



19th Conference of the International Workgroup for Palaeoethnobotany



13-17 June 2022

Clarion Congress Hotel
České Budějovice
Czech Republic

Abstract Book

Jaromír Beneš, Michaela Ptáková, Alexandra Bernardová (eds.)

Adam Lebeda, Kateřina Kročová (technical redaction)



19th Conference of the International Workgroup for Palaeoethnobotany



MACRO-THEME 1:

**ARCHAEOBOTANY AND ETHNOBOTANY AS EXPLANATORY
TOOLS IN THE ARCHAEOLOGICAL RECORD**



MACRO-THEME 1: ARCHAEOBOTANY AND ETHNOBOTANY AS EXPLANATORY TOOLS IN THE ARCHAEOLOGICAL RECORD

Topic 1.1. From processing to plate: Archaeobotanical approaches to cooking and consumption

IWGP22-0140 - The last supper: Analysis of organic residues on pottery from the Early Medieval necropolis of Holohlavy, Czech Republic

Nevenka Atanasoska¹, Jan Tříška^{2,3}, Jan Bednár^{3,4}, Josef Vilímek⁵, Kristýna Budilová⁶, Jaromír Kovárník⁶, Veronika Komárková⁶, Antonín Majer⁷, Lukáš Kučera⁸, Radomír Tichý⁹, Jaromír Beneš^{1,6}

¹*Institute of Archaeology, Faculty of Philosophy, University of South Bohemia, České Budějovice, Czech Republic*

²*Department of Chemistry, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic*

³*Laboratory of Metabolomics and Isotopic Analyses, Global Change Research Institute, Brno, Czech Republic*

⁴*Department of Ecosystem Biology, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic*

⁵*Department of Chemistry, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic*

⁶*Laboratory of Archaeobotany and Palaeoecology, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic*

⁷*Palackého 29, PSČ 387 01 Volyně- Czech Republic, Volyně, Czech Republic*

⁸*Department of Analytical Chemistry, Palacký University, Olomouc, Czech Republic*

⁹*Department of Archaeology, Philosophical Faculty, University of Hradec Králové, Hradec Králové, Czech Republic*

The analysis of organic remains on pottery is currently an essential source of data on nutrition and other aspects of daily life. There is plenty of data in the historical literature about the diet in the Middle Ages. It is generally known that cereal porridge was a frequently consumed meal. It was prepared in several different ways and with different ingredients; it had cereals as its base, with millet predominating among the peasants. In this study, we would like to test this assumption. To gain knowledge about nutrition in the Early Middle Ages, we performed analyses of the organic residue from a group of twenty vessels from a burial site discovered in 2017 near the present-day village of Holohlavy in the

Czech Republic. Several types of analyses were applied to the samples taken from the vessels in a burial context. The most effective technique was gas chromatography/mass spectrometry, which revealed the presence of miliacin in some of the vessels examined. Miliacin is a typical marker for millet – the most commonly found compound in the caryopses of this cereal. Starch and phytolith analysis confirmed the information on the mixing of the porridge with flours made of various plants. The phosphate analysis and the presence of a compound with an exact mass of m/z 662.4482 (C₄₉H₅₈O), but an unknown structure yet, confirmed that the vessels were used before being placed in graves as goods. In addition to this, the presence of cholesterol was confirmed in a few samples, indicating the addition of fat or meat in meals. The closed shape of vessels indicates, with high probability, that they may have been to prepare porridges. The burial site investigated is currently one of the largest early medieval cemeteries discovered. The assemblage of vessels is the most extensive set ever to be analysed in the Czech Republic.



Figure: Vessel from the early medieval cemetery. Holohlavy, Czech Republic

IWGP22-0071 - Cultivated and edible wild plants from Early Iron Age lake sediments of Traunkirchen (Upper Austria, Austria)

Marlies Außerlechner¹, Peter Trebsche¹, Susanna Cereda¹, Helena Seidl da Fonseca², Markus Staudt¹

¹University of Innsbruck, Department of Archaeologies, Innsbruck, Austria

²Naturhistorisches Museum Wien, Kuratorium Pfahlbauten, Vienna, Austria

The Traunkirchen site is located at the western shore of Lake Traunsee in Upper Austria (Austria) and in the northern area of the Eastern Alps. Records linked to Bronze and Iron Age burial and settlement contexts document human occupation ashore. In 2020, archaeological underwater prospections, including drill core sampling, took place near today's shore. Two Early Iron Age cultural layers of selected cores were archaeobotanically studied to gain information about the preservation of plant macro remains and human activities. The cultural layers had a total volume of 270 ml and a total weight of 207 g. They were processed by wash-over/wet sieving and using mesh widths of 2.0, 1.0, 0.5 and 0.25 mm. The oversized material contained a noticeable assemblage of more than 10 edible plant taxa and charcoal fragments, while archaeological and bone finds were missing. The cultivated plants, such as *Hordeum vulgare* (barley), *Triticum dicoccum* (emmer) and *Panicum miliaceum* (broomcorn millet), remained charred, uncharred, as entire caryopses, spikelet forks and glume bases. Uncharred fruit wall tissues from cereals and probably tissues from cultivated legume seeds were also found. Furthermore, a remarkable number of uncharred lemma/palea fragments was found. Only lignified parts, such as nut pericarp fragments, nutlets and pyrenes of edible wild plants, including *Cornus mas* (cornel cherry), *Corylus avellana* (hazel), *Fragaria vesca* (European strawberry), *Prunus spinosa* (sloe), *Rosa* (rosehip), *Rubus fruticosus* (blackberry), *Rubus idaeus* (raspberry) and *Sambucus nigra* (black elder), were recovered. The composition of plant macro remains, remain types, preservation states and frequencies suggest specific anthropogenic plant deposits that reflect the importance of plant resources, food processing and consumption. They also reveal further interdisciplinary issues involving the role of this archaeological site.

IWGP22-0172 - Bread, dough, and batter: further exploration and future study of South Indian Neolithic and Iron Age culinary practice

Jennifer Bates¹, Seetha Reddy², Smriti Haricharan³, Kelly Wilcox Black⁴, Kathleen Morrison⁵

¹*Seoul National University, Department of Archaeology and Art History, Seoul, Republic of Korea*

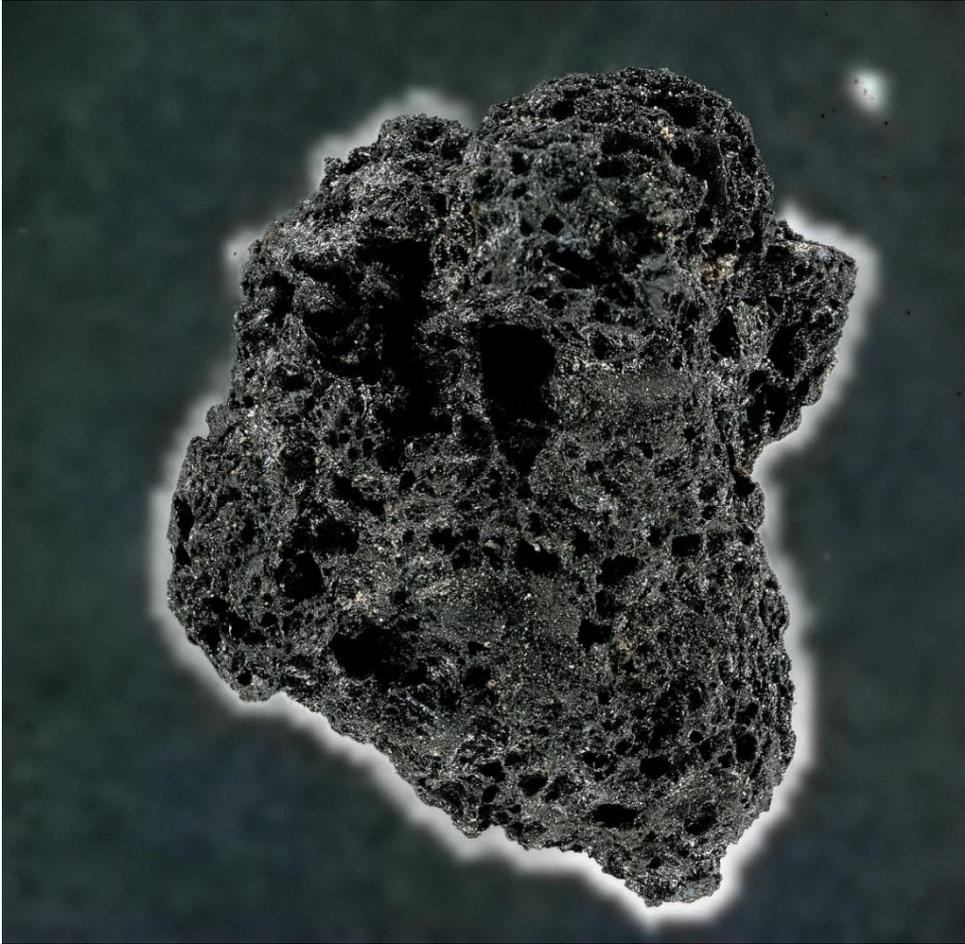
²*Reddy Anthropology, n/a, Davis, USA*

³*National Institute of Advanced Studies- Indian Institute of Science Campus, Heritage Science and Society Program- School of Humanities, Bangalore, India*

⁴*University of Chicago, Department of Anthropology, Chicago, USA*

⁵*University of Pennsylvania, Department of Anthropology, Philadelphia, USA*

Food lumps and crusts have now been recognized as a crucial part of archaeobotanical analysis, with finds from Europe, the Near East, and South Asia analysed and providing new interpretations of how past plants were turned into foods. These amalgams of plant materials allow insights into more than the taxa lists of plants used or even just present on a site; they represent how people engaged with and created food items out of plants, in turn shining a light on notions of food processing, preparation and cooking techniques and culinary traditions. As part of the work at the South Indian site of Kadabakele, with its long occupational history from the Neolithic to the 16th century, we have been looking at how millets and pulse-based foods were an important part of local culinary traditions. In a recent paper we outlined a preliminary analysis of two Iron Age food lumps, demonstrating that people were using both millets and pulses to make food items through a variety of culinary techniques and technologies, from dry doughs to wet batters. In this paper, we outline how this pilot study is being developed further through South Asian taxa and culinary-practice specific experimental work and chemical (isotopic and organic chemistry) analyses on the hundreds of lumps present at the site. Through this development of our initial work we hope to provide not only reference material for future work in South Asia, but also multi-proxy methods for looking at the macroremains of cooking and consumption.



IWGP22-0273 - New archaeobotanical data from the Roman villa of Villamagna (Urbisaglia, Marche Region, Italy)

*Riccardo Carmenati*¹, *Girolamo Fiorentino*², *Roberto Perna*¹

¹University of Macerata, Department of Humanities, Macerata, Italy

²University of Salento, Laboratory of Archaeobotany and Palaeoecology- Department of Cultural Heritage, Lecce, Italy

Since 2018 the University of Macerata, linked with the Laboratory of Archaeobotany and Paleoecology of the University of Salento, has started the study of archaeobotanical records from the excavation of the Roman villa of Villamagna. Target sampling was carried out during the last two excavation campaigns in the *pars Rustica* (2019, 2021). Samples from the first archaeological excavation (2007-2010) were also recovered and processed.

The villa is in the central part of the Marche, a region where seeds, fruits, and charcoal are little analysed in archaeological contexts. The complex was probably built around the 1st century BC, presumably from one of the members of an important *gens* of the nearby colony of *Pollentia-Urbs Salvia*, perhaps of the *Herenni*. Seems to be inhabited until Vth century AD.

The carpological remains from the villa are all charred. The record examined come from the level of reuse of the *pars Urbana* dug in 2017. Moreover, fruits and seeds from samples taken in the last two archaeological excavation campaigns were taken, processed, and determined in the laboratory. The contexts are very different. A burial. Two spoliation pits. The contents of a *dolium defossum* characterized by the exclusive presence of Paniceae without *scutella*, maybe sprouted. A combustion structure, possibly an oven, whose primary coating layer consists of carbonised oily fruits (*Vitis vinifera* L., *Olea europaea* L., *Juglans regia* L.). The production of this construction could concern the *dolium* with Paniceae, less than one metre away. *Vitis vinifera* L. is the most attested and investigated *taxa*. Morphometric and statistical (PCA) analyses confirmed biometric analyses determining the belonging to the wild subspecies. It is, perhaps, the use of local cultivars with seeds that have no shape and morphology of domestic seeds.

IWGP22-0208 - From flotation to usable heritage: how palaeobotanical data are used to solve unemployment in Senegal

*Alioune Deme*¹

¹*Université Cheikh Anta Diop, Department of History, Dakar, Senegal*

In Africa, amid economic, social and environmental crises, marked by poverty, youth unemployment and the expansion of the desert, universities in general, and the Social and Human Sciences in particular, have a great challenge to take up: play their part in solving these problems. The response to these challenges requires them to constantly reinvent themselves and innovate. Research – development backed by a cross-functional, efficient, innovative, and collaborative approach becomes a very important tool to achieve that goal.

This paper reports on archeological research in the Middle Senegal Valley where archaeobotanical analysis revealed the cultivation of *Pennisetum glaucum* since the first millennium BC. Using 9th -12centuries Arab records, oral records, and ethnographic data, we were able to highlight some culinary practices during the second millennium AD. Thanks to a collaboration between the archaeology lab and the food science lab at the school of Engineering, one culinary practice was reconstructed. Students who were part of this collaborative research were then able to create their own business by selling that medieval delicacy called *Koddeh*.

IWGP22-0165 - Revitalizing indigenous culinary traditions an archaeobotanical multidisciplinary approach to identifying archaeological Caçabí bread, a case from precolonial Borikén (Puerto Rico)

Jose Julian Garay-Vazquez¹, José Oliver¹, Dorian Fuller¹

¹University College London, Institute of Archaeology, London, United Kingdom

The archaeobotanical enquiry on past foodways has been reinvigorated via the analysis of food lumps (charred multi-component plant aggregates). The characterization of food aggregates has provided archaeobotany a means to answer Sherratt's (1991) provocative statement that "people do not eat species, they ate meals" via recovering information about sensuous intangible aspects food traditions resulting from preparation and cooking. However, the study of food aggregates is currently restricted to the Old World, especially the Near-East (González-Carretero et al. 2017) Europe (Heiss et al. 2017), and more recently parts of Africa (Fuller and Gonzalez-Carretero 2018) and the Indian subcontinent (Bates et al. 2022). To a lesser extent, the study of food lumps from Kadabakele in southern Deccan demonstrated that well preserve charred food lumps can be found in tropical locations. Therefore, in this paper the results of the first New World case study of a directly dated *caçabí* bread (tuber-based meal made with *Yuca* [*Manihot esculenta*]) fragment from a precolonial indigenous archaeological site in Borikén (Puerto Rico). The identification of a tuber-based meal was possible via mixed methods approach that incorporated Hather's (2000) tuber identification methods with the microstructural analysis of charred food remains, considered alongside recipes from ethnohistorical documents, and experimental archaeology approaches centred on cooking. Moreover, aspects about how a multidisciplinary methods approach can contribute to indigenous revitalization efforts via the recovery of lost traditional knowledge will be presented, looking at the *caçabí* bread recipe through time.

IWGP22-0032 - Inside and out: recent studies of ancient meals in Denmark

Peter Steen Henriksen¹, Morten Fischer Mortensen¹, Mette Marie Hald¹

¹*National Museum of Denmark, Environmental Archaeology and Materials Science, Kgs. Lyngby, Denmark*

Two recent research projects have focused on the analysis of remains of meals from, respectively, a collection of ancient latrines, and the Tollund Man bog body. Here we present some of our methods and results.

The Tollund Man intestine contents undoubtedly represent the closest we get to an actual ancient meal. We discuss our methods of quantifying the chewed-up plant remains in order to reconstruct the composition of the meal, and present our results and interpretation of the nature of the meal.

Latrine contents feature remains of meals once they have left the human body; they have the advantage of being found more often than bog bodies, but the disadvantage of often being mixed with other types of organic remains. We discuss this challenge, as well as the plethora of plant foods that have been identified, and how they tie into societal changes and trade networks.

For both projects, the close collaboration between archaeobotanists and palynologists has provided us with data that would have been impossible to gather with only one of the disciplines at hand. We discuss the advantages of this interdisciplinarity in the study of meals and outline further lines of investigation.

IWGP22-0084 - Exploring prehistoric food preparation processes through exceptionally well-preserved waterlogged plant remains from Ploča Mičov Grad, Lake Ohrid, North Macedonia

Amy Holquin¹, Mike Charles¹, Müge Ergun¹, Amy Bogaard¹

¹*Universty of Oxford, School of Archaeology, Oxford, United Kingdom*

Late Neolithic archaeobotanical remains from the submerged lakeshore pile-dwelling site of Ploča Mičov Grad, Lake Ohrid in North Macedonia, are exceptionally well-preserved, thanks to anaerobic waterlogged conditions. This site is currently under research as part of the ERC synergy EXPLO project, a collaboration of the universities of Bern, Thessaloniki and Oxford, designed to investigate human subsistence with the adoption of agriculture at lakeshore sites in south-east Europe. At the site of Ploča Mičov Grad, the remains of crops, fruits, nuts, and wild/weed plants are preserved in a dense cultural layer, in places up to 1.7-m thick. The organic remains have survived in a range of preservation states within the waterlogged layer, from uncharred to partially charred and fully charred forms. Here, we show how these different preservation types can each provide additional information regarding plant processing for consumption, adding greater detail to understandings of *chaînes opératoires* in food-making than may be possible with only one of these preservation forms.

IWGP22-0211 - The common and the rare: a review of Early Modern Dutch plant food consumption based on archaeobotanical urban cesspit data

Merit Hondelink¹, Mans Schepers²

¹*Groningen University, Archaeology, Groningen, Netherlands*

²*Groningen University, Landscape History, Groningen, Netherlands*

Past plant food consumption has been studied diachronically and spatially for many Dutch settlements. However, research into the plant food consumption of Early Modern Dutch inhabitants of urban settlements is somewhat underrepresented in the scientific archaeobotanical literature. To fill this knowledge gap, archaeobotanical data from cesspits dating to the period ad 1500–1850 contained in the Dutch Relational Archaeobotanical Database were analysed. First, edible plant taxa were distinguished from medicinal plants and potentially edible weeds. Then, seeds and fruits were distinguished from pollen. Finally, the remains were quantified to form an overview of the plant taxa consumed per urban settlement and, from there, to provide insight into regional and temporal changes in plant food availability and preferences. The combined archaeobotanical dataset, consisting of cesspit material from 51 cities, comprised 97 edible plant taxa. Surprisingly, 20 of these taxa are consistently present in 50–100% of all settlements in the 350 years under study. Based on the archaeobotanical finds from the cesspits, we conclude that the overall plant food consumption of Early Modern Dutch urban inhabitants does not seem to have changed very much over time.

IWGP22-0112 - An update on Late Iron Age and Medieval beer production in Denmark

Peter Mose Jensen¹, Mads Bakken Thastrup¹

¹*Moesgaard Museum, Department of Archaeological Science and Conservation, Aarhus, Denmark*

Archaeobotanical discussions of early beer production in Denmark have traditionally focused on the use of barley grain as basis for beer brewing and on the role of sweet gale (*Myrica gale*) and hops (*Humulus lupulus*) as beer additives. Studies have so far indicated a general transition from sweet gale to hops as the main beer additive in Denmark during the 14th to 15th centuries AD. Recent archaeobotanical studies, however, have now expanded upon the discussions about early Danish beer production. This presentation will therefore provide an updated overview of the topic, focusing on three recent archaeobotanical case studies going from Late Iron Age through to the Medieval period (8th – 15th century AD).

1. A house used for glass working activities from the early 8th century AD Ribe in southwestern Jutland that contained both hop and sweet gale. The hops from Ribe are an addition to a small number of other south Scandinavian pre-Viking Age hop finds.
2. Two pit houses from the 11th – 12th century AD in Herning in western Jutland, which contained large quantities of seeds and catkins from sweet gale and flowers and leaves from heather (*Calluna* sp.) This combination indicates that a part of the brewing process took place in the pit houses.
3. A burned down brewery from Odense city on the island of Funen from the late 14th- early 15th Century AD. The archaeobotanical investigations of the building revealed remains of hops and sweet gale as well as a carbonized wooden box containing about 23 liters of carbonized and partially malted barley and oat.

IWGP22-0263 - Cooking recipes as historical source between food production and consumption

*Helmut W. Klug*¹

¹*University of Graz, Centre for Information Modelling, Graz, Austria*

The handwritten tradition of German cooking recipe texts before 1500 comprises about 5000 recipes that were written down from 1350 onwards. The texts mirror the eating habits of the upper class from the 10th to the 17th century. In the international research project *CoReMA – Cooking Recipes of the Middle Ages*, these texts were transcribed for a digital research corpus of the entire recipe corpus. Cooking recipes represent a major source of culinary history. They convey firsthand how the staples produced in agriculture and imported via long-distance trade were processed into food. Cooking recipes document eating habits both in abstract form (as universal, basic recipe) and in temporal, regional and personal aspects (as individual renditions of a recipe). For the late medieval cooking recipe tradition, these data are available in the form of annotated ingredients and cooking tools, the provenance of the source manuscripts, the writing dialects, and the dates of origin. The individual recipes communicate certain eating habits, culinary preferences or combinations of ingredients. To some extent they also document social as well as diachronic change. In contrast to archaeological finds recipes communicate rather a theoretical approach towards foodstuffs. With the help of the data created in the *CoReMA* project, the presentation will focus on plant-based ingredients. The questions covered will include: What plants are named in the cooking recipes? What dishes are cooked with plants? How are these ingredients processed? What tools are used for processing? The presentation will on the one hand outline the text corpus as well as the potential the text type cooking recipe might provide for archaeological research. On the other, it will offer an overview of the food plants and their processing, but also a summary of the questions they raise.

IWGP22-0118 - Porridges and mushes in northwestern European Neolithic culinary tradition

Lucy Kubiak-Martens¹, Tania F.M. Oudemans², Dragana Filipovic³,
Wiebke Kirleis⁴

¹*BIAX Consult Biological Archaeology & Environmental Reconstruction, Zaandam, Netherlands*

²*Kenaz Consult & Laboratory, Kenaz Consult & Laboratory, Berlin, Germany*

³*Institut für Ur- und Frühgeschichte Christian-Albrechts-Universität, Kiel, Germany*

⁴*Institut für Ur- und Frühgeschichte- Christian-Albrechts-Universität, Kiel, Germany*

It is fascinating to be able to understand how, in prehistory, people prepared their daily meals. Food has multiple purposes. Next to satisfying hunger, it is one expression of cultural identity and often serves to strengthen social bonds between people, neighbors and distant groups. Food residues encrusted on pottery provide an excellent source of information about culinary tradition. They can tell how people prepared their everyday meals, what foods were cooked, and (in the most ideal cases) what pots were used for what kind of foods. The study of food crusts, however, is a complex matter and different techniques are usually combined to identify the use of prehistoric pottery. In this study, we focus on the combined approach of microscopic (SEM) and biomolecular (DTMS) analysis.

This paper presents the results of the study of charred food residues from two Middle-Late Neolithic sites: Den Haag-Steynhof in the Netherlands, associated with the Vlaarding culture and Oldenburg LA77 in Germany, associated with the Funnel Beaker culture. The sites concerned in this study share the chronological timespan of the north-western European prehistory but they represent different cultural traditions. In this presentation, we would like to see how differently, or perhaps similarly, people at both sites prepared their daily meals, and whether or not different cultural traditions are mirrored in their culinary practices.

IWGP22-0004 - The Archaeology of Contraception in the Greco-Roman World: An Archaeobotanical Case Study on Contraceptive Plant Use in Soranus' 'Gynaecology'

Melody Li¹

¹University of Oxford, Institute of Archaeology, Oxford, United Kingdom

When looking at what and how people cooked, brewed and consumed foods, we should also consider how to distinguish the medicinal uses of food plants. The food-medicine continuum which operated in Mediterranean antiquity (as well as in many other places, times, and cultures) is well known to scholars of ancient medical texts but often overlooked by archaeologists. One difficulty in distinguishing past plant use is the fact that food-processing methods often share similar tools, rials and ingredients to medicinal processing methods. Within medicine, an interesting example is a contraception. References to contraception and birth control appear in Greco-Roman medical texts and the majority of these ingredients are plants. Many of these contraceptive ingredients (pomegranate, fig) are also foods commonly retrieved from Mediterranean contexts. Androcentric knowledge structures critiqued by feminist theorists unintentionally linger in archaeological enquiry. In archaeobotany, this is reflected in the dominance of research into the origins of agriculture and subsistence studies. The 'sexed'/gendered use of plants may become overlooked, as research designs drive archaeologists to mostly interpret plants in terms of food, fuel, construction, and climate. This paper analyses the potential for developing a framework to interpret archaeobotanical evidence as expressions of contraceptive use in the Greco-Roman world. In a novel application of the crop-processing model developed for subsistence archaeobotany, this study produced a 'contraceptive processing model' by recreating five recipes from Soranus' Gynaecology (2nd century AD). The preliminary results show that some of these recipes generate characteristic by-products and macro-remains along the *chaînes opératoires*. Although a pilot study, the experimental analogues generated in this project are useful exercises to re-train our eyes in how we see and categorise plants. It calls to consider the medicinal aspects of past food processing and the potential to interpret archaeobotanical remains as expressions of contraceptive use. Perhaps desire, like hunger, also leaves archaeological traces.

IWGP22-0005 - The Taste of Tea: Examining Changes in Tea Preparation Methods Through Ceramics

Melody Li¹

¹University of Oxford, Institute of Archaeology, Oxford, United Kingdom

The smell, flavour, and taste of past food are often deemed too ephemeral and subjective to study and consequently ignored in archaeological study. The use of the tea plant (*Camellia sinensis*) however, and the practice of drinking tea is intimately tied with taste, smell and flavour. Historical sources and poems from the Tang Dynasty onwards celebrate the sensory experiences of drinking tea, and the relationship between tea-tasting and ceramic type has been noted in literature, both ancient and modern. This link between the tea plant, connoisseurship and ceramics provides a tantalising area of study for sensory archaeology and archaeobotany. Sensory archaeology is a theoretical approach that acknowledges the presence of senses in the past. It considers the role of embodied sensory experiences in relation to material objects and collective identity over time. There is a growing call to bring sensory epistemology into the very way we create archaeological research, but little formal research on Chinese assemblages from a sensory perspective exists. This paper examines tea-ware and tea preparation methods in China from the Tang – Ming dynasties (AD 618-1644), with a focus on Tang tea ware described by Lu Yu's (AD 733-804) *The Classic of Tea*. It situates archaeobotanical and ceramics studies within a sensory archaeological framework outlined by Hamilakis (2015), and advocates for archaeologists to re-conceptualise the notion of 'taste'. The physical properties of tea vessels cater to facilitating desired flavour preferences - they are vessels are designed to heat *Camellia sinensis* leaves to release their chemical components and consequently unleash taste. Although this paper focuses on a sensory approach to Chinese tea-ware, the framework provides food for thought for other vessels associated with cooking, brewing, serving and culinary use.

