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Faculty of Environmental Sciences

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Topic: **Environmental Archaeology of Farmers and Pastoralists – What to Eat in the Case of Crop Failure?**

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(eds.)
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CONTENS

Faculty of Environmental Sciences (FŽP)

Accommodation (KOLEJE JIH)

PROGRAMME

Monday, 27th January

8:30–10:00 Registration
10:00–10:20 Opening conference

10:20–11:00 Keynote lecture:
Hejcman M.: Volcanic eruptions, crop failures, famines and the caring capacity of the planet for the human population

11:00–12:15: SESSION 1:
Lisá L. et al.: Floor maintenance of medieval buildings as a possible cultural behavioural status? Preliminary interpetations of floor formation processes from Medieval Brno, Czech Republic
Koštial J. CH.: Is your garden big enough? Some speculative calculations over the One Hectare Hypothesis
Pokorná A.: Cereal crops in an Early Medieval stronghold Královice, Central Bohemia
Jungová M. et al.: *Rumex alpinus* as the ancient food plant introduced into the Czech Republic by colonists from the Alps

12:15–13:45 Lunch break

13:45–15:15: SESSION 2
Budilová K. & Atanasoska N.: Farmers and Pastoralists – case hypothesis od Pelagonia and Mariovo (Republic of North Macedonia)
Karlík P. & Poschlod P.: How is the age of calcareous grasslands affecting the occurrence of plant species and vegetation composition
Pravcová I. et al.: Archaeological research of pluzina field systems as a phenomenon of historical landscape of Czech Republic
Asare M.O. et al.: Seventy years of settlement activities at former German-Togoland resulted in development of African dark earth soil characterized by the accumulation of C, N, P, K, Ca, S, Mn, Fe, Zn, Cu, Sr, and Rb
Mlejnek O.: Interdisciplinaria Archaeologica, Natural Sciences in Archaeology Journal is Crossing the Threshold of a First Decade

15:15–15:45 Coffee break

15:45–16:15 Plenary discussion:

Prach J. et al.: Paleoecologically valuable sediments endangered by mud removal from ponds and wetlands during activities leaded by nature conservation authotoies (in Czech)

16:15–17:00: POSTER SESSION:

Látková M. & Tamaškovič J.: Charred food supply from Bratislava Castle

Lisá L. et al.: Archaeology of empty spaces – geoarchaeological research of Mt.Beuvray/Bibracte – Celtic oppidum in light of micromorphology

Krčová D.: Archaeobotanical remains from Zohor, dist. Malacky, Slovakia

17:00–17:45 Keynote lecture:

Šmejda L.: Remote sensing approach to a comparative study of agroecosystems

18:00 Reception

Tuesday, 28th January

9:00–10:00: SESSION 3

Rakava V. & Šmejda L.: Distribution of pottery fragments of the last two centuries in arable fields: the case from the Žluticko region

Fanta V.: Thirty Years' War and human carrying capacity – from historical geography to population ecology

Ptáková M. et al.: From Mesolithic hunters to Iron Age herders. A unique record of woodland exploitation from eastern Central Europe (Czech Republic)

Beneš J. et al.: Unclear boundary: Pastoralists and settled agriculturalists in Sub-Saharan Africa – subsistence, domestication, dynamics

10:00–10:30 Keynote lecture:

Shai I.: Economic life of an Iron Age Judahite Town: A View from Tel Burna

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11:00–12:15: SESSION 4

Janovský M. et al.: Chemistry of soils and sediments from an Ancient site in the southern Levant: Tel Burna as a case study in the multi-elemental study of post-depositional and depositional processes

Żurek K. et al.: The Network of defence settlements from the Bronze Age between the Biebrza and Narew during environmental crisis

Kalicki T. & Kłusakiewicz E.: The Holocene changes of sedimentation types in the upper Kamienna river flood plain (Kielce Upland, Poland)

Borderie Q.: Where are the crops? Geoarchaeologial and archeobotanical studies of early medieval floors from northern France

Bęben A. et al.: We are in swapland. First results of geoarcheological research on sebneolithic settlement in Liosk

Novák J. et al.: Long-term history of woodland under human impact: archaeo-anthracological synthesis for lowlands in the Czech Republic

12:15–13:30 Lunch

13:30–15:30: Excursion:

University tropical greenhouses with tropical crops, university brewery and beer production, experimental breeding of domestic animals

15:30–16:00 Coffee Break

16:00–16:45 Keynote lecture

Ackermann O. et al.: Agricultural Systems and Terrace Pattern Distribution Along Climatic Gradient: From Sub-humid Mediterranean to Arid Conditions

18:00 Social evening

Wednesday, 29th January

8:30–17:00 Post-conference tour

Agricultural systems and terrace pattern distribution along climatic gradient: from sub-humid mediterranean to arid conditions

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Agricultural terraces are a well-distributed agrotechnical method around the world. The current presentation aims to provide a holistic picture of agricultural terrace spatial distribution along a climatic gradient of sub-humid Mediterranean, semi-arid and arid climate zones.
Three case studies of agricultural terraces in the Land of Israel are presented according to their geographic occurrence.

