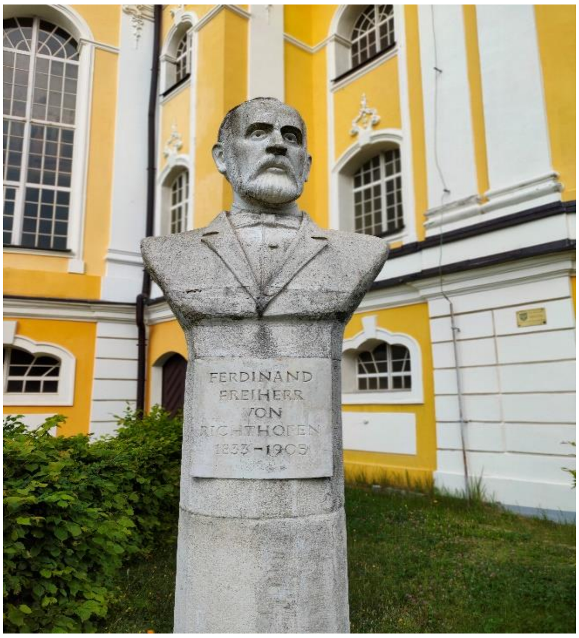
8TH LOESS SEMINAR
"REMARKABLE IDEAS AND PERSONALITIES IN LOESS RESEARCH"

15–18 June 2024, Wrocław (Poland)



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The Committee for Quaternary Research Polish Academy of Sciences

Institute of Geography and Regional Development University of Wrocław

Commission on Earth and Environmental Sciences, PAN, Wrocław Branch

Polish Quaternary Union, POLQUA

Loess and Pedostratigraphy Working Group INQUA

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Abstract & field guide book

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Seminar schedule:

Saturday, June 15

The Alfred Jahn Cold Regions Research Centre, Fryderyka Joliot-Curie 12, 50-383 Wrocław

17:00 - 21:00 Ice-breaker party

Sunday, June 16

Meeting point: Max Born Square

Field trip

10:00 Meeting at Max Born Square

11:45 – 12:45 Pokój - Ferdinand Richthofen birthplace

13:00 – 14:00 dinner – Namysłów

15:00 – 16:00 Trzebnica loess-paleosol sequence

17:00 Back to Wrocław

Monday, June 17

The Alfred Jahn Cold Regions Research Centre, Fryderyka Joliot-Curie 12, 50-383 Wrocław

10:00 *Opening ceremony*

Oral session I

10:20 **Ian Smalley** *Two Hundred Years of Loess: 1824-2024- A Celebration*

10:40 **Andrij Bogucki** *Pavlo Tutkovskyi as a Founder of the Study of Ukrainian loess*

11:00 **F. Lehmkuhl** *Challenges and new insights in loess mapping approaches: More than 100 years history in Europe*

11:20 **P. Moska** *Luminescence Techniques in Geosciences: Insights and Challenges in Geochronology for Polish Loess Deposits*

11:40 *cofee break*

12:10 **R. Schaetzl** *The Contributions of Dr. Francis Hole to the Loess Community in the USA*

12:30 **O. Tomeniuk** *"However, there remains one way, and this is an appeal to the terrain, an appeal to this single, true and inexhaustible source of all knowledge and all valuable synthesis": Yuriy Polanski and Loess Research in Ukraine Between the Two World Wars*

12.50 **Z. Jary** *Wrocław/Breslau as a Loess research center: German and Polish researchers*

13:10 *Lunch*

Oral session II

14:00 **Q. Hao** *Changes in monsoon precipitation in western Loess Plateau under a 2°C interglacial warming*

14:20 **S. Marković** *Reconstruction of the Pleistocene interglacial environments based on Loess-Paleosol sequences in the southeastern part of Carpathian Basin*

14:40 **L. Soreghan** *Dust and Loess in Earth's Deep-Time Record*

15:00 **J. Wenying** *Vegetation and climate changes since the LGM in China: evidence from pollen records in loess and lake sediments*

15:20 **P. Kenis** *Beyond the limitations of bulk sample geochemical composition: the detailed investigation of aeolian deposits using automated mineralogy and SEM/TEM+EDS investigation*

15:40 *Coffee break*

Poster session

P. Kenis *Frozen hell - when icesheet meets melted quartz*
M. Krawczyk *Loess-paleosol sequence in Biały Kościół*
M. Krawczyk *Loess-paleosol sequence in Trzebnica - preliminary results*
P. Moska *Luminescence stratigraphy of loess deposits from Trzebnica*
P. Mroczek *Multi-proxy studies unraveling paleoclimatic secrets in loess: insights from the Middle Dnieper Region*
Milica G. Radaković *From snail perspective: differences between Červený Kopec (Czechia) and Veliki Surduk/Stari Slankamen (Serbia) loess-palaeosol sequences*
Z. Sowińska *Ice wedge pseudomorphs at archeological site Trzebnica 2: characteristics and research history*

17:00 *tour around the center of Wrocław*

19:00 *conference dinner*

Tuesday, June 18

The Alfred Jahn Cold Regions Research Centre, Fryderyka Joliot-Curie 12, 50-383 Wrocław

9:30 – 12:00 *Open lectures by visiting professors*

Ian Smalley *Great Personalities and ideas in loess research - Ten Significant Loess People; 1824-1964*

Andrij Bogucki *Geneza, pozycja stratygraficzna oraz interpretacja klimatyczno-środowiskowa struktur peryglacjalnych plejstoceńskiej wieloletniej zmarzliny w sekwencjach lessowo-glebowych Wyżyny Wołyńsko-Podolskiej*

Slobodan Marković *The history of Danube loess research, Danube loess stratigraphy and the idea of a unified loess stratigraphic model*

12:00 Final discussion and conclusions

12:30 Lunch

13:30 Tour of the main building of the University of Wrocław

14:30 – 18:00 Field trip to the ***Biały Kościół loess-paleosol sequence***

Oral Sessions

Two Hundred Years of Loess: 1824-2024- A Celebration

Ian Smalley[1]

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Loess in Heidelberg; named, defined and described by Karl Caesar von Leonhard in 1824. Section 89 of vol.3 of his ‘Characteristik der Felsarten’ contains the first account of the sedimentary material which we cam to know as Loess.

Charles Lyell published vol.3 of ‘The Principles of Geology’ in 1833. This volume contained a small section on loess, on loess in the Rhine valley- in 1833 loess was essentially confined to the Rhine valley. This book introduced loess to the world at large. It is said that his copy reached Charles Darwin in 1834 in Valparaiso, on his great circumnavigation.

Also in 1833 Leonard Horned gave his paper on the Loess at Bonn to a meeting of the Geological Society in London. This was not published until 1836 but it was probably the first presentation on loess in English. Horner in particular described loess as an interesting material which presented several novel geological problems.

As a sediment: it was associated with the Rhine, so logically it was deposited by the Rhine, or perhaps from lakes which were formed from Rhine waters. Darwin in the ‘Origin’ in 1859 was happy to have the loess as a Rhine sediment ‘We have evidence in the loess of the Rhine of considerable changes of level in the land..’

In 1877-1885 Ferdinand von Richthofen published ‘ China: Ergebnisse einer Reisen und darauf gegrundeter Studien’ in 5 vols. The loess description and discussion in vol.1 were largely responsible for establishing the aeolian theory of deposition and the fame of Richthofen, and showing the importance of Chinese loess.

In 1890 John Hardcastle in Timaru, New Zealand introduced the really key idea into loess research (an idea that drives much of todays research) that loess recorded climate. He claimed loess as a ‘Climate Register’.

In 1912 L.S.Berg was in Chernigov- the report on the work there would launch the controversy around the ‘in-situ’ or ‘pedological’ theories of loess formation. Berg wrote the idea of ‘loessification’ into the loess literature, and focussed some attention on the nature of loess ground material. The essential property of loess ground is its collapsibility- the ground structure collapses when loaded and wetted, and hydroconsolidation ensues. The open structure of loess ground caused by aeolian deposition allows collapse to occur; the bond properties caused by loessification allow the process to proceed. Geology and pedology are involved (and reconciled).

Pavlo Tutkovskyi as a Founder of the Study of Ukrainian loess

Andriy Bogucki[1], Olena Tomeniuk[1,2]

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Pavlo Tutkovskyi (1858–1930) is one of the most famous Ukrainian scientists. The years of his fruitful scientific activity fell on the end of the XIX - the beginning of the XX centuries. He conducted research in the fields of geology, mineralogy, geomorphology, geography, micropaleontology, hydrogeology, Earth Sciences, etc. Therefore, he can be considered a scientist and encyclopaedist. He founded the geological scientific school in Ukraine, the Institute of Geological Sciences of the Ukrainian Academy of Sciences, the National Museum of Natural History, etc.

