Detecting the fingerprints of past agricultural practices through integrated soil scientific and archaeobotanical data

1. Introduction

The main objective of the postdoctoral project was to perform a methodological development suitable to detect past agricultural practices through the application and integration of geoarchaeological and archaeobotanical methods. Multiple case studies were carried out on samples sets collected at various archaeological sites. The focus was on Bronze Age, Iron Age and Migration Period sites, however case studies dealing with other cultural units were also involved. The case studies represent a development in the applied methodology and range from simple archaeobotanical site analysis to integrated use of multiproxy approaches, including macro- and micro-archaeobotany, geochemistry and micromorphology. These methodological steps were organised into research panels.

The integration of geoarchaeological and archaeobotanical methods proved to have a positive effect on the archaeological interpretation of the subjected issue. While geoarchaeological methods were successfully used to decipher the 'invisible' fingerprints and spatial patterns of agriculture-related activities, the analysis of archaeobotanical finds provided tangible evidence for the understanding of human-plant relations. The results of the project demonstrated it that the use of the abovementioned methods holds an invaluable significance in the understanding of how human populations interacted with their environment in those archaeological eras, which cannot be researched on the basis of written or iconographic sources.

2. Materials, methods and outputs – overview of the results

Samples representing the archaeological sites listed in *Table 1* were associated with the four research panels of the project.

The identification of past agricultural activities performed in households is highly dependent on the proper analysis of soil scientific, geochemical and botanical indicators that transmit important information on the quality and quantity of the subjected activities. Beyond the limits of interpreting archaeological finds of these features, these indicators were found to be vital to establish links between human activity and household space regardless of the examined archaeological era. The project focused on the activity area analysis of household units and semi-subterranean features, as well as on the interpretation of geoarchaeological and archaeobotanical data from the perspective of agricultural activities performed within the subjected sites by implementing (micro- and macro-) archaeobotanical and geoarchaeological methods.

In order to identify a method of activity area analysis both existing data was used, which mainly covered macro-archaeobotanical raw data. Throughout the project these datasets were re-evaluated and statistically analysed in order to retrieve information on past practices of agricultural activities and subsistence strategies. In addition to that, new analyses in my own expertise covering geoarchaeology and phytolith analysis were performed both on archived samples and newly collected ones. These data inputs were used to perform data integration and methodological development throughout the postdoctoral research.

Table 1. Archaeological sites, applied methods and scientific outputs of the project

Archaeological site*	Number of analysed samples	Represented archaeological era / culture	Applied methodology[1]	Scientific output[2]
Kakucs-Turján mögött	248 + 45 + 11	Bronze Age	GEO_ARCH, GEO_CHEM; PHYT	1; 3; 6
Perkáta-Forrás-dűlő	24	Bronze Age	KARP; PHYT; GEO_ARCH; SOIL	-
Sarkad-Vártabla	14	Bronze Age	GEO_ARCH	4
Százhalmobatta-Földvár	23 + 9 + 43	Bronze Age	KARP; PHYT; SOIL; MICROMORPH	1; 6; 7
Győr-Ménfőcsanak, Széles-földek	27 + 14 + 14	Iron Age/Celtic	KAPR; PHYT; SOIL; GEO_CHEM	6; 7
Ófehértó-Maró 76.	3	Iron Age/Celtic	KARP	2
Apc-Farkas-major	18	Sarmatian	KARP	2
Hatvan-Baj-puszta	6	Sarmatian	KARP	2
Alsóheténypuszta-Kapospula	20	Roman Period	GEO_ARCH; GEO_CHEM	3
Keszthely-Fenékpuszta	27	Roman Period Migration Period / Avar	KARP; KARP_MORPH; CHAR	3
Petőfibánya-Iskola utca 5. lh.	3	Migration Period / Avar	KARP; SEM_EDS	5
Hajdúböszörmény-Téglagyár 2.	23	Middle Age (12th-13th)	KARP	1

**Sites are listed in chronographic order*

The number of analysed samples within *Table 1* represent different sample sets. In order to demonstrate this the numbers are presented separately. Different methodological approaches were applied to reconstruct contemporary human activities, and this required different sample types. These include: bulk samples for basic soil parameters, for geochemical element analysis; bulk samples for phytolith recovery, thin section microlayers for phytolith scanning and analysis, raw archaeobotanical data. In some of the cases (e.g. anthropogenic sediment samples collected in the inner space of an Iron Age feature at *Győr-*

