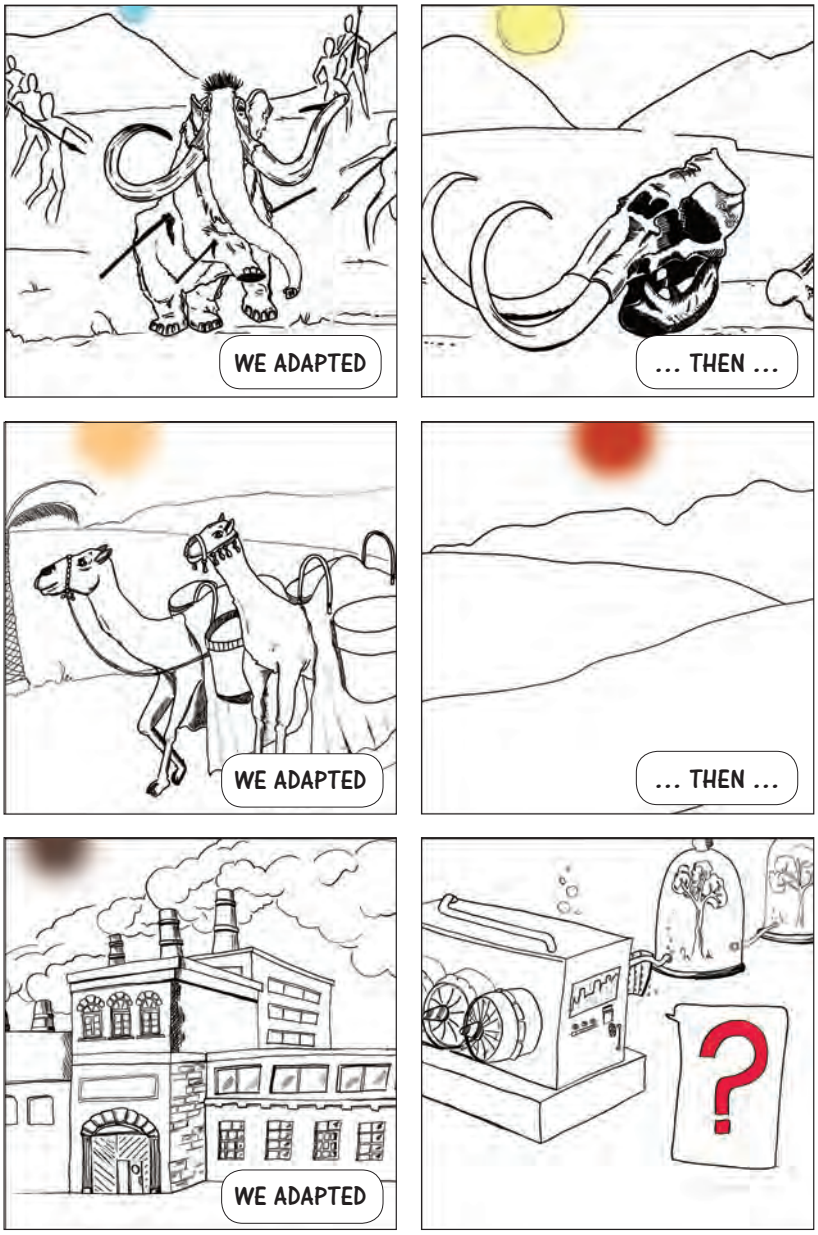
SERBIAN ACADEMY OF SCIENCES AND ARTS

EURASIAN ENVIRONMENTAL DYNAMICS AND HUMANS: INTERACTIONS OVER DIFFERENT TIME SCALES



ДИНАМИКА ЖИВОТНЕ СРЕДИНЕ И ЉУДИ НА ПРОСТОРУ ЕВРОАЗИЈЕ: ИНТЕРАКЦИЈЕ У РАЗЛИЧИТИМ ВРЕМЕНСКИМ ПЕРИОДИМА

27–29th JUNE 2019, BELGRADE

EED&H

EURASIAN ENVIRONMENTAL DYNAMICS AND HUMANS: INTERACTIONS OVER DIFFERENT TIME SCALES

Belgrade, 27-29 June 2019

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PROGRAM

Thursday, 27th June, Hall 2, 1st floor

17.00–19.00 Kick off meeting of LEADER network initiative
19.00–20.00 Icebreaker Party at SASA Club, Mezzanine
19.00–20.00 Registration

Friday, 28th June, SASA Grand Hall, 2nd floor

9.00 Registration
9.30–9.45 OPENING ADDRESSES
Academician Vladimir S. Kostić, President of SASA
Slobodan B. Marković corresponding member of SASA, President of the Conference Scientific Committee

Plenary Session 1
Chair persons: Frank Lehmkuhl, Binggui Cai and Slobodan B. Marković

10.00–10.30 **Jef Vandenberghe et al.**,
Specific External Impact on Fluvial Evoulution: The Last Glacial Tisa Catchment in Hungary and Serbia
10.30–11.00 **Frank Lehmhuhl et al.**,
Landscapes and paleolandscapes in SE Europe during the last glacial cycle and their relevance for human habitats and dispersals of anatomically modern humans

11.00–11.30 Coffee break

11.30–12.00 **Jef Vandenberghe & Slobodan B. Marković with Thomas Stevens**,
The geo(morpho)logical eveolution of the Petrovaradin historical site at Novi Sad during the last ice age

12.00–12.30 **Binggui Cai et al.**,
Multi-decadal variability of Eastern Asian Summer Monsoon during 2.8 ka cold event and its responding to solar activity and Greenland climate

12.30–14.00 Lunch break

LEADER Session 1

Chair persons: Xinbo Gao, Amin Ghafarpou, Anca Avram and Milica Radaković

14.00–14.20 **Amin Ghafarpou et al.**,
Iron oxide characterization of loess-paleosol samples with diffuse reflectance spectrophotometry: Initial insights into magnetic enhancement mechanism in northern Iranian loess-paleosol sequences

14.30–14.50 **Aleksandar Antić et al.**,
Promoting paleontological heritage of mammoths in Serbia through a cross-country thematic route: evalution and potentials

15.00–15.20 **Jacek Skurzynski et al.**,
Geoshemistry of loess: Eurasian deposits compared

15.30–15.50 **Long Han et al.**,
Geochemical evidence for the diversity of provenance of loess in southern China

16.00–16.30 Coffee break

POSTER Sessions

Chair persons: Janine Bösken, Shuzhen Peng and Slobodan B. Marković

16.30–19.00 **Poster sessions** – guided tour, each author has 5-7 minutes to provide main information about the poster, SASA Club, Mezzanine

20.00–22.00 Conference dinner, Hotel Palace

Saturday, 29th June, SASA Grand Hall, 2nd floor

Plenary Session 2

Chair persons: Jef Vandenberghe and Gyorgy Sipos

9.30–10.00 **Gyorgy Sipos et al.**,
Specific Late Pleistocene and Holocene aeolian activity in the Pannonian Basin, environmental and human perspectives

LEADER Session 2

Chair persons: Viorica Tecsa, Xiaofang Huang, Yongda Wang and Aleksandar Antić

10.00–10.20 **Ximbo Gao et al.**,
The different climatic response of pedogenic hematite and ferrimagnetic minerals: Evidence from particle-sized modern soils over the Chinese Loess Plateau

10.20–10.40 **Milica Radaković et al.**,
Quantitative relationships between climate and magnetic susceptibility of soils on the Bačka Loess Plateau (Vojvodina, Serbia)

10.40–11.00 **Zoran Perić et al.**,
A post IR IRSL chronology of the Nosak loess-paleosol sequence in NW Serbia

11.00–11.30 Coffee break

BOOK OF ABSTRACTS

EED&H

Specific External Impact on Fluvial Lowland Evolution: The Last Glacial Tisa Catchment in Hungary and Serbia

J. Vandenberghe[1,2], C. Kasse[1], D. Popov[2], S. Markovic[2], D. Vandenberghe[3], S. Bohncke[1] and G. Gabris[4]

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External impact on the development of fluvial systems is generally exerted by changes in sea level, climate and tectonic movements. Here, it is shown that a regional to local differentiation of fluvial response may be caused by semi-direct effects of climate change and tectonic movement; for example, vegetation cover, frozen soil, snow cover and longitudinal gradient. Such semi-direct effects may be responsible for specific fluvial activity resulting in specific drainage patterns, sedimentation series and erosion–accumulation rates. These conclusions are exemplified by the fluvial archives of the Tisa catchment in the Pannonian Basin in Hungary and Serbia from the middle of the last glacial to the Pleistocene–Holocene transition. Previous investigations in that catchment are supplemented by new geomorphological–sedimentological data and OSL-dating. Specific characteristics of this catchment in comparison with other regions are the preponderance of meandering systems during the last glacial and the presence of very large meanders in given time intervals.