It is worth emphasising that Pavlo Tutkovskyi was a trailblazer in many of his endeavours. His entire life was closely tied to Ukraine. He was born on March 1, 1858, in the town of Lypovets near Vinnytsia. In 1882, Pavlo Tutkovskyi graduated from the University of Kyiv, where from 1884 to 1895 he worked as a conservator of the Mineralogical and Geological Cabinet. In 1904, the researcher became a part-time employee of the Geological Committee. He was responsible for mapping the 16th sheet of the ten-verst geological map of European russia.

In 1911, P. Tutkovskyi defended the work "Fossil Deserts of the Northern Hemisphere" for the academic title of Doctor of Geography. In 1913, the scientist was elected a Privatdozent, and in 1914 - a full Professor at the Department of Geography of the University of Kyiv. Since 1919, P. Tutkovskyi has been an Academician of the Ukrainian Academy of Sciences, and in 1926 - director of the newly established Institute of Geological Sciences of the Ukrainian Academy of Sciences.

The contribution of P. Tutkovskyi to world science is difficult to overestimate. Among his main scientific achievements, the following should be emphasised.

1. The study of the Quaternary period, in particular, the glacial complex and the development of the theory of the origin of loess, in which the scientist assigned a decisive role to winds (foehns), which formed in the area of high atmospheric pressure above the glacier, captured dusty material from the periglacial zone and carried it to the surrounding plains. This hypothesis was called aeolian-glacial. P. Tutkovskyi also has priority in the study of lake loess and the mollusc fauna discovered in it. Lake loess is generally limited to the lower part of the loess strata. The academician emphasised the role of Quaternary sediments as the parent material of modern soils, which due to the diversity of landscapes significantly impacts human culture and economic activity.

2. Pavlo Tutkovskyi was an initiator of micropaleontological research in Ukraine. His fundamental works on the study of Palaeogene and Cretaceous foraminifera have not lost their importance until today. The academician predicted the great scientific significance of microfaunistic study.

3. The scientist was a creator of bibliographic catalogues from various branches of natural sciences, which were the most complete at the time and included comprehensive latest sources of scientific information.
4. P. Tutkovskyi also had significant achievements in hydrogeological research, in particular, he was involved in the development of the first projects of the artesian water supply of major cities such as Kyiv, Minsk, etc.
5. The explorer considerably contributed to mineral resources study, chalk karst investigation in Volhynian Polissia, artesian water exits to the surface and much more.

Academician Pavlo Tutkovskyi's contribution to Ukrainian and world science is remarkable. In honour of the scientist's merits, in 2007, the National Academy of Sciences of Ukraine established the Pavlo Tutkovskyi Award, which is granted by the Department of Earth Sciences of the National Academy of Sciences of Ukraine for outstanding scientific works in the fields of geology, geography, oceanology, geoecology, climatology and meteorology.

Challenges and new insights in loess mapping approaches: More than 100 years history in Europe

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Loess is one of the most important terrestrial archives of Pleistocene landscape and environmental evolution. Loess maps have a long history in Quaternary sciences and the first European loess map was published by Grahmann (1932). Fink et al. (1977) created a map for Western, Central and Eastern Europe at a scale of 1:2,500,000 in collaboration with researchers from various countries. This map was completed and digitised by Haase et al. (2007). The mapping of Quaternary sediments throughout Europe was one of the main goals of INQUA since the last 100 years and is still an ongoing topic (Asch, 2020).

However, loess mapping remains challenging as there are two main directions: one from soil sciences and the other one from geology. As the world's most fertile soils are developed in loess they are mapped and presented in soil maps. Bertran et al. (2016) used topsoil textural data from the Land Use and Cover Area frame Statistical survey database to create a map of aeolian sediments in Europe.

In Germany, the mapping of loess and loess derivates started at the end of the 19th century and was mainly conducted by the Prussian Geological Survey (Preußische Geologische Landesanstalt, Wagenbreth, 1999). In the course of these mappings, only sediments with a thickness of more than 2 m were considered. This led to gaps, especially concerning the loess distribution. The focus of geological mapping usually does not lie on the Quaternary deposits, which leads to a fragmentation of the sediment distribution in maps. This method does not allow any assertions about the thickness or detailed timing of deposition of the sediments. In addition, the geological mapping spanned a long period of time and includes a multitude of different mappers. Due to the various procedures and loess definitions, artificial boundaries occur not just at administrative borders, but also within the same map sheet.

On a European scale Lehmkuhl et al. (2021) provide a new loess map of Europe including the differentiation of the loess in 6 main and 17 subdomains, in order to understand and explain the factors controlling their distribution. For the subdivision they used the following criteria: (1) influence of silt production areas, (2) affiliation to subcatchments, as rivers are very important regional silt transport agents, (3) occurrence of past periglacial activity with characteristic overprinting of the deposits.

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Luminescence Techniques in Geosciences: Insights and Challenges in Geochronology for Polish Loess Deposits

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Numerical dating through luminescence methods stands as a cornerstone in various disciplines including geology, geomorphology, paleogeography, and archaeology, providing crucial insights into the ages of sediments and archaeological artifacts. This method's widespread applicability owes much to the ubiquitous presence of quartz and feldspar minerals in the natural environment. In Poland, both thermoluminescence (TL) and optically stimulated luminescence (OSL) have been extensively utilized for dating loess, a sedimentary formation rich in climatic archives. Although OSL exhibits clear advantages over TL dating, particularly in sedimentary contexts such as loess, its broad acceptance is a recent development. Notably, TL findings from Polish loess sections established the groundwork for the Polish loess chronology in the 1980s. This chronology, augmented by subsequent OSL investigations, substantially enhances our comprehension of past climatic patterns. However, a considerable number of luminescence dates remain unpublished, underscoring a disconnect between laboratory research and the dissemination of results.

The Contributions of Dr. Francis Hole to the Loess Community in the USA

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Dr. Francis D. Hole (1913-2002) was a geography and soil science professor at the University of Wisconsin-Madison (USA) for most of his career. He also maintained a position as the head of the Soil Survey Division of the Wisconsin Geological and Natural History Survey. His research and wide knowledge of soils culminated in his coauthored textbook, Soil Genesis and Classification, which was the pedology "bible" for decades. Hole also led the development of the academic journal, Soil Survey Horizons, and authored the text, Soils of Wisconsin. In 1983, Wisconsin became only the second state to officially recognize a state soil – the Antigo silt loam; Hole popularly led the effort to have this legislation pased. Antigo soils are formed in ca. 70 cm of loess over glacial outwash, and are a prominent agricultural soil in the state. His string advocacy for Antigo soils helped to popularize the loess deposits of Wisconsin. Hole's 1950 map of the loess and dune sand deposits of Wisconsin likely served as the base information for the much acclaimed map by James Thorp and H.T.U. Smith (Pleistocene Eolian Deposits of the United States, Alaska, and parts of Canada, 1952). This map served as the primary map of the eolian deposits for much of North America. Hole's work on loess derived mainly from his love and understanding of soils and his years of fieldwork in the state. Thus, like many loess scholars today, he "found" loess through a non-eolian, academic channel. Francis was a gifted, award-winning teacher and a gentle soul. Loved by all, especially his students, Francis's influence on the fields of soils, pedology, and eolian systems continues even to today.

"However, there remains one way, and this is an appeal to the terrain, an appeal to this single, true and inexhaustible source of all knowledge and all valuable synthesis": Yuriy Polanski and Loess Research in Ukraine Between the Two World Wars

Olena Tomeniuk[1,2]

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In 2024, the term "loess" will be 200 years old. These deposits are the most widespread type of continental Quaternary sediments in Ukraine, covering more than 70% of its territory within the European loess belt.

The study of loess issues in Ukraine at the end of the 19th and beginning of the 20th centuries was documented in the works of Pavlo Tutkovskyi, Oleksandr Nabokykh, Volodymyr Laskarev, Volodymyr Krokos, Volodymyr Riznychenko, Roman Vyrzhykivskyi, and other researchers.

In the 1920s and 1930s, one of the most important contributions to the loess study of the Volhyn-Podillia Region we can reasonably consider the scientific achievements of Professor Yuriy Polanski (1892–1975). Among the scientific heritage of the Ukrainian loess researcher, it is possible to single out more than a dozen comprehensive articles and monographs focused on the study of Pleistocene stratigraphy, loess, Palaeolithic issues, as well as research on palaeogeography and palaeogeomorphology of this territory.

