19th CONFERENCE OF ENVIRONMENTAL ARCHAEOLOGY

ABSTRACT BOOK

„Archaeology of Resources...”

5th - 7th February, 2025, Nitra, Slovakia

Katedra archeológie
Univerzita Konštantína Filozofa v Nitre

FILOZOFICKÁ FAKULTA
UKF v Nitre

MINISTERSTVO ŠKOLSTVA, VÝSKUMU, VÝVOJA A MLÁDEŽE SLOVENSKEJ REPUBLIKY

19th Conference of Environmental Archaeology 2025

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ABSTRACT BOOK

DEPARTMENT OF ARCHAEOLOGY

FACULTY OF ARTS, CONSTANTINE THE PHILOSOPHER UNIVERSITY IN NITRA, SLOVAKIA

The conference is held under auspices of the The Ministry of Education, Research, Development and Youth of the Slovak Republic and the IANSA journal https://www.iansa.eu/

Location: Constantine the Philosopher University in Nitra, Slovakia
Date: 5th – 7th February 2025

The front cover: Archaeological sites on the summits of the hills in the Tribeč Mountains: the ruins of the medieval Gýmeš Castle on the right and Veľký Lysec, which features a hillfort from the Lusatian culture of the Early Iron Age on the left. In the background is the summit of Pohronský Inovec mountain. Photo: Jaroslav Košťál
The back cover: An extensive gold mining area, covering approximately 180 hectares, located in the Valley of the Chvojnica stream in Malinovo and Nitrianske Pravno (Prievidza district), dating from the 14th to the 18th centuries AD.. Digital elevation model, source: Geodesy, Cartography and Cadastre Authority of the Slovak Republic. Visualisation: Tibor Lieskovský

Nitra 2025
ISBN 978-80-558-2257-0

19th Conference of Environmental Archaeology 2025

February 5-7, 2025, Nitra, Slovakia

„Archaeology of Resources ... ”

The conference focuses on archaeology of resources and brings together papers that aim to understand how ancient societies utilized, managed, and interacted with natural resources mostly through examination of the material remains of past human activities related to the exploitation, management and conservation of resources such as water, soil, minerals, plants, and animals.

The papers address questions from five key topics:

- Agricultural practices – crop cultivation, fieldscapes and water management from botanical, isotopic or soil data perspectives
- Animal husbandry and hunting – feeding, breeding and hunting techniques and their role in subsistence economies
- Exploitation of raw materials – technologies, mining, quarrying techniques
- Environmental impact and sustainability – deforestation, land use, pollution, hydraulic engineering
- Trade and exchange networks – distribution, analysis of isotopes and elements from pottery, metals and food remains and residues

CONFERENCE PROGRAM

Wednesday, 5th February 2025

8:00	REGISTRATION OPEN
9:10	OPENING CEREMONY
9:30	Sánchez Díaz, F. – García Sanjuán, L.: The decline of Iberian Megasites and the 4.2 Ky BP climatic event
9:50	Crabtree, P. J.: Hunted Resources in Neolithic and Early Chalcolithic Tepecik, Turkey
10:10	Jakobitsch, T.: Revealing Winter Feeding Strategies: Animal Dung from the Neolithic Pile Dwelling of Mooswinkel, Austria
10:30	Kofel, D.: Did the Prehistoric diet differ? Archaeobotanical analyses of the first farmers in the territory of central and northern Poland
10:50	COFFEE BREAK
11:10	Petřík, J. – Petr L. – Hanáček, M. – Kele, S. – Milovský, R. – Tóth, P. – McKay, N. – Bátora, J.: Mid-Holocene Climate Shift in Central European Isotopic Records with Insight from Santovka, Slovakia
11:30	Timm, P-M. – Kirleis, W. – Wunderlich, M. – Bistáková, A. – Cheben, I. – Furholt, M.: New archaeobotanical data on crop cultivation and use of plant resources in Lengyel settlements in south-western Slovakia
11:50	Salisbury, R. B. – Gyucha, A. – Nagy, B.: Hydrological controls on the Great Hungarian Plain: Risk, resilience, and ditched enclosures during the Neolithic and Bronze Age
12:10	Saratikyan, A. – Danielyan, H. – Badalyan, M.: The Role of the Hrazdan river in shaping Yerevan's Ancient environment in the 1st Millennium BC
12:30	LUNCH BREAK
14:10	Moniaki, K.: Exploring storage practices on the island of Crete during the Hellenistic period: a case study from the site of Dreros
14:30	Pető, Á. – Kovács, G. – Saláta, D. – Kenéz, A. – Vicze, M.: Subsistence strategies in the Middle Bronze Age Carpathian Basin as seen in the archaeobotanical record of a Vatya house (Százhalombatta-Földvár, Hungary)
14:50	Oravkinová, D. – Števko, M. – Villa, I. M. – Zachar, T. – Furmánek, V. – Olexa, L. – Olšav, Š.: Bronze in Early and Middle Bronze Age Eastern Slovakia: source, production and distribution
15:10	Gašpar, A. – Petřík, J.: Material Aspects of OFCC Ceramics in the Košice Basin
15:30	COFFEE BREAK

15:50 Agulló Máñez, X. – Gutiérrez-Rodríguez, M. – Grau Mira, I.: Micro-contexual approach to ancient agriculture and paleoenviroment: the case of La Fernoveta (Ibi, Alicante, Spain)

16:10 Beneš, J. – Tušlová, P. – Budilová, K. – Komárková, V. – Brychová, V. – Juřičková, L. – Kovačiková, L. – Ivorra, S. – Bouby, L. – Ardjanliev, P.: A Multidisciplinary Investigation of the Roman Site St. Petkina Niva in the Ohrid Region, North Macedonia: Local Wine Production and Environment

16:30 Egri, M. – Roibu, C. – Grindean, R. – Tanţău, I. – Rustoiu, A. – M. McCarty, M.: Wood consumption patterns on the middle Mureş valley (Transylvania) during the Late Iron Age and Roman provincial period

16:50 Szmoniewski, B. Sz. – Voinea, V. – Lityńska-Zając, M. – Bălăşescu, A. – Vasile, G.: Walnuts, the essential food for souls? - interdisciplinary studies on remains from Early Roman tumulus at Cheia – Vatra Satului, Constanța County, Romania

17:10 Przepióra, P. – Kalicki, T. – Maturlak, M. – Podrzycki, L. – Zubek, K.: Przeworsk community's bloomery activity and microartefacts in the alluvia: case study in the middle and confluence sections of Czarna Nida River (Holy Cross Mts. region)

17:30 Dresler, P.: Silos, granaries and barns as a manifestation of the socio-economic system of early medieval society

17:50 BREAK

18:00 POSTER SESSION & LITTLE REFRESHMENTS

Thursday, 6th February 2025

8:50 Mlejnek, O.: IANSA journal presentation

9:10 Türk, A. – Borzová, Z. – Pintérová, B.: Typological and technological remarks for the evaluation of the secondary uses Great Moravian ornamental button finds from Subbotci (Ua) Grave 2. Latest results of the radiocarbon chronology on the Great Moravian-Early Hungarian relations at the end of the 9th c. AD

9:30 Petr, L. – Kočár, P. – Lisá, L. – Mlejnek, O. – Kočárová, R. – Lanta, M.: Development of the Central European landscape from the Early to High Middle Ages based on environmental record from wells and natural sites

9:50 Hrubý, P. – Kopečná, M. M. – Petr, L. – Kočárová, R. – Malý, K.: Destroyed Woods in Medieval Metallurgical Landscapes – Case Study of Čejkov (CZ)

10:10	Ferenczi, L. – Janovský, M. P. – Trubač, J. – Klír, T.: Stable isotope analysis in soil prospection reveals the type of historic landuse under contemporary temperate forests in Europe
10:30	Hladík, M. – Látková, M. – Kovačiková, L.: Interactions Between Environment, Ecology, and Economy in the Early Medieval Mikulčice-Valy Hinterland
10:50	COFFEE BREAK
11:10	Wiezik, M. – Reiffers Čierniková, M. – Zezulková, M. – Hájková, P. – Jamrichová, E.: The use of the mountain landscape since prehistoric times - the role of man in the origin of the high-altitude grasslands of the Western Carpathians
11:30	Štubňa, J. – Fülöp, R. – Borzová, Z.: Provenance of Glass Beads from a Child's grave in the Conquering Hungarian Burial in Lužianky
11:50	Rozmus, D. – Kalicki, T. – Szmoniewski, B. Sz. – Miśta-Jakubowska, E. – Czech-Błońska, R. – Suliga, I. – Kolasa, P.: Polymetallic deposits in Upper Silesia and Lesser Poland – a new piece to the puzzle of trade and exchange in Europe in 10th and 11th c. A.D.
12:10	Szenthe, G. – Ferenczi, L. – Cosma, C. – Daczó, L. – Dobos, A. – Gáll, E. – Rácz, Zs.: Exploring environmental constraints of migration period settlement in the Mureş Valley, Romania
12:30	LUNCH BREAK
14:10	Lisá, L. – Fair, T. – Kučera, L. – Marethová, B. – Peška, M.: The basements of medieval houses could serve as barns
14:30	Drnovský, P. – Hájková, O. – Hejhal, P. – Horák, J. – Krause, D. – Louda, J.: The renewed archaeological research in the Krkonoše Mtns. focused on 18th century attempt at innovative agricultural management of the mountains
14:50	Vatansever, A. – Lisá, L. – Kočár, P. – Kočárová, R. – Buriánek, D. – Bajer, A. – Petr, L.: Evidence of iron production in the Uzbek khanates, using the example of the Ravat site in south-western Kyrgyzstan
15:10	Derner, K. – Petr, L. – Kočárová, R. – Kočár, P. – Malina, O. – Crkala, J. – Peksa, V.: Impact of mining on vegetation in tin mining areas in the Ore Mountains/Erzgebirge/Krušné hory. First results obtained in the ArchaeoTin project
15:30	Moravcová, M. – Liščák, P. – Vitovič, L. – Fordinál, K. – Maglay, J. – Ondrejka, P. – Ondrus, P. – Žjak, R. – Pauditš. P. – Dananaj, I. – Jelínek, P. – Zeman, I. – Kyrc, L. – Reiffers Čierniková, M. – Bystrická, G.: Determining the age and genesis of slope deformations based on the analysis of the effects of climate change and anthropogenic activities on the hillfort of Zámčisko at Unín (Western Slovakia)

15:50	COFFEE BREAK
16:10	Anevlavi, V. – Prochaska, W. – Pike, S. – Cirbo, E. – Angelopoulou, A. – Kravaritou, S.: The Karika Quarry: A Multidisciplinary Approach to Marble Extraction on Tinos Island
16:30	Kalicki, T. – Konstantinovski Puntos, C. – Konstantinovski Puntos, J.: Morphometry of the Kuris alluvial fan (Cyprus) - comparative analysis of manual and GIS methods
16:50	Hamdeen, H. M.: What can tethering stones, wall paintings, and traveler's literature tell us about hunting and exporting live animals from the ancient Sudan?
17:10	Pišút, P. – Čejka, T. – Szwarczewszki, P. – Kohilová, R.: Memory of the alluvial soil (polycultural archaeological site at Vajnory, SW Slovakia)
17:30	Pokorný, P. – Šída, P. – Ptáková, M. – Hošková, K. – Prach, J.: Prehistoric forest grazing in north Bohemian sandstone areas
17:50	Koštial, J. Ch. – Lisá, L.: We Always Remember for Whom We Make a Tandyr
18:10	CLOSING CEREMONY
19:15	CONFERENCE DINNER

Friday, 7th February 2025

EXCURSION TO SMOLENICE AND ARCHEOPARK IN CÍFER-PÁC

ABSTRACTS OF PAPERS

The decline of Iberian Megasites and the 4.2 Ky BP climatic event

SÁNCHEZ DÍAZ, Francisco[1] – GARCÍA SANJUÁN, Leonardo[1]

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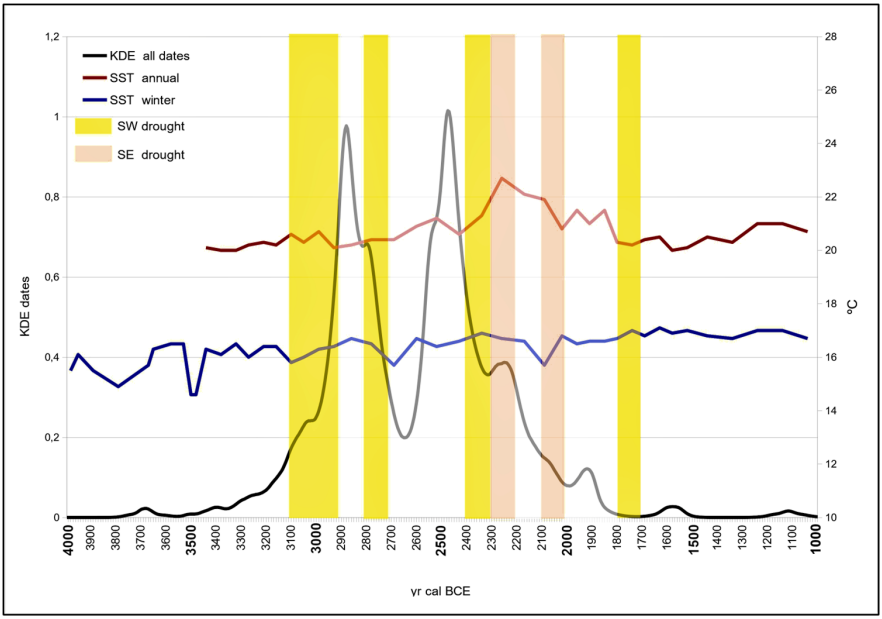
During the Copper Age (c. 3200-2200 BCE) a new type of settlement appeared in the Iberian Peninsula, known as 'megasites' because of their surface areas of between 13 and 450 hectares. Recent research suggests that these sites, located on the soils with the highest agrological fertility and close to the main rivers, may have had an aggregational rather than residential character. They show a duration of around a thousand years on average, or even a millennium and a half, unparalleled until then by any large settlement in Europe. This long durability indicates a high capacity for resilience, adaptability and sustainability. Moreover, all these megasites show a similar 'biographic' pattern of rapid growth, peak, crisis, recovery and new peak, decline and demise. The synchronicity on these cycles and the final 'collapse' of these megasites suggests that the causes behind their decline must have operated at a supra-local scale. Several papers have pointed to climatic change as a potential main factor in their demise, based on the obvious simultaneity between the end of the Copper Age towards 2300-2200 BCE and the so-called '4.2 ky BP climate event'. However, the current availability of more precise radiocarbon chronology shows that this monocausal explanation is overly reductionist, as the decline in anthropogenic signatures predates climate change. While the 4.2 ky climate event may have been a decisive driver of instability, previous social and economic vulnerabilities may have amplified its consequences. It is therefore crucial to take into account the complex feedbacks between socio-economic and environmental processes. This paper analyses the interactions between external variables such as climate fluctuations, resource depletion, disruption of trade networks and population replacements to explain this 'collapse' in a socio-ecological perspective.

Figures

Fig. 1. Kernel density estimation of summed probability distribution of all calibrated dates and climate indicators. (Climate data from Schirrmacher et al., 2019)



Hunted Resources in the Neolithic and Early Chalcolithic Site of Tepecik, Turkey

CRABTREE, Pam J.[1,2]

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Long-term excavations at the site of Tepecik in Cappadocia, Turkey have yielded an enormous faunal collection, including material from both the Neolithic and the Early Chalcolithic periods. We joined the excavation and analysis team in 2014 and began the study of the Early Chalcolithic materials from the site, beginning with the faunal remains recovered in the 2013 season. While the Early chalcolithic faunal collection is dominated by the remains of caprines and smaller numbers of cattle, the faunal materials also included substantial numbers of wild mammals, including equids, wild cattle, wild pigs, red deer, roe deer, bear, foxes and hares (see *Crabtree/Campana 2024*). During the 2023 and 2024 field seasons we began studying the recently excavated Neolithic faunal remains from the site. While this material was also dominated by the remains of domestic caprines, the Neolithic assemblage also yielded the remains of a number of wild species. This paper will compare the use of wild mammal remains at Tepecik from the Chalcolithic and Neolithic periods in order to examine the role that hunting played at this early farming site.

References:

Crabtree/Campana 2024 – Pam Crabtree/Douglas V. Campana: Hunting in the Early Chalcolithic of Cappadocia, Central Turkey: Evidence from Çiftlik-Tepecik. In: Vitezović, S. and Arampatzic, Ch. (eds) Hunting and Fishing in the Neolithic and Eneolithic—Weapons, Techniques and Prey. Oxford 2024, 28-35.

Revealing Winter Feeding Strategies: Animal Dung from the Neolithic Pile Dwelling of Mooswinkel, Austria

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Waterlogged archaeological layers provide a wealth of organic materials to be studied. In the case of the Late Neolithic pile dwelling Mooswinkel at lake Mondsee (Austria), the dung of caprinae (goat and/or sheep) and cattle was found. Their presence in the archaeological layers, together with manure indicators, such as stable bedding material and insects, identified the layers as stable manure. Archaeobotanical and palynological studies of the manure, as well as microhistological analyses of plant remains from the dung revealed the seasonality of the layer formation and allowed to reconstruct animal feeding practises as well as the impact of livestock keeping on the forest. The results show that leaf hay and grass hay were used as fodder during the winter season. The impact of fodder acquisition and pasturing in the forest resulted in a formation of a mosaic landscape of natural and semi-natural habitats.

Keywords: Waterlogged, animal dung, botanical remains, animal fodder

Figures

Fig. 1. Plant and insect remains from the pile dwelling Mooswinkel (Photo copyright: T. Jakobitsch).

Did the Prehistoric diet differ? Archaeobotanical analyses of the first farmers in the territory of central and northern Poland

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Archaeobotanical studies were undertaken at three Neolithic sites: Kałdus, site 4, Browina, site 4, and Równina Dolna, site 3. Browina and Kałdus are located to the north of Toruń, at the territory of so-called Chełmno Land, Kuyavian-Pomeranian Voivodeship whereas Równina Dolna is situated to the north-east of Olsztyn, Warmian–Masurian Voivodeship.

All aforementioned sites were intensively settled both in the Prehistoric and historic times. Yet, the presentation includes results of carpological and anthracological analyses of plant macroremains preserved as charred in soil samples and as imprints in pottery sherds and daub fragments. Researched materials were collected in features assigned to various Neolithic cultures including: the Linear Pottery culture, the Lengyel and Polgar complex, the Globular Amphora culture, and the Funnel Beaker culture.

Assemblages comprise occasional barley (Hordeum vulgare), wheat (*Triticum sp*.), and indeterminate cereal (*Cerealia indet*.) grains along with abundant hulled wheat (*T. monococcum/dicoccon/spelta*) chaff. In addition, materials consist of occasional seeds and fruit of ruderal and segetal plants. Charred wood is represented by oak (*Quercus sp*.), ash (*Fraxinus excelsior*), and Scots pine (*Pinus sylvestris*).

Based on the undertaken research, the following questions arose: 1) do the assemblages differ between different sites? 2) is it possible to trace relations between assemblages and purposes of features/various cultural groups/etc.? 3) are there differences in diets between different cultures located at the same site? 4) were the stored goods intended for humans or livestock? 5) is it possible to establish the function of a feature relying just on archaeobotanical data? 6) were the crops cultivated at the site or brought to?

The results shown in the presentation are part of a bigger project: “Different background, same diet? Agriculture of first farmers at the territory of the lower and middle Vistula: cultural and chronological dynamics in the light of archaeobotanical analyses” (NCN 2023/48/C/HS3/00173) and further studies, including stable isotopes and phytoliths, are still awaiting conduction. Yet, some of the questions will find answers during the presentation as studies of plant macroremains, even sparse, might bring to light interesting insights into activities undertaken by Neolithic farmers.

Keywords: first farmers, archaeobotanical analysis, central and northern Poland

Mid-Holocene Climate Shift in Central European Isotopic Records with Insight from Santovka, Slovakia

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The formation of a travitufa at the Santovka site has resulted in the preservation of a valuable record of interactions between the climate and environment including local human impact. Here, we combined geochronology and litho-, chemo-, microstratigraphy and δ18O /δ13C stable isotopes to compare palaeoclimatic records of Santovka with reference records from Central and southeastern Europe in terms of significant climate shifts. The prevalent part of the section studied, which spans between 8200 and 6400 cal BP, is represented by fluvial/fluvio-lacustrine sediments and lake marl. Surprisingly, an abrupt change in both isotopic records was found around 7400–7250 cal BP, which is likely connected to increased detrital input and some minor palaeoecological changes. The suggested climate shift around 7400–7200 cal BP was detected at most sites in both δ18O and δ13C records, unlike the 8200 (8.2 ka) BP event, which was detected only in δ13C record. This development is synchronous with declining solar irradiance and increased evidence of drift ice in the North Atlantic and could be connected with change in atmospheric circulation in Central Europe. We contextualize this development with the archaeological record, specifically with the spreading of agriculture associated with Linear pottery culture. These findings provide important insights into the interplay between climate change, the environment, and ancient human societies in Central Europe during the Middle Holocene.

New archaeobotanical data on crop cultivation and use of plant resources in Lengyel settlements in south-western Slovakia

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Since 2012, Linearbandceramic (LBK) and post-LBK sites have been prospected and excavated in the Žitava Valley, Slovakia, as part of a German-Slovak cooperation between Kiel University and the Archaeological Institute of the Academy of Sciences in Nitra (*Cheben et al. forthcoming; Furholt et al. 2020*). The Čifaré site dates to the 5th millennium BCE and thus lies at the transition from the LBK and Želiezovce groups to the post-LBK groups, which are referred to as the Lengyel groups in south-west Slovakia (*Hajnalová 2007; Hajnalová/Dreslerová 2010; Filipović et al. 2020; Schroedter 2020*). Five Lengyel period houses were identified at Čifáre (*Wunderlich et al. 2024*). One of the houses was excavated and sampled for archaeobotanical investigations in 2023.

Here we present the results on the archaeobotanical assemblage for this post-LBK house from Čifáre, consisting of charred seeds and fruits as well as charcoal fragments. The archaeobotanical results will be discussed in terms of trends and tendencies in the selection of food and plant resources. As the state of research on plant resource utilisation and crop selection in Lengyel sites is still patchy, any additional data is important to further our understanding of post-LBK plant cultivation in the 5th century AD. To obtain a general overview of Lengyel plant use, we will compare the results from Čifáre with the results of macro remain analyses from two other Lengyel sites in south-western Slovakia, namely Svodín (*Hajnalová 1987*) and Podhájska (own results). Furthermore, a comparison of the crops cultivated in the LBK and post-LBK periods in terms of change and continuity over time provides a basis for further interpretation and future causal research, as the transition from the LBK to the post-LBK is often described as a period of radical change in economic, political and social terms.

Keywords: plant economy, SW-Slovakia, Lengyel

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Filipović et al. 2020 - D. Filipović/H. Kroll/W. Kirleis: Archaeobotanical remains from the LBK

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Wunderlich et al. 2024 - M. Wunderlich/T. Kühl/K. Furholt/M. Furholt/I. Cheben/A. Bistáková/R. Winter/K. J. Schönebaum/R. Löber/V.-L. Boensch: Pits, houses and rondels: New results on the Lengyel habitation in the Žitava Valley, Southwestern Slovakia. Praehistorische Zeitschrift, 2024, 1–48.

Hydrological controls on the Great Hungarian Plain: Risk, resilience, and ditched enclosures during the Neolithic and Bronze Age

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There is a long history of excavations and investigations at Neolithic and Bronze Age settlements on the Great Hungarian Plain. Common features of this period in the region are ditched enclosures surrounding large, well-known settlement mounds, or tells, and smaller and lesser-known tell-like mounds. These ditches have been interpreted as intended for defence, hydrological control, animal management, to segregate different parts of the community, or as being instrumental in constructing social memory and community.

In this paper, we consider Late Neolithic and Bronze Age hydrological controls as a form of risk management, constructed to mitigate environmental changes and potentially thwart attacks. Evidence from over 15 years of research in the low-lying Körös Region indicates that hydrological events (floods) were low-energy and regular (annual)(*Gyucha et al. 2011*). These events were at least in part predictable and manageable, not requiring any specific strategies other than settlement location on geomorphological ridges and islands. During the middle-to-late Neolithic transition, however, macroregional evidence suggests wetter conditions, with increasing precipitation (*Gulyás/Sümegi 2011; Gulyás et al. 2020*). The mosaic of backswamps, oxbow lakes, and marshlands, such as the Kis Sárrét, in the Körös Region would have been overwhelmed by increasing water inputs. Liveable or farmable land, including flood-free lag surfaces, must have been restricted or reduced, even though the riverine energy level remained low (*Salisbury et al. 2013*). Digging ditches around settlements, and using the sediments to raise the settlement surface, would mitigate rising groundwater levels. Furthermore, in some cases the ditches altered the local hydrology by connecting river channels. During the Neolithic, the ditches might also have served as fortifications at a time when violence was common in other parts of Central Europe (*Smith et al. 2020*). The ditches, therefore, might have served at least two intended functions. Unintended consequences might have included increased cooperation between different groups, and, in the short term, brought people together. However, despite initially improving cultural resilience by reducing threats and improving community consilience, these ditches ultimately might

have generated segregation between those within the ditches and those outside, as well as over-exploitation of resources, thereby reducing resilience.

Overall, this study highlights the dual functions of Neolithic and Bronze Age ditch systems on the Great Hungarian Plain as both means of hydrological controls and defence systems, emphasizing their role in mitigating challenges being both environmental and social in nature. While these systems initially fostered cooperation, coherence, and sustainability, they may have inadvertently contributed to social differentiation and resource overuse, ultimately undermining long-term resilience. These findings underscore the complexity of human-environment interactions and the unintended consequences of risk management strategies in prehistoric communities.

Keywords: Resilience, risk, palaeohydrology, Neolithic, Carpathian Basin

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The Role of The Hrazdan River in Shaping Yerevan's Ancient Environment

(The first half of 1st the Millennium BC)

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Armenia's diverse topography, characterized by mountains, lakes, and rivers, has played a central role in shaping ancient landscapes and human settlements. Archaeological evidence often reveals settlements located along river banks, indicating a reliance on these waterways for sustenance and economic activity. These structures reflect the strategic importance of waterways to ancient societies, influencing settlement patterns, resource use, and trade. The Hrazdan River (also known as Zangu) is the left tributary of the Araks. It has its source in Lake Sevan and flows in a general southwest direction. The river is 141 km in length and passes through Gegharkunik, Kotayk, the city of Yerevan, then Ararat marz, before flowing into the Araks River (map 1).

The archaeological monuments in the Hrazdan River basin span various historical periods, with the earliest evidence dating back to the Paleolithic era (*Adler et al. 2012*, 21-37). Yerevan, one of the oldest continuously inhabited cities in the world, offers a distinctive vantage point for examining the interrelationship between ancient societies and their hydrological environments. The history of Yerevan (Erebuni) dates back to the 8th century BC (*Badalyan 2023*, 29), and its strategic location on the Hrazdan River provided essential resources for its early inhabitants. The city's evolution from a modest settlement to a prominent urban center during antiquity was significantly shaped by its proximity to water sources. Rivers, springs, and reservoirs were integral to agricultural practices, commercial activities, and the daily lives of the inhabitants, facilitating the growth of complex societies. Archaeological surveys have identified indicating that the community had a sophisticated understanding of water management. Archaeological excavations at Urartian locations, including the ancient settlement of Erebuni and Teishebaini, have revealed structures that were associated with water management and storage (pic 1, 2).

A review of the historical evidence suggests that irrigation in Urartu was primarily utilized for viticulture. This is evidenced by the discovery of wine storage vessels in Teyshebaini (*Piotrovsky 1970*, pic. 9-14). The cuneiform inscriptions linked to Rusa II, particularly from a stela near Zvartnots, detail the conversion of uncultivated lands into vineyards, orchards, and fields through the construction of the Umeshini canal (Echmiadzin canal) (*Musheghyan 1971*, 211-212). Additionally,

clay cuneiform tablets from Karmir Blur provide further insights into daily life, trade relations, and socio-economic conditions in the region. These findings emphasize the significance of water management and agricultural development in Urartian kingdom.

Keywords: Yerevan, Urartu, Hrazdan River, settlements, Erebuni, Teishebaini, Dzoraberd

Acknowledgments

The work was prepared in the framework of the scientific project (21AG-6A080) entitled „The culture of water use in the Armenian highlands from ancient times to the present days".

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Figures

Fig. 1. Topographic map of area of Yerevan city with main archaeological sites, Cartographer: Henrik Danielyan.