IWGP22-0026 - Exploring food transformation during the Bronze Age in northern Germany

Merle Oelbüttel¹, Wiebke Kirleis¹

¹Institute of Pre- and Protohistoric Archaeology, Collaborative Research Center 1266, Kiel, Germany

Archaeobotanical analyses have demonstrated that a wide spectrum of cultivated plants was used during the Younger Bronze Age in northern Germany, which lasted from the end of the 2nd until the mid-1st millennium BC. This spectrum included newly arrived crops such as broomcorn millet, faba bean and hulled barley, resulting in a broader crop spectrum than in the Neolithic or Early Bronze Age. As yet, there has been no research if and how these changes in the crop repertoire were reflected in the cuisine in northern Germany. Were the new crops included in meals? Were there new combinations of crop food ingredients? This poster presents an early stage of research about food and food preparation techniques in the Bronze Age of northern Germany by combining carpological studies with charred food remains morphology and anatomy using light and scanning electron microscopy. The poster shows an example of this inspired by a situation encountered at the Younger Bronze Age settlement of Dobbin 27 in northeastern Germany. Here, a whole ceramic pot was found in situ in a fireplace, with a large quantity of grains of hulled barley, broomcorn millet and emmer in it, perhaps representing remains of a single meal that accidentally burned. The initial phase of the project entails experimental work focused on processing and cooking of cereal grains (whole and ground to coarse and fine flour), as well as wild plant remains in controlled conditions. Subsequently, they are cooked to a mush and then exposed to controlled heat until charred in an attempt to build a reference collection as tool for identification of components of the archaeological finds of food. The experiment, and the 'meals' created within it, are presented and discussed here.

IWGP22-0062 - Early Neolithic plant economy: The grinding stones from Frydenlund, a Funnel Beaker site in Denmark

*Welmoed Out¹, Juan José García-Granero², Marianne H. Andreasen¹,
Wiebke Kirleis³, Niels Andersen⁴*

¹*Moesgaard Museum, Department of Archaeological Science and Conservation,
Højbjerg, Denmark*

²*IMF-CSIC Spanish National Research Council, Department of Archaeology and
Anthropology, Barcelona, Spain*

³*Kiel University, Institute for Pre- and Protohistory, Kiel, Germany*

⁴*Moesgaard Museum, Department of Archaeology, Højbjerg, Denmark*

In northern Europe, the Early Neolithic begins with the presence of people of the Funnel Beaker culture. Relevant archaeological sites are often characterized by the presence of megalithic monuments, pottery and domesticated plants and animals. Since then, both cultivated and collected plants were exploited, but the relative importance of crops *versus* wild plants is not clear. This contribution aims to shed more light on the role of crops and gathered plants by means of analysis of the grinding stones of the Early Neolithic site of Frydenlund in Denmark. Frydenlund, dating to 3635+/-5 BCE, is an archaeological site of the Funnel Beaker culture phase Ic. The site was excavated in 2009-2012 by Odense Bys Museer and Moesgaard Museum. The site consisted of two houses that were turned afterwards into specific grave monuments, barkær structures of the unchambered longbarrow type. The houses and grave monuments were in use during a period of five to ten years only (Andersen 2015, J. Olsen unpublished data). Earlier analysis of seeds and fruits have demonstrated the presence of crop plants and a large variety of wild plants, including e.g. emmer wheat, naked barley, durum wheat, hazel nut and lesser celandine (Andreasen 2017; Kirleis 2019). To investigate the plant economy at Frydenlund in further detail, fourteen grinding stones have been subjected to analysis of starch grains and phytoliths. Were all grinding stones used for plant processing? Which plant species have been processed using the grinding stones? Can this give further information on the relative importance of crops and wild plants in the farmers' daily live?

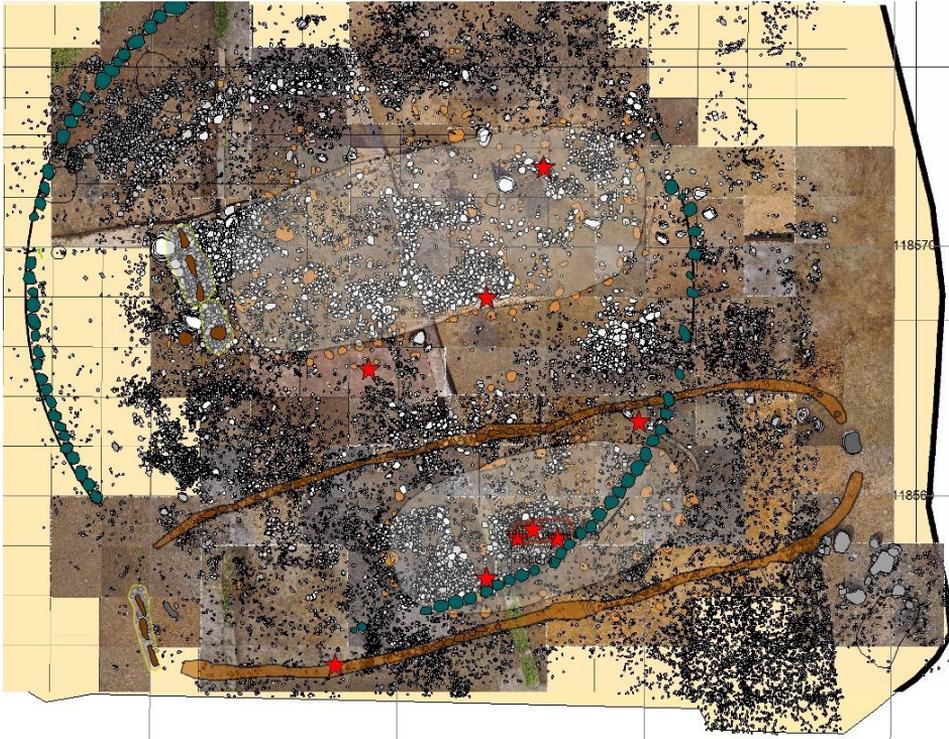


Figure: Frydenlund (figure: N. Andersen). The stars indicate finds of grinding stones.

IWGP22-0267 - Cereal dough production in Puglia during the Hellenistic age: a comparison of the literary sources and archaeobotanical data

Marianna Porta¹, Girolamo Fiorentino¹

¹University of Salento, Cultural Heritage, Lecce, Italy

We can make use of various informational tools for the archaeobotanical study of cereal food products in the historical age. Written sources are an important resource in reconstructing the various types of foods known and their production chains. However, for some historical periods the sources are incomplete or completely absent, as is the case for the Hellenistic period in southern Italy. In Puglia, the fourth and third centuries BC were a period of profound cultural change, which may also have had an impact on the knowledge, perception, and production of food. The research project aims to reconstruct the varieties and methods of cereal dough production in Puglia during the Hellenistic age, using a combination of literary sources and scientific sources, including microscopic and chemical data based on the archaeological remains. This paper presents the preliminary results of a study of the ancient Greek and Latin sources, covering a broad chronological span (VIII BC - X AD), that has allowed us to identify some varieties of products and production methods over time. The recipes selected were subjected to an initial phase of experimental reproduction with careful control of the parameters, carried out in collaboration with the Mulino Maggio farm, the project's business partner. A study of the cellular, starchy, and phytolytic components of modern and archaeological cereal food products will be carried out in collaboration with the CaSEs (Cultural and Socio-Ecological Dynamics Research Groups) of Pompeu Fabra University of Barcelona, to investigate how the microscopic components are transformed and conserved during their preparation.

IWGP22-0169 - Plant use in the platform chamber complex: A paleoethnobotanical approach to Structure 1 at Alto Pukara, Bolivia

*Caleb Ranum*¹

¹*University of Alabama, Department of Anthropology, Tuscaloosa, USA*

Located on the Taraco Peninsula on the shores of Lake Titicaca in the Bolivian Altiplano, Alto Pukara was a Middle Formative site inhabited between 800 and 400 BCE by the Chiripa peoples. Alto Pukara is the smallest site on the peninsula centered around its platform chamber complex consisting of two structures on a raised mound. This study investigated the plant foodways of the residents of Alto Pukara using paleoethnobotanical remains recovered from sediment samples recovered from 84 excavation loci. Results suggest that the local cuisine was primarily based on staples such as quinoa and tubers and that food was prepared using camelid dung that was burned to fuel cooking fires. Moreover, when compared to published data from paleoethnobotanical research conducted by Whitehead (2007) at the peninsula's preeminent site of Chiripa, this study found that the cuisine was very similar with a few exceptions. The locals inhabiting Alto Pukara, for example, made greater use of the newly domesticated oca (*Oxalis tuberosa* L.) than those in the main settlement of Chiripa. The study also identified two main activities that occurred at Structure 1 of Alto Pukara's Platform Chamber Complex: (1). Ritual feasting outside the structure on the raised platform and (2). Cooking of foods accompanied by additional ritual activities inside the structure. This reinforces evidence from Robin Beck's (2004) architectural analysis of the site that suggested Alto Pukara's platform chamber complex functioned as a location for ritual events that tied inhabitants of the site with their ancestors.

IWGP22-0092 - New evidence for food in the Late-Medieval Balkans: Archaeobotany of Venetian Houses at Butrint in southern Albania

Diego Sabato¹, Leonor Peña-Chocarro², David Hernández³

¹*Universitat de València, Departamento de Prehistoria- Arqueología e Historia Antigua, Valencia, Spain*

²*Instituto de Historia CSIC, GI Paleoconomía y Subsistencia de las Sociedades Preindustriales, Madrid, Spain*

³*University of Notre Dame, Department of Classics, Notre Dame, USA*

The Roman Forum Excavations (RFE) Project discovered three Venetian houses, dated from the 14th to the 16th century, at the site of Butrint, located on the coast of SW Albania. Inscribed as a UNESCO World Heritage Site in 1992, the city is among the most important archaeological sites in Albania, having evolved from a Greek emporium to a substantial Roman colony to a bishopric in the Middle Ages. The Republic of Venice acquired Butrint, together with Corfu, in 1386 and held them until the fall of the Republic in 1797. The Venetian houses are the first dwellings of the Late Medieval period to be excavated in this region and are among the few excavated in the Balkans. The larger, two-story house had been destroyed by fire in the first half of the 16th century, apparently connected with the sack of the city of 1537. Thereafter the Venetians abandoned the old city, but maintained a small outpost on the edge of the headland to defend the lucrative fisheries and the enclave from small-scale Ottoman attacks. The collapsed roof of the house sealed and preserved the contents of a vast quantity of plant macro remains including cereals, pulses, and other plants, of which the most abundant was naked wheat. The density distribution of the deposition suggests that foodstuffs were stored in the upper floor of the house, probably to keep them away from ground humidity. The presence of a wide range of vetches and vetchlings may be associated with cultural use. Indeed, baked products made with cereal-pulse maslins were common during the Middle Ages, and traditional uses of some of these crops remain locally attested in regions associated with Albanian culture. The analysis of this assemblage provides a new window into a period and territory rarely studied for its archaeobotany.

IWGP22-0156 - On the formation of millet aggregates in archaeological assemblages

Andrés Teira-Brión¹, Joeri Kaal²

¹University of Oxford, School of Archaeology, Oxford, United Kingdom

²Pyrolyscience, Pyrolyscience, Santiago de Compostela, Spain

Millet domestication had several centres in Asia and Africa, and then progressively expanded for millennia to Europe and other regions around the world. The benefits of millet crops in terms of climatic adaptability and resistance to adverse conditions facilitated the adoption of their cultivation among many diverse communities, making millet a key food source in the past. Grain aggregates are one of the most frequent remains in archaeological sites where these cereals are present. This type of archaeobotanical evidence has been interpreted as remains of food processing, thermal treatment and stored grains. However, few studies attempted to determine the origin of these assemblages by laboratory experiments and molecular characterization of the aggregates.

This work aims to understand the formation of millet aggregates through grain assemblages of *Panicum miliaceum* and *Setaria italica* found in archaeological sites, and their comparison with those obtained from controlled laboratory and open-fire experimentation. Preliminary results show that the aggregates have signs of complete carbonisation and would have been subjected to high temperatures, causing graphitisation. Any aggregation agents, such as tar or asphaltene components, were not detectable, either because it had not formed during heat treatment or posterior thermal alteration. These results allow us to interpret part of the documented aggregates with an origin in combustion processes from relatively small grain assemblages, and not necessarily related to food preparation. The conclusions of this work will provide an interpretative pathway for the archaeobotanical assemblages of millet.

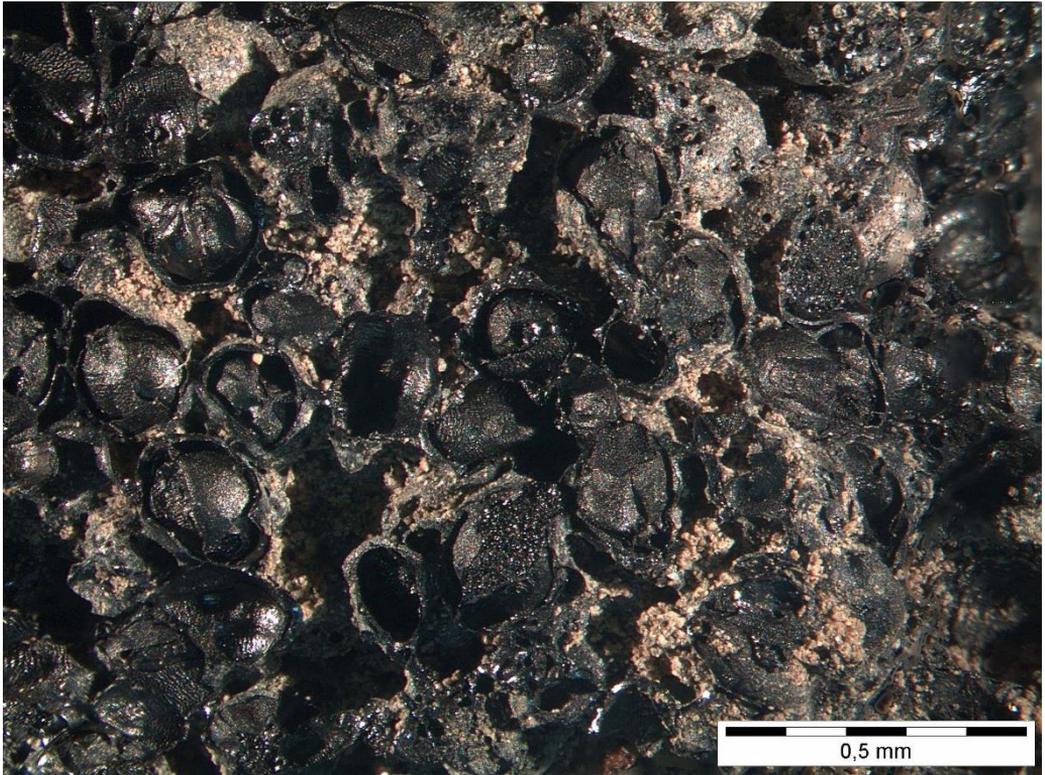


Figure: Aggregate of *Setaria italica* grains.

IWGP22-0189 - What's for meal? Food procurement and consumption in the 1st millennium Sikyon

Kyriaki Tsirtsis¹, Evi Margaritis¹, Juan José García-Granero², Silke Müh-Frederiksen³, Konstantinos Kissas⁴

¹*The Cyprus Institute, STARC, Nicosia, Cyprus*

²*Humane, IMF-Csic, Barcelona, Spain*

³*National Museum, of Denmark, Copenhagen, Denmark*

⁴*Hellenic Ministry of Culture, Ephorate of Antiquities of Arcadia, Tripoli, Greece*

Food procurement and storage, as well as cooking practices, reflect important daily activities and scheduling decisions, which can be deciphered through the study of archaeobotanical remains. This poster attempts to unfold snapshots of the daily life, and especially meal preparation and consumption activities, at the 1st millennium site of Sikyon, in southern Greece. Both macrobotanical (charred seeds and grains) and microbotanical (starch granules) remains are used to decode the agricultural and cooking activities that took place at this site. While macrobotanical remains have the potential to shed light on a wide range of human-plant interactions, from resource management and environmental impact to cultural modification of plant products and the plants themselves, starch granules are a source of information concerning plant use and human dietary behavior. As such, the interdisciplinary nature of the present study not only allows for the tracing of exploited plant resources, relationships between people and plants, and past day-to-day rural life during the 1st millennium in southern Greece, but also facilitates suggestions concerning cooking and consumption of foodstuff.

IWGP22-0261 - From field to fork: plant acquisition, preparation and consumption at Early Bronze Age Dhaskalio (Cyclades, Greece)

Kyriaki Tsirtsis¹, Juan José García-Granero^{2,3}, Özgür Cizer⁴, Carolyne Douché³, Cristina N. Patús², Evi Margaritis¹

¹*The Cyprus Institute, Science and Technology in Archaeology Research Center, Nicosia, Cyprus*

²*Spanish National Research Council, Institució Milà i Fontanals de Recerca en Humanitats, Barcelona, Spain*

³*University of Oxford, School of Archaeology, Oxford, United Kingdom*

⁴*Universität Tübingen, Early Prehistory & Quaternary Ecology, Tübingen, Germany*

The Early Bronze Age site of Dhaskalio is located on an islet off the west coast of the today-uninhabited island of Keros (Cyclades, Greece), the site of the world's earliest maritime sanctuary (in use from ca. 2750 to 2250 BCE). Keros has become very well known in recent years for the complex of sites at its western end. Beyond the eye-catching and unusual ritual activities at the sanctuary, recent excavations have uncovered remains of a large building complex that in some senses foreshadows the processes of urbanisation beginning in immediately subsequent centuries in Crete and later elsewhere in the Aegean. At Dhaskalio, amongst impressive findings concerning monumentality or craft production, thus far a 'signature' for domestic activities is proving surprisingly elusive. By examining the evidence for agricultural regimes of the Early Bronze Age Cyclades this study will explore the role of evolving subsistence strategies supporting the investment of people and infrastructure on Keros, and try to determine the agricultural economy of this unusual site in its wider network both on Keros and in the wider Cyclades, asking what specific changes in agricultural practice supported the rapid expansion of the proto-urban settlement on Dhaskalio. This study will also explore how the inhabitants of Dhaskalio acquired plants foods, with evidence of both local crop production and importation, how they processed them and how they consumed them through the integrated analysis of macrobotanical remains from domestic contexts and microbotanical remains from food-related artefacts conducted within the framework of the URBAN project, funded by the Research and Innovation Foundation of Cyprus. The results will contribute to an evolving debate about agricultural change and specialization during the mid-third millennium in Greece.

IWGP22-0242 - Early and high medieval fireplaces and oven constructions in Brittany, western France: structures for drying the cereal harvest?

Julian Wiethold¹, Charlotte Hallavant²

¹*Institut national de recherches archéologiques préventives Inrap, Inrap Grand Est-
Laboratoire archéobotanique, Metz cedex 2, France*

²*Hadès - Buero d'investigations archéologiques, Laboratoire archéobotanique, F-31240
L'Union, France*

Longitudinal-shaped oven constructions are between the most common, but also most enigmatic archaeological structures discovered in early and high medieval settlements (7th to 11th/12th c. AD) of the coastal areas of Brittany, western France. These fireplaces are commonly situated in the settlement area, but others are isolated or in distance from the settlements. Some excavations have revealed important numbers of these features. Typical features of the excavated oven structures is a longitudinal pit up to 2 m long with only slight reddish traces of burnt loam or clay at its walls, commonly interpreted as a burning chamber accompanied in some cases by faint traces of a fire-channel to submit the combustion material and manipulate the fire. The filling is characterized by varying sandy to loamy sediments intercalated with layers rich in charcoal and high amounts of carbonized cereals, especially oats (*Avena sativa*, *Avena strigosa*) and rye, but some have also revealed naked wheat and hulled barley. Within the last 15 years several of these oven-fillings have been studied by archaeobotanical analysis, revealing important spectra of cereals witnessing local oat and rye cultivation on the poor, acid and often loamy or sandy soils of Brittany. These corn-drying ovens seem to be an agricultural installation so far limited to early to high medieval settlements of western France, in regions with frequent rainfalls and relatively mild winters.

Here we present some emblematic examples of these structures and the archaeobotanical results giving evidence of regularly practiced cereal processing in medieval settlements of Brittany. The accompanying weed spectra are suggesting a local winter cereal cultivation of rye and naked wheat, while oat and barley can have been either summer or winter crops. The corn-drying structures are suggesting a drying process with an oven chamber probably covered by flat stones on which the harvest was placed.

Topic 1.2. Wild plant use among foragers and farmers

IWGP22-0184 - Plant exploitation and paleoclimate at two Natufian sites in Mount Carmel, Israel: The contribution of charred wood and seeds

Chiara Belli¹, Valentina Caracuta², Dani Nadel³, Elisabetta Boaretto⁴, Reuven Yeshurun⁵, Mina Weinstein-Evron⁵

¹*University of Haifa, Zinman Institute of Archaeology, Haifa, Israel*

²*University of Montpellier, Institute des Sciences de l'Évolution de Montpellier, Montpellier, France*

³*University of Haifa, The Zinman Institute of Archaeology, Haifa, Israel*

⁴*Weizmann Institute of Science, Kimmel Center for Archaeological Science, Rehovot, Israel*

⁵*University of Haifa, The Zinman Institute of Archaeology, Haifa, Israel*

Mount Carmel was the heartland of the Natufian culture (ca. 15,000–11,500 cal BP), comprising the first sedentary hunter-gatherers, before the onset of the Neolithic lifeways. The Natufians were innovative in many fundamental ways, using stone for constructing dwellings, burying their dead in dense graveyards, and producing a wide variety of decorative and art objects; their economy focused on hunting gazelles, as well as on a wider than ever variety of small animals. Although the Natufian is studied for about 100 years, two crucial issues are still hotly debated in the literature and are addressed here: the scale of local climatic fluctuations and plant exploitation by the Natufians. Both are discussed by studying the anthracological and carpological remains from two Natufian sites in Mount Carmel. The largest of the two is el-Wad Terrace, with a sequence covering the Early and Late Natufian, and a particularly rich array of stone features and material remains. The second is Raqefet Cave, a burial site during the Late Natufian. The macro-botanical remains from both sites provide environmental details as well as evidence of local plant exploitation. The paper presents the relevant detailed and ¹⁴C-dated floral assemblages (including specimens of almond, oak, and wild progenitors of pulses) from the two sites and discusses their contribution to the issues of local climate fluctuations and plant use by the Mount Carmel Natufians.

IWGP22-0150 - Wood-supply, food consumption and landscape at Barcino (Barcelona, NE-Iberia): archaeobotanical evidence from the Wall proximities to approach the city-environment relationships

Sabrina Bianco^{1,2}, *Llorenç Picornell-Gelabert*³, *Oriol López Bultó*⁴, *Ethel Allué*^{1,5}, *Santiago Riera Mora*⁶

¹*Catalan Institute of Human Paleoeology and Social Evolution IPHES-CERCA, Archaeobotany, Tarragona, Spain*

²*University of Barcelona UB, Faculty of Geography and History, Barcelona, Spain*

³*University of the Balearic Islands - ArqueoUIB research group, Department of Historical Sciences and Theory of the Arts, Palma de Mallorca, Spain*

⁴*Autonomous University of Barcelona UAB, Department of Prehistory, Bellaterra-Barcelona, Spain*

⁵*University Rovira and Virgili URV, Department of History and Art History, Tarragona, Spain*

⁶*University of Barcelona UB - SERP research group, Faculty of Geography and History, Barcelona, Spain*

Plant-based raw materials as wood or seeds/fruits were fundamental to the economy of settlements in antiquity, as they provided construction material, timber, fuel and food.

In particular, in a Roman city there were many activities and facilities that required fuel according to a recurrent use of fire: from domestic heating and kitchens, to the widespread *thermae*, as well as several workshops (i.e. pottery, metallurgical and glass productions), bakeries or other food processing installations. Moreover, food plants such as cereals, pulses, fruits, nuts and condiments were the base of the diet and the Roman cuisine, so they were critical resources for the reproduction of the urban model. Accordingly, archaeobotanical remains of such fuel, timber or food not only reflect the past resources availability in a given environment, but also a precise socio-economic and cultural background, made of choices, practices and specific preferences which led to modify the surrounding landscape. On this line, the aim of this work is to spread light on the land use and the level of anthropization of woodlands around the Roman colony of *Barcino* (Barcelona), founded at around 10 BCE in the northeast of *Hispania Citerior* region. This research is based on a multi-proxy analysis of micro and macro archaeobotanical remains (pollen, charcoals, seeds/fruits) sampled in different sites in proximity of the city wall perimeter, especially moat contexts. The material studied resulted from the archaeobotanical samplings performed in commercial and rescue excavations carried out throughout the last decade in the city of Barcelona. These valuable results constitute the backbone of the first systematic study on wood fuel use,



food consumption and land management in Roman times in Barcelona. Furthermore, this study provides relevant data to build the history of the landscape of the Barcelona plain and its changes through time.

IWGP22-0024 - Getting to the Root of the Problem: On the importance of plant root foods in Mesolithic hunter-gatherer subsistence in Europe

Rosie Bishop¹, Lucy Kubiak-Martens², Graeme Warren³, Mike Church⁴

¹*Arkeologisk Museum, Universitetet i Stavanger, Stavanger, Norway*

²*Biax Consult, Biological Archaeology & Landscape Reconstruction, Zaandam, Netherlands*

³*School of Archaeology, University College Dublin, Dublin, Ireland*

⁴*Department of Archaeology, Durham University, Durham, United Kingdom*

Carbohydrate consumption in hunter-gatherer societies has been much debated, with dietary estimates from studies of modern hunter-gatherers used as a reference standard for modern human nutrition. However, relatively little is known about the role of carbohydrates in past hunter-gatherer diets in temperate Europe because farming has been the main mode of subsistence since early prehistory. Plant roots and rhizomes provide a major source of carbohydrates and archaeological evidence indicates that these resources were gathered, perhaps routinely for food by Mesolithic hunter-gatherers in Europe. This paper presents new evidence for the harvesting of edible plant roots at Northton, a Mesolithic hunter-gatherer site located in the Western Isles of Scotland, in the north-west corner of Europe. The excavations at Northton uncovered abundant remains of Lesser Celandine root tubers and produced the first evidence for the use of Bitter-Vetch tubers at a hunter-gatherer site in Europe. In this presentation we report on the analysis of the root and rhizome remains and other plant macrofossils from the site, present new food composition data showing the significance of roots and rhizomes as a source of carbohydrate and energy for hunter-gatherers in Europe and consider the significance of plant root foods within European hunter-gatherer subsistence.