- In the Judean Mountains, under sub-humid Mediterranean conditions, with an annual rainfall average of ~600 mm. The terraces are distributed on the slopes and in the valleys, as direct rain is sufficient for sustainable agriculture.
- In the Southern Shephelah, under semi-arid conditions, with an annual average rainfall of ~350 mm. The terraces are located in small spots on the slopes, and in terrace fields in the valleys, as direct rain and additional runoff from the rocky outcrops enable sustainable agriculture.
- In the Negev Highlands, a region under arid climate conditions with an annual rainfall average of 100 mm, runoff farm terraces are located in valleys and were based on water harvesting from the slopes.

In sum, the climate has a dominant effect on agricultural terrace distribution, and ancient farmers knew how to adapt to different climate conditions.

Keywords: agricultural terraces, runoff farms, water harvesting, system services, anthropogenic landscape

Seventy years of settlement activities at former German-Togoland resulted in development of African dark earth soil characterized by the accumulation of C, N, P, K, Ca, S, Mn, Fe, Zn, Cu, Sr, and Rb

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Can less than a hundred years of past settlement activities in former colonial sites substantially increase the content of anthropogenic elements and result in the formation of African Dark Earth soil (AfDE) has never been addressed. We performed multi-element analysis of AfDE soil from a late 19th to mid-20th century AD former German-Togoland settlement, Ziavi-Galenkuito in the Volta Region of Ghana. The relatively neutral reaction and black color of soil mainly from charcoal inclusion in the Ziavi-Galenkuito site contrasted with moderately acidic brown Ferric Acrisol in the control site located on the same metasedimentary/Voltaian bedrock. Organic C and total N, P, K, Ca, Mn, Fe, Cu, Zn, Sr, and Rb contents were substantially increased and vice versa for C/N ratio in the 0–40 cm layer of the AfDE soil compared to respective control without settlement activities. Contents of plant-available (Pav) P, K, Ca, S, Fe, Cu, and Zn were higher in the AfDE soil compared to the control. The increased contents of above-mentioned elements resulted from their accumulation in disposed organic waste and biomass ash. Significantly higher contents of total and Pav elements in 0–10, 10–20, and 20–40 cm layers of AfDE soil compared to their respective control suggested that chemical signatures from past settlement activities can be determined even in the upper soil layer. Positive correlations between the content of P and K, Mn, Sr, Fe, Ca, Zn, Rb, Cu

implied that these elements were indicators of anthropogenic activities. Total and Pav P, K, Ca, Fe, Cu, and Zn contents were well correlated, however, total contents of elements are much suitable for geoarchaeological purposes as enrichment factor can easily be calculated. We concluded that AfDE soil with substantial accumulation of anthropogenic elements can develop even in less than a hundred years if settlement activities are adequately intensive.

Keywords: Acrisol; anthropogenic element; Ghana; multi-element analysis; organic waste; biomass ash

We are in swapland. First results of geoarcheological research on subneolithic settlement in Lipsk

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The territory of north-eastern Poland in the Neolithic era was a "living' border" – a natural basis for permeating, crossing and mutual exchange of ideas and patterns of behaviour between farmer groups and hunter-gatherer communities. Although is so close to the coexistence of these two different lifestyles, prehistoric agriculture was not adopted by hunter-gatherer groups during this period. Their lifestyle has remained traditional, that is, inextricably linked to the vast area of the great-valley.
The population was in constant motion and did not lead a settled lifestyle. They periodically grouped in special places, such as in the forms of elevated terrain. They gathered in special places that were well-known to them.
The aim is to present the preliminary results of geoarcheological studies of the Lipsk site.
The object under study is located in the north-eastern part of the Biebrza Valley (Podlaskie Voivodeship). The site is located on an elevated dune in the central part of a large peat plain. From the south it is adjacent to the modern Biebrza riverbed. On the eastern side of the hill, at a distance of about 100 meters, there is a paleo-cortico of a currently non-existent watercourse, whose relic is a vast (about 0.5 ha) and shallow old river lake.
Given, the preference of subneolithic groups, such a topographical location of the dune is an ideal place to set up a temporary camp. This was confirmed by the results of the archaeological research. During the survey, a rich number of ceramic materials and flint tools were discovered and documented. These materials must be attributed to the German culture, which until the disappearance at the beginning of the Bronze Age did not adopt agriculture in this territory and lived from hunting and gathering.