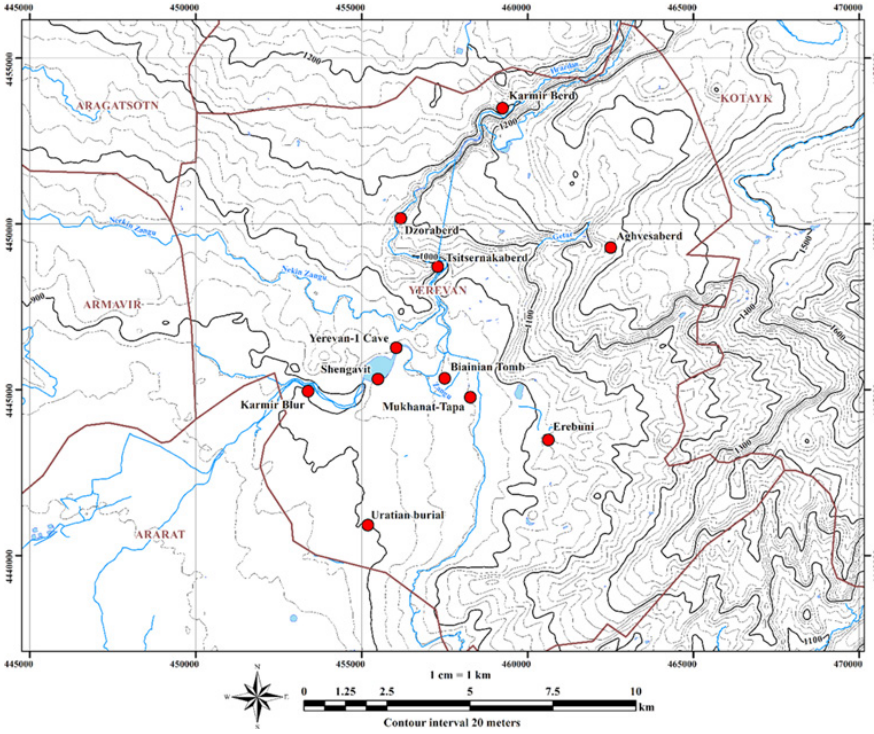

Fig. 2. The Erebuni fortress (782 B.C.) and panoramic view of the Yerevan, Photo by Makoto Arimura

Fig. 3. Wine storage vessels in Teyshebaini, ©The State Hermitage museum.

Exploring storage practices on the island of Crete during the Hellenistic period: a case study from the site of Dreros

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Archaeological research on the island of Crete was mainly focused on uncovering the Minoan past; as a result, later periods were outshined. Until recently, the available data for these periods mainly derived from ancient writers, epigraphic sources, scarce architectural remains, and some understudied material evidence. In the last twenty years, research has attempted to shed light on the Archaic, Classical and Hellenistic sites of Crete. One such case is Dreros in East Crete, a site with a long history, which occupied two neighbouring hills and the saddle in between, adjacent to a large valley and two small plains. The ongoing research conducted by a joint mission of the Ephorate of Antiquities of Lassithi and the French School of Athens has unearthed so far parts of the agora, two buildings, and a temple.

This study attempts to combine the material evidence of a complex Hellenistic building -spatial analysis, storage vessels, and archaeobotanical remains- and the inscriptions found across the island to reconstruct the economic practices of Hellenistic Crete by highlighting both the agricultural basis of the economy and the importance of storage in Dreros.

This building consisting of several rooms, a large hall, and a cistern, lies approximately 50 m. North of the agora and extends over a terrace. Two of the rooms were identified as storerooms based on the presence of numerous vessels such as storage jars, amphorae, basins, jugs, cups, etc. More than twenty-eight pithoi, of an estimated capacity of more than 6,000 liters, suggest that storage played a significant role within the household. The distribution of these vessels across the building indicates well-organized space utilisation designed for the preservation of foodstuffs. However, the unusually large number of storage vessels points to storing provisions for larger-scale contingencies and not just the household's needs. In this respect, the archaeobotanical evidence further reinforces the idea that the household's economy was closely tied to agriculture, focusing on the cultivation of cereals, legumes, and fruits.

In addition, the rich epigraphic record from Crete during this period provides valuable insights into these socio-economic dynamics. Inscriptions might detail alliances, trade agreements, or even decrees related to agriculture and food storage in response to war or environmental pressures. These records can also shed light on how city-states managed communal resources or imposed taxes to support military endeavours, which may have influenced individual households' needs to maintain substantial reserves.

Keywords: storage practices, archaeobotany, pithoi, Hellenistic Crete

Subsistence strategies in the Middle Bronze Age Carpathian Basin as seen in the archaeobotanical record of a Vatya house (Százhalombatta-Földvár, Hungary)

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The Middle Bronze Age in Central Europe saw substantial developments in household activities, reflective of the broader socio-economic transformations of the era. Individual households within the settlements were involved in a variety of subsistence and craft activities. One of the primary economic activities was agriculture.

Archaeobotanical evidence indicates that plant processing activities were integral to daily household life. These included tasks such as threshing, winnowing, and grinding, often conducted in open areas or designated spaces within settlements. The careful design and maintenance of storage facilities underscore the importance of planning and resource management.

A house unearthed at the Middle Bronze Age tell site of Százhalombatta-Földvár yielded over 12 000 pieces of charred archaeobotanical remains. Among cereals, einkorn dominates the record, while the presence of legumes as part of the subsistence was also evidenced. A wide variety of gathered plants were recovered (*Malus sp., Rubus sp., Cornus sp., Vitis sp*.). Signs of storage pests (e.g. weevil) were detected, which helps to understand food storage and management practices on the settlement.

The detailed sampling of the house provided a good opportunity to compare differences and similarities of the use of space within the house. The observations suggest that part of the inner space was used for preparation purposes, as indicated by high amounts of chaff, food remains prepared *Quercus* acorns.

Bronze in Early and Middle Bronze Age Eastern Slovakia: Sources, production and distribution

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Around 1600 BC, at the transition between the Early and Middle Bronze Age, the communities of eastern Slovakia experienced a significant peak in bronze metalworking. The artefacts, produced and been in circulation, became during this period increasingly integrated into wider European trade networks. In that regard, available archaeological evidence could be associated with active local metallurgy, indicating the importance of metal production in the region's socio-economic development. Despite this, the sources of copper used in these artefacts remain uncertain and are only indirectly linked to nearby deposits in the Slovak Ore Mts., where available geochemical signatures of Cu-bearing minerals are primarily confined to western and central mining districts.

To further enhance our understanding on this field of research, chemical (EDXRF, ICP-OES/MS) and lead isotope analyses (MC-ICP-MS) were conducted on bronze artefacts from four central sites in Eastern Slovakia, namely Košice-Barca, Nižná Myšľa, Spišský Štvrtok, and Včelince. Particular attention was paid to bronze by-products and casting molds, which are key indicators of local metalworking-related practices. Our provenance investigations also included copper minerals from hydrothermal ore deposits in the Spišsko-gemerské rudohorie Mts., attempting to correlate these resources with the artefacts under study.

By synthesizing archaeological, geochemical data along with material studies, our pilot results contribute to a deeper understanding of the complex production and distribution systems of the time. It shows that fortified settlements not only served as presumed centers of metallurgy but also actively participated in regional and interregional exchanges. Research sheds light on how localized production centers contributed to a dynamic trade network within the broader European context, thereby illustrating the interconnectedness of these early metallurgical societies.

Acknowledgements: The work was supported by Scientific Grant Agency of the Slovak Republic under the grant 2/0093/24 and by SAS Return Project Scheme for Parents Returning to Work after Maternity or/and Parental Leave.

Keywords: Early Bronze Age, Middle Bronze Age, eastern Slovakia, metallurgy, bronze arfefacts, copper ores, geochemical analyses

Material Aspects of OFCC Ceramics in the Košice Basin

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The Otomani-Füzesabony Cultural Complex (OFCC), a prominent East Carpathian Bronze Age culture (ca. 1900–1400 BCE), is characterized by its distinctive ceramic style and hierarchical settlement structure. Fortified sites within the OFCC, such as Nižná Myšľa in East Slovakia, exemplify the complex social organization, centralized planning, and craft specialization of this culture (*Oravkinová 2018*). Strategically located at the edge of the Košice Basin and Slanské Hills, near the confluence of three rivers, Nižná Myšľa served as a commercial hub for trade and cultural exchange. Over 40 years of systematic research at the site have identified two settlement phases: an early acropolis (Settlement I) with an associated northeastern cemetery, and a later, larger fortified settlement (Settlement II) covering over 75,000 m² and incorporating the earlier cemetery (*Olexa/Olšav/Szabová 2021*).

This study examines ceramics from both phases of Nižná Myšľa, as well as comparative materials from regional sediments, the fortified settlement of Barca and the open settlement of Táborisko, both situated approximately 10 km northwest and linked to Nižná Myšľa's earlier phase. The geological context, particularly sufficient local raw materials, played a crucial role in ceramic production. The geological bedrock in the Nižná Myšľa area includes tertiary marine sediments, tuffites, and pyroxene andesites, with volcanic material from the Slanské Hills contributing to the composition of the region's sediments. Alluvial deposits from the Hornád River, rich in volcanic, metamorphic, and marine rocks, influenced raw material composition near all mentioned sites (*Petřík 2017*).

We analyzed almost 180 various samples using Powder X-Ray Fluorescence (ED-XRF), thin-section petrography, X-Ray Diffraction (powder-XRD), and Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM-EDS). The analysis of ceramics from the older phase of Nižná Myšľa revealed diverse raw material sources, firing technologies, and production techniques, offering valuable insights into OFCC technological practices. Ceramics from the younger phase highlighting both technological diversity and continuity.

This interdisciplinary study contributes to our understanding of Bronze Age ceramic production and its relationship to economic structures, trade, and cultural dynamics in the East Carpathian region. The results underscore localized adaptations to the Košice region's geological environment, its specific features and interactions with broader regional trade networks.

Keywords: Nižná Myšľa, Bronze Age, fortified settlement, pottery, provenance

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Figures

Fig. 1. Thin section images of ceramics under cross-polarized light (XPL). A) Andesite and dacite inclusions, B) Grog with metamorphic rocks; C) Volcanic glass; D) Mica-schist, E) Basalt between metamorphic rocks, F) Biotite and mica.

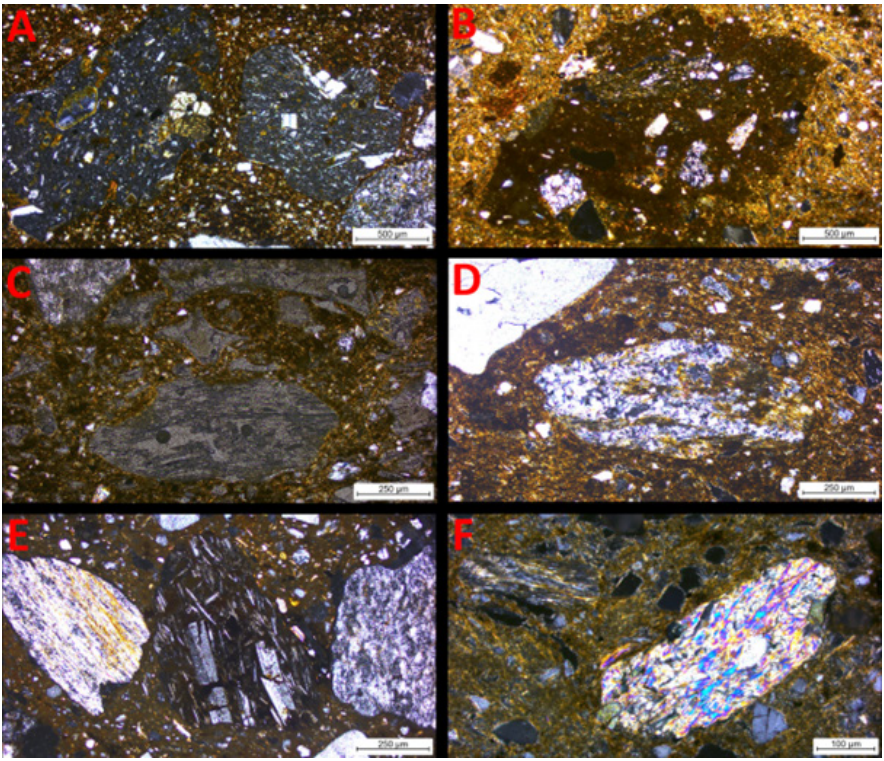
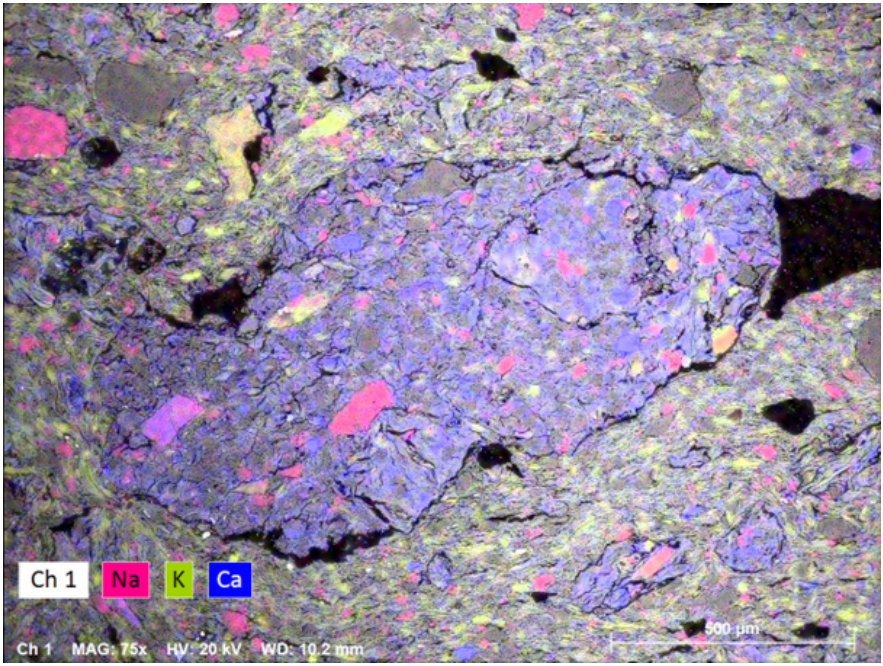


Fig. 2. Backscattered Electron Image (SEM-EDS) with elemental mapping of sodium, potassium, and calcium. A piece exhibits enrichment in calcium and depletion in potassium compared to the surrounding ceramic material.



Micro-contexual approach to ancient agriculture and paleoenvironment: the case of La Fernoveta (Ibi, Alicante, Spain)

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This study seeks to critically reassess and expand our understanding of ancient agricultural practices during the Iberian Iron Age and Roman periods in the Iberian Peninsula. By employing a microstratigraphic approach, we integrate physicochemical and geochemical analyses with detailed soil micromorphology at the Ibero-Roman site of La Fernoveta, located in Ibi, Alicante. This combination of high-resolution methods provides robust empirical data, offering insights into both historical soil cultivation practices and the broader paleoenvironmental conditions that shaped land use in this region.

Our research is guided by the hypothesis that the inland territory of Contestania in eastern Iberia adhered to the Intensive Smallholders model, characterized by intensive soil management and small-scale agricultural production. To evaluate this, we analyse key pedofeatures such as sedimentary crusts, reworked soils, and tillage marks, which reveal evidence of plowing, manuring, and erosion. These features indicate sustained efforts to optimize soil fertility despite the challenges posed by environmental variability. Specifically, carbonate leaching, rapid sedimentation, and organic matter degradation highlight episodic changes in land use and rainfall patterns, suggesting periods of both stability and stress. Therefore, the paleoenvironmental dimension is central to this study, as it provides a framework for understanding the interplay between climatic fluctuations and economic transformations.

This research significantly contributes to the broader discourse on protohistoric agriculture by situating land management practices within their specific environmental and socio-economic contexts. The integration of paleoenvironmental and microcontextual analyses allows us to explore how climatic factors, such as periods of increased precipitation or drought, may have interacted with socio-political pressures during the transition from the Iberian Iron Age to Roman occupation. By examining these dynamics, we aim to clarify whether shifts in agricultural practices were driven primarily by environmental challenges, cultural continuities, or external influences associated with Roman colonization. By addressing these questions, this research serves as an impetus for further exploration into the complexities of protohistoric agrarian systems and their responses to changing environmental conditions.

Keywords: Iron Age, agricultural practices, soil micromorphology, geochemistry, intensive agriculture

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Figures

Fig. 1. Profile and sampling of the site. Orange boxes are soil micromorphology boxes and green dots are geochemical samples. Highlighted horizon is the one of our chronological interest (s. II b.C.-II a.C.)

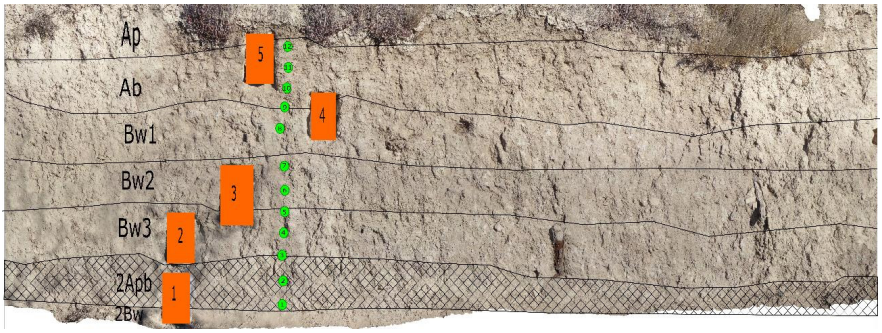
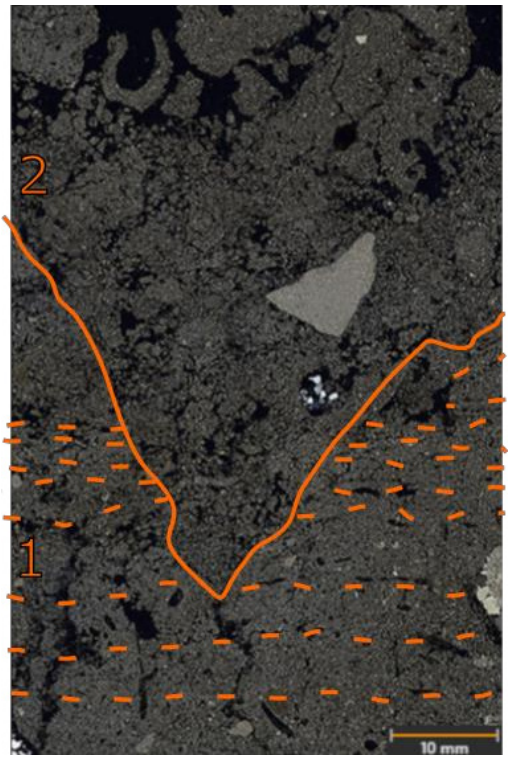


Fig. 2. Fer22-1-4 thin section, which shows 2 microfacies. The 1 below with and horizontal preferential orientation and lenticular structure could be produced by ice and cryoturbation but the 2 at the top shows tillage and agricultural practices breaking this structure and mixing topsoils, subsoils and crusts.



A Multidisciplinary Investigation of the Roman Site St. Petkina Niva in the Ohrid Region, North Macedonia: Local Wine Production and Environment

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In recent years, a Roman rural settlement of St. Petkina Niva has been investigated in North Macedonia. In 2022, a test trench revealed the foundations of a stone structure and the inner space of a room with several storage vessels (dolia). One of the vessels (no. 3) was still placed in situ, with a bottom inserted into the bedrock. Organic matter, likely pine tar, coated the inner surface of the vessel. The soil samples from the room were rich in organic material, including archaeobotanical macroremains, charcoal, animal bones, and snails. Besides other plants and seeds, the anthracology and archaeobotany identified amounts of charred wood (*Vitis*) and pips of the grapevine. Morphometric measuring showed that most of the pips came from domesticated vines. The Vitis charcoal and abundant pips were concentrated around and inside the dolium no. 3, which seems to be used for wine fermentation and storage, likely attesting to local wine production. The inner tar coating created natural antiseptic conditions and served as a content preservative, possibly also as a flavouring agent. The wine, stored in tared jars, acquired a specific taste. Today, it is known as a pine wine, retsina, in Greek. Two of the vine seeds found next to the vessel gave identical 14C data, narrowing the chronology of the cultural layer into the 2nd half of the 2nd c. AD – end of the 4th c. AD.

The anthracological material is characterized by the prevalence of charcoal from Platanus wood. Together with the occurrence of Vitis, walnut tree (*Juglans regia*) and Pomoideae wood types, the assemblage indicates the proximity of an orchard and a vineyard, suggesting the investigated site was agriculturally oriented. Among the animals, caprines (*Ovis/Capra*), pig (*Sus sp*.), roach (*Rutilus sp*.) and European eel (*Anguilla anguilla*), which is historically linked to Lake

Ohrid, where it migrated from the coast of the Adriatic Sea via the Drin River at a young age, have been documented. The mollusc communities also indicate an open landscape with low grass vegetation and occasional scrub. The two most abundant species, *Xerolenta obvia* and *Mediterranea inopinata*, are now typical of pastures in agricultural landscapes.

Keywords: Roman period, North Macedonia, organic material, wine production, dolium

Figures

Fig. 1. Position of St. Petkina Niva on a map of the Ohrid region (site 2085).

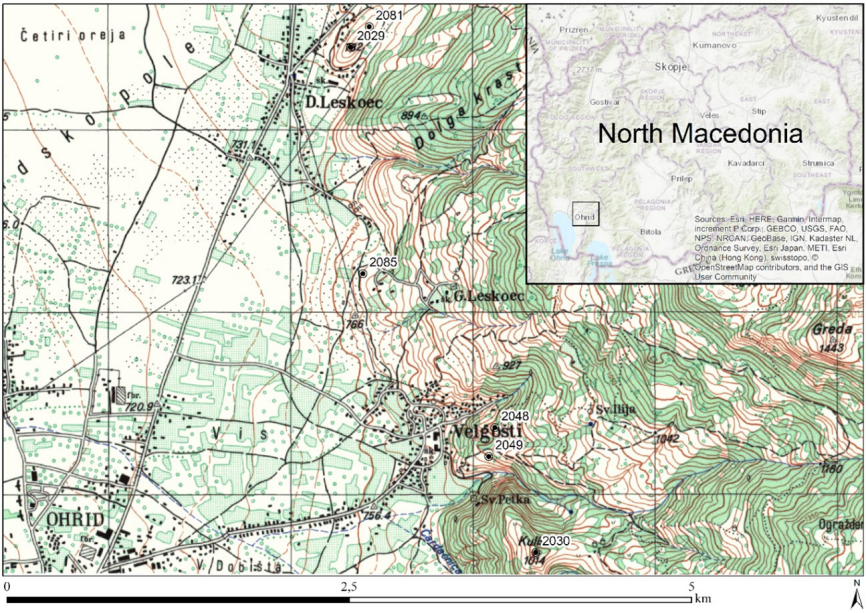
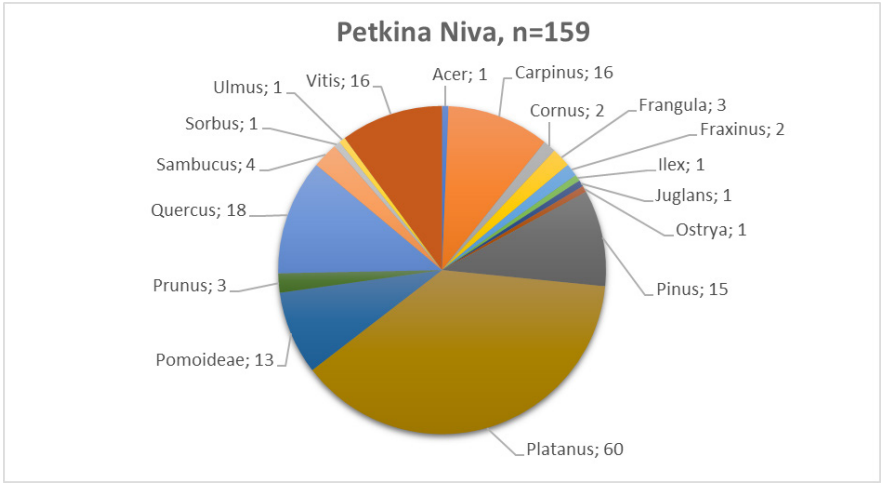


Fig. 2. The dolium no. 3 in situ and its recovery from the primary context.

Fig. 3. Anthracological assemblage from St. Petkina Niva.



Wood consumption patterns on the middle Mureş valley (Transylvania) during the Late Iron Age and Roman provincial period

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Wood, either raw or as charcoal, was the main type of fuel used in ancient times in most of temperate Europe not only to heat dwellings and process foodstuffs, but also in a wide variety of other economic, social and ritual activities that implied the use of fire. Besides that, wood was widely used as building material for public or private structures and installations, and also to make a wide range of objects, including containers, tools, weapons, transport devices, ritual paraphernalia and so on. Nevertheless, wood artefacts needed special anaerobic or desiccating conditions to be preserved in archaeological contexts from temperate Europe, unless they were burned either deliberately or accidentally. Even in the latter case, they are primarily preserved as smaller or larger charcoal fragments, which are commonly found in variable quantities in almost all archaeological contexts, unlike the unburned artefacts. Due to this widespread presence, the analysis of charcoal remains has the potential to offer meaningful insights into the wood consumption patterns of different communities, and also into the composition of nearby woodlands and their management. A more detailed picture of the ways in which the local environment and its resources were used can be obtained by integrating the results of this analysis with the data provided by pollen diagrams from nearby peat bogs and other deposits and the analysis of macrobotanical remains.

Starting from these observations, the proposed paper will take into consideration the archaeological and environmental evidence coming from a number of recently investigated Late Iron Age and Roman provincial archaeological sites on the middle Mureş valley in Transylvania, using a comparative diachronic approach that is better suited to identify both the wood consumption patterns and the effect of changes in land-use practices and the exploitation of wood resources at the micro-regional scale through time. Samples retrieved from archaeological contexts belonging to different categories of sites and structures are included into the analysis, e.g. rural and urban settlements, fortresses and forts, workshops

and ritual places etc. The aim is to cover a broader, representative spectrum of activities in which both raw wood (as fuel or finished artefacts) and charcoal were used over a longer or shorter period of time. Additionally, pollen data obtained from a number of samples retrieved from peat bogs and other deposits in the same micro-region will also be included into the discussion.

Keywords: Late Iron Age, Roman period, eastern Carpathian Basin, wood consumption, charcoal analysis, pollen analysis, macrobotanical remains

Walnuts, the essential food for souls? - interdisciplinary studies on remains from Early Roman tumulus at Cheia – Vatra Satului, Constanța County, Romania.

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The tumulus no 1 is located on the eastern boundary of the village Cheia on the plateau dominating over the landscape in its highest peak (Fig.1). The diameter of the almost leveled barrow is 75 m (Fig.2). During the excavations carried out in 2022, in the middle part of the barrow two bi-ritual graves (M1- cremation; M2 - inhumation) were found and one dog's skull (*Voinea et al. 2023*). The small number of burned remains does not allow for determining the age and sex of the buried person. In the case of the skeletal grave (M2), it was a nearly complete and well-preserved skeleton of a child of about 7 years of age, showing metabolic (cribra orbitalia type) and infectious pathological changes (periostitic lesions, possibly scurvy; resorption lesions and hypervascularization, possibly tuberculosis). In upper part of the trench where the robbers entered to grave 1 (M1) the head of a dog was deposited. A carnivore skull was discovered in the same complex. The biometric and morphological study of this carnivore skull shows that it comes from a very large dog. In the cremation burial pit (Fig.3.A) which has analogies in the closest area (barrows cemetery at Hârșova) as well as in the province of Thrace, pyre debris and grave goods were found (*Buzdugan et al. 2000*). Unfortunately, this grave, as written above, was robbed in antiquity and its chronology based on a few finds (Hadrian's coin and clay lamp) can be related to end of the 1st/beginning of the 2nd century AD.

In the examined botanical samples collected from this grave, whole fruit and pieces of the nutshell (the endocarp) of the *Juglans* were found (Fig.3.B). These specimens were uncharred and charred and smaller that present-day cultivated forms of *Juglans regia*. Walnut seeds (kernels) contain fats, proteins, sugar, dietary fiber and eatable oil rich in unsaturated fatty acids. They also include a number of micro-elements like calcium, copper, magnesium, iron, phosphorus, potassium and, among others, B group vitamins; they are tasty and ready for direct consumption. They are high in calories, and the nutritional value of 100 grams of fresh weight obtained from shelled nuts is 654 kcal.

The presence of the ritual plant offering in burials is a reflection of the tradition of sharing and offering the food between the living, i.e. members of the family

or the local community, and those buried who were leaving them (cf. *Bouby/Marinval 2004; Casas-Agustenech et al. 2011*). The archeological material from the burial presented provides an important contribution to the discussion about the ritual use of plants in mortuary practice in the Roman World.

Keywords: walnuts, grave, tumulus, Early Roman period

References:

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Figures

Fig. 1. Location of the tumulus: 1 – Cheia-Vatra Satului, Romania.

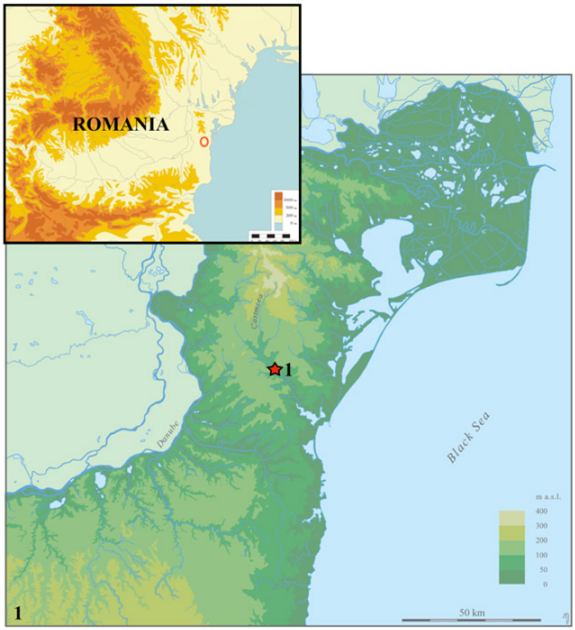

Fig. 2. Remains of the Early Roman Tumulus (photo St. Georgescu)

Fig. 3.A. Horizontal layout of the cremation grave M1 (photo St. Georgescu)

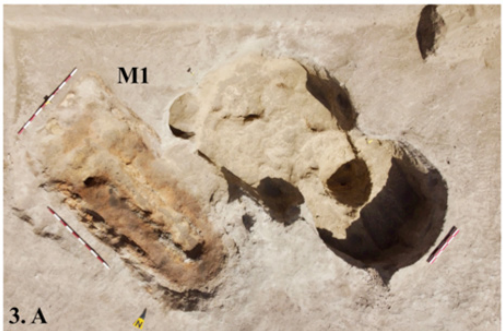

Fig. 3.B. Fruit of Junglas Regia from the grave M1 (photo B. Szmoniewski)

Przeworsk community's bloomery activity and microartefacts in the alluvia: case study in the middle and confluence sections of Czarna Nida River (Holy Cross Mts. region)

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Czarna Nida River is a meandering third-order river flowing through the central part of the Kielce Upland. The catchment area includes a fragment of the Paleozoic core of the Holy Cross Mts. and the southwestern part of their Permian-Mesozoic margin. The Czarna Nida valley lay in the bloomery production center from the Roman period and later in Old-Polish Industrial District (*Bielenin 1992*). In the NE part of the Holy Cross Mts., the people of the Przeworsk culture were involved in smelting iron ore (*Orzechowski 2007*). Single smelting sites were also located in SW part of this region in the Czarna Nida River valley (*Przychodni 2006*)(Fig.1). The preliminary results suggest the iron microspherules found in the floodplain sediments may confirm the archaeological data of the Prehistoric metallurgical activity in Biała Nida and Czarna Nida River valleys (*Kalicki et al. 2024; Maturlak 2024; Przepióra et al. 2024*).