Certainly, one of Yu. Polanski's most significant work is the monograph "Podolien Studies: Terraces, Loesses and Morphology of the Galician Podillia on the Dnister" published in 1929. During his research of the Podillia Region, Yu. Polanski's main goal was to establish and develop the stratigraphy of the Pleistocene, to specify successive changes in flora and fauna, climate and Palaeolithic, and ultimately to solve the main issue of the morphogenesis of Podillia based on new factual material. He emphasised the importance of field research in drawing true scientific conclusions, stating in the "Podolien Studies": "However, there remains one way, and this is an appeal to the terrain, an appeal to this single, true and inexhaustible source of all knowledge and all valuable synthesis".

Among the most important achievements of the scientist in the study of loess, the following should be remarked.

- Using innovative research methods, he first separated the Volhyn-Podolian loess cover into three distinct horizons of different ages, corresponding to three glacial epochs.
- During the study of the loess covers of the Middle Dnister Region Yu. Polanski applied a comprehensive approach in the stratigraphic description of loess-soil horizons, involving various criteria for assessing the properties and conditions of formation of these deposits.
- He characterised the selected loess horizons with fossil flora and fauna, particularly, malacofauna, which he determined by himself; based on the found plant and animal remains,

he attempted to make climatic reconstructions of the time of accumulation of Pleistocene sediments.

- The scientist developed the theory of the aeolian origin of loess.
- Yu. Polanski expressed the progressive idea of involving the covering loess and palaeosol strata of the terraces to solve the problem of the time of their formation and distribution (for the Dniester River Valley); he gave an important place to the issue of loess of different ages on terraces ("loesses and terraces" theory).
- The researcher convincingly proved that loess horizons are divided by fossil soils or gaps in sediment accumulation.
- The scientist highlighted the stratigraphic importance of the fossil soil layers. He linked the accumulation of loess material to cold and dry glacial periods, while the fossil soils were associated with warm and moist interglacial periods. This was a progressive concept at that time.
- He drew attention to the chronological relationship between loess and glaciation epochs, based on which he correlated the loess sediments of Volhyn-Podillia with the moraine deposits of Western Europe and the Middle Dnipro Area.
- During the stratigraphic studies of the Quaternary loess of the Middle Dnister Region, Yu. Polanski discovered numerous settlements of Palaeolithic humans. He associated the findings of artefacts with specific stratigraphic horizons, enabling more accurate dating of both - the Palaeolithic artefacts and the loess-soil strata.

For a long time, the name of Professor Yuriy Polanski was undeservedly removed from scientific circulation by the Soviet authorities. However, for his remarkable ideas in the loess research of Ukraine, the scientist deserves to restore historical justice, whose time has come.

Wrocław/Breslau as a Loess research center – from German to Polish researchers

Zdzislaw Jary[1]

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Wrocław is the largest city in Lower Silesia. It has no direct connection with loess areas because it is located in the Odra river valley. However, the Odra river played an important role in the process of loess sedimentation in the Pleistocene. There are loess covers of various thicknesses on both sides of the Odra valley. There are several loess areas in Lower Silesia, which are most often surrounded by shallow patches of loess-derived sediments. The most important loess areas are the Głubczyce Upland, the Niemcza-Strzelin Hills, the Ślęża Massif, the Kaczawskie Upland and the Trzebnica Hills.

The loess of Lower Silesia were the subject of scientific research conducted by German and Polish researchers. Several of them had particularly strong ties to the region. Probably the most prominent was the famous German geographer **Ferdinand von Richthofen**. He was born in the village Carlsruhe (Pokój), studied in Breslau/Wrocław Uniwersity and then became a professor in Berlin. He is generally considered to be the author of the aeolian hypothesis of loess genesis. Perhaps Richthofen's greatest contribution was to popularize the aeolian hypothesis of the origin of loess. Probably even before Richthofen, many researchers considered the possibility of an aeolian origin of loess. One of them could have been **Albert Orth**, a German soil scientist, Quaternary geologist and farmer. Already in 1872, he postulated an aeolian origin of the loess between Ślęża Mount and Trzebnica Hills. Another great scientist associated with Breslau/Wrocław was **Johannes Wolfgang Adolf Werner Soergel**, a German geologist and paleontologist. He was an important pioneer in loess stratigraphy. He worked at Breslau as a professor at the Breslau University.

The group of Wrocław loess researchers of Polish origin is opened by **Alfred Jahn**. He was an outstanding geomorphologist specializing in periglacial geomorphology. His works on loess and periglacial issues stood out from other articles published in Poland. In these difficult times he maintained very good contact with world literature. **Jerzy Cegła** came from Lublin and moved to Wrocław in 1968 where he obtained the position of assistant professor at the University of Wrocław. In 1972, he obtained his habilitation based on the thesis entitled "Loess Sedimentation in Poland". He specialized in sedimentology and periglacial geomorphology. He proposed a new interpretation of some deformation structures, pointing to the role of loading processes. He emphasized the role of wet surfaces in the loess sedimentation process and confirmed his hypotheses with laboratory experiments. He organized a Laboratory of Experimental Geomorphology in Książ Castle near Wałbrzych. Unfortunately, his scientific career was interrupted by his premature death as a result of a fire that took place in Książ on October 1, 1984, on the first day of my work at the University of Wrocław. **Krzysztof Brodzikowski** was an outstanding sedimentologist and Quaternary geologist, specializing in the study of deformation structures of soft sediments. He was a student of Jerzy Cegła. Together with Tom Van Loon, they published the first book summarizing the knowledge about glacigenic sediments (1991). He had never seen glaciers before but he had a huge imagination. In a detailed analysis of glacigenic sedimentary environments, he identified environments where loess was deposited and where loess may have been deposited but did not survive due to its extremely low facies preservation potential. Like Jerzy Cegła, he died prematurely at the age of 44.

Changes in monsoon precipitation in western Loess Plateau under a 2°C interglacial warming

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Knowledge of the past warm climate may help to inform our understanding of future warming. However, the available evaluations are primarily limited to the Last Glacial-to-Holocene warming, which has fundamental differences from the current interglacial warming, particularly in changes in Arctic ice volume in the future. Comparative paleoclimate studies of earlier warm interglacial periods can provide more realistic analogs. Here, we present high-resolution quantitative reconstructions of temperature and precipitation from Huining loess-paleosol sequence in western Chinese Loess Plateau over the past 800 kyr. Firstly, we used frequency-dependent magnetic susceptibility (χ_{fd}) and diffuse reflectance spectroscopy (DRS)-determined hematite (Hem) content to develop the climofunctions for annual precipitation (P_A) and annual temperature (T_A), respectively: P_A mm/yr = 85.00*ln(χ_{fd} 10^{-8} m^3/kg) + 370.34 (n = 180, S.E. = 39.52 mm); T_A °C/yr = 1.80*($Hem_{content}$ g/kg) + 3.84 (n = 180, S.E. = 1.54°C); Then, the climofunctions were applied to χ_{fd} and Hem data of Huining section to reconstruct changes in annual precipitation and annual temperature over the past 800 kyr. We found that the average annual precipitation increase, estimated by the interglacial data, was only around one-half of that estimated for the Last Glacial-to-Holocene data, which is attributed to the amplification of climate change by Arctic ice volume variations. Analysis of the interglacial data suggests an increase in monsoon precipitation of ~100 mm for a warming level of 2°C on the Chinese Loess Plateau.

Reconstruction of the Pleistocene interglacial environments based on Loess-Paleosol sequences in the southeastern part of Carpathian Basin

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Loess-paleosol sequences in the southeastern part of Carpathian Basin are among the oldest and most complete terrestrial records of loess – paleosol sequences, and hence provide valuable information on the paleoenvironmental evolution in the region. The thick loess sequences in Serbia contain a detailed paleoclimatic record of the last ~1 Ma. The correlation of paleo- and environmental-magnetic data from these loess-paleosol sequences provides an opportunity to compare paleo-environmental dynamics that have been obtained from interglacial fossil soils; Chernozems, Phaeozems Cambisols and Luvisols occur. These regional interpretations are presented as maps for different time slices, demonstrating the Middle Pleistocene climatic and environmental transition in south-central- Europe. Interglacial fossil soil complexes have great value as sensitive archives for reconstructing Pleistocene climatic and the associated environmental evolution in this part of Europe.