IWGP22-0246 - Macchia, acorns and crops: daily life and diet in Corsica. Recent archaeobotanical data from Neolithic to Iron Age (5700-200 BCE)

*Thomas Camagney¹, Laurent Bouby², Daniele Arobba³, Isabel Figueiral⁴,
Lucie Martin⁵, Vanessa Py⁶, H el ene Paolini-Saez⁷, Kewin P eche-Quilichini⁸,
Thomas Perrin⁹, Pascal Tramoni¹⁰, Delhon Claire¹*

¹Universit e C te d'Azur- CNRS, Cultures et Environnements Pr histoire- Antiquit -
Moyen  ge CEPAM, Nice, France

²Universit  de Montpellier- CNRS, Institut des Sciences de l'Evolution ISEM, Montpellier,
France

³Istituto Internazionale di Studi Liguri, Museo Archeologico del Finale, Finale, Italy

⁴Universit  de Montpellier- CNRS- Inrap, Institut des Sciences de l'Evolution ISEM,
Montpellier, France

⁵Universit  de Gen ve/Universit  Savoie-Mont Blanc- CNRS, Laboratoire d'arch ologie
pr historique et anthropologie/Environnements- Dynamiques- Territoires et Montagnes
Edytem, Gen ve/Chamb ry, Switzerland

⁶Universit  de Toulouse Jean Jaur s- CNRS, G ographie de l'Environnement GEODE-
LABEX DRIIHM, Toulouse, France

⁷Laboratoire R gional d'Arch ologie/Universit  de Toulouse, Travaux et recherches
arch ologiques sur les cultures- les espaces et les soci t s TRACES, Ajaccio/Toulouse,
France

⁸Universit  de Montpellier- CNRS/Collectivit  de Corse, Arch ologie des Soci t s
M diterran ennes ASM- MCC/Mus e de l'Alta Rocca, Montpellier/Levie, France

⁹Universit  de Toulouse Jean Jaur s- CNRS, Travaux et recherches arch ologiques sur les
cultures- les espaces et les soci t s TRACES, Toulouse, France

¹⁰Inrap M diterran e/Universit  de Montpellier- CNRS, Arch ologies des Sciences
M diterran enne, Lattes, France

Corsica was occasionally inhabited during the 9th-7th millennia BC, but the human presence only became permanent during the Early Neolithic, with the arrival of the first farming populations (5700 BCE). These communities were obliged to interact with an insular ecosystem differing from those of the mainland and characterized by a high rate of endemism. The island presents a great diversity of landscapes, due to its geology and particular relief; this provides a great variety of resources but may also impose constraints on farming practices. Even though pollen records document the Holocene evolution of the vegetation, the exploitation of vegetal resources by pre- and protohistoric agro-pastoral communities was poorly documented until recently. Archaeobotanical studies in Corsica remained largely sporadic and unpublished for a long time; however, the recent dynamic in archaeological fieldwork led to the multiplication of anthracological and carpological studies. Beside a synthesis of available data, we

propose a focus on four recently studied sites, distributed throughout the island, and dated between the Early Neolithic and the Iron Age (5700-200 BCE). These studies show that human communities frequented diverse biotopes and point to strategies in plant food management based on a range of resources, including cereals, pulses and wild fruits, especially oak acorns. The current renewal of data highlights a balance between forest and crop resources and leads us to question the link between the changes in plant resources management and social mutations or technological improvements. Our knowledge about the evolution of subsistence systems with intensified Mediterranean cultural influences during Bronze and Iron Ages, and more specifically new agrarian practices imported over a long period, needs to be improved. In addition, the impact of human activities on the natural vegetation and the setting, the appearance and development of the Corsican macchia needs to be better assessed understood.

IWGP22-0103 - Archaeobotany as heritage in Lolcura: past wild plant gathering in today's highly fragmented ecosystem (Southern Chile)

Constanza Roa Solís¹, Aylen Capparelli²

¹Facultad de Ciencias Naturales y Museo, División Arqueología, La Plata, Argentina

²CONICET-Facultad de Ciencias Naturales y Museo, División Arqueología, La Plata, Argentina

Los Catalanes cave or *Lolcura* (S 37° 48', W 72° 29', 130 masl) is located in the Renaico basin in *Collipulli* municipality (Araucanía district, Southern Chile). Nowadays, the forestry industry (mainly pine and eucalyptus plantations) is the principal cause of landscape deterioration, to the detriment of the Sclerophyll/Temperate forest that forms patches of vegetation associated with ravines and mountains. This region is also the land of *Mapuche* people, the descendants of the Native Americans who inhabited this area before the Spanish arrival (ca. AD 1540). They called it *Gulumapu*: the “*Mapuche* country” between the Pacific ocean and the Andes mountain range. The strong relationship between *Mapuche* people and the environment remains clear in several aspects of their lives. For instance, the *Mapuche* concept of *Mahuida* (mountain, forest) refers to the procurement area of wild plant resources. Today *Mapuche* people use intensively crops such as bread wheat, which is an essential plant in their economy; however, they also profit from wild plants from the forest, either for food, medicine, handcraft, or construction. During the excavation of the cave, we developed a sampling program including anthracological, phytolith, starch grain, and carpological analyses. Here we present the results of the latter. The carpological record shows the uses of different plant taxa in the last 2000 years. We will focus on the use of trees such as *peumo* (*Cryptocarya alba*) and *maqui* (*Aristotelia chilensis*), as well as herbs such as *madi* (*Madia sativa*) and grasses (Poaceae). We discuss the results according to the *Mapuche* traditional botanical knowledge, compiled by missionaries and naturalists, and the local ecological knowledge of the *Mapuche* communities living around the cave. From the archaeobotanical record, we can value the uses of the forest in the past and the importance of generating laws for bio-cultural-diversity preservation.

IWGP22-0124 - Offering into sacred waters: evidence from seeds/fruits, woods/charcoals and pollen

Eleonora Clò¹, Alessandra Benatti¹, Elisabetta Castiglioni², Mauro Cremaschi³, Assunta Florenzano¹, Marta Mazzanti¹, Anna Maria Mercuri¹, Maria Chiara Montecchi⁴, Barbara Proserpio^{2,5}, Rossella Rinaldi¹, Mauro Rottoli², Paola Torri¹, Andrea Zerboni³, Giovanna Bosi¹

¹Laboratory of Palynology and Palaeobotany - University of Modena and Reggio Emilia, Department of Life Science, Modena, Italy

²AR.CO, Cooperativa di Ricerche Archeobiologiche, Como, Italy

³University of Milan, Department of Earth Sciences "A. Desio", Milano, Italy

⁴Gallerie Estensi, Ministero della Cultura, Modena, Italy

⁵PrECLab - University of Milan, Department of Cultural and Environmental Heritage, Milano, Italy

The Noceto Vasca Votiva is a wooden structure of the 15th century BC located in the Central Po Plain near Parma (N-Italy). The tank was built from the Middle Bronze Age inhabitants (Terramare culture) of the local settlement likely for religious purpose. It was filled with water, thus favoring waterlogged anoxic conditions that allow the preservation of the structure and other organic materials. The wide range of remains are generally link with a ritual role involving agrarian and water cult. Cereals (*Hordeum vulgare*, *Triticum monococcum*, *T. diccoccum*, *T. timopheevii*, *T. aestivum/durum*, *Secale cereale* and *Panicum miliaceum*) seem to have a predominant role in rites. The copious chaff remains, and pollen cluster suggest the deposition of whole spikelets. On the other hand, legumes are practically absent. The abundant macroremains of *Vitis vinifera*, with ubiquitous pollen, and *Cornus mas* are both partially charred. The analysis also shows the presence of other "fruit", such as *Corylus avellana*, *Juglans regia*, *Rubus fruticosus*, *Fragaria vesca/viridis*, *Sorbus/Pyrus* (documented also from Non-Pollen Palynomorphs by the occurrence of brachysclereids), ... potentially involved as offerings. The peculiar feature of this context is the presence of pollen of many entomophilous species, which are testified also by seeds/fruits. Abundance and diversity of these remains suggest that beautiful and smelling flowers were placed inside the structure during votive practices. There is also evidence of aromatic plants, such as *Anethum graveolens*, *Apium graveolens*, and *Melissa officinalis*. The analyses of woods and charcoals (mostly *Quercus* deciduous) also enrich the ethnobotanical information provided by this monument as a rich archive of organic material and botanical remains useful to outline and clarify different aspects of human behavior.

IWGP22-0066 - Late Pleistocene to Holocene archaeobotanical records from Liang Jon, East Kalimantan, Indonesian Borneo

India Ella Dilkes-Hall¹

¹University of Western Australia, Archaeology- School of Social Sciences, Perth, Australia

Despite its archaeological and geographical strategic importance to trace human evolution and migration, Borneo's prehistory is not well understood. Although recent research indicates that present day Borneo rainforests may be the product of a deep history of ecological dynamics, related to both natural (e.g. climate change) and cultural factors (e.g. human influence on forests through time), this and other archaeobotanical interpretations are built almost solely on evidence from one archaeological site, Niah Cave, located in Malaysian Borneo. In the limestone karst systems of Sangkulirang-Mangkalihat Peninsula (SMP), East Kalimantan, a province of Indonesian Borneo, the world's oldest known rockart exists with images dating to at least ~40,000 years old. In 2019, archaeological excavations were conducted at Liang Jon, a limestone rockshelter located in this region. Excavations revealed a rich cultural sequence covering the period from around 16,700 calibrated radiocarbon years before present (16.7 kyr cal BP) until the late Holocene—a time of dynamic environmental, social, and economic change throughout Island Southeast Asia.

This presentation presents preliminary results on the analysis of the extraordinary archaeobotanical record recovered from Liang Jon. Information on diet, subsistence strategies, plant processing techniques, seasonality, and changes in plant use over time help to create a better understanding of localised paleoethnobotanical practices and environmental conditions and how these may fit into broader regional patterns of rainforest plant use in Borneo in the past.

IWGP22-0120 - Reconsidering the Broad Spectrum Revolution: Insights from Madjedbebe rockshelter, northern Australia

***Anna Florin**^{1,2,3}, **Andrew Fairbairn**^{2,4,5}, **May Nango**⁶, **Djaykuk Djandjomerr**⁶,
Chris Clarkson^{2,4,5,7}*

¹*St John's College, St John's College, Cambridge, United Kingdom*

²*University of Wollongong, Australian Research Council Centre of Excellence for Australian Biodiversity and Heritage, Wollongong, Australia*

³*University of Cambridge, McDonald Institute for Archaeological Research, Cambridge, United Kingdom*

⁴*University of Queensland, School of Social Science, Brisbane, Australia*

⁵*Max Planck Institute for the Science of Human History, Department of Archaeology, Jena, Germany*

⁶*Gundjehmi Aboriginal Corporation, Gundjehmi Aboriginal Corporation, Jabiru, Australia*

⁷*University of Wollongong, Centre for Archaeological Science, Wollongong, Australia*

A broad spectrum diet, including the exploitation of a wide variety of wild plant foods, has historically been considered a pre-cursor to the origins of agriculture. However, increasing evidence globally points to the use of a range of plant foods, including seeds and underground storage organs, by Pleistocene humans and their closest ancestors. At Madjedbebe, a rockshelter in northern Australia, early occupation by ~65 kya is associated with the use of a diverse diet of fruits, nuts, seeds, palm and underground storage organs, and evidence for intensive plant processing and associated technologies. This presentation considers this early diet and its change over time in response to changing environment and demography. This included a broadening of the diet during drier glacial stages, as well as changes in the seasonal round and incorporation of new foods with the formation of freshwater wetlands following sea level rise in the late Holocene. However, the foundations of the economy evidenced at Madjedbebe, including seasonal mobility, a broad diet and requisite plant processing and grinding technologies, were maintained through time. The exploitation of a broad spectrum plant diet is, therefore, likely an older foraging strategy than once hypothesised, and a key component of the resilient economic system evidenced at Madjedbebe, allowing for cultural continuity in the face of pronounced environmental change.

IWGP22-0042 - Use of red elderberry fruits in the Jomon period

Nodoka Hiraoka¹, Hiroo Nasu², Akihiro Kaneko³

¹Okayama University of Science, Graduate School of Biosphere-Geosphere Science,
Okayama, Japan

²Okayama University of Science, Center for Fundamental Education, Okayama, Japan

³Okayama University of Science, Research Institute of Viticulture and Enology,
Okayama, Japan

Red elderberry (*Sambucus racemosa*) is considered one of highly used plants in the Jomon period resulting from frequent findings of the stones at many sites. The fruits and stones contain cyanide-producing glycosides rendering them toxic. Red elderberry brewing has been argued from the excavations at Sannaimaruyama and Ikenai site where huge layers of red elderberry stones and masses of seeds mainly consisting of red elderberry covered by stem-like plant remains were found, although it is questionable whether alcoholic beverages made from fruits existed in the period or not. At this point, the use of red elderberry in the Jomon period is still enigmatic. In this study, we 1) experimented the possibility of red elderberry brewing with other fruits, based on the ratio of fruits excavated at Ikenai site, 2) investigated contexts and status of excavated red elderberries from the archaeobotanical database in Japan, 3) collected ethnological cases of worldwide elderberry use, 4) measured nutritional values of modern fruits of *S. racemosa* subsp. *kamtschatica*. As a result, 1) elderberry produced only less than 1% of alcohol due to its low sugar content, 2) high percentage of charred stones were found from houses, hearths, and pits, and charred red elderberry stones adhered on the inner surface of pottery shards were also found. 3) Native American cooked red elderberry fruits for detoxification before consumption and storage, 4) the fruits contained relatively high levels of vitamin C and E. These results suggest that like North American and European ethnographic sources, red elderberry fruits may also have been used by the Jomon people for medicinal purposes or stored food as a rich source of vitamins by cooking. At least, it can be assumed that red elderberry in the Jomon period had multiple uses aside from brewing.

IWGP22-0178 - Cultivating and foraging – land- and plant-use during the Nok culture in central Nigeria, 1500-1 BCE

Alexa Höhn¹, Louis Champion², Julie Dunne³, Katharina Neumann¹

¹Goethe-Universität, Archäologie und Archäobotanik Afrikas, Frankfurt am Main, Germany

²University of Geneva, Department of Genetics and Evolution- Anthropology Unit, Geneva, Switzerland

³University of Bristol, Organic Geochemistry Unit- School of Chemistry, Bristol, United Kingdom

The exploitation of wild plant food resources is an essential part of traditional West African farming systems and is still extremely important in rural communities today. A high diversity of plant species are exploited for their edible parts, whether cooked or raw, providing valuable vitamins and minerals, enhancing the consumption of starchy staples and, in some cases, even substituting animal fats largely. The Nok culture, known for its eponymous terracotta figures, is one of the early plant cultivating groups, where the combination of foraging and farming is archaeobotanically evidenced. The Nok people occupied the savanna-forest ecotone from c. 1500 BCE, introducing pearl millet (*Cenchrus americanus*), domesticated earlier in the arid northern grass-dominated savannas, into the more southern woodlands of central Nigeria. Archaeological and archaeobotanical evidence attest to a lifestyle combining foraging for fruits and leaves, bee products and hunting with the cultivation of at least two crops, pearl millet and cowpea (*Vigna unguiculata*). Organic residue analysis (ORA) of over 450 vessels revealed complex lipid distributions denoting the processing of various plant types, including leafy vegetables. Lipid evidence for plant oils, as produced by *Canarium* fruits (*Canarium schweinfurthii*), is absent from the pots, but ubiquitously present in the macro-botanical record, which might indicate the raw consumption of these tree fruits. Suberin, also attested by ORA, points to the exploitation of foraged bark, used as condiments, tea or medicine, but could also derive from the preparation of tubers such as (unpeeled) yams, a natural resource of the region, still cultivated there today. Thus, unequivocal proof of yam processing remains elusive, and whether it was foraged, tended or cultivated is equally unresolved.

IWGP22-0040 - Contribution of wild and domesticated plants to subsistence: A multiproxy investigation of Neolithic and Kerma period diet at Kadruka, Sudan

Charles Le Moyne¹, Alison Crowther¹, Patrick Roberts², Maddy Bleasdale³, Jocelyne Desideri⁴, Quan Hua⁵, Nicole Boivin²

¹*The University of Queensland, School of Social Sciences, St Lucia, Australia*

²*Max Planck Institute for the Science of Human History MPI-SHH, Archaeology, Jena, Germany*

³*University of York, Department of Archaeology, York, United Kingdom*

⁴*Université de Genève, Département de Génétique & Evolution, Genève, Switzerland*

⁵*Australia Nuclear Science and Technology Organisation ANSTO, Centre for Accelerator Science, Lucas Heights, Australia*

Despite recent advances, the intricacies of plant exploitation amongst Early and Middle Holocene populations in the Middle Nile Valley of northeastern Africa remains relatively unknown. This gap in our understanding concerning the trajectory of subsistence systems is largely attributable to interrelated issues of preservation as well as the inadequate application of systematic archaeobotanical recovery techniques within the region. Consequently, it is currently unclear whether rare finds of Near Eastern domesticated cereals reported from funerary contexts reflect local small-scale farming or purely reflect the consumption and symbolic display of trade commodities by emergent hierarchies during the Neolithic. Barley chaff previously reported from graves at Kadruka 1 in Upper Nubia is often cited within archaeological discourses debating the nature of early food production systems within the Middle Nile. This paper presents new findings from analyses of human dental calculus and dietary isotopes from Kadruka 1 and Kadruka 21 that contextualise the previously reported domesticated cereals. Results demonstrate the consumption of hydrophytic Panicoid grasses and suggest a limited subsistence role for domesticated cereal crops at Kadruka during the Neolithic.

IWGP22-0125 - Wild Britain: the use of wild plant resources by the first farming societies

*Ines Lopez-Doriga*¹

¹*Wessex Archaeology, Environmental Archaeology, Salisbury, United Kingdom*

This paper reviews the archaeobotanical evidence for the exploitation of wild plant resources from archaeological sites in England and Wales recently investigated by Wessex Archaeology, including some Early Neolithic sites with the oldest directly dated cereals in Britain (first half of 4th millennium cal BC). Charred plant remain evidence from a range of sites dating from the Neolithic to the Bronze Age, comprising domesticates and a diversity of wild plant remains, point to the complementary role of both types of resources in British early agricultural societies. The role of hazelnuts is often the object of debate in this type of context, with ongoing discussions on the potential overrepresentation of nutshell fragments in the charred archaeobotanical record. Experimental approaches to study the taphonomy of hazelnut remains are employed to enhance the understanding of specific formation processes underlying the shell fragment assemblages. The potential use by prehistoric societies of less-frequently documented wild plant resources is investigated reviewing the archaeobotanical and ethnobotanical information.

IWGP22-0268 - Ethnobotanical knowledge and plant use among traditional farmers around the Niokolo-Koba National Park, Senegal

Tereza Majerovičová^{1,4}, *Idrissa Manka*², *Miguel Ballesteros*³, *Jiří Bumerl*^{1,4},
*Jan Novák*¹, *Ladislav Šmejda*⁵, *Alioune Deme*², *Jaromír Beneš*^{1,4}

¹University of South Bohemia, Laboratory of Archaeobotany and Palaeoecology,
Institute of Archaeology, České Budějovice, Czech Republic

²Université Cheikh Anta Diop de Dakar, Département d'Histoire- Faculté des Lettres et
Sciences Humaines, Dakar, Senegal

³University of South Bohemia, Department of Botany, Faculty of Science, České
Budějovice, Czech Republic

⁴ University of South Bohemia, Institute of Archaeology, České Budějovice, Czech
Republic

⁵University of West Bohemia, Department of Anthropology- Faculty of Arts, Plzeň, Czech
Republic

Traditional agricultural societies maintain an inseparable sociocultural bond with local plant resources. Here we studied this relationship in villages around the Niokolo-Koba National Park in Senegal. The founding of the park in 1954 caused the abandonment of 18 villages that were relocated outside of the protected area. The inhabitants were displaced either to newly established villages or to old traditional villages. In this context, we aimed to determine the cultural importance of plant species for inhabitants' livelihoods. We used available literature and field interviews to elaborate a catalogue of useful species, attributing local names used by different ethnic groups to their scientific nomenclature, determining plant use and whether neighbouring inhabitants depend on the park for the collection of some species. Among the species considered, woody species such as *Adansonia digitata*, *Ceiba pentandra* and *Kaya senegalensis* showed as cultural keystone species for food, medicine, architecture, and ritual use. Despite villages are self-sufficient due to their traditional agricultural practices and newly established villages benefit from better connections to road networks for goods supply, inhabitants still rely on wild plant resources occurring in the Park to fully address their socio-cultural needs. Understanding the importance of livelihood-relevant plant species is key for the preservation of traditional knowledge in highly diverse but rapidly changing societies in West Africa.



Figure: Use of different wood species in living village Badon, Senegal

IWGP22-0210 - Ritual use of tree in animistic religion in surrounding villages of Niokolo Koba National Park, Senegal

Idrissa Manka^{1,2}, *Tereza Majerovičová*^{3,4}, *Alioune Deme*^{1,2}, *Jaromír Beneš*^{3,4}, *Ladislav Šmejda*^{5,6}, *Jan Novák*⁴

¹*Department d’Histoire, Faculté des Lettres et Sciences Humaines, Université Cheikh Anta Diop, BP 5005- Dakar Fann- Sénégal,*

²*Unité de Recherche en Ingénierie Culturelle et en Anthropologie URICA- Ecole Doctorale Etudes sur l’Homme et la Société ED-ETHOS- Université Cheikh Anta Diop- BP 5005- Dakar Fann- Sénégal, Archaeology, Dakar, Sénégal*

³ *University of South Bohemia, Institute of Archaeology, Branišovská 31, České Budějovice, Czech Republic,* ⁴*Laboratory of Archaeobotany and Palaeoecology, Faculty of Science, University of South Bohemia- Na Zlaté stoce 3, České Budějovice-Czech Republic*

⁵*Department of Spatial Sciences- Faculty of Environmental Sciences- Czech University of Life Sciences Prague, Czech Republic*

⁶*Department of Anthropology, Faculty of Arts, University of West Bohemia, Plzeň, Czech Republic*

Created in 1954, the Niokolo Koba National Park (south-eastern Senegal) represents the symbol of biodiversity in Senegal. It shelters the majority of the plant species of the Sudano-Sahelian savannas. Nowadays the park is surrounded by several hundred villages whose population maintains a relationship with the vegetation inside the park. Some of these bonds are shaped by totemic beliefs and practices. Indeed, despite the influence of Islam, Christianity or Modernisation, human population continue to adhere to traditional beliefs. Local inhabitants give a sacred character to certain plants and animals seen as intermediaries between people and the supernatural world. These natural mediators are called “dialan” in the Mandinka language. The word dialan means fetish and comes from the name of the tree *Khaya senegalensis*, “diala” in Mandinka. Moreover, not all plant species are chosen as a ritual tree. The choice of the “dialan” tree depends not only on its shape and size, but above all, it should be considered as a residence of “djins” or occult forces. In some villages, the local populations venerate this plant as a divinity. Thus to solve a social problem, it is quite frequent for them to request help from the “dialan”, to which a great feeling of respect and consideration is dedicated. The solicitation of “dialan” necessarily involves sacrifices, rituals or sometimes simple incantations. In this study, our objective is to show what is totemism, which trees are used in the totemic ritual and why? What is “dialan” and what is its place in the life of the people of Niokolo Koba?

IWGP22-0089 - Charred and uncharred: Pleistocene and Holocene archaeobotanical remains of *Celtis australis* in the Mediterranean Basin

Carmen Martínez Varea¹, Yolanda Carrión Marco¹, Ernestina Badal García¹, María Dolores Raigón Jiménez²

¹Universitat de València, Prehistòria- Arqueologia i Història Antiga, Valencia, Spain

²Escuela Técnica Superior de Ingeniería Agronómica y del Medio Natural, Universitat Politècnica de València, Departamento de Química, València, Spain

Remains of *Celtis australis*, commonly known as Mediterranean hackberry or nettle tree, are usually present in Palaeolithic sites of the Mediterranean Basin. However, their uncharred state of preservation and the absence of wood charcoal remains of this species raise some doubts regarding the contemporaneity of the remains and the deposit wherein they were found. In fact, some researchers have considered them intrusive in the analysed assemblages.

Our aim is to discuss the presence and role of this species in a Paleolithic context after the analysis of the chronological distribution of their remains, the mineral composition of their endocarps and their potential use as food.

In this communication, all the available palaeobotanical information of *Celtis australis*, including different types of remains (wood, charcoal, seeds, pollen and leaves), is gathered. Based on these data, the history of this species, considering the possible impact of the Quaternary climatic changes on its geographical distribution, is reconstructed. Moreover, the results of a chemical composition analysis of the fruits are presented, with which we assess their potential as food, especially in hunter-gatherer contexts, also having in mind the ethnobotanical information.

IWGP22-0093 - You cannot eat nuts without breaking shells. Plant exploitation during the Final Upper Palaeolithic and the Mesolithic in Southern France

*Carmen Martínez Varea*¹, *Laurent Bouby*², *Auréade Henry*³, *Ingrid Bertin*³,
*Aurélié Liard*³, *Isabelle Théry-Parisot*³, *Jean-Paul Huot*⁴, *Mathieu Langlais*⁵,
*Jean-Baptiste Mallye*⁵, *Thomas Perrin*⁶, *Nicolas Valdeyron*⁶

¹*Universitat de València, Prehistòria- Arqueologia i Història Antiga, Valencia, Spain*

²*Institut des Sciences de l'Évolution de Montpellier, Paléo-écosystèmes- climat- sociétés- Équipe Dynamique de la biodiversité- anthropo-écologie, Montpellier, France*

³*Université Côte d'Azur, Cultures et Environnements Préhistoire- Antiquité- Moyen Âge, Nice, France*

⁴-, *Independent researcher, France, France*

⁵*Université de Bordeaux, De la Préhistoire à l'Actuel: Culture- Environnement et Anthropologie, Pessac, France*

⁶*Université de Toulouse Jean Jaurès, Travaux et recherches archéologiques sur les cultures- les espaces et les sociétés, Toulouse, France*

In Western Europe, the end of the Pleistocene and the beginning of the Holocene record significant and rapid climatic and cultural changes. Technological and economic transformations mark the end of the Upper Palaeolithic, defining new technocomplexes, such as the Azilian, the Laborian or the Epimagdalenian and the development of the Mesolithic. The increase of temperatures and humidity favours the development of forested areas, profoundly transforming the landscapes experienced by hunter-gatherer groups. Recently, paleoethnobotanical material from five archaeological sites of southwest France yielding Epipalaeolithic and Mesolithic occupations has been analysed: Tourasse (Haute-Garonne), Roquemissou (Aveyron), Borie del Rey (Lot-et-Garonne), Cuzoul de Gramat (Gramat, Lot), and Sanglier (Reilhac, Lot). These occupations cover a long period from 13500 to 6500 cal BP, allowing to discuss the evolution of landscapes and plant uses. Charcoal analyses point at the progressive and contrasted development of the ligneous biomass, within the general process of closure of the landscape marked by the progression of deciduous oak. The carpological analysis evidences the exploitation of different plant resources, specially *Corylus avellana*. The abundant presence of hazelnut pericarps can be assessed in terms of economic specialisation, and a taphonomic analysis is applied to infer the possible processing of the hazelnuts. Nevertheless, and besides the incidence of methodological issues for some sites, the differences regarding taxonomic diversity could be linked to ecological or cultural factors, which will be discussed here in the light of carpological and anthracological data.

IWGP22-0101 - A plant macrofossil analysis of plant use in the Ivane Valley, Papuan highlands, Papua New Guinea

*Elise Matheson*¹

¹*University of Queensland, School of Social Science, Brisbane, Australia*

The plant-based subsistence practices of contemporary communities throughout New Guinea are highly variable, drawing on the use of native and introduced plant species. It is assumed that such variability was also the case in the past, though throughout the island the long-term development of plant exploitation remains poorly understood. Archaeobotanical evidence from the Ivane Valley in the highlands of PNG has the potential to greatly inform understandings of the antiquity and development of highland plant exploitation practices, with contexts dating from the Late Pleistocene to the mid-Holocene. Of particular interest in previously published work has been the exploitation of endemic highland *Pandanus* species, including *Pandanus iwen* identified through macrofossil analysis, USO's (underground storage organs) and other highland fruits/nuts (identified as starches). This paper discusses recent research on the plant macrofossil assemblages from sites in the Ivane Valley which confirms the use of *Pandanus* at in the valley throughout its sampled occupation, though demonstrates the presence of other plant resources, including USO's and endocarps. Spatial differences in plant use are seen between occupation sites and a possible transition in *Pandanus* use in the mid-Holocene. While clearly focused on native and endemic taxa, the evidence demonstrates a dynamic and varied history of plant use in the Ivane Valley.