[1] KARP: macro-archaeobotany (carpology); KARP_MORPH: seed morphometry; CHAR: wood and charcoal analysis; PHYT: phytolith analysis; GEO_ARCH: general geoarchaeological survey (mapping, description); SOIL: soil scientific parameters (geoarchaeology, pedology); MICROMORPH: thin section soil micromorphology; GEO_CHEM: multi element analysis (geoarchaeology, geochemistry); SEM_EDS: scanning electron microscope, energy dispersive X-ray spectroscopy.

[2] 1: journal article (peer-reviewed, international); 2: journal article (peer-reviewed, Hungarian); 3: book chapter (international); 4: book chapter (domestic, in English); 5: book chapter (domestic, in Hungarian); 6: abstract (international); 7: abstract (Hungarian).

Ménfőcsanak, Széles-földek archaeological site) samples sets overlap so they are not listed twice, however multiple methods were applied to the same (sub-)samples.

3. Overview of the results in the light of the original working plan

The submitted application covered a set of well-defined deliverables that marked the pathway of the project. The deliverables helped to track the progress of the project and at the end they can be used to demonstrate that the research remained consistent to the work plan. Deliverables assigned to each project year covered both technical milestones and defined scientific outputs in the form of various publications types. The following table (*Table 2*) intends to give a summary on the deliverables and how they were accomplished throughout the postdoctoral research project.

Two deliverables were not fully accomplished (*Table 2*). Deliverable D1.3 was integrated into a book chapter covering also an analysis of the Roman Age and Migration Period of the Carpathian Basin. Due to the delay in the publishing of the book/monograph the subjected manuscript is not yet published. Deliverable D3.3 could not be fully accomplished by the termination of the project. Due to the delay in the laboratory work, which can partly be explained by the development of the pandemic situation, the finalisation of two manuscripts intended to be submitted to peer-reviewed international journals shifted. These papers are closing finalisation and will be submitted shortly after the end of the project.

In the case of deliverables D1.4 and D2.1 one research paper per deliverable was planned. Due to the fortunate unforeseen progress within a couple of research activities in the earlier stages of the project further papers (both in Hungarian and in peer-reviewed international journals) could have been published, thus exceeding the planned fulfilment.

Table 2. Deliverables of the project

Deliverable	Content of deliverable	Result	Comment
D1.1	Completion of the research material database (RMDB)	Setting-up the database of the research material included the selection and categorisation of archaeological features and finds from selected sites. The RMDB was compiled in order to have a well-structured dataset to work with. The main methodological steps were the following: 1) selection and inventory of archaeobotanical and geoarchaeological samples collected from archaeological features and workshops linked to past agricultural activity; 2) compiling sample sets for features that represent one functional unit within the examined archaeological sites (e.g. household clusters, workshop areas etc.); 3) defying the origin of the samples: archaeological floors, activity layers of buildings, waste pits and middens, postholes.	The RMDB was set up at the beginning of the project, however in the course of the research work extra samples were integrated into the database in the case of a few sites.
D1.2	Launching project website	www.agripast.hu	Launching of the website shifted, but it was put in operation within the timeframe of the project.
D1.3	Review paper on activity area analysis research	- Gyulai F, Heinrich-Tamáska O, Saláta D, Kenéz Á, Ftaimi N, Molnár M, Pető Á *in press* Castellum Pannonicum Pelsonense 8: 137–158.	The Gyulai et al. paper was finalised at the end of the first project year; it is still in press due to the delay in publishing of the embedding volume.
D1.4	Preparation of original research article	- Gyulai et al. (2019) Environmental Archaeology: The Journal of Human Palaeoecology 24(3): 229-247. (https://doi.org/10.1080/14614103.2017.1397872) - Pető et al. (2017) Archeometriai Műhely 14(2): 117-128. - Pető et al. (2018) Archeometriai Műhely 15(2): 117-124.	-
D2.1	Preparation of original research article	- Pető et al (2019) Journal of Archaeological Science Reports 27: 101-117 (https://doi.org/10.1016/j.jasrep.2019.101999) - Niebieszczański et al (2019) Journal of Archaeological Science Reports 25: 409-419 (https://doi.org/10.1016/j.jasrep.2019.04.014) - Kovács et al. (2020) Archaeological and Anthropological Sciences 12: 258 (https://doi.org/10.1007/s12520-020-01205-z)	-
D2.2	Outreach/dissemination activity: preparation and publishing of propagatory papers	- Pető et al. (2017) Határtalan Régészet IV: 25-29. - Pető (2018) Magyar Régészet 2018/4: 1-3. [http://files.archaeolingua.hu/2018T/Upload/Forum_Peto_H184.pdf] - Gyulai et al. (2019) Határtalan Régészet IV(3): 44–47. - Pető (2020) Határtalan Régészet V(3): 82–87. - Pető Á, Kenéz Á (2020) A Földgömb XXXVIII(343): 71–75.	-
D3.1	Geoarchaeological dataset	Both background data (location, arch. site, context, type etc.) and raw data retrieved through the applied scientific methods (pH [KCl; H2O]; CaCO3%; texture coefficient [K_A]; salt%; TOC%, H%; P_{total}; element distribution measured by ICP-AES) were gathered and summarised in a database.	Database was not made public.