The aim of the study was to identify and interpretate traces of metallurgical activity in the Nida bloomery center region from the Roman period in the alluvium of the middle section of Czarna Nida near Łaziska and Ostrów and confluence section of Biała Nida and Czarna Nida at Żerniki. The Magnetic Spherule Separation method (MSS) was used (i.a. *Houbrechts et al 2020*), which has recently been performed on the other Holy Cross Mts. rivers, where different ages metallurgical activity has been developing (i.a. *Kalicki et al. 2023; Przepióra/Kalicki 2024*).

There are only a few traces of metallurgical activity in the alluvium of the Czarna Nida floodplain. In the middle section a microspherules were detected in the fillings of oxbow lakes from the Roman period and in contemporary alluvium. Otherwise, in the Medieval oxbow lake fills a microslags was found. The small number of microartefacts in the sediments is most likely related to periodic or episodic activity of the Prehistoric metallurgy over a long period of time or small scale of production (*Przepióra et al. 2024*). Similarly to middle section, iron spherules were detected also in contemporary alluvia and the oxbow lake fill in the confluence section of the Czarna Nida and Biała Nida River (*Kalicki et al. 2024, Maturlak 2024*)(Fig. 1).

Some of these microartefacts may come from bloomery sites discovered in the area (*Przychodni 2006; Krupa 2015*), but they most likely could be redeposited from the upper sections of the Czarna Nida and accumulated in the confluence of the Biała Nida and Czarna Nida Rivers. Fluvial transport of spherules from bloomeries sites located in the Czarna Nida valley is confirmed by the lack of metallurgical traces in the alluvium of the Biała Nida upper section (G6, G8 profiles), which is also confirmed by the lack of bloomeries sites in this area (Fig. 1).

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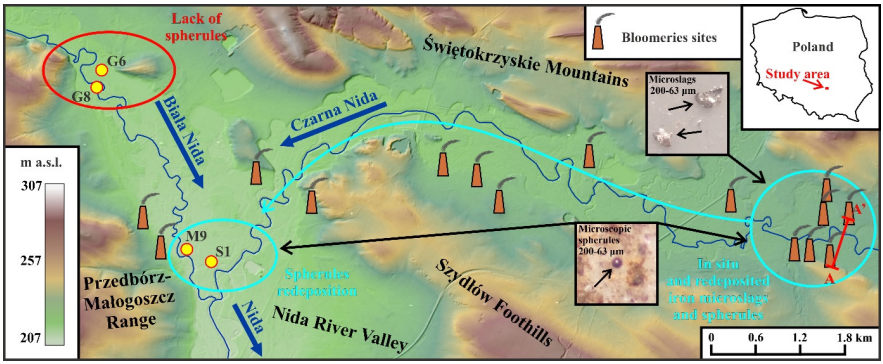
www.geoportal.gov.pl

www.zabytek.pl

Figures

Fig. 1. DEM of middle section of Czarna Nida River and confluence section of Czarna Nida and Biała Nida River (geoportal.gov.pl) with location of study geological profiles (G6, G5, M9, S1), cross-section (A-A'), bloomeries sites based on Archaeological Map of Poland (Przychodni 2006, zabytek.pl) and interpretation of the iron microspherules redeposition



Silos, granaries and barns as a manifestation of the socio-economic system of early medieval society

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Archaeological information on the storage of agricultural products is limited to that which we can identify in excavations. Compared to the historical and ethnographic records, however, archaeological research lags, or rather stands still. Collaboration with the natural sciences is not helping to improve the situation either. Unfortunately, cooperation regularly occurs after the discovery rather than during it, and only exceptionally before the discovery itself. Even so, this apparently does not prevent archaeologists from creating seemingly sophisticated and functional systems that have found their way into the work of historians. This paper points out the limits of creating socio-economic systems based on archaeological sources alone, which at first glance produce wondrous images, but at the second glance raise extraordinary doubts in our minds.

Interdisciplinaria Archaeologica, Natural Sciences in Archaeology

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The focus of *Interdisciplinaria Archaeologica – Natural Sciences in Archaeology* journal (IANSA) is the ongoing cooperation of archaeology with the natural sciences and other disciplines. The journal's interests include bioarchaeology (archaeobotany, archaeozoology, archaeogenetics and anthropology), geoarchaeology (geochemistry, micromorphology, petrography, material analyses, environmental reconstruction), dating methods in archaeology and other fields such as computational archaeology, digital documentation etc. We publish contributions that aim to solve archaeological questions utilizing the methods of the natural sciences and other fields. The birth of IANSA reflected the growing need of scientists in Central Europe to access an international journal focused on the methods of the natural sciences and interdisciplinary cooperation in archaeology. The growth of natural science methods within archaeology has been very dynamic and our target group of readers has grown during last decade and along with traditional archaeological institutions it includes specialized natural science institutions (natural science departments associated with archaeology focused museums, specialized laboratories, etc.) in the Czech Republic and abroad.

This year the journal will celebrate its 15th anniversary. Therefore, this presentation will try to conclude its development in last years and also our plans for future will be presented. Being one of the official organizers of this conference we would like to invite all CEA participants to publish in IANSA. It is possible to submit your manuscripts via online editorial system on www.iansa.eu.

The journal is strictly scientific, peer reviewed, and publishes only in British English. Each article is reviewed by two specialists in fields related to the content of the article. IANSA is listed in journal databases such as Web of Science, Scopus, ERIC and DOAJ. Current impact factor is 0.2. A hardcopy of the journal is issued semi-annually, on glossy paper, with an initial circulation of 250 pieces. It is available in electronic format on the journal's web page www.iansa.eu.

Key words: archaeological science, scientific journal, fifteenth anniversary, bioarchaeology, geoarchaeology, archaeometry, impact factor

Figures

Fig. 1.

Typological and technological remarks for the evaluation of the secondary uses Great Moravian ornamental button finds from Subbotci (Ua) Grave 2.

Latest results of the radiocarbon chronology on the Great Moravian-Early Hungarian relations at the end of the 9th c. AD

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The archaeological antedecent of the early Hungarian heritage in the 9th-10th century Carpathian Basin in Eastern Europe is referred to by international archaeological scholars as Subbotcy-type sites, following the name of the first site in Ukraine. Research on this archaeological horizon has developed significantly over the last 10-15 years. Among its outstanding finds are the decorated gold plates excavated in 1985 in the Grave 2 at Subbotcy. As to their origin, there has been some debate in the research community as to whether they were made with a secondary use of decorative plate buttons (called „gomíky“) of Great Moravian origin, as suggested by István Erdélyi in 1989, who translated into Hungarian first the russian publication. After photographs were taken of the objects in 2010, it became possible to examine the ornaments and their parallels in detail and to prepare a theoretical reconstruction, which was published by Ádám Bollók in 2015. Here, the idealised sketch differed slightly from the data provided by the two plates, since the two gold plates were hammered out of the lower and upper hemispheres of two plate marbles that once formed a pair but which had slightly differently detailed ornaments.

In our presentation, we review the finds based on the latest research results of Great Moravian decorative buttons (*Kavánová 2009; Krupičková 2020; Mesterházy 2000; Ottenwelter 2020*), based on the new classification of Czech and Slovak archaeological specialists. In this way, we will also try to define the narrower region of origin of the object. It is therefore certain that it is indeed Moravian button type made using the plate technique, probably from the Mikulčice and Staré Město region.

The finds under discussion are of outstanding importance for the historical and chronological interpretation of Subotcy-type sites. In the case of the early Hungarians, the written sources preserve the information that their troops were

involved in the Karolingian-Moravian conflict (9th c. AD) and appeared regularly in the Carpathian Basin after 862. They may thus have been brought to the middle reaches of the Dnieper River by soldiers returning to their homes in the south.

As for the archaeological chronology, we will try to provide a basis for a more precise chronology of the Moravian decorative knobs by providing radiocarbon measurements from one of the graves in the three graves in the Subbotcy cemetery under discussion.

In the second half of our work we will look at the Moravian-Hungarian relations of the late 9th century, since recently we have been able to obtain radiocarbon dates for nearly a dozen armed, isolated early Hungarian male graves from the Carpathian Basin, whose burials have an upper date range between 860-895/900 (*Somogyi/Türk 2024*). This provides a new perspective for a better understanding of the historical processes in the Carpathian Basin at the end of the 9th century during the period of the Great Moravia.

Keywords: Hungarian conquest period, Great Moravia, Subbotsi horizon, Early medieval „gombíky“, radiocarbon data, written sources

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Figures

Fig. 1. Decorated Great Moravian gold plate knobs in secondary use originated from an early Hungarian grave at Subbotcy (Ua)

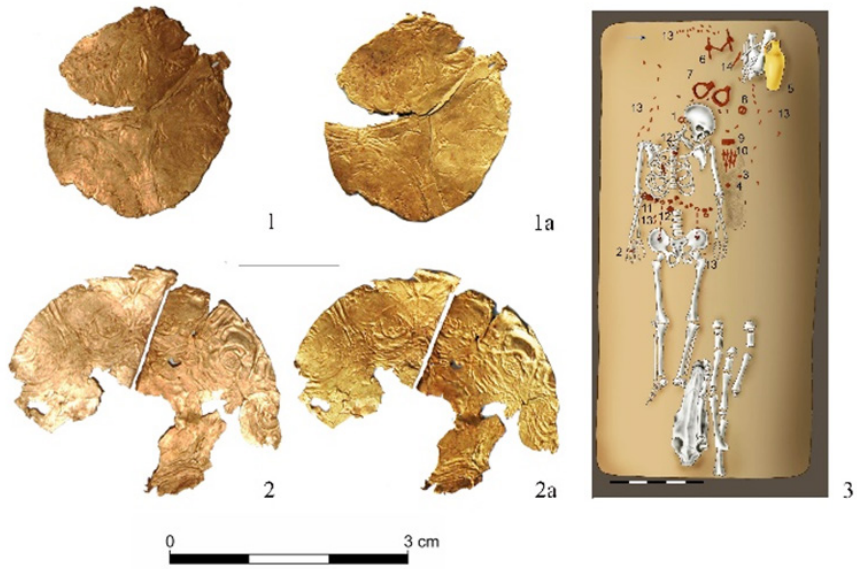


Fig. 2. Reconstructions of Moravian decorated buttons. 1: Subbotsy, Grave 2 (*Bollók 2015*, 376, 118:6 kép); 2: Staré Město-Na Valách, Grave 133/51 (*Chorvátová 2008*, 154, Fig. l. 3); 3: Staré Město-Na Valách", Grave 134/49 (*Chorvátová 2008*, 154, Fig. l. 4)

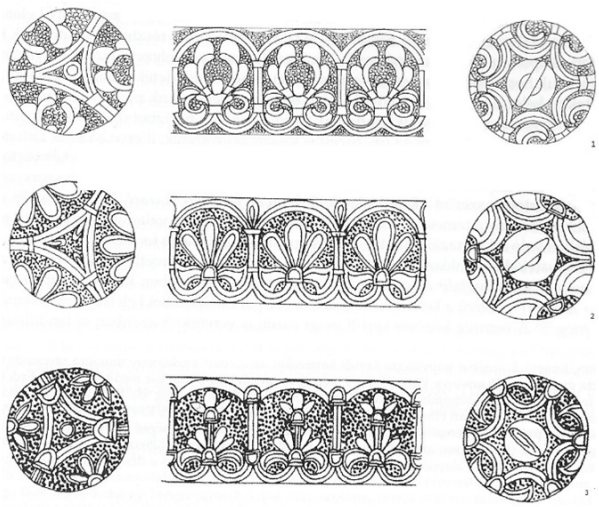
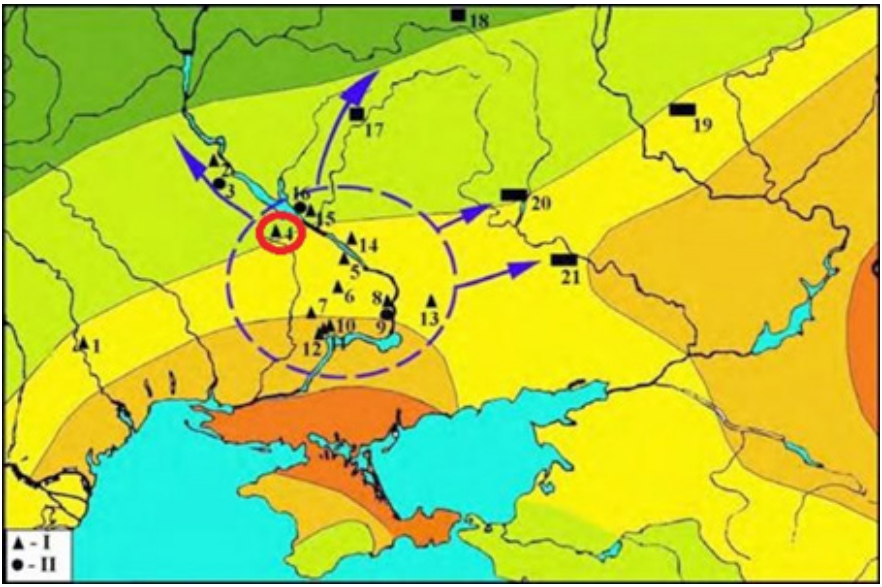


Fig. 3. The Subbotcy-type sites (2011), with red the Subbotcy cemetery site (after *Komar 2018*)



Development of the Central European landscape from the Early to High Middle Ages based on environmental record from wells and natural sites

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First 1300 years of Common Era in Central Europe are characterized by turbulent population movements, well visible in archaeological evidence connected to gradual development from tribal society to state structures, which resulted during the 13th Century in the consolidation of complex mediaeval kingdoms. In the Early Middle Ages, water sources, such as springs and wells, are usually located outside of the settlements and they were also used as a source of water for cattle in the pastoral landscape. There was a major change in settlement pattern during the 13th Century connected with a High Medieval colonisation. This change concerned structures of already existing settlements as well as a major extension of the settlement area. Also, a common location of wells moved to the build-up areas in Medieval villages and towns.

In a frame of our project, we have studied several sites on the periphery of the so-called “old settlement area”, which were colonized on beginning of the 13th Century. First example is a deserted Medieval settlement near **Střílky** on the foothills of the Chřiby Hills in southern Moravia. In the middle of the 13th Century this settlement, which is not mentioned in the written sources, probably served as the economic base for the nearby castle founded by a Moravian nobleman Smil of Zbraslav and Střílky. A timbered well excavated in this settlement was dendrochronologically dated to the mid-13th Century and its organic rich infill without signs of cleaning or disturbance provided paleoenvironmental record reflected in pollen grains, plant macroremains, charcoal and wood, gives evidence of deforested landscape with a presence of thermophilic plant communities and common Mediaeval crops.

Another recently excavated deserted Medieval settlement near **Opatovec** (Svitavy district) was founded in a quite different environment. This upland area was deforested just before the founding of the village, which is documented by

a presence of uprooting tree features. Pollen record from nearly the water spring sediments gives evidence of former silver fir forest later replaced by meadows and fields. There were two wells excavated in the build-up area of the Opatovec settlement, which were dendrochronologically dated to the 13th Century. The infills of these wells has signs of repeated disturbance probably resulted from the more intensive maintenance. Pollen record from these wells corresponds with common synanthropic vegetation of trampling sites with pastoral impact.

High-medieval colonization had a huge impact not only on forests distribution and their species composition, but also on the non-forest vegetation. Many new anthropogenic habitats were founded during this process and thermophilus species reached higher altitude then in the previous period. These habitats were dependent on traditional management and they were endangered by abandonment of settlements. The need of well maintenance depended on many factors, i.e. the stability of the geological substrate and the intensity of the use which might be also connected with the presence of surrounded vegetation cover.

Keywords: Colonization - forest - water well - Mediaeval - human impact

Destroyed Woods in Medieval Metallurgical Landscapes – Case Study of Čejkov (CZ)

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This paper will present methods of detailed research into the changes of the medieval landscape and

forest in the dynamic 13th century. It will be presented on an area in the middle of the marginal highlands where, in addition to agriculture, the exploitation of Pb-Ag ores and their metallurgical processing were also significant.

Archaeological excavations at the medieval mining site of Čejkov in 2024 uncovered medieval ore processing plants, specifically ore washing equipment, in the floodplain of the stream. It was a recessed reservoir, the walls of which were of splintered wood panels and the frame was of logs. Dendrochronologically, these structures can be dated back to the 1270s. The main stratigraphic component was tailings analysed geochemically and mineralogically. On the holocenic basis of the floodplain, the excavated take was sediment with a majority share of subfossil timber and carbon, which is probably a relic of forest cut in the Middle Ages, but also waste after timber processing (chips and cuttings). Stratigraphies were, of course, sampled for palynology and macro-remains. The data obtained enable the reconstruction of the local forest stand in the Middle Ages, but mainly the knowledge of the chain of woody use from selection during the deforestation to the final product of the wooden construction components or artefact.

Keywords: Middle Ages, Alluvia, Mining and Smelting Sites, Deforestation

Stable isotope analysis in soil prospection reveals the type of historic land-use under contemporary temperate forests in Europe

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The determination of δ13C and δ15N values is a common method in archaeological isotope analysis— in studying botanical and human remains, dietary practices, and less typically soils (to understand methods of agricultural cultivation, including fertilization). Stable isotope measurements are also commonly used in ecological studies to distinguish different ecosystems and to trace diachronic processes and biogeochemical mechanisms, however, the application of this method in geochemical prospection, for determining historic land-use impact, remains unexplored. The study at hand focuses on a deserted site of a Cistercian manor, dating from the thirteenth to fifteenth centuries. Isotopic measurements of anthropogenically influenced soils have been compared to approximately 400 archaeobotanical, soil, and sediment samples collected globally. The results reveal the potential of isotope measurements in soil to study the impact of past land use as isotope measurements identify specific types of agricultural activities, distinguishing crop production or grazing. δ13C and δ15N ratios also likely reflect fertilization practices and—in this case—the results indicate the presence of cereal cultivation (C3 cycle plants) and fertilization and that the site of the medieval manor was primarily used for grain production rather than animal husbandry.

Keywords: Middle ages, Manuring, Soil geochemistry, δ13C and δ15N

Interactions Between Environment, Ecology, and Economy in the Early Medieval Mikulčice-Valy Hinterland

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The main goal of this paper is to explore the environmental and ecological interactions that shaped the economic foundation of the early medieval fortified site of Mikulčice-Valy, a significant cultural and political center of Great Moravia. It focuses on three key locations-Prušánky, Mikulčice-Podbřežníky, and Hrušky - to reconstruct patterns of land use, agriculture, and the exploitation of natural resources during the early Middle Ages. Through archaeobotanical and archaeozoological data, the research provides a comprehensive understanding of how environmental conditions and social structures influence approaches to resource management and community organization.

The analysis begins by placing the Mikulčice-Valy fortification within a broader environmental and historical context, emphasizing its strategic location near the Morava River and its rich natural surroundings. This geographical position offered the community fertile floodplains, forests, and wetlands, enabling diverse subsistence strategies. However, the use of these resources was not dictated solely by ecological factors but was closely linked to the community's social and economic organization.

Archaeobotanical data from these sites reveal insights into agricultural practices, including the cultivation of cereals such as wheat, barley, and millet, alongside legumes and oil crops. Evidence of crop rotation and fertilization suggests a developed understanding of sustainable agricultural techniques. Additionally, the proximity of the sites to riverine and forested areas supported a mixed economy in which agriculture was supplemented by fishing, hunting, and foraging. This diversification of resource use reflects not only the community's adaptability to environmental conditions but also social stratification, which may have influenced access to certain resources.

Archaeozoological evidence complements these findings by highlighting the role of animal husbandry in the region. Domestic species such as cattle, pigs, and sheep formed the economy's backbone, while wild species' remains indicate ongoing engagement in hunting activities. Analysis of bone assemblages provides information on livestock management practices, including slaughter patterns, dietary preferences, and the use of animals for secondary products such as milk, wool, and draught power. These practices underscore the interconnection between ecological possibilities and social needs, illustrating how resource use

was tailored to the demands of a complex, hierarchical community.

Focusing on Prušánky, Mikulčice-Podbřežníky, and Hrušky, the study reveals the intricate linkages between environment, economy, and society, providing valuable insights into daily life and resource management strategies in the Great Moravian hinterland of Mikulčice-Valy.

The use of the mountain landscape since prehistoric times - the role of man in the origin of the high-altitude grasslands of the Western Carpathians

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The high mountain grasslands of the Western Carpathians support communities of high biodiversity and serve as a refuge for many light and cold demanding species. However, they are currently threatened by nutrient inputs, treeline shifts due to climate change and abandonment of forest management. Our research aimed to elucidate the post-glacial history of the upper parts of selected mountain ranges in the Western Carpathians, focusing on the impact of human disturbance on vegetation dynamics. Most palaeoecological studies of prehistoric human impact have focused on long-standing settlements in the lowlands and foothills. Mountainous areas have rarely been included in this research because it has been assumed that they were less affected by humans in prehistory. However, there is a growing body of data (archaeological and palaeoenvironmental) showing that prehistoric humans also influenced areas at higher altitudes through various types of activities (*Wiezik et al. 2023*). Landscapes at higher altitudes could be used for cattle grazing or for selective tree felling. The question remains whether human-induced deforestation and subsequent mowing or grazing played an important role in creating and maintaining treeless areas in forested parts of the mountains. Traditionally, the origin of these grasslands is dated to the 15th century AD, when seasonal mountain grazing was allowed. However, the presence of several light-demanding glacial species suggests an older origin or even Holocene continuity of treeless habitats. By identifying the human impact in the pollen record (through the presence of secondary human indicators, open landscape indicators, coprophilous fungi indicating grazing, as well as peaks of micro-charcoal particles indicating fires) from different mountain ranges in the Western Carpathians, we showed that humans probably contributed to the transformation of forest into alpine grassland already since prehistory and kept it open through long-term management practices until recently, when many grasslands became overgrown with woody vegetation due to the abandonment of traditional land use, including pasture.

Acknowledgements:

The research was supported by the Slovak Research and Development Agency under Project APVV-19-0319, by the long-term developmental project of the Czech Academy of Sciences (RVO 67985939) and by the OP JAK under Grant No. CZ.02.01.01/00/22_008/0004593 "Ready for the future: understanding long-term resilience of the human culture (RES-HUM)".

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Provenance of Glass Beads from a Child's grave in the Conquering Hungarian Burial in Lužianky

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By archaeological research in 2017 and 2018 in Lužianky, Nitra district was discovered a part of conquering Hungarian burial site include child's grave (*Borzová et al. 2023*). The latter contained a set of 31 pieces of glass beads. Morphologically, all the pieces belong to the group of segmented beads. The surface of the bead shows a characteristic elongated striae structure, typical of beads made by the drawing technique, which was not used locally during this period. From the typological point of view, these beads are rarely found in the Carpathian Basin of the Early Middle Ages, which evokes their foreign origin. This is also indicated by the analysis of the production technology, according to which the beads in question were not produced in the Carpathian Basin, but could have been imported thanks to trade contacts. The question of the origin of the beads in question in the grave of the young child from Lužianky is being answered through the analysis of the glass.

Glass production, known since the Late Bronze Age, includes lowering quartz's melting point using sodium, potassium, and calcium elements. Originally developed in Mesopotamia and Egypt, glassmaking advanced in the Roman Empire, where glassblowing shaped tableware and vessels. The eighth-century disruption of sodium carbonate (natron) imports from Egypt led to shifts in production, using wood ash in Europe. Glass types—natron and plant ash (plant or wood)—vary in magnesium and potassium content (*Syere/Smith 1961; Shortland et al. 2006*). Plant ash glass, derived from halophytic plants, shows less chemical variability than raw plant ashes, emphasizing regional material specialization for consistent glass production (*Barkoudah/Henderson 2006*). Quantitative chemical (WDS) analyses of glass beads were obtained using an electron microanalyser JEOL-JXA850FE. Photographic documentation of relationships between minerals was carried out in the BSE mode. To determine the provenance, we analyzed the content of alkaline and alkaline earth elements, specifically Ca, K, Na, and Mg. In the four representative glass beads studied, the CaO content ranged from 5.16–7.02%, K_2O from 2.29–3.15%, Na_2O from 9.37–13.57%, and MgO from 4.39–6.16%. Plant ash glass of Islamic period can be broadly separated into two regional

groups – Mesopotamian and Eastern Mediterranean – based around MgO and K2O (*Freestone 2006*). Mesopotamian plant ash glass is characterized by higher MgO and K2O (*Freestone 2006; Phelps et al. 2016; Schibille et al. 2018*). It is knewn into two groups based on flux content: Type 1, which has lower MgO/CaO and P2O5/K2O ratios, and Type 2, which has higher ratios of both. This distinction is also seen in the sand-related elements, with Type 2 glass typically using sand sources with fewer impurities (*Phelps et al. 2016; Schibille et al. 2018*). The samples analyzed were identified as Mesopotamian Type 2.

The chemical analysis of the beads confirmed the existence of trade routes between the Arab world and Europe, including Central Europe, even after the fall of the Roman Empire. Trade between the two macroregions was certainly managed by the Byzantine Empire.

Key words: Hungarian conquest period, glass beads, glass types, plant ash glass, Mesopotamian glass, Chemical composition.

Acknowledgements:
The research was executed with support from Agency VEGA nr. 2/0167/24.

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Figures

Fig. 1. Children's grave from Lužianky with the discovery of beads. Photo: O. Žaár.

Fig. 2. Compositions of glass beads represented in the Na2O-(K2O+MgO)-CaO ternary diagram, used to determine the flux. 1 = Soda–lime glass with natron; 2 = soda–lime glass with ashes; 3 = soda–potash glass; 4 = potash–lime glass; 5 = lime glass.

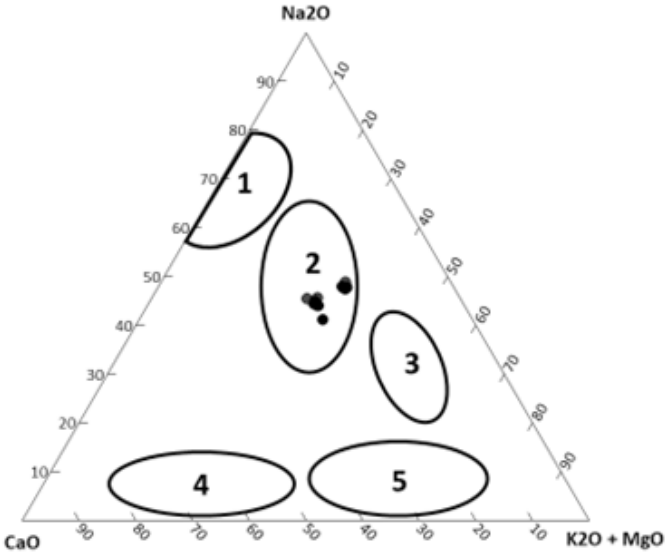
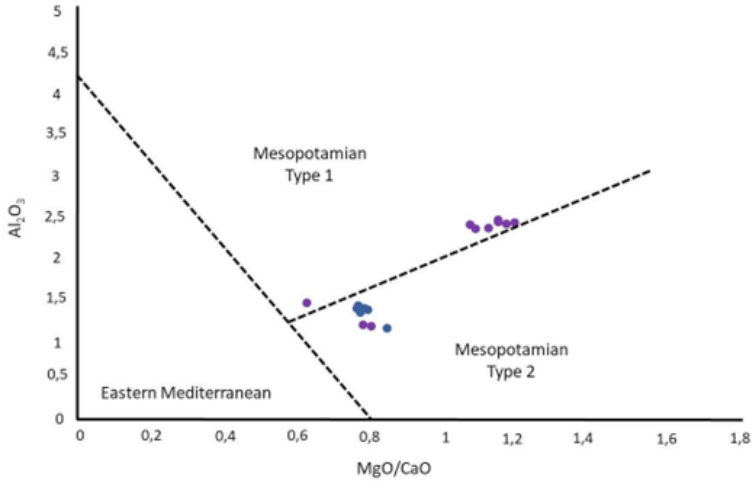


Fig. 3. Alumina versus magnesia to lime ratios of published data of glasses from Levantine and Mesopotamian contemporary sites.



Polymetallic deposits in Upper Silesia and Lesser Poland – a new piece to the puzzle of trade and exchange in Europe in 10th and 11th c. A.D.

