continuous loess cover with a considerable thickness of on average 3-6 m and a set of typical landforms, of which the most spectacular element are gullies. A specific area of interest includes a gully located near the village of Nowolesie (λ17.05 E/φ50.71 N) on the western slope of the Strzelin Hills.

Analysis were carried out in the laboratory of ground science at the University of Wroclaw and include grain size analysis of sediments (laser diffractometry, Mastersizer 2000), measurement of carbon content (Turin method), measurement of the content of geogenic as well as heavy metals in samples (Cu, Pb, Zn, Cd, and Fe by AAS). In cooperation with the Silesian University of Technology, sediments were dated (radiocarbon and OSL methods).

A high-resolution ^{14}C dated chronology and Mollusc-based paleoclimatological signals from the thickest and best resolved loess/paleosol record of the LGM in the Carpathian Basin

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DOI: 10.18154/RWTH-2019-10499

The Madaras brickyard profile found at the northernmost fringe of the Bácska loess plateau is one of the thickest and best developed last glacial loess sequences of Central Europe. According to initial ^{14}C and paleontological (quartermalacological) dates, the 10 m profile corresponds to a period between 29 and 12 ky cal BP (MIS 1 & 2). In order to tackle signs of small scale centennial climatic fluctuations at our site, recorded in the NGRIP Greenland ice core and marine cores from the Northern Atlantic, the construction of an independent high resolution time-scale is needed. In our work 5 age-depth models have been constructed relying on 32 ^{14}C (AMS) dates using various statistical and probabilistic approaches. The best model was chosen to reconstruct an acceptable time-scale and calculate sedimentation rates for the profile. Based on our findings, sampling at 2 cm intervals thus yielded a resolution of ca. centennial scale even when uncertainty related to measurement and calibration error is considered. Calculated average sedimentation rates were 4 times higher than previously reported. The peak accumulation periods are dated to the nadir of the LGM and to the time of rapid climate changes recorded in the referred international paleoclimatic records (Heinrich Events 1-2). 24 species and 110 506 specimens of molluscs were collected and identified from 250 samples of the loess profile at Madaras in the southern part of the Carpathian Basin. Changes in the Quaternary malacofauna observed within the brickyard loess wall at Madaras suggest a number of dynamic climatic and local environmental changes in the Bácska loess area during the Middle and Upper Pleniglacial periods. Thermophilous immigrant forms from the Balkans (e.g. *Granaria frumentum*) also intruded into the central parts of the Great Hungarian Plain, corresponding to their northernmost distribution boundary for this period. On the other hand, due to its relatively low topography, this region is geographically

open towards the south, likely enabling the rapid expansion of thermophilous elements into the area from refugia located along the northern margin of the Balkans (e.g. from southern part of the Fruska Gora Hills) during the interstadials and terminal phase of the Middle Pleniglacial. Therefore, the malacological-based data suggests that this site represents as a paleobiogeograpical fluctuation unit during the last phase of the Ice Age.

The research were supported by the European Union and the State of Hungary, co-financed by the European Regional Development Fund in the project of GINOP-2.3.2-15-2016-00009 'ICER and the grant TÁMOP-4.2.1.C-14/1/KONV-2015-0013 courtesy of the National Excellene Program of the Hungarian Government and co-financed by the EU.

Mind the Gap
The Westphalian Basin within the context of the resettlement of Europe after the LGM

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DOI: 10.18154/RWTH-2019-10565

The Westphalian Basin lacks evidence of human presence during the Late Upper Palaeolithic (c. 18-14 ka cal BP), which stands in clear contrast to its neighboring regions. To the North, the Hamburgian is present from c. 15 ka cal BP, while the Magdalenian is well known from the Rhine-Meuse and the Elbe-Saale area from around 16 ka cal BP.

The existence of this “No Man’s Land” between the Magdalenian and Hamburgian settlement zones has been argued before but the different factors, which might have led to this situation have never been critically evaluated. Using data from the two bordering Magdalenian settlement zones (Rhine-Meuse & Elbe-Saale), GIS-based predictive archaeological modeling will be applied to investigate the potential for a Magdalenian occupation in Westphalia according to the topographic and economic conditions. It will then be possible to compare the suitability of the region with the inhabited areas and to answer the question if Magdalenian hunter-gatherers avoided the Westphalian Basin because it was less attractive for them then the surrounding regions.

Other factors may also be responsible for the fact that no sites from this time period could be found in Westphalia. Therefore, the occurrence of post-sedimentary processes like modern land use, sedimentation/erosion and activity of avocational collectors in each region will be evaluated and then compared with the predictive archaeological model. These source-filters may dramatically influence site-visibility and skew the archaeological record in the region. By comparison of both settlement pattern analysis and source-filtering we hope to be able to provide better models for explaining the archaeological record visible today.