D3.2	Integrated archaeobotanical dataset	Both background data (location, arch. site, context, type etc.) and raw data retrieved through the applied archaeobotanical analysis methods (phytolith morphology frequencies, list of taxa etc.) were gathered and summarised in an integrated database.	Database was not made public.
D3.3	Preparation of research articles	- Pető et al. in prep.: Activity area analysis of an Iron Age household unit by the means of geochemical and phytolith data. - Pető et al. In prep.: Understanding Iron Age agricultural practices: Case study from the Carpathian Basin base on archaeobotanical evidence of the Győr-Ménfőcsanak, Széles-földek archaeological site.	Delay of laboratory work in the 3rd project year, and the need of re-processing a few samples of #Panel3 resulted in the delay of finalising the final papers.
D3.4	Delivery of research data in the form of oral presentation and posters at national and international conferences	- Pető Á (2018) Produzieren-Verzehren-Repräsentieren. 30. Internationales Symp. "Grundprobleme der frühgeschichtlichen Entwicklung im mittleren Donauraum". Brno, 14-16. November 2018.; p 3. ISBN 978-80-7524-023-1 (Keynote Speech) - Pető Á, Kenéz Á (2019) ΜΩΜΟΣ – Őskoros Kutatók XI. Összejövetele – Környezet és ember. BTM Aquincumi Múzeum. 2019. április 10-12.; p. 80. ISBN 978-615-5341-64-9 (poster presentation) - Pető Á (2019) "IV. Fenntartható fejlődés a Kárpát-medencében konferencia" pp. 91-92. ISBN: 978 963 269 879 3) (oral presentation) - Pető Á, Kovács G, Vicze M (2020) 26th Annual Meeting of the European Association of Archaeologists, Budapest, 26–30 August 2020. (oral presentation)	-

4. Highlighted case studies

The most relevant case studies, representing different methodological considerations, are briefly summarised in the following. The order of the case studies represents the stages of the methodological development accomplished throughout the project, and are in line with the research panels of the project. Since only some of the results are highlighted here, please refer to the attached detailed publication list for further details.

Hajdúböszörmény-Téglagyár '2'. The archaeobotanical assemblage recovered from 12th–14th century household contexts of *Hajdúböszörmény–Téglagyár '2'* revealed the plant-based subsistence strategy of a Late Árpád Age population. By comparing the identified plant remains of Hajdúböszörmény to the other, previously analysed, Late Árpád Age sites, several cultural differences but also similarities could be observed [1]. The economy and subsistence strategy of this seemingly culturally isolated population is reflected both on their material culture, and the bioarchaeological fingerprint they leave behind. Within the major plant groups, such as the cereals and pulses, the similarity in the record between the Hajdúböszörmény settlement and the other Christian Árpád Age settlements is supported by the archaeobotanical data, however they probably formed part of a different cuisine. It should be emphasised that caryopsis remains dominated the cereal record of the site. Taken into account that the main activities of the settlement's inhabitants were linked to commerce and trading, and that no archaeobotanical evidence points to cereal cleaning activity within the boundaries of the settlement, it might be hypothesised that their subsistence strategy of obtaining and securing cereal sources for bread making was based on buying or trading stocked cereal assemblages from external sources. This possibility presumes that the Hajdúböszörmény population was either not forced to deal with cereal cultivation, or the knowledge was partly or entirely missing. The horticulture of the site is represented by pulses and various backyard vegetables. The species spectra of vegetables show differences, which serve as evidence of possible horticultural dissimilarities. The occurrence of cabbage and watermelon is restricted in this archaeological period to Hajdúböszörmény only. The occurrence of watermelon is probably a 'forerunner' of the culturally controlled economic change in horticultural management. Based on the archaeobotanical study our research provided new insights into the subsistence strategy and foodways of a culturally isolated Ishmaelite population of the 12th–13th century Carpathian Basin. The ethno-archaeobotanical information identified a