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The question of sources of raw materials used for the production of jewelry or coins has been the interest of not only archeologists but also of researchers in other scientific fields. The exploitation of mineral resources is connected with many other issues such as giving the account of the scale of the phenomenon in the light of pollution documented on peat bogs, kinds of preferred minerals in various time periods, stages of technical sophistication of their processing, or determining the scale of their exploitation in the light of written sources.

In the Early Medieval economy of Europe, silver was one of the most important metals which naturally occurs in geological deposits of polymetallic nodules – mainly in the form of lead ores and copper ores. Due to results of isotopic analyses, the accessing and smelting of lead started in area in question as early as in the Hallstatt period (5th/6th c. B.C.) (*Miśta-Jakubowska et al. 2024a*). In the 10th and 11th c. A.D., lead deposits located around Olkusz played a key role in the Early Medieval economy not only within the territories under the rule of Piast's dynasty, which is also proved by the isotopic analyses. Lead was an export good, and its trading routes reached Kiev Rus', Bohemia and Slovakia (*Chugaev et al. 2020; Merkel et al. 2024; Ettler et al. 2015*). It was the metal which dominated in the Piast lands (*Miazga et al. 2022*). In regards to silver, it was mainly obtained by melting of Asian coins during the 11th c. (*Miśta-Jakubowska et al. 2024b*). Processing of polymetallic nodules in the Silesian-Cracovian region, which probably started in the 10th c., supplemented the local demand for this metal. The frequency, however, is noticeable on a lesser scale than obtaining the metal in the process of melting Arabian coins as well as in the processing of lead.

Intensive exploitation and processing of lead ores have been proved by the occurrence of multiple archeological sites of foundries in region of Upper Silesia

and Lesser Poland as early as at least 9th c. A. D. (Fig. 1). Moreover, isotopic analyses of the lead used in products dated in the 10th c. A.D. point to the lead ores having been obtained from the Upper Silesian-Lesser Poland deposits, whereas the increased shares of heavy metals polluting the ores deposited in peat bogs in this region suggest an even earlier chronology of the starting the processing of lead and probably of silver as well (Malik et al. 2023). Based on some available production waste, chaîne opératoire could be reconstructed in the process in which, apart from lead and silver, also litharge was obtained (Fig. 2). The latter was used as the main compound of glazing pottery which was a phenomenon in the 11th c. Central Europe (*Bodnar et al. 2006*) (Fig. 3).

The activities of mining and processing polymetallic nodules from the Upper Silesian-Cracovian region was undoubtedly an important and characteristic element of the Early Medieval network of trade and exchange of minerals.

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Figures

Fig. 1. Schematic map of Kraków and Silesia Upland Lead-Zinc deposits and distribution of archeological sites with traces of the lead ore processing.

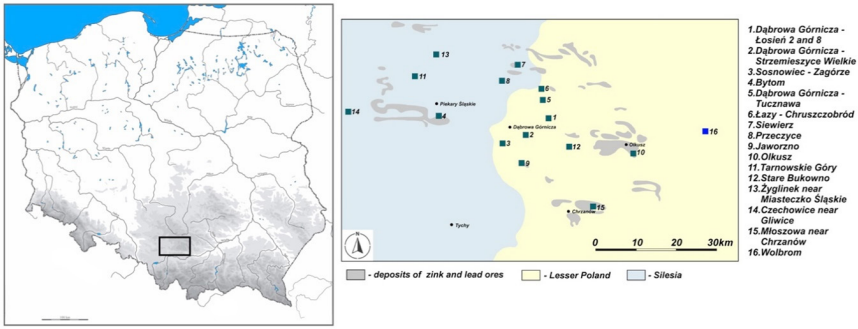

Fig. 2. A lead ingot found in Dąbrowa Górnicza - Strzemieszyce Wielkie (Fig.1. no 2, photo (photo P. Kolasa).

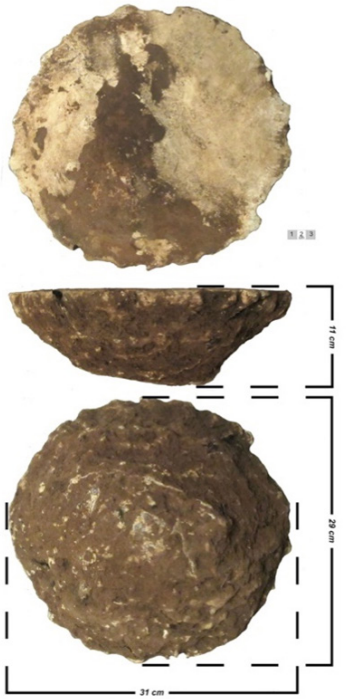

Fig. 3. Glazed pottery from cemetery in Dąbrowa Górnicza - Strzemieszyce Wielkie (Fig.1. no 2, photo B.S.Szmoniewski).

Exploring environmental constraints of migration period settlement in the Mureş Valley, Romania

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The authors present preliminary results of archaeological topographical project focusing on the Transylvanian Basin, carried out in the framework of a project on early medieval networks, settlement, production and distribution systems (Project No. TKP2021-NKTA-24 financed by the Hungarian NRDI Office). During the Avar period (7th–8th century AD), the Avar type archaeological record was concentrated in the middle section of the catchment of the River Mureş (Transylvanian Basin, Romania), where important economic resources (salt deposits) may have been exploited. We investigate patterns of long-term settlement changes between the Roman (1th -2nd c. CE) and the Árpád period (11th-13th c. CE), and more specifically the settlement network of the Avars, studying environmental parameters. In the post-Roman period, a radical settlement contraction is documented. In the Migration period and the early medieval period another settlement contraction phase, changes in settlement intensity, and the vertical and horizontal displacement of settlements can be observed. Until the Árpád period, a slow recovery could be identified. The fluvial environment seems to have determined human settlement in every historical period, and different patterns of settlement could be documented in the Mureş valley and in the valleys of its tributaries. The settlement pattern was influenced by local and supra-regional road systems, and, most probably also by the two salt deposits, situated to the south of the Mureş (in Ocna Mureş, and Ocnişoara). The area of the Mureş catchment divides into different microregions, characterised by different geological and hydrological conditions, and the core area of Avar settlement (our study area) is found in a region where there were comparatively rather favourable soil conditions for agriculture. The various factors influencing settlement patterns form a complex set of conditions, which we are still in the first stages of understanding. Thus, our contribution also attempts to outline perspectives for further research.

The basements of medieval houses could serve as barns

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The medieval house is a phenomenon representing the way medieval cities functioned as well as the development of our contemporary culture. However, just as it is the case with prehistoric objects, the archaeological finds mainly detect its underground parts, the so-called basements. These often recessed parts of houses provide information about building constructions and at the same time about the formation of the walking surface, in other words the floor of the building.

By its very nature, the floor is actually a kind of sedimentary archive, from which it is possible to obtain fairly complete information about the conditions under which it was created and how it was further used using appropriate methods. Floors have many forms, they can be specifically shaped according to specific conditions or cultural customs, they can be treated in different ways, but they practically always carry information about how the owner of the house took care of the space in which he lived. One of the combinations of methods is micromorphological analysis combined with geochemical composition, chemistry, possibly paleoecological pollen analysis or anthracological and macroresidue analysis.

So what can be said about the possible function of basement spaces? These spaces are an integral part of the house and the assumption is that they had mainly storage function. Using the example of two medieval houses, we will try to show the possibility of using basements for housing animals. One of the basements is located in Brno in the Padovec area, the other in Ostrava in the Lauby area. In both cases, the house dates back to the 13th and 14th centuries. In the case of the Padovec site, the basement area was situated in a relatively dry environment represented geologically by a loess substrate, in the case of the Lauby site, it was a moist river floodplain environment. In both cases, dark, in some places more or less laminated layers forming a layer more than 10 cm thick were visible within the floor set. Micromorphologically, these layers were interpreted as manure layers, in the case of the Lauby site separated by a remediation layer. Thanks to the alignment of the internal textural elements, it can be proven that it is always sedimentation on the spot and it is not spread manure. The layers are characterized by the amount of horizontaly layered organic matter interspersed with mineral

fractions, further articulated phytoliths and especially faecal spherulites. The captured organic matter is in various stages of decomposition, it is primarily grass stalks, leaves or bark. In the case of the Lauby locality, the individual organic remains are interspersed with sandy matter, occasional charcoal and, occasionally, common kitchen waste, such as shells or fragments of burnt bones. This can be interpreted as a kind of remediation preventing moisture penetrating from the subsoil or delimiting odors. Similar surface modifications were observed and detected at the Veselí nad Moravou locality in the case of the research of medieval horse stable. At the Lauby locality, in the organic sediments of the floor set, mainly elevated phosphorus values and a biochemically high content of stanols and fatty acids were detected. Based on the combination of given proxies, these layers can be clearly identified as stables. Although it is essentially a pilot study, it is necessary to reevaluate the existing ideas about the function of basement spaces in a medieval house.

The renewed archaeological research in the Krkonoše Mtns. focused on 18th century attempt at innovative agricultural management of the mountains

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The Krkonoše Mountains, Czechia's highest, stand out for their unique blend of characteristics: 1) while well-documented by natural sciences, ethnology, and history, their archaeological narrative remains sparse. 2) These mountains host Baudenwirtschaft, a specific agrarian system with good comparative potential: to Alps, where it originated and from which it was later introduced to Krkonoše by Tyrolean colonists, and to Carpathians, with similar environment but distinct subsistence system imported from Romania. 3) The 18th century witnessed ambitious economic reforms of Baudenwirtschaft in Western Krkonoše, aiming for diverse agricultural output from integrated livestock, hay, dairy, and even wheat production at quite challenging altitudes. However, while the overarching plans and outcomes of these reforms are documented, the specifics and details of their implementation remain largely unknown. This underscores the indispensable role of archaeology in uncovering the nuanced reality behind historical and ethnographic accounts. This project focuses on excavating two emblematic, subsequently abandoned farmsteads, completely situated within the 18th century timeframe. It will be based on archaeological excavation of farmsteads supplemented by geoarchaeological analysis to delineate human-induced landscape alterations (e.g. intensive agricultural management of meadows and fields), employing methods such as geochemistry, micromorphology, or paleobotany.

The project of renewed archaeological research aims to elucidate the implementation of those reforms, assess their environmental impacts, and correlate these findings with historical records, drawing parallels with similar developments in the Alps and Carpathians. It is led by the University of Hradec Králové's Department of Archaeology (UHK), in collaboration with the Krkonoše Mountains National Park Administration and its Museum in Vrchlabí (KRNAP).

The lecture presents the state of the art of this research activities, including the summary of the excavation of one of the buildings connected to the Baudenwirtschaft (excavation seasons from 2023 and 2024), the findings of the fieldwork prospection (details of the ditch system around the farmsteads used to manure the meadows) and the results of the environmental research (focused on geochemical analyses of the impact of the farmsteads activities on soils in the area.

Evidence of iron production in the Uzbek khanates, using the example of the Ravat site in south-western Kyrgyzstan

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Archaeological survey in the vicinity of the village Ravat (Batken region, Kyrgyz Republic) get a collection of objects dated to a wide period from the beginning of Common era to the present. The valley is a natural west-east corridor connecting the present-day cities of Batken in Kyrgyzstan and Istaravshan in Tajikistan, bordered on the south by the Shadymyr Mountains and on the north by the Turkestan Mountains., It's an important determinant for settlement in this area since the beginning of human activity.

Exploitation and metallurgical production areas are concentrated on the western side of the present-day village of Ravat. The group of objects consisting of an exploitation area directly linked to the ore processing area located in the close vicinity. This place is mentioned in contemporary written sources stating the mining and processing of iron ore in the area as a significant source of iron in the wider context of Central Asia since the 15th century.

A field survey discovered the horizons of exploited ore from ore rich cobblestones were identified there as well as the alluvial fans of spoil. Iron production is confirmed by the presence of a large amount of forge slag and waste corresponding to metallurgical activities. Moreover the recent erosion of the valley exposed structures of several furnaces. Rock samples of potential ore, together with the slag were taken for provenance analysis including the petrography, microprobe as well as isotope analyses. Charcoal were determined such as juniper (Juniperus sp.). Currently, the local juniper forests are mainly dominated by the species Juniperus polycarpos subsp. seravschanica). The exploitation and production areas are part of a wider complex of buildings associated with the adjacent fortifications that controlled the extraction and processing of iron ore. According their morphology, can be dated to the period of the Bukhara Khanate (1500–1785) or the early Kokand Khanate (1709–1876; *Azizov 2015*, 58—159; *Beysembiev 2009*, 143—237; *Grenoble 2003*, 60—387; *Nabiev 1973*).

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Impact of mining on vegetation in tin mining areas in the Ore Mountains/Erzgebirge/Krušné hory. First results obtained in the ArchaeoTin project

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4,000 years of tin mining beginning with stream working of the placer deposits in the Bronze Age and culminating in the 16th century is the subject of research by the Czech-Saxon project ArchaeoTin. The research has so far found a medieval dating on the Czech side. The greatest natural impact of of streamworks on nature is the human-induced erosion and accumulation processes, which are incomparably greater in volume than in the mining of primary deposits. In addition to research on the stream workings themselves, on-site charcoal and proxy palynological data from peat bogs and alluvium are being evaluated for vegetation development. The first results on the Czech side of the mountains show a high dominance of spruce in historical periods, probably already as part of the original vegetation and not only in secondary forests. While the alluvium in this research generally showed rapid sedimentation unsuitable for detailed understanding of vegetation development, the cores from peat bogs yielded promising results, indicating a period of insignificant human activity preceding the main colonization activity associated with deforestation. Their interpretation and dating will be the subject of further research.

Figures

Fig. 1. Research area in the western Ore Mountains.

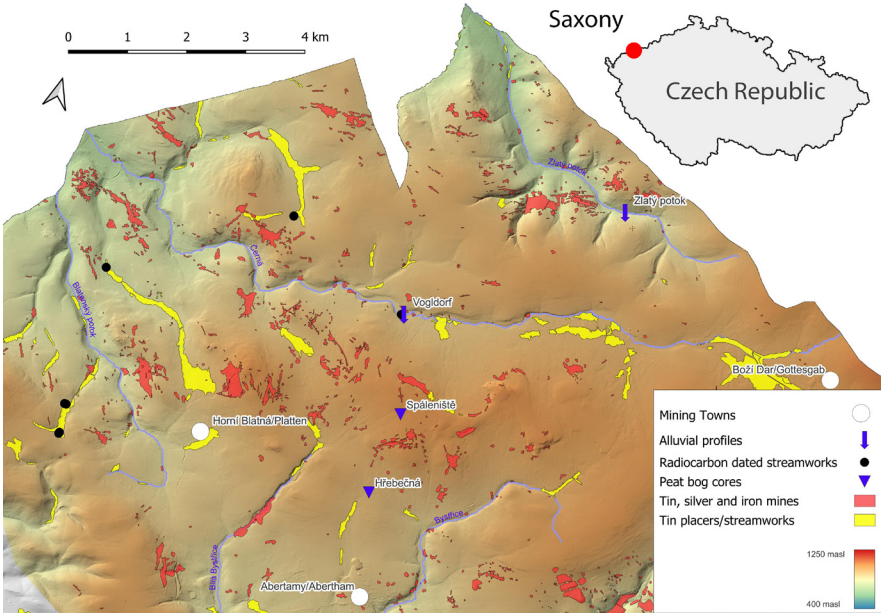
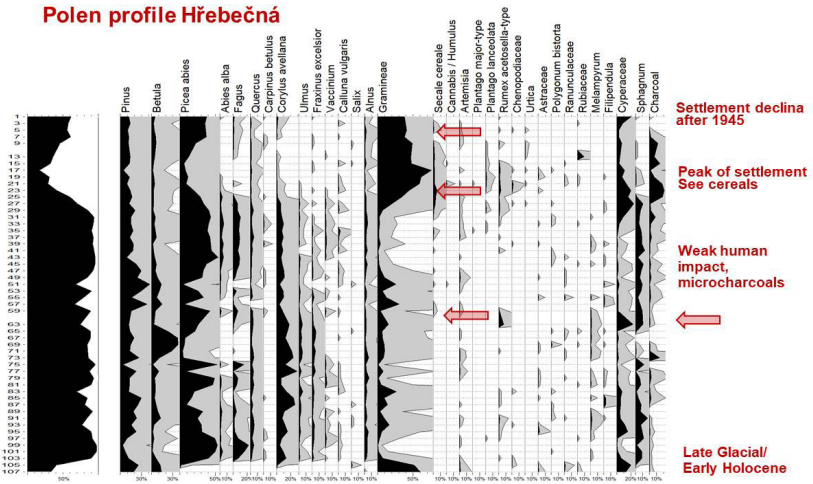


Fig. 2. Pollen diagram of the peat bog near Hřebečná showing human activities before the main occupation period.



Determining the age and genesis of slope deformations based on the analysis of the effects of climate change and anthropogenic activities on the hillfort of Zámčisko at Unín (Western Slovakia)

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The research elaborates the study case of a historical settlement/fort at the location of Zámčisko at Unín (Chvojnická pahorkatina Upland, Figs. 1 and 2), which was affected in the past by multi-generational slope deformations of various types.

The fort (Fig. 2) was built and populated over a longer period of time: from the early and middle Bronze Age (2,000-1,250 BC) to the early Roman period (0-180 AD) (*Studeníková, 1980*, 1982). This is a model (case) study of slope deformations that affected the historical objects of the hillfort. It is an innovative research of the relationship between slope deformations and cultural (archaeological) heritage on the territory of the Slovak Republic.

The greatest emphasis is placed on the identification and registration of the slope deformations that have affected the area of the hillfort and its surroundings since its inception, during its operation up to the present day. It is even probable that the fortification systems damaged by the landslides could facilitate the conquest/occupation of the fortress by the enemies. The ambition of the research (Fig. 2.) was to determine the periods of their formation, temporal development and genesis, based on analyses of the effects of climate change and anthropogenic activities. Geological, engineering geological, geophysical, archaeological, palaeobotanical, geochronological (AMS 14C dating) and malacofauna research was used for these interpretations. The samples for dating were acquired from three trial pits (Fig. 3) and a handful of manually drilled boreholes within slope deformations with a special focus on fortification lines. Thus, a multidisciplinary approach of correlation between the analysis of slope deformation activity and cultural heritage has been achieved. Detected slope deformations were input in the Register of slope deformations operated by State Geological Institute of Dionýz Štúr SGIDŠ (https://app.geology.sk/geofond/zosuvy/).

The subject of the research was a comprehensive spatio-temporal view of climatic changes and related paleoenvironmental changes in sedimentary environments within landslide areas. Identified slope deformations were

classified based on their relative ages (fossil, synchronous with settlement of the fort and younger, i.e. those that were generated after the hillfort was abandoned). Based on the geophysical profiles of electrical resistivity tomography (ERT), the subsurface geometry of slope deformations (the depth of the shear surface) was supplemented, which served to create a conceptual development model of these slope deformations and for 3D visualization as well. The main tool on the basis of which the landslides were identified and delineated along with field verification and mapping, was a high-resolution LiDAR-derived DTM (DMR 5.0; ÚGKK SR).

One of the important results of the research is the compilation of a new geological map covering the area surrounding the hillfort of Zámčisko, which applies the DMR 5.0. The area of interest equals to 22 km2.

The slope deformations occurring in the area of hillforts collect a large amount of various information on a relatively small area, which can, with the right research methodology, be used for the reconstruction of the formation of slope deformations in space and time, as a result of climate changes and human activities. The specific geological structure – relatively permeable Radimov gravels of the Holíč Fm. (Sarmatian), overlying a relatively impermeable siltstones and mudstones of the Lakšárska Nová Ves Fm. (Karpatian) – conditioned the emergence of a diverse range of slope deformations and varying degrees of activity: block ridges, block fields, landslides, debris flows and their mutual combinations, while their total area reaches 5.5 km2. Regarding the progress in interdisciplinary methods of field and special laboratory research, slope deformations deserve special attention as a unique archive of climatic and environmental records of a landscape.

The great contribution of this study is the fact that until now no one in Slovakia has focused on slope deformations in the area of hillforts from the point of view of researching the impact of climate change and investigating the period of their creation in the context of the historical settlement of these cultural sites. This study is a pilot project of its kind.

Another important contribution of the study is its multidisciplinary and interdisciplinary research bringing together experts from several scientific and professional institutions of the Slovak Republic and various scientific fields of geology, geophysics, sedimentology, archaeology, geochronology and palaeobotany.

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https://app.geology.sk/geofond/zosuvy/.

Figures

Fig. 1. A) The position of the Chvojnická pahorkatina Uplands within Slovakia. Coordinate grid for ETRS89. B) Geomorphological division and hypsometry of the Chvojnická pahorkatina Upland and the position of the studied area (wider surroundings of the Unín-Zámčisko Hillfort).

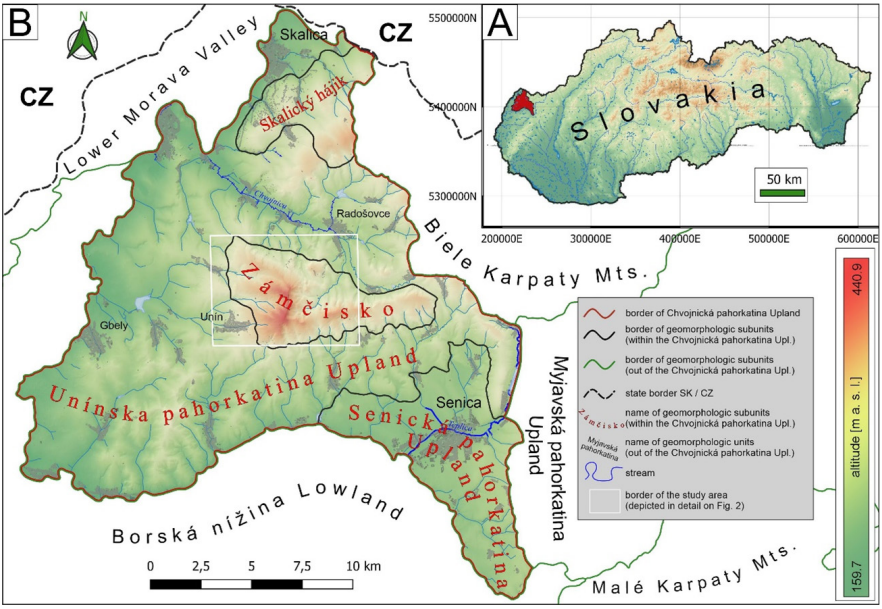


Fig. 2. A. Hypsometry of the wider surroundings of the Unín-Zámčisko Hillfort. B. Detailed view of the studied area of the Unín-Zámčisko hillfort. Height interval of contour lines 1 m (© Lieskovský, T., edited by Bystrická, G.).

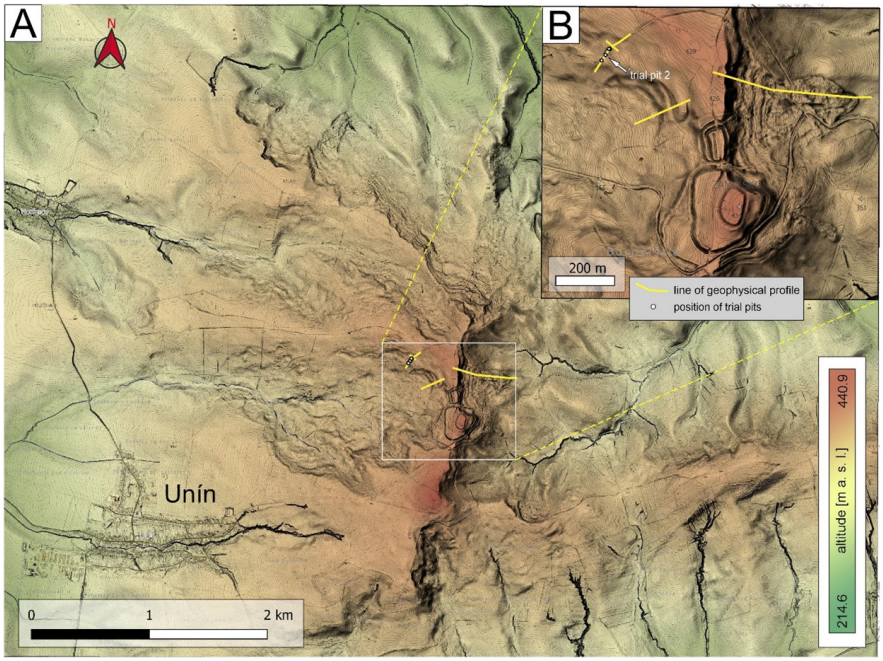
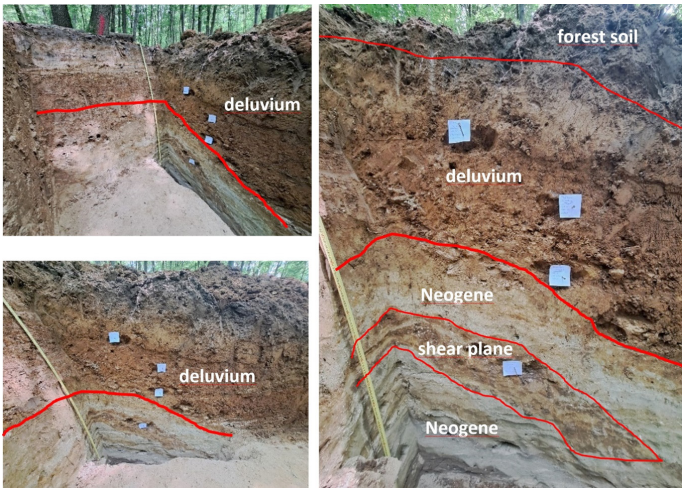


Fig. 3. Field research of the peripheral (fortification) line of the hillfort disturbed by slope deformation. Trial pit 2 – situated in the disturbed reach of the fortification line (by a landslide).



The Karika Quarry: A Multidisciplinary Approach to Marble Extraction on Tinos Island

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Through an analysis of tool marks, imprints on the parent rock, unfinished objects, ancient graffiti, and quarry waste, ancient quarries offer a wealth of information about the organisation, manufacturing processes, transportation, and broader stone trade and production networks they supported. Adopting an intra-cross-craft approach, this study examines the various stages of stone production, from the primary extraction at quarries to the expansive phases of artefact manufacturing.

Recent investigations on Tinos Island have uncovered several previously unexamined quarries, including the Karika quarry, which serves as the focus of this study. By integrating archaeological and archaeometrical methods—such as white marble provenance studies using stable isotope analysis and ICP-MS analysis—with digital archaeological prospection techniques (e.g., LiDAR and photogrammetry), this research offers a holistic view of the quarry's operation. These approaches provide detailed insights into extraction methods, transportation, and marble production, highlighting the unique qualities of the materials.

This interdisciplinary methodology sheds light on both the ancient and modern implications of marble industries in the Cycladic Islands. It expands our understanding of the marble terrain through topographical, archaeological, geological, and historical lenses, contributing new perspectives on the extraction techniques, production processes, and the cultural significance of Cycladic marble in regional and broader historical contexts.

Keywords: Ancient Quarries, Marble Provenance, Archaeometry, Cycladic Islands, LiDAR and Photogrammetry

Figures

Fig. 1. The Karika quarry, showcasing evidence of both modern and ancient extraction marks (© Anevlavi V.; ÖAI/ÖAW).

Morphometry of the Kuris alluvial fan (Cyprus) - comparative analysis of manual and GIS methods

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Visual analysis of hypsometric maps to distinguish flattenings of various origins and slopes has been used by geomorphologists for the last 100 years since the introduction of the method of representing relief using isolines in cartography. Recently, the introduction of GIS systems has made it possible to automate this type of morphometric analysis of surface features. The effectiveness of both methods is largely dependent on the degree of diversity and nature of the morphology, denivelation, occurrence of recesses, etc., and the greatest difficulties occur in flat and poorly differentiated areas. Therefore, in order to test and compare both methods, a very slightly inclined and monotonous alluvial fan of Kouris in southern Cyprus was selected. The alluvial fan/delta of Kouris is about 2 km long and about 5 km wide along the Mediterranean coast. It forms a vast lowland between the end of the carbonate margin of the Troodos Mountains, with the ancient city of Kourion on its edge, and Limassol (Lemesos) and the Akrotiri peninsula.

This place is located in a tectonically active area (*Zomeni 2012, Evelpidou 2023*). The manual method consisted of determining flattenings on a contour map. This map was vectorized based on contour lines. Flat areas (0.0-0.6o) were directly generated using GIS (Geographic Information System) from the slope map from the DEM (Digital Elevation Model).

More flat areas (and larger in area) are located on the western part of the delta (Fig. 1). They have a NW-SE extension, consistent with the direction of the coastline. Their length ranges from 1500 to 400 m, and the average width is 300 m. The most homogeneous and occupying the largest area are located closest to the Mediterranean coast (polygons 1 and 2). They are almost 2000 m long and about 300 m wide. A percentage (68-22%) coverage of both divisions (layers) was obtained, i.e. the agreement between the flattening surface marked out manually and obtained using the GIS method. The obtained result indicates a positive correlation between the two methods (Fig. 2). Moreover, it can be noticed that flattening surfaces up to 20 [m] above sea level are particularly suitable for verifying the research results (Fig. 3).

The result of the applied analysis proves that the surfaces marked out manually are made more precisely than the surfaces marked out by computer. Despite the significant overlap of the polygons (especially in the lowest parts of the delta), it can be stated that it would be most beneficial to use a map made manually for

carrying out detailed field research. A map made using the second method can only be a verification map. However, the result could be better, having a raster with an even higher spatial resolution.

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Evelpidou et al. 2023 – N. Evelpidou/A. Ganas/A. Karkani/E. Spyrou/G. Saitis: Late Quaternary Relative Sea-Level Changes and Vertical GNSS Motions in the Gulf of Corinth: The Asymmetric Localization of Deformation Inside an Active Half-Graben. Geosciences 13, 2023, 329.