Keywords: subneolithic, hunter-gatherer communities, geoarcheologic, dune

Unclear boundary: Pastoralists and settled agriculturalists in Sub-Saharan Africa – subsistence, domestication, dynamics

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Mobile pastoralists and settled agriculturalists have shaped the core of human population in Sub-Saharan Africa since the last green phase of Sahara in the Early and Middle Holocene. Origins of both social and subsistence systems are still obscured by the limited amount of adequate bioarchaeological and palaeoenvironmental data. However, new evidence has been brought into light in the last decade about indigenous animal and plant domestication, which processes were strongly related to the environmental dynamics of savanna and tropical forest. We discuss the key role of shifting ecosystem boundaries and the connectivity between regions at times of green Sahara. Available sedimentary records will be confronted with ongoing investigations of living agricultural villages and behavioural strategies of pastoralists. The unstable spatial boundaries between biomes, pastoralists and agriculturalists during the Holocene have been controlled by the climatic variability, human agency and pathogen dynamics.

Keywords: Africa, Holocene, domestication, animals, pastoralist, agriculturalist, villages

Where are the crops? Geoarchaeologial and archeobotanical studies of early medieval floors from northern France

Quentin Borderie

Associate researcher CNRS UMR7041 ArScAn

Due to the lack of well-preserved stratifications and to the absence of micromorphological investigation on historical domestic building, the nature of medieval indoor floors is barely known in Western Europe, except concerning hardened stone materials (pavement, mosaics). Recent micromorphological investigations focused on early medieval floors from high statute dwellings (castra) from Gien (Loiret) and Boves (Somme) have revealed that floors can be partly or totally made with graminae phytoliths. Those plant remains are located on the surface of earthen floors, but they can also be the only material recovering trampled waste. The absence of phosphate features or of faecal spheruliths ruled out the hypothesis of the use of dung to build the floors. Moreover, the morphometric analysis of the dendritic phytoliths show that most of them are formed in cereal husks. Rare occurrence of such a practice have already been notice in France, but only for the 14th–15th c., like in the milites houses of Chalucet (Haute-Vienne). In Boves, the thickness of the layers and the probable regular cleaning of floors seem to indicate that the processing of crops took place into the building. In Gien, the plant mats are thinner and include other plant material. This can indicate that the crops are processed in the surrounding and that husks are reuse in order to build floors. In addition to the new data on floor material and building processes, those results also highlight the ways of processing cereal and give new evidence of social practice of waste management.

Keywords: phytoliths, husks, Middle Ages, castle, waste, building

Farmers and Pastoralists – case hypothesis od Pelagonia and Mariovo (Republic of North Macedonia)

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Geographical and climate predispositions of regions for sure played an important role in prehistoric settling and human activity. We focus on the neighbouring regions of the Pelagonia plain where hundreds of sites from the Neolithic and later periods are registered and Mariovo, a hilly – mountainous region rising above Pelagonia on the eastern side, in which human activities started also in the Neolithic period (maybe even earlier), but according to the current investigations, with a smaller intensity than in the plain. So far, a distinct evolution of both areas can be noticed in several scales: existence of different settlement concepts (tells in the fertile plain and settlements on more strategic positions in Mariovo, characteristic for the earlier stages of prehistory), bigger concentration of burial mounds in the hilly region of Mariovo and the material culture (for example wider virality of zoomorphic representations in Mariovo). The contribution discusses whether and how the differences in environmental features such as a configuration of the terrain, hydrology, climate, soil type and vegetation might have influenced settling patterns, sustainability of subsistence strategies and social features of the communities. Also, we want to show the potential and need of some future archaeo-environmental survey in the area and address the methods we tend to use for obtaining some first palaeoecological insight into the development of steppe-like grasslands in Mariovo.

Keywords: prehistory, Pelagonia, Mariovo, environmental and social factors

Thirty Years' War and human carrying capacity – from historical geography to population ecology

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We studied the population dynamics in Bohemia in the 17th and 18th centuries in the context of various environmental conditions. In the first half of the 17th century, the population of this area was lowered by the Thirty Years' War. This enormous disturbance was later followed by a slow repopulation. We collected population size data for 88 randomly selected villages and compared the population dynamics with different geographical predictors. Our results show that the repopulation was highly dependent on the disturbance extent and that the population size of individual villages was mediated by soil fertility and cadastre size. This is a demonstration that the "carrying capacity" was affecting the human populations even in the modern times.