Middle Palaeolithic of the Dniester: Levallois at Neporotovo 7

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DOI: 10.18154/RWTH-2019-10566

The most famous Levallois sites in the valley of the Middle Dniester are Molodova I and V. In 2012, a new multi-layered site, Neporotovo 7, was discovered, which allows to clarify the chronology of the emergence and presence of Levallois industries in this region.

The site Neporotovo 7 is located on the 50–60m terrace of the right bank of the Dniester River. In a more than 10m thick loess-paleosol sequence dating from MIS 3 to MIS 6, three Middle Palaeolithic archaeological horizons (AH 7, AH 3a, and AH 3) can be attributed to the so-called Molodovo variant of Levallois.

The Molodovo variant of Levallois represents, in contrast to classical centripetal Levallois, a specific system of preparation of the Levallois cores by the combination of unidirectional or convergent removals along with supplementary scars oriented from the lateral and distal platforms. Lateral and bilateral preparation of cores occurs frequently as well. There are rare and occasional triangle blanks similar to "Levallois points".

The collection of Neporotovo 7 - AH 7 (MIS 6) is characterized by the Molodovo variant of Levallois reduction, as is evident from samples of cores and blanks (flakes and blades) with convergent-sub-crossed, unidirectional-sub-crossed, unidirectional-lateral, and other combinations of scar patterns. Levallois cores frequently were reduced from the two sides. Non-Levallois reduction strategies are represented by unidirectional, orthogonal and convergent reduction.

AH 3a (MIS 5b) is represented by a small number of artifacts. Both non-Levallois and Levallois reduction strategies have been identified in this assemblage. Unidirectional, bidirectional, radial and crossed cores demonstrate non-Levallois primary knapping. At the same time some cores have preparation features characteristic for the Molodovo type of Levallois: unidirectional removals, which come from the main platform, are combined with supplementary removals from the lateral and distal platforms. We do not exclude that these samples could be determined as "Levallois cores in a stage

of repreparation". Faceted platforms of blanks support the conclusion about the Levallois nature of this archaeological assemblage.

AH 3 (MIS 5a) includes cores and blanks, which were produced by Levallois and non-Levallois reduction strategies. Among the non-Levallois objects the most representative are cores and blanks with unidirectional, bidirectional, crossed and sub-crossed scar patterns. Levallois cores have sub-crossed, convergent-lateral and unidirectional-distal preparation of their upper surface. With the exception of one unusual triangle-shaped Levallois radial core, all other Levallois cores have rectangle/sub-rectangle shape with prominent supplementary lateral/distal platforms.

In all archaeological assemblages discussed here, tools are not numerous and often presented by simple side-scrapers, retouched flakes/blades, and denticulates.

All three AHs of Neporotovo 7 (AH 7, AH 3a, and AH 3) have definite features of Levallois reduction strategy. At the same time, the Levallois ratio in each AH is different. In AH 3 and AH 3a there are examples of parallel reduction, which are quite similar to the Upper Palaeolithic volumetric types (sub-cylindrical/cylindrical).

The Levallois assemblage of AH 7 is technologically identical to the assemblages of the sites Molodova I and V as well as Ketrossy. The stratigraphic position Neporotovo 7 - AH 7 indicates that this Levallois industry of Molodovo variant currently is the earliest in Eastern Europe.

State-of-the-art overview of the Löss-Paleolithic of Poland

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DOI: 10.18154/RWTH-2019-10567

In Poland, loess occurs in the southern part of the country in the highlands, on the northern foreland of the Sudetes and the Carpathians. Most of these sediments come from the time of the last glaciation - Vistulian. Thin covers of loess from the penultimate glaciation have been preserved in Upper Silesia. Only a few sites from the middle Paleolithic remain in the loess. Of particular importance are the sequences from Piekary and Kraków-Zwierzyniec in the upper Vistula river basin. The important loess sites from the Upper Paleolithic are Kraków-Spadzista. A layer of solifluction was found here. An important loess site with a long history of research is Góra Puławska, where the Aurignatian camp was recognized a hundred years ago.

The discoveries of the Mikokian knives (*Keilmessergruppen*) workshop in Upper Silesia in Pietraszyn are very important, as well as the other recent discovery of the Szeletian Culture in Lubotyń. They lie in thin, heavily reduced loess.

In the eastern part (Lesser Poland) loess creates several-meter profiles. New discoveries in this zone represent the cultural sequence from the transition from the middle to upper Paleolithic documented for Kraków-Książe Józef street. One of the recently positively verified Upper Paleolithic loess sites is Jaksice on the bank of the Vistula. This overview shows a large grouping of sites in and around Kraków. The evaluation of this phenomenon must be careful. In fact, the area around this city is covered with loess. But some specific factors influenced the concentration of the Middle and Upper Paleolithic settlements, both cave and loess open sites. Not only the presence of loess as a deposit documenting Paleolithic settlements is responsible for this concentration. Other factors include rich deposits of flints, numerous caves and exposed locations on the riverside hills, as well as the activity of a nearby university center, must be taken into consideration.