Landscapes and paleolandscapes in south-eastern Europe during the last glacial cycle and their relevance for human habitats and dispersal of anatomically modern humans

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Pleistocene landscape dynamics affect environmental conditions, and may have had a major impact on the habitats of anatomically modern humans (AMH). In this contribution, reconstructions of modern and late Pleistocene environments are presented and discussed following a series of transects from the Carpathian Basin to the Black Sea. These transects include geomorphological features and landscapes such as the distribution of dune fields, alluvial plains, and especially loess in the lowlands up to the paleoglaciers of the Carpathian Mountains. We understand such transects as tools for data visualization over a wider region, following a west-east direction and a (paleo)climatic gradient. As data visualization, the presented landscape model must extrapolate on existing data, and is therefore partly artistic by its nature. In the West, the Carpathian Basin and its landscape mosaic (loess, alluvial plains, terraces, and dune fields) are visualized, followed towards the East by the Danube gorges cutting through the Carpathian Mountains, including the foothills west and east of Iron Gates. East of the Carpathians, in the Lower Danube area, the alluvial plains and terraces of the Danube and its tributaries are currently the dominating features of the landscape. However, north and south of the Lower Danube plain, the Carpathian and Balkan mountain ranges present a different environment, which is of major importance for a better understanding of more recent environmental changes and the related landscape evolution. During the last glacial cycle, this dependence may have been even more important, especially through strong seasonality of rainfall and therefore of glacial meltwater runoff, that had an impact on discharge rates of the main river systems in the region.

With the data visualisation algorithm employed, the landscape evolution model extrapolates on existing information and brings forward novel insights, being therefore rather innovative in nature. Moreover, results from ongoing sedimentological and paleoclimatic research on several important sites in the Carpathian Basin and the Lower Danube area are presented. In addition, an upland-lowland environmental

model highlighting the most important paleoclimatic and habitational constraints for successful peopling of this region by AMH during the Late Pleistocene (i.e. water availability, food availability, biodiversity, raw material availability) is further proposed. We suggest that the foothills of the mountain ranges in the Carpathian Basin were preferred habitats for AMH during their arrival and dispersal in south-eastern Europe. This Aurignacian land-use model (Hauck et al., 2018) describes the interaction of early modern humans with their environment. One important parameter is the specific distribution of archaeological sites that exemplifies their boundedness to specific eco-zones.

Hauck, T.C., Lehmkuhl, F., Zeeden, C., Bösken, J., Thiemann, A., Richter, J. (2018): The Aurignacian way of life: Contextualizing early modern human adaptation in the Carpathian Basin. Quaternary International 485:150-166

The geo(morpho)logical evolution of the Petrovaradin historical site at Novi Sad during the last ice age.

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The fortress of Petrovaradin is situated on a Danube terrace with the top of the bedrock at c. +123 m. Terraces occur at levels of +90-100 m, +120-130 m, +145-150 m, 195-200 m and 220-230 m. Consequently, we propose that the surface on which the fortress has been built belongs to the 120-130 m terrace.

Below the constructional material of the fortress building, a section of 1,90 m of undisturbed fine-sandy silt with dispersed pebbles was exposed. It overlies the solid bedrock that served as the fundament for the fortress. The grain-size distribution of the section shows a general similarity with typical primary (air fall) loess in Vojvodina. The main constituent is the silt fraction that largely exceeds the clay and sand fractions. The main differences between the sediments at this section and primary (air fall) loess are the substantially higher sand content at Petrovaradin, the slightly, but significantly, lower clay content, a poorer sorting, and a modal size that is generally slightly coarser than in most primary loess. Locally, oblique lamination and dispersed gravel and gravel strings occur. The obvious deviations from an original loess point to transport by running water of that original loess sediment which is typical for floodplain deposits. The reworked character is most clearly expressed in the lower part of the section (1,40-1,90 m), while the upper part (0-1,40 m) has better retained the original loess properties. The deposition process was at times interrupted by (embryonic) soil development, which indicates periods of morphological stability. The age of the terrace is determined by luminescence analysis (OSL) from 7 samples pointing to an age of 26 to 43 ka (with 2 outliers) for the upper 1,40 m of the section.

As terraces commonly formed in cold periods, the lowest step in the Pleistocene terrace staircase at Petrovaradin (+ 90-100 m) dates from the last cold period (~MIS 2). The derived incision rate of the Danube (now at +77-79 m) since that time is c. 0,75 mm/a (15 m in c. 20 000 years). On the basis of the OSL-dating we propose that the terrace on which the Petrovaradin fortress has been constructed should have been abandoned at least before 43 ka, i.e. during the previous cold period (~MIS 4). The derived incision rate of the Danube since it abandoned the terrace at c. 60000 years ago is c. 0,73 mm per year (43,5m over 60000 years). It is assumed that the Danube incised at a rate that was equal to the land uplift.

Multi-decadal variability of Eastern Asian Summer Monsoon during 2.8 ka cold event and its responding to solar activity and Greenland climate

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Introduction: The 2.8 ka cold event in EASM domain

The 2.8 ka cold event is one of well known abruptly climate events during the late Holocene (Bond et al.,2001). Previous documents shown weak Eastern Asian Summer Monsoon (EASM) (Wang et al., 2005) and less precipitation in the northern margin of EASM area during 2.8 ka event. The forcing of this event has been pointed to Solar activity (Wang et al., 2005), but the detail forcing mechanism is still unclear. Considering the significantly negative excursion of solar activity during 2.8 ka, high resolution record of EASM with well age constraining is helpful for us to better understand this mechanism.

Evidence from stalagmite isotope record from Northeastern China

In this study, stalagmites MD11 and MD12 from Miaodong (41°03´N, 125°31´E), Northeastern China were analyzed. The Miaodong stalagmite oxygen isotope sequence covering 3.04~2.60 ka B.P. , constrained by 7 high precise ^{230}Th ages, was built. The variability of Miaodong stalagmite oxygen isotope is interpreted as change of EASM intensity or monsoon precipitation in this area. Based on these ages with low errors (two sigma, 18 to 23 years), the Miaodong record give a detail evolution of EASM and precise transfer time of 2.8 ka event. From 2.88 ka B.P. to 2.62 ka B.P., the Miaodong record exhibits two weak EASM intervals, 2.81~2.87 ka B.P. and 2.76~2.66 ka B.P. respectively. The later one covering about 100 year is the key period of 2.8 ka event, and exhibits an symmetrical shifting processes. EASM abruptly decrease at around 2.76 ka B.P., and reached its worst state at about 2.68 ka B.P., following by an abruptly strengthening process. This transfer point (2.68 ka B.P.) is little younger than those stalagmite records from southwesten China (ca. 2.71 ka B.P., Wang et al., 2005), but coincides with Solar Activity Index well. In general, the evolution of EASM indicated by Miaodong record coincides with those of total solar irradiance (ΔTSI) (Steinhilber F et al, 2012) with any delay, indicating solar activity forcing via a fast dynamic mechanism. Unlike with southeastern records which shows gradually decrease of EASM from about 2.88 kaB.P. until ca. 2.71 ka B.P. and abruptly increase

from then on, the instantaneously response of Miaodong record to ΔTSI without any delay indicates that the decrease of TSI (Steinhilber F et al, 2012) maybe result in intense cold climate over North Atlantic Ocean (Bond et al.,2001) and high latitude area of North hemisphere (Grootes, 1993), and then decrease the EASM via atmospheric remote-correlation.