Keywords: thirty years war, disturbance, rural settlement, population ecology, historical demography, human carrying capacity

Volcanic eruptions, crop failures, famines and the caring capacity of the planet for the human population

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Crop failures and famines have many reasons such us unfavourable weather conditions, changes in political regimes, wars and overpopulation of different world regions. Many sudden changes in weather conditions responsible for crop failures and consequent famines are connected with large volcanic eruptions. There are many examples of such eruptions from the history, Lake Toba on Sumatra (cca 73 000 BC), Campanian Ignimbrite eruption in Italy (37 280 BC), Lacher See in Germany (10 900 BC), Minoan eruption of Thera in Greece (1627 BC), Illopango in Central America (534 AD), Samalas on Lombok in Indonesia (1257 AD), Kuwae in Vanuatu in Pacific ocean (1452 AD), Laki on Iceland (1783 AD), Tambora on Sumbawa in Indonesia (1815 AD), Krakatoa in Indonesia (1883 AD) and many others. Eruptions with Volcanic Explosivity index 6 and higher (> 10 km3 of ejecta) are able to change climate worldwide on several years following the eruption and to cause "volcanic winter". The most famous is year without summer on northern hemisphere in 1816 following eruption of Tambora in 1815. This eruption was followed by crop failures, famines, cannibalism and extreme floods in many regions of northern hemisphere. Although human population is still growing today, famines are less and less common today because of modern agricultural technologies such as the use of mineral N fertilizers. It is estimated, that approximately half of the current human population can be on the planet Earth only because of the use of mineral N fertilizers. Although sufficient food production during normal years, famines can not be fully eliminated after large eruptions in the future.

Keywords: volcanic explosivity index, weather conditions, crop failure, famines, nitrogen fertilizers

Chemistry of soils and sediments from an Ancient Site in the southern Levant: Tel Burna as a Case Study in the multi-elemental study of post-depositional and depositional processes

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Ancient tel is a type of an archaeological site, where the deposition and post-deposition processes took place in the past. We asked how we can determine them in the context of archaeology and how to interpret the past-human activities. The tel Burna's area B2 was chosen to test these hypotheses. Using X-ray fluorescence spectrometry, we determined the content of 20 elements in soil samples from archaeological strata dated from Late Bronze to Iron Age IIb.
The content of elements was divided into three groups according to their origin. The first group consisted of Ca, Sr, LE, Ti, Fe, and Zr. These elements were associated with the natural background at the site and post-deposition processes related to the content of Ca, which was decreasing in the depth of soil profile. The second group consisted of K, P, Mn, Al, Si, and Zn. The content of elements P and K was significantly increased in the squares containing the debris of dwellings. The third group consisted of Cu, which related to the Late Bronze Age fill containing crucibles and slags at the Iron Age casemate wall. The hypothesis about secondary deposition of the fill at the wall was confirmed using optically stimulated luminescence.

We demonstrated that the deposition and post-deposition processes can be interpreted using the X-ray fluorescence spectrometry and optically stimulated luminescence. The R package robCompositions has proved to be a suitable tool to analyse compositional geochemical data at the area of ancient tel.

Acknowledgements

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Rumex alpinus as the ancient food plant introduced into the Czech Republic by colonists from the Alps

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The Monk's Rhubarb, *Rumex alpinus* L., is perennial plant inhabiting nutrient-rich areas. It is native in the mountains of Central and Southern Europe, but its current distribution has been partly affected by its utilisation as vegetable and medicinal herb in the past. *R. alpinus* was used as part of the special dish called "farchon", made from *Chenopodium bonus-henricus*, *Urtica dioica*, and *Rumex alpinus* in the Alp regions. In mountain areas, *R. alpinus* was used for various purposes, e.g. leaves to surrogate of sauerkraut or spinach, stems were peeled and applied instead of rhubarb, or eaten fresh or put into cakes. In Albania, *R. alpinus* is one of the most commonly quoted and used wild food plants, used as vegetables mainly cooked with dairy products and rice or as filling for home made savory pies. The stems were peeled and used instead of rhubarb, or eaten fresh, the leaves, seeds, roots and rhizomes were used also for the treatment of several health disorders. Recently, *R. alpinus* is regarded as a troublesome weedy species in many European mountains. In the Czech Republic, R. alpinus is the invasive plant, which was introduced into the Krkonoš Mts. by colonists from the Alps in the 16th century as food plant.

Keywords: Alpine dock; weed; nutrients; retranslocation, plant organs

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The Holocene changes of sedimentation types in the upper Kamienna river flood plain (Kielce Upland, Poland)

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Changes of sedimentation types in the Holocene were often connected with human impact. According Kruk (1988) and Kruk et al. (1996) these changes marked especially strongly in the Neolithic because of settlement and agriculture development.

Archaeological research conducted in the upper Kamienna river valley showed that human activity in this time was connected above all with mining. This activity was identified with area of the Rydno Archeaological Reserve. Then extensive area of the Pleistocene terrace was influenced by mining and processing of hematite (from local outcrops) and processing of chocolate flint obtained mainly from Orońsko surroundings. These processes have begun in the Palaeolithic, and in the Neolithic exploitation of these resources was still intenisive (Kardyś 2007; Kardyś et al. 2009).