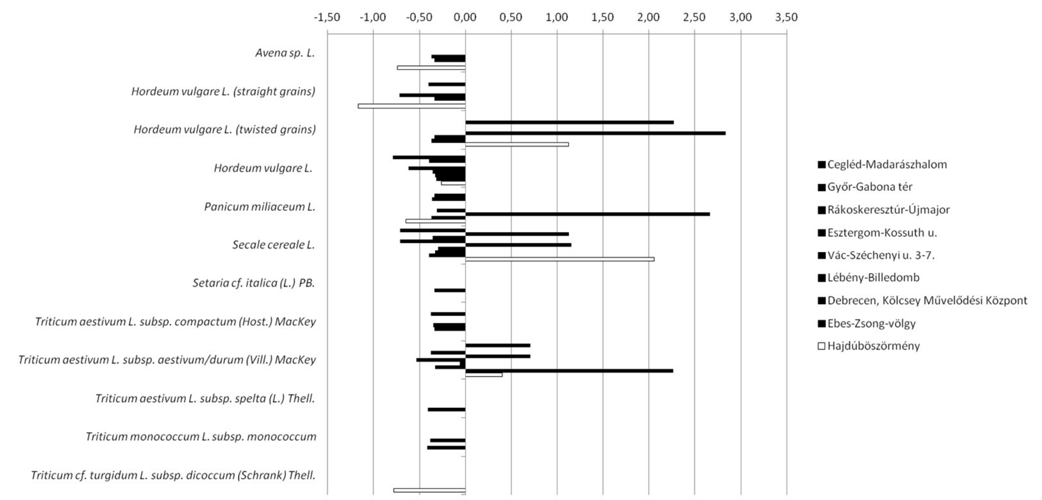

Fig 1. Standardised data (z score) of the cereal record of Hajdúböszörmény–Téglagyár '2' (white bars) and the contemporary other Late Árpád Age (black bars) archaeological sites (used after Gyulai et al. 2019 – [1]).

population that used similar plant resources as the vast majority of the Christian Árpád Age population of the medieval Hungarian Kingdom but in a different way and with a different strategy.

Keszthely–Fenékpuszta. The archaeobotanical sample set of *Keszthely–Fenékpuszta* provided significant information on the question of agricultural knowledge transfer between the Romans and the inhabitants of the Migration Period [2]. The survival of the knowledge and practice of Roman agriculture, especially the question of continuity of cereal and fruit production, as well as that of viticulture, is still debated from both pro and contra perspectives. One of the major questions is whether continuity of agricultural know-how also implies population continuity. The known agricultural tool assemblage of the Migration period differs from that of the Roman period and tools suitable for fruit and grapevine husbandry are very rare in the archaeological material of the Migration Period. The retrieved archaeobotanical data suggest that the grapevine varieties cultivated in the Roman period survived and that the know-how associated with their cultivation – at least in some reduced form – could be inherited locally. *Keszthely-Fenékpuszta* provided archaeological evidence of continuity in the settlement structure. Based on the macro-archaeobotanical samples significant difference between the two subjected periods could not be detected. Besides, other palaeoecological investigations have shown continuity of land use in the region. All that suggests that Roman agricultural praxis, including viticulture, may have survived at least in some aspects.