Dust and Loess in Earth's Deep-Time Record

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Although dust and loess deposits are best-known and most studied from Earth's Quaternary (mostly Pleistocene) record— having been first named in 1823 by Karl Caesar von Leonhard, they are increasingly recognized in deep time. The earliest mentions of inferred loess and eolo-marine dust (that is, eolian-transported dust deposited into marine environments) from Earth's deep-time record occurred in the early 1900s. The first full-fledged studies establishing deposits as loess or eolo-marine dust emerged in the 1980s-1990s.

Paleoloess, or loessite— consists of quartzo-feldspathic mud-/siltstone in typically structureless (massive) units, with common paleosols and minimal signs of fluvial activity. Wet surfaces enhance dust trapping, thus monotonous sections of subaqueously deposited mudstone and siltstone can record eolian delivery where other means of transport can be reasonably eliminated, e.g., in carbonate reef-, playa- and epeiric strata.

Inferred paleoloess deposits reach thicknesses exceeding 1000 m in the Permian of paleo-equatorial Pangaea, such as the western-midcontinent U.S. and Europe, recording extraordinary volumes of dust (silt) production. Indeed, Permian loess deposits from western equatorial Pangaea are the thickest known from any time in Earth history. Many of the approaches used to study Quaternary loess are applicable to deep-time, such as particle-size analysis, provenance, rock magnetism, and geochemistry. Provenance data document derivation from the (broadly speaking) Central Pangean Mountains, after inferred transport in fluvial systems draining these mountains. Nearly all paleoloess documented from Earth's pre-Quaternary record comes from periods that coincide with icehouse climates, such as the Neoproterozoic, late Ordovician, late Devonian, Carboniferous, and Permian.

Major loess deposits of the Quaternary commonly occur in mid- to high-latitude regions, owing to the well-known capacity for glaciers to produce silt. However, thin loess deposits also occur in warm deserts, unassociated with a glacial origin. The equatorial setting of the vast Permian loess deposits is remarkably unusual relative to the Quaternary, and signals conditions quite different from Earth's recent record— conditions that remain under investigation.

Vegetation and climate changes since the LGM in China: evidence from pollen records in loess and lake sediments

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Vegetation reconstructions were based on pollen data from the Chinese Loess Plateau (CLP) and the Hengduan Mountains. The climate in the CLP is mainly controlled by the East Asian monsoon, leading to a significant climatic gradient across this region. Mean annual precipitation and temperature increase from ~300 mm and ~8 ºC in the northwest to ~700 mm and ~14 ºC in the southeast. Pollen analysis was conducted on loess deposits from ten sites across the CLP to identify the spatial patterns of vegetation and climate since the LGM. The Hengduan Mountains, located southeast of the Tibetan Plateau, are climatically influenced by the Indian monsoon. Pollen analysis was conducted on sediments from two alpine lakes to reconstruct the migration of the forest zone since the LGM.

In the CLP, steppe prevailed both in the cold-dry LGM and the warm-humid mid-Holocene. During the LGM, vegetation in the northwest mainly consisted of *Artemisia*, *Echinops*-type, *Taraxacum*-type, and Chenopodiaceae, and vegetation in the southeast was characterized by the same types but with a slight increase in Poaceae. During the mid-Holocene, vegetation was more diverse, with Poaceae, *Artemisia*, *Echinops*-type, and Chenopodiaceae dominant in the northwest, and *Pinus*, *Corylus*, Poaceae, *Artemisia*, and *Selaginella sinensis* dominant in the southeast.

In the Hengduan Mountains, forest plants have dominated over the past 23.3 ka. Successive colonization of different tree communities has occurred: grass and temperate deciduous broadleaved trees dominated from 23.3 to 15 ka; warm temperate deciduous broadleaved trees from 15 to 8 ka; and finally, warm temperate coniferous trees and subtropical evergreen broadleaved trees dominated from 10 to 5 ka and peaked at 7.1 ka and 6 ka, respectively. A minimum upward migration of 650 m for *Tsuga dumosa* forest occurred from the LGM to the mid-Holocene.

Beyond the limitations of bulk sample geochemical composition: the detailed investigation of aeolian deposits using automated mineralogy and SEM/TEM+EDS investigation.

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Geochemical research dominates in the study of loess-palaeosol profiles both in the world and in Poland. On their basis, parameters such as the stage of weathering, the extent of soil-forming processes, the locality of the source of material, or even the degree of compliance of the composition of rare earth elements with widely used standards such as UCC (Upper Continental Crust) are determined. This type of research, despite its high resolution (Skurzyński et al. 2024), does not tell us the whole truth about the examined object and sometimes even covers up very important information or generates more and more questions that the knowledge of the elemental composition alone cannot answer. The next step we took was to quantitatively analyze the mineral composition and learn the granulometric composition, which was provided by the QEMSCAN® SEM (Scanning Electron Microscope) based method. We have adapted this method to test the silt fraction, which is described in more detail in Kenis et al. 2020. The automated method based on imaging and elemental analysis in the micro-area allowed for simultaneous examination of rock-forming and accessory phases (including non-transparent ones), which is impossible to achieve using optical microscopy. On average, we analyzed 130,000 particles per sample (58 samples). However, like any method, this one also has its limitations. So, in the next step, we decided to look at individual particles in SEM. It was possible to distinguish several forms of carbonates, zircons and TiO2 polymorphs that are important for paleoenvironmental interpretation. However, for some phases and forms of occurrence, SEM was not a sufficient method. Problems arose when trying to more closely examine the polymineral coating on the particles. Here, the answer turned out to be a high-resolution transmission microscope (HR TEM) and all the complicated preparation associated with it. Transmission microscope research revealed that coating is not a random sheath made of clay matter, but an ordered and complex structure (Kenis et al.2023). Additionally, during TEM studies we noticed carbonate fibers of various sizes and shapes, which were initially interpreted as bacterial fossils. After more detailed inspection and literature review, they were identified as calcite nanofibers. Such a characteristic form of carbonate occurrence is very useful when considering the advancement of soil-forming processes and the degree of weathering of the material in situ. Another benefit of using the TEM imaging technique was to look inside the quartz particles. Contrary to the assumptions, it turned out that it is difficult to find a single-crystalline object and, moreover, it is difficult to find an object that has not been texturally changed. The next and perhaps most important surprise was the presence of nano-inclusions of lamellar minerals, the presence of which is beyond the detection threshold for other methods. The presence of such impurities as dislocations and inclusions can effectively influence the light emission in optically stimulated luminescence (OSL), which is very widely used in dating young sediments. To check what type of quartz grains/particles emit the wavelength used in dating (approx. 340 nm; Moska 2021), we decided to look at the matter using an SEM with a cathodoluminescence attachment. From the initial observations, we can mention a few interesting observations. One of them is the relationship between tectonically deformed particles and this electromagnetic wavelength and the significant predominance of particles of the dusty fraction glowing in this range over the grains of the sandy fraction. The cathodoluminescence method also allows us to determine the type of rock in which quartz was formed or processed (Boggs & Krinsley 2006). Perhaps a broader look at this issue will also allow us to discover what the emission activator of this wavelength is - it has not been discovered yet.

In our opinion, further detailed research and the inquisitiveness needed in this topic, together with an interdisciplinary approach, will significantly expand our knowledge about loess- paleosol sequences and answer more and more emerging questions. We can conclude our history of loess research from Tyszowce by answering a frequently asked question - Is there a reasonable limit to the detail of measurement? Our answer remains unchanged – for us there are only technical limitations.