Zomeni 2012 – Z. Zomeni: Quaternary Marine Terraces on Cyprus: Constraints on Uplift and Pedogenesis and the Geoarchaeology of Palaipafos (tapescript of PhD dissertation submitted to Oregon State University), 2012, 120.

Figures

Fig. 1. Flat areas on the slope map of Kouris alluvial fan/delta.

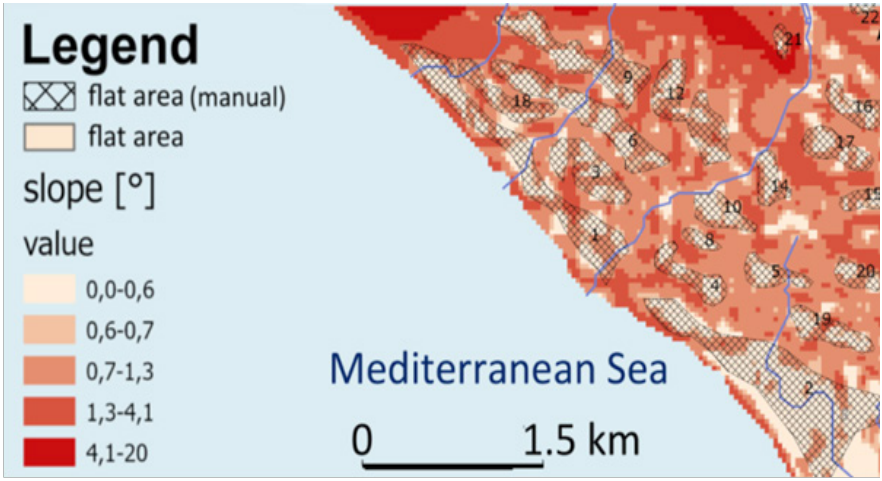


Fig. 2. Compatibility between flat areas (manual and automatic).

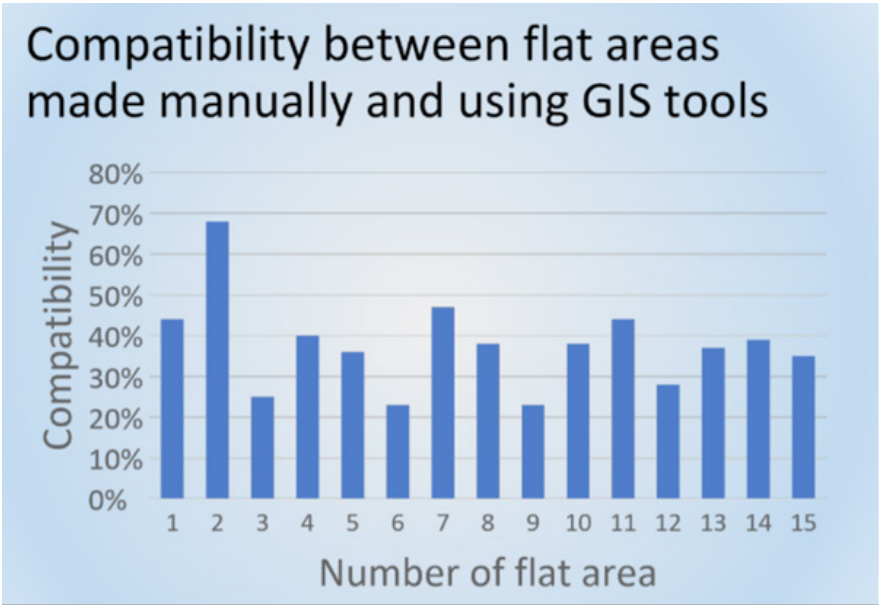
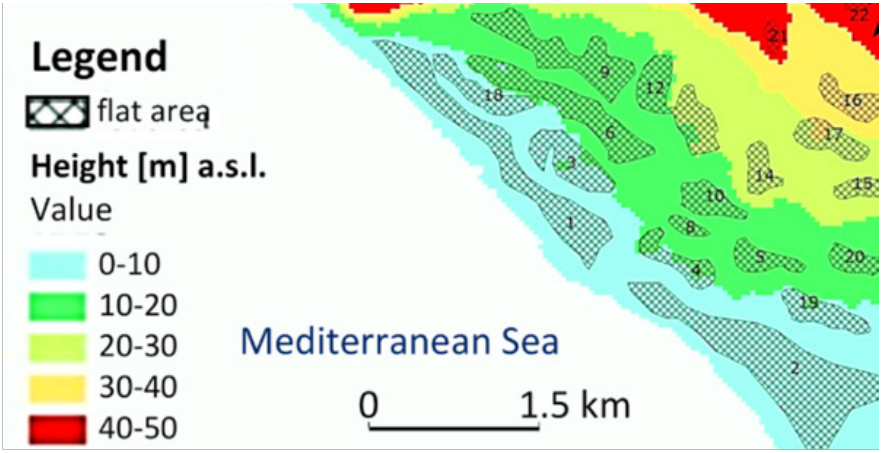


Fig. 3. Manual flat areas and hypsometry of Kouris alluvial fan/delta.



What can tethering stones, wall paintings, and traveler's literature tell us about hunting and exporting live animals from the ancient Sudan?

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Animal products were probably the earliest commodities that were trad¬ed from Nubia to Egypt, some wall paintings in Egypt, for example in the temple of Beit el-Wali, other sites, show the Egyptian Pharaoh kings receiving live animals as Nubian booty. The live animals include giraffe, lion, leopard, gazelle and ostrich. Judging from the physical characteristics and aggressive behaviors depicted for some of the animals, making traps with tethering stones to cripple the animal allows the hunter to capture, tame it and export the wild animal alive. These tethering stones are stone artifacts with grooves or notches at their short axes, average in length and weight, this hunting technique, supported by many rock arts appears from the early and middle Holocene in Northeastern Africa and Sudan. Ignatius Pallme and another traveler during the early ninth century in Sudan described the way of hunting a live animals like a giraffe and exporting from Sudan to Alexandria in Egypt and then into other countries. This paper will focus on the results of the archaeological field works of tethering stones in the many regions of Sudan (more than one thousand and a half pieces were reported on the edge of wadis and on the flat areas) and how these results support the hypotheses hunting wild game animal by tethering stones and it is possible these stones became an essential part of the animal trade process from Sudan to Egypt as seen in the wall paintings and to Europe during the classic period because there are many Savanna live animals appear for example in a grand procession staged by Ptolemy II (Philadelphus) to celebrate the Ptolemaieia, which introduced in 279 BC and in Rome as well, and it is not surprising, therefore, that some of the earliest living animals arrived in Europe as diplomatic gifts or traded commodities with Africa, and probably Sudan as supporting by archaeological, iconographical and historical evidences that we will present in paper.

Keywords: Tethering stones, Hunting, Exporting, live animals, wall painting, Sudan

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Figures

Fig. 1. Tethering stone.

Fig. 2. Distribution map of tethering stones in Sudan.

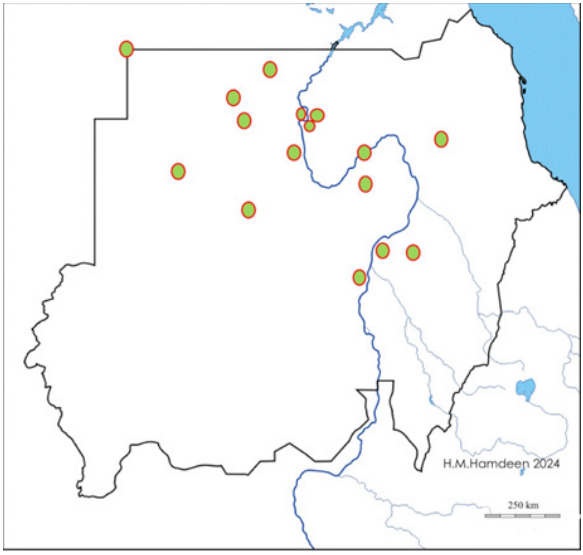

Fig. 3. Wall painting of the temple of Beit el-Wali.

Memory of the alluvial soil (polycultural archaeological site at Vajnory, SW Slovakia)

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In this paper we present results of an interdisciplinary research of the alluvial soil from the polycultural archaeological site located at the eastern margin of the Slovak capital Bratislava (SW Slovakia). Rescue excavations were initiated by a construction of E58 and D4 elevated crossing taking place in June to August of 2018. Studied area comprised numerous finds from the Neolithic, La Tène period and Middle Ages (Great Moravian graveyard). We studied local soil in an undisturbed profile (under HV transmission line), located within a distinct black belt. Pedological and paleoecological data, magnetic susceptibility, radiocarbon dating, combined with archaeological finds and historical map information, allowed the evolution of the soil during the Holocene period to be understood. Ecofacts – molluscan shells, plant seeds, charcoals, wood fragments, ossicles etc. – were retrieved by flotation of bulk samples. The soil, currently classified as the Loamic Phaeozem (*Calcaric, Humic*; cf. IUSS Working Group WRB, 2022), is derived from loamy, carbonaceous alluvial deposits. As a molluscan record indicates, the soil possibly initiated as the Gleyic Fluvisol and later evolved into the Mollic Fluvisol, thanks to the surplus capillary water. Molluscan death assemblages (in total 173 shells, belonging to 19 species) were dominated by land snails (17 species, mainly by *Vallonia pulchella*). The earliest of the three distinguished malacozones (90 – 130 cm) still contained some steppe species (e. g. *Granaria frumentum, Chondrula tridens, Euomphalia strigella*). The soil body under study mainly evolved by an episodic vertical accretion of flood silty loams (overbank alluvium). Both molluscan and plant macrofossil record (the latter still incomplete) point to the open country, partially moist (= polyhygrophilous / hygrophilous snail species) with only scattered trees, affected by humans (seeds of different weeds). For the youngest period, from 13th century onward, palaeoecological data are congruent with the information of historical charters and 18th and 19th century historical map data. They show successive palaeoenvironmental changes from alluvial meadows/ pasture through small-block arable fields (until 1950) up until recent large-block post-collectivisation fields. According to our data and a presence of brown and black verges at the excavation site, prehistorical soilscape was more diverse and a local floodplain slightly undulated as a result of former river activity. Ideal sites

for Neolithic houses were dry patches with chernozemic soils with gravel layers starting in a shallow depth, which efficiently blocked excessive wetness.

Keywords: alluvial soil, Danube River, palaeoenvironment, Mollusca, magnetic susceptibility

Acknowledgements:

This research was funded by project n. 1/0245/23 of the Slovak VEGA Agency. The authors also thank to A. Žitňan and M. Horňák from AA AVALA, Ltd and VIA MAGNA, Ltd, respectively, for invitation to participate in the study and for the fieldwork assistance.

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Prehistoric forest grazing in north Bohemian sandstone areas

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The use of the forest environment in the prehistory of Central Europe is a challenging topic. It is difficult to study using classical means, which is especially true of forest grazing, which we specifically focused on. Therefore, we tried an innovative approach using new methods (sedaDNA, phytoliths) and new types of sites (remains of domestic animal shelters under rocky overhangs with preserved droppings/dung). We supplemented these investigations with traditional pollen analysis of wetland profiles, which, however, reflect forest grazing only unreliably, against the background of a much more massive pollen fallout from trees and under conditions of not entirely reliable indication (only through so-called secondary pollen indicators).

We found the most suitable conditions for our research in the North Bohemian sandstone areas. It turns out that forest grazing has been gradually developing here since the Neolithic. It reached its first peak in the Late Bronze Age, when it even resulted in temporary and localized deforestation. It also played an important role later, which is especially true for the entire Iron Age and the Early Middle Ages. For now, we can only speculate whether forest grazing has been a specific adaptation of subsistence strategies to the environment of Bohemian sandstone areas, or a geographically more widespread phenomenon. At the moment, we are cautiously leaning towards the second of the above options. It is quite possible that marginal, forested areas (for which we coin the term “Hinterlands”) were a crucial additional source of livelihood for prehistoric agricultural communities settled in the fertile lowlands of Bohemia and Moravia.

Our CEA contribution will be a summary of three studies published so far on the topic of forest grazing in North Bohemian sandstone areas (*Ptáková et al. 2021, Pokorný et al. 2022, Zampirolo et al. 2024*) and the broad contextual background that was also published earlier (summarized in the volume by *Šída/Pokorný, eds., 2020*). However, we are adding newly investigated sites (a key one from Bohemian Switzerland, for example), new pollen and plant macrofossil analyses from animal dung, and a new synthesis of proxy data from wetland pollen records.

Keywords: prehistoric quarrying, middle holocene, vegetation, Neolithic

Acknowledgements: We are grateful for the financial support from the TA ČR project "Paleoekologická rekonstrukce ekosystémů jako podklad pro plánování ochrany zvláště chráněných území " (no. SS07010074; 2024 – 2026).

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Soil, water and fur - enthnoarchaeology of tandyrs in South Kyrgyzstan

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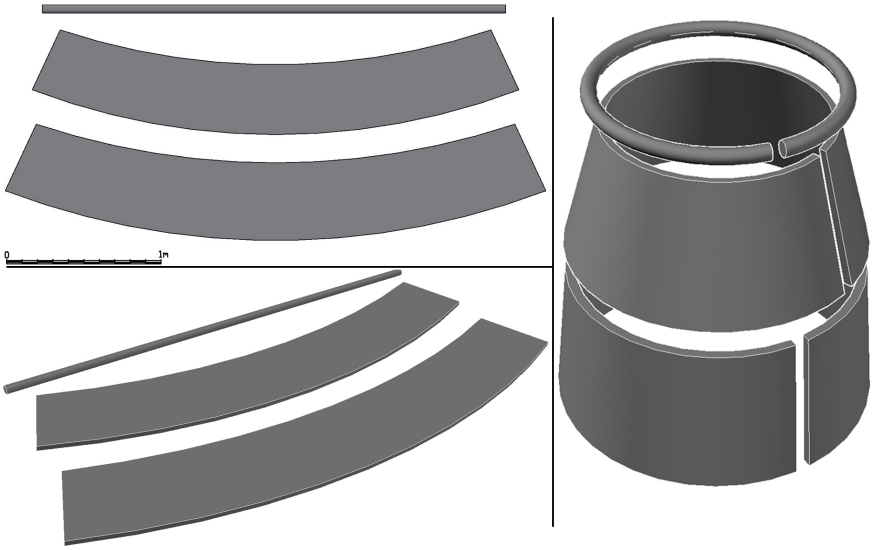
The paper discusses the ethnoarchaeology of tandyr production in traditional societies of southern Kyrgyzstan - a complete process using single-use local materials that leads to a sophisticated device for baking bread and bread derivatives. The contribution is a) descriptive - it defines the standard of technological tradition and b) analytical, which tries to imply potential traces of the archaeological record of these activities (production, distribution, operation). After applying the „Pompeii premise", the result is unsatisfactory from an archaeological point of view, and so the proposed (only?) method of identifying tandyrs in the archaeological record is the means of archaeometry - the scientific analysis of ceramic fragments, which, due to the specific production process, differ significantly from the standard ceramic inventory (table and utility ceramics).

Figures

Fig. 1. A beautiful demonstration of the entropy of matter in the process of making a tandyr. Osh, southern Kyrgyzstan, Salyev family workshop, 2022.

Fig. 2. Isometric view of the geometric primitives of the tandyr core body. Ideal reconstruction.



ABSTRACTS OF POSTERS

Land as a Resource: Demänovská Slatina pollen archive and exploitation of regional resources in the past 3000 years

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Anthropic resource exploitation in the Liptov Basin is reflected in vegetation changes recorded in the sedimentary archives in at least past 3000 years. The exploited resources include soil for plant cultivation, vegetation cover for grazing, and forests as a source for construction wood and fuel.

The poster will present an analysis of the pollen archive in Demänovská Slatina as well as the regional landscape archaeological artefactual record. The aim of this comparison is to identify the resource exploitation that is not visible well by means of archaeological artefacts. We shall try to chalk out the exploitation intensity that can be demonstrated through founding and abandonment of fields, maintaining deforested landscape by grazing, mowing and burning, and last, through impacts on woodland by means of selective logging.

The detailed pollen archive from Demänovská Slatina fen recorded the regional landscape development from the Bronze Age, with a maximum anthropogenic impact in the Middle Ages and Modern Era. The exploitation of land resources had impact on vegetation change to such an extent that, for instance, triggered formation of fen vegetation and made it possible to survive until the present.

Keywords: pollen archive, Liptov region, land use, Late Bronze Age - Modern Era

Acknowledgements:

This research was supported by the project “Paleoenvironmental and Chronometric Research of Important Archaeological Artefact-Ecofact Complexes in Slovakia”, project code 09I03-03-V04-00672, in the frame of The Recovery and Resilience Facility (Plán obnovy a odolnosti), by the Slovak Research and Development Agency project APVV-20-0044 “Vplyv využívania prírodných zdrojov na spôsob života v dobe bronzovej a v dobe železnej”, by project VEGA 2/0035/22 “Relikty kultúrnej krajiny – identifikácia a interpretácia”, and by project OP JAK CZ.02.01.01/00/22_008/0004593.

Reconstruction of the Geospatial Relationships of Execution Sites in Kremnica (Slovakia) and Their Interactions with Intangible Socio-Cultural Resources

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The presented topic focuses on the reconstruction of geospatial relationships of locations associated with executions in the town of Kremnica and their interaction with intangible resources, utilizing Geographic Information Systems (GIS) within the given landscape context. The research focuses on the sites of Fernkreuz, Šibeničný vrch, and the chapel for the executed. It integrates digital cartographic methods with historical and archaeological data to identify and analyse the spatial relationships between these potential execution sites and their impact on the physical and sociocultural landscape.

By employing advanced GIS technologies, the study accurately locates execution sites and analyses their accessibility, visibility, and relationships with nearby monuments, as well as intangible resources such as local legends and oral traditions. These intangible resources, which form an integral part of the landscape and cultural context, provide new insights into the connections between physical sites and the deeper social, cultural, and historical contexts of the region.

The research findings reveal that the execution sites in Kremnica were not isolated locations of punishment but played a pivotal role in the landscape and cultural memory of the area. The strategic placement of these sites, designed to maximise their visibility and psychological impact, is exemplified by Šibeničný vrch with its prominent hilltop location. The conclusions presented here contribute to a broader understanding of the potential of GIS in the study of execution sites and its application to the interpretation and preservation of historical sites. They also establish a foundation for further research into this subject.

Keywords: Reconstruction of Geospatial Relationships, Execution Sites, Geographic Information Systems (GIS), Kremnica, Gallows Hill, Fernkreuz

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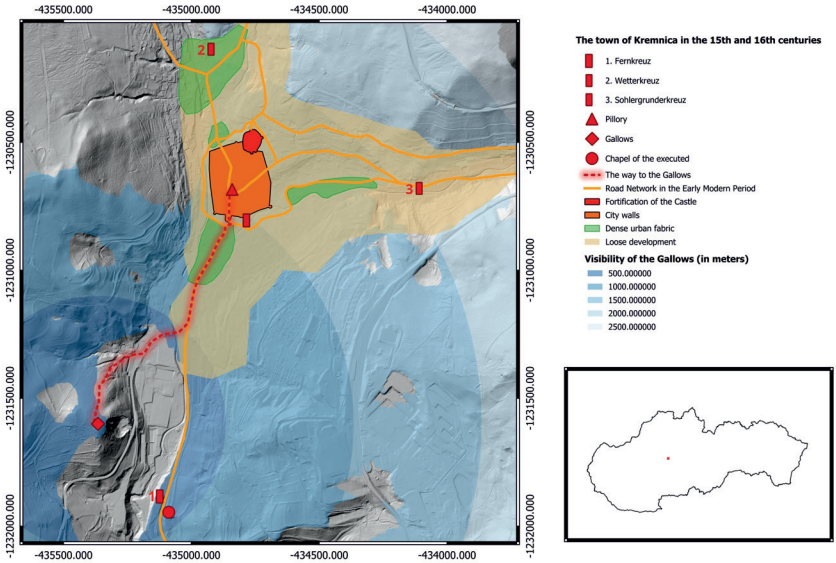
Figures

Fig. 1. A sacral object called Fernkreuz, located on the southern border of the town of Kremnica. Historical written sources confirm executions in its vicinity. Photo: V. Uhrinová.

Fig. 2. The map depicts a digital terrain model (DMR 5.0; ÚGKK SR) with a visualization of historical and landscape elements of the town of Kremnica. It shows the roads and the original built-up area of the town, dating back to the 15th and 16th centuries. The red geometric symbols represent locations where judicial practices were carried out during this historical period. The blue circular radii indicate the visibility of the gallows (black point), which was originally located south of the town. This map interprets the context of individual objects in the landscape and highlights their spatial interconnections, providing insight into the interaction between the town's built-up area, roads, and places of justice. The visual analysis of the blue radii demonstrates the extent to which the gallows were visible from the surroundings, emphasizing its symbolic significance in the medieval landscape. Map created by: D. Bešina.



Feeding the Roman army at Iža: the testimony of archaeozoology

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Despite a long history of archaeological and archaeozoological research, the results of the analysis of the animal remains from the Roman fort of Iža - the *Brigetio* outpost - have not yet been fully evaluated and remained scattered in hardly accessible sources. Recently, all published articles and unpublished scientific reports, manuscripts or theses have been collected and reviewed in order to provide the first comprehensive overview of the analyses of the animal bones and shells found at the site. This poster provides a state-of-the-art summary of the data and the most important results of archaeozoology relevant to the understanding of the diet and provisioning of troops stationed here over three centuries.

About six thousand specimens of bones and shells have been analysed so far, representing mainly the earth-and-timber phase (AD 2nd century) of the camp's existence. Their identification has been carried out since 1984 by the researchers from the Slovak Academy of Sciences including C. Ambros, J. Šteffek, T. Čejka, and M. Fabiš. So far, only the study of M. Hajnalová and J. Rajtár (2009) and the master's thesis of *K. Šimunková* (*2013*) touch upon the subject of the military supply and the subsistence. It can be stated that the assortment of animals and the mortality profiles testify to the army's dependence on domestic (probably local) animal sources, with sporadic use of the species with origins in Africa (*Equus asinus*) and the Mediterranean (*Ostrea edulis*, *Hexaplex trunculus*). Soldiers mainly consumed the meat of adult sheep and goats, between the second and fourth year of age. The representation of all body parts of animals attest that animals were delivered to the camp on hoof and killed at the point of consumption, in or near the camp. The material has not yet provided evidence of the consumption of preserved meat. The osteometric data recorded also indicate the use of meat of castrated bulls and roosters. The animal bones were in a fragmentary state and showed mainly man-made modifications - traces of butchery, indicating local kitchen processing, as well as the working of bones and antlers for the purpose of making and repairing simple decorations, domestic tools and parts of weapons (e.g. bow inlay). Not yet fully explored, but abundant mollusc and fish remains point to the regular exploitation of freshwater fish, especially large-sized carps (*Cyprinus carpio*), pikes (*Esox lucius*) or catfish (*Silurus glanis*) and sporadic consumption of molluscs (e.g. *Unio crassus*).

Keywords: Pannonia, Limes Romanus, military diet, meat supply, use of animals

Acknowledgements:

This work has been supported by the APVV-21-0257 research project "EDORIMS – Roman Period Elites of the Suebi People in the Central Europe".

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Figures

Fig. 1. Iža, Leányvár: 1 – location of the Roman fort as a bridgehead of Brigetio; 2 – an aerial view of the fort remnants (National Cultural Monument and UNESCO site); 3 – ground plan of the stone fort and parts of the earth-and-timber fort. Source: Archive of the Archaeological Institute of SAS.

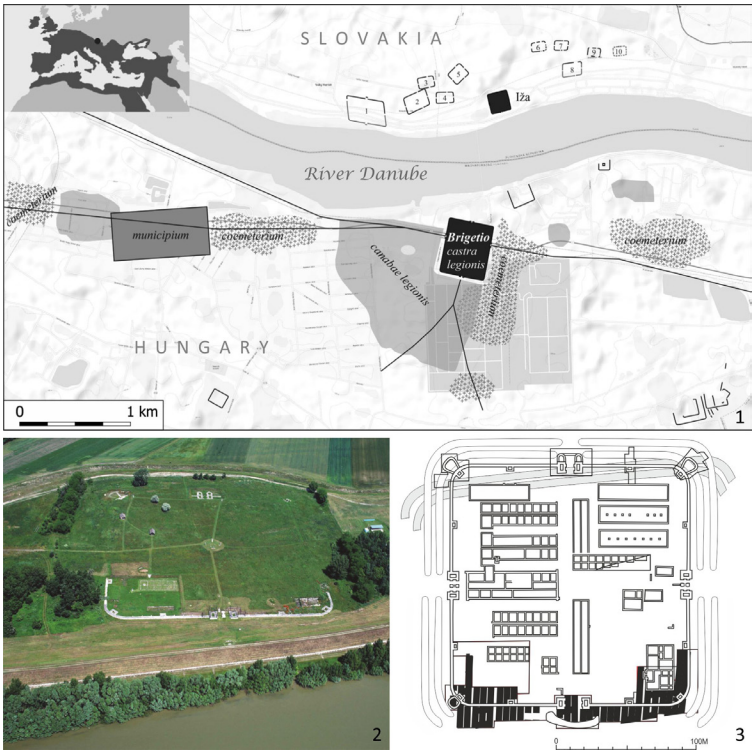

Fig. 2. Iža, Leányvár. Selection of the fish and shellfish remains from the earth-and-timber camp and the stone fort. 1 – a vertebrae of elderly, large-sized catfish (*Silurus glanis*); 2 – a heath snail (*Xerolenta obvia*) shells; 3 – a river mussel (*Unio crassus*) , 4 – a trunculus murex (*Hexaplex trunculus*), 5 – a European flat oyster (*Ostrea edulis*). Photo by Z. Bielichová, J. Rajtár, and P. Červeň.

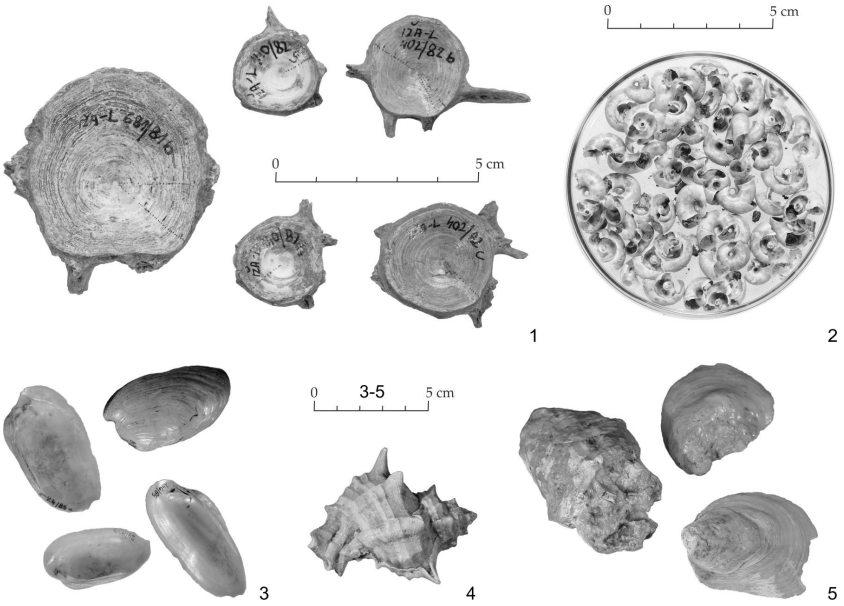

Fig. 3. Iža, Leányvár. Selection of the mammal remains from the earth-and-timber camp. Photo by Z. Bielichová.

Peculiar traces of distant contacts. The case of two unique female burials from the early Middle Ages

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A unique collection of nearly 90 small red beads was discovered in the rich burial of an adult woman at the early medieval cemetery of the social elite in Bodzia (central Poland) (Czech-Błońska, Krajczewski 2017) (Fig. 1). The chemical composition and structure of selected items were analyzed using electron microprobe analysis (EMPA), X-ray fluorescence (XRF) and Raman spectroscopy (RMS). An comparable set of 27 red beads, part of a necklace composed of glass, carnelian and ceramic beads was found in the burial of a 14-year-old girl at the cemetery by the church of St. George in Kostoľany pod Tribečom (Slovakia) (Baxa, Bisták 2009; Staššíková-Štukovská, Hložek 2009) (Fig. 2). Comparative studies confirmed the similarity composition and structure between the bead collections from these two burials.

Archeometric studies have shown that the beads are made of arsenic sulphide glass. This glass was obtained by melting natural arsenic sulphide (yellow orpiment). The objects were formed at a temperature of about 350°C. The increased content of Sb, Pb, Cu, Te and Se may indicate that arsenic sulphide used for the production of arsenic sulphide glass co-occurred with stibnite and other sulphides and sulfosalts of copper and lead. This mineral assemblage is typical of low-temperature hydrothermal polymetallic deposits from Maramureș (Czech-Błońska et al. 2023). Lead isotope analyses (LIA) were also performed on a lead glass bead found in grave 78 in Kostoľany pod Tribečom. The results indicate the use of lead from deposits in the Olkusz area, on the border of Upper Silesia and present-day Lesser Poland (Poland) in the production of the ornament.

Lead glass and arsenic-sulphide beads were luxury items, possibly indicating the high social status of their owners. The similarity of the burial equipment in Bodzia and Kostoľany pod Tribečom, including the presence of beads, may indicate common cultural patterns or even direct contacts between these regions. The origin of the Maramureș orpiment and the Olkusz lead connects both regions in a larger trade and technological network of Central Europe in the 10th–11th

centuries. The finds from Bodzia and Kostoľany pod Tribečom may indicate that these communities were part of this network, and the presence of luxury beads in their burials was a sign of their prestige and participation in international contacts.