Disentangling millennial-scale climate variability in south-eastern European loess-paleosol sequences

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DOI: 10.18154/RWTH-2019-10436

Owing to the nature of their formation, loess-paleosol sequences are valuable terrestrial archives in investigating past variability in the long-term global dust dynamics. As the primary constituent of loess and a major component of global climate forcing, mineral dust serves as a proxy that allows for direct comparison of loess data with chronologically better resolved ice and lacustrine records. Motivated by the recent emergence of high-resolution magnetic and sedimentological data on Lower Danube loess-paleosol profiles, we explore advances and drawbacks in comparing regional paleoenvironmental response to millennial-scale climate variability during last glacial cycle. We show that the Lower Danube loess preserves a convincing record of millennial-scale variability that resembles the Greenland interstadials/stadial variability. In order to explore regional patterns of change, we also focus in comparing loess records with better-established lacustrine and marine records from southeastern Europe. As reliable chronological control is still the major limiting factor in exploring the full paleoclimate potential of loess records, we also discuss regional implications in defining an improved loess chronostratigraphic framework based on several lines of chronological evidence, including tephrochronology.

Production system of shaping tools in the late Middle Palaeolithic: the case of the Micoquian workshop from SW Poland

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DOI: 10.18154/RWTH-2019-10569

Shaping tools in Central Europe are well-known from the late Middle Palaeolithic assemblages attributed to Micoquian or Keilmessergruppe/Prądnik cycle. However, the reconstruction of production methods and operational chain concerning shaping tools is hindered due to lack of workshops. The aim of this paper is to present results of the study on remains of the Micoquian workshop Pietraszyn 49a which has been recovered in 2012 in SW Poland. Conducted research comprise morphometric analysis of waste material, refits of tools and their pre-forms, reconstruction of production stages using 3D models, experimental replication as well as microscopic examination of technological traces. This work has been financially supported by Polish National Centre of Science (no project 2017/25/B/HS3/00925).

It was observed that the manufacture was preceded by the selection of flat nodules or chunks of erratic flints. During the tool shaping mineral and organic hammers were used. Approximately 40 bifacial tools were prepared at the site. Although it seems that the manufacture of tools was not governed by rigid rules, several "imperatives" were present. One of the most important steps was the separation of the active part consisting of working edge, sometimes in relation with a tip. Another important working step was the creation or separation of a passive or prehensile part, consisting of a base and a back.

The refitting study of lithics lead us to the conclusion that the production resulted in individualized forms, among which plano-convex specimens predominate. Shaping processes had different dynamics, depending on volume and quality of raw material as well as the specific part of the tool. It seems that the shaping of the flat side of the tools costed less effort and time than the shaping of the convex sides of tools. During the reduction phase, humans produced many flakes and sometimes blades. They have sporadically been used as blanks for expedient tools. It is worth mentioning that the site hasn’t provided any traces

of core reduction. It seems that the production of bifacial tools could have been a part of logistic systems of hominins related to hunting strategies and food extraction.

Living in the wind: Upper Pleistocene loess and human peopling in the Po Plain (Northern Italy)

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DOI: 10.18154/RWTH-2019-10498

Upper Pleistocene (MIS 4–2) loess sequences occur in most of continental Europe and in Northern Italy along the Po Plain Loess Basin. Loess outcrops are common along the flanks of the Po Plain and along the shorelines of the Adriatic Sea. Wind-blown deposits accumulated on top of glacial deposits, fluvial terraces, uplifted isolated hills, karst plateaus, slopes, basin of secondary valleys, and in a few cases inside rockshelters. Loess bodies are generally thin and affected by pedogenesis; in a few cases, deposits are slightly reworked by slope processes and bioturbation (including human-induces pedoturbation). Notwithstanding, loess in the Po Plain is an important archive of paleoenvironmental record providing crucial information on the Upper Pleistocene environmental setting of the region. Along some loess-palaeosoil sequences, investigated from a geochronological and pedological point of view, frequentation by Mousterian Neanderthal groups is attested. Archaeological findings, compared with those from rock shelters, confirm the sporadic frequentation of marginal open areas during the cold/arid and highly fluctuating climate of the MIS 3, providing a more complete picture of the human occupation, mobility, and exploitation of natural resources of Northern Italy.

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Acknowledgements

We thank all the sponsor for their financial support and for promoting this workshop. Moreover, we thank the reviewers for their suggestions on the abstracts. We acknowledge Ulrike Kerstin and Mirjam Utz from the University of Cologne for producing the conference banner and title cover. We thank Dr. Shumon T. Hussain for supervising this and for advertizing the workshop in social media. We are grateful for the help of the staff of the RWTH Gästehaus, the Katholische Hochschulgemeinde, and Monis Stehcafé in organizing this nice meeting. Finally, we thank Anja Knops without whom nothing would be running smoothly at the PGG department and Dr. Mescherowsky for her support in publishing this abstract book.