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Poster Session

Frozen hell - when icesheet meets melted quartz

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During the first ever survey of micro and nano textures on quartz dusty particles from the loess-paleosol profile in Tyszowce, shear stress fractures and other objects not previously described were observed. Shear stress fractures correspond to those described by Martinelli et al. 2020. This is what the experimental results of Martinelli et al. (2020), Weichert, R., & Schönert, K. (1978), Tromans, D., & Meech, J. A. (2001, 2002), precisely define and what conditions had to be met for the formation of appropriate fractures, which opens the way to the interpretation of the intensity of abrasive and glaciotectonic processes. The mechanism of crack bifurcation formation seems to be particularly interesting, the effects of which are also observed in loess particles (Fig.1B). Each crack split occurs when the so-called critical velocity is reached - climit (1990 m/s), and the increase in the crack propagation speed leads to even greater fragmentation. On this basis, a rule can be formulated - the greater the bifurcation frequency, the greater the crack propagation speed. However, such rapid propagation of cracks has consequences in the form of nano scale hot spots, i.e. local temperature changes that can lead to melting of the quartz material (temperature reach over 1700°C; Brodie & Rutter 2000). Melting and recrystallization textures such as euhedral craters or quartz recrystallization are also observed in loess particles. In addition, we notice a number of previously undescribed textures which, in our opinion, are directly related to high tension/compression stress and local melting of the material. One of the textures we have described is the tab shape texture which also shows the direction of propagation of circumferential crack on the edge of conchoidal fracture (Fig.1A). It is also worth mentioning not only what we saw, but how it was observed and how to look for this type of texture in the future. Imaging often nanometric-sized textures would be impossible without appropriately selected SEM (Scanning Electron Microscope) measurement parameters. Low-energy imaging (2 keV) and ultrasonic particle cleaning in ultra-pure water and a rotary-tilt graphite sputtering procedure are the main components of the success. It is also important that during aeolian transport, the fresh face of dust particles was protected with polymineralic surface coating (Kenis et al. 2023), which allowed the micro and nano textures to remain almost intact.

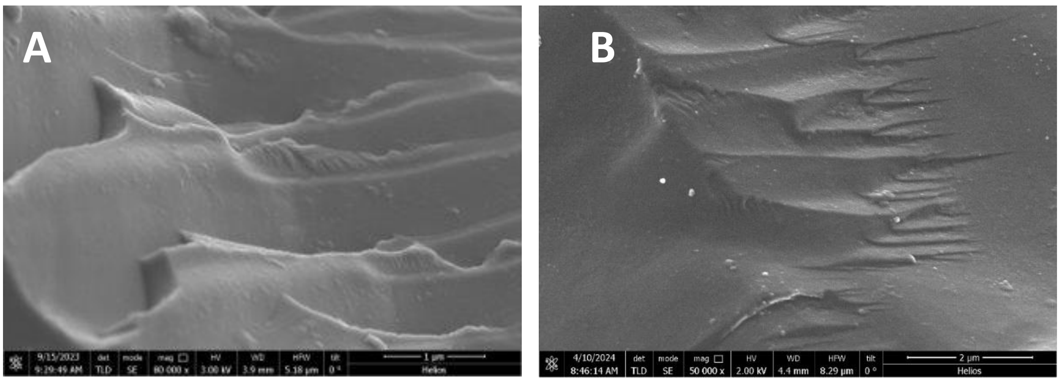

Fig.1. SEM (SE mode) images of quartz textures. A – Tab shape fracture, B – crack bifurcation.

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Luminescence stratigraphy of loess deposits from Trzebnica.

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This abstract presents a study focused on a loess profile situated in Trzebnica, Western Poland, within the Trzebnica Hills region. The well-preserved loess formation exhibits distinct stratigraphic units, offering an opportunity to enhance the chronostratigraphy of loess in Poland. Historically, Trzebnica's loess Quaternary deposits were uncovered in a brickyard on the Winna Góra slope, ranging from 6 to 14 meters beneath the present surface. The brickyard's southern wall exposes glacial sediments, identified as residues of MIS 12 Glaciation through stratigraphic correlation and indicator-stone analysis. Lithic artefacts identified with the Lower Palaeolithic were found in the analysed sediments in the 1980s and 1990s of the 20th century. A lower horizon containing 1,400 specimens and individual faunal remains was deposited above glacial till in gravels and sands. Approximately 1.2m above this, artefacts were found in a sandy layer, which were classified as the upper horizon (220 specimens). The lower horizon with artefacts was referenced to MIS 15-MIS 13, while the upper horizon to MIS 11. Our luminescence investigation, based on 15 samples, aims to validate the historical assumption regarding the presence of loess deposits from MIS11 or older in this location, which have not undergone scientific chronostratigraphic examination via luminescence methods before. Initial findings suggest that the prevailing perspective on this matter requires revision, indicating the potential for a significant reinterpretation of the site's geological history.
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Multi-proxy studies unraveling paleoclimatic secrets in loess: insights from the Middle Dnieper Region

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This study presents comprehensive multi-proxy research unveiling paleoclimatic secrets in loess deposits from the Middle Dnieper Region. Focusing on the Pleistocene loess-palaeosol sequences, our work provides new insights into the climatic and environmental dynamics of this period. Employing a wide range of multidisciplinary techniques, including detailed grain size distribution, chemical composition analysis, advanced colorimetric measurements, paleomagnetic studies, and luminescence dating, this research significantly contributes to the environmental history reconstruction of the region.

The study encompasses the analysis of 11 distinct loess units and 10 palaeosol units that reflect the complex climatic fluctuations of the Middle and Upper Pleistocene. A crucial aspect of our research is the till layer from the Dnieper I (Saalian) Glaciation (MIS 8), serving as an important stratigraphic marker within this Quaternary sequence. Laboratory results, including spectrophotometric analysis, confirm significant variability in the chromatic parameters of loesses, illustrating the dynamic evolution of the natural environment from loess accumulation during cold phases to soil formation in warm periods.

Field methods involved detailed lithological and pedological sediment characterization at key geological sites, enhancing our understanding of fluvial, glacial, and loess accumulation processes. The laboratory methodologies were critical in clarifying transport, deposition, and transformation processes of glacial and aeolian materials, indicating significant loess autochthony. The integration of digital spectrometers for colour analysis conducted on powdered samples in the lab added objectivity to our findings, contrasting traditional field-based Munsell Soil Colour Chart methods. This approach enabled the creation of a digital colour record corresponding to the analogue Munsell scale, lending further objectivity to colour descriptions.

OSL dating played a pivotal role in determining the age of loesses from the last glaciation, providing precise chronological markers for these deposits. This method was instrumental in establishing the temporal framework for the Pleistocene environmental changes documented in our study. Additionally, separate paleomagnetic studies were conducted to understand the magnetic properties of these sediments, further aiding in the stratigraphic positioning of the loess and paleosol units. Similarly, palynological studies were carried out independently, offering valuable insights into the vegetation dynamics and climatic conditions of the time.

Detailed grain size analyses were performed using laser diffraction, a method that enabled high-resolution characterization of the sediment's particle size distribution. This analysis was essential for understanding the aeolian transport mechanisms and depositional environments, providing a more comprehensive picture of the loess formation processes.

By merging local environmental observations with broader regional influences, this research provides a fresh perspective on the Pleistocene stratigraphy of Central and Eastern Europe. The findings emphasize the complex interplay between glacial movements, loess deposition, and soil formation, enriching our understanding of the Pleistocene climate legacy and its impact on the landscape. This nuanced approach not only sheds light on the dynamic processes shaping the region during the Pleistocene but also contributes to the broader discourse on climate change and landscape evolution over geological timescales.

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From snail perspective: differences between Červený Kopec (Czechia) and Veliki Surduk/Stari Slankamen (Serbia) loess-palaeosol sequences

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In this study, we present the results of a malacological investigation conducted on the Stari Slankamen and Veliki Surduk loess-palaeosol sequences in northern Serbia, followed by a comparison with the established interpretation of Červený Kopec. These sites are known for preserving one of Europe's oldest continuous records of Pleistocene environmental changes, spanning nine glacial-interglacial cycles. Notably, Červený Kopec (Brno) is situated approximately 520 km northwest of the Serbian profiles. Our main aim was to evaluate how the snail assemblage reflects the environment of glacial-interglacial transitions.

The loess samples obtained from the two Serbian profiles were sieved, after which terrestrial gastropod shells were manually collected and identified whenever feasible. In total, 66,871 shells from terrestrial gastropods were recovered from the Serbian profiles. We applied interpretations of the shell assemblage following methodologies outlined by Sümegi and Krolopp (1995) and Ložek (1964), with the goal of inferring the most likely environmental conditions in terms of temperature, humidity, and vegetation.

Comparative analysis between the interglacial environmental reconstructions of Červený Kopec and Stari Slankamen/Veliki Surduk was based on differences in soil types. We utilized the Danube loess stratigraphy as a framework for stratigraphic correlation between these profiles. The interpretation of Červený Kopec is based on the work of J. Kukla (1975), who published malacological data analyzed by V. Ložek.

Our findings suggest that while glacial periods exhibited notable similarities across both sections, the greatest diversity of environmental conditions was observed during interglacial periods. When comparing interglacial periods, those in Serbia tended to follow the trend of aridification towards the end of the Pleistocene, resulting in a steppe environment during both glacial and interglacial periods.