Although intensifying of anthropopressure degree in the Neolithic, did not stated that this activity caused sedimentation changes in alluvia. Dating of deposits from this area show that these changes had place later, it means in the Subatlantic. They were reflected mainly in palaeochannel fills deposits and layers of the Roman Period and the Late Medieval buried soils (Barwicka, Kalicki 2012; Kłusakiewicz et al. 2018; Kalicki et al. 2019).

Keywords: changes of sedimentation types, flood plain, Rydno Archaeological Reserve

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How is the age of calcareous grasslands affecting the occurrence of plant species and vegetation composition

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Dry calcareous grasslands are among the most remarkable habitats in Central Europe, interesting from the point of view of various scientific fields, e.g. landscape history. In the majority of the area, the grasslands are semi-natural, but with high biodiversity and the presence of relict plant species.
Spatial dynamics of this habitat is not trivial and unidirectional, because in addition to strong decline, many new areas have also emerged on abandoned arable fields. Therefore, two concepts, ancient and recent grasslands, have been defined in order to better approach the researched issue.
The lecture aims at understanding of effect of age on quality of particular grasslands. The main approach was the phytosociological sampling of above-ground vegetation, attention was also paid to the soil seed bank. Additionally, wide range of abiotic parameters were measured.
The study was carried out in three regions with well-preserved dry grassland vegetation: Swabian Alb in Baden-Württemberg (Kaltes Feld), Franconian Alb in Bayern (Kallmünz) and Bohemian Karst in Bohemia (Srbsko).
We identified plant species indicating the historical status of the grasslands. The best species with a clear indication ability across different regions are *Asperula cynanchica*, *Carex caryophyllea*, *Carex flacca*, *Filipendula vulgaris*, *Helianthemum nummularium* s.l., *Hippocrepis comosa*, *Prunella grandiflora* and *Thymus praecox* s.l. for ancient grasslands and *Agrimonia eupatoria*, *Agropyron repens*, *Dactylis glomerata*, *Potentilla reptans*, *Trisetum flavescens* and *Vicia cracca* for recent grasslands.
Both ancient and recent grasslands can be very well preserved and highly valuable from a nature protection point of view. We found significant differences in some abiotic habitat parameters, especially in soil reaction and water-holding capacity.

Though there were differences in seed bank composition and size between regions, we found a uniform pattern of plant traits, which depended on the age of the grassland. The main conclusion is that seed banks in contemporary calcareous grasslands still reflect the history of former land use, in this case arable cultivation, even though it occurred a long time ago (up to 150 years). Indicators of former arable fields are germinable seeds of weeds, which have persisted in the soil to the present. By contrast, weedy species are completely absent from the seed banks of ancient grasslands.
The history (former land-use, age of habitats) of grassland localities is a fundamental attribute, which very good explains species composition of vegetation and is not simply replaceable by habitat properties. We would like to emphasize that dry calcareous grasslands are not only a traditional source of forage for livestock or a priority object of nature conservation, but also a very specific cultural monument.

Keywords: ancient grasslands, biodiversity, Bohemian Karst, Central Europe, conservation value, dry grassland vegetation, Jurassic mountains, land use indicators, recent grasslands, soil properties, soil seed bank

Is your garden big enough? Some speculative calculations over the One Hectare Hypothesis

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The article deals with the size of agriculturally used surfaces in prehistoric timesand its delimitation. While the upper limit is obviously given by the physicalabilities of the community to utilize as much land as possible, the lower limit isoften referred to as "One Hectare Hypothesis".Archaeological research of prehistoric nutrition and agriculture is based mainlyon the results of archaeobotany or ethnographic studies. While archaeobotanyprovides archaeology predominantly with data on a qualitative portfolio of crops,ethnography is more accommodating to variable aspects of prehistoricagriculture. However, this issue can be studied without the contribution of thesedisciplines and model the topic speculatively and theoretically in the spirit of thebest traditions of Popper's logic.

Keywords: prehistory, nutrition, agriculture, One Hectare Hypothesis

Archaeobotanical remains from Zohor, dist. Malacky, Slovakia

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Archaeobotanical remains were collecting during the archaeology excavation settlement from Zohor (location Piesky), whitch is situated on the west part of Slovakia. This settlement is dating in to the Roman period and that has been permanently inhabited since the 1th to the 4nd century AD. On the locality was unearthed extensive central Germanic settlement with urn cemetery, German princely-seat and the princely graves from the early Roman period.
The archaeobotanical samples, collected during the excavations, came from the various types of archaeological contexts like pits, storage pits, stake pits, well and oven.
Plant macro-remains has been preserved in charred and mineralized form. Material was bad preserved and fragmented. It were found or identified 56 botanical taxa which contain cultivated and wild species, mostly weeds. From the cultivated rops were approximately 80% of all specimens barley and millet. Exceptional findings of plant macroremains (grape vine and walnut), which prove so-called luxury species have also been found on the site. The low residue density and the mixed nature of the mterial in samples with cereals, husks, weeds, wood charcoals, small fish bones and amphibians show to the context of 'settling waste', which is likely to arise over a long period.