The homogenous cultural identity that emerged during the Middle Bronze Age (2000–1450 cal BC) in the central territory of the Carpathian Basin is identified uniformly as the Vatya culture. The Vatya people created multi-layered tells, open air horizontal, as well as fortified settlements along the western and eastern bank of the Danube river. These archaeological sites are significant elements of the cultural and natural heritage of the Carpathian Basin. Their significance does not only lie within the possibility to reconstruct the life, society and material culture of Vatya populations, but the buried soils and anthropogenic sediments hold significant information on prehistoric human-environment interactions. Samples from four archaeological sites formed part of the postdoctoral project: *Kakucs-Turján mögött*, *Százhalombatta–Földvár* and *Perkáta–Forrás-dűlő*; *Sarkad-Vártábla*.

Kakucs–Turján mögött. In the case of *Kakucs-Turján mögött* the stratigraphy of the site was revealed and described in detail by the means of high-resolution geoarchaeological mapping designed and carried out on the basis of magnetometric plan [3]. The central nucleus of the site was identified as the dwelling area. Based on the results of the cores deepened in the dwelling area of the site a subsequent study, analysing the spatial distribution of geochemical and soil parameters were conducted [4]. The houses displayed sets of archaeological material confirming the whole spectrum of economic activities typical for the Middle Bronze Age in the region. Among numerous finds, wattle and daub walls with wooden posts were recorded corresponding to the location of anomalies detected on the magnetic plan. Within the house, a clay hearth and kiln were revealed alongside numerous artifacts providing evidence of specific activities. The sedimentological and geochemical analyses of the collected samples showed spatial differences in the anthropogenic indicators. Differences between the housing and open spaces could also be detected. Geochemistry, especially the phosphorous content, indicated that waste disposal or raw material used for household industry activities was concentrated in the area outside the building. This area served also for other activities involving bronze items, which was evidenced by the high amounts of copper and zinc. In the light of the archaeological and geoarchaeological results it must also be considered that these spaces and buildings could have been multifunctional overtime, which would result both in the mixing and in the masking of activity specific data. Archaeobotanical data retrieved from *Kakucs–Turján mögött* gave further insights to the everyday life of the settlement's inhabitants [5]. The botanical results indicate that the most important economic plant species were einkorn (*Triticum monococcum* subsp. *monococcum* L.) and lentil (*Lens culinaris* Medik.), followed by barley (*Hordeum* spp.) and field pea (*Pisum sativum* L.). The presence of only small numbers of weeds and cereal by-products suggests that kitchen-ready cereal grains and legume seeds were present in the house. This finding was underlined by the phytolith analysis, which demonstrated the presence of morphotypes indicative for cereal by-products (e.g. chaff). Consequently, the results suggest that cereal-processing activities did take place in the settlement area.

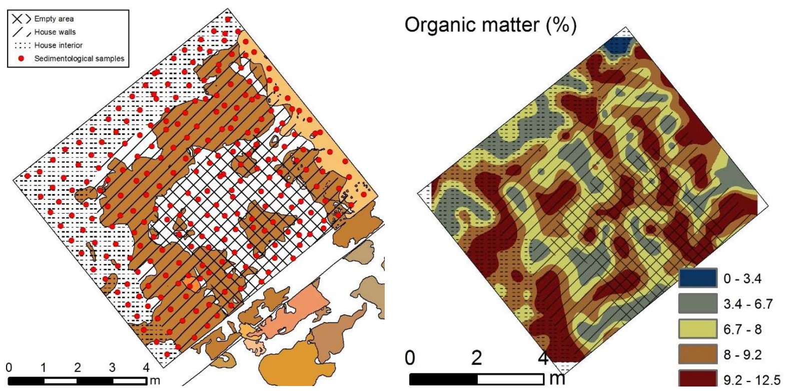

Fig 2. The total horizontal sampling and the spatial distribution of TOC% at Kakucs-Turján-mögött (used after Niebieszczański et al (2019) – [4]).

Százhalombatta–Földvár. Multiple household compounds, including houses and pits of the Vatya culture were subjected to combined geoarchaeological and archaeoboanical analysis (incl. phytolith analysis of bulk samples and that of soil thin sections). As a methodological development phytolith analysis was combined with thin section soil micromorphology in order to better understand the use of inner space at house Nr. 3147 of the site [6]. Methodological consideration of phytolith analysis in fixed analytical environment was also discussed [*cf.* 6]. Detailed phytolith analysis shed light on how by-products of the cereal cleaning process were incorporated into the building materials of the house. Well-structured plant material in some of the earthen floors show different development phases of the house. Phytolith indicators represented local, *in situ* deposition of both grass – most likely cereal – vegetative (stem and leaf) and generative (chaff) material. Besides, relatively high amount of charred plant material could also be detected in the form of plant organic matter and charcoal fragments. The phytolith signal undoubtedly demonstrated the presence of chaff material. This assemblage that derives from cereal cleaning activity within the house can be considered as a deposition of chaff material saved for further processing. Moreover, the simultaneous occurrence of grass stem, leaf and inflorescence material at a different location of the house was considered to be an indication of dung presence.