Bond G, Kromer B, Beer J, et al (2001) Persistent solar influence on North Atlantic climate during the Holocene[J]. Science 294(5549): 2130-2136.

Wang Y J, Cheng H, Edwards R L, et al (2005) The Holocene Asian monsoon: Links to solar changes and North Atlantic climate. Science 308 (5723): 854-857.

Steinhilber F, Abreu J A, Beer J, et al (2012) 9400 years of cosmic radiation and solar activity from ice cores and tree rings. Proceedings of the National Academy of Sciences of the United States of America 109 (16): 5967-5971

Grootes P M et al (1993). Comparison of oxygen isotope records from the GISP2 and GRIP Greenland ice cores. Nature 366: 552-554.

Iron oxide characterization of loess-paleosol samples with diffuse reflectance spectrophotometry: Initial insights into magnetic enhancement mechanism in northern Iranian loess-paleosol sequences

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Introduction:

Loess sediment in the mid-latitude of Eurasia provides an excellent sedimentary archive for understanding the past climate and environment changes in the continental interior. North Iran is a key site that connects European and Asian loess zones. At present, diffuse reflectance spectrophotometry (DRS) is a useful qualitative technique for identifying Iron oxides in loess-paleosol sequences. Balsam and Deaton (1991) demonstrated that the position of peaks and valleys on the first derivative of the spectral curves are indicative of sediment composition and mineralogy. Our research on the two Late Quaternary loess-paleosol sequence at Mobarakabad and Aghband in northern Iran, focusing on testing the feasibility of DRS for identifying iron oxides (hematite (Hm), goethite (Gt), and maghemite (Magh)) of the samples. The detailed micromorphology, mineralogical analysis, and multi-proxy indices records of the sections previously presented in Ghafarpour et al. (2016).

Results and discussion:

Our DRS data confirm that Hm produces a very distinctive first derivative peak at 565 nm. Goethite has two first derivative peaks, one at 535 nm and the other at 435 nm. The first-derivative peak at 595 indicates the presence of Magh. The results of DRS indicate Hm/ Gt and Magh/Hm exhibit a significant positive correlation with magnetic susceptibility (MS).Also, Hm/ Gt and Magh/Hm have a significant positive correlation with %Red/Green (r^2=0.94), however a negative correlation with %Reflectance (r^2=0.89). However, MS has a negative correlation with Gt/(Hm+Magh). Our work therefore supports previous findings that Magh/Hm ratio differs between the loess and soil samples (Vandenberghe et al., 1998) and also that the Hm/Gt ratio serves as a sensitive dry/wet indicator in loess section (Ji et al., 2004). In addition, in agreement with Liu et al. (2007) the ratio of the concentration of maghemite-magnetite to Hm is superior to low-field magnetic susceptibility alone for estimating paleoprecipitation. Factor analysis of the first derivative values of the samples (using Principal Component Analysis) extracted three factors with eigenvalues greater than one. For the three factors the percent of total variance explained by each fac-

tor from the most important (factor 1) to the least important (factor 3) is 58.85%, 18.41%, 6.89%. Factor 1 appears to be a combination of clay minerals, possibly illite (325nm) and kaolinite in the both sections. At Aghband, Factor 2 incorporates both Gt with small amounts of chlorite. However, Factor 2 at Mobarakabad, is primarily Magh and this indicates the high weathering of chlorite, decrease in Gt and also the pedogenic production of Magh compared to Aghband section. Therefore, pedogenic maghemite-magnetite might be the major contributor to the contrasts in magnetic enhancement between the northern Iranian loess and paleosols. Factor 3 is interpreted as Hm in the Aghband section and Hm with some amounts of Gt (secondary peak at 435nm) at Mobarakabad.

Balsam, W.L., Deaton, B.C., 1991. Sediment dispersal in the Atlantic Ocean: evaluation by visible light spectra. Rev. Aquat. Sci. 4, 411–447.

Ghafarpour, A., Khormali, F., Balsam, W., Karimi, A., Ayoubi, S., 2016. Climatic interpretation of loess-paleosol sequences at Mobarakabad and Aghband, Northern Iran. Quaternary Research, 86(1), 95-109.

Ji, J.F., Chen, J., Balsam, W., Lu, H.Y., Sun, Y.B., Xu, H.F., 2004. High resolution hematite/goethite records from Chinese sequence for the last glacial–interglacial cycle: rapid climatic response of the East Asian Monsoon to the tropical Pacific. Geophys. Res. Lett. 31, L03207. doi:10.1029/2003GL018975.

Liu, Q., Deng, C., Torrent, J. and Zhu, R., 2007. Review of recent developments in mineral magnetism of the Chinese loess. *Quaternary Science Reviews*, *26*(3-4), pp.368-385.

Vandenberghe, R.E., Hus, J.J., Grave, D.E., 1998. Evidence from Mossbauer spectroscopy of neo-formation of magnetite/maghemite in the soils of loess / paleosol sequence in China. Hyperfine Interact. 117, 359–369.

Promoting palaeontological heritage of mammoths in Serbia through a cross-country thematic route: evaluation and potentials

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Introduction: mammoth fossils in Serbia

The principal aim of this paper is to emphasize the palaeontological tourism potential and geoconservation values of mammoth fossils throughout Serbia. These fossil remains provide an excellent basis for the establishment of the first ever mammoth route in Serbia. The route stretches from the city of Kikinda in the north to the city of Jagodina in the south, encompassing the basins of three major rivers, the Danube, Tisa and Morava River. Throughout history, these rivers have been a place where different cultures have flourished over a long period of time. Also, many prehistoric animals such as mammoths and other species inhabited these areas continuously for nearly a million years. This is supported by numerous archaeological as well as paleontological remains of mammoths and other animals which represent faithful witnesses of the long and vivid history of this area (Marković et al., 2014; Tomić et al., 2015).

Methodology and expected results

The current state and tourism potential of the selected mammoth sites was evaluated by using the CREM model for tourism route evaluation (Božić and Tomić, 2016). The application of this methodology will provide us with crucial information for future route development and help us identify which areas and sites require more attention as well as identify the major fields for improvement at each mammoth site in order to attract a larger number of tourists in the future.

Marković, S.B., Korać, M., Mrđić, N., Buylaert, J-P., Thiel, C., McLaren, S.J., Stevens, T., Tomić, N., Petić, N., Jovanović, M., Vasiljević, Dj.A., Sümegi, P., Gavrilov, M.B., Obreht, I. (2014). Palaeoenvironment and geoconservation of mammoths from the Nosak loess-palaeosol sequence (Drmno, Northeastern Serbia): Initial results and perspectives. Quaternary International, 334-335, 30-39.

Tomić, N., Marković, S.B., Korać, M., Mrđić, N., Hose, T.A., Vasiljević, Dj.A., Jovičić, M., Gavrilov, M.B. (2015). Exposing mammoths - from loess research discovery to public palaeontological park. Quaternary International, 372, 142-150.

Božić, S., Tomić, N. (2016). Developing the Cultural Route Evaluation Model (CREM) and its application on the Trail of Roman Emperors, Serbia. Tourism Management Perspectives, 17, 26-35.