Keywords: archaeobotany, Zohor, Roman period

Charred food supply from Bratislava Castle

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The understanding of the economic relationships in the central agglomerations from Great Moravia Period with the focus on theirs plant-food production is one of the most important topic for the Early-Medieval archaeology. In spite of this fact until now there are only a few Great Moravian agglomerations from Slovakia that were excavated in more complex way where were also the attention been payed to the sources of the foods included the food-processing and storing. Recently is the Bratislava castle (the north terrace) site one of the relatively few Slovak sites which allows solving the (paleo) economical questions. During the excavation in the year 2014 the charred concentrations of purified cereal stocks were found at one of the excavated site. This concentration occurred in various cultural layer-strata, but also in storage pits which were carved into the Bratislava Castle Hill rock beds. Due to high concentrations of burned cereals it is possible to observe the changes and differences in the composition of individual cleaned stocks. At the sites is dominated mainly the stocks of bread wheat, but there were identified also the stocks of the rye, millet and barley. In addition to the cereals, there were also found in stocks in smaller quantities the legumes (lentils, peas and Celtic beans) and pips of cultivated fruit (peach).

Keywords: Bratislava, archaeobotany, Early Middle Ages, cereals, food supply

Archaeology of empty spaces – geoarchaeological research of Mt.Beuvray/Bibracte – Celtic oppidum in light of micromorphology

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The production of iron in fact allowed one of the stages of agricultural revolution in the past. The use of iron-made tools helped people to move into lands situated in higher altitudes, where the conditions for agriculture were not so suitable as in lowlands with occurrence of fertile soils. Such occupational sites may be represented by the "Celtic" oppida which are a distinctive urban phenomenon of the Iron Age. The most enigmatic parts of oppida are areas called "empty spaces". It means, that these areas seem to be unused, respectively, it does not contain any traces of house constructions or another type of archaeologically detectable occupation. There are many hypotheses of what such places served for. The hypotheses also count with the possibility that these areas were in fact used for agriculture purposes. One of the most famous and largest oppidum situated in eastern France and called Mt. Beuvray/Bibracte was choosen to test different hypotheses of how the "empty spaces" were used. Since 2019 the geoarchaeological research, including micromorphology in combination with archaeobotany and other environmental proxies started there. The first results show, that one of the "empty spaces" of site named La Terrasse was in the past surrounded by ditch and intentionally covered by 50–70 cm of fertile soil. What was the potential of this site for agricultural purposes will show the further analyses.

Floor maintenance of medieval buildings as a possible cultural behavioural status? Preliminary interpetations of floor formation processes from Medieval Brno, Czech Republic

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The way people used different types of buildings and how they used their living space in the past is often imprinted into the floors of these buildings. The term floor is quite complex and to understand it, more than macroscopic observations are needed. One useful method is the application of micromorphology in an archaeological context. The timber and earth architecture of medieval Brno is still not well known. A rescue archaeological excavation of block 601 near Veselá Street revealed a unique situation where above ground floors dating to 13th–14th centuries survived buried under a garbage dump and discarded construction material. Two groups of buildings excavated in superposition within different parts of a single plot revealed that it is possible to track different maintenance practices through time and space. In the first building, sweeping maintenance practice was demonstrated, while in the younger building situated in the same area, a wooden floor was revealed. In the third and fourth building, the maintenance practices were different again due to a wetter environment. The third (older) building revealed hay and straw covering followed by sweeping while matt coverings were laid on the surfaces and swept in the fourth (younger) building. The information deduced from micromorphological observations has not solved the questions about the floors fully, but it has certainly elucidated possible interpretations of the oldest phases of the town development.

Interdisciplinaria Archaeologica, natural sciences in archaeology journal is crossing the threshold of a first decade

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The focus of Interdisciplinaria Archaeologica – Natural Sciences in Archaeology journal 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 crosses the threshold of a first decade of its existence. Therefore, this presentation will try to conclude its development in last ten 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 indexes such as Scopus, ERIC and DOAJ. 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.