IWGP22-0091 - The exploitation and use of fruit trees during the Pre-Pottery Neolithic in Cyprus

Maria Rousou¹, Andréa Parés², Margareta Tengberg³, Odile Daune-Le Brun⁴, Alain Le Brun⁵

¹UMR 7209: AASPE MNHN-CNRS / University of Cyprus, Homme et Environnement / History and Archaeology, Paris / Nicosia, France

²Muséum départemental du Var, Jardin départemental du Las, Toulon, France

³Umr 7209 : AASPE MNHN-CNRS, Homme et Environnement, Paris, France

⁴UMR 7041 : ArScAn Université Paris Panthéon Sorbonne-Université Paris Nanterre-CNRS, Sciences humaines et humanités, Paris, France

⁵UMR 7041: ArScAn Université Paris Panthéon Sorbonne-Université Paris Nanterre-CNRS, Sciences humaines et humanités, Paris, France

The common occurrence of wild and domesticated fruit remains in Pre-Pottery Neolithic sites in Cyprus demonstrate their importance in the life of past human societies. Their status and role in human alimentation was strongly correlated in one part to the availability of species in the exploited environments, as well as to the eating choices and agricultural practices. Several fruit trees could have played a double role: as food and/or as fuel resources. This article deals with the exploitation of fruit trees in Neolithic Cyprus, with a diachronic view through the Pre-Pottery Neolithic (ca. 10th millennium-5500 BCE) and with a special focus on the latest Pre-Pottery Neolithic phase (Khirokitian culture or Late Aceramic Neolithic). New archaeobotanical evidence (seed, fruit, charcoal) from Ayios Tychonas-*Klimonas* (ca. 9500 BCE), Parekklishia-*Shillourokambos* (8200-7500 BCE) and Khirokitia-*Vounoi* (7500-5500 BCE) contribute to the analysis of the role of several fruit species, such as pistachio, fig tree, carob tree, olive tree, in human alimentation and everyday life. The question of fruit trees introduction in Cyprus as early as the PPN is developed, as well as the status of fruits in the Neolithic dietary habits.

IWGP22-0090 - Wild plant uses in Nubian farming villages

*Philippa Ryan*¹

¹*Royal Botanic Gardens Kew, Interdisciplinary Research, London, United Kingdom*

After previously studying crop plants in contemporary Nubian villages (northern Sudan), a further project investigated wild plant uses by farming households. This case-study provides an insight into the local uses of wild plants for various purposes (especially food, fodder, fuel, materials, medicinal). The plants predominantly grew locally within the farming and village environments, and from along the nearby riverbank. More than 70% of the local wild taxa had at least one purpose. There were also some instances of semi-managed/cultivated wild edible species. Many of the useful species are agricultural weeds and, as such, are a category of useful wild plants that are (at least in terms of their abundance and proximity to farmers homes) especially associated with farming environments. It is hoped that these findings will contribute to broader archaeological and ethnobotanical debates focusing on differences between the wild plant categories used by farmers versus foragers. More broadly, the exploitation of wild plants proximate to farms and villages helps to highlight their complementary role alongside domesticates. In many cases, wild plants exploited today are either absent in the regional archaeological record, or their past uses ambiguous. Ethnobotanical studies can help us approach the archaeological record with a more nuanced understanding of the exploitation of wild resources.

IWGP22-0149 - Pyre fuel and plant macrofossils from cremation burials of the first millennium AD: the Imen'kovo culture of the Mid-Volga region

Yulia Salova^{1,2}

¹*Tyumen Scientific Centre SB RAS- IPOS- 86 Malygina str.- Tyumen 625026- Russia, Department of Archaeological and Environmental Reconstructions, Tyumen, Russian Federation*

²*Laboratory of Archaeobotany and Paleoecology, Faculty of Science, University of South Bohemia, Na Zlaté stoce 3, České Budějovice, Czech Republic*

The paper presents results of charcoal and macrofossil analysis of the cremation burial grounds of the Imen'kovo culture that occupied the Middle Volga region in 400-650 CE. We analyzed assemblages from four necropolises: Bogorodski, Maklasheevka 4, Komarovka and a burial ground in the Zhigulevsk 2 occupation site. The study used methods of quantitative analysis of macroremains in accordance with their belonging to burial complexes. Comparative analysis of data from archaeological collections and the results of charcoal determination at 4 sites included cluster analysis and analysis of principal components.

Charred remains were recorded at the bottom of burials, among cremated bones or in the in-fill of graves and mortuary vessels. The assemblages contained charcoal, caryopses and stems of millet and cereals, seeds and stems of grasses and weeds, and shoots of thorny shrubs. The size of the charcoal pieces did not exceed 3 cm, being much smaller in most burials. The species composition of charcoal from cremations indicates that all locally-available woody taxa were used for the funeral pyre, instead of choosing certain types of trees for ritual purposes. Thus, the composition of the cremation fuel reflected the vegetation composition of the encasing landscape. Dominant charred taxa in the Imen'kovo cremations were *Tilia* and *Betula* (linden and birch), the typical components of the "slash-and-burn landscape" of the Middle Volga region during this period. Despite the fact that all the burial grounds were located at the higher grounds in the landscape, the presence of riverine taxa - *Alnus*, *Salix*, and *Ulmus* (willow, alder and elm) and abundance of charred herbaceous remains in the charcoal spectra points at floodplains or mouths of gullies as a probable location of cremation platforms. An important detail of the funeral rite, revealed by the research, is placing unhulled millet, soaked and germinated before cremation, into the funeral pyre.

IWGP22-0063 - The first archaeobotanical finds from Central Asian cave sites: Holocene plant use in the Ferghana Valley and the Pamir Mountains

Kseniia Ashastina¹, Svetlana Shnaider², Temirlan Chargynov³, Nuritdin Sayfullaev⁴, Robert Spengler¹

¹*Max Planck Institute for the Science of Human History, Department of Archaeology, Jena, Germany*

²*Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences, Archaeology and Ethnography, Novosibirsk, Russian Federation*

³*Kyrgyz National University, Faculty of History and Regional Studies, Bishkek, Kyrgyzstan*

⁴*National Academy of Sciences of Tajikistan, A. Donish Institute of History, Archaeology and Ethnography, Dushanbe, Tajikistan*

Caves and rock shelters have attracted humans for hundreds of thousands of years. The well-preserved sediments within these natural time capsules provide detailed environmental, paleontological, and archaeological information. The Tian-Shan and Pamir mountains have been an important cultural corridor of human movement between Central and East Asia throughout the Quaternary. Studies of caves and rock shelters located at various elevations and covering a broad time span are clarifying many pressing issues in Central Asian archaeology, including what the routes of dispersal of plants and animals looked like, the evolutionary changes of those organisms over time, and the dynamics of prehistoric cultural change.

We present the first results of a series of small-scale archaeobotanical studies of plant remains recovered from four recently excavated cave sites in Central Asia – Obishir 5, Surungur, Istikskaya, and Kurteke. The Obishir-5 and Surungur sites are located in the southern part of the Ferghana Valley, Kyrgyzstan – a crossroads between plains of the western steppe and high mountain regions. While the Istikskaya and the Kurteke sites provide insights into the archaeology of high-elevation mountain occupations in the Pamir mountains of Tajikistan. Three sites, Obishir-5, Surungur, and Istikskaya, provide plant macrofossil evidence for human presence at the site. We identified domesticated grains of naked barley and wheat, with their rachises, indicating that barley and wheat were present and/or processed at the Obishir-5 and Istikskaya sites. Along with other prominent finds were identified hulled barley, foxtail millet grains, shell fragments of walnuts, and seeds of *Rosa* sp.



Given these promising results from Early and mid-Holocene layers, the potential for further data from earlier layers, potentially covering the Pleistocene/Holocene transition, seems high, and we plan to continue research in this region.

IWGP22-0198 - Going beyond the Mediterranean triad with a waterlogged botanical assemblage from Piraeus, Greece (5th - 1st centuries BCE)

Jane Tully¹, Evi Margaritis²

¹*The University of Texas at Austin, Department of Classics, Austin, USA*

²*The Cyprus Institute, Science and Technology in Archaeology and Culture Research Center, Nicosia, Cyprus*

The study of archaeobotanical remains in first millennium Greece has focused on subsistence practices based on cereals, legumes, and fruits, while a broad spectrum of available wild taxa is passed over in silence. This paper presents preliminary results from the analysis of waterlogged botanical material from excavated wells at Piraeus in Attica, Greece, an assemblage that offers a uniquely rich perspective on the wider world of plant use in Classical and Hellenistic Greece. Plant remains were recovered from twenty-eight wells, in deposits dating to the late fifth to first centuries BCE. While most archaeobotanical studies in Greece deal with carbonized remains, the waterlogged conditions of the Piraeus wells preserved small seeds of wild taxa as well as leaves and branches indicative of the local vegetation and landscape. Little is known about foodways or local landscapes of cultivation in Piraeus, the port of Athens, whose diverse inhabitants were drawn by commercial opportunities from throughout the eastern Mediterranean in the second half of the first millennium BCE. Combining new paleoethnobotanical data with previous textual and archaeological research promises to enrich our understanding of plant use in an ancient Greek city with insights into varied urban foodways and engagement with the landscape and its resources.

IWGP22-0155 - The role of wild roots and tubers in Iron Age Northwest European funerary practice at Dieren (the Netherlands)

Wouter Van Der Meer¹, Lucy Kubiak-Martens¹

¹BIAX Consult, Archaeobotany, Zaandam, Netherlands

Underground storage organs (USO's) of wild plants have been an important source of food for hunter-gatherer and early agrarian societies. The role of these root foods has long been underestimated in traditional archaeobotany, but this has been somewhat remediated in the last decades. However, even nowadays there seems to be much less interest in the identification of archaeological parenchyma from Bronze Age and Iron Age sites. This recent study shows that wild roots and tubers also held significance for later societies.

Thirty out of ninety cremation burials at the Iron Age cemetery at Dieren in the Netherlands contained charred archaeological parenchyma. In contrast, cereals, fruits and nuts were scarce. Three types of parenchyma were identified using a Scanning Electron Microscope (SEM): tubers of cinquefoil (*Potentilla*), tubers of fumewort (*Corydalis solida*), and rhizomes of *Cyperaceae*. Corms of onion couch (*Arrhenaterium elatius* subsp. *bulbosum*) were also present in parenchyma assemblages. It seems unlikely that all these belonged to local vegetation, accidentally charred during cremation. Tubers of cinquefoil, corms of onion couch and possibly fumewort tubers have been identified in iron age cremation burials elsewhere in Northwest Europe. Tubers of fumewort and cinquefoil species have been used as food source according to ethnographic sources, and the rhizomes of various *Cyperaceae* species are edible. It is likely that some of these species, or perhaps all, had a function in funerary ritual. In this presentation, we would like to see to what extent 'food for the dead' would be an explanation to the archaeological parenchyma from Dieren cremations. This study shows the necessity to further integrate the identification of USO's in traditional archaeobotany, to increase our knowledge of the role of wild plants in later agrarian societies.

IWGP22-0134 - The importance of wild plant resources in the Neolithic: A case study of the lakeshore settlement of Grandson-Corcelettes/Les Pins (Switzerland)

Patricia Vandorpe¹, Örne Akeret¹, Marlu Kühn¹, Lucia Wick¹

¹IPNA, Dep. Umweltwissenschaften, Basel, Switzerland

The site of Grandson-Corcelettes / Les Pins is located at Lake Neuchâtel (430 m asl), western Switzerland, and was occupied during several phases of the Late Neolithic (between 3000 and 2500 BC roughly). Besides the cultivation of food plants, the inhabitants of Grandson used wild plant resources for various purposes by adding fruits, berries, nuts etc. to supplement their daily intake. Wild plant species, many of them with edible seeds, represent 65% of the total amount of plant macro remains found. An estimation of their proportion within the plant diet, based on calories, showed that they accounted for more than half of the calorific intake. This is in line with similar calculations performed for other prehistoric Circum-Alpine settlements (e.g., layer 13 of Parkhaus-Opéra in Zürich (CH) and Arbon-Bleiche 3 (CH)). It is clear that wild plants were very important for the diet in Grandson, and probably more important than cultivated plants. Moreover, their role in the plant diet has probably been underestimated until now and should be further investigated in future archaeobotanical studies. The wild plant species spectrum shows that most of them were gathered in the woodlands and semi-open habitats close to the village, whereas the riparian forest only seemed to play a marginal role. In addition, there are indications that the Jura mountains (reaching 1600 m asl near the lake shore villages) were also exploited by the settlers. Wild plants were not only used for the human diet but also as staple food for domestic animals. The analysis of macrofossils and pollen from dung pellets of goat or sheep produced a diverse spectrum of species and showed that the animals grazed outside the village throughout the year in a variety of places, including, forests, fallow fields and grassland-like habitats.

IWGP22-0081 - History of woodland management: the Neolithic

Caroline Vermeeren¹, Kirsti Hanninen¹, Welmoed Out²

¹*BIAX Consult, Archaeobotany, Zaandam, Netherlands*

²*Moesgaard Museum, Department of Archaeological Science and Conservation, Aarhus, Denmark*

Written and iconographic sources provide proof of woodland management in historical times, but when did this practice start? It is often assumed that this could go back as far as the Neolithic. Is this correct?

To create better methods to investigate woodland management, a model was developed to distinguish between managed and unmanaged wood, using the combination of diameter and number of annual rings (figure 1, Out et al. 2013). Management, i.e. pollarding and coppicing, results in a higher quantity and quality of wood due to better access to light. Managed trees are supposed to grow faster, producing thicker annual rings. The model was tested by means of analysis of modern trees, resulting in reference graphs per taxon.

To investigate woodland management in the past, case studies from Neolithic archaeological sites from different parts of Europe have subsequently been compared to the reference graphs. Both published case studies (Out et al. 2020) and new, unpublished case studies will be presented here. None of the case studies provided evidence of woodland management. Different possibilities will be discussed to explain this result.

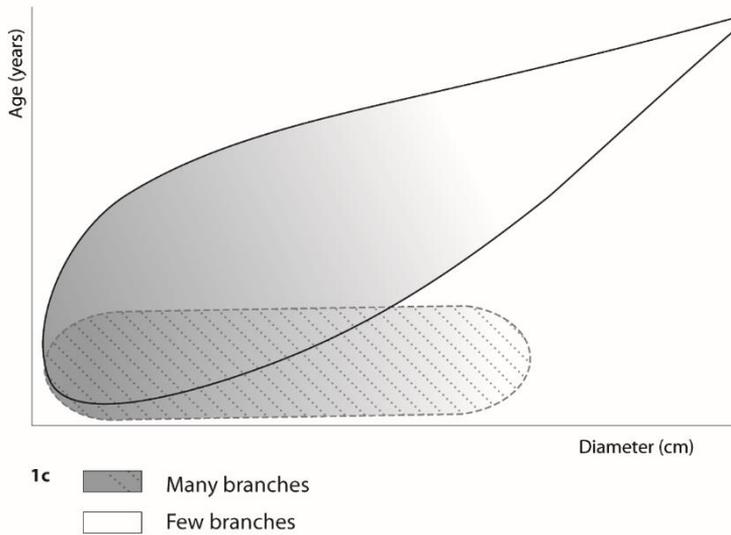


Figure: Growth model of managed (dashed) and unmanaged wood/trees, combination of diameter and age.

Reference:

Out, W.A., Vermeeren C., Hänninen K. 2013. Branch age and diameter: useful criteria for recognising woodland management in the present and past? *Journal of Archaeological Science* 40:4083–4097 2013

Out, W.A., Baittinger, C., Čufar, K., López Bultó, O., Hänninen, K., Vermeeren, C. 2020. Identification of woodland management by analysis of roundwood age and diameter: Neolithic case studies. *Forest Ecology and Management* 467

Topic 1.3. Plants structuring society: trade and globalisation

IWGP22-0039 - Foodways of the Silk Road in Kyrgyzstan

Chie Akashi¹, Seiji Nakayama¹

¹Teikyo University, Institute of Cultural Properties, Fuefuki, Japan

While there are numerous records revealing what products were traded across the Medieval Silk Road, there is little knowledge regarding what life was like along the route. This study attempts to investigate archaeobotanical materials of Ak-Beshim, a trading city along the Silk Road, to reveal its food culture. Located on the bank of the Chuy River, north of Kyrgyzstan, Ak-Beshim appears in historical documents as *Suyab*, an important trading centre in Central Asia. It housed various people of different backgrounds between the fifth and eleventh centuries: Sogdian merchants and officials from the Tang Dynasty, pastoralists and farmers, Christians, Buddhists, and Muslims. We present the results of the pilot study of the macro-botanical remains from this site and discuss the foodways of those international residents.

IWGP22-0011 - Food and plant trade in the Roman period: An examination of the archaeobotanical remains from Guissona, Spain

Theoni Baniou¹, Esther Rodrigo², Nuria Romani²

¹Catalan Institute of Classical Archaeology ICAC, Landscape Archaeology Research Group GIAP, Tarragona, Spain

²Autonomous University of Barcelona, Department of Ancient and Medieval History, Barcelona, Spain

This presentation will discuss new archaeobotanical finds recovered from the Roman city of Guissona, Spain, that bring new information on diet and food trade in the western part of the Roman Empire. The Roman town of *lesso* was founded in the beginning of the 1st century BC following the basic Roman urban design of this period and it is considered one of the most important sites in the area. Some of the key features of the city that renders it of high significance to bioarchaeological studies are five wells that have preserved material in anaerobic conditions. Such conditions are extremely rare in the Mediterranean while in the Iberian Peninsula, archaeobotanical studies of such contexts in the Roman period are very few with *lesso* offering the first waterlogged results in Catalonia. In this presentation, we focus on two wells excavated in 2017 and 2020. The first of these wells was located just outside the city walls and was associated with a building interpreted as likely a hostel, offering accommodation and food to travellers. The second one is found within the city walls, in close proximity to the public bath complex of the city. The ongoing archaeobotanical study of the two wells has revealed a rich assemblage of foods that demonstrates several differences between the two different spaces. The analysis of the finds of the two wells offers ultimately new insights into the circulation of goods during the Roman period, informs on their differential access and investigates the potential reasons behind this.

IWGP22-0154 - Ongoing archaeobotanical investigations at the Bronze Age urban settlement of Togolok 1, Turkmenistan: An assessment of crop diversity and timing

*Traci N Billings*¹

¹*Max Planck for the Science of Human History, Archaeology Department, Jena, Germany*

Great potential to elucidate the origin, arrival, and diffusion of economic crops between Europe and Asia lies with the study of plants in Central Asia. Togolok 1 is an urban settlement located on the piedmont between the Kopet Dag foothills and the Karakum Desert in southeastern Turkmenistan. The build-up of cities and increased exchange in the region during the Bronze Age (late 3rd -early 2nd millennium B.C.) is attested by archaeological evidence (e.g., ceramics, carnelian beads, and other material finds). Togolok's location on a crucial east-west corridor for the movement of people and goods within Central Asia and its adjacent regions (i.e., the Iranian Plateau, Afghanistan, the Indus Valley, etc.) make it valuable to understanding the globalization and trade of different crop species. Given the lack of written records from Togolok, archaeobotany provides us with a vital tool for understanding the role of these plants in structuring this Bronze Age society. Togolok 1 is only one of a few sites in Turkmenistan to have been systematically examined for archaeobotanical evidence and a wide variety of crops including, cereals, legumes, and fruits have been uncovered from its rich macro-botanical assemblage (which dates to the early second millennium B.C.). These finds add new insights into the dietary choices, interregional trade networks, and the complex subsistence strategies practiced by Bronze Age populations in the region. In addition to examining the local food system, this presentation also explores how several key species (e.g., barley, wheat, millet, peas, lentils, etc.) found at Togolok 1 fit into broader trends related to the timing and movement of plants through Eurasia.

IWGP22-0014 - Plant remains immerse in raw earthen architecture: reflecting constructive and domestic archaeological data from colonial contexts of the Argentine Northwest

Vanina Castellón¹, María Laura López¹, Aylen Capparelli¹

¹Consejo Nacional de Investigaciones Científicas y Técnicas CONICET - Universidad Nacional de La Plata, Facultad de Ciencias Naturales y Museo. División Arqueología, La Plata, Argentina

The objective of this work is to analyze, from an archaeological and ethnobotanical approach, the botanical remains present in the raw earthen architecture of Nuestra Señora de Talavera, one of the first colonial urban settlements established along the Iberian advance during the 16-17th centuries in the Argentine Northwest. This city was founded in 1562, but after about fifty years of its existence, various reasons forced its inhabitants to move and re-found it in a new location, both of them included in what is currently called the archaeological locality of Esteco, sites I and II respectively (Salta, Argentina). It is in Esteco II where remains of mud bricks, mortars and walls belonging to one of the main buildings, the “Iglesia Mayor”, were preserved and are the object of analysis in this work. The sampling procedure, processing of the sediments and identification of botanical macro and microremains, predominantly opal silica phytoliths, were carried out on the basis of standard methodology. Among the archaeobotanical results, the presence of wild and cultivated grasses stands out, the latter represented by native species such as maize, as well as exotic ones such as wheat. Diatoms and microcharcoals were also recorded. Complementarily to the archaeobotanical research, both ethnobotanical observation and interviews were conducted with local inhabitants with knowledge about earth traditional construction techniques. This information contributed to suggesting a set of vegetable fibres that could be intentionally incorporated to the mud in the past, as well as to postulating a series of archaeological material correlates expected from the construction process. Finally, the integration of both kinds of approaches allows us to propose a set of processing and building techniques carried out at the study site, as well as to discuss the informative potential of plant remains from earthen architecture to recognize constructive cultures and domestic activities in colonial contexts.

IWGP22-0199 - Minor cereals in north Italy: the case study of the Basilica of Santa Maria Maggiore in Trento

*Marialetizia Carra*¹

¹*Bologna University, Department of History- Culture and Civilization, Suzzara MN, Italy*

The archaeological excavation in the Basilica of Santa Maria Maggiore in Trento took place between 2007 and 2010 by the Department of History, Culture and Civilization of Bologna University. During the excavation, numerous soil samples were taken and subjected to flotation for the carpological study. The presence of evidence from the Roman, Late Antiquity and Middle Ages has allowed us to reconstruct the evolution of cereal farming in this long period of time (first - fourteenth century AD). In particular, the development of the cultivation of minor cereals (millet, rye and sorghum) and their role in the different chronological phases have attracted our attention.

Millet (*Panicum miliaceum*) has been known in Italy since the end of the Neolithic, but its systematic cultivation dates back to the Bronze Age. In Roman times, millet was considered the food of the poor, therefore its cultivation contracted, and then expanded again in late antiquity and medieval times. Also on our site, the millet is always present, but with a greater importance in the phases of the tenth - thirteenth century. Although known since the Neolithic period, rye (*Secale cereale*) appears occasionally in Italy and its systematic cultivation is traced back to Late Antiquity. In Santa Maria Maggiore, rye appears from the fifth century and progressively increases its importance in the subsistence economy. Finally, sorghum (*Sorghum bicolor*) is known but not cultivated in Roman times; the cultivation of sorghum seems to date back at least to the fifth century and only in northern Italy. In our case-study, sorghum appears only from the tenth century, slightly increasing its importance in the 13th - 14th century. This paper presents the research carried out on the Santa Maria Maggiore site and the bibliographic comparisons used to reconstruct the history of these cereals.

IWGP22-0100 - Evolution of agriculture in parallel with the development of cities in Mesopotamia. New archaeobotanical investigations in Iraq

Caroline Douche¹, Mike Charles¹

¹University of Oxford, Institute of Archaeology, Oxford, United Kingdom

During the 4th-3rd mill. BC, small villages of Mesopotamia progressively grew into large cities, ruled by political, religious and economic institutions. Cultural expansions and climate change contributed to socio-economic transformations and adaptations, including development in crop production. But while agriculture appears to be one of the main drivers behind the emergence and development of the first Near Eastern cities, the evidence mostly derives from indirect sources such as 3rd and 2nd mill. BC cuneiform texts rather than directly from archaeobotanical material. The recent resumption of excavations in Iraq, allows the recovery and study of charred macrobotanical remains (seeds, fruits, chaff) from newly excavated sites located in northern and southern Mesopotamia and offers an opportunity to reconstruct the evolution and regional variability of plant production between the 7th and 1st mill. BC. The presentation aims to define the characteristics and redraw the evolution the northern and southern agriculture along with the urbanisation of societies.



Figure: The archaeological site of Girdi Qala (northern Iraq), with a mix orchard in the front (photo taken by drone by J. Lisein in 2019).

IWGP22-0227 - New archaeobotanical data from the Early and Middle Iron Age in Zambia

*Jeremy Farr*¹

¹*University of Queensland, School of Social Science, Brisbane, Australia*

Archaeobotanical investigations of four sites in Zambia spanning from ~500CE to ~1200CE provide a stronger footing for understanding evolving foodways, food production and approaches to food security in the Early and Middle Iron Age. Presence of endocarp remains across all the sites underlines the enduring importance of wild plants for people in Zambebian biogeographic region as an important component of nutrition and palate. Likewise, the presence of pottery across all sites suggests shared concepts and broad approaches to cuisine that likely involve starchy porridges with a vegetable relish. The conspicuous absence of domestic cereals from Early Iron Age sites, however, presents a challenge for the notion of the ‘Bantu Package’, pottery, metallurgy, and cereal farming. This raises the prospect of more archaeologically ephemeral staples such as mushrooms, yam, truffles, and other tubers that remain an important dietary buffer in Zambia today. In contrast, the Middle Iron Age site features pearl millet, finger millet, and sorghum indicating the importance of diversification in a region affected dramatically by the El Niño-Southern Oscillation. Significantly, no Iron Age site has yet demonstrated a clear entry-point of these domestic cereals and there are few reliable early dates in southern Africa. Far more research in the region is needed, but data from this study raises an intriguing question: Is the adoption of cereals, and with it increased evidence sedentism and long-distance trade and exchange, a key feature of the political economic change that delineates the Early Iron Age from the Middle Iron Age?

IWGP22-0132 - Salvage crops, "savage" people - an integrated anthropological and archaeobotanical consideration of millet cultivation by Adivasi communities in Odisha (India)

Sofia Filatova¹, Ashutosh Kumar², Nidhi Trivedi², René Cappers¹, Peter Berger²

¹Groningen Institute of Archaeology, Bioarchaeology, Groningen, Netherlands

²Faculty of Theology and Religious Studies, Comparative Study of Religion, Groningen, Netherlands

The Odisha millet mission was initiated by the state of Odisha (India) in 2017 in order to revive the practice of millet cultivation in regions inhabited by Adivasi communities, indigenous tribes of the Indian subcontinent that traditionally engage in millet cultivation. Adivasi communities are generally regarded as backward and inferior and, originally, millets were considered a marginalised poor-man's food. Currently, millets are a crucial component of the UN's Sustainable Development Goals (SDG's) due to their exceptional nutritional and ecological attributes. As a result, the promotion of millets by agroscientists and policymakers is causing fundamental changes in the status of millets in India from a marginalised crop to a smart food.

Our project aims to investigate the entanglement of crops and culture, specifically millets and Adivasis, in the changing circumstances that have been initiated by the Odisha Millet Mission. For this purpose, we will integrate approaches of cultural anthropology and archaeobotany with the objective to better understand specific circumstances and related societal consequences of crop selection. The methodology employed by our project is two-fold: (i) an ethnographic consideration of Adivasi communities in Odisha that employ two different practices of millet cultivation (shifting cultivation and rice/millet cultivation) and (ii) an archaeobotanical investigation of the macro-history of millets in eastern India, with an emphasis on crop selection.

In this poster, we synthesise our main project aims, objectives and methodologies. We further discuss how our results might be of relevance to the understanding of past changes in agricultural practice reflected in the archaeological record, current societal issues related to crop-food production, and the future impact of crop selection on cultural diversity and biodiversity.