The geochemistry of loess: Eurasian deposits compared

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Loess is aeolian sediment which is one of the most extensively distributed surficial Pleistocene deposits in Eurasia. It makes up the most broad and voluminous loess area on Earth that stretches some 10,000 km eastward to China's Pacific coast. One of the thickest and the best-studied loess covers is in China, but loess is widespread also over rest of Asia, especially in Russia and in many countries of Central Asia. The loess of Europe occupies the western end of the Eurasian loess area, where the thickness varies between a few decimeters to several tens of meters, and the cover often is not continuous.

European loess, considering chemical composition, is not so well-investigated as the loess in Asia. Due to the limited amount of information the European loess is often overlooked in comparative analyzes conducted on a larger scale (eg. Muhs, 2018). The aim of this work is to fill the gap in knowledge on geochemical composition of the European loess, using the available published data from some European countries and the new data from Poland.

The geochemical differentiation of European loess is clearly visible, especially between "periglacial-related" sediment of North European Loess Belt (eg. Polish loess) and the Carpathian Basins' loess (eg. Hungarian loess). However, the internal variability of Polish loess is also very interesting, because the loess of western Poland is more weathered and more abundant in clayey, aluminous material compared to the "fresh" loess of eastern Poland, which is enriched in coarser, more feldsparic component.

The chemical compositions of European loess is shown against the Asian loess, following the idea taken from the article "The geochemistry of loess: Asian and North American deposits compared" (Muhs, 2018).

The research of geochemical composition (ICP method) of the most important Polish loess-palaeosol sequences had been performed under the National Science Centre project no. 2017/27/N/ST10/01208.

Muhs D., 2018. The geochemistry of loess: Asian and North American deposits compared. Journal of Asian Earth Sciences, 155: 81-115.

Geochemical evidence for the diversity of provenance of loess in southern China

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Introduction: Provenance of northern *Xiashu* loess

The thick '*Xiashu* loess' in southern China is distributed not only in the Yangtze River valley, but also and most extensively in the region between the Qinling Mountains and the lower reaches of the Yangtze River (Named 'northern *Xiashu* loess' in this study). However, there are few studies of the provenance and climatic implications of the Xiashu loess in this latter region.

Geochemical compositions of *Xiashu* loess and the implications

Here we present the results of a provenance study of Last Glacial loess samples from twenty-two typical Xiashu loess sections, using the major and trace element composition as a provenance indicator. Seventeen of the sites are located to the north of the Yangtze River and our primary aim was to determine the provenance of the Xiashu loess within this region. The <20 um fraction was employed for provenance tracing.

The results showed that there are remarkable spatial changes for the major and trace elements compositions of the loess samples from the 22 section, in sharp contrast with rather uniform compositions for the loess deposits on the Chinese Loess Plateau (CLP). A comparison with the published CLP loess data and fluvial sediments from the Yangtze River valley indicated that the geochemical compositions of the Xiashu loess to the north of Yangtze River are clearly distinguished from the loess from the CLP and sediments from the Yangtze River. The above results suggest that dusts forming the norther *Xiashu* loess were not mainly sourced from the deserts in northern China as the CLP loess, or from the fluvial sediments in Yangtze River valley. The distinct spatial changes in geochemical compositions between loess sections suggest a relative short-distance transportation and less well-mixed nature for the southern dust. All the lines of evidence points to that the northern *Xiashu* loess in southern China are mainly from the local dust sources with spatial anisotropy in floodplain of Huai River, a major river between the Yellow and Yangtze rivers. The aridification of local floodplains in the present humid northern subtropical area during the last glacial, that supplied the dusts, may be responsible for occurrence of the Xiashu loess deposits of the age in southern China.

Late Pleistocene and Holocene aeolian activity in the Pannonian Basin, environmental and human perspectives

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The rivers of the Pannonian Basin had built extensive alluvial fans in the past. Due to postgenetic tectonic and geomorphic processes several of these has got in a relatively uplifted position in the Pleistocene, which gave way to the realm of aeolian processes under dry climatic conditions on vast areas of the basin. The main period of aeolian activity is placed to the LGM, however there are numerous pieces of evidence that dune formation renewed several times during the Pleistocen Holocene transition and even during the drier phases of the Holocene.

Nevertheless, earlier the timing of aeolian phases was assessed on the basis of geomorphological analysis and a limited number of radiocarbon data. In the past decade however a growing number of OSL age data has been published from these areas, mostly by the Luminescence Dating Laboratory of the University of Szeged. The primary aim of the present research was therefore to make an inventory of the available published and unpublished OSL ages, and to assess the temporal and spatial pattern of aeolian activity in the past 20 ka.

In total nearly 150 age data were considered from 18 sites, representing four large sand dune areas, that were developed on the alluvial deposits of the Danube (Somogy Alluvial Fan, Danube-Tisza Interfluve, Deliblato Sands) and the Tisza River and its tributaries (Nyírség Alluvial Fan). Beside presenting case studies we will assess the strength of the aeolian signal through time by analysing the number of coinciding age data, the number of sites affected and the rate of deposition where it was calculable. Although results correspond to the general framework of aeolian history in the region they also underpin the significance of local events especially in the Holocene and in relation with human agency.

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The different climatic response of pedogenic hematite and ferrimagnetic minerals: Evidence from particle-sized modern soils over the Chinese Loess Plateau

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Introduction: paleoclimate implication of pedogenic hematite

Paleosol horizons in loess/paleosol sequences provide us an important paleoclimate archive of past warm periods. Magnetic properties of soils show great potential in paleoclimatic reconstructions. However, the dominant climatic factors on the production of pedogenic hematite remain controversial.

Evidence from particle-sized modern soils

Here, we present the results of a comprehensive investigation of the magnetic properties and statistical analysis of a suite of clay and silt fractions of modern soil samples from 179 sites across the Chinese Loess Plateau (CLP) and adjacent regions. Our results show that pedogenic ferrimagnetic minerals are sensitive to mean annual precipitation, while pedogenic hematite formation is preferentially dependent on mean annual temperature. High ambient temperature favors the production of hematite, probably through promoting the transformation of maghemite to hematite, as well as directly from ferrihydrite to hematite.

Conclusion

The pedogenic hematite is predominantly controlled by mean annual temperature. The confirmation of the temperature-dependent nature of hematite on the CLP provides a new possibility for quantitatively reconstructing the paleotemperature history of Chinese loess/paleosol sequences.

Quantitative relationships between climate and magnetic susceptibility of soils on the Bačka Loess Plateau (Vojvodina, Serbia)

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Magnetic properties of soils formed in and on loess substrate and their relation to climate are of general interest in paleoclimate and pedological research. The loess-paleosol sequences (LPS) in the Vojvodina region (Serbia) have been the subject of intensive study. On the Bačka loess plateau (BLP), covering approximately 2500 km2, six different soil types are observed. While the stratigraphy of the LPS has been investigated the relation between climatic factors and magnetic properties of surface soil have not yet been examined. In this study we analyze 50 samples of chernozem soils, which have been dominated by climatic factors during their formation. Previous studies have confirmed that the formation of magnetic properties in soils is related to climate, and especially rainfall, because of the response of hematite and goethite to different, climatically-driven regimes. The sensitivity of certain iron-bearing minerals to climate has also been documented in the literature. Climatic variables for the BLP were derived from six- decade national meteorological datasets. Low frequency magnetic susceptibility (χ) and frequency dependent magnetic susceptibility (χfd) were determined for each site and compared to the mean annual precipitation (MAP), mean annual temperature (MAT) and the De Martonne aridity index. The meteorological variables were interpolated to sampling points by Kriging method in ArcMap 10.1.

Our results suggest that values of χ and χfd both decrease from south to north and so does the precipitation. Thus, our work provides new evidence for the relationship between precipitation, temperature, aridity and magnetic properties of modern top soils. The obtained and analyzed data may help in the future to improve transfer functions of the relationship between magnetic susceptibility and climatic data.