Keywords: archaeological science, scientific journal, tenth anniversary, bioarchaeology, geoarchaeology, archaeometry

Long-term history of woodland under human impact: archaeo-anthracological synthesis for lowlands in the Czech Republic

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The first anthracological analysis in the Czech Republic was performed 86 years ago; however, the quantitative and qualitative shift occurred at the beginning of the 21st century. Charcoal data from archaeological sites have been widely used for reconstructing woodland vegetation, but usually only on the local level. Most anthracological research is concentrated in the lowland and upland regions (140–550 m a.s.l.), because the prehistoric agricultural sites are closely associated with areas of the most fertile land. The quantity of published data plus our unpublished work from the Czech Republic (over 800 prehistoric agropastoral sites comprising >230,000 identifications) is thus unique on the international scale. Our research project attempts the first systematic evaluation of anthracological results from archaeological sites in the Czech Republic. The aim is to reconstruct the middle-and upper- Holocene history of woodland in the surrounding of human settlements from the Neolithic (7300 BP) to the Migration Period (1450 BP) in the lowland areas of the Czech Republic. Another study aim is to compare the archaeo-anthracological data to other environmental aspects in the vicinity of archaeological sites (e.g. topography, altitude, geology, soil, climatic conditions) thus trying to reveal regional differences and diversity in the anthracological record.

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Cereal crops in an Early Medieval stronghold Královice, Central Bohemia

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An Early Medieval stronghold Královice was investigated archaeologically in 2013 under the leadership of Ivo Štefan (Faculty of Arts, Charles University). This hillfort situated SE from Prague is not known from written sources. According to artefacts, two phases of settlement ((*i*) second third of the 10th to 11th Century A.D., and (*ii*) 12th century to first half of the 13th Century A.D.) were distinguished. The aim of the archaeobotanical analysis was to reveal possible changes in subsistence on the site during the Early Middle Ages and to contribute to interpretation of the original function of investigated objects (pits). In total, over one thousand litres of sediment were processed (flotation technique) and almost 18,000 plant macro-remains belonging to about 70 species were found.

Cereals accounted for 54% of charred macrofossils. Rye (*Secale cereale*) predominated (55% of the determined cereals) followed by millet (*Panicum miliaceum*, 30%). Other cereals, wheat (*Triticum aestivum*/*compactum*, 7%), barley (*Hordeum vulgare*, 3.5%) and oats (*Avena sativa*, 3%) were represented only minimally. The results will be compared with other fortified settlements in Central Bohemia (e.g. Libice, Stará Boleslav and Prague) and with written sources.

Keywords: archaeobotany, Central Bohemia, cereal crops, Early Middle Ages, stronghold

Paleoecologically valuable sediments endangered by mud removal from ponds and wetlands during activities leaded by nature conservation authotoies (in Czech)

Jindřich Prach, Petr Karlík, Jaromír Beneš

Recently, the availability of funds, technical possibilities and widespread efforts to eliminate drought have led to increasingly frequent mud removal from ponds, dredging of pools for amphibians and similar activities funded or even initiated by state nature conservation authorities. During these activities, valuable sediments with potential for palaeoecological and archaeobotanical research disappear.

The contribution will include brief examples, both positive and negative, of cooperation of palaeoecological research with nature conservation activities in this field. The main aim is the plenary discussion of this problem and discussion of possibilities for better cooperation.

Archaeological research of pluzina field systems as a phenomenon of historical landscape of Czech Republic

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Pluzina is a significant landscape feature not only in Czech Republic but also across Europe. Field systems were not the object of interest for a long time from archaeological perspective. Archaeologists focused their attention on the abandoned medieval villages and village's agrarian background was usually omitted. In last decade we can observe more concentration of interest to the agrarian background of the village, especially thanks to developed methods of environmental archaeology. Another new feature is a reconstruction of environment of medieval and the early modern villages using archaeobotanical methods, in particular pollen analysis. In this time NAKI II project (Ministry of Culture Foundation) „Identification and protection of preserved remnants of historical pluzina system" is taking place. Aims of this project is to inform about important role of the field systems and to provide a basis for qualified protection of them which are missing in Czech Republic and also worldwide. Five different pluzina field systems were chosen in different location across Czech Republic. Nowadays there is taking place archaeological and palaeoecological research of hedgerows (boundaries between terraced fields) aiming to date these systems with exact methods and collecting other data for detailed description of construction and for reconstruction of vegetation.

Keywords: pluzina, hedgerows, agrarian background, villages, environmental archaeology, palaeoecology

From Mesolithic hunters to Iron Age herders. A unique record of woodland exploitation from eastern Central Europe (Czech Republic)

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In a continuous, perfectly stratified sedimentary record discovered under a large sandstone overhang, we analysed multiple biological remains, archaeological features and artefacts. This multi-proxy record has allowed us to examine the behaviour of humans in a permanently forested environment, throughout almost the entire Holocene. We prioritized attention to massive finds of dung pellets and bedding layers documenting that the site was used as an animal pen and shelter, thus facilitating livestock grazing in forests. Our results imply that such practices have occurred already since the Neolithic, but most robust evidence of these is given for the Iron Age and Early Middle Ages. Detailed analyses of dung document woodland grazing and foddering with branches, acorns, beechnuts, and agricultural waste. In addition, the wide pa-

leoenvironmental context of this in-depth investigation provides evidence of the impact of pastoral subsistence strategies on ecological functions, species composition and diversity of the local forest ecosystem.