Ice wedge pseudomorphs at archeological site Trzebnica 2: characteristics and research history

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The archaeological site Trzebnica 2 (51.32° N, 17.07° E) is located within the Vine Mountain (219 m a.s.l.) which is one of the highest hills of the Trzebnica Hills. The area was repeatedly affected by the Scandinavian glaciation during the Pleistocene. This part of the Silesian Rampart, of which the Trzebnickie Hills are a part, was shaped by glaciotectonic processes (Migoń et al. 2021). In addition to the fact that the Pleistocene glaciation largely shaped the relief of the land, it was also associated with a specific climate and periglacial environment. The cold climate, intense erosion and scarce vegetation were conditions favorable to the sedimentation of loess, which is characteristic of many formerly glaciated European areas. As they are formed in a cold climate, the occurrence of this type of sediments indicates the ancient extent of the periglacial zone stretching on the foreland of the Scandinavian ice sheet. Within loess covers, characteristic "markers" are also preserved in the form of various structures resulting from processes such as gelifluction, thermokarst or frost processes. They provide additional evidence for the cold climate of the periglacial zone. The largest structures associated with the periglacial environment are ice wedge pseudomorphs, which are treated as evidence of the former extent of permafrost. Structures of this type were identified at the site Trzebnica 2, which was initially mainly the object of strictly archaeological research, as well as sedimentological (Jary et al. 1990; Traczyk 1996). In 1991, the first mention of approximately 3-meter-long epigenetic ice wedge pseudomorphs found in the lower complex of dust deposits appeared (Burdukiewicz 1990, 1991). In 1993, an independent study of fracture structures was published, which described two levels of such structures, discovered in two neighboring outcrops (Burdukiewicz, Goździk 1993). Ice wedge pseudomorphs at the archeological site Trzebnica 2 were marked by specific structures related to gelifluction and thermokarst processes. The latest research, conducted in 2023, aimed to re-discover one of the pseudomorphs and interpret it. The structure is characterized mainly by massive fill, with its upper part marked by collapsed layers of sediment above. Particularly noteworthy are the numerous traces of thermokarst processes, mainly in the form of iron concretions at the base of the structure. Ice wedge pseudomorphs at Winna Góra are clearly characterized by structures resulting from intense processes related to the prolonged presence of water in the vicinity of the structures during the melting of the ice wedges. This may be the result of conditions specific to this site and is an additionally valuable element in the interpretation of pseudomorphs and the environment in which they were created.

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Field trip

Loess-paleosol sequence in Trzebnica – preliminary results

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Loess in the neighborhood of Trzebnica is well known, although it is poorly described. Some older authors (Tietze 1910; Czajka 1931; Meister 1936; Schwarzbach 1942) described the distribution of loess and discussed only in general its structure and genesis. From among younger literature dealing with Trzebnica loess (Rokicki 1950, 1952; Dylik 1952; Jahn, Szczepankiewicz 1967; Raczkowski 1969), only Rokicki (1952) discussed in more detail its structure and properties, although neither loess profile nor its stratigraphy was presented. Both older authors and Rokicki (1952) found that the lowermost parts of loess cover are commonly interstratified with sand. Moreover, at least three types of loess have been recognized: "typical" loess, sandy loess, and loess-loam. Rokicki (1952) suggested also that eolian genesis is satisfactorily documented only for a part of loess-like deposits near Trzebnica; others represent redeposited material. The loess lies on a strongly inclined surface and shows structures that suggest slope transport of the deposit. This transport is thought to have been synchronous with an eolian supply of material.

The loess discussed occupies the southern slopes of the hillock Winna Góra. These slopes are strongly inclined, from 10° up to 30°, and they are incised by numerous dry valleys cut into loess. Loess at Winna Góra forms the northernmost fragment of loess cover near Trzebnica; the summit and northern slopes of the Winna Góra hillock are occupied by glacial deposits.

The presented Trzebnica loess-paleosol sequence was prepared in 2023. During the research, previous lithological descriptions were verified and samples were taken for further laboratory analyses (including grain size analysis at a continuous interval of 2 cm; OSL dating; color).

During field research carried out in December 2023, the following sequence of sediments was recorded in the vertical wall of the outcrop (Fig.2.):

0.0 – 0.4 m	A horizon of brown soil
0.4 – 1.1 m	B horizon of brown soil, numerous vertical, dark-colored root slots
1.1 – 1.75 m	laminated sediment, brown and light laminas dipping west towards the fill of the wedge, the lower border is clear, highlighted by a dark lamina of approx. 5 cm
1.8 – 2.15 m	massive loess with increased content of humus material, lower border highlighted by weak Fe lamina
2.15 – 2.9 m	streaked loess, gley streaks (visible at 2.4 m) with a darker color, at 2.57 and 2.75 m laminae slightly pulled upwards in the area of the wedge filling
2.9 – 3.7 m	clearly laminated loess, horizontal laminae, clearly sandy level, laminae of various colors and thickness
3.7 – 5.3 m	laminated loess, disturbed, laminas rarer than in the level above; clear, continuous, slightly disturbed sandy laminae at the depth. 4.4 – 4.43 m, 4.65 –

	4.68 m, 4.95 – 5 m; inserts of lighter material whose upper boundaries are marked by sandy laminae; in the lower part of the level
5.3 – 5.4 m	pale horizon, the upper border is clearly darker, the lower border is highlighted by an approx. 1 cm insert of yellow Fe material
5.4 – 6.0 m	streaked loess, at 5.6 m there is a continuous Fe lamina, the lower boundary is clear, disturbed
6.0 – 6.2 m	insert of darker, displaced material (flow structure), multi-fraction material with increased dust content, the level dips towards the west
6.2 – 7.0 m	laminated horizon, distinct horizontal laminae of brown, dark yellow and light color, in this part of the level there are sands and single gravels and distinct brown concretions; from 6.87 m laminated loess, laminates are rarer, more yellow in the lower part, gley color in the upper part
7.0 – 7.6 m	gleyed loess, streaked, glazing more visible in the lower part of the level, sharp border
7.6 – 7.8 m	gravel bad
7.8 – 8 m	clay horizon

The results of OSL dating are presented below (Fig.3):

Loess-paleosol sequence in Biały Kościół

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The loess exposure in Biały Kościół (λ = 17°01'30"E, φ = 50°43'30"N, 185 m above sea level) is composed of top and slope facies loess (Jary, 2007). It is located in a disused clay pit on the western slope of the Oława valley.

Loess covers in the area were previously described by Raczkowski (1969) and Ciszek (1997). The complete loess-soil sequence in Biały Kościół was prepared and characterized in 2001 (Ciszek et al. 2001). Preliminary results of pollen analyzes were presented by Komar et al. (2009). Mineralogical features of the Biały Kościół loess based on the analysis of heavy minerals were published by Chlebowski et al. (2004a, 2004b). The characteristics of lithostratigraphic units and the interpretation of periglacial phenomena were discussed by Jary (2007, 2010) and Jary and Ciszek (2013). The results of TL and OSL dating of the profile were presented by Fedorowicz (2006) and Moska et al. (2019).

The loess profile in Biały Kościół was presented several times to participants of international conferences (including Closing the gap - North Carpathian loess traverse in the Eurasian loess belt", international workshops, 6th loess seminar in Wrocław, May 16–21, 2011; "Kukla LoessFest", Wrocław, September 2014). Due to its unique succession, comparable to the typical Late Pleistocene sequences of eastern Poland, Ukraine and Russia, the exposure of loess in Biały Kościół was presented during four subsequent (IV, V, VI and VII) Loess Seminars organized by the Department of Physical Geography of the University of Wrocław.
The currently presented profile was prepared in 2017. During the research, previous lithological descriptions were verified and samples were taken for further laboratory analyses (including grain size analysis at a continuous interval of 1 cm; OSL dating; color).

During field research carried out in November 2008, the following sequence of sediments was recorded in the vertical wall of the outcrop (Fig.2.):

0,00 – 0,30 m “A” horizon of the Holocene soil.

0,30 – 0,44 m “AB” horizon - transition level of the Holocene soil.

0,44 – 0,76 m “B” horizon of the Holocene soil.

0,76 – 1,00 m BC horizon

1,00 – 1,32 m homogenous loess, in the lower part more brown; small Mn concretions

1,32 – 1,43 m a continuous, lighter layer - small Fe concretions. This layer is cut by the gap emerging from the above-layered layer. This gap is emphasized by Ca and Mn

1,43 – 1,95 m spotted/streaked loess. Stains / streaks with different orientations, brown (humus?). At 1.80 m and 1.90 m continuous Fe levels

1,95 – 2,20 m insert darker material (probably from the material filling the stains from the layer above).