A post-IR IRSL chronology of the Nosak loess-palaeosol sequence in northeastern Serbia

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Introduction: Absent chronologies

On the territory of Serbia, Quaternary deposits are mainly distributed in the Vojvodina region where they cover about 95% of the area. Major research interest during the last two decades has been focused on these loess deposits. During this short period loess in Vojvodina became one of the most important Pleistocene European continental climatic and environmental records (Marković et al., 2008, 2015). Unlike the loess deposits in Vojvodina, which were investigated on a fairly large scale, the loess sections in north-eastern and central Serbia, until recently, remained almost uncharted. The interest for the loess sections in central Serbia was intensified with the discovery of several steppe mammoth and other mammal skeletons from Middle Pleistocene fluvial deposits in 2009 and 2012. However, apart from the preliminary luminescence dating on two samples, and the ESR dating of an enamel plate removed from a mandibular tooth of the mammoth skeleton discovered in 2012, the chronology of this site, until now, remained unestablished.

pIRIR ages and dust Mass Accumulation Rates

Here we present the preliminary pIRIR200,290 dating results of 10 samples from the last glacial-interglacial cycle, recovered from the Nosak loess-paleosol sequence in northeastern Serbia. For the last glacial loess unit L1, the calculated ages range from 20.7±4.25 to 103.0±6.03 ka. As expected, most of the samples from the upper part of the L1 unit fall in MIS 3, except for samples 133059 (185 cm depth) and 133058 (285 cm depth) which are at the transition to MIS 2, defined as the last glacial maximum. The pIRIR200,290 ages of the two lowermost L1 samples are consistent with MIS 5 (130-75 ka) and imply that most likely, the complete last interglacial is represented at the Nosak site. The underlying S1 pedocomplex is dated at 108.5±8.55 ka, corresponding to MIS 5d.

The luminescence ages presented us the opportunity to develop a continuous and fully independent age versus depth model for the Nosak site. At this point we have to underline that the sampling resolution is not high enough to detect discrete

accumulation variations and hiatuses, however it is sufficient to identify general accumulation trends and patterns of dust deposition. In this study, we chose to implement the Bayesian age-depth modelling methodology using the Bacon code of Blaauw and Christen (2011) based on 10 OSL/pIRIR200,290 data points. The resulting age depth model was used to calculate dust Mass Accumulation Rates (MAR) in order to reliably estimate the past atmospheric dust flux (Albani et al., 2015). The Bacon model shows a peak in MAR around 33-44 ka, with maximum values around 176 g m-2 a-1. These MAR values are fairly low when compared to the average values for last glacial Central-Eastern European loess (Újvári et al., 2010), although European loess deposits show considerable variation in MAR and the peak MAR values for the Nosak site are more consistent with the studies of Perić et al. (2018) for the Titel loess plateau and Stevens et al. (2016) for the Chinese loess plateau.

A hemispheric MAR trend?

The pIRIR200,290 ages at the Nosak site show a steady increase with depth, where no abrupt changes or noticeable irregularities have been observed, which allowed us to develop a continuous age-depth model. The consistency of the MAR implies constant intensities of dustiness during the most part of the last glacial with no apparent major hiatuses. The similarities of the MAR values at the Nosak site with the values at the Titel loess plateau on the one, and the Chinese loess plateau on the other end of the Eurasian loess belt, suggest that dust activity during the last glacial-interglacial cycle may have had a hemispheric trend.

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POSTER ABSTRACTS

EED&H

Testing polymineral post-IR IRSL and quartz SAR-OSL protocols on Middle to Late Pleistocene loess at Batajnica, Serbia

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The loess paleosol sequence of Batajnica (Vojvodina region, Serbia) is considered one of the most complete and powerful terrestrial archive of paleoclimatic conditions during Middle and Late Pleistocene [1]. The section reaches a thickness of 40 m and comprises at least five major loess-paleosol couplets. Previous studies on Batajnica include pedostratigraphical correlations, rubification index and environmental magnetic data [2].

In order to achieve the first numerical chronology for this profile, four sets of ages were obtained using different luminescence dating methods on quartz and feldspars. Equivalent doses on fine (4-11 μm) and coarse (63-90 μm) quartz fractions were measured using single-aliquot regenerative dose (SAR) protocol while on polymineral fine grains two elevated temperature infrared stimulation methods (pIRIR225 and pIRIR290) based on SAR protocol were used. The age reliability for each protocol was investigated by comparing natural and laboratory dose response curves. For fine and coarse quartz, the curves overlap up to ~ 150 Gy and ~ 250 Gy, respectively suggesting that SAR protocol provides reliable ages up to ~ 40 ka on fine quartz and ~ 100 ka on coarse quartz. The natural and laboratory dose response curves for pIRIR225 are consistent over the entire dose range investigated (> 1000 Gy) whereas the pIRIR290 natural dose response curve lies above the regenerative dose response curve. Luminescence ages on coarse quartz and polymineral fine grains (pIRIR225) are in agreement whereas pIRIR290 ages are systematically overestimated. The upper age limit of coarse quartz SAR and polymineral fine grains pIRIR290 and pIRIR225 protocols is restricted to the Last Glacial Interglacial cycle due to the field saturation of the natural signal. Our results suggest that the choice of the mineral and luminescence technique to be used for dating loess sediments should take into consideration the reported limited reliability of each dating protocol.

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The early Upper Paleolithic site of Crvenka-At (Vršac, northeastern Serbia), its timing and paleoenvironmental conditions

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While it is generally accepted that the initial settlement of western Eurasia by modern humans originated in Africa, the timing, trajectory and conditions of this spread are still not fully understood (Davies et al., 2015; Staubwasser et al., 2018; Teyssandier and Zilhão, 2018).

An often discussed potential corridor of human dispersal into Central Europe is the Danube catchment, where the course of the Danube River as well as the elevated positions at the border of the basin were suggested as possible pathways (Conard and Bolus, 2008; Hauck et al., 2018; Kozłowski, 1992). Crucial for this discussion is the Banat region, a historic area at the border of Romania, Serbia and Hungary, which offers various environmental and geographical settings. In order to improve our understanding of Paleolithic occupation in this area, we rediscovered and sampled the previously known site of Crvenka-At, close to the city of Vršac in northeastern Serbia (see also Chu et al., 2016). Two profiles containing Aurignacian artifacts embedded in sandy deposits were investigated. Electrical Resistivity Tomography (ERT) measurements, grain size and color analyses, and luminescence dating (pIRIR) were undertaken to increase our understanding of the timing and characteristics of the deposits. Our results confirm previous findings suggesting a multiple-occupation Aurignacian site with an age between ~41–34 ka. This age range goes well with other findings in the Banat region, such as the earliest securely dated early modern human mandible in the nearby Peștera cu Oase, Romania (Soficaru et al., 2007; Trinkaus et al., 2003). This suggests that modern humans exploited a wide range of ecological and topographic settings during their initial dispersal into Europe.

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Clay mineralogy of last glacial cycle loess of Stari Slankamen (Northern Serbia) and the weathering intensity revealed by chlorite ratio

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Introduction

Clay minerals, widely occurring in various kinds of sediments, document a wide spectrum of environments of their formation and alteration. Clay mineralogy has been applied in Carpathian Basin loess provenance and paleoclimate researches, but previous results are at relatively low resolution. By conducting the first high-resolution clay mineralogy analysis on Serbian loess, we reconstructed detailed variation of clay mineralogy of last glacial cycle, and discussed its origin and paleoclimatic indications.

Clay mineral assemblage and its origin

The clay mineral assemblage is made up of 42.9% illite, 31.38% smectite, 17.15% chlorite, and 8.57% kaolinite. The variation of illite content is not perfectly correlated with pedostratigraphy, which is lowest at the bottom of last interglacial paleosol (S1), and highest at Holocene soil (S0). Smectite content shows almost mirroring variation, while chlorite and kaolinite content remain relatively stable along the profile. At bottom of S1, there might be pedogenic transformation of illite to smectite, but the pedogenic impose on clay mineral assemblage might be limited over the whole profile. We suggest mainly detrital origin for clay minerals.