Keywords: environmental archaeology, Holocene, stratified site, rockshelter, dung, agropastoralism

Distribution of pottery fragments of the last two centuries in arable fields: the case from the Žluticko region

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This presentation summarizes research based on the assemblage of artefacts dating from the 19th to early 20th centuries, obtained by fieldwalking and analytical collections of artefacts in the surroundings of Vladař hill in West Bohemia. We studied the relationship between the distribution of modern pottery in the present-day arable fields and previous land use. Several methodological approaches of landscape archaeology were used for an evaluation of observed pottery distribution: namely an analysis of archival written and cartographic sources, analysis of aerial photographs from various decades of the last century, satellite imagery, and of processed lidar data. We found that 19th century ceramic distribution reflects correctly the state of the field systems recorded in historic maps, dating from the same period. There are, however, differences in the preservation of field systems, depending on the type of modern land use. In the forested areas, the field relicts are preserved in a much better condition and for a longer time than in the areas of ongoing arable agriculture. Here the situation is observably complicated further by intensive soil erosion occurring in excessively large fields, created in the post-war period.

Economic life of an Iron Age Judahite Town: A view from Tel Burna

Itzhaq Shai

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The archaeological excavations at Tel Burna (located in the lower hill of Judah) revealed significant remains of the economy, agriculture, and the daily life of the local inhabitants during the Iron Age II. The material includes finds that were discovered in different excavation areas, some on the fortified summit and others on the eastern slope where agricultural installations are located (some visible on surface). In this paper, I will the site and its role in the Iron Age alongside the various finds (botanical, features, installations and buildings) that reflects the changes of the site's history and role in the economic life of Iron Age Judah.

Remote sensing approach to a comparative study of agroecosystems

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This presentation discusses emerging tools for semi-automatic processing of large collections of remote sensing and spatial data. Satellite sensors, aerial imagery and numerous GIS datasets contain a treasure trove of information about spatial organization of landscapes inhabited by human populations adapted to diverse environments. The present-day monitoring of the Earth's surface by advanced imaging and mapping systems provides invaluable insights into cultural landscape development. The patterns of contemporary land use have usually resulted from previous long-term evolutionary trajectories of human-environment interaction. In this sense, we can speak of entire landscapes as a specific category of cultural heritage, where their fragmentation, distribution of soil types and vegetation patterns carry their own specific historic memory and can be studied as archives, accumulated over prolonged periods. Modern technological infrastructures and their application programming interfaces (APIs) allow for time and cost-effective handling and analyses of extensive datasets. This kind of human-machine cooperation, use of broadband Internet connection and powerful computing infrastructures, significantly enhance our opportunities to study landscape patterns across various space-time scales.

The network of defence settlements from the Bronze age between the Biebrza and Narew during environmental crisis

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The earth's climate is not constant and has been constantly changing. The climatic optimum, that is, the gradual tendency to increase the temperature of the earth's surface falls during the Holocene period. However, in this relatively stable climate conditions there were periods of colder and warmer. Such cold climate fluctuations we call the Bond events.

The main aim of the presentation is to present the geoarcheological conditions of "Valley of Forts" type settlements of prehistoric communities in times of climatic crisis.

The defensive settlement network "Vallef Forys" is located in the border area of two large geographical provinces of Eastern and Western Europe exactly in north-eastern Poland (Podlaskie Province). All 26 settlement structures are located in the central and upper Narew and Biebrza River basins.

These forms were constructed in a coherent system, and their classification was made possible by their morphological features (*a*) and topographical location (*b*):

(*a*) the design of all structures is characterised by a circular or slightly oval center surrounded by one, two or three rings of embankments;

(*b*) all facilities are located within river valleys, mainly Narew and Biebrza, or their smaller tributaries. They are poorly visible in the morphology of the area, which is probably a result of a significant level of their leveling.

Preliminary results of the selected sites show that these settlement structures have functionally facilitated around 900 BC (HaB/V EB) and were used for storage facilities by the communities of Urnfield culture in the Bronze Age This chronology is confirmed by the first absolute dating (OSL) of sediments from Jatwieża Duża site, which determine the age of 2.93 ± 0.44 ka (UJK-OLS-98). This date should be combined with the period of the second Bond Event, the so-called Cold Iron Age. Likely climate change and the progressive decrease of temperatures and related events forced the accumulation of food by this ancient societies.

Keywords: bond event, valley Forts, geoarcheological, Bibrza river, Narew river

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