2,20 – 2,32 m clearly laminated loess (light and dark non-horizontal lamellas).

2,32 – 3,00 m delicately laminated loess with numerous concretions and stains of Mn. At 2.70 m, barely visible layer of lighter material with Fe laminate.

3,00 – 3,34 m laminated loess with lighter materials (gley?) and more orange laminates. Numerous spots of Mn.

3,34 – 3,70 m laminated loess with laminates as above. The whole is closed by deformed Fe lamina filled with a different type of material.

3,70 – 4,10 m deformation zone. Numerous Fe laminas (most visible on 3.97 m and 4.10 m) intersecting at various angles. On the border, numerous loess puppets and spots of Mn. Under the Fe laminates gley inserts (?).

4,10 – 4,70 m the distinctive gley horizon in the form of deformed horizontal levels with numerous Fe laminates as well as concretions and Mn stains. At a depth of 4.40 m, there is a fairly clear erosion limit. Inserts of lighter material in the form of deformed laminates.

4,70 – 4,76 m gley horizon.

4,76 – 5,20 m laminated loess = inserts of lighter material + loess + Fe laminates. Numerous concretions of Fe.

5,20 – 5,48 m transition zone - clear and continuous but disturbed Fe and glay laminas. The lower part is strongly gleyed

5,48 – 6,50 m L1SS1 soil - gray gley with inserts of lighter material with distinct, disturbed Fe laminates. Light gray gley inserts at 6.15 - 6.20 m, 6.33 m and 6.44-6.50. At the depth of 5.80 m, a number of loess puppets. The lower border is the continuous layer of the ferruginous hardpan, strongly disturbed.

6,50 – 6,80 m L1LL2 - loess with a clear, continuous lamination of Fe. At a depth of 6.50 m, 6.55 m, and 6.60 m, clear Fe laminates, distributed to the right side of the profile (towards W direction). There are traces of gley in the form of horizontal inserts.

6,80 – 8,20 m L1LL2 unit. Noticeable delicate lamination and clear gley horizons at depths: 7.00 - 7.03 m, 7.43 - 7.56 m and 7.75 - 7.90 m. Numerous Mn concretions almost in the entire layer. Horizon with charcoal (?) at 7.20 - 7.30 m. The lower part of the horizon is more homogeneous.

8,20 – 8,35 m tongue gelifluction zone, strongly gleyed with Mn stains. Tongues oriented to the left side of the profile (direction E). Top of S1 soil.

8,35 – 8,70 m gray humus horizon (A?) of S1 soil, numerous charcoal.

8,70 – 9,00 m bright horizon (E or B) of S1 soil, sandy, disturbed with distinctive laminates coming out of the higher horizon. The bottom border is the horizon of gravel pavement.

9,00 m - rusty, orange horizon (B?) sandy, very fine granular in the lower part, numerous small wedges filled with lighter material. In the lower part, the sediment takes on a brick structure.

The sequence of loess and paleosol in Biały Kościół consists of five litho-pedostratigraphic units that developed in the late Pleistocene and Holocene: three soil units (S0, L1SS1, S1) and two loess units (L1LL1, L1LL2).

The polygenetic S1 pedocomplex, as interpreted by Jary (2007), developed during the last interglacial period (eem = MOIS 5e) and in the early part of the last glacial period (MOIS 5d-5a). It consists of the thick Bt illuvial horizon, developed on a heterogeneous sandy-silty substrate, the E eluvial and A accumulative horizons, and a well-marked EA transitional horizon with charcoal inserts. In this pedocomplex, erosional and/or deformation surfaces can be observed, indicating a complicated history of the development of the pedocomplex. In the final stage of development, the top parts of this unit were transformed by glial and cryoturbation processes.

A characteristic feature of the Biały Kościół loess sequence is the presence of a thicker, approximately 2-meter-high level of L1LL2 carbonate loess, probably deposited during the Lower Plenivistulian (MOIS 4; Jary, 2007). Such a well-developed L1LL2 loess unit rarely occurs in the loess profiles of southwestern Poland.

In the top of the L1LL2 loess, interpleniglacial soil (pedocomplex) L1SS1 was developed. The development of this pedocomplex probably took place in the middle pleniglacial of the last glacial period (MOIS 3). In the Biały Kościół it is built of accumulated levels of gley-tundra soils, located on a degraded cambic level. The L1SS1 pedocomplex is clearly isolated in the outcrop and is marked by grain size indicators and the share of calcium carbonates and organic carbon. The top of the tundra-gley soil was deformed by the processes of frost swelling and solifluction.

Above the L1SS1 soil there is an extensive loess unit L1LL1, which was most likely deposited during the upper pleniglacial and late glacial of the last glacial period (MOIS 2). The L1LL1 lithostratigraphic unit shows considerable variation in profile. Noteworthy are the weak tundra-glial soil, periglacial deformation levels and several initial gley horizons. Jary (2007) believes that they are evidence of uneven loess deposition rates and variable climatic conditions during MOIS 2.
In the top of L1LL1 loess, modern S0 brown soil was developed.

OSL age were performed by Piotr Moska and discussed by Moska et al. in 2019. The results are presented below (Fig.3):

Field trip destinations - Pokój, Namysłów and Trzebnica

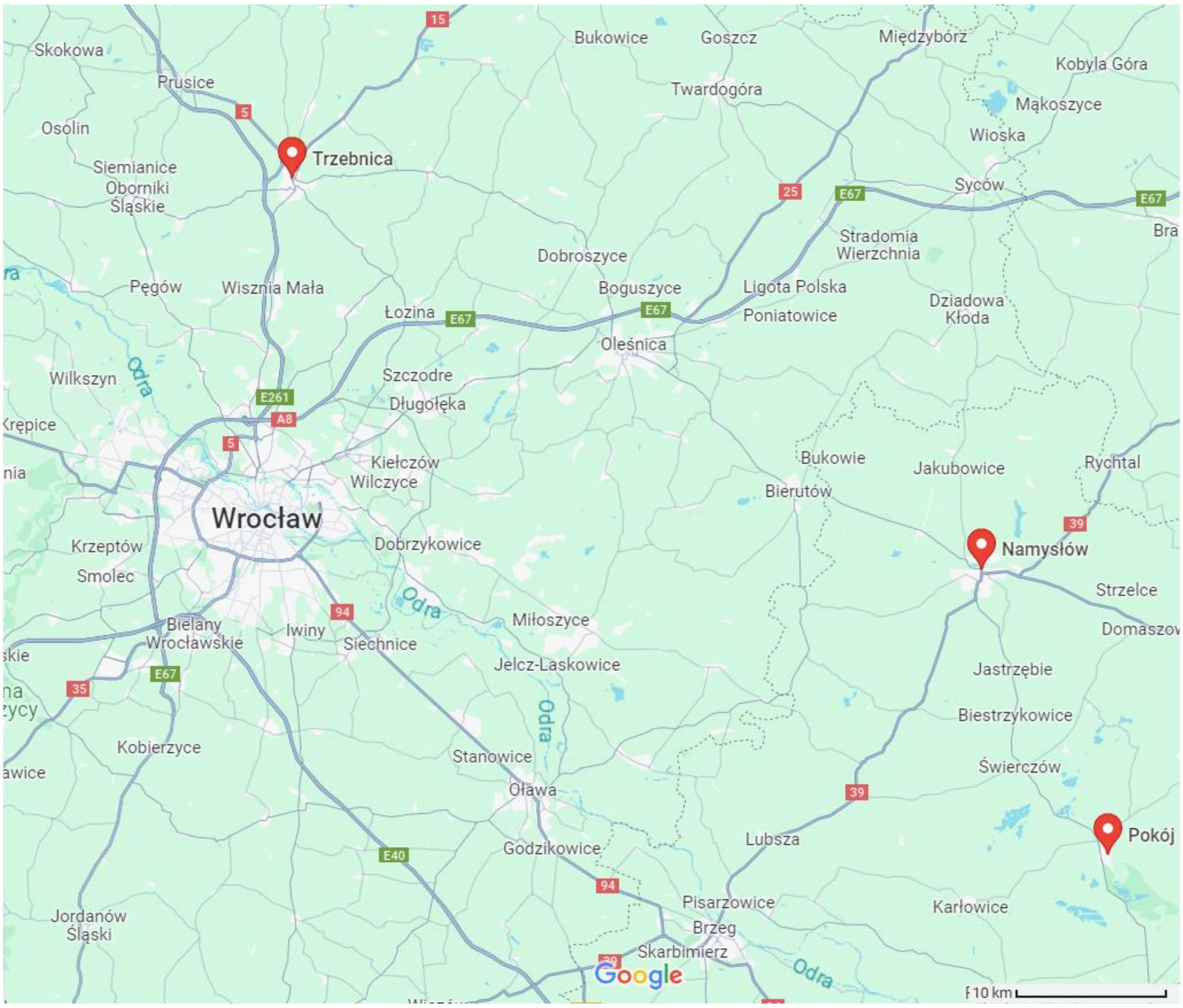

Fig. 4 Map of the field trip destinations (red marks).