Weathering intensity revealed by chlorite ratio

Chlorite ratio was recently suggested to characterize Fe^{2+} leaching of Chinese paleosols in the early stage of chlorite weathering. In Stari Slankamen profile, last interglacial paleosol yielded significantly higher chlorite ratio (averaged 0.63) than last glacial loess (averaged 0.44), suggesting strong interglacial weathering. We suggest that chlorite ratio might be a weathering proxy that's widely applicable in loess around the world.

Isotopic constraints on the source of loess in southern China and its implications for glacial aridification of the northern subtropical region

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Introduction: Provenance of loess in southern China

The thick 'Xiashu loess' in southern China is distributed not only in the Yangtze River valley, but also and most extensively in the region between the Qinling Mountains and the lower reaches of the Yangtze River. We recently published a paper (Han et al., 2019) about the loess provenance in the main part of Xiashu loess region using major and trace element geochemistry, but the isotopic evidence hasn't been reported.

Evidence from neodymium and lead isotopic compositions

Here we present the results of a provenance study on the Last Glacial loess samples from 22 typical Xiashu loess sections, using the provenance indicator of neodymium and lead isotopic compositions. The εNd(0) of Xiashu loess is systematicly lower than -11, while loess in Chinese Loess Plateau (CLP) show higher εNd(0) values, ranging from -11 to -9. For lead isotopes, the Xiashu loess show lower 208Pb/206Pb and 207Pb/206Pb than CLP loess. Thus, the difference in the isotopic compositions between the Xiashu loess and the CLP loess support our idea that the Xiashu loess is not sourced from deserts of the Asian interior. We further suggest that the alluvial plain in the present drainage of the Huai River was the primary dust source for the Xiashu loess based on the isotopic evidence.

Conclusion

Evidence from neodymium and lead isotopic compositions shows that the Xiashu loess and the CLP loess share no common provenance, and confirms the local provenance of Xiashu loess, which indicates the aridification of present humid northern subtropical region in south China for dust emission during the glacial to form the loess deposits.

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Optically stimulated luminescence ages of the Hengyu Site and Their Implications for Anthropogenic Activities in the Fuzhou Basin South China

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Introduction: The Hengyu Site in Fuzhou Basin, China

Fuzhou Basin, surrounded by low mountains and hills with elevations of 50-500 metres, is a middle to-late Quaternary sedimentary faulted basin situated on the East China Sea coast, and the Min River meanders through the centre until it flows at last into the East China Sea. The granitic basement rock formed during the late Yanshanian and Jurassic periods. Since the middle to-late time of the late Pleistocene, the basin has experienced continuous subsidence, and the sedimentary depositional structure is complicated and changeable and includes marine facies, terrestrial facies, and marine-terrigenous facies. The geomorphological environment of Fuzhou Basin became a bay during the Holocene transgression stage and then evolved into a fluvial outwash floodplain during the late Holocene. Therefore, the Fuzhou Basin is an ideal area for understanding the coupling relationship between sea-level change, regional subsidence, and anthropogenic activity.

The Hengyu site is located on a low terrace, which on average is only six metres above sea level, approximately 200 metres east of Anpu village in the northern of Fuzhou Basin. The site location is a natural extension of Mount Gushan from the viewpoint of geomorphologic features. The high-lying southeast and low-lying northwest areas gradually tilted. This site was discovered in 2016, and cultural remains were found in a 1.1-metre-thick cultural layer believed to be mid-Holocene in age. It covers an area of approximately 10,000 m2, of which 2,000 m2 were excavated in 2016 and 2017. Abundant remains belonging to different stages of cultures were found at the Hengyu site in the north-eastern Fuzhou Basin. Specifically, this site has seven cultural strata. The relics found mainly include housing sites, pools, ditches, ash pits, wells and tombs, which lasted from the Neolithic age through the Shang, Zhou and Han dynasties to the Tang, Song, Yuan, Ming and Qing dynasties.

Evidence: Chronology of Hengyu site and Their Implications for Anthropogenic Activities

Chronology is a crucial scientific question for both archaeological and palaeoenvironmental studies in coastal areas of South China (Jin et al., 2017). Methodo-

logically, both optically stimulated luminescence (OSL) dating and AMS14C dating should be suitable for archaeological sites if we are able to obtain proper dating materials (Yu et al., 2016). Cross checking between different age data is important for confirming the chronology or revising the potential deviation (Jin et al., 2018; Song et al., 2015). In this study, the Hengyu Neolithic site, located in Fujian Province, South China, has significant archaeological remains and, was dated using blue-stimulated optically stimulated luminescence (OSL) and accelerator mass spectrometry radiocarbon 14 techniques (AMS14C) on nine medium-grained quartz and three carbon samples through the Neolithic sequence. The results provide new insights into understanding the relationship between environmental evolution and human activities in the middle to late Holocene in the Fuzhou Basin and coastal areas of South China. The ages of the site deposits associated with abundant artefacts vary from 4.8 to 1.67 kaand can be divided into two main phases: the Tanshishan culture period and the Bronze culture period. In contrast, the persistent periods of ancient human activities at the Hengyu site seem to correspond to regional sea- level changes and the East Asia winter monsoon (EAWM) as a secondary factor, which can affect human activities through sea level impacts. The warm and thalassocratic conditions provided a liveable environment for ancient humans of Fujian and even South China. The ages of two building column bases are linked to the early stage of the Han dynasty, suggesting a potentially favourable habitation environment; that is, ancient humans occupied and settled this area for the long- term within this time period, which is consistent with sea-level changes and palynology records.

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Colorimetric perspective of loess-paleosol sequences as an indicator of paleoclimatic and paleoecological processes: Dukatar pedocomplex S5 – Titel loess plateau (North Serbia) case study

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Changing color is one of the most striking features of loess–paleosol sequences in Vojvodina (North Serbia): the loess is light yellow and the interstratified paleosols are brown/reddish-brown. This study represents the second detailed joined colorimetric and rock magnetic investigation on a loess-paleosol sequence in the Vojvodina region. The aim of this paper is to derive information on the Middle Pleistocene paleoenvironment from a high resolution multi-proxy assessment of the iron mineralogical composition at the Dukatar pedocomplex S5 loess paleosol sequence at Titel loess plateau (North Serbia). The investigated sequence is formed due to global paleoclimatic changes during the Middle Pleistocene. Observed color changes in loess and intercalated paleosols can be interpreted as a consequence of different climate conditions under which pedocomplexes were formed. Sampling and laboratory investigation of the above mentioned pedocomplex provided rock magnetic and colorimetric perspective on the Middle Plistocene climate presented in this study. Wet and dry colors were determined using a Munsell soil color chart. Color reflectance of loess and paleosol samples was determined colorimetrically using a KONICA MINOLTA chromameter CR-400. Color values as determined by the chromameter are given in the CIE L*, a*, b* color space. Wet and dry colors, determined by Munsell soil color chart were used for calculation of Rubification (RI) and Melanization (MI) Indices. As an alternative proxy for soil reddening and changes in the hematite content, the Redness Index (RI1) was determined as well. The Redness Rating (RR) was calculated as average from moist and dry Munsell colors for strongly rubified pedocomplex S5. Rock magnetic results for the Dukatar pedocomplex correlates well with the previous studies of the Titel loess plateau sequences, implying that investigated paleosol was formed during MIS 13-15, while colorimetric results indicate a period of increase in

summer temperature and/or duration of summer dryness. Due to paleopedological interpretations, measured colorimetric and soil development index values, it can be pointed out that investigated sequence, presented in this study indicate a succession of interglacial environmental changes from semi-humid subtropical environments (S5) towards landscapes with typical steppe soils (S1) as shown in previous study for the Tamiš loess plateau. These findings support previous observations and analysis from the Batajnica and Stari Slankamen sites, key sites of the Vojvodina loess region, and highlight the potential of a joined colorimetric or spectrometric analyses and rock magnetic analyses in paleoenvironmental investigations on loess paleosol sequences.