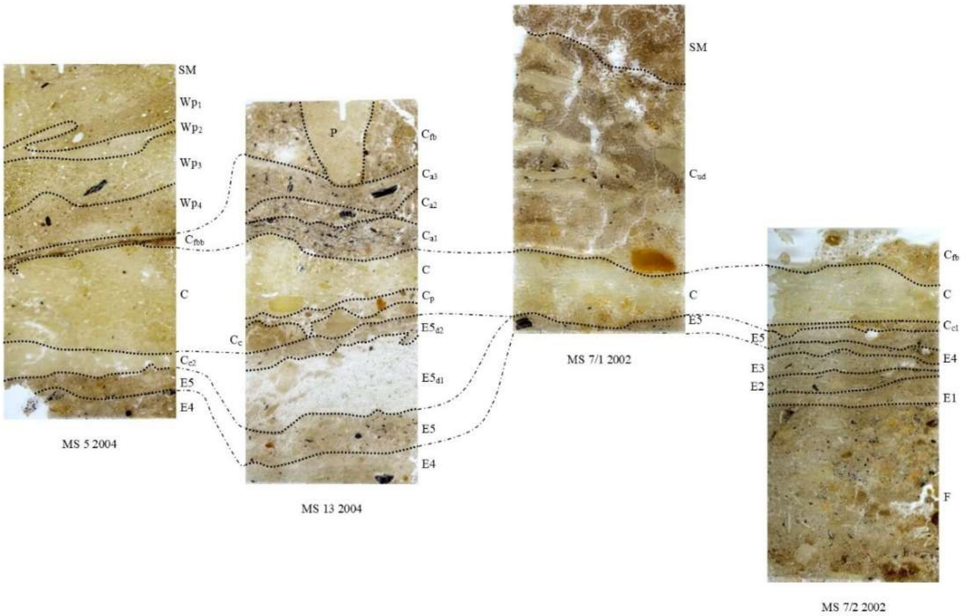

Fig 3. Stratigraphic links between the microlayers on the soil thin sections taken from the Middle Bronze Age Vatya house at Százhalombatta–Földvár; microlayers were subjected to phytolith scanning and analysis (used after Kovács et al. 2020 – [6]).

Győr–Ménfőcsanak, Széles-földek. Samples from *Győr–Ménfőcsanak, Széles földek* archaeological site were processed and analysed in the third (last) project year. Due to the delay in the laboratory work (see explanation in *Section 3*) data are not yet published. For this reason, a more detailed summary is given on the work that has been undertaken. As mentioned in *Table 2,* publications of the results are in preparation and are nearing finalisation, and consequently submission.

The Iron Age settlement excavated at *Győr–Ménfőcsanak, Széles földek* archaeological site provided significant research material for the understanding of how Iron Age communities interacted with their environment, how semi-subterranean features were used, and what agricultural activities were performed in the household compounds. Numerous household clusters were sampled previously, which included buildings, pits, hearths and wells. The main focus within the current postdoctoral research was on the activity area analysis of building Nr. 210, and on the reconstruction of the Iron Age agricultural practices based on the archaeobotanical analyses of anthropogenic material deriving from various features. Based on the ample macro-archaeobotanical evidence, which covers over 130.000 remains, and on the phytolith record of the samples, the reconstruction of a village-like settlement with a very strong and highly-developed cereal production could be reconstructed. The plant-based economy of the site is twofold, because the frequency of the ancient hulled wheat species is still significant, however a shift towards the modern naked wheat species could also be detected. Based on the archaeobotanical evidence it seems that the main harvested cereals of the Iron Age settlement were einkorn (*Triticum monococcum* subsp. *monococcum* L.), bread wheat (*Triticum aestivum* L. subsp. vulgare (Vill.) MacKey) and spelt (*Triticum aestivum* L. subsp. spelta (L.) Thell.). In order to gain a deeper insight to the use of space and the potential agricultural practices more semi-subterranean features within the settlement area were subjected to high-resolution total horizontal sampling. The inner space of feature Nr. 210 was divided into 27 equal sampling clusters. Anthropogenic sediment samples taken from each cluster were divided in order to provide subsamples for each methodological approach. The inner space of this feature and its activity area analysis was accomplished through the following methods: basic soil analysis (pH [H_2O, KCl]; K_A; $CaCO_3$%; TOC%; H%; P_{total}); geochemical element analysis using ICP-AES (incl. 48 elements); carpology and phytolith analysis. Absolute dating of the analysed feature was accomplished through the C-14