IWGP22-0167 - *Triticum timopheevii* in southeastern and eastern Europe: Overview of the finds across space and time

*Dragana Filipovic*¹, *Wiebke Kirleis*², *Amy Bogaard*³, *Eugenia Gkatzogia*⁴, *Ivanka Hristova*⁵, *Glynis Jones*⁶, *Angeliki Karathanou*⁴, *Georgia Kotzamani*⁷, *Pavlos Lathiras*⁴, *Alexandra Livarda*⁸, *Elena Marinova*⁹, *Stavroula Michou*⁴, *Djurdja Obradović*¹⁰, *Pelagia Paraskevopoulou*⁴, *Chryssi Petridou*⁴, *Tzvetana Popova*¹¹, *Haroula Stylianakou*⁴, *Soultana Maria Valamoti*⁴

¹Kiel University, Institute for Pre- and Protohistory, Kiel, Germany

²Kiel University, Institute for Prehistory and Protohistory, Kiel, Germany

³Oxford University, School of Archaeology, Oxford, United Kingdom

⁴Aristotle University of Thessaloniki, School of History and Archaeology and Center for Interdisciplinary Research and Innovation CIRI-AUTH, Thessaloniki, Greece

⁵Umeå University, Environmental Archaeology Laboratory, Umeå, Sweden

⁶Sheffield University, Department of Archaeology, Sheffield, United Kingdom

⁷Hellenic Ministry of Culture and Sports, Directorate of Prehistoric and Classical Antiquities, Athens, Greece

⁸Rovira i Virgili University, Catalan Institute of Classical Archaeology ICAC, Tarragona, Spain

⁹Landesamt für Denkmalpflege Baden-Württemberg, Regierungspräsidium Stuttgart, Gaienhofen, Germany

¹⁰Institute of, Archaeology, Belgrade, Serbia

¹¹Bulgarian Academy of Sciences, Institute of Archaeology, Sofia, Bulgaria

Triticum timopheevii s.l. (“new” glume wheat, NGW) was first recognised as a distinct prehistoric cereal crop through work on archaeobotanical finds from Neolithic and Bronze Age sites in northern Greece. This was later followed by its identification in archaeobotanical assemblages in other parts of Europe, both through new finds (e.g. at Stillfried in Austria), and the revision of ambiguous wheat chaff or grains, such as those from central and eastern Balkans (Bulgaria and Serbia). Subsequently, *timopheevii* wheat remains started to be confirmed at a series of prehistoric sites across Europe, most recently, for instance, in Moldova. In this paper, we provide an overview of the archaeobotanical finds of Timopheev’s wheat in prehistoric southeastern and eastern Europe. Our aim is to reconstruct regional and macro-regional histories of the distribution of this wheat and to assess the timing and socio-ecological context of its appearance in this part of the continent, as well as its status as a crop during the six millennia of prehistoric farming in the area. So far, the earliest records come from the Aegean (Greece) and are chronologically followed by finds from the central and

eastern Balkans and the northern Black Sea coast. Our study reveals variable patterns in the research area, with some Neolithic sites showing that *timopheevii* wheat was a crop in its own right and others indicating that it was a minor contaminant of einkorn or emmer. In some regions, we observed a diachronic development, from Timopheev's wheat being a minor occurrence to becoming a crop cultivated on its own during the Bronze Age, as demonstrated by the almost pure, often large deposits. Despite its prominent role at some Neolithic and Bronze Age sites, by the Iron Age *T. timopheevii* appears only as a minor component, probably a contaminant of other cereals.

IWGP22-0275 - Archaeobotany in “Sicily in transition” (SIC-Transit ERC AdG 2015 Project). From Arab to Aragonese plant assemblages in a cultural connected world

Girolamo Fiorentino¹, Milena Primavera¹

¹University of Salento, Department of Cultural Heritage, Lecce, Italy

The SIC-transit Project aims at assessing the impact of successive changes in regime on medieval Sicily in a period that spans from the 6th to the 15th centuries. The regimes that the island, located in the centre of the Mediterranean, experienced have been registered in the form of cultural and socio-economical changes documented in archaeological and bioarchaeological records. The analysis of plant remains assemblages, from Mazara del Vallo and Castronovo di Sicilia archaeological sites, alongside their taphonomy and context of recovery, provide new insight into the early arrival and diffusion of allochthonous easternmost plants (both edible and non-edible) in the island and along with Mediterranean Europe. The cultural connection between the east and the west Mediterranean during some of these centuries has been crucial in shaping the agrarian landscape of Sicily, traditional food identity and environment of the island so as revealed by archaeobotanical analyses.

IWGP22-0067 - Vegetal remains at the ancient site of San Basilio, in the Po delta (Rovigo, Italy)

Alessandra Forti¹, Fiorenza Bortolami², Giovanna Gambacurta², Nicoletta Martinelli³, Cecilia Moscardo⁴

¹Università Ca' Foscari, Dipartimento di Studi Umanistici, Venezia, Italy

²Università Ca' Foscari, Dipartimento di Studi Umanistici, Venezia, Italy

³Laboratorio Dendrodata, Laboratorio Dendrodata, Verona, Italy

⁴Università di Bologna, Dipartimento di Storia Culture e Civiltà, Bologna, Italy

In the years 2018-2022, a research project was initiated at the Greek-Etruscan site (dated VI-V cent. BC) located in the ancient Po delta. According to the survey and investigation conducted in 2019, in 2021 a trench was set at the north bank of a large man-made channel, detected by aerial photos, that margined a fossil dune in ancient times, on which the site was settled. Structural stratigraphic units consist in flattened floors and pavement levels, as well as portions of pressed terracotta, which indicate production areas, with large focal areas maybe outdoor. Other evidence refers to light and precarious roof structures, airborne or subaerial. The archaeological materials are scarce and do not provide a unitary chronological indication, which will be studied in the future. On the bank of the canal multi-layered structures with concocted beams, blanched plates -probably related to aerial or subaerial installations- are flanked by a deposit consisting of vertical and small wooden elements that support a deck consisting of branches and twigs intertwined, carefully worked small planks, whose function remains uncertain. Numerous remains of fruit and seeds (nuts, hazelnuts, chestnuts, pine cones etc.) were incorporated in this structure. We present here Dendrochronological and radiocarbon analyses and preliminary analysis of the vegetal remains collected at the site.

IWGP22-0123 - First millennium CE crop diffusion unprecedented but still gradual: New evidence from Negev Highland trash mounds

Daniel Fuks¹, Yoel Melamed², Yotam Tepper³, Tali Erickson-Gini⁴, Guy Bar-Oz⁵, Ehud Weiss²

¹*University of Cambridge, McDonald Institute for Archaeological Research, Cambridge, United Kingdom*

²*Bar-Ilan University, Martin Szusz Department of Land of Israel Studies and Archaeology, Ramat-Gan, Israel*

³*Israel Antiquities Authority, Central District, Tel-Aviv, Israel*

⁴*Israel Antiquities Authority, Southern District, Beer Sheva, Israel*

⁵*University of Haifa, Zinman Institute of Archaeology, Haifa, Israel*

Agricultural centers of origin and early pathways of crop diffusion have comprised a vibrant research focus for decades, motivated in part by these topics' relevance to crop evolution and improvement, as well as the rise of states and empires. Crop diffusion in later historical periods is relatively poorly researched but is key to a long-term perspective of agricultural evolution and societal change. Systematic retrieval and identification of plant remains from Negev Highland (Israel) trash mounds recently yielded fresh insights on first millennium CE crop diffusion within the context of Holocene agricultural change in southwest Asia and the Mediterranean basin. New data on 24 cultivars among 144 taxa retrieved and identified from 11 rubbish middens spanning the first seven centuries CE at three representative sites of the region enable a reevaluation of the 'Islamic Green Revolution' (IGR) thesis vis-à-vis 'Roman Agricultural Diffusion' (RAD), and both against long-term crop diffusion since the Neolithic. Among the finds, some of the earliest aubergine (*Solanum melongena*) seeds in the Levant represent a component part of the proposed IGR which allegedly transformed agricultural landscapes throughout the Mediterranean basin. However, seven species introduced during the first couple centuries BCE and CE—among them two unprecedented in southern Levantine archaeobotany—implicate the RAD as the greater force for agricultural diffusion. Meanwhile, the significantly higher relative frequency and ubiquity of southwest Asian 'founder crops' and early fruit tree domesticates affirms that crop diffusion and agricultural development over the Holocene proceeded gradually, although not at a constant rate. Considering the IGR and RAD together, crop diffusion during the first millennium CE had a greater impact than any period since the Neolithic.

IWGP22-0056 - Flora&Fauna: A comparative study of farming practices in ancient Greece and in indigenous and colonial areas in Italy (ca 800–550BC)

Lou Godefroy^{1,2}, *Jan Paul Crielaard*³, *Véronique Matterné*⁴, *Aurélié Salavert*⁵, *Milena Primavera*⁶, *Girolamo Fiorentino*⁶, *Evi Margaritis*⁷, *David Reese*⁸

¹*Vrije Universiteit, Faculty of Humanities- Art- Culture- History and Antiquity, Amsterdam, Netherlands*

²*Museum National d'Histoire Naturelle, Equipe Pacem, Paris, France*

³*Vrije Universiteit Amsterdam, Faculty of Humanities- Art and Culture- History- Antiquity, Amsterdam, Netherlands*

⁴*Centre National de Recherche Scientifique, PaCEM-Patrimoines culturels et naturels des sociétés européennes et méditerranéennes, Paris, France*

⁵*Muséum National d'Histoire Naturelle, Equipe Presage, Paris, France*

⁶*Università del Salento, Laboratorio di Archeobotanica e Paleoecologia, Lecce, Italy*

⁷*The Cyprus Institute, Science and Technology in Archaeology and Culture Research Center, Nicosia, Cyprus*

⁸*Yale University, Department of Anthropology, New Haven, USA*

From the eighth to the sixth centuries BC, Greek colonists settled along the shores of the Mediterranean and an important new chapter in the history of the ancient world began. But did these Greeks operate on their own or were they dependent for their food and staple supply on local knowledge and networks? This problem is approached through the most basic elements in the life of the Greek migrants and local inhabitants to the so-called Greek 'colonization', namely agricultural practices, land use, and craft production in the earliest years of settlement with the NWO project "What went into the melting pot?". Science-based methods are employed to analyze and compare the organization of these elements in the Greek motherland, and in the indigenous-colonial milieu in southern Italy. By comparing these datasets, it will be possible to define the extent to which colonial communities imported knowledge of agricultural systems and craft production, or whether autochthonous methods were adopted and/or adapted. This obtained insight can be used as a proxy for the influx of new people and ideas and for the transformations of local and migrant societies that took place. The generation and comparison of these datasets will be conducted under four subprojects, including the PhD research 'Flora&Fauna'. In this study, the archaic plant remains from five settlements distributed between Greece and Italy was analysed. The data are enriched through the comparison of published and unpublished archaeobotanical and

archaeozoological data from 49 settlements within the same geographical area (domestic/ritual contexts), information from classical written sources and modern ethnoarchaeological investigations in order to infer and compare subsistence strategies and surplus production during the period. This presentation aims to present the main goals and employed methods of this interdisciplinary approach to be able to rediscuss our way to consider agricultural practices from microscale to megascale.

IWGP22-0058 - Non-wood fuels used in the Roman amphora workshop of El Mohíno (Palma del Río, Spain)

*Justine Gomes*¹, *Núria Rovira*², *Iván González-Tobar*³, *Ophélie Tiago Seoane*¹, *Enrique García Vargas*⁴, *Stéphane Mauné*⁵

¹University Paul Valéry, Doctoral student- UMR5140 "ASM", Montpellier, France

²University Paul Valéry, Archaeobotanist- UMR 5140 "ASM", Montpellier, France

³University Paul Valéry, UMR5140 "asm", Montpellier, France

⁴University of Sevilla, Departamento de Prehistoria Y Arqueología, Sevilla, Spain

⁵CNRS, Research Director- UMR5140 "ASM", Montpellier, France

The amphora workshop of El Mohíno, located in the Hispanic province of Baetica, was excavated in 2018 under the supervision of I. Gonzalez Tobar, O. Tiago Seoane et S. Mauné as part of the project OLEASTRO funded by LabEx Archimède (university Paul Valéry of Montpellier). It consists of two separate batteries of kilns, each containing four combustion structures. The site is occupied between the change of era and 140 AD. Its main productions are olive oil amphorae (Dressel 20) and more occasionally *defrutum* amphorae (Haltern 70).

One of the main research axes concerned the fuel used in the kilns. During the excavation, olive pits were visible to the eye and the question arose whether other non-wood fuels would also have been used. A total of 13 samples was thus taken in the kilns (595 litres of sediment). Archaeobotanical analysis identified a total of 11 576 seed and fruit remains.

The analysis confirmed the use of olive (*Olea europaea*) pressing waste as fuel by the presence of whole and fragmented kernels and fruit flesh. Olive pomace has been used as fuel since the Early Bronze Age and its utilization increases during Roman Antiquity thanks to the massive production of olive oil, in particular in the Baetica province (e.g., in the neighbouring and contemporaneous amphorae workshop of Las Delicias). Taxa from the mixed oak grove (*Cistus*, *Crataegus* and *Pistacia lentiscus*) bear witness to some woody species also used for this purpose. In contrast, the presence of cereals, especially hulled wheats (*Triticum dicoccum* and *T. monococcum*) and barley (*Hordeum vulgare*), a broad bean (*Vicia faba*) and grape pips (*Vitis vinifera*), as well as weeds (*Lolium temulentum*, *Phalaris paradoxa*, *Rapistrum rugosum*) and other wild plants (*Malva* sp., *Medicago minima*, *Scorpiurus muricatus*, *Prunella vulgaris*) may suggest that food and cleaning waste were also thrown into the fire.

IWGP22-0079 - Study and Analysis of Plant remains from the tomb of Tutankhamun

*Naqmeldeen Hamza*¹, *Claudia Moricca*², *Laura Sadori*³

¹Grand Egyptian Museum, Conservation Center, El Kanater El Khairia, Egypt

²Sapienza University of Rome- Rome- Italy, Environmental Biology, Rome, Italy

³Sapienza University of Rome, Environmental Biology, Rome, Italy

When thinking about Pharaohs, Tutankhamun (1334–1327 BC, 18th Dynasty) immediately comes to mind. The discovery of his tomb by Howard Carter in 1922 remains one of the most spectacular archaeological finds, having occurred almost accidentally. Tutankhamun's tomb is in fact famous for the presence of numerous golden objects and other prestigious artifacts, including the remarkable funerary mask, the fine jewelry and the shrine with poignant statues of goddesses. Howard Carter, the archaeologist famous for the discovery of the burial, also managed to acknowledge the potential value of less prestigious findings, including plant remains. After a selection of the most interesting elements of the “botanical treasure”, which included flowers, a dried pomegranate and a basket with *Hyphaene thebaica* (L.) Mart. (doum palm) fruits, the remaining plant material was swiped from the surfaces of the tomb and deposited in a big wooden box (200 x 50 x 50 cm ca.). The box was closed in 1933 and was stored in the Egyptian Museum in Cairo until 2017. In 2018 it was moved to the Grand Egyptian Museum. The big box not only contains plant (seeds, fruits, cuticles, wood) remains, but also organic remains of not yet clear origin. During the analysis a total of 50 liters of sediment were separated, resulting in more than 8000 plant remains. The carpological remains retrieved from the box are still in excellent condition, preserved by mummification, and generally allowed identification at a species level. Identified remains included fruits and seeds belonging to 14 families and 23 species, and few remains still under identification. The identified remains belong to food, ornamental, and medicinal plants and help in defining the plants available in Egypt to celebrate the immortality of a king in the fourteen century B.C.

IWGP22-0021 - Agricultural economies in the face of environmental and political change: Kinet Höyük and resilience through the Iron Age

*Makayla Harding*¹

¹*The University of Queensland, School of Social Science, Brisbane, Australia*

This paper investigates the effects of state power in the Iron Age on networks of crop production, trade and consumption at the port town and trade centre Kinet Höyük in southern Turkey. Findings were achieved through analysis of macrobotanical samples from Kinet, covering the 11th to 6th centuries BC. Samples from 115 contexts were analysed, identifying shifts in crop-processing practices, food security, and risk management correlated with changes in cultural phases and state influence. The Early Iron Age of Kinet Höyük allows for understanding of how the site recovered from the socioeconomic and environmental upheavals of the Bronze Age collapse, while later phases give comparative insight into the control of imperial and state powers on the site's resources and trade activities. Results indicate that proportions of water-sensitive and valuable cereals in the EIA were high, demonstrating that a focus on economically valuable crops for trade was possible during unstable periods. In later periods with evidence for strong Neo-Assyrian control, a prioritisation of 'cash crops' and a narrowing of access to other foods can be interpreted in the assemblage. Finally, by the Late Iron Age, expanding crop diversity and presence of regionally uncommon foods can be linked to large-scale imperialism by the Medians and Neo-Babylonians, and their effect on the scope of trade routes in the region. This paper aims to contextualise these findings within the trade landscape of the Iron Age Mediterranean, the economic resilience of Kinet Höyük, and the needs of the many state powers exerting control over Kinet's port.

IWGP22-0182 - New Archaeobotanical Evidence for *Coriandrum sativum* and *Sesamum indicum* from a Neopalatial (c.1750-1450 BC) Building at Knossos-Anetaki, Crete

*Carly Henkel*¹, *Evi Margaritis*¹

¹*The Cyprus Institute, Science and Technology in Archaeology and Culture Research Center STARC, Nicosia, Cyprus*

Archaeological evidence has long established the active role that Minoan Knossos played in the eastern Mediterranean trading networks of the Late Bronze Age. As the main commercial palace centre on Crete, Knossos engaged in the production, trade and redistribution of economic commodities, including plant resources. Recent archaeobotanical results for a Neopalatial (c.1750-1450 BC) building located within the urban periphery of the Palace of Knossos, at the site of Knossos-Anetaki, has provided new evidence for the use of coriander (*Coriandrum sativum*) and sesame (*Sesamum indicum*) on the island during this period. These finds represent the movement of plant taxa from south-west Asia, in the case of coriander, and from south-east Asia, India or sub-Saharan Africa, in the case of sesame. While archaeobotanical evidence attests to the presence and possible cultivation of coriander in Greece since the Early Bronze Age, its presence on Crete is represented by only a few finds to date. Conversely, sesame has remained conspicuously absent from the entire Bronze Age archaeobotanical record of Greece until now and this taxon certainly represents an imported commodity. This paper will present the contextual details surrounding the recovery of coriander and sesame at Knossos-Anetaki and discuss the social-cultural and socio-economic implications of these finds for Late Bronze Age Crete in light of the available textual records and existing archaeobotanical evidence for both Crete and Greece.

IWGP22-0157 - Practices and knowledge inherited from the use of "chili" in the Rimac Valley (Peru) from 555 AD to the present

Luisa Del Rosario Hinojosa Garcia¹, Joaquina Alban²

¹Universidad Nacional Mayor de San Marcos, Etnobotánica y Botánica Económica, Lima, Peru

²Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Etnobotánica y Botánica Económica, Lima, Peru

One of the economically important genera used since pre-Hispanic times in the New World has been *Capsicum* L. (Solanaceae), known as “ají, chile, uchu, huayka”. It is native to tropical and temperate zones in Central and South America, Mexico, and the Antilles (Barboza, 2019; Barboza et al., 2020). It has approximately 42 species and includes five that have been domesticated: *C. annuum* L., *C. baccatum* L., *C. chinense* Jacq., *C. frutescens* and *C. pubescens* Ruiz & Pav (Heiser & Smith, 1953; Heiser & Pickersgill, 1969; McLeod et al., 1982; Perry et al., 2007; Dias, 2013; Pérez-Castañeda et al., 2015; Carrizo et al., 2016). The earliest finds (5650-4100 BC) of their remains are located between the coast of Peru and Ecuador (Raymond, 1999; Perry et al., 2007; Perry, 2012; Chiou & Hastorf, 2014). On the central coast of Peru, in the valley of the Rimac river, Huaca Pucllana is located, a ceremonial archaeological site (Flores, 2005, 2015), associated with the Early Intermediate period (200-650 AD), characterized by having been the scene of the first cultivation practices as a result of the agricultural intensification of the time (Lumbreras, 2019). During the excavations of the 2014 season archaeological seeds and fruits were found. The results of the morphometric analysis allowed to identify the use of the species *Capsicum baccatum*, *Capsicum chinense* and *Capsicum frutescens*. Currently, the inhabitants of the middle valley of Rimac use *Capsicum* L. species in various ways, for this reason ethnobotanical research was carried out to determine the cultural importance and uses of the species used. The results indicated medicinal (rubefacient and antiseptic) and ritual use. In this way we express that there could be a cultural hilum of chili, that is, a remnant of traditional ecological knowledge, with roots from pre-Hispanic times and with expressions of use today.

IWGP22-0102 - Approach to changes in the Argentinian native food production during the first centuries of Spanish colonial times (16th-17th centuries)

Maria Laura Lopez¹, Alexandre Chevalier²

¹National Council for Scientific and Technical Research - National University of La Plata, Div. Archaeology, La Plata, Argentina

²Royal Belgian Institute of Natural Science, Earth and Life History Division, Brussels, Belgium

The objective of this presentation is to offer the first data about the European crops that were grown in central Argentina during the Spanish Colony in the 16th and 17th centuries and that were possibly incorporated into the indigenous subsistence. Since 2017, we have worked in Guayascaté place (Córdoba, Argentina), where several archaeological sites were identified. In Argentina, Spaniards arrived during the 16th century. They founded several cities and developed agriculture based on European methods with European livestock and crops. The research we are presenting aims at documenting the attitude of natives toward these new products: did they integrate rapidly the new crops into their diet? Were they, on the contrary, reluctant to adopt the colonizer's foods and relied still for a long time on previous available foods? What is the timeline for potential acculturation? Finally, which new production practices and foodways were associated with the new crops? To address these questions, we relied first on colonial documents dated from the 17th century describing the economic activities that were developed there. According to them, wheat (*Triticum* sp.) and barley (*Hordeum* sp.) were the main European crops produced, with the addition of grapes (*Vitis* sp.) and olives (*Olea europea*). The agricultural and arboricultural production was carried out by indigenous people under Spanish command. Natives had thus to learn and integrate new agricultural practices. However, maize (*Zea mays* L.) continued to be produced. Second, we relied on archaeobotanical analyses to discern when and which European crops were grown. Phytoliths were recovered from the agricultural plots at Pueblo Guayascaté 1.2 archaeological site. The results allowed us to observe European Triticeae as well as American crops. Both archaeobotanical and colonial documents data will allow us highlight the acculturation trends occurring in Argentina and South America.

IWGP22-0068 - Agriculture and citadel in Bronze Age western Anatolia: New insights from stable isotope analysis and functional weed ecology

Tom Maltas¹, Vasif Şahoğlu², Sevinç Günel³

¹*University of Oxford, Institute of Archaeology, Oxford, United Kingdom*

²*Ankara University, Department of Archaeology, Ankara, Turkey*

³*Hacettepe University, Department of Archaeology, Ankara, Turkey*

The Bronze Age of western Anatolia was a period of marked social and economic development, including the rise and collapse of the elite citadels that characterise the region. Despite evidence which suggests that farming was a key source of elite wealth within citadels, the nature of Bronze Age agriculture and its potential role(s) within these developments are poorly understood. In this paper, we address this by presenting the results of a suite of archaeobotanical analyses, including stable isotope analysis of crop remains and functional ecological analysis of their associated weeds, conducted on assemblages from five sites in the Izmir region of western Anatolia. Our results indicate that cereal cultivation was ‘low-input’ throughout the Late Chalcolithic and Bronze Age, with low arable fertility and mechanical disturbance. In contrast, pulses were grown on more intensively managed plots. Land management strategies were adapted to the tolerances of different crops, with barley grown on drier fields than glume wheats in the Late Chalcolithic. A shift in strategies is apparent between the early Early Bronze Age (EBA) and late EBA-early Middle Bronze Age, with a focus on drought-tolerant cereals cultivated on drier soils with water management practices redirected towards pulses. This was plausibly a response to drier climatic conditions following the 4.2ka event. Farming systems were integrated within varying social environments. A shift from more communal to autonomous household production between the Late Chalcolithic and early EBA plausibly created the potential for sustained high wealth inequality within settlements. This appears to have fostered the emergence of centralising social structures designed to dampen inequalities in arable production. Archaeological evidence for wealth inequality within settlements with highly developed centralising structures suggests that they facilitated the emergence of high status and wealthy individuals, however, and may have been the precursors to the elite citadels of the late EBA.

IWGP22-0007 - Foodways in flux: A new survey of archaeobotanical remains from post-medieval Ireland

Meriel Mcclatchie¹, Susan Flavin², Ellen O Carroll¹

¹University College Dublin, School of Archaeology, Dublin, Ireland

²Trinity College Dublin, Department of History, Dublin, Ireland

This paper will explore the nature and meaning of foodways in post-medieval Ireland, based upon a new survey of archaeobotanical remains from more than 50 excavations across the island. The sixteenth and seventeenth centuries were a period of increasingly globalised trade when new foods arrived in Ireland, some of which, such as the potato, eventually became dietary staples. Irish food cultures were also influenced by neighbouring Britain, which ruled over Ireland at the time, as well as Europe, but some food choices seem to reflect more local traditions. Over the past two decades in Ireland, hundreds of archaeological excavations have unearthed food-related materials dating to the sixteenth and seventeenth centuries, including archaeobotanical and zooarchaeological remains, and artefacts, such as cooking and eating utensils. The ERC-funded "FoodCult" research project is consolidating these environmental and artefactual datasets with evidence from historical sources, as well as undertaking new stable isotope analyses on human bone and organic residue analyses of ceramics. This interdisciplinary approach is enabling the project to develop ground-breaking understandings of food and identity in a complex society. The paper will focus on the archaeobotanical dataset from the FoodCult project, exploring key trends in plant use in the context of wider archaeological and historical evidence. For further information about the FoodCult project, which runs from 2019 to 2024, visit the project website at <https://foodcult.eu/>.

IWGP22-0043 - Food globalization in southern Central Asia: Urban archaeobotany in Bukhara

Basira Mir-Makhamad¹, Kseniia Ashastina¹, Robert Spengler III¹

¹Max Planck Institute for the Science of Human History, Archaeology, Jena, Germany

The Silk Road was the greatest network of communication and exchange in the ancient world; by the turn of the second half of the first millennium AD, commercial trade linked Asia and supported the development of a string of large urban centers across Central Asia. The main artery of the medieval trade routes followed the Zerafshan River and was linked by mercantile cities, most importantly the capitals of Afrasiab and Bukhara functioned as central nodes. Bukhara served as the capital during the peak periods of commerce, spanning the Samanid (AD 875–999) empire, and remaining a prosperous center into the Qarakhanid period (AD 999–1220). We present the first archaeobotanical study of archaeobotanical plant remains from the city that was a center of education, artistic development, and communication prior to Mongol advances in 1220 in the region. The Bukhara samples are extremely rich in economic plants, representing the richest systematic archaeobotanical assemblages thus far recovered in Central Asia, including spices and annual and perennial crops, allowing Sogdians, Samanids, and Qarakhanids to feed large cities in the desert and support a far-reaching commercial market.