Mineral magnetic variation of the Serbian loess-paleosoil sequence and its implications for the last one million years climatic changes

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Introduction

The loess–palaeosol sequence in the Danube River basin, Northern Serbia, the longest and most complete sequence in Europe, provides a unique long-term archive of paleoclimate on the European continent. We established high-resolution multiparameter mineral magnetic records for the Serbian Titel-Stari Slankaman composite loess-paleosol section over the last 1.0 Myr, and compared them with the records of China.

Evidence from mineral magnetic pareameters

The loess-paleosol sequence in Serbia shows a similar loess-paleosol pattern of glacial- interglacials cycles to those in China, with low value of magnetic susceptibility in loess uints and high in paleosols. Meanwhile, χ and χfd% have a highly positive correlation, which indicates the enhancement of χ in paleosols may be caused by very fine-grained maghemite/magnetite particles of pedogenic origin. The ratios of SIRMAF100mT/SIRMAF30mT, SIRMAF100mT/SIRMAF60mT and HIRM all display a long-term decreasing trend over the last 1.0

Myr. This long term trend is in good agreement with variations of Chinese loess, which is attributed to a long-term decrease in the relative contributions of eolian hematite during glacial stage and of pedogenic hematite during interglacial stage, and indicates a long-term increasing aridification and cooling (Deng et al., 2006). Interestingly, the glacial–interglacial oscillations and upward decreasing trend of magnetic parameters are more significant in Serbia before S3.

Conclusion

High resolution magnetic records of Serbia and China reveal a broadly similar pattern of climatic changes in both orbital- and super-orbital- time scale, which may indicates continental- wide aridification and cooling over the last 1.0 Myr cause by expansion of the Arctic ice-sheet. However there are still some differences existed, which are well worth being further explored.

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Environmental changes in the upper Bukhtarma River basin and its influence on landscape transformation (High Altai, Kazakhstan)

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Introduction: High Altai

The northern part of Central Asia is occupied by the Altai Mountains, located on the bioclimatic border of the steppe and taiga. Its western part is formed by partially glaciated High Mountain massif (Belukha 4506 m a.s.l.) which is very sensitive to modern climate changes being strongly influenced by semi-dry climate from the south and Artic air masses from the north. This area is characterized by one of the largest increases in temperature on the earth in recent decades (IPCC 2014). These rapid growth (~ 1°C/decade) affects all elements of the Altai Mts. natural environment, above all the rapid glaciers retreat, changes in the hydrological regime or shifting the upper and lower timberline. Our aim is to recognize the direction and dynamics of these changes based on multidisciplinary analyzes: sedimentological, geomorphological and dendrochronological. The research area is located in the upper part of the Bukhtarma River basin located in the western part of the High Altai Mountains. The river, right tributary of the Irtysh River, has glacial regime shaped mainly by the glaciers of the Belukha massif. Modern observations show that the glaciers in the Altai Mountains are melting rapidly (Aizen et al., 2005, Jary et al. 2012). The main relief features in this part of the Altai are high LIA moraines and wide and deep u-shaped valleys associated with the Pleistocene glaciation (Chlachula, 2001)

Modern environmental changes

Two research areas were selected for detailed study of modern environmental changes in the Kazakh High Altai Mts:1) the upper Bukhtarma River valley and 2) the upper part of the White Berel River catchment. Geomorphological mapping and mineral and plant samples collection were carried out during field research. The wide valleys are covered by Pleistocene sandy and silty deposits connected with Pleistocene aeolian and glacifluvial activity. Typical landforms within these covers are deep young gully networks. The present development of erosion processes is linked to collectivization during the Soviet Union time. The dendrochronological and geomorphological analysis of glacial and glacifluvial landforms confirmed rapid glaciers retreat in the Belukha massif. Mineral sediment transported in suspension in the glacial rivers is deposited in the upper parts of the valleys. This fluvial silty material can be winnowed, transported and redeposited in the lower parts of the main Altai Mountains valleys. This contemporary loess accumulation was confirmed on the basis of sedimentological analysis.

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Revisiting the chronology of Pleistocence/Holocene transition as recorded by loess deposits of central Great Plains: an optically stimulated luminescence dating and multi-proxy analysis of the Enders section (Nebraska, USA)

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Loess deposits of the central Great Plains and the intercalated soils therein contain the potential information for developing high-resolution terrestrial past climate records. The Enders section, located in southwest Nebraska, central Great Plains, provides a detailed record of Holocene loess deposition and soil development in Nebraska. Based on field observations well-preserved Peoria Loess and Brady Soil units have been identified along with two prominent and three incipient buried soils intercalated in Bignell Loess unit.

Here we present a multi proxy (magnetic susceptibility, grain size, δ18O and δ13C isotopes) analysis and an optically stimulated luminescence (OSL) chronology based on Single Aliquot Regenerative dose (SAR) protocol applied to 4-11 μm, 63-90 μm and 90-125 μm quartz grains.

As previously reported by others at nearby sites, Brady Soil shows unexpectedly low values for the magnetic susceptibility. On the other hand, the two prominent buried soils identified within Bignell loess are represented by peaks in the magnetic susceppribility data. Grain size data shows a decrease in the coarse (>63 μm) material and a proportional increase in the fine (<2 μm) fractions in the unit correlated with Brady Soil, while the paleosoils identified in the field within Bignell loess do not show any particular grain size structure. Preliminary δ18O and δ13C isotopes data give information on related to changing abundance of C3 and C4 vegetation. Following the application of typical intrinsic rigor tests of the OSL dating method as well as by its application on three grain size fractions of quartz, we are confident that the obtained OSL ages are accurate. The OSL ages indicate that Peoria Loess deposition ended around 13-14 ka. The termination of Peoria Loess deposition is marked by the Brady Soil, dated here to OSL ages of 12.7 $\pm$ 0.8 ka to 9.5 $\pm$ 0.6 ka. We further confirm that Bignell Loess accumulated episodically throughout the Holocene, starting from 9-10 ka.

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The 4.2 ka BP event and its resulting cultural interruption in the Daihai Lake basin at the East Asian summer monsoon margin

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The 4.2 ka BP event has been widely investigated since it was suggested to be a possible cause for the collapse of ancient civilizations. With the growth of proxy records for decades, however, both its nature and its spatial pattern have become controversial. Here we present a climatic record of Daihai Lake spanning the period between 5 and 3 cal ka BP, together with a cultural series for the lake basin around 4 cal ka BP, to identify the regional nature of the 4.2 ka BP event and the relationship between climatic variation and cultural evolution. The climatic record reveals a significant dry event at the interval of 4.39–4.25 cal ka BP that could be a regional manifestation of the 4.2 ka BP event in the northern margin of the East Asian summer monsoon. The cultural series suggests an interruption between two different cultures during the period of 4.3–4.0 cal ka BP. We suggest that the cultural interruption in the Daihai Lake basin might have been caused by the monsoon-related dry event. Humans primarily engaged in agriculture likely left the lake basin because the drainage basin became unsuitable for agrarian activities as the climate became too dry, thus leaving a cultural vacancy of several centuries in the lake basin.

Monthly Precipitation Reconstruction Potential: Evidence from intra-annual tree ring oxygen isotopes variations on the southeastern Tibetan Plateau

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We present a long-term seasonal tree ring oxygen isotope (δ18O) time series by analyzing four segments (S1, S2, S3 and S4) per year during the period of 1951-2009 on southeast Tibet Plateau to investigate the monthly precipitation reconstruction based on high-resolution oxygen isotope analysis. Intra-annual tree ring δ18O showed a distinct seasonal cycle. δ18O maxima in the beginning of growing season, and δ18O decreased from the beginning of growing season to the end of growing season. Correlation analysis indicated that δ18O in different intervals of growing season was affected by different month precipitation. δ18O of S1 and S2 in the beginning of growing season has strongest correlations with June precipitation, δ18O of S3 at the middle of growing season is most relevant July precipitation, and δ18O of S4 at the end of growing season is most affected by August precipitation (r=-0.67). The linear regression model between δ18O of S4 and August precipitation can pass all of the rigorous statistical tests for calibration and verification commonly employed in dendroclimatology. These results reveal that long-term seasonal tree ring δ18O has potential to reconstruct monthly precipitation changes.