AMS radiocarbon dating of botanical samples. In order to statistically compare the data from the sampled quadrats, multivariate statistical analysis was performed on the transformed data sets and heat maps were generated to visualise the horizontal distribution of the applied parameters.

One of the most interesting results are linked to the horizontal distribution of different cereal indicators (both within the macro- and in the micro-archaeobotanical range. As it is shown on *Figure 4*, the use of the inner space within the house is dominated by quadrants that show a low n_c/n_{ch} ratio value, which indicates the presence and dominancy of chaff. The concentration of elongate dendritic LC phytolith morphotype in the samples is high compared to undisturbed natural soil environments in this geographical region. This phytolith morphotype is produced in the inflorescence bracts of cereals its accumulation represents the presence of cereal inflorescence material within the feature. This phenomenon is further supported by the high ratios of articulated silicified tissue elements that can be linked to cereal chaff. In opposition to previously analysed semi-subterranean features these data are in line with each other. Both the macro-botanical results, and the phytolith analytical results refer to the presence of cereal chaff (glume, palea, lemma), indicating an agricultural function to feature Nr. 210.

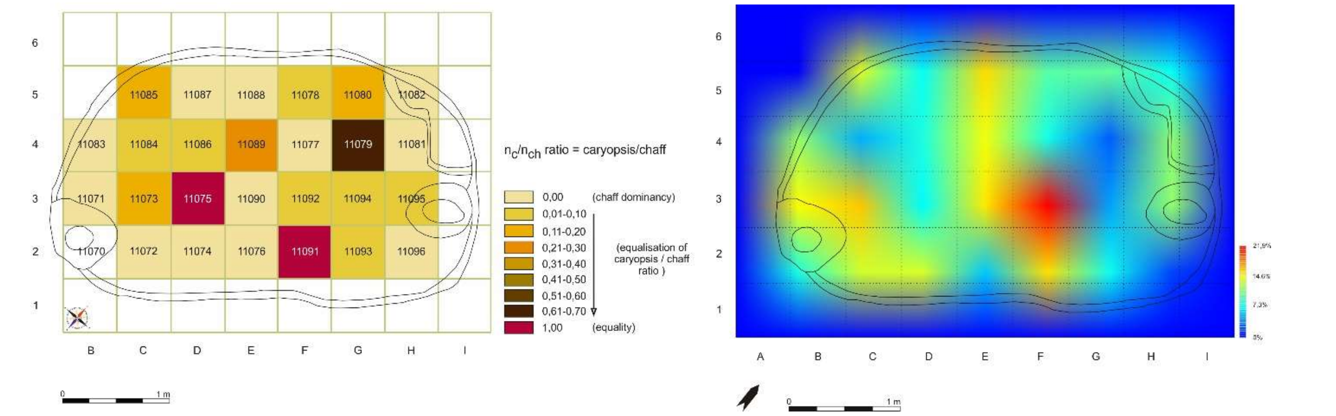

Fig 4. Distribution of cereal caryopsis and chaff remains within the inner space of feature Nr. 210 (to the left), and the heat map of the elongated dendritic LC morphotype projected to the plan of Feature Nr. 210 (to the right) (unpub. data).