These results provide valuable insights into the role of Central Europe in the early Middle Ages, highlighting the operation of craft workshops that utilized raw materials sourced from different parts of the region.

Keywords:

Early Middle Ages, mineral ornaments, arsenic sulphide glass; lead glass, archaeometric analysis

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Figures

Fig. 1. Bodzia. Grave no D 171: a - photographic plan (phot. S. Gronek: Buko, 2017, 215); b - drawing plan (draw. A. Hurnowicz: Buko 2016, 71) with grave inventory (1–3 – clusters of mineral beads; 4 – rock crystal bead; 5 - non-monetary silver plate double folded; 6 – coin; 7 - 4 fragments of a gold plaque; 8 – knife; 9 – wooden bucket); c - plan of the cemetery with marked graves (nos. D 148–175, E 27–880). Grave no D 171 with mineral beads marked with red colour (ed. by M. Kara, I. Sobkowiak - Kara, draw. by P. Szejnoga: Buko, 2017, 66); d - a set of beads made of arsenic sulphide glass from the cemetery in Bodzia. Photo: R. Czech-Błońska.

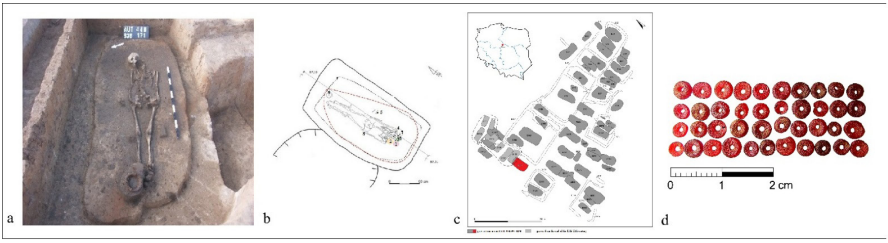
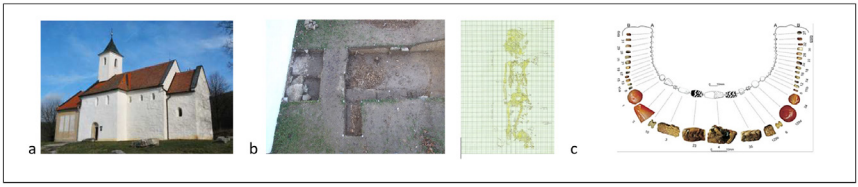


Fig. 2. Kostoľany pod Tribečom: a – St. Georges Church; b - grave no 78: photo and drawing plan from the excavations in 2006; c - reconstruction of the necklace from grave 78: **A** – drawing; **B** – enlarged photos of drawn beads, the smallest one made of arsenic-sulphide glass, no. 4 bead made of lead glass subjected to lead isotope analysis. Draw., photo by D. Staššíková-Štukovská (after *Staššíková-Štukovská/Hložek 2009*, 88).



Millennia of change in the Jeseníky Mts: The role of fire and grazing in shaping subalpine ecosystems

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The history and utilization of the Central European subalpine vegetation outside the Alps and Carpathians remains surprisingly little known.To fill this gap, we chose the Eastern Sudetes mountain region with a natural subalpine zone, continuously existing throughout the Holocene. We present a 2800-year-long history documented with pollen, non-pollen palynomorphs, plant macro-remains, charcoal, geochemistry, and associated written archival records.

We identified six periods of subalpine vegetation development:

1. **800 BC – AD 1010:** Species-rich subalpine grasslands, gradually overgrown since AD 400, with one major fire event dated to 670-820 AD;
2. **AD 1010-1330:** Expansion of forest and reduction of the treeless area, with occasional fires around AD 1100 and AD 1300;
3. **AD 1330-1630:** First signs of possible human activities in vegetation, confirmed by fire events since AD 1530, by historical records of ox grazing during the 16th century and later, and by disturbances leading to erosion recorded by geochemistry;
4. **AD 1630-1760:** Deforestation and expansion of subalpine grasslands due to a new type of management – hay cutting along with ox grazing, with less erosion;
5. **AD 1760-1950:** Strong human impact – hay cutting led to the maximal extent of subalpine grasslands, cessation of grazing and burning (absence of charcoal); since AD 1850, „alpine-style" cow grazing and tourism;
6. **After AD 1950:** Abandonment, reduction of the treeless area, expansion of forest, and the planting of *Pinus mugo* and dwarf shrubs.

Natural subalpine forest-free areas existed during the Iron Age but later began to be overgrown by forest, probably due to climate. A huge fire recorded during the early medieval period may have been a deliberate attempt to reverse the overgrowth and keep the peaks treeless, perhaps for a good view and control of the area. However, after that, there was an overgrowth of the peaks until AD 1330 when we infer from the pollen the first recorded management – grazing associated with burning extensively used to increase/maintain the extent of the treeless area.

Our results confirm earlier research on fire events on the peaks of the Jeseníky Mts and provide evidence of human efforts to modify vegetation at the highest

elevations since at least the early Middle Ages. It is highly desirable that these paleoecological findings be complemented by archaeological research on the highest altitudes of the Eastern Sudetes, which is still completely lacking.

Keywords: subalpine vegetation, Holocene, pasture, burning, hay cutting, Sudetes Mts.

Drainage Channels and Historical Land Use: Paleoecological Reconstruction of Juríkova Jama in the Rudava Valley

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The aim of the study is to identify land use types from the first cultivation in the 17th century to the present day. The study area, *Juríkova jama*, is located in the Rudava Valley, on the left bank of the Rudava river, and lies in the cadaster of the village of Studienka, Malacky District. The site is positioned 3 meters above the current floodplain on Pleistocene terrace with majority of the site periodically to permanently waterlogged due to springs located at the contact between the terrace and glacial plain. The study site features a potential paleomeander (*wagram*), delineating the floodplain's maximum extent, a predominantly forested central area with *Alnus* as the dominant tree species and remnants of anthropogenic landforms in the form of dug drainage channels associated with gleyic fluvisol, and a smaller meadow characterized by sand-rich soil. Digging channels to manage water for irrigation or drainage of soil was a technique used in Europe from the Middle Ages until the 20th century to heighten the cultivating potential of areas that were otherwise not as productive. These practices were largely abandoned during the 20th century (*Renes et al. 2020*). The cultivation of waterlogged soils in the study area is potentially associated with a series of watermills established along the Rudava river during the 17th century, around which settlements evolved over time, often adopting the names of mill lords or tenants (*Pišút et al. 2023*). Local name *Juríkovci* persists to this day.

Preserved paleoecological proxies in the soil are being used to provide a basis for studying past landscape and socio-economic dynamics at this site, while historical records were used for verification. Cumulative soil samples were collected from four probes from depths 0 – 30 cm and macrofossils retrieved by flotation, after which remains were determined and analyzed. The samples are rich in plant seed remains, with species representation primarily including *Alnus*, *Cannabis*, and *Panicum* and additional species of grasslands, which could provide insights into past agricultural activity. Complex paleoecological research conducted approximately 1 km west and on the same side of the floodplain as our site identified species that are wet meadows and anthropogenic indicators but without anthropogenic landforms present (*Pišút et al. 2023*).

Keywords: drainage, channels, land use, reconstruction, paleoenviroment, plant proxy

Acknowledgements:
The research was supported by VEGA under No. 1/0245/23.

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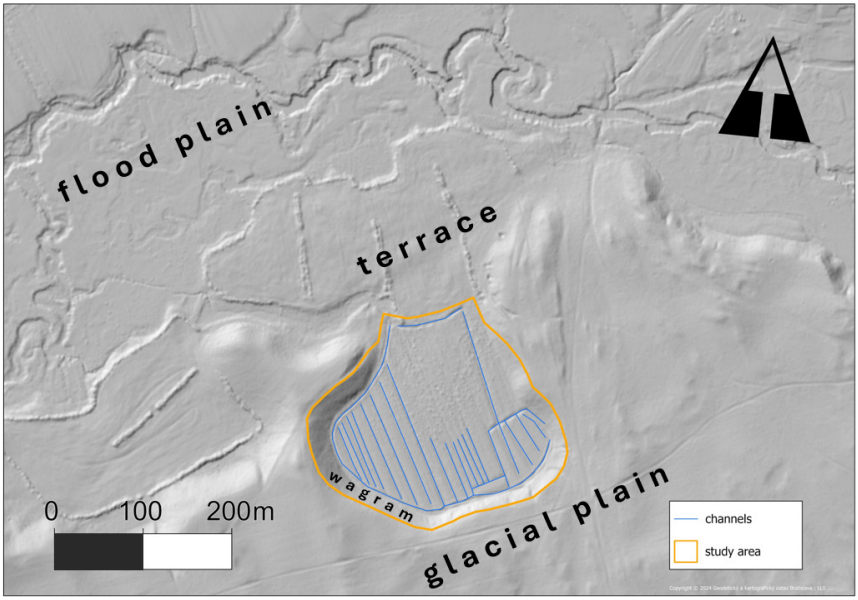
Figures

Fig. 1. Geomorphological situation of Juríkova Jama site with marked dranage channels.



Plant macro remains deposited at the Celtic *oppidum* of Altenburg-Rheinau: preliminary analyses

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The late Laténe oppidum of Altenburg-Rheinau was erected on two peninsulas protruding into the Rhine River close to the Rhine Fall near Schaffhausen (CH). Due to this strategic and favourable position offering the opportunity of controlling the waterway of the Rhine River, the site is interpreted as a late Iron Age commercial metropolis. Therefore, its archaeobotanical assemblages are a highly promising piece of the puzzle for a better understanding of the ongoing changes in anthropogenic impact on the landscape and land use during the Middle European Iron Age. The analysis of seeds and fruits as well as charcoals found in the investigated structures aims to shed light on activities such as food processing, discarding of refuses and depositions of by-products, but might also reveal potential hints on agricultural strategies. As a result, the knowledge upon agricultural practices and land use activities for such important sites in the late Laténe Period is intended to be extended. Furthermore, the economic importance and activities of Altenburg-Rheinau can be elucidated and put into a regional and diachronic context.

Keywords: Oppidum, Archaeobotany, Seeds and Fruits, Charcoal Analysis, Late Latène

Integration of geochemical and geophysical data in archaeological prospection and excavation – current state of the art

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Geochemical and geophysical approaches are quite often used in archaeological prospection. Each of them has its own advantages and disadvantages. Geophysics is good especially for fast fieldwork on vast areas and high density of data, geochemistry enables to identify various activities, especially with multi-elemental approach of XRF technologies. The integration of these methods enables to combine the strengths of both methodical approaches and potentially uncover underground archaeological reality with better contextual information level. We have developed such integrative approach (*Horák et al. 2024*) and applied this method on several sites. Every site has its unique specifics and sampling design. The geophysical method of prospection is magnetometry and geochemical data were obtained by pXRF technology.

We present several examples from various researches in various conditions: Iron Age enclosure of "Viereckschanze" type in Bělčice; not excavated prehistoric hillfort in Kobeřice located in forested area; La Téne period oppidum Bibracte with two areas: one placed in steep slope conditions (la Côme Chaudron) and one with dense underground stone architecture (le Parc aux chevaux). The last site is the construction of the D35 highway in Czechia, where we researched two areas covering several hectares, both on the arable fields, with dense prehistoric and protohistoric settlements including glass and metal working activities. Both areas were also fully excavated archaeologically.

Keywords: XRF, Data integration, Magnetometry, Prospection

Acknowledgements: This research initiative originated in the activities of the COAST action CA 17131 SAGA: The Soil Science & Archaeo-Geophysics Alliance (www.saga-cost.eu). The geochemical datasets were obtained during the project "Geochemical insight into non-destructive archaeological research" (LTC19016) of subprogram INTER-COST (LTC19) of program INTEREXCELLENCE by Ministry of Education, Youth and Sport of the Czech Republic. It was also supported by the Czech Science Foundation [Project: Mobility of materials and life cycles of artefacts: archaeometry of metals and glass of the La Tène and early Roman period;

project number: 18-20096S]. Some datasets were obtained by activities of the Archaeogical-Environmental Laboratory during rescue excavations of Czech highway infrastructure due to willingness of the Centre for Fieldwork Archaeology of the Department of Archaeology of University of Hradec Králové.

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Medieval Ore Mill in Havlíčkův Brod (CZ)

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Rescue excavations in 2020-2021 (ARCHAIA Brno, IAM FF MU) at Havlíčkova Brod uncovered a medieval ore processing plant integrated with metallurgical (smelting) workshop in the floodplain of the stream. Dendrochronological samples specify dating to the 1270s to the 1290s. Organic materials such as leather artefacts and wooden artefacts have been preserved in anaerobic conditions. The central object was a relic of a mill with a water wheel fragment. The wooden artefacts, as far as possible, were analysed and evaluated morphologically as well as in terms of technical and structural functions. The most significant were fragments of at least one water wheel with a diameter of 5 meters. The water wheel of this construction is the oldest and thus unique discovery in medieval Europe. By identifying the woods used to build the mill, it is possible to follow the preferences in the selection of the material. The results of these analyses were compared with the composition of species in the discovered segment of cut forest stand. The composition of the woods in the parts of the mill demonstrates the advanced knowledge of medieval craftsmen who selected the materials for their adequate technical properties.

The authors will attempt to functionally interpret the discovered relics of the medieval technological device, not only using this archaeo-environmental approach, but also using written and iconographic sources. It is therefore consistently multidisciplinary research.

Keywords: Middle Ages - Water Wheel - Wooden Artefacts

Investigation of Birch Tar from the Germanic Cemetery in Očkov

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Birch tar has been discovered in graves since the Neolithic period, spanning a wide geographical range. It appears in both cremation and skeletal graves up to the Migration Period. The practice of depositing lumps of tar in graves is particularly characteristic of the Elbe region during Roman times. In western Slovakia, this custom is evident at Germanic burial sites such as Kostolná pri Dunaji, Bešeňov, Očkov, etc. A similar pattern is seen in Moravia, for instance at sites like Kostelec na Hané and Šaratice. Evidence from the Kostelec na Hané cemetery indicates that a lump of tar was placed in the urn beneath cremated bones, suggesting that it was burned in the urn before the bones were deposited on top (*Zeman 1961*, 270).

At the Očkov cemetery, tar was found in 119 graves, spanning the entire chronological range of the site. The tar was present as black or brown lumps, varying in shape and size, often irregular, and relatively lightweight. When ignited, it burns with a faint flame and emits a pleasant scent (*Kolník 1956*, 267).

To investigate the tar from Očkov, we selected three samples from different graves and analyzed them using FTIR (Fourier Transform Infrared Spectroscopy) and Pyr-GC/MS (Pyrolysis Gas Chromatography–Mass Spectrometry). These techniques aim to provide a deeper understanding of the function and production of birch tar during the Roman period.

FTIR is particularly effective in identifying distinct functional groups in birch tar and monitoring how these groups change during heating or cooking in its production. In contrast, GC-MS is useful for identifying the soluble molecular components of tar, offering insights into its botanical origins and production techniques (*Schmidt/Koch 2024*). Our analysis of three birch tar samples using FTIR and GC-MS confirmed the presence of characteristic functional groups and thermal degradation products typical of birch tar.

These findings contribute to our understanding of birch tar's role in Germanic burial practices, revealing both its chemical composition and its cultural significance.

Keywords: FTIR, Pyr-GC/MS, western Slovakia, Roman period, funeral practices

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Schmidt/Koch 2024 – P. Schmidt/T. J. Koch: The molecular composition of birch tar and its infrared spectrum. Archaeological and Anthropological Sciences 16, (193), 2024. https://doi.org/10.1007/s12520-024-02102-5

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Reflection of climate and human impact in relief and sediments of Biała Nida basin (Holy Cross Mts. region in Poland)

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The Biała Nida drainage basin (1030.5 km2) covers the upland area of the W part of the Paleozoic core and the SW part of the Mesozoic margin of the Holy Cross Mts. The river is 52.4 km long, has a slope of 1.13‰ and a poorly developed nival regime with meltwater (III-IV) floods.

The Biała Nida valley has not been covered by detailed paleogeographic studies so far, although such studies have been recently carried out in its partial catchments: Wierna Rzeka (Łososina)(length 35.6 km, basin 314 km2) and Hutka (*Chrabąszcz et al. 2017*; *Kalicki et al. 2019*; *2020*; *2021*; *Pabian et al. 2022*; *Przepióra et al. 2023b*). Currently, detailed studies focus on the Biała Nida section downstream of Jaców up to the connection with Czarna Nida near Żerniki (*Kalicki et al. 2024*; *Przepióra et al. 2024*) and include geomorphological and geological mapping of the Quaternary sediments, sedimentological and geochemical analyses of sediments (granulometry, organic substance and carbonate content, analysis of ferrous spherules, etc.), radiocarbon, TL and OSL dating, as well as changes in the meandering riverbeds and land use in the catchment in recent centuries based on cartographic data (*Biskupska et al. 2021*).

Between Jaców and the mouth of the Wierna Rzeka (Łososina), the Biała Nida meandered intensively, undercutting sandy, probably Vistulian, terraces (Bizoręda) and widening the valley floor. This process probably proceeded since the Late Glacial, because under the semicircular undercuts of the terrace edges, large palaeomeanders are preserved, exceeding several times the present day. Thera are probably the late Glacial macromeanders also known from other Holy Cross Mts. rivers, e.g. Czarna Nida (*Kalicki et al. 2012*), Czarna Staszowska (*Twaróg et al. 2020*), Czarna Konecka (*Kalicki et al. 2022*) and numerous European valleys (*Kalicki 2006*). Downstream of the mouth of the Wierna Rzeka River there are no macromeanders, while on the valley floor there are several tectonic horsts and erosional remnants as well as several alluvial cut and fill of various ages.

The oldest dated channel changes occurred at the beginning of the Atlantic. The Biała Nida palaeomeander at Mosty (profile G7) was cut off before 8100±90 BP (MKL-6536) 7443-6699 cal. BC, i.e. in a similar period to the Wierna Rzeka palaeomeander near Młynki, which intensively migrated laterally from 8230±90 BP

(MKL-38927415-7061) cal. BC (profile WR 27) and was cut off before 7790±100 BP (MKL-3573) 6721-6453 cal. BC (profile WR 14) (*Kalicki et al. 2021*). The next cut-off occurred in the Atlantic: Łososina meander at Bocheniec I before 6430±100 BP (MKL-4555) 5481-5216 cal. BC (*Kalicki et al. 2021*), and Biała Nida one at Las Wilkomija before 5830±70 BP (MKL-6740) 4845-4501 cal. BC. However, the channel changes in the mid-Atlantic were probably caused by single events, and the frequency and magnitude of floods must have been small, as evidenced by peats without clastic interbeds of flood deposits accumulating in the palaeomeanders of Biała Nida near Jaców from 6170±70 BP (MKL-6741) 5306–4938 cal. BC and near Mosty (G7) from 5720±80 BP (MKL-6537) 4774–4363 cal. BC. Peat bogs in the valley bottom also formed in the Subboreal, e.g. in the area between the Biała and Czarna Nida rivers near the erosion remnant at Borki (profil M3: from 4230±70 BP (MKL-6535) 3011-2581 cal. BC) inhabited since the Neolithic.

In the Roman period, the Biała Nida basin was located outside the iron metallurgy region of the Przeworsk culture in the Holy Cross Mts. (*Orzechowski 2007*). This is confirmed by the lack of macro- and micro-slags and iron spherules in alluvia. Only the area of the Biała Nida and Czarna Nida interfluves was located within the Nida metallurgical region (*Przepióra et al. 2024*), which led to its deforestation, activation of aeolian processes and formation of buried soils, e.g. on the Borki erosional remnant at 1930±190 BP (*Śnieszko 1978*), after calibration 400 BC-400 cal. AD, and also an increase of fluvial activity, as evidenced by the sandy cut and fill of the Biała Nida near Mosty (profile G5) dated to 1590±110 BP (MKL-6538) 245-650 cal. AD.

Until the Middle Ages, in the alluvial facies of the oxbow lake fill and floodplain, there are no clastic layers in the organic sediments, which may suggest autogenic sedimentary conditions in these environments, referring to the regime of the Biała Nida and its tributaries. However, later, increasing human impact in the catchment caused changes in the depositional conditions. Variable conditions, recorded as three levels of buried soils (Zastawy), occurred only in the immediate vicinity of the Biała Nida riverbed on the levee, from 1100±50 BP (MKL-6739) 774-1028 cal AD (891-994 cal AD - 68.3%). In the Wierna Rzeka valley, such sedimentation changes were dated to 610±40 BP (MKL-3133) 1290-1409 cal. AD (Młynki II) and 190±70 BP (MKL - 4556) 1523-1630 cal. AD (Bocheniec I; *Kalicki et al. 2021*).

In the Middle Ages, the Biała Nida basin was located within the Old Polish Industrial District, and from the mid-14th to the 20th c., mining and smelting of copper and lead ores and the associated hydrotechnical construction on the river developed intensively in the Hutka River basin (Pabian et al. 2022, Przepióra et al. 2023b). In recent centuries, as a result of direct human impact in fluvial systems, anthropogenic anastomoses have formed in several sections (*Chrabąszcz et al. 2017*). Changes in land use in the Biała Nida basin, which can be analyzed in detail since the 19th century based on cartographic data (*Biskupska et al. 2021*), have had a significant impact on the natural environment and its functioning in recent years.

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Sources of iron ore for metallurgy in the Holy Cross Mts. during the Roman period – a new look

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Systematic research on ancient iron metallurgy in the Świętokrzyskie region has been conducted since the 1950s, but the issue of iron ore mining has been treated marginally and is very poorly understood. Therefore, the aim of the research was to determine the possible sources of iron ore for the Prehistoric metallurgy from the Roman period in the Świętokrzyskie region based on the analysis of the geological structure and literature (*Janiec/Kardyś 2021*).

The main centre of iron metallurgy was located N of the main range of the Holy Cross Mts. in the Kamienna River basin, in the Pokrzywianka catchment, and several smaller regions are known, among others, from the Czarna Nida valley (*Bielenin 1992; Przychodni 2006; Orzechowski 2007*). In the Pokrzywianka catchment, Paleozoic sandstones, quartzites, conglomerates, limestones, dolomites, shales and greywackes are exposed under the loess cover, in which polygenetic iron ores occur. However, for the Prehistoric metallurgy, only weathering ores – limonite ores formed on outcrops of sedimentary and hydrothermal deposits – were important.

Such deposits were mined at Rudki, located northward of Nowa Słupia (*Orzechowski 2007*). However, the way of the deposition means that in the Prehistoric times the ore could only be excavated from the weathering cap of this deposits. Considering the scale of metallurgical production, it could not fully satisfy the demand, and it was too far from the Nida River region. Therefore, the mine in Rudki could not have been the only source of ore extraction.

The specific shape (basin) and geological structure of the Pokrzywianka catchment area cause the formation of an “iron basin” in which iron compounds can precipitate. Large iron concretions have been described and found in the loess bottom from this area (Fig. 1). Their extraction was facilitated by a dense network of dry valleys (ravines) cutting through the loess. Such a location of ore extraction sites can be indicated and confirmed by the location of shafts from the last centuries (Fig. 2). In turn, in the Nida River region, bog iron ores found in the Holocene marshy oxbow lakes of the Czarna Nida River could have been used for smelting (Fig. 3).

The problem requires further research, especially field verification of the frequency of occurrence of the above-mentioned deposits in Quaternary sediments.

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Figures

Fig. 1. An example of the occurrence of iron ore limonite (*Klatka 1955*)

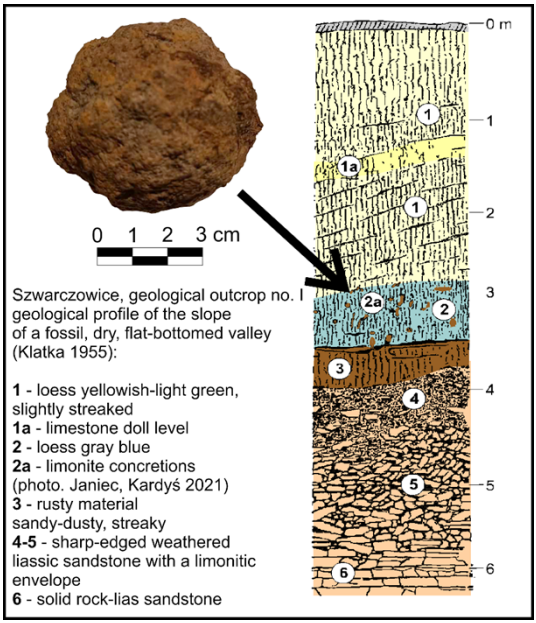


Fig. 2. An example of modern, historical (19th and 20th c.) traces of iron ore mining in DEM (geoportal.gov.pl), often located along the edges of loess gorges in the vicinity of the Szyby village, southward of Ostrowiec Świętokrzyski (Świętokrzyskie Voivodeship, Poland)

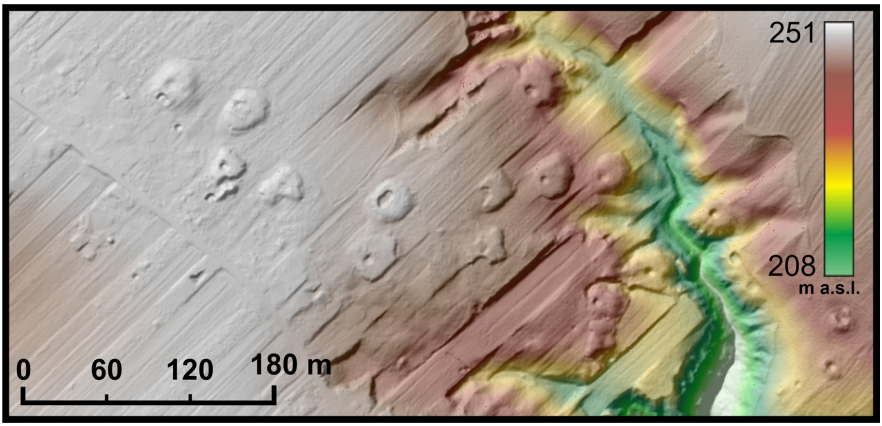
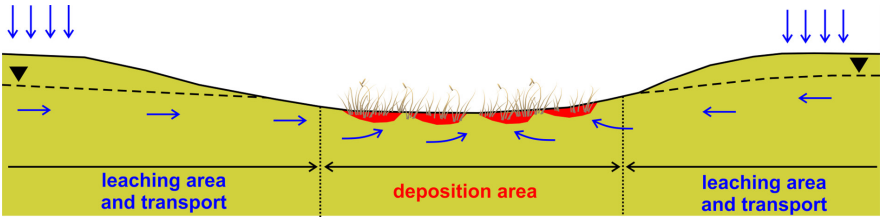


Fig. 3. Schematic presentation of bog iron deposition (based on *Jachowicz et al. 1964*)



Early Middle Ages to Early Modern period archaeological and archaeobotanical records from Prague-Nusle (Czech Republic)

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During a rescue excavation prompted by the planned redevelopment of the former brewery complex in Prague-Nusle (Czech Republic) in 2021 - 2023, a polycultural settlement was uncovered. The site has a long tradition of settlement since the Neolithic period. Early medieval settlement begins in the 6th century and represents a typical example of a settlement with iron production in the Prague early medieval agglomeration. The form of settlement gradually changes from an open settlement (6th – 13th century) the form of separate homesteads (14th – 17th century). In the early modern period, we know of at least one homestead, a historical road and several stages of mill water chanells that pass through the area. The early modern brewery was established at 1723. The site was sampled for macrofossil and pollen analysis. The environmental material presented here was collected from the infills dated from the Early Middle Ages to Modern period.

This paper presents the results of the study of plant macroremains. The large sampling carried out at the site allowed us to analyze various contexts representing the Early Middle Ages, High Middle Ages, and Modern period. A total of 45 samples taken in 30 features and layers was analyzed (235,8 litres of sediment), containing 4,894 plant remains in total preserved in charred, uncharred and mineralised states.

The results of the analyses raise several questions concerning taphonomic processes and sampling methodologies during rescue excavations. Therefore, the objective of this paper is to investigate these questions by focusing on the variety of data obtained from different contexts and time periods. The comparison of various states of preservation in individual samples, species diversity and frequencies are presented and discussed in the paper as well as their relation to other archaeological artefacts. Selected features are presented in more detail, including two houses that were focused on in the sampling proces because they contained a significant amount of environmental data. The examination of differences between samples brings new insights into data for comparable rescue excavations, where sampling is often conducted either randomly or purposively.

Keywords: plant macroremains, Prague-Nusle, archaeobotany, Middle Ages, Modern period, taphonomy

Wooden artifacts from a medieval ore mill on Stříbrný potok (Bohemian-Moravian Highlands)

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Bohemian-Moravian Highlands was an important area of mining and metallurgical production in the High Middle Ages. Mining activities changed the landscape: deforestation, exploitation and processing of ores can still be seen in the terrain and floodplain fills.

A 2020 rescue excavation (ARCHAIA Brno, ÚAM FF MU) near Havlíčkův Brod uncovered a 13th-century medieval ore processing site in the Stříbrný potok floodplain. Favourable natural conditions preserved a substantial amount of organic material, especially wooden artifacts and remains of cut forest *in situ*. The central object of the archaeological site was the relict of water mill, which was used for processing the mined silver ore.

The artefacts analysed were subjected to morphological evaluation and technical interpretation. The collection includes structural, technical and connective components of the water-powered equipment. Among the key findings were fragments of at least one overshot water wheel, with a diameter of 5 meters. This wheel, made up of rims, pods, cork partitions and connecting pins, represents a unique and significant European find. By the identification the tree species used in these artifacts, it was possible observe the preferences for manufacturing individual mill components. The results of these analyses were compared with the unprocessed wood found in the rest of the site (cut forest *in situ*) and the natural composition of the contemporary forest in the vicinity. The intentional selection of wood species demonstrates the advanced knowledge of medieval craftsmen, who chose materials based on their durability and suitability for specific construction purposes.