IWGP22-0017 - *Nannorrhops ritchiana*: the dwarf palm tree of the king in the 24th-23rd century BC palace of Jericho

Claudia Moricca^{1,2}, *Lorenzo Nigro*¹, *Elisabetta Gallo*¹, *Laura Sadori*²

¹*Sapienza University of Rome, Department "Italian Institute of Oriental Studies – ISO", Rome, Italy*

²*Sapienza University of Rome, Department of Environmental Biology, Rome, Italy*

Tell es-Sultan, the Early Bronze Age city of Jericho is one earliest urban centers of 3rd millennium BC Palestine. The 2015-2017 excavations carried out by Sapienza University of Rome and the Palestinian MoTA-DACH have yielded charred botanical finds ascribable to the destruction of the palace by a fire in 2350 BC ca. The most enigmatic retrieved plant macro-remain is represented by a round fruit found in the subsidiary room behind the throne room of Royal Palace G, next to a vase, in the burnt filling overlying the platform. Classical archaeobotanical methods combined with a computed tomography scan allowed for it to be identified as a drupe of a dwarf palm. Two dwarf palms were taken in consideration: the Mediterranean dwarf palm (*Chamaerops humilis* L.) and the Mazari palm (*Nannorrhops ritchiana* (Griff.) Aitch. native to the Saharo-Indian region), both with small, round/oval fruits, none of which currently growing nearby Jericho. A detailed analysis of herbarium samples of both species stored in Rome (RO), Florence (FIAF) and Edinburgh (E), has allowed to identify the charred drupe as *Nannorrhops ritchiana*. Iconography, archaeobotanical literature and archaeological data were crucial for its interpretation. The presence of the Mazari palm in the palace suggests the existence of an overland commercial track to the south-east, across the desert of Saudi Arabia, which only recent excavations and other finds have revealed. While the medical properties of such palm are widely attested, the specific context of retrieval suggests a sacred use of the plant, thus backdating its possible use as a religious symbol/cult object.

IWGP22-0018 - Motya through the millenia: Analyzing Phoenician impact on the local vegetation

Claudia Moricca^{1,2}, *Lorenzo Nigro*¹, *Federica Spagnoli*¹, *Federico Cappella*¹,
*Nina Ferrante*¹, *Sharon Sabatini*¹, *Laura Sadori*²

¹*Sapienza University of Rome, Department "Italian Institute of Oriental Studies – ISO", Rome, Italy*

²*Sapienza University of Rome, Department of Environmental Biology, Rome, Italy*

The archaeological site of Motya consists of a small island (ca. 40 ha) in western Sicily, between the present-day cities of Trapani and Marsala. Due to its strategic setting in the middle of the Mediterranean, within the Marsala lagoon, and to the presence of freshwater sources, the site was chosen by Phoenicians as a settlement in the 8th century BC. However, it was occupied since the 17th century BC. In recent years, archaeobotanical samples have systematically been collected from excavated contexts at Motya. Here we present the data collected so far from both secular and sacred contexts dated between the 16th and the 5th centuries BC, attributable to pre-Phoenicians and Phoenician phases. In particular, the Bronze Age is poorly studied in Sicily, with only 9 sites being investigated for plant remains, none of which in western Sicily. Information about past environment was gathered from anthracology, when possible, coupled with pollen data. Mediterranean vegetation, dominated by *Quercus* evergreen, *Pistacia lentiscus* L. and *Olea europaea* L., characterizes the entire timespan. Carpological studies contribute to the environmental reconstruction, also providing data concerning food plants, crop cultivation and processing. Changes in vegetation can be observed, including the introduction of economic species from the East (*Punica granatum* L. and *Juglans regia* L.) and plausibly the West (*Pinus* cf. *pineae* L.) during the Phoenician occupation. Furthermore, *Erica arborea* L. and *Juniper* sp., which no longer grow within a 50 km radius from Motya, were found throughout the studied period. Their disappearance could have been caused by land-overexploitation, aridification or a combination of the two. Noticeable is also the shift from *Hordeum vulgare* L., the cereal of preference in prehistoric Motya, to naked wheats from the 8th century onwards. Finally, the study of sacred contexts allowed to identify ritual practices and plant offerings, such as *Cupressus sempervirens* L. and *Vitis vinifera* L.

IWGP22-0074 - Medieval pearl millet in the Iberian Peninsula

Guillem Pérez Jordà¹, Diego Sabato¹, Leonor Peña-Chocarro²

¹*Universitat de València, Departamento de Prehistoria- Arqueología e Historia Antigua, Valencia, Spain*

²*Instituto de Historia. CSIC, Arqueología y Procesos Sociales, Madrid, Spain*

Pearl millet (*Pennisetum glaucum* L.) is a crop originating in West Sub-Saharan Africa, which has not been documented in the Iberian Peninsula yet. Desiccated preserved inflorescences, spikelets and grains of pearl millet have been recovered from Benaxuai site, a cliff granary located in the upper part of the Turia river valley (Valencia, Spain), along with many other plant remains.

The dating of these materials to the 12th century AD places these remains at a time when the Iberian Peninsula was part of the Almohad empire, which extended from the area of nowadays Mali and Mauritania to Syria including the south of the Iberian Peninsula. We do not know whether this crop was introduced at this time or before, although there is a clear link with the Islamic presence in this territory. Several Valencian Medieval sources report the presence of a cereal named “Dacsa” which has been often related by historians to sorghum (*Sorghum bicolor* (L.) Moench). The name “Dacsa” is used today as “maize” in Catalan language and it was probably transferred from an old crop in the 16th century when maize was introduced into Europe. Due to the resemblance between the cob of maize and the inflorescence of pearl millet, we suggest that the latter was the original crop named “Dacsa” in the Medieval texts, which was probably a widespread crop before the introduction of maize.

This work is part of the project MIPLANTS (PGC2018-101362-B-I00) MCNU

IWGP22-0076 - From Ditch to Home

Guillem Pérez Jordà¹, Diego Sabato¹, Damià Ramis², Peter van Dommelen³

¹*Universitat de València, Departamento de Prehistoria- Arqueología e Historia Antigua, Valencia, Spain*

²*Independent Researcher, None, Ciutadella, Spain*

³*Brown University, Joukowsky Institute for Archaeology, Providence, USA*

The archaeobotanical remains recovered in Area E of Nuraghe S'Urachi (Sardinia) offer a wealth of information about the agricultural activities and vegetable diet of this community between the 7th and 3rd centuries BC. The site was surrounded by a defensive ditch that has preserved waterlogged organic remains from the 7th century BC. The ditch was gradually backfilled with domestic trash from the beginning of the 6th century BC onwards, and the later levels only preserve charred remains.

There are no major changes in the archaeobotanical record over time, and alongside cereals such as hulled barley and naked and hulled wheat, leguminous plants such as lentils, peas and broad beans are documented. At the same time, there is a large amount of fruits, including grapes and, to a lesser extent, figs, olives and pomegranates. Other cultivated plants include vegetables such as melons, as well as flax, for which there is evidence of its possible use for the extraction of oil and the processing of its fibres for textile production. Wild plants include a group of fruits that may have been used as foodstuffs (myrtle, mastic, blackthorns and blackberries), as well as a large group of wild plants that grew along the edges of the ditch and as weeds between the cultivated fields.

*This work is part of the project AGRISLAND (PID2020-118033GB-I00)

IWGP22-0282 - Archaeobotanical evidence of complex vegetable tanning during the modern period: The example of Chièvres (Wallonia, southern Belgium)

Sidonie Preiss¹, Mona Court-Picon², Dolores Ingels³

¹IRSNB, O.D. Earth and Life History, Brussels, Belgium

²Royal Belgian Institute of Natural Sciences, Archaeosciences Unit, Brussels, Belgium

³Agence Wallonne du Patrimoine, Direction opérationnelle zone ouest, Mons, Belgium

Between 2013 and 2015, a large-scale preventive archaeology operation was conducted in the town of Chièvres by the Archaeological Service of Wallonia. On the site of "Chièvres-Tannerie" was discovered the collector, in place, of two of the tanks of the tannery dating from the 19th century. One of the two vats discovered could be completely excavated and its filling delivered organic material suitable for archaeobotanical studies. These were undertaken in order to shed light on the functioning of the tannery and provide information on the type of tanning used. Tanning is the operation that consists in transforming the skin into leather thanks to tannins; these substances of different natures (vegetable, mineral or combined) allow the transformation of a putrescible skin into a durable and rot-proof material. Not surprisingly, the pollen assemblages record many tannin-rich taxa such as forest (*Quercus* deciduous types, *Fagus sylvatica*, *Castanea sativa*) or fruit (*Prunus* sp.) trees and some herbaceous species (*Artemisia*, *Plantago*, *Filipendula*), but also other useful interesting microfossils. In parallel, bark of undetermined hardwoods has been found within the botanical macroremains. But the most striking finds consist in numerous pits of dates (*Phoenix dactylifera*) and very fragmented pits of Chebulic Myrobolan (*Terminalia chebula*), two imported species. As much as the presence of the date raises questions, the presence of the Chebulic Myrobolan has its place in this context. Indeed, since the beginning of the 20th century, the dried fruit of the Chebulic Myrobolan is one of the best known tanning materials, exported in a considerable way, mainly from Bombay (Brandis 1906). Thanks to the analyses of botanical macro- and micro-remains, we can approach the mode of tanning carried out in Chièvres. Furthermore, based on historical and archival researches, we will focus on the import, distribution and use of Chebulic Myrobolan in Belgium in modern times.

IWGP22-0013 - Plants as building materials: Recording endangered wooden architecture

Kelly Reed¹, Marcel Vellinga¹, Aylin Orbasli¹

¹*Oxford Brookes University, School of Architecture, Oxford, United Kingdom*

Plant-based materials have shaped building traditions globally throughout history. The use of local plant species has created a hugely diverse architectural heritage that has shaped the way people lived and interacted with the local environment. In recent years, a growing interest in traditional construction has emerged as a response to the need to use more sustainable building materials and methods. However, a shift to engineered building materials, mechanised and large-scale construction over the past century and the now global availability of many of these products has meant many traditions have been lost and many traditional buildings are endangered. There is therefore an urgent need to record plant use within traditional buildings. Here we present the Endangered Wooden Architecture Programme, which is creating an open access record of plant-based building traditions, some of which date back into prehistory e.g. Sumerian *mudhifs* (Broadbent 2008). Some of these records include ethnographic observations, plant species identification and dendrochronology. This programme provides a unique resource for understanding how plants have shaped building techniques, social organisation and cultural values, and the local landscape.

Reference:

Broadbent, G. The ecology of the *Mudhif*. *WIT Transactions on Ecology and the Environment* 113: 15–26

IWGP22-0213 - The role of monastery gardens in the process of dissemination of useful plants. Archaeobotanical and historical evidence

Jarmila Skružná¹

¹Laboratory of Archaeobotany and Palaeoecology, Faculty of Science, University of South Bohemia, České Budějovice, Czech Republic

Early medieval literary sources originated in the Carolingian monastic environment, such as the tract *De cultura hortorum*, serve as the evidence of the fact that a number of non-native species of useful plants were known outside their original distributing area. Was it just an act of theoretical literary knowledge of exotic medicinal plants, spices, fruits and vegetable species, or evidence of their practical use and cultivation? Did the situation in the territory under the administration of Charles the Great differ from the situation in Central Europe isolated by the Alps? Might they have been the Benedictines, who disseminated useful plants in Central Europe, as the first order which expanded to the territory of the Czech Republic (The Duchy of Bohemia) as early as the end of the 9th century? We assume it was so as, at that time, monasteries served as the centres of learning and academic thought where intellectual elite lived and worked. These centres were connected into a functional information network spreading across the whole Europe. Might archaeobotanical data support this hypothesis? In the Czech Republic, monastery environment receives insufficient attention. There is evidence from seven monastery archaeological sites dated to the Middle Age and the Early Modern Time along with the results from a recent archaeobotanical examination of the baroque cesspit in the Plasy Monastery (Western part of the Czech Republic). According to Western European research, local middle age monastery sites have an 'archaeobotanical signature' characterised by a high diversity and abundance of plant macroremains. Might it be the same in Central Europe? Might local monastery sites also have their own 'archaeobotanical signature'? Approaching the topic in the European context, this presentation serves as the introduction into a Europe-wide comparative study of archaeobotanical research results complemented by a historiography investigation of monastery environment.

IWGP22-0009 - Agricultural Change and Introduction of New Crops in Prehistory till Roman Times on the Balearic Islands, Spain

*Hans-Peter Stika*¹, *Aleta Neugebauer*¹, *Cristina Rihuete Herrada*², *Robert Risch*², *Rafael Micó*², *Vincenc Lull*²

¹*Institute of Biology, Molecular Botany 190a, Stuttgart, Germany*

²*UAB- Facultat de Filosofia i Lletres, Departament de Prehistòria, E-08193 Bellaterra, Spain*

The Balearic Islands are located within the Mediterranean Sea, in some distance to the mainland of Iberian Peninsula and southern France, with strong currents limiting the reachability for human colonisation. According to the current state of research, the Balearic Islands were colonised much later than central and eastern Mediterranean islands, starting from the end of the third millennium to the beginning of the second millennium. The number of archaeobotanical records is low and consists mainly of cereals and few pulses. Cereals finds were dominated by hulled barley (*Hordeum vulgare* var. *vulgare*), few naked barley (*Hordeum vulgare* var. *nudum*), some free-threshing wheats (*Triticum aestivum/durum/turgidum*) and only few hulled wheats (*Triticum monococcum/dicoccum*). Pulses are represented by few finds of grass pea (*Lathyrus cicera/sativus*) and faba bean (*Vicia faba*) while lentil (*Lens culinaris*) is missing. During the transition from Tayalotic towards Roman Times, the number of crops increases. The unpublished site of Son Fornés in the centre of the isle of Mallorca adds many samples and archaeobotanical finds from one thousand years (Talayotic to Posttalayotic to early Roman Times).

Changing societies are visible in the archaeological records. Arboriculture was first introduced to the island of Ibiza in the first millennium BC in contexts linked to Phoenician colonisation. Olive oil (*Olea europaea*) and wine production (*Vitis vinifera*) developed remarkably on this island and were oriented toward export. The introduction of new crops was delayed on Mallorca and Menorca. Millet (*Panicum miliaceum*), almond (*Prunus dulcis*) and stone pine (*Pinus pinea*) were introduced during the first millennium BC. Very special single finds of date palm (*Phoenix dactylifera*) and chestnut (*Castanea sativa*) most probably from early Roman Times in a burial cave on Menorca, hints to the influence from the south and the east. Trade seems to be an increasing factor from the first millennium BC onwards.



Figure: Son Fornés, Mallorca, sactuary 2 (front) and talayot 1(background)

IWGP22-0159 - New insight into the spread of millet (*Panicum miliaceum* and *Setaria italica*) in Italy during the Bronze Age

Cristiano Vignola^{1,2}, Andrea Cardarelli³, Laura Sadori¹

¹Sapienza University of Rome, Environmental Biology, Rome, Italy

²Max Planck Institute for the Science of Human History, Palaeo Science and History Group, Jena, Germany

³Sapienza University of Rome, Science of Antiquities, Rome, Italy

Panicum miliaceum L. (broomcorn millet) and *Setaria italica* (L.) P. Beauv. (foxtail millet) are two cereal crops whose archaeobotanical record is far to be fully understood. In China remains of millet are dated to the 6th millennium BC and from the mid-3rd millennium BC it appears in western Asia. In Europe both the archaeobotanical remains and the stable carbon isotope evidence of millet reveal that the cultivation and consumption were firmly established since the Middle/Late Bronze Age. In Italy, millet is attested in the northern regions already during the fifteenth century BC, when the Terramare culture developed, and only sporadically on the Tyrrhenian coast of central Italy before the Roman period. The site of Monte Croce-Guardia, Arcevia (central Italy), investigated by Sapienza University of Rome since 2015, is on a hilly position, close to the Adriatic coast and dated to the Late Bronze Age. The best-preserved archaeological deposits are represented by refuse material discharged from the settlement areas into a ridge, which was terraced in a later phase and possibly hosted economic activities. The plant assemblage of the refusal deposits comprehends a variety of crop remains, among which millet grains, both *P. miliaceum* and *S. italica*, are ubiquitous. The abundance of millet soon after its introduction across Europe seems to reflect its cultivation, although wild forms could have existed as weeds. They are resistant to drought and tolerant of low soil fertility and may have represented a securer harvest than other cereals due to their short growing season. Moreover, they were commonly known as being used for fodder for animals. Due to the absence of contemporary evidence, the archaeobotanical study of Monte Croce-Guardia aims to fill a gap of knowledge into the introduction of millet cultivation in Italy.

IWGP22-0265 - Baroque Švamberk farmyard – the Central European exotic experiment of the early modern era nobility

Libor Vobejda^{1,2}, Tereza Šálková^{1,2}, Zuzana Thomová^{1,3}

¹ *Institute of Archaeology, Faculty of Arts, University of South Bohemia, Branišovská 31a- CZ 370 05 České Budějovice, Czech Republic*

² *Laboratory of Archaeobotany and Paleoecology, Faculty of Science, University of South Bohemia, Na Zlaté stoce 3, CZ 370 05 České Budějovice, Czech Republic*

³ *South Bohemian Museum in České Budějovice, Department of Archaeology Fráni Šrámka 4- CZ 370 05 České Budějovice, Czech Republic*

The archaeobotany of the above ground parts of the building features studies specific types of sediments. These anthropogenic sediments in their nature significantly differ from their counterparts – soils filling the sunken features. One type of these above ground sediments is the vault infills. Vault infills are predominantly composed of dry waste. Their main purpose was to create a layer of thermal insulation. Švamberk, the object of our research, is a unique farmyard built and occupied during modern times, and a collection of nearly one hundred dendrochronological dates was built on the material from there. The dating of the timbers has revealed that there were periods of significant rebuilding at the end of the 17th century, at the beginning of the 18th century, and importantly at the end of the 18th century.

The examined structures correspond to the activity after the Thirty Years' war. According to the written sources, the object was in possession of the Schwarzenberg house, one of the most powerful noble houses in the Habsburg monarchy – its members served as diplomats across Europe. Various experiments in the cultivation of exotic plants took place in the farm complex, and these activities are imprinted in the vault infills. Surprising are e.g. seeds of plants originally from the Americas (*Zea mays*, *Helianthus annuus*), Asia (*Oryza sativa*), and Africa (*Sorghum bicolor*). Assemblages from various buildings are different. A lot of species point out the activities done in the area. Macroremains show the structure of the early modern landscape. Agriculture activities were focused on a wide range of crops (legumes, cereals, and vegetables). Dendrochronology has helped to date archaeobotanical material; it has also exposed the origins of the construction wood: while pines and firs were local, spruce timbers were shipped via rafts from the Šumava mountains.

Topic 1.4. Method development within archaeobotany

IWGP22-0234 - An inter-laboratory sieving test with waterlogged sediment samples: how comparable are our results?

Ferran Antolin¹, Herbig Christoph², Marinova Elena³, Nuria Rovira⁴, Mans Schepers⁵, Bigna L. Steiner⁶, Tjaša Tolar⁷, Liesbeth van Beurden⁸

¹German Archaeological Institute, Department of Natural Sciences, Berlin, Germany

²Institute of Archaeological Sciences, University of Frankfurt, Frankfurt am Main, Germany

³Archaeobotany Lab, State Office for Cultural Heritage Baden-Württemberg, Gaienhofen-Hemmenhofen, Germany

⁴ASM- Archéologie des Sociétés Méditerranéennes- UMR5140, University Paul-Valéry Montpellier, Montpellier, France

⁵Centre for Landscape Studies, University of Groningen, Groningen, Netherlands

⁶IPNA/IPAS- University of Basel, Department of Environmental Sciences, Basel, Switzerland

⁷Institute of Archaeology, Research Centre of the Slovenian Academy of Sciences and Arts, Ljubljana, Slovenia

⁸BIAX, Archaeobotany, Zaandam, Netherlands

Waterlogged deposits are unique sources of palaeoenvironmental and palaeoeconomic information, but their potential so far has not been fully exploited at a large scale, partly due to the difficulty of putting data produced by different teams together. Different institutions have developed their own methodologies in order to maximize results and minimize time investment on these usually very rich samples. This resulted in a series of methodologies used at different steps of sample preparation and analysis that have never been compared.

A group of archaeobotanists got together in the framework of an SNF Scientific Exchanges funding opportunity under the project title “Towards a standardized methodology for archaeobotanical research in wetland sites”, the aim of which was to organize a workshop (that should be taking place in May 2022). A (non-random) subsample of the group participated in the first test before the workshop took place. Within this test, 5 master samples from 4 different sites were subdivided into 5 subsamples and sieved by 5 different research groups to be eventually analysed by the same person. The results obtained will be used to produce a first assessment of the inter-laboratory differences generated by differing sieving practices concerning waterlogged sediments.

IWGP22-0238 - Scanning electron microscopy for differentiating charred endocarps: A case study for tracking *Rhus/Toxicodendron* species in Japanese prehistory

Antonella Aquaro¹, Christian Leipe², Pavel E. Tarasov³

¹Deutsches Archäologisches Institut, Wissenschaftliche Abteilung der Zentrale, Berlin, Germany

²Nagoya University, Institute for Space-Earth Environmental Research ISEE, Nagoya, Japan

³Freie Universität Berlin, Institute of Geological Sciences- Paleontology Section, Berlin, Germany

We suggest a method which uses scanning electron microscopy (SEM) for differentiating charred endocarps of *Rhus/Toxicodendron* species growing in Japan. Our case study is centred on a set of modern reference fruits of six *Rhus/Toxicodendron* species. We developed a simple identification key that is based on two prominent traits of the endocarp's tissue structure observed by means of SEM, i.e., tissue alignment and density. The different *Rhus/Toxicodendron* species showed unique tissue structures of the inner endocarp layer and proved inter alia that the endocarp structure of lacquer tree (*Toxicodendron vernicifluum*) fruits is distinct from that of the other species occurring in Japan and thus is securely identifiable. We successfully applied the method to an abundant record of charred *Rhus/Toxicodendron* endocarps recovered by flotation from Okhotsk culture layers dating to ca. 490–880 CE at the multi-component Hamanaka 2 archaeological site, Rebun Island, Hokkaido region, northern Japan. The results show that Asian poison ivy (*Toxicodendron orientale*) was used at the site over a period of up to 3000 years (Final Jomon to Classic Ainu period). The presented identification key will help to track the use of *Rhus/Toxicodendron* species in Japanese prehistory. In addition, it will contribute to ongoing discussions about the origin of the lacquer tree and the question of whether it is distributed naturally across Japan or was introduced by early human migration or exchange. SEM-based analyses of morphological traits of endocarp cross-sections may be also used to differentiate between members of other genera that include important economic plants, such as *Prunus* and *Olea* species.

Reference:

Leipe, C., Aquaro, A., Tarasov, P.E. (2022) Scanning electron microscopy for differentiating charred endocarps of *Rhus/Toxicodendron* species and tracking the use of the lacquer tree and Asian poison ivy in Japanese prehistory. *Journal of Archaeological Science: Reports* 41, 103335. <https://doi.org/10.1016/j.jasrep.2021.103335>.

IWGP22-0251 - Archaeobotany of Likpe Kukurantumi Earthwork Settlement, Ghana: Presentation of the Research Project

Patricia Ayipey^{1,7}, Adela Pokorná², Dela Kuma³, Samora Harry Ayivor⁴, Bright Amedeke⁵, Rexford Kedze⁵, Jesse Ayivor⁶, Jaromír Beneš⁷

¹*University of South Bohemia, Institute of Archaeology, Ceske Budejovice, Czech Republic*

²*Institute of Archaeology, Academy of Science- Prague, Prague, Czech Republic*

³*Northwestern University, Department of Anthropology, Evanston-Illinois, USA*

⁴*Protestant Theological Faculty, Department of Ecumenical Theology and Practical Theology and Bio Ethics, Prague, Czech Republic*

⁵*University of Ghana, Department of Archaeology and Heritage Studies, Legon-Accra, Ghana*

⁶*Institute for environment and sanitation studies, University of Ghana, Legon-Accra, Ghana*

⁷*Laboratory of Archaeobotany and Palaeoecology, Faculty of Science, University of South Bohemia, Ceske Budejovice, Czech Republic*

Ghana has witnessed massive transitions in its history from the Stone Age period to the modern era. There is quite a little research in Ghana on the Late Stone Age period, the trade networks of the sub-Saharan and trans-Atlantic trades, and colonialism, as compared to the Iron Age period of Ghana. The popular research on the Iron Age period has been verifying whether the invention of iron production was an independent or diffusions' invention. However, little is known about the food production character of the Iron Age period in Ghana. To understand the Iron Age period of Ghana, studies on Earthworks cannot be ignored. In this study, we aimed to understand the relationship between the landscape and human population in the early times through the investigation of the abandoned earthwork settlement at Likpe Kukurantumi. The study aimed to contribute new empirical evidence that documents some of the evolution of West African food tradition during the past 2 millennia through the analysis of archaeobotanical samples of the Likpe Kukurantumi Earthwork. Both anthracology and phytolith analyses of the archaeobotanical materials recovered from the excavation conducted revealed that the site is rich in archaeobotanical data. Available literature and field interviews with indigenous people who are community knowledge holders helped to elaborate a catalog of plant species and their uses in the study area. Furthermore, data from the study shows the paleoethnobotanical analysis of the archaeobotanical remains recovered from the study area. More so, the result of this research contributes to social complexities and the subsistence economy employed by a complex society



during the first millennium AD in Ghana. This community-collaborative research is timely because it helps to document, preserve, and conserve Likpe's cultural heritage. The research, therefore, contributes to knowledge and the discourse on the environmental archaeology of Likpe and its earthwork construction.

IWGP22-0228 - New tools to optimize the identification of (archaeo) botanical macro remains

Lina Begemann¹, Roberta LC Dayrell¹, Florian Hartig¹, Jakub Geyer², Peter Poschlod¹

¹*University of Regensburg, Faculty of Biology and Preclinical Medicine, Regensburg, Germany*

²*University of South Bohemia, Department of Computer Science, Budweis, Czech Republic*

In (archaeo-) botany, macro remains like plant seeds are frequently found. Assigning these remains to plant species helps e.g. to reconstruct the land use history and is thus an imperative tool. A common method to identify macro remains is to compare them with seeds of extant taxa. However, reference material is mostly scattered throughout different publications or not available, hindering the identification of taxa in macro remains, especially of wild species. In order to optimize the identification process, we measured seed morphological traits of approximately 1,600 different plant taxa from Central Europe. We acquired images of seeds using a flatbed scanner and microscope and used image processing tools to extract morphometric and colorimetric measurements. We also recorded morphological traits, such as attachments and surface structures (e.g. hairs and scales). We then set up a database that includes images of seeds, as well as the information on seed morphological traits, including texture, colour, shape and size. Filters can be applied in the database to narrow down the species that match the desired traits. In a concurrent approach, morphological traits are provided as inputs to classification models. The method aims to calculate the accuracy with which seeds can be assigned to a taxon in the database. These new tools provide important and reliable resources for the identification of macro remains of wild species, which often requires an otherwise more time-consuming and not always successful approach.

IWGP22-0193 - Controlled charring of plant underground storage organs for the preparation of reference material

*Marian Berihuete-Azorín*¹

¹Institut Català de Paleocologia Humana i Evolució Social, UCO Archaobotany, Tarragona, Spain

Charring is the most common state of preservation of archaeobotanical remains. For this reason, reference collections of charred specimens are as important for archaeobotanists as fresh ones. Over the last decades, a growing corpus on charring experiments has developed, mainly focused on cereal grains and seeds. Regarding underground storage organs (USOs), the available information is much more limited with just a few experiments carried out. However, as the corpus of USOs' remains recovered at archaeological sites is growing, we consider that reference material needs to be produced consistently to provide assistance with their identification and interpretation. In this work we present the results of a series of experiments made on market available species of different kinds of USOs: true bulbs (onion and garlic), stem tubers (potato), tuberous roots (sweet potato) and taproots (carrot and beet). The aim is to design an effective protocol for the production of charred reference material that can be easily adapted to gathered wild species, and that will also help to better understand and interpret the predepositional processes that affected archaeological remains. Different temperatures, charring times, and previous state of the items have been tested allowing us to gain a first insight into the topic. This poster presents the results as a proposal for further research.