The geochemical properties of the feature were described through the elemental composition of the quadrants. The raw geochemical data (retrieved with ICP-AES method) was subjected to principal component analysis to determine similar spatial units within the building. Moreover, the samples were compared to the same data set of a background soil profile in order to avoid misinterpretations deriving from modern anthropogenic influence. As shown on *Figure 5*, four statistically different spatial units could be defined. The purple quadrant was found to bear similarities with the parent material of the site. The red quadrants differed from the others in the lower organic matter in-put that affected the inner space of the feature. This is also underlined by the heatmaps of the basic soil parameters of the building (*Figure 5*). The blue and the green quadrants significantly differed from all background soil samples, indicating a well-defined anthropogenic effect and origin. Furthermore, the green areas are the one that showed the highest TOC% and P_{total} values as well. The soil chemical results indicate a high organic matter input concentrated in the middle section of the building. Complemented by the distribution patterns of the phytoliths indicating floral parts of cereals, the interpretation of the use of the building's inner space as an activity area unit becomes more diversified. Using the qualitative assessment and the distribution of these plant indicators, multiple functions and more possible ways can be outlined regarding the use of the building.

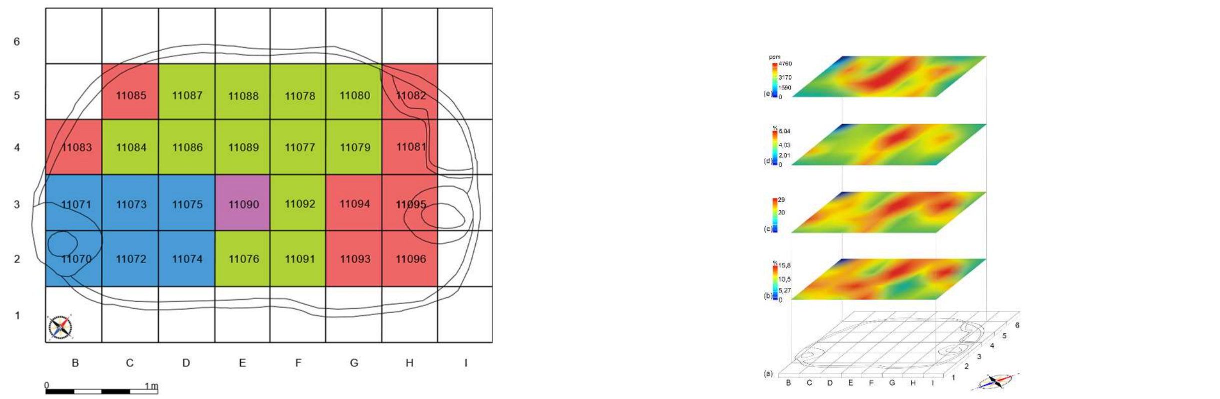

Fig 5. The grouping of sampling quadrants based on the PCA of the ICP-AES raw data (to the left) and the heatmaps of basic soil parameters of feature Nr. 210 (a. plan of the feature, b. $CaCO_3$%, c. K_A, d. TOC% and e. P_{total}).

5. Additional results

Not only site specific (see *Table 1*) results were reached within the frames of the postdoctoral project. So called 'additional results' are those, which are not positioned in the core of the project, but are related to the background and to the basic research of the applied methods. Among these, cooperation with researchers at the Isotope Climatology and Environmental Research Centre (MTA-ATOMKI/INR-HAS) was being conducted in order to create baseline data and background research for the application of archaeobotanical data and methods in the applied research activity done within the frames of the current postdoctoral research project. The scientific output of this cooperation resulted in the publication of multiple papers published in Q1 rated peer-reviewed journals [7; 8].

Two scientific book chapters in the field of (archaeological) soil micromorphology were also published during with previous dates [9; 10]. Although these are minor contributions in length, I consider these two book chapters as important forums for disseminating the methodological development and research work carried out within the frames of this project.

A handbook [11] containing the methodological developments and the research experience gained in the current postdoctoral project was published. The volume is being used in higher education (e.g. MATE), as well as in archaeobotanical research within the cultural heritage institutions.

In accordance with the original working plan emphasis was put on the outreach activity throughout the project. Results of these cover educational and informative papers. Although these publications are not considered as scientific papers, they form an important part of the research activity in disseminating results and research activity to the wider public. The most important results of outreach and dissemination activity are listed in Table 2 under D2.2.

Scientific networking and cooperation remained was a stable part throughout the project. The cooperation that started previously with national and international research projects/institutions provided important research material input for the project. These co-operations opened up the possibility for knowledge transfer and dissemination of methodological tools and research experience to a broader spectrum dealing with the agricultural and subsistence history of the Carpathian Basin.

6. References

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