The research results contribute to a deeper understanding of the natural environment of the Bohemian-Moravian Highlands and the technological methods of wood processing and the impact of human activity on the surrounding landscape. The obtained data facilitate the reconstruction of local landscape changes, which remained visible long after the mining site's operations ceased.

Keywords: wooden artifacts, archaeobotany, wood identification, high middle ages, human impact on the landscape, ore mill

Exceptional find of gold/electrum plates in the late Hallstatt grave – preliminary report

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In 2024 an exceptional late Hallstatt grave was found during an archaeological excavation in the Tribeč Mountains (W Slovakia). Lower layers of cremation burial was interspersed with more than 200 pieces of small golden plates of irregular shape. Two iron horse bits and four bronze phalerae have clearly set the grave in the late Hallstatt period. Various instrumental methods were employed to shed more light on this unique grave find and original form and function of golden plates.

The burial situation of the grave was documented in raw format for later sequential 3D polygonal modelling of individual levels. Each level was referenced in the geodetic JTSK system. Based on the geodetic reference system, we are able to layer and study the individual models and situations, as well as their mutual relationships and context. Based on detailed digital 3D documentation, the author team is implementing an ideological reconstruction of the burial situation, including an application in augmented reality.

Iron horse bits were subjected to RTG analysis for a better understanding of their morphological and chronological classification. The plates were subjected to optical, fluorescence and morphometry microscopy. SEM-EDX analysis of individual artefacts was applied to determine the composition of the plates more precisely (gold and electrum). For analysis of possible organic components adhered to the surface, we used FTIR spectroscopy and pXRF analysis. As direct measurement of adherent soil and vegetable material did not provide satisfactory results, extraction protocol for targeting the waxes and lipidic materials was used. For extraction of lipids, an azeotrope of solvents was refluxed through an unconsolidated soil. A subsequent combination of solvent extraction and ultrasonic extraction proved to be an effective tool for this analysis, even with limited sample size. Further analyses are planned to characterize the soil sample more accurately (e.g. GC-MS).

Keywords: Tribeč Mountains, late Hallstatt period, cremation grave, material analyses, gold/electrum plates

Acknowledgements:
This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-22-0151.

Figures:

Fig. 1. Golden plates in late Hallstatt cremation grave in situ. Photo: P. Kmeťová

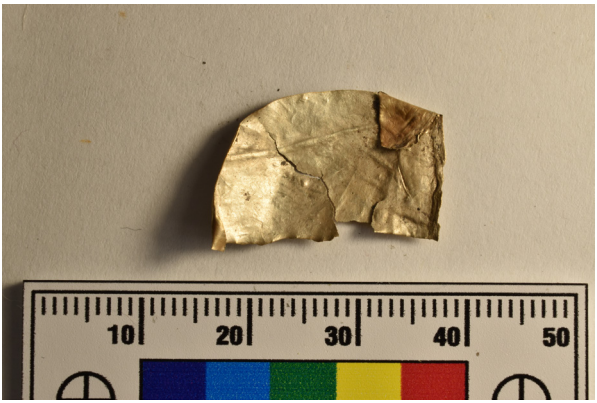
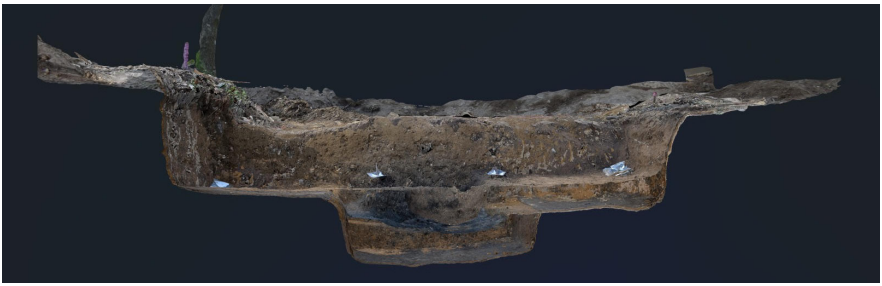


Fig. 2. One of the gold/electrum plates selected for the SEM-EDX analysis. Details visible on surfaces of the plate(s) will be subjected to further research. Photo: P. Kmeťová

Fig. 3. A cross-section of archaeological layers of the grave. Author: P. Ďurica



Opportunities and choices along the Danube at Százhalombatta-Földvár, Hungary (SAX Project)

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Százhalombatta-Földvár is a Bronze Age settlement that is seated on the western hight bank of the river Danube, some 30 kms south of Budapest. It is one of the most extensively researched tell settlements of the Carpathian Basin (*Poroszlai/Vicze 2000*; *2005*; *Vicze/Sørensen 2023*) from that period. Tell-settlements appear as mounds and are multi-layered sites that attest to a specific way of living between 2500 and 1450 BC. At these sites the same prehistoric community lived continuously on the same spot for hundreds of years. The successful tell settlement of Százhalombatta-Földvár, with an extent of over 800 years during the Hungarian Bronze Age, gives us a unique opportunity to study a long-term human-environment relationship. Although exploitation of the environment is a necessity for any settled human society (deforestation, extraction of various raw materials, soil utilization for crop production and/or grazing, etc.), and its manifestation within the archaeological record can be quite clear (*Kovács et al. 2024*; *Sørensen et al. 2020*; *Vretemark/Sten 2020*), the case of Százhalombatta however shows that sustainability was just as important. The long-term and continuous settled life resulting in the subsequent formation of the tell must have been to some extent be in harmony with its immediate environment. The initial deforestation at the time of the establishment of the settlement was a substantial modification of the landscape (*Füleky/Kovács 2002*). Nevertheless, the community could remain and flourish through the subsequent almost 800-900 years (*Poroszlai 2000*; *Vicze 2013*) that could be achieved through the right choices. In the presentation we are going to explore some of the choices the inhabitants made in regard to their environment during the life-time of the settlement.

Acknowledgements:

This research is funded by the National Research, Development and Innovation Office (grant number: FK_142894). It is also part of the HÁRT (Archaeological soil micromorphological investigation of Neolithic and Bronze Age households in relation to construction materials and techniques, and use of space) project of the National Institute of Archaeology, Hungarian National Museum Public Collection Centre (NRI 405899).

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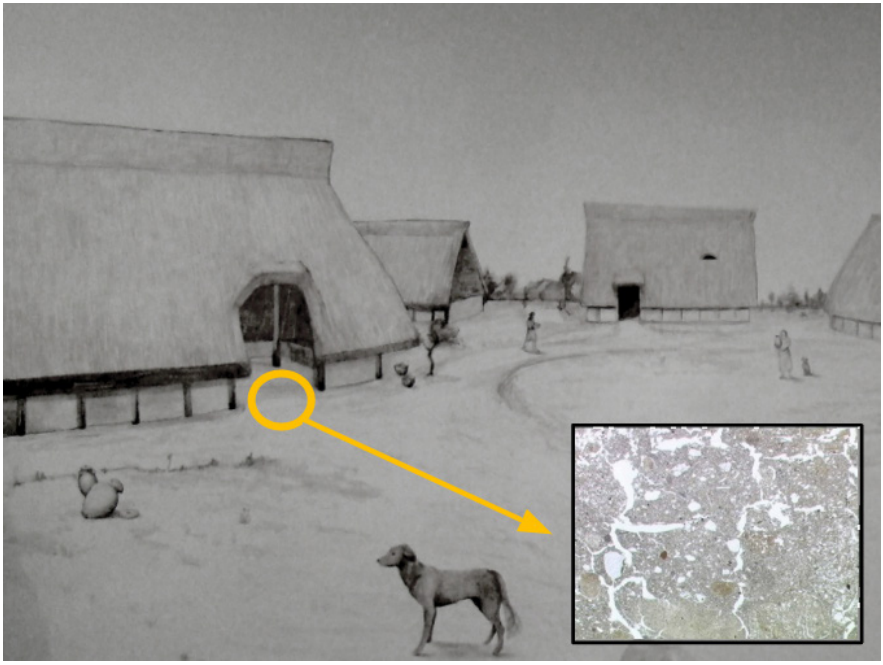
Figures

Fig. 1. View of Százhalombatta-Földvár Bronze Age tell settlement

Fig. 2. Loess as floor building material identified at the site, demonstrating not only the available raw material, but also choice and knowledge



Medieval Metallurgy as Central Resource in the Mountains

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Among the most important resources in the mountains are raw materials. No matter if it is the stone for the chipped industry in the deepest past or specific metals upon which even the most modern human technologies are dependent. Regarding the Middle Ages, the area of today´s Slovakia the Štiavnické Vrchy Mts. always comes to mind. The production of precious metals in this area is broadly known. However, the origins of the mining activities here are unclear and are contaminated with romantic legends of Celtic pioneers based on no evidence even in serious publications. Even though the question of possible prehistoric and early historic mining activities remains unclear there are some new insights on the beginning of medieval production of metals. The latest data come from a longer-term non-destructive survey in the Štiavnické Vrchy Mts. area.

The survey was in the first stages aiming at the ancient anthropic landscape, documentation of its forms and seeking of the relations and processes behind these individual forms. In the current stage individual sites are looked at in more detail. To achieve this goal coring was chosen as the main method. The samples examined from the point of view of multiple scientific fields brought a multidisciplinary dataset. Among the data were the first metallurgy-related absolute chronology dates in this region. Notably, the oldest date convenes with the few existent earliest written sources in which the area starts to emerge in the written record. The dates linked with the specific process, which in this case is metallurgy allow further interpretation of historical records and new assumptions on the importance of metal exploitation in the creation of medieval society in the region. Another important aspect is the archaeo-metallurgical results, which not only shed some light on the processing of metal ores itself but through the comparison of broader data can help with the indirect insight into the relations between different parts of the population. The relation can be observed whether in space through the distribution of resources and products or in time through

know-how transmission. Another important result from the data is the chemical imprint of the metallurgical processes which could be used for further site prediction. That is not the only use of this data, as it can be used as a proxy for the impact rate on the long-term ecological burden.

Keywords: Metallurgy – coring – Middle Ages – technology - non-destructive survey

Acknowledgements

„This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-22-0151.“

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Figures

Fig. 1. Spatial analysis of resources in north-eastern the foothills of Štiavnické Vrchy Mts. at Dobrá Niva. (Background map ALS data by The Geodesy, Cartography and Cadastre Authority of the Slovak Republic, visualization: Tibor Lieskovský, analysis: Martin Miňo)

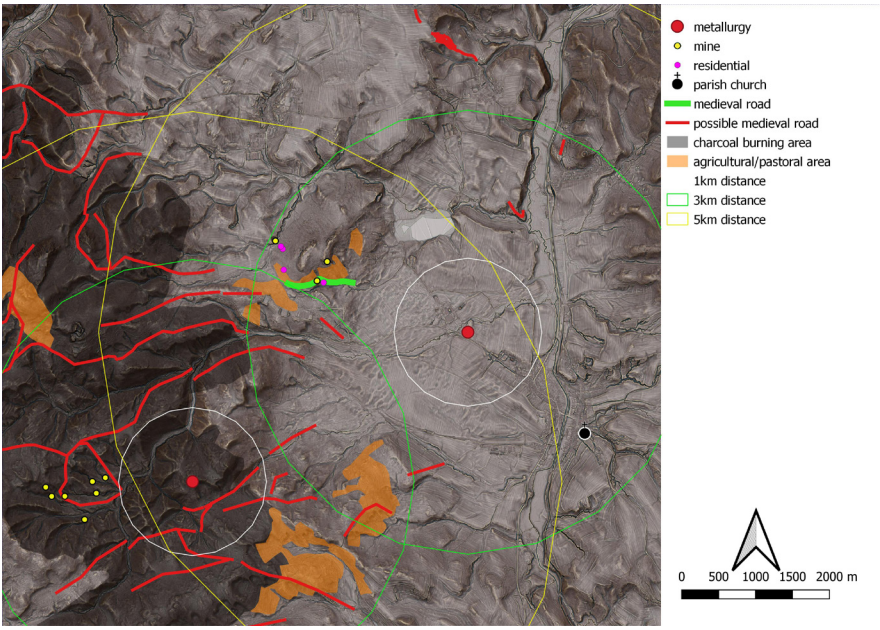


Fig. 2. Iron bloomer slag from Banská Hodruša – Kerling, photo: Martin Miňo

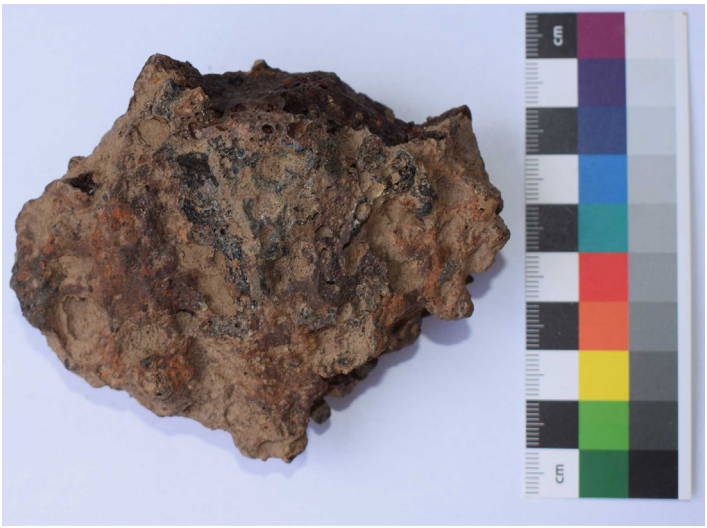
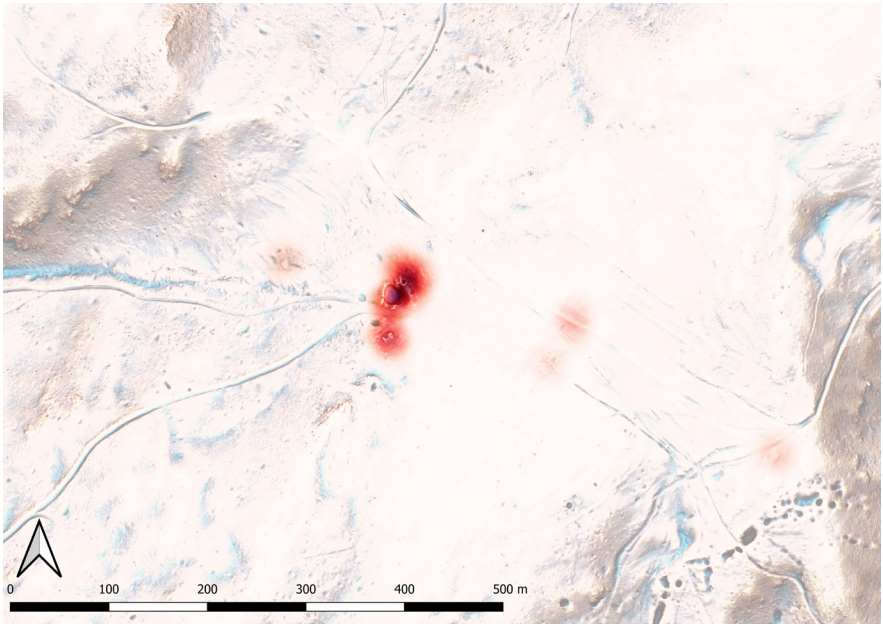


Fig. 3. Metallurgy-related lead pollution concetrations at Banská Hodruša – Kerling.



Mining of galena in the region of Łagów, in the Świętokrzyskie Mountains

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The aim of the research was to gather information on galena mining in the Łagów area in the past. Łagów is a town located in Poland (fig. 1.), within the Kielce Upland, in the Świetokrzyskie Mountains mesoregion (*Richling et al. 2021*). The local geological structure is quite diverse, key to the local mining industry are formations of the Devonian period, mainly dolomite and limestone (*Nowak et al. 2006*). In these formations near the town of Łagow, and mainly in the village of Płucki, that galena was mined in the past (*Kalina/Mirowski 2010*). The galena deposits found here are vein deposits running through Middle and Late Devonian limestones and nest deposits (*Fijałkowski 1970*).

Łagów was one of the galena mining centers in the Świętokrzyskie region in the past. While much more information is available on the extraction of this resource in the area of Kielce (Karczówka hill) or Chęciny, the exact origins of galena mining here in the Middle Ages are unknown (*Hadamik 2017*). The mining was probably related to the pottery developing in the 14th–15th centuries, because galena was used here to color ceramic glazes. More information about local mining dates back to the 17th and 18th centuries. One of the bishops to whom the land belonged permitted the extraction of up to 2.5 m^3 of galena per year in Płucki (*Fijałkowska/Fijałkowski 1971*). Miners in the 17th century encountered older shafts, which confirms that galena mining existed here earlier. In 1730, there were 8 mining shafts in this village. The amount of galena mined in the Łagów area, as well as the importance of the site in the extraction of the raw material, declined significantly in the 18th century (*Kalina/Mirowski 2010*). In 1916-1917 galena was still mined here by Austrians, according to historical sources the amount of material they extracted was 3 tons (*Rubinowski 1966*). The first field geological survey of the ore-bearing area in Płucki was carried out in 1928 by Jan Czarnocki of the National Geological Institute.

The largest galena deposits were found in the western part of the village of Płucki. Today, signs of extraction are hard to find here. The digital elevation model shows some forms, which may be related to local galena mining in the past. The place needs to be further investigated. In the future, isotopic testing of galena is expected to enable comparisons with for example Olkusz ores. It will allow to find the origin of lead, which was used to create artifacts.

Keywords: Mining, Natural resources, Galena, Holy Cross Mountains

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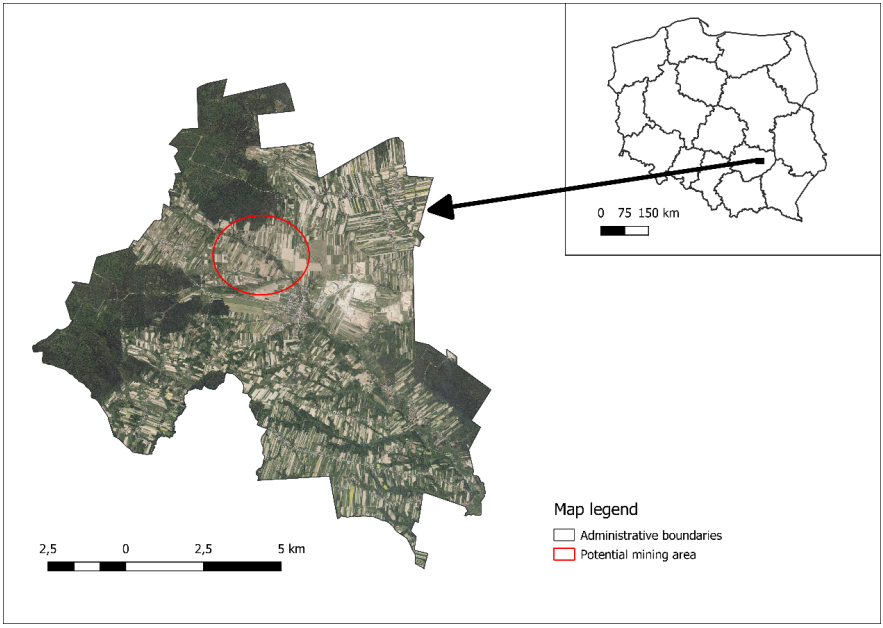
Figures

Fig. 1. The location of Łagów in Poland (Source: Główny Urząd Geodezji i Kartografii)



Archaeological textiles from the Hallstatt Period site of Býčí Skála Cave

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The Býčí Skála Cave, a prominent Hallstatt Period (575–450 BC; Ha D1b–D3) sanctuary in Moravia, Czech Republic, is notable for its connections to elite groups and its exceptional preservation, which has enabled the recovery of extensive environmental datasets (*Golec 2017*). The 2020–2021 revision excavation by the University Olomouc employed a multidisciplinary approach, building on 150 years of scholarly research at this remarkable site. This study highlights textile fragments recovered during the excavation, found both as charred remains and as mineralized textiles attached to bronze artefacts. The primary objective is to analyse these archaeological textile fragments to determine their weave structure, quality, raw material and state of preservation. The findings – in comparison with other textiles from Early Iron Age Central Europe - enhance our understanding of funerary practices and the role of textiles in reflecting social and cultural identities during the Hallstatt Period.

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Figures

Fig. 1. Charred textile remains from Býčí Skála Cave. Photo: M. Ptáková.

The European Highlands as an Example of the Development of Cultural and Historical Landscapes

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The paper deals with a comparison of the development of the cultural landscape and its recognizable changes due to the influence of anthropogenic activities on the territories (Figure 1) of the former Brtnice manor in the Bohemian-Moravian Highlands (Czech Republic), the Krásná Hôrka manor in the Gemer region (Slovakia) and the LaRoche manor in Morvan, Burgundy (France). Similar geomorphological and geological conditions are the basic factors for the comparison of the course of land use, the emergence of settlement structures, the economies reflected in them, as opposed to the established administrative structures, reinforced by the political situation in the Middle Ages and the Modern Age. It is not only a question of tracing the effects of the simultaneous movement of central places and changes in their hinterland, but also the appearance of individual settlement units with their economic background.

In order to make a basic comparison of the three areas under study, a representative sample of all the estates was selected in the form of cadastral areas that included the central locations of the main manorial settlements (Figure 2). These are the cadastral areas of Brtnice, Krásnohorské Podhradie and Larochemillay. For data collection, LiDAR surveys were used in combination with cartographic sources, which are available in various forms for the regions analyzed. LiDAR data are already freely available for the Czech Republic and Slovakia, while the French data were provided by Le Centre archéologique Européen de Bibracte. The cartographic sources are mainly private, but also state mapping works, which in all cases serve as a starting point for the appearance of the landscape segment for the period shortly after the mid-19th century at the latest. Using the comparative method based on these sources, we can reconstruct the economic background on the Czech territory after its codification in the 13th century (*Mazáčková-Žaža 2021*) with the situation that occurs in France, where the settlement structure is much longer and it is possible to follow the normative development and its adaptation over a much longer period, in comparison with the medieval settlement strategy in Slovakia, where medieval legal regulations are rather an exception. However, the cartographic sources for the 19th century are identical in all regions and have the same factual basis.

The area where the former Laroche estate was located is a region whose settlement dates back to the beginning of our era and is connected with the formation of the landscape of the Roman provinces and the application of Roman law (*Drška 2011*). This fact makes it possible to study the landscape and its legal

divisions since protohistory. The region of the Bohemian-Moravian Highlands was permanently settled only at the beginning of the Middle Ages (*Bajer et al. 2016*), which creates a unique opportunity to compare the use and application of the normative landscape from the beginning of its settlement to the present. A similar settlement situation can be found in the Gemer region of present-day Slovakia. In Gemer region, whose landscape, unlike that of Brtnice, shows more signs of mining activities (*Kilík 2015*) as opposed to the non-ferrous economy of the Bohemian-Moravian Highlands, there are villages with the same Medieval layout and hitherto little-known economic background as in Bohemia.

Keywords: landscape archaeology, LiDAR, highlands, non-destructive archaeology, subsistence

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Figures

Fig. 1. Geographical location of studied areas.

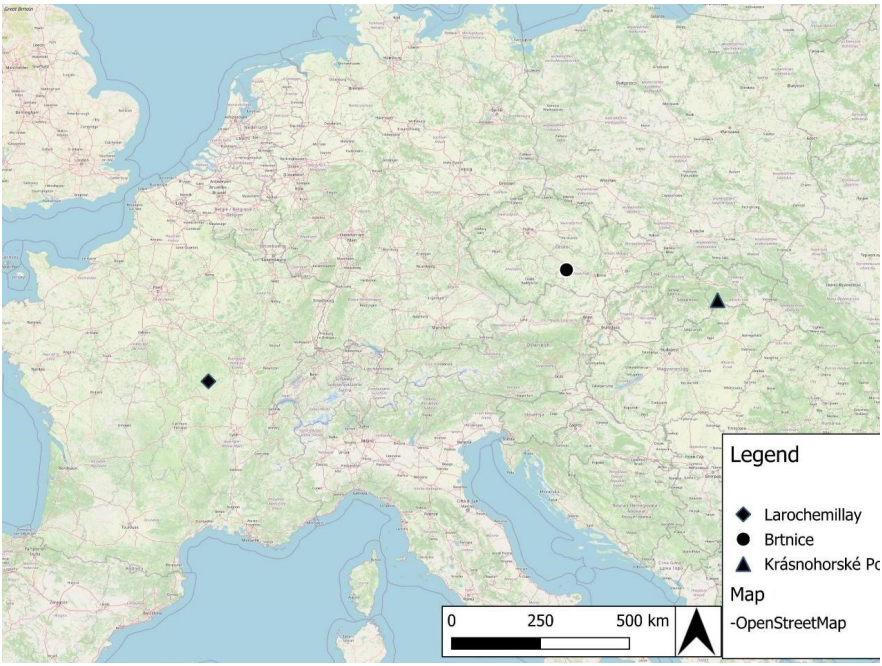
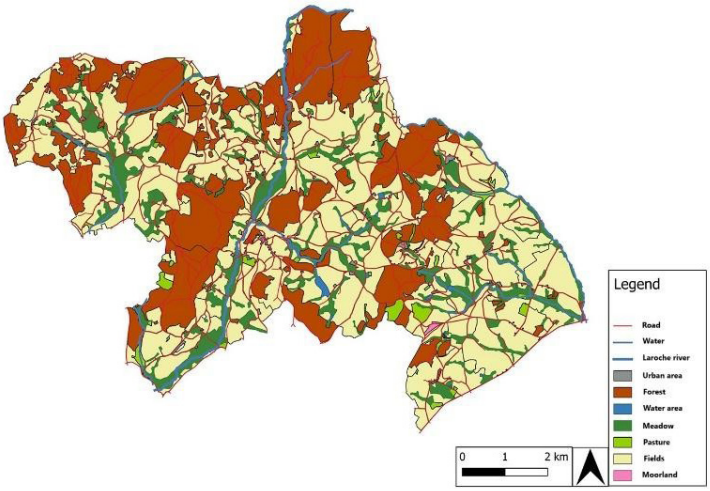


Fig. 2. *Settlement models of the cadastres of the study areas* in mid-19 century.



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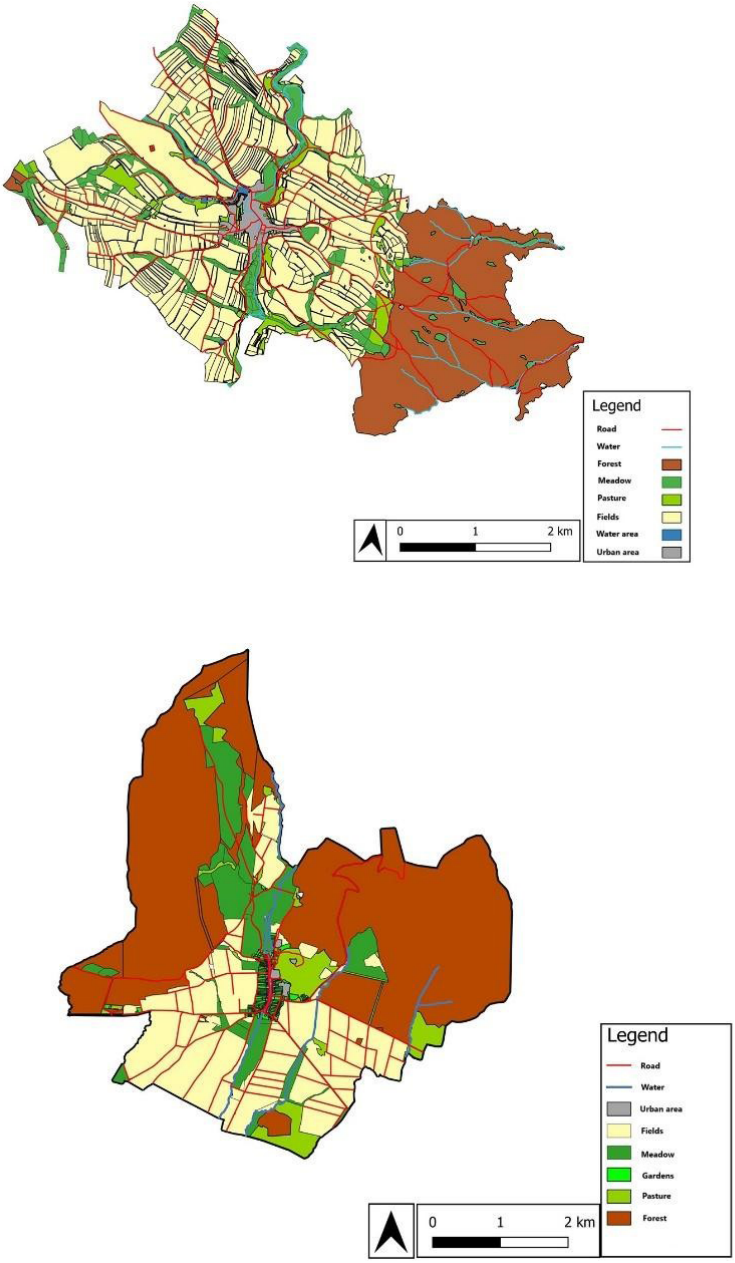

Investigating the Hallstatt Period Sanctuary of Býčí Skála Cave:

A Multidisciplinary Archaeobotanical and Anthracological Study of Ritual Practices and their environmental impact

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The Býčí Skála Cave in Moravia (CZ) is known as a central cave sanctuary from the Hallstatt period (800–450 BC). It is exceptional for its preservation of organic materials and the evidence of social elites. The revision excavations carried out in 2020 and 2021 provided a unique opportunity for a broad, multidisciplinary study. This paper presents preliminary results from anthracological, archaeobotanical and palynological analyses.