Pokój (German: Carlsruhe, old Polish/Silesian: Pokoy) - is a village in Namysłów County, Opole Voivodeship, in southern Poland. Pokój is located in the mesoregion of the Silesian Lowlands (Opole Plain) at an elevation of 150–160 m a.s.l.. The village is located within the Stobrawa Landscape Park, which protects the natural lowland landscape with forest complexes. Pine and mixed forests occupy as much as 80% of the area. Pokój was established in 1748 as a hunting lodge by Duke Charles Christian Erdmann, a scion of the House of Württemberg, whose ancestors had been enfeoffed with the Silesian Duchy of Oels (Oleśnica) in 1649. In 1842, the village had a population of 2,069. In the mid-19th century, the residents spoke mostly Polish and German. In 1847 Carlsruhe received the status of a spa town (Bad). The village currently has c. 1,500 inhabitants. Of the historic sites, The Baroque Sophia's Church finished in 1775 is preserved, as is the extended English garden laid out by the Württemberg dukes. A characteristic feature of the village are the streets that radiate out from the central square where the ducal palace was located (no longer in existence, destroyed during World War II).

From the point of view of natural sciences, two outstanding geographers were born in the Pokój: Duke Friedrich Paul Wilhelm of Württemberg (Fig. 4) (1797 – 1860) – naturalist and explorer, participated in and organized several expeditions in North America, North Africa, and Australia. In 1829, he discovered the headwaters of the Missouri River.

Ferdinand Freiherr von Richthofen (Baron von Richthofen) (Fig. 4) (1833 – 1905) – geographer and explorer, participated in several expeditions to North America and Asia, loess researcher and was one of the first to point out its aeolian genesis. He is noted for coining the term "Seidenstraße" - "Silk Road" in 1877.

Another prominent figure tied to the history of Pokój is a German composer and conductor Carl Maria von Weber (Fig. 4) (1786 - 1826). He was best known for his operas and is considered a crucial figure in the development of the German Romantic opera. His piano compositions influenced famous composes in the likes of Mendelssohn, Chopin and Liszt. Carl Maria von Weber was hosted by Duke Eugen of Württemberg at the ducal palace in the winter of 1806-1807. During that time, von Weber wrote two symphonies (Jähns 50/51).

Fig. 5 People tied to Pokój. From the left: Duke Friedrich Paul Wilhelm of Württemberg, Ferdinand Freiherr von Richthofen and Carl Maria von Weber.

Namysłów (German: Namslau, old Polish/Sliesian: Namysłōw) – is a historic town in Opole Voivodeship, in southern Poland. Namysłów is located in the mesoregion of the Silesian

Lowlands (Oleśnica Plain) at an elevation of c.140 m a.s.l.. The town is located in the Widawa River valley, the right tributary of the Odra River. Currently it has around 16,000 inhabitants. Namysłów was established at the beginning of the 13th century but was destroyed in 1241 during the first Mongol invasion of Poland. It was refounded by Polish Duke Bolesław II the Bald in 1249. Namysłów was briefly an independent city during the 14th century and was enriched by the trade route from Wrocław to Kraków, especially with linen. Despite significant damage during World War II, the town has preserved several valuable historic monuments:

- medieval defensive town walls with the Krakowska Gate and numerous towers
- Namysłów Castle, dating back to the 14th century (Fig. 5)
- Saints Peter and Paul church built in years 1405–41 (Gothic) (Fig. 5)
- Saints Francis of Assisi and Peter of Alcantara church and the former Franciscan monastery, dating back to the 14th century (Gothic)
- Church of the Immaculate Conception of the Blessed Virgin Mary, dating back to the 13th century
- Town Hall at the Market Square

Fig. 5 Landmarks in Namysłów. On the left: Namysłów Castle, on the right: Saints Peter and Paul church.

Trzebnica (German: Trebnitz, old Polish/Silesian: Trzebńica) – is a historic town in Lower Silesia Voivodeship in south-western Poland. Trzebnica is located in mesoregion Silesian Rampart (Trzebnica Hills) at an elevation 160 – 210 m a.s.l.. Trzebnica Hills is a terminal moraine formed during the Wolstonian Stage of the Pleistocene (300,000 - 130,000) and characterized by a hilly relief with relative heights exceeding 100 meters. In 1250 Trzebnica received town privileges, it passed under the jurisdiction of the Lower Silesian Duchy of Oleśnica in 1323. Although the town was devastated several times by fires and plague, by Hussite troops in 1430 and during the following wars, Trzebnica is rich in historical monuments. There is an important pilgrimage center near the Trzebnica Loess Documentation Site. In 1202 the Silesian Piast Duke Henry I the Bearded and his wife Saint Hedwig of Andechs founded hier a Cistercian convent, the present-day Sanctuary of St. Jadwiga in Trzebnica, the first in Poland (Fig. 6). The vast monastery complex consists of an abbey church and residential buildings. The church was built in the late Romanesque style, to which Baroque additions were made in 1741. The abbey also became a mausoleum of many rulers of the Silesian Piasts.

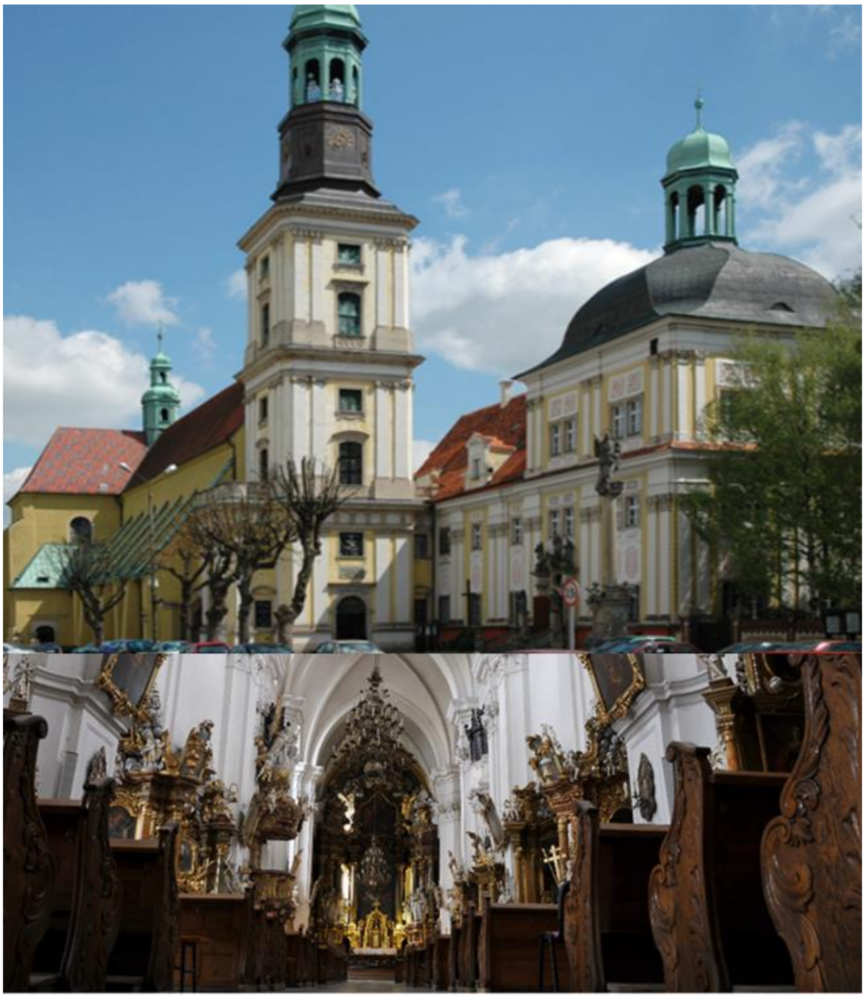

Fig. 6 Sanctuary of St. Jadwiga in Trzebnica. On the top: outside, on the bottom: inside, main nave.