IWGP22-0286 - Comparison of a soil seed bank with actual vegetation in alluvial floodplain of Lužnice river

Alexandra Bernardová¹, Adéla Pokorná², Jitka Klimešová³, Jana Martinková³, Andrea Kučerová³, Barbora Jonášová¹, Patrick Saccone^{4,5}

¹Laboratory of Archaeobotany and Palaeoecology, Faculty of Science- University of South Bohemia in Ceske Budejovice, Czech Republic

²Institute of Archaeology of the Czech Academy of Sciences, Prague, Czech Republic

³Institute of Botany of the Czech Academy of Sciences- Czech Republic, Prague, Czech Republic

⁴Austrian Academy of Sciences, Institute for Interdisciplinary Mountain Research, Vienna, Austria

⁵University of Natural Resources and Life Sciences, Department of Integrative Biology and Biodiversity Research, Vienna, Austria

The study compares a soil seed bank with actual vegetation in alluvial sites of the upper stream of Lužnice river for three biotopes. We focused on two different soil seed bank investigation methods to reveal the applicability of macrofossil analysis for the interpretation of palaeoecological records. Within the study, we collected samples from 10 localities in the Lužnice river alluvial floodplain from three different biotopes at each location and made a list of actual vegetation.

Each sample was divided into two and one half investigated as a sample for the macrofossil analysis. The second half was used for germination. The results were compared with actual vegetation. The results show quite a low overlap (20 %) of the species found in soil and the actual vegetation and a similar overlap (23 %) with species found by the germination experiment. The total number of species was lower in sediment than in recent vegetation. However, even the reduced number of species could be used to describe the environment effectively. Also, essential seed traits that positively affect long term seed preservation in soil were determined.

IWGP22-0259 - ArboDat 2.0 - towards a joint evaluation tool and data repository

Felix Bittmann¹, Moritz Mennenga²

*¹Lower Saxony Institute for Historical Coastal Research, Natural Sciences,
Wilhelmshaven, Germany*

*²Lower Saxony Institute for Historical Coastal Research, Cultural Sciences,
Wilhelmshaven, Germany*

Currently the steadily increasing amount of archaeobotanical data is collected and archived digitally in many formats and databases, mostly limited to the groups retrieving it. In the frame of almost each larger project or scientific program a specific database is established to register the new data and to meet with the aims of the project. At best, the data is kept in a central repository of a leading or larger institution involved after the end of a project or program, available and accessible for their own members only. But often, groups working together and collecting data, disintegrate afterwards starting new cooperations elsewhere and no further development of the repositories takes place.

Since about 25 years the MS Access-based program package ArboDat has been developed to collect archaeobotanical data in a standardised way and its different versions has been adopted by scientists from more than 20 countries. Originally also developed as a database program to register data of a related project, it gained interest and use of a wider community. Although the structure allows data exchange between colleagues and groups, the free data accessibility and long-term storage is not granted. Also ensuring the compatibility to updates and new MS Office-versions needs free working capacities to make the necessary adaptations. How this can be overcome will be subject of the lecture and the further prospected development will be discussed.

IWGP22-0038 - The optimal sample size of cereal grains and pulse seeds for stable isotope research is now well-defined

*Otto Brinkkemper*¹, *Ricardo Fernandes*²

¹*Cultural Heritage Agency of the Netherlands, Landscape, Amersfoort, Netherlands*

²*Max Planck Institute for the Science of Human History, Radiocarbon Laboratory, Jena, Germany*

To our knowledge, there is no objective assessment in the literature available on the optimal number of cereal grains and leguminous crop seeds to be used for measurement of carbon and nitrogen stable isotopes. Archaeological formation processes play a decisive role in the heterogeneity of the stable isotope's signals preserved in charred remains of crop plants. Apart from the natural variability within one single plant, different seeds of one type of crop in an archaeological context may have derived from very different fields around the settlement. Numbers used in different studies (mostly of cereals) to meet the expected variation vary from 'at least 5' (Alagich *et al.* 2018: 148) and 6 grains (Riehl *et al.* 2014: 12353) via 'at least 10' grains (Bogaard *et al.* 2013: 12593) and 10-15 grains (Kanstrup *et al.*, 2011: 2880; Kanstrup *et al.* 2012: 2539) to 30 grains (of the smaller seeded *Pennisetum glaucum*, Styring *et al.* 2019: 669). To identify a statistically founded minimum number of cereal grains needed for an adequate isotopic average, we selected four samples of one charred crop plant each (three cereals and one pulse crop) from Dutch sites. For each of these samples, 15 subsamples of one single seed/grain, and one subsample of 5, 10, 15 and 20 seeds/grains were pulverized and homogenized without pre-treatment. The selected samples had shown no effect of pre-treatment in an earlier study (Brinkkemper *et al.* 2018). From this earlier study, we also have measurements of 30 untreated grains from these samples. Isotopic measurements (by means of IRMS) were performed at the laboratory of Bradford (UK). This dataset allows for a robust assessment of the minimum number of grains/seeds required.

IWGP22-0114 - Palaeoassocia as methodological tool for phytosociological analyses is further developed

Otto Brinkkemper¹, Mans Schepers², Onno van Tongeren³

¹*Cultural Heritage Agency of the Netherlands, Landscape, Amersfoort, Netherlands*

²*Groningen University, Centre for Landscape Studies, Groningen, Netherlands*

³*Data Analysis Ecology, n.a., Arnhem, Netherlands*

In 2013, Schepers *et al.* published the first version of Palaeoassocia, an adapted version of the software package Associa. Palaeoassocia identifies the most likely plant communities for species lists of archaeobotanical plant assemblages. The archaeobotanical list of species within a sample (or a site) is compared with a dataset of actual presences of plant species in natural vegetations, including arable field weeds. In Palaeoassocia an association value is calculated for each pair of species in a given sample based on their separate and combined presences in the database underlying the syntaxonomy of the vegetation of the Netherlands. The resulting association table has positive and negative values, indicating higher respectively lower probability of co-occurrence than expected for independent probabilities of occurrence. This table needed to be ordered manually to group species that were likely to cooccur frequently. After this manual step, the groups of species were attributed to the most likely present-day plant communities by the software program. We tested the methods on a data set of mainly crop weeds from a medieval deep stable in Best, where the construction of a byre appears to date dendrochronologically to 1263 AD, the oldest known standing farming construction in the Netherlands. Fifteen archaeobotanical samples of dung layers in the subsoil of the byre were studied archaeobotanically by the first author. The manual ordering of data of four selected samples appeared to result in groups that differed to a greater or lesser degree between the three researchers involved. The larger the number of species in a sample, the greater the variation. Therefore, we extended Palaeoassocia with methods based on clustering, constrained by criteria that are implicitly also used in manual ordering. Finally, we developed a direct linkage method that avoids the side road over associations between species.

IWGP22-0288 - Study of Seed Taxon Classification with Neural networks and Multiscale Feature Enhancement for Future Classification of Seeds from Archaeological Deposits

Ivo Bukovský¹, Vojtech Barnat², Ondrej Budik¹, Miroslav Skrbek¹, Peter Poschlod³, Michaela Ptáková⁴, Veronika Komárková⁴, Alexandra Bernardová⁴, Kristýna Budilová⁴, Roberta Dayrell³, Lina Begemann³, Jaromír Kovárník⁴, Jakub Geyer¹, Jaromír Beneš⁴

¹University of South Bohemia, Department of Computer Science, České Budějovice, Czech Republic

²Czech Technical University in Prague, Faculty of Mechanical Engineering, Prague, Czech Republic

³University Regensburg, Institute of Botany, Regensburg, Germany

⁴University of South Bohemia, Laboratory of Archaeobotany and Palaeoecology, České Budějovice, Czech Republic

The study proposes the concept of seed taxon classification by neural networks with multiscale feature enhancement. The automatic plant seed recognition by this proposed transfer learning technique with *Neural Networks* (NN) intends to expand archaeobotany's analytical possibilities significantly. The principle is that samples of several dozen taxa of recent seeds help to train NN to recognize seeds from archaeobotanical assemblages. Our results by *Deep Convolutional Neural Networks* (DCNN) on our recent seed datasets confirm the DCNN be the top tool as we achieved the classification accuracy of 99.01 % (similar promising results were recently published in [1] on larger dataset [2]). Thus, DCNN overwhelms traditional classification methods when applied to seeds without complicated image preprocessing. In our approach, we propose the basis of a self-learning system that learns classification and improves its robustness with the growing database. The taxa where DCNN performs weaker are automatically identified and clustered by the lower area under *Receiver Operating Characteristic* (ROC) curves. Multiscale feature extraction is proposed to improve the overall classification technique's performance further. Furthermore, we propose to carry out an explainability study of trained DCNN to analyze the feature's importance as they may affect DCNN performance for recent seeds vs. seeds from archaeobotanical assemblages.

Reference:

Loddo, M. Loddo, and C. Di Ruberto, "A novel deep learning based approach for seed image classification and retrieval," *Comput. Electron. Agric.*, vol. 187, p. 106269, Aug. 2021, doi: 10.1016/j.compag.2021.106269.

"Searchable Seed Image and Illustration Gallery - Plants - Canadian Food Inspection Agency.

"https://inspection.canada.ca/active/netapp/idseed/idseed_gallerye.aspx?item_sNum=-1&famkey=&family=&keyword=&letter=A (accessed Jan. 31, 2022).

IWGP22-0151 - Digging up the dung: Interpreting plant materials and seed taphonomy in an experimental fumier deposit

Nit Cano-Cano^{1,2}, Aitor Burguet-Coca^{1,2}, Marian Berihuete^{1,2}, Ethel Allué^{1,2}

¹*Catalan Institute of Human Paleoeology and Social Evolution IPHES-CERCA, Archaeobotany Unit, Tarragona, Spain*

²*Universitat Rovira i Virgili, Department of History and History of Art, Tarragona, Spain*

The seeds of a wide variety of plant taxa can survive the passage through the digestive tract of livestock and can be found in an intact and often identifiable state in the excrements of the consuming animal. That is especially true in the case of small and/or hard coated seeds. Due to these circumstances, it has been hypothesized that these plant remains could be an important component of the archaeobotanical record in contexts of animal penning and dung burning, known as *fumiers*.

Accordingly, numerous studies developed since the early 1980s have researched how part of the seed assemblage can potentially be incorporated into the archaeobotanical record through the presence of animal dung, particularly with the use of dung as fuel, construction material, or fertilizer.

Here we study the presence of plant macro-remains found in modern goat and sheep dung prior to combustion events and document the preservation of these botanical remains when subjected to controlled charring events in reducing and oxidizing environments at different temperature ranges. These samples come from three different contexts, with dung collected from two free grazing and one enclosed herd. The aim of the taxonomic and taphonomic study of these macro-remains is to identify specific features related to the morphological alteration of the seeds when digested and due to charring.

The humidity level and time since deposition of the collected samples were taken into consideration to study the degradation of the seed assemblage that would naturally occur in *fumier* deposits. The feeding habits and the plant species from the neighbouring areas of the pen and pasture zones of the studied herds have been noted to assess the representativeness of these types of seed assemblages in order to reconstruct past livestock practices.

IWGP22-0096 - Study of the plants remains without remains! Positive casts of the plant's impression from the Christian Pottery surfaces in Sudan

*Hamad Mohamed Hamdeen*¹

¹*University of Al Neelien, Department of Archaeology, Khartoum, Sudan*

Pottery is one of the main diagnostic objects in archaeology, and imprints on pottery, therefore, have an obvious advantage as once detected, they can be culturally classified and dated. The evidence of plants on pottery consists of impressions of small plant materials such as seeds/grains, husks, and leaves, and during the firing of the pottery, these plant materials are burnt away leaving cavities that retain more or less the same external morphological features as the plant remains themselves. The paper will present the recent research of the positive cast for plant's impression from the two Christian sites; El Ga'ab and Banganarti site in northern Sudan. The materials include one big ceramic basin from El Ga'ab and 2.829 pot-sherds from the Banganarti. To make casts, a small paintbrush was used to clean the ceramic. The casts of the impressions were made using air-drying latex, a flexible mould compound, and left for 1 hour to dry. Next, the latex mould compound was mixed with Indian ink to enable direct observation of the casts and to dilute the compound. Finally, the material was photographed, and casts with clear impressions were selected for further examination using M6C-10 and SMART 5MP PRODELTA/optical microscopes. The procedure for identifying the plant casts was mainly based on comparing external morphological features (i.e. shape, size, and surface pattern) with reference collections. Plants that were identified from Banganarti Church include wheat (*Triticum* sp.), barley (*Hordeum* sp.), and bitter apple (*Citrullus colocynthis*), and from El Ga'ab include wheat (*Triticum* sp.), barley (*Hordeum* sp.). These results from these two Christian sites show that it is evident that the positive-cast methodology has potential for the identification of plant impressions on pottery surfaces, and can help for further comparison with other plant remains from other sites, and can help for reconstructing the Palaeoenvironment and Palaeoeconomy during the Christian period in Sudan.

IWGP22-0269 - Multi-proxy analyses of deepened byres (potstallen) from Roman age Belgium

*Neeke Hammers*¹

¹*ADC ArcheoProjecten, Landschapsarcheologie, Amersfoort, Netherlands*

Deepened byres from Roman settlements in Belgium have been associated with changes in the agricultural system, as the appearance of the byres is assumed to be related to the need for the application of more manure to keep marginal soils suitable for production. Sites in the region have been subjected to archaeobotanical and palynological research to establish changes in the landscape, as well as the produced crops. In this study, the focus is on the byres themselves, as to assess which natural scientific methods can be applied to retrieve information on both the contents of the byre fill, but also the agricultural regimes and landscape development. For this case study, two sites have been selected: Brecht, Ringlaan and Puurs, Lichterstraat (region Antwerp, Belgium). In order to analyse the composition of the byre fills, multiple proxies have been studied: plant macrofossils, pollen and phytoliths. Additionally, stable isotope analysis ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) has been applied to charred cereal grains and other cultivated plants from byres as well as settlement contexts to get insights in the application of manure. The different strands of information collected through these proxies will be discussed.

IWGP22-0223 - Creation of an Archaeobotany reference collection: experiences from the Ethnobotany and Economic Botany department Museum of Natural History- UNMSM (Lima-Peru)

Luisa Del Rosario Hinostroza Garcia¹, Joaquina Albán¹, Leydy Rita Gines², Lady Nicolle Ramirez³, Andrés Luliquis²

¹*Universidad Nacional Mayor de San Marcos- Museo de Historia Natural, Etnobotánica y Botánica Económica, Lima, Peru*

²*Universidad Nacional Pedro Ruiz Gallo, Escuela de Arqueología, Chiclayo, Peru*

³*Universidad Nacional Mayor de San Marcos, Escuela de Arqueología, Lima, Peru*

The action of collecting is innate in humans; the interest in ordering objects of different colours, shapes and textures is as old as we are. Also, it is considered a natural characteristic for organizing the collections in a “systematic” way. Scientific collections and museums maintain a close link that dates back to the beginning of the 16th century because they are fundamental institutions that seek to preserve the artistic, historical and biological heritage. Biological collections are reservoirs of living or preserved organisms that contain basic information about the biological diversity of a particular place and time. Around this point, from the Ethnobotany and Economic Botany laboratory of the Museum of Natural History - UNMSM, two projects are being developed that contribute to the creation of biological collections: The Ethnobotany collection and Archaeobotany reference collection. The creation of the latter is mainly made up of macrobotanical samples from excavations on the coast of Peru. The good conservation of the remains, influenced by the aridity of the Peruvian coast, has allowed their preservation to be optimal, thus conserving most of their diagnostic structures that facilitate their taxonomic determination. Thus providing information on ecology, biodiversity, taxonomy and domestication, among others. In this way, the implementation of this information in an open access database will facilitate the search, promote research and promote scientific dissemination to researchers and the general public on a national and international scale.



IWGP22-0158 - Plant remains preserved in products of metal corrosion: source of evidence on ancient plant materials and environment from burial contexts

Ivanka Hristova¹, Elena Marinova², Juliana Atanassova³

¹*Umeå university, Department of Historical- Philosophical and Religious studies, Umeå, Sweden*

²*State Office for Cultural Heritage Baden Wuerttemberg, Laboratory for Archaeobotany, Geienhofen-Hemmenhofen, Germany*

³*Sofia University "Sv. Kliment Ohridski", Department of Botany, Sofia, Bulgaria*

Products of metal corrosion have the capacity to preserve remains of organic matter, including plants. Their study enlarge our knowledge on the economy and rituals of past societies and provide information about the surrounding environment. Here we present results of pilot palaeobotanical analyses of cemeteries from the Black Sea coast of Bulgaria (Varna Chalcolithic necropolis and Hellenistic necropolis of Nessebar) aiming to explore their potential and limitations. The studied organic remains come from corrosion crusts built on the surface of metal objects and analysed for plant macroremains and pollen. Palynological data from the Varna Chalcolithic necropolis showed predominance of xerophytic and halophytic herbaceous communities and mixed oak forests on the surrounding hills. Additionally, anthropogenic indicators and pollen grains of cereals were identified. The macrobotanical analysis attested Cornelian cherry as the main wood used for the handles of copper axes. Imprints of rush stems – probably coming from matting were identified. The palynological analysis from the Hellenistic necropolis of Nessebar showed groups of pollen of *Vitis*, *Cistus*, Fabaceae and Rosaceae, indicating the use of their flowers/ branches in the burials. Pollen of Poaceae, Brassicaceae, Chenopodiaceae, *Plantago* and *Rumex* suggested open ruderal vegetation. In addition, some NPP, like Chlamidospores, gave indication of locally dry and mesotrophic conditions. The plant macroremains revealed further interesting aspects of the burial ritual. Fruits of almond were deposited parallel to each other on the iron strigillas; flax fibbers and wood of pine were part of bronze wreaths. The results are promising to reconstruct details of the burial ritual and involved in it plant materials, which could be missed by traditional sampling or not preserved in dry soil conditions and in absence of metals. With this paper, we would like to drive the attention of the scientific community to the potential of corrosion products as source of archaeobotanical information.

IWGP22-0153 - Morphometric variation of seeds as a tool for tracing barley history: modern diversity and preliminary archaeological results in Lattara (France)

Angele Jeanty¹, Jérôme Ros¹, Núria Rovira², Natàlia Alonso³, Ramon Buxó⁴, Camille Dham¹, Célia Lecomte¹, Cyprien Mureau¹, Sarah Ivorra¹, François Balfourier⁵, Laurent Bouby¹, Allowen Evin¹

¹*Institute for Evolutionary Sciences of Montpellier, Dynamics of Biodiversity- Anthropoecology, Montpellier, France*

²*Archéologie des Sociétés Méditerranéennes, Archéologie des Milieux et des Ressources, Montpellier, France*

³*Departament d'Història, Grup d'Investigació Prehistòrica, Lleida, Spain*

⁴*Museu d'Arqueologia de Catalunya, Museu d'Arqueologia de Catalunya, Girona, Spain*

⁵*UMR INRA/UBP Genetics- Diversity- Ecophysiology of Cereals, Diversité et Organisation des Ressources Génétiques, Clermont-Ferrand, France*

Following its domestication in the Fertile Crescent, barley spreads into the west of the Mediterranean basin during the Neolithic period and represents today a major cereal in many agrarian systems. Geometric morphometrics, a series of quantitative approaches for studying the size and shape variation of objects, has provided encouraging results for studying barley seed diversity. In that vein, the first aim of this study was to document the current barley morphometric diversity using 2950 modern barley seeds belonging to 68 varieties. We demonstrate that barley grains record morphological diversity of the ear (2-row/6-row, naked/hulled), winter and spring varieties, and environmental factors during its cultivation. Using these results, the second aim was to document barley diversity at the archaeological site of the Gallo-Roman port of Lattara (Lattes, France) dated from the Iron Age to the Middle Ages as an example of morphometric perspectives in archaeology. The large sampling carried out at the site allowed to analyze of 2000 archaeological seeds from 40 samples. Morphometric diversity from various sectors of the city and various periods (500 BC – 900 AD) can thus be contrasted and characterized in comparison to our modern reference collection. It opens interesting perspectives for studying barley diversity over the eight millennia since the onset of agriculture in the whole of the northwest Mediterranean basin in the framework of the DEMETER project (ERC Starting Grant; PI A. Evin).

IWGP22-0256 - Unravelling drylands agriculture: experimental, ethnographic, and archaeobotanical modelling

Carolina Jiménez-Arteaga¹, Marco Madella¹, Abel Ruiz-Giralt¹, Stefano Biagetti¹, Alessandra Varalli¹, Francesca D'Agostini¹, Carla Lancelotti¹

¹*Universitat Pompeu Fabra, Humanities, Barcelona, Spain*

Agriculture in drylands, especially where rainfall is scarce and erratic, is often deemed unfeasible in the absence of irrigation. However, there exist modern ethnographic instances of rainfed agriculture of millets in areas where annual rainfall is well below the supposed lower limit for cultivation. These examples hint at the possible occupations of areas, in the present and in the past, that were up to know thought to be uninhabitable. Therefore, being able to detect this type of agricultural practices in the past has the potential to change the established narratives of drylands. This paper illustrates the results of experimental, ethnoarchaeological, archaeobotanical and modelling approaches to the study of millets cultivation, from the present to the past and back, carried out within the *Resilience and Adaptation to Drylands project* (RAINDROPS). In particular, it centres on: (i) results of ethnographic interviews conducted in Sudan, Ethiopia and Pakistan with local millet farmers, which highlight the preference towards local crops and the relatively little importance of irrigation; (ii) the modelling of worldwide ethnographic information collected on millets cultivation practices, which indicates how modern local ecological knowledge can be used to approximate past land use patterns; and (iii) the creation of a “reference collection” of archaeobotanical proxies to detect plant water availability directly from archaeobotanical remains. We maintain that the combination of modelling, based on Traditional Ecological Knowledge, and the analysis of phytoliths and stable isotopes from grains and phytoliths, can provide a suitable frame of reference to reconstruct dryland agricultural practices.

IWGP22-0163 - Feeding the Gap: A modern experimental cultivation project towards the creation of new tools that explore past agriculture

*Alexandra Kriti*¹, *Alexandra Livarda*¹, *Ioannis Mylonas*², *Elissavet Ninou*³,
*Hector Orengo*¹

¹*Institut Catala d' Archaologia Classica, Landscape Archaeology Research Group, Tarragona, Spain*

²*Hellenic Agricultural Organization-Dimitra, Institute of Plant Breeding and Genetic Resources, Thessaloniki, Greece*

³*International Hellenic University IHU, Department of Agriculture, Thessaloniki, Greece*

In this paper we aim to present a new experimental cultivation project in the north of Greece and how this can be used towards the development of new tools that will allow investigation of agriculture in the past. The project focuses on barley (*Hordeum vulgare* L.) and involves experimental cultivation under field conditions of 22 accessions under different cultivation regimes at the Institute of Plant Breeding and Genetic Resources, based at Thermi Thessaloniki, north Greece. The barley genotypes are originating from various regions of contemporary Greece and constitute the traditional landraces of each region up to the point of the Green Revolution. We have also included a modern cultivar from Thessaloniki, which is used as a control reference. Different cultivation regimes are examined by differentiating input levels of water and manure simulating traditional agricultural practices. By conducting daily observations and measurements on all the plants during their maturity, we are accessing the landraces' response to the climatic and environmental conditions, as well as their potential impact on the phenotype of the grain and its dietary value. After presenting the experiment we discuss the on-going application of a combination of various methods, such as stable isotope analysis, geometric modern morphometrics and artificial intelligence, on the harvested grains and how these can be then potentially applied to archaeological assemblages to inform on past agriculture.

IWGP22-0162 - A pilot study of a new 3D GMM-based machine learning algorithm for the identification of crop landraces and agricultural practices

*Alexandra Livarda¹, Hector A. Orengo¹, Michael Wallace², Peter Martin³,
Alexandra Theodora Kriti¹*

¹*Catalan Institute of Classical Archaeology ICAC, Landscape Archaeology Research Group GIAP, Tarragona, Spain*

²*University of Sheffield, Archaeology, Sheffield, United Kingdom*

³*University of Highlands and Islands, Agronomy Institute, Orkney, United Kingdom*

This paper presents a new methodological approach for the identification of crop landraces and agricultural regimes. Geometric modern morphometric (GMM) analyses of plant remains based on two-dimensional data have been proved promising as a means to differentiate between crop landraces. This approach can be considered a 'direct' analysis of crop remains, applied to individual specimens in the archaeological record. Another major development in direct analyses of crop remains has been stable isotope analyses, used effectively to infer past agricultural practices. Cost and the destructive nature of analysis are barriers to the widespread adoption of stable isotope analysis.

In this paper we are presenting a new approach of direct analysis of grains, employing three-dimensional GMM in combination with artificial intelligence that offers an innovative, non-destructive and low-cost new tool that uses the full complexity of grain morphology. We first briefly explore the potential of this new tool to distinguish different agricultural regimes and then present our first application on distinguishing landraces. We use as an example here, a six-row barley landrace associated with the highlands and islands of Scotland, and other British and Scandinavian barley landraces. Using modern specimens of known origin and growing regimes, we present the results of their 3D shape recording and analysis using GMM. We then outline a series of measures, ratios and indices, which were used in machine learning-based analysis to produce a new algorithm for the automated classification of grain shape according to landrace. These results are then compared with those obtained by 2D-GMM, applied previously by Wallace and colleagues (2018), and their efficacy is discussed.

IWGP22-0183 - Of peas, apples and sheep...or using archaeobotanical and isotopic analyses to understand the first alpine agropastoral systems

Lucie Martin¹, Estelle Herrscher², Thierry Blasco³, Maryline Montanes³, Janet Battentier⁴, Cédric Lepère⁴, Manon Vuillien⁴, Lionel Gourichon⁴, Guy André², Alain Carré⁴, Arnaud Mazuy⁴, Claire Delhon⁴

¹*University of Geneva / University of Savoie Mont-Blanc, Laboratory of Prehistoric archaeology and anthropology / UMR 5204 EDYTEM, Geneva, Switzerland*

²*CNRS- Aix Marseille Université- Ministère de la Culture- MMSH, UMR 7269- Lampea, Aix-en-Provence, France*

³*CNRS- Sorbonne Université, Laboratoire d'Océanographie de Villefranche- LOV, Villefranche sur Mer, France*

⁴*CNRS- Université Côte d'Azur, UMR 7264- Cepam, Nice, France*

During the Neolithic, many caves or rock-shelters located in the Alps and their piedmonts were used for pastoral purposes. Pertus 2, one of these “sheepfold caves”, at 1000 m a.s.l., was occupied during the Neolithic (3850-3000 BC) by shepherds and potters. It benefits from excellent preservation conditions that have facilitated the establishment of multi-parameter analyses of the bioarchaeological remains found in the fossil dung layers (plant micro- and macro- remains and animal bones), along with a large number of stable isotopes analyses. Archaeobotanical work has revealed the remains of cereals, especially einkorn, as well as pulses (pea and lentil), suggesting significant agricultural activities. Wild plants, possibly consumed by humans or livestock, were also common. This assemblage includes oak buds and acorns, whole apple fruits and pips, and fir needles. At a relatively high altitude, the production of both livestock products and crops raised several questions concerning the feeding of the flocks and the maintenance of soil productivity.