The initial results from the anthracological analysis (based on 1414 determination) align with the expected forest composition surrounding the sanctuary, with the notable exception of the very low presence of beech. These findings suggest the use of locally sourced firewood and reflect the natural woodland composition of the surrounding area in an uninhabited landscape. The low representation of beech is particularly striking.

The macrofossil analysis reveals a dominant presence of millet, found both as individual grains and in charred clumps. Other cereal and legume species typical of the Hallstatt period were also present in the assemblages. Among the wild plants, ruderal species predominated.

Analysis of the floated material revealed some interesting finds: in addition to charred organic clumps, bee heads and textile fragments were also discovered. Further analysis of these finds is forthcoming.

Samples for pollen analysis were collected from 3 probes, however, most of the samples were pollen sterile, with the exception of the samples taken directly from the area of the wooden burial chambers at a depth of about 1 m, where large amounts of pollen were present, both qualitatively and quantitatively. The pollen spectrum was strongly dominated by herbaceous species, in particular Artemisia

(wormwood), Salvia-type (salvia), Filipendula (tussock) and Trifolium repens-type (clover). The pollen data from such specific taphonomic conditions (cave, burial layers) are difficult to interpret and probably reflect burial gifts such as flowers or food (meat or drink) rather than the natural environment of the cave.

Keywords: Anthracology, Archeobotany, Hallstatt Period, Sanctuary of Býčí Skála Cave

Changing agricultural systems? Agriculture and plant-based diet during the Early and Middle Bronze Age on the Upper and Middle Danube

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The Bronze Age represents a period of agricultural changes, the majority of which were already completed in the Late Bronze Age. The Early and Middle Bronze Age therefore play a key role when it comes to the adoption and spread of these new agricultural techniques. The range of plants cultivated in these periods is known thanks to the long tradition of archaeobotanical research. The processes and techniques behind agriculture and plantbased diet are however, still not well understood. The arrival and spread of new crops along the Upper and Middle Danube during the Bronze Age, the cultivation, preparation and storage techniques of the various crops, the food processing techniques and the degree of distribution of agricultural products in the Early and Middle Bronze Age are largely unknown. The poster presents my ongoing dissertation project supervised by Katharina RebaySalisbury and Andreas G. Heiss. The main research question of the project is: **Whether and how agricultural strategies and plant-based diets changed in a key area of European Early and Middle Bronze Age societies between the 23rd and 14th centuries BC?** The spatial focus of the project is on the Upper and Middle Danube, a complex transport and communication area connecting the northern Alpine foothills with the Carpathian Basin, through which fundamental innovations and technologies were frequently communicated, transformed and adapted. This area therefore offers ideal conditions for studying changes in agricultural practices and nutrition. To answer this question, numerous new archaeobotanical data sets from different settlement types and periods have been and are being collected and analysed in combination with existing Bronze Age data sets from the research area. The aim of the project is to explain the processes of agriculture and plant-based diet as well as their changes and thus create a basis for a better understanding of the agrarian societies of this region.

Cementochronology meets archaeozoology: exploring the age and season of death of early medieval game

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Cementochronology, used in archaeozoology, focuses on the analysis of microscopic cementum increments in the teeth of hunted mammals found in archaeological excavations. It allows us to assess their age and the relatively accurate period of year when they were caught. Both information can approximate the use of natural resources of animal origin and the timing of their availability or allow us to understand the seasonal dynamics of the activities of the past societies associated with specific places. Our study aims to present the possibilities of using the method of cementochronology in relation to archaeozoological findings of the teeth of red deer (*Cervus elaphus*), wild boar (*Sus scrofa*), and roe deer (*Capreolus capreolus*) obtained from the filling of four pits of the early medieval hillfort in the South Bohemian Netolice (Czech Republic), dating to the 11th to 12th centuries. In the early Middle Ages, the animal component of the diet was dominated by the meat of livestock and venison represented a welcome enrichment. Hunting was mainly a matter for the privileged population, but it is also sporadically documented among other groups, which were forbidden to hunt. Before applying cementochronological method to archaeozoological finds, it was validated on recent mammals from the same region. For most of the teeth of recent fauna we have studied, cementum increments can be considered as a relatively reliable indicator for estimating age and season at death. By connecting archaeozoological data from the early medieval hillfort Na Jánu with the results of the analysis of tooth root cementum, we found out that the game hunting in the unfavourable part of the year (autumn-winter), for example deer hunting, occurred mainly when they were in the best condition and their meat contained more fat.

Keywords: Cementochronology – dental cement – animals – seasonality – hunting – archaeozoology

Food and fuel related economy of the Bibracte oppidum (France) – an introduction to the PhD project

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The study of economic aspects associated with procurement and management of food and fuel, the two essential commodities for human survival, is fundamental for understanding the functioning of any society, including those of the late Iron Age ones that built the oppida - complex fortified settlements featuring elements of urbanism.

The site on Mont Beuvray in Burgundy identified as oppidum Bibracte since the 19th century and excavated almost continuously (*Goláňová 2023*, 51; *Guillaumet 1996*, 46-49) became the case study for this thesis. One of a key questions of the scientific discourse pertains to the organization of food supply for the oppidum (*Goláňová 2023*, 72). *J. Wiethold* (*2011*), along with many others, sees the immediate environs of Mont Beuvray unsuitable for arable farming, suggests that staple cereals and pulses were imported from surrounding lowland areas and further distant calcareous regions. The studies of fuelwood are rare and limited (*Bellavia 2013*; *2014*; *2015*) and did not yet address its origin. Thus, the aim of the dissertation is to use both old and new archaeobotanical data originating from various areas of Bibracte for verification of existing hypotheses regarding food and formulating new ones concerning fuel sources.

The examination of archaeological finds of crops used as food and the accompanying wild species will serve the following: 1.) define the origin of the samples in terms of crop processing (products/wastes) and geography (local/imported); 2.) reconstruct the arable practices (intensive/extensive, traditional/innovative, subsistence/surplus oriented) (cf. *Van der Veen 1992*; *Hajnalová 2012*, 33-36); 3.) to reveal evidence of additional activities connected to management, consumption and discard of plant foods. Further, the study of wood charcoal through anthracology and dendroanthracology will address the questions of the conditions of growth of woodlands and practices used for their management (cf. *Kabukcu 2018*).

The thesis will evaluate already published findings obtained from the occupation/settlement areas of the site excavated before 1999 (*Wiethold 1996*; *2011*, 221-252) in conjuction with new data obtained through thesis project (Fig. 1). The new samples for this project come from excavations of different settlement parts of the site (Fig. 1, Tab. 1) each with different functions and excavated by different teams. Majority of new materials were collected between 2000 and 2016. To obtain statistically robust data, all available samples will be analyzed, although due to time constrains, larger volume samples are being subsampled. The poster presents

the first results obtained from the study of new seed assemblage from PC2 and partly also PC14 and PC15.

Keywords: Bibracte, Iron Age, food, fuel, seeds, wood charcoal, carpology, anthracology, palaeoeconomy, arable practices, forest management

site	excavating teams	number of site	number of samples
(Parc aux Chevaux - domus) PC1	FR; FR/SW	chantier 7	23
Pâture du Couvent	HU/GE/IT; H	chantier 9	8
Porrey	AU	chantier 11	9
Champlain	PL/CZ/FR; PL/FR	chantier 19	73
East side ramparts du Porrey	AU	chantier 29	30
(Parc aux Chevaux - terraces) PC14, PC15	IT ; FR/BE; FR	chantier 34	149
Porte du Rebout	FR	chantier 35	1
(Parc aux Chevaux - domus) PC2	FR	chantier 41	43
		TOTAL	**336**

Tab. 1 *Number and distribution of samples in the oppida precinct*
Legend: *FR: France; SW: Switzerland; HU: hungary; GE: Germany; IT: Italy; AU: Austria; PL: Poland; CZ: Czech Republic; BE: Belgium*

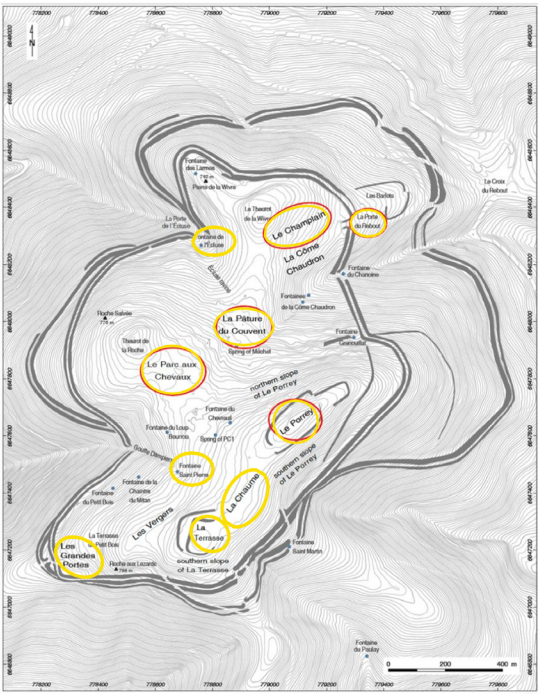

Fig. 1. *Bibracte, Mont Beuvray. Plan of the oppidum with marked chantiers for this project analysis (red cicrles) and already published analysis (yellow circles) (Goláňová, et al., 2023 p. 53)*

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Natural and Economic Basis for the Emergence of the Early Medieval Hillfort Agglomeration in Bojná

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The aim of this presentation is to explore the natural factors that may have driven the emergence and development of early medieval hillfort agglomeration in the Považský Inovec region, along with its economic hinterland. The author analyses paleoecological and geographical data, radiocarbon data, and compares them with outcomes of nearly two decades of archaeological research on the Bojná agglomeration.

The decision of early medieval settlers to inhabit the Marhát area significantly influenced the destiny of this agglomeration throughout the Early Middle Ages. It is possible that as early as the 7th century, or no later than the 8th century, the first hillfort was established on the Žihľavník hill in Bojná. The placement of this central site almost at the heart of the region where iron ore was processed suggests a direct relationship between these two phenomena. Additionally, the proximity to gold-bearing areas, which allowed for gold extraction from local streams, likely played an important role. The primary function of the earliest hillfort in Bojná appears to have been more symbolic than military, and it is highly probable that it also served as a hub for trade exchange.

It is evident that the establishment of the later Bojná-Valy fortress in the 9th century, along with an entire network of defensive points, the residence of a local nobleman, and a rotunda, was built upon the earlier tradition of the site. This continuity utilized both the symbolic and practical advantages of the location, including its strategic position relative to settlement clusters, the route connecting the Nitra and Váh valleys and extending further to Moravia, its defensive hilltop features, and access to iron deposits.

Paleoecological data analysis, however, indicates that the construction of the extensive defensive agglomeration surrounding the Bojná-Valy fortress had a significant environmental impact. The appearance of plant and photophilous mollusk macrofossils in the Dastín pollen profile, around 1100 calBP, alongside an increase in charcoal particles in sediments, suggests that substantial anthropogenic deforestation occurred during this period. Similar studies conducted in Poland over many years have demonstrated correlations between historical construction activities and tree pollen concentrations in fossil profiles. This timeframe corresponds precisely to the functioning of the hillfort, which was built in the late 9th century and used for several decades.

The environment, however, did not revert to its previous state. A marked in-

crease in *Triticum t.* and *Secale t.* pollen concentrations, along with herbaceous plant pollen and a further decline in beech and oak pollen from around 1000 cal-BP, indicates that these areas were permanently occupied by humans. This development facilitated the growth of medieval settlements in the Považský Inovec region.

Keywords: Early Middle Age, Great Moravia, stronghold, natural resources, ore deposits

Acknowledgement:

This work was supported from the Programme Johannes Amos Comenius – Project „MSCAfellow7_MUNI“ (No. CZ.02.01.01/00/22_010/0008854)

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Studies of wood materials of house 3700 at Százhalombatta-Földvár archaeological site, Hungary, Bronze Age – Preliminary results

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In our work, we studied the charcoal materials of a Middle Bronze Age house (id 3700) excavated at the high loess plateau of Százhalombatta-Földvár archaeological site. Our aim was to provide data for the usage of wood materials in the house, on the site and also for the archaeological period. To reach our aim we studied the xylotomical characteristics of the charcoal samples by means of microscopic examination of the fresh fracture surfaces formed on the samples. The majority of the fragments were related to oak species, but elm species could also be found in smaller quantities. In a smaller proportion, in a few samples, field maple, poplar/willow species and spindle tree could also be identified. It should be emphasized that the usage of different species within the house shows specific characteristics and it is also important to mention that approximately one sixth of the so far examined samples are from shoots or branches younger than 3-5 years old – almost all of which could have been cut in the middle/end of the vegetation period. Considering our results, it can be stated that the species found fit well into the picture of the Bronze Age vegetation of the site and its surroundings, which includes both the deeper, riverine habitats of the Danube and the woodlands and scrubs of the higher areas.

Forest environment of Neolithic mountain quarrying areal at Jistebsko, North Bohemia

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At the beginning of the Early Neolithic (LBK, 5500 BC), people penetrated high into the forests of the Jizera Mountains in order to obtain strategic raw materials for the production of Neolithic axes. Quarrying and processing of metabasite took place here for more than 600 years, so it is natural to ask how this human activity affected the local environment, which we can study thanks to large anthracological assemblages from Neolithic hearths in the production workshops and preserved pollen in the fills of the quarrying pits. Thanks to these, we can characterise the environment as a forest throughout the period of extraction, with a very different species composition to that of today. Deciduous woods with linden, elm, oak and ash dominate. Hazel, birch and pine document local lightening. The humid windward side of Maršovický vrch hill and the spring area are probably occupied by spruce. The forest species of the upper Holocene (fir and beech) are so far only a sporadic admixture to the hitherto stable nutrient-rich deciduous forests. In the newly surveyed central part of the site we find evidence of deep quarrying, which is well reflected in the pollen analysis, which shows a strikingly high percentage of fern spores. We also see evidence of elevation and habitat gradients, with ash and lime increasing on the lower slopes and spruce increasing towards the top of the hill.

Using environmental methods, it is possible to describe the environment of the Neolithic quarrying area as a purely forested one, where quarrying caused only local disturbances, manifested in the higher presence of light-loving species. The human presence and its impact on the forest was extensive, but over a large area and for a very long period of time. The research is also important from a methodological point of view, since the preservation of pollen in the dry fills of quarrying pits is unexpected and, in addition to characterising the vegetation, allows indirect dating of the sediments.

The State of Preservation of Human Bones From the Conquering Hungarian Burial Ground in Valaliky village (eastern Slovakia) in the Context of Natural Influences

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In 2023, an archaeological research was carried out by the Archaeological Institute v. v. i. SAV in the cadastre of the village of Valaliky, situated in Košice-okolie district, during which the burial ground of the conquering Hungarians was completely uncovered (*Luštíková et al. 2024*). More than a third of the estimated number of 280 graves, have been anthropologically analyzed so far. One of the results of the analyses to date is the state of osteological material preservation, which is very variable in this case: from solid preserved bones, through fragile and fragmentary bones to extremely fragmentary bones (*Gordon/Buikstra 1981*).

The scientific question, or rather the topic of our contribution, is the search for the causes of the different state of the human bone preservation from the excavated burial site. These differences may be related to the age and sex of the buried population here. Another group of possible causes of the variable state of the bone preservation can be related to the different manifestations of the burial rite, especially to the different methods of burial, or placing the bodies in the ground – with a coffin or without a coffin in an organic covering, or placing the bodies directly to the ground without a covering (see *Píšteková 2011; Prokeš 2007*).

Last but not least, we focused on the analysis of several other aspects of the natural environment that could have an impact on the different state of the bone preservation. This may include the influence of the georelief characteristics of the burial area (e. g. slope, aspect), different geological settings (*Kaličiak et al. 1996*), or different depth of grave pits embedded in the Quaternary deposits. Likewise, the nature of the soil and specific soil properties, such as soil pH, soil type, dynamic soil environment (fluctuations of a groundwater level, moisture and grain size) could have an impact on the different state of the bone preservation (*High et al. 2015; Kendall et al. 2018; Kibblewhite et al. 2015; Nielsen-Marsh et al. 2000; Todisco/Monchot 2007*).

By analyzing the individual aspects of the different state of the human bone preservation from the Valaliky burial site, we will try to find dependency factors

that can be applied to future taphonomic research at other burial sites and thus predict the possibilities of using specific complementary biological methods.

Keywords: Conquering Hungarian Burial, Early Middle Ages, Antropology, Geology, Soil Properities, Taphonomic Processes

Acknowledgements: This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-22-0151 and funded by the EU Next Generation EU through the Recovery and Resilience Plan for Slovakia under the project No. 09I03-03-V02-00038 and by Agency VEGA nr. 2/0167/24.

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Figures

Fig. 1. The degree of preservation of bones in individual categories in the area of the burial ground in Valaliky and their abundance.

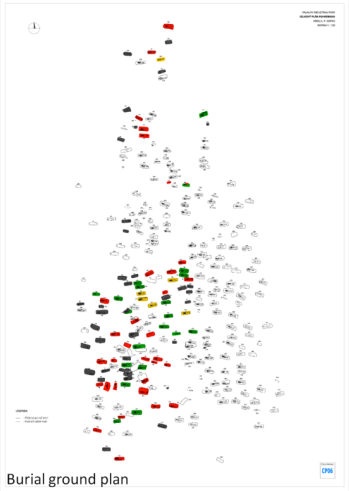


Fig. 2. Examples of different states of preservation of osteological material from graves 169 and 181 from the Valaliky burial ground. Photo: M. Tábiová

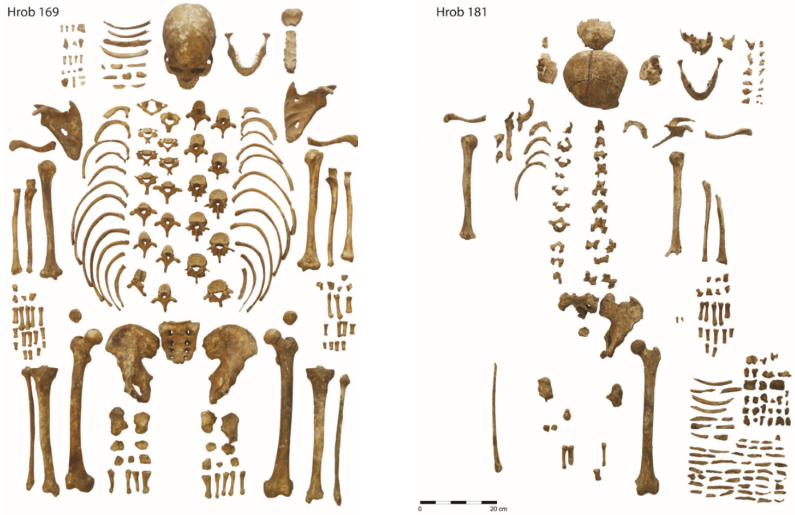
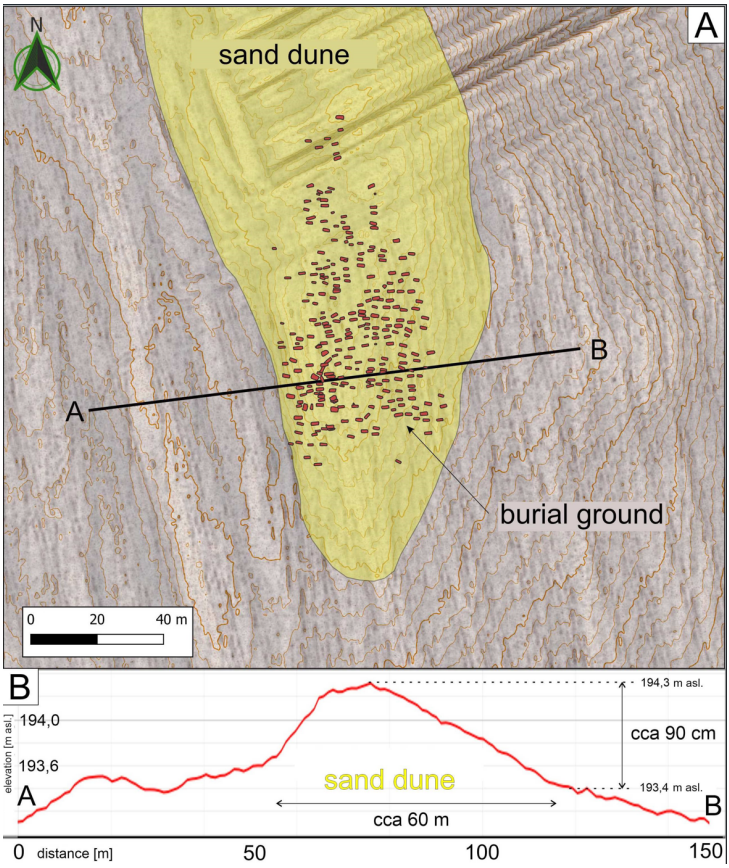


Fig. 3. A Presumptive position of the sand dune at the Valaliky site inferred from field archeological research together with a high-resolution LiDAR-derived digital terrain model (DMR 5.0; ÚGKK SR). B Cross section of the sand dune generated from a high-resolution LiDAR-derived DTM (resolution 25 cm/px, altered by T. Lieskovský, Faculty of Civil Engineering, Slovak University of Technology in Bratislava).



Avar Animal Husbandry in Slovakia - A Case Study of the Obid Settlement

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The analysis of animal bones from the Avar Khaganate site of Obid (West Slovakia) has provided new insights into the archaeozoology of the early Middle Ages. The site is located in the immediate vicinity of a burial ground excavated at the same time. The analysis of the bones from the settlement brought new information about local economy and waste management. The results suggest a dominant cattle husbandry with combination use. The main component of the cattle husbandry appears to be a milk production. Domestic pigs and caprines were also highly represented. Caprines were bred for milk and, in the case of the sheep, for wool, as well. Local breeding was highly possible for all three species. They may also have used alternative means of subsistence, e.g. aquatic shellfish. Hunting was not important for the inhabitants of this settlement; wild animals accounted for only 1% of the total NISP. The Obid settlement appears to be a production site where they bred, slaughtered and processed their own animals.

Keywords: Avar khaganate, early medieval site, settlement, animal husbandry, zooarchaeology

Preliminary Data on the Analysis of Archaeological Wood Remains from Százhalombatta-Földvár

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The aim of this research was to study the anatomy and ring structure of woody remains uncovered at the Százhalombatta-Földvár archaeological site. The analysis of the wood contributes to a better understanding of the everyday life of the Bronze Age tell settlement and the relationship between the local community and their environment. By examining wood that underwent various preservation processes, we can gain insights into the land-use practices of the era and the composition of the former vegetation surrounding the tell and its vicinity.

Microscopic analysis was conducted on four sample groups, comprising a total of 11 subsamples. When identification was possible, the samples were categorized from both wood anatomical and taxonomic perspectives. Among the subsamples, four were likely subfossil remains with very poor preservation, while the remaining seven were charred wood with poor to moderate preservation. Taxonomic identification revealed one field maple (*Acer campestre*), two sessile oaks (*Quercus petraea*), and three pedunculate oaks (*Quercus robur*). These species are consistent with the hypothesized former vegetation of the site and its broader environment. The identified species suggest the presence of a riparian hardwood forest near water and an upland forest in areas of higher elevation.

Keywords: Százhalombatta-Földvár, Bronze Age tell, Wood anatomy

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DEPARTMENT OF ARCHAEOLOGY LOGO

Seemingly, no one will ever find out where the idea for the logo of the Department of Archaeology of the Constantine the Philosopher University came from. It appeared suddenly one day, and professors and students agreed on it. It has been with us since the birth of the department in 1996. It has barely changed over the years. Why? Surely, because we couldn't find a better motif to characterize our work...

When Anton Točík first investigated the fortified settlement of the Maďarovce culture from the Early Bronze Age at the world-famous site of Nitriansky Hrádok, Zámeček, in the 1960s, experts suspected it would be an extraordinary site. Among the objects that immediately attracted the most attention was a several-centimetre-long bone disc with a striking spiral decoration. This tiny artefact in itself testifies not only to the importance of the site and its discovery, but also to the people who inhabited it and the civilization they created.

The disc itself is most commonly interpreted as a phalera, part of a horse's harness. The fact that people in southwestern Slovakia were able to use horses for transport purposes as early as the 16th century BC testifies to the technical sophistication of their culture. The possibility of long-distance transport and the eventual use of the horse in combat brought them closer to the level of the civilization centres of the time.

Even more significant for archaeological knowledge is the decoration of the object. It consists of five intertwined spirals connected into one closed unit. The spiral as a decorative

element is clear evidence that the bearers of the Maďarovce culture were in direct contact with the civilizations of the eastern Mediterranean, more specifically the Aegean region, from where this motif reached central Europe, probably through trade contacts.

The small disc from Zámeček is thus clear evidence that the inhabitants of the Carpathian Basin more than 3,500 years ago belonged to a wider circle of civilizations that pushed the course of history forward.

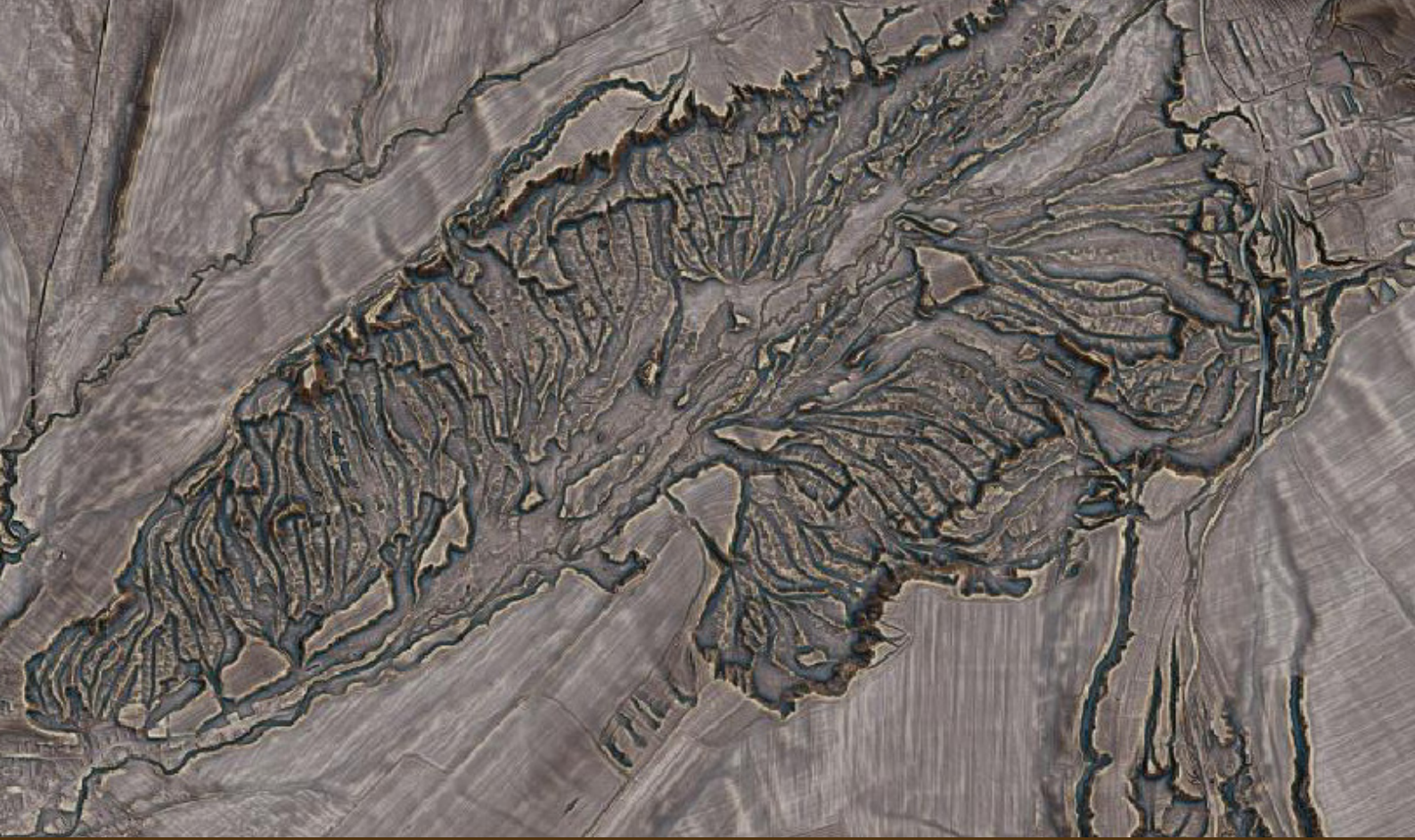
And how do these facts relate to the existence and activities of our department? Why has this artefact become our symbol? The spiral defines the infinite nature of the archaeologist's work. The never-ending research, the hunger for facts. Each discovery reveals new horizons, beyond which there are other spaces to explore. The spiral is always turning, and the archaeologist in it.

The disc, as evidence of our ancestors' contact with Mediterranean civilizations from the Bronze Age, expresses our openness. There are no lone wolves in science. We are all part of a large archaeological community, and just as the people of the Maďarovce culture set out on journeys of discovery millennia ago, so too are we in contact with experts from other countries.

So let this conference be part of the great spiral of cooperation between archaeologists all over the world.

Author: Pavol Šteiner (Department of Archaeology, Faculty of Arts, Constantine the Philosopher University in Nitra)

ARCHEOPARK CÍFER PAC



ISBN 978-80-558-2257-0