Keywords: Monthly precipitation reconstruction, *Abies georgei*, seasonal variations of tree ring oxygen isotopes, southeast Tibet Plateau

Spatiotemporal changes in C4 plant abundance in China since the Last Glacial Maximum and their driving factors

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Knowledge of changes in the distribution of C3 and C4 plants in relation to climate change is the key to predicting the biosphere's response to future climatic warming. There are significant differences in the spatiotemporal evolution of C4 plant abundance at different latitudes since the Last Glacial Maximum (LGM), and the factors responsible remain debated. In this study, we reconstructed the spatiotemporal pattern of C4 plants in China since the LGM, based on a synthesis of δ13C records of soil organic matter from paleosol sequences and δ13C records of individual n-alkanes from lake and marine sediments. The results indicate that, spatially, maximum C4 abundance during the LGM was in South China; while maximum C4 abundance occurred in the Chinese Loess Plateau in North China during the early and mid-Holocene. Temporally, in North China, C4 plant abundance initially increased since the LGM, reached a maximum during the early and mid-Holocene and then decreased; however, the opposite trend occurred in South China. Combined with a physiological-process model used to study the sensitivity of C3 and C4 plants to changes in climate and atmospheric *p*CO2 in different regions, our results reveal that temperature was the dominant factor driving C4 plant expansion in North China, whereas atmospheric *p*CO2 and precipitation were the main factors controlling C4 plant abundance in South China.

The studies of Danube loess: An overview

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As one of the most valuable terrestrial deposits, loess is widespread on the Eurasia. Danube loess locates at the western end of Eurasian loess belt, and the loess-paleosol sequences (LPs) are among the longest in Europe extending back to over 1 million years. In recent years, there have been great progresses in studies of Danube loess, especially in paleoclimate and paleoenvironment reconstruction. This paper firstly presents an overview of Danube loess, including a brief introduction of its research history, the distribution, sedimentary and geochemistry properties. Then, the provenance, chronology, stratigraphy, the climate and environment changes on different time scales are highlighted. Finally, we discuss the current research deficiencies and prospects of Danube loess.

Conclusion:

The Danube loess study started from Serbia in the late 17th century and until the 6th INQUA in 1961 more scientific researches came into being. Danube typical loess is distributed in four regions but mainly in the middle and lower Danube basin with the basal age to over 1 million years. The composition of Danube loess is similar with Chinese loess in many aspects, such as grain size, major mineralogy and major geochemistry. As for the provenance of Danube loess, three potentials are discussed, alluvium of Danube and its tributaries, underlying bedrocks and the dust from North Africa. Considering the complex nomenclature system of Danube loess in different countries, a unified loess lithostratigraphy model has been proposed for a better comparison recently. The climate changes show a trend of progressive aridification on long-term time scale, and spatially this trend can extend out of the basin to the Russian plain. On orbital time scale, the LPs show glacial-interglacial cycles, though small discrepancies exist on different locations. The identification of millennial abrupt changes in the LPs are still controversial because of the limitations of resolution of samples and the accuracy of time scales.

However, there are still many aspects should be further studied in detail. Firstly, a clear provenance and formation mechanism of the Danube loess still remain uncertain. Then the forcing of climate change in the Danube basin needs to be solved after the applicability of climate proxies and time scales have been assured. Finally, considering that the European loess is semi-circular in the outer periphery of high latitude, the differences and similarities among the Eurasian loess belt is important for us to unearth the climate changes of northern high-latitude.

Coupled models reveal spatial dispersal of global population and its response to climate changes between Last Glacial Maximum and Early Holocene

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Currently numerous studies have used the geological and archaeological records to reveal the relationship between climate and population fluctuation at temporal scale. The rapid growth and spread of archaeological sites occurred between Last Glacial Maximum (LGM) and Early Holocene (EH) could be largely attributed to significant climate change during the glacial and interglacial periods. However, because the coverages of climatic and archaeological records are both limited and unbalanced, it is hard to quantitatively evaluate the impacts of different climate factors on changes of population size and distribution. Here, a population model is used together with a climate model to simulate the spatial dispersal of global population between LGM (about 19 ka BP) and EH (about 9 ka BP) and identify the corresponding controlling climatic factors from global to regional scales. Our results show that the boundary of potential population distribution moved northwards between LGM and EH with the increases of total inhabited area (about 16.04×106 km2), population size and density (about 74.28×104 person and 0.58 persons per 100 km2), which is supported by archaeological sites distributed in old continents (e.g. China and Europe) during LGM and EH. The change of population density in middle-high latitude and low latitude was mainly contributed by hunting groups and gathering groups, respectively. The sensitivity of population to changes in climatic variables suggests that increasing temperature was the dominant factor driving both hunting and gathering population expansion in middle-high latitude between LGM and EH, however, precipitation played a key role in change of hunting population in low latitude, while change of gathering population in low latitude was determined by temperature and precipitation. Above relationships are validated by statistical analysis among changes of archaeological sites, simulated population densities and climate variables. Our study provides a new interpretation of the responses of population to climate changes during glacial and interglacial periods from both temporal and spatial scopes.

Key words: population, LGM and EH, hunting and gathering, climate changes

A Late Quaternary lacustrine geoarchive from the south-eastern Carpathian Basin in the context of early modern humans

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Upper Pleistocene geoarchives in the Carpathian Basin are predominantly composed of loess-paleosol sequences and are accompanied by only few lacustrine archives dating to this time frame. In 2015 a 10 m sediment core was retrieved by vibracoring within a depression northwest of Vršac and east of the Banat Sands in the south-eastern Carpathian Basin (North-Eastern Serbia) yielding a lacustrine sequence. The region is still lacking detailed paleoenvironmental reconstructions despite its crucial role in the late Pleistocene dispersal of modern humans into Europe along the main river valleys tributary to the Danube.

Sedimentological analyses give evidence of phases of aeolian silt sized sediment input within a predominantly lacustrine depositional environment. In addition, levels of carbonate precipitation were observed in the core, some intervals being rich in clay and decalcified. No coarse fluvial sediment is apparent while the ostracod species composition indicates some allochthonous input, suggesting a rather continuous sedimentation during the Upper Pleistocene and into the Holocene.

Here results from core images and description, grain-size data and ostracods are discussed, including age models based on 14C and luminescence dating.

The mixed rice and millet agriculture in Neolithic age lower Minjiang River of China: Phytolith evidence from the Baitoushan site

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Introduction

Questions about origin and spread of rice and millet agriculture have always been the hot topics in archaeobotany and agricultural archaeology research. The beginning and development process of agriculture in the lower reaches of Minjiang River are of great importance to the research on the timing and route of southward dispersal of agriculture and proposed initial expansion of proto-Austronesians. However, due to the lack of detailed archaeobotanical work, the beginning of rice and millet farming in this region remain unclear.

Evidence

In this study, phytolith analyses, together with radiocarbon dating of samples from a newly excavated site named Baitoushan in the lower reaches of Minjiang river, showed that rice and millet have already arrived in the lower Minjiang river region around 5,000 cal a BP. A mixed rice and millet agriculture may thus have been established in this region. This is the first time that millet was found in the Tanshishan cultural layer (ca.5000-4300 cal a BP) of the lower Minjiang River. This study provides new evidence for the spread of rice and millet to the southeast coastal areas of China, as well as sheds lights on the understanding of early cultural communications between Taiwan and the mainland of China in the Neolithic Age.


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