In the framework of the project *AgroPastCN*, we carried out isotopic analyses (C, N) of animal bones and plant remains to explore the relationships between cultivation, gathering, and breeding practices in this mountain context. This talk will present the results of several dozen analyses carried out on archaeological cultivars, wild plant remains, and experimental fields. Our results show that the farmers who kept their herds in Pertus 2 cave managed an elaborate agropastoral system. The livestock was fed with leaves of deciduous trees but also probably with cereal chaff and/or pulses. The diversity of agricultural production and nitrogen isotopic values recorded in cereals grains allow us to consider field fertilization practices. The isotopic data seem to point to the mixing of cereals and pulse cultivation (together or alternatively in the same field) as a way to maintain soil productivity due to nitrogen inputs from legumes.

IWGP22-0064 - Inter- and intra-observer variation in phytolith morphometry

*Welmoed Out*¹, *Alison Crowther*², *Marta Dal Corso*³, *Rand Evett*⁴, *Juan José García-Granero*⁵, *Kristýna Hošková*⁶, *Marta Portillo*⁷, *Robert C. Power*⁸, *Javier Ruiz-Pérez*⁹, *Linda Scott Cummings*¹⁰, *Monica Tromp*¹¹, *Luc Vrydaghs*¹², *Kali Wade*¹³, *Mario Hasler*¹⁴

¹*Moesgaard Museum, Department of Archaeological Science and Conservation, Højbjerg, Denmark*

²*University of Queensland, School of Social Science, Brisbane- Queensland, Australia*

³*Kiel University, Institute for Pre- and Protohistory, Kiel, Germany*

⁴*University of California, Department of Environmental Science- Policy- and Management, Berkeley- California, USA*

⁵*IMF-CSIC Spanish National Research Council, Department of Archaeology and Anthropology, Barcelona, Spain*

⁶*Charles University, Faculty of Science- Department of Botany, Prague, Czech Republic*

⁷*Institució Milà i Fontanals-Spanish National Research Council IMF-CSIC, Department of Archaeology and Anthropology, Barcelona, Spain*

⁸*Ludwig-Maximilians-Universität München, Graduate School of Humanities and Human Sciences- Hokkaido University- Japan, München, Germany*

⁹*Texas A&M University, Department of Ecology and Conservation Biology, College Station- Texas, USA*

¹⁰*PaleoResearch Institute, n/r, Golden- Colorado, USA*

¹¹*University of Otago, Southern Pacific Archaeological Research SPAR- Archaeology Programme, Dunedin, New Zealand*

¹²*Maritime Cultures Research Institute MARI – VUB, Department of Art Studies and Archaeology, Brussels, Belgium*

¹³*Atlatl Archaeology Ltd, n/r, Lethbridge, Canada*

¹⁴*Kiel University, Variationsstatistik, Kiel, Germany*

Identification of archaeobotanical remains is generally based on characteristics such as simple linear measurements of size and shape as well as the surface or cell structure of the remains. In the case of closely related taxa, however, simple size and shape measurements do not always allow for distinction. In such situations, computer-assisted morphometry may offer a solution, since it allows for the collection of more complex variables and the detection of subtle differences. For example, morphometry has been used to identify grape pips, olive stones and opium poppy seeds (e.g. Terral et al. 2004, 2010; Jesus et al. 2021), as well as to identify phytoliths from inflorescences and leaves of grasses, particularly cereals (e.g. Ball et al. 1999; Portillo et al. 2006; Out et al. 2014).

Within the field of phytolith analysis, methodological standardization has always been a point of attention. Concerning phytolith morphometry, this has resulted in the development of open source morphometric software (Ball et al. 2016). An aspect that has, however, received little attention so far is inter- and intra-observer variation. Are data collected by different researchers equivalent? Are analyses by individual researchers repeatable? These questions are important since it may affect identifications.

Under the auspices of the International Committee for Phytolith Morphometrics (ICPM), appointed by the International Phytolith Society (IPS), a new project has started to investigate inter- and intra-observer variation among phytolith specialists. This contribution will present the project and preliminary results.

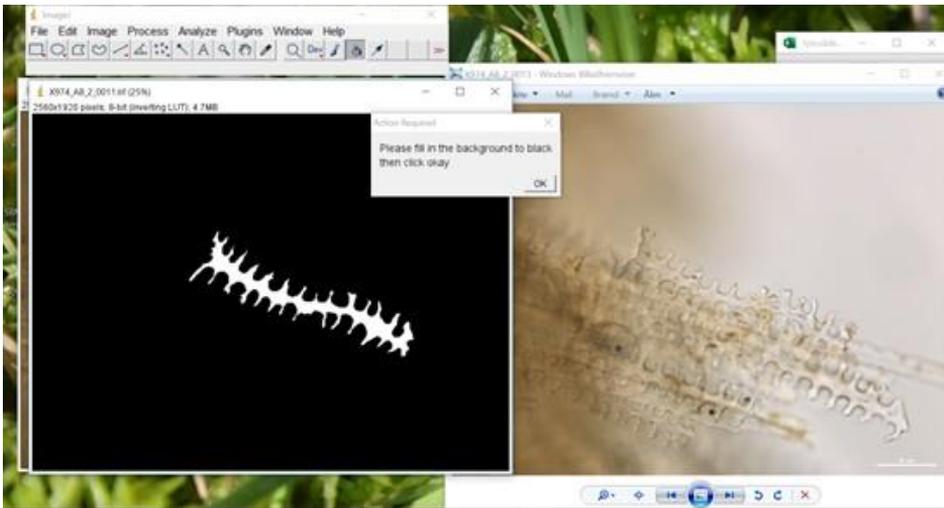


Figure: Phytolith morphometry using the software developed by the International Committee for Phytolith Morphometrics (Ball et al. 2016)

IWGP22-0260 - Vegetation in Medieval Prague. A complex methodological approach for interpretation of macro-remain data

Adéla Pokorná¹, Alžběta Mandelová², Kateřina Mrkvičková³, Lubomír Tichý⁴, Eva Jamrichová⁵, Petr Starec⁶

¹*Czech Academy of Sciences, Institute of Archaeology of the Czech Academy of Sciences-Prague, Prague, Czech Republic*

²*Faculty of Arts- Charles University, Department of Archaeology, Prague, Czech Republic*

³*Labrys- o.p.s., charitable trust, Prague, Czech Republic*

⁴*Masaryk University, Department of botany and zoology, Brno, Czech Republic*

⁵*Institute of Botany of the Czech Academy of Sciences, Department of Palaeoecology, Brno, Czech Republic*

⁶*Prague City Museum, Department of Archaeology, Prague, Czech Republic*

Previous studies suggest that there appears to have been a decline of semi-natural vegetation in urban contexts during the Middle Ages (Kozáková et al. 2009). However, it is generally difficult to provide detailed reconstruction of synanthropic vegetation on the basis of archaeobotanical data, due to taphonomic distortion of macro-remain species composition. In our paper, we will demonstrate our approach of how to filter these distortions. The area of today's Wenceslas Square (Prague, the Czech Republic) was located outside the city walls until the middle of the 14th century, after which it became the square of the New Town of Prague. It has been demonstrated elsewhere (Pokorná 2016) that the sediments in the square area provide favourable conditions for the preservation of organic material, which has led to a high species diversity of the identified waterlogged macro-remains. Construction work in the square in 2018 enabled detailed sampling of the profil dated from the middle 14th to 15th centuries in several parallel sections (archaeological investigation was carried out by the Prague City Museum).

Our aims were:

- 1) to determine the vegetation types that most likely correspond to the species composition of the samples
- 2) to test whether the species composition significantly changed depending on the depth of the profile, i.e. whether it is possible to consider a change in the local environment (or in the source area of the imported macro-remains) over time
- 3) to test whether the species composition significantly changed in space, i.e. whether there were different environments (different activities) in various parts of the square.

- 4) to describe the characteristics (i.e. functional traits and other properties) of the plant species found
- 5) to identify species which almost certainly did not grow on the site and were brought there from elsewhere (these are mainly weeds and meadow species)

IWGP22-0266 - Macro-remain Vegetation Index

Adéla Pokorná¹, Petra Hájková², Lubomír Tichý²

¹Czech Academy of Sciences, Institute of Archaeology of the Czech Academy of Sciences-Prague, Prague, Czech Republic

²Masaryk University, Department of Botany and Zoology, Brno, Czech Republic

Macro-remains (seeds/fruits) of wild growing plants are an important source of environmental information of the past. However, the interpretation of macro-remain data is complicated by a combination of several factors which bring uncertainty to the system: (i) one sample represents a combination of macro-remains from various sources, i.e., all the species never grew together within one biotope; (ii) the species composition of macro-remains' assemblage is mostly fragmentary, compared to the original vegetation. Moreover, ecological niches of species are often wide and overlapping. Our aim was to create a tool for (relatively) objective interpretation of macro-remain data in archaeobotany and palaeoecology. We present here a Macro-remain Vegetation Index which is a number indicating relative probability that at least part of the macro-remains in the sample comes from the particular vegetation type. The numerical calculation of the Index is based on syntheses of current vegetation, mainly the frequency and fidelity of each species in respective vegetation types. In our paper, we describe the way the index was derived and demonstrate possible ways to apply it to specific fossil data.

IWGP22-0212 - Environmental sampling in archaeology: How many finds do we overlook... and does it matter?

Michaela Ptáková¹, Jiří Bumerl¹, Veronika Komárková¹, Lenka Kovačiková¹, Jan Novák², Simona Poláková³, Martin Pták⁴, Petr Šída⁵, Václav Vondrovský⁶

¹*University of South Bohemia, Laboratory of Archaeobotany and Palaeoecology, České Budějovice, Czech Republic*

²*Charles University, Department of Botany, Prague, Czech Republic*

³*Czech University of Life Sciences, Faculty of Environmental Sciences, Prague, Czech Republic*

⁴*University of South Bohemia, Institute of Archaeology, České Budějovice, Czech Republic*

⁵*University of Hradec Králové, Department of Archaeology, Hradec Králové, Czech Republic*

⁶*Institute of Archaeology of the Czech Academy of Sciences, Department of Information Sources and Landscape Archaeology, Prague, Czech Republic*

It has become common practice for archaeologists to collect archaeobotanical samples as a source of information about past food, agriculture and environment. Beside this, the samples commonly contain small artefacts that are difficult to spot with the naked eye. In order to investigate the effect of sampling on the composition of artefacts and ecofacts, a sampling experiment was conducted in which infills of two Early Neolithic features (Radčice, Czech Republic) were collected in their entirety, which means that 100 % of their infill was processed in the laboratory to recover all preserved plant macroremains, charcoal, animal bones, pottery, daub and stone industry. This contribution thus provides data to evaluate the effectiveness of different sampling approaches and presents models assessing how the degree of knowledge is affected by the sampling strategy with respect to the individual categories of finds and research questions. Apart from assessing sampling adequacy with respect to the number, distribution and volumes of collected samples, the significance and informative value of artefacts “overlooked” in the field bring considerations relevant to archaeobotanists as well as archaeologists.

*This work was supported by the Czech Science Foundation grant No. 21-16614S: At the fringe of the neolithization: strategies of the first farmers of South Bohemia.

IWGP22-0147 - Underground silo storage and its effects on long-term grain preservation: a new archaeological and archaeobotanical experimental approach

*Jerome Ros¹, Thierry Pastor¹, Cecile Dominguez², Eric Yebdri³, Carole Puig⁴,
Tanguy Wibaut², Francis Fleurat-Lessard⁵, Jean-Michel Savoie⁵*

¹*Institut des Sciences de l'Évolution de Montpellier, umr 5554 CNRS, Montpellier, France*

²*INRAP, Méditerranée, Saint-Estève, France*

³*INRAP, Méditerranée, Villeneuve-les-Béziers, France*

⁴*Acter, umr 5136 FRAMESPA, Perpignan, France*

⁵*INRAE, ur 1264 MYCSA, Bordeaux, France*

Findings of charred seeds in archaeological silos are quite common, and often raise the question of their origin: are they seeds in primary position (remnants of burnt-in-place stocks) or secondary position (waste discharged into the structure)? To answer this question, archaeobotanists use data from ethnographic publications and experimental work. The discovery of in-place stocks is a great opportunity to document many aspects of past agricultural practices (species and types of remains stored, degree of processing of the stored remains, monospecific or mixed stock, human or animal destination). The discovery of large silo areas in medieval Mediterranean France with sometimes more than 2,000 silos, many delivering archaeological seeds, has revived questions about silage practices, how these structures functioned and their role in past societies. In this sense, the ANR project SilArchaeoBio, following experiments that began in 2016, is currently carrying out a brand new archaeological and archaeobotanical experimental research. This research, conducted in southern France (Alénia, eastern Pyrenees) relies on the creation ex nihilo of a new functional silos area, planned for the long term (10-15 years). This work aims to address various issues: management and evolution of plant stocks and of the structures through time and taphonomy of the filling. Regarding the archaeobotanical approach, the research consists of documenting several parameters: effect(s) of silo storage on the preservation/degradation of ensiled remains, role of crop processing on the quality of seed conservation, role and advantages of mixed storage, the effect of humidity on the stock, chances of stock preservation when the silo is cleaned by fire, etc. The results obtained so far on stored *Vicia faba* seeds and *Triticum monococcum* grains are encouraging: they present modes of conservation not described in the ethnographic literature and make it possible to start rethink the way of interpreting the archaeological seeds encountered in archaeological silos.

IWGP22-0276 - Reconstructing settlement zones. Acquisition of plant resources in the Late Bronze Age settlement area Březnice (South Bohemia) around 1000 BC

Tereza Šálková^{1,2}, Kristýna Budilová², Jan Novák³, Jaroslav Pavelka⁴, Antonín Majer⁵, Jaromír Kovárník², Barbora Strouhalová⁶, Libor Vobejda^{1,2}, Ondřej Komárek⁷, Petra Marešová², Roman Křivánek⁶, Martin Kuna⁶, Petr Menšík⁸, Ondřej Chvojka¹, Jaromír Beneš^{1,2}

¹*Institute of Archaeology, Faculty of Arts, University of South Bohemia, Branišovská 31a-CZ 370 05 České Budějovice, Czech Republic*

²*Laboratory of Archaeobotany and Paleoecology, Faculty of Science, University of South Bohemia, Na Zlaté stoce 3, CZ 370 05 České Budějovice, Czech Republic*

³*Department of Botany, Faculty of Science, Charles University, Albertov 6, CZ 128 43 Praha 2, Praha, Czech Republic*

⁴*Centre of Biology, Geoscience and Environmental Education, University of West Bohemia, Sedláčkova 15, 306 14- Plzeň, Czech Republic*

⁵*Palackého 62, CZ 38701- Volyně, Czech Republic*

⁶*Institute of Archaeology of the CAS, Letenská 4, CZ 118 01 Prague, Czech Republic*

⁷*U Trojice 2661, CZ 370 04 - České Budějovice, Czech Republic*

⁸*Department of Archaeology, Faculty of Arts, University of West Bohemia, Sedláčkova 15, CZ 306 14 Plzeň, Czech Republic*

Březnice is an extraordinary Late Bronze Age site with a unique cumulation of peculiar long sunken features interpreted as ritual remains of the communal activity. Our study is focused on the reconstruction of the settlement structure and character of the environment from which the site drew resources. Results of an archaeobotanical analyses clearly demonstrated significant deforestation and intensive land use in the vicinity of the study site. A wide range of crops was grown in drier, less often wetter fields as the weed taxa showed. The analyses enable to reconstruct several types of grasslands: dry pastures and fallow fields on plateaus and slopes, wet pastures or meadows in the floodplain. Acidophilous oak forests, alluvial forests, and shrubs were reconstructed as the most common forest habitats in the vicinity of the study site.

The analysis of plant macroremains has shown that most of the feature infills have a waste character. The spectra of plants were often similar in the infills of the features that were located close to each other. An anthracological analysis detected the same spectra of species in trenches and pits. The assemblages contained charred remains of firewood; a significant portion consisted probably

of burnt oak wood constructions. Phytolith and starch analyses detected remains of various parts of uncharred plants. Protein detection identifies the proteins contained in the infill sediments, referring to the presence of manure and meat. A micromorphological analysis indicated that the infills of the different types of features were similar – they contained uncharred plant remains, clay and ash. Phosphate anomalies were found only in some of the features, suggesting that the infills contained various amounts of organics. The measurement of magnetic susceptibility has led to the conclusion that the features were filled at once.

IWGP22-0247 - Archaeobotany as a tool for the archaeology: historical field systems in the Czech Republic, its dating and past environmental characteristics

Ivana Šitnerová^{1,2}, Jaromír Beneš^{1,2}, Tereza Majerovičová^{1,2}, Jiří Bumerl^{1,2}, Veronika Komárková², Václav Fanta³, Petra Marešová², Lenka Hrabáková^{1,2}, Kristina Janečková³

¹*Institute of Archaeology, Faculty of Arts, University of South Bohemia, Branišovská 31a-CZ 370 05 České Budějovice, Czech Republic*

²*Laboratory of Archaeobotany and Paleoecology, Faculty of Science, Na Zlaté stoce 3, CZ 370 05 České Budějovice, Czech Republic*

³*Czech University of Life Science, Faculty of Environmental Science, Praha, Czech Republic*

Historical field systems in the Czech Republic are called “pluzina”. These are agricultural structures of all fields, meadows and pastures connected to settlement by paths and are delimited often by hedgerows of shrubs. They are typical for Central Europe (Czech Republic, Poland, Austria, Slovakia). The same type of unit is called “die Flur” in Germany. Its origin is usually dated from the medieval period to the early modern age. They are fundamental landscape features because of their ecological and historical value. Despite of this, they are not protected, and they are continuously destroyed by ploughing and deforestation.

Our project “Identification and protection of preserved remnants of historical pluzina system” is very complex. The crucial part of the archaeological field research is based on archaeobotanical methods. We perform archaeological research at the boundaries of selected agricultural systems. The main goal is to date chosen pluzina systems and to get other historical and archaeobotanical information. Botanical macroremains are used for the dating by radiocarbon method, sediment of profile is dated by the optically stimulated luminescence (OSL) with a control of sedimentation integrity by radionuclides ²¹⁰Pb and ¹³⁷Cs. Needles of spruce or fir seems to be the most suitable material for it. OSL dating is used in case of presence of non-charred botanical macroremains. All these dating methods are compared with archaeological data (archaeological dating of historical settlements; technological elements of agricultural terraces) and historical dating (written sources). Ecological and other environmental data (especially pollen analysis) are obtained to create a comprehensive overview of this landscape phenomenon and form macromodels of their development.

In this contribution we present our archaeobotanical results (in some cases only preliminary) from five chosen pluzina field systems in the Czech Republic and we give an overview about two macromodels which are based on our research.

IWGP22-0280 - An archaeobotanical database for COREX - From correlations to explanations: towards a new European prehistory

*Claudia Speciale*¹

¹*University of Gothenburg, Historical Studies, Goteborg, Sweden*

In this Poster we present the structure and the aims of the archaeobotanical part of the database for the ERC-2020-SyG - ERC Synergy Grant COREX - From correlations to explanations: towards a new European prehistory.

The project aims to uncover the key processes behind the genetic and cultural diversity in Europe from the first farmers, 6 000 BC, to the end of the Bronze Age, 500 BC. We approach this challenge by applying novel modelling approaches allowing us to move from correlations to explanations of how changes have been shaped by the dynamic interaction of cultural innovation, migration, admixture, population growth and collapse, landscape transformation, dietary change, biological adaptation, social structure, and the emergence of new diseases. Our findings will serve to determine what the impact of the movement of people was on the European landscape, simultaneously on multiple scales: continental, regional and local, providing a research program defying the boundaries of archaeology, genetics and mathematical modelling. Thus by identifying prehistoric regularities in the interactions of human biology, social and economic organisation, and demography we will be able to compare them to anthropological and historical models of such processes in recent times, to form a more comprehensive understanding of the nature of migration, integration and cultural change, then and now.

The database will include the archaeobotanical data available for the sites, allowing to collect the carpological record from France to the Urals and from the Balkans to the Scandinavian peninsula for this large span of time.

IWGP22-0130 - Using modern analogue botanical macroremain data for the interpretation of layer formation processes in archaeobotanical records

Bigna L. Steiner¹, Stefanie Jacomet¹, Parick Grillas², Gaël Piquès³, Margaux Tillier³, Núria Rovira³

¹IPAS Integrative Prehistory and Archeological Science, Department of Environmental Sciences- University of Basel, Basel, Switzerland

²Tour du Valat, Research institute for the conservation of Mediterranean wetlands, Arles, France

³Archéologie des Sociétés Méditerranéennes- UMR 5140, Département d'Histoire de l'Art et Archéologie- Paul Valéry University Montpellier 3, Montpellier, France

Aquatic and wetland modern analogue botanical macroremain data can provide a tool to evaluate archaeological wetland sites in a more objective way. Modern analogue samples from different wetland types and different areas of the littoral can provide a basis for the interpretation of the nature and degree of aquatic influence and layer formation processes in archaeobotanical records of wetland sites. So far, we tested this method in two case studies. For the port of *Lattara*, a Roman coastal site from Southern France, we created a dataset using modern analogue samples from different wetland environments in a nature reserve, taken in transects perpendicular to the shoreline along moisture gradients. For Neolithic pile dwelling sites from Central Switzerland, a dataset from the literature consisting of modern analogue samples from the littoral of different lakes was used.

In both cases, the modern analogue datasets helped to interpret layer formation processes in the archaeobotanical record. In the case of the coastal region in France, we were also able to differentiate the sampled wetland types (saline/brackish or fresh water) and areas of the littoral (submerged, shoreline, unsubmerged), showing the potential of this method. We would like to discuss the possibilities and problematics of this method as well as ways to further develop and establish it within wetland archaeobotany.

IWGP22-0097 - Identification of archaeological pulse seeds using biometric measures and geometric morphometric

Miquel Taronj¹, Laurent Bouby², Vincent Bonhomme², Natàlia Alonso³

¹*Universitat de Lleida, Departament d'Història, Lleida, Spain*

²*Institut des Sciences de l'Évolution de Montpellier, Département Paléo-écosystèmes-climat- sociétés PAST, Montpellier, France*

³*Universitat de Lleida, Departament d'Història, Leida, Spain*

The taxonomic identification of archaeological seeds of certain cultivated pulse species is challenging due to a combination of a low interspecific differences and large intraspecific variability. This study develops two probabilistic models (biometric and morpho-geometric) that establish which species have more similarities with the doubtful archaeological pulse seeds. The species studied are: grass peas (*Lathyrus cicera/sativus*), lentils (*Lens culinaris*), peas (*Pisum sativum*), bitter vetch (*Vicia ervilia*), broad beans (*Vicia faba*) and vetch (*Vicia sativa*). The two models are founded on data from three different types of samples that are unquestionable as to their taxonomic identification: current seeds, current charred seeds and archaeological seeds. Both the archaeological seeds without taxonomic doubts and those that do have them, are from archaeological sites of the Bronze and Iron Age in the Western Mediterranean.

The biometric model uses the measures of length, width and thickness of the three types of seeds, yielded a discriminant linear model applicable to unidentified archaeological seeds. The morpho-geometric model is based on the shape of the seeds of the three types gleaned from geometric morphometry, specifically through outline analyses converted into coefficients by means of elliptical Fourier transformations. Archaeological seeds with doubtful identifications are then classified using a Linear Discriminant model based on shape descriptors. First, the accuracy of the two models on modern and archaeological without taxonomic doubts material was assessed. The results indicate that the models are marked by relatively high predictive percentages, especially in the morpho-geometric case. Therefore, these models yielding taxonomic re-identifications on unidentified archaeological seeds with a high degree of confidence and a small margin of error.

The positive outcome of this models paves the way for the identification of archaeological legume seeds that could not be done by traditional methods.

IWGP22-0020 - Experimental charring to assess the isotopic effects on stable carbon and nitrogen isotope ratios in *Panicum miliaceum* and *Setaria italica*

Andrés Teira-Brión¹, Amy Bogaard¹, Michael Charles¹

¹University of Oxford, School of Archaeology, Oxford, United Kingdom

Human-plant encounters have led to socio-economic changes such as in the use of the land, the social division of work, the agricultural system, and the human diet. *Panicum miliaceum* L. and *Setaria italica* (L.) P.Beauv. were the first C₄ photosynthetic pathway crops in Europe, arriving in the 2nd Millennium BCE. Both crops are resilient to a variety of agroclimatic challenges, require minimal energy input to yield grain, have a short growth cycle, and are well adapted to limited rainfall and poor soils. The seeds are highly nutritious and produce a large supply of biomass that can be used for livestock feed. These advantages made millets very attractive to diverse agrarian systems. Building on taxonomic identification of preserved macroscopic remains (archaeobotany), recent methodological advances can increasingly be tracked archaeologically through multi-proxy research. Particularly, stable isotope analysis has changed the way we interpret archaeological evidence by providing new information from organic plant and animal remains.

Previous work on cereals has suggested distinct $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values among different plant parts, such as chaff, straw, or leaves, compared to grains. This implies that consumption of different plant parts by humans and livestock, respectively, would lead to differences in their isotopic signatures.

Through an experimental design that reproduces different conditions of charring, we present preliminary results concerning the isotopic effect of charring on *Panicum miliaceum* and *Setaria italica* to address key questions in millet agriculture and consumption. The results reveal stable isotope ratios among different parts of plants, and their variability in both crops. The data obtained will provide a benchmark for comparative studies elsewhere.



Figure: Inflorescences of *Panicum miliaceum* (left) and *Setaria italica* (right).

IWGP22-0036 - Auto-fluorescent phytoliths. A new proxy for burned plant material

Luc Vrydaghs¹, Martin Hodson², Tiriana Segato³, Marie-Paule Delplancke³, Alexandre Chevalier⁴, Yannick Devos¹

¹*Maritime Cultures Research Institute MARI - VUB, Department of Art Studies and Archaeology, Brussels, Belgium*

²*Department of Biological and Medical Sciences, Faculty of Health and Life Sciences, Oxford, United Kingdom*

³*Service 4 MAT, Ecole Polytechnique de Bruxelles, Brussels, Belgium*

⁴*Royal Belgian Institute of Natural Sciences, Quaternary Environments and Humans, Brussels, Belgium*

Fire has played a major role in the history of humankind. Ranging from domestic and economic activities up to plant cover management in relation to agricultural expansion, a wide range of activities used fire. However, in the absence of charred remains within archaeological deposits, the detection of burned plant material is not always straightforward.

A number of methods have been used in the past to determine whether phytoliths in archaeological contexts have been fired and/or heated: morphological alterations, colouring and opacity, refractive index and Raman spectroscopy. However, none of these have satisfactorily discriminated between burned and unburned phytoliths. We will report on a series of investigations into auto-fluorescence in heated phytoliths.

Our work has been in two parts. Firstly, we examined phytoliths found in soil thin sections of well-characterised modern and archaeological contexts from Northern Europe. Secondly, we carried out experimental work to determine the precise temperatures at which auto-fluorescence occurs.

We have unequivocally shown that auto-fluorescent phytoliths can be found in many archaeological contexts where heating or burning has occurred. Fresh and unheated material showed no auto-fluorescent phytoliths, while combustion features and burned material revealed many auto-fluorescent phytoliths. These included both cell wall and lumen phytoliths.

Based upon these observations experimental work has been undertaken to determine the temperatures and the environmental conditions under which phytoliths fluoresce. This signal may then become an important proxy complementing the previously developed techniques. As such, integration of various proxies can provide a systematic and straightforward method to track evidence of fire and heating of phytoliths within archaeological contexts.

IWGP22-0160 - To be or not to be attributed to specific plants? The example of the cereal phytoliths

Luc Vrydaghs¹, Terry B. Ball², Alexandre Chevalier³, Yannick Devos¹

¹*Maritime Cultures Research Institute MARI - VUB, Department of Art Studies and Archaeology, Brussels, Belgium*

²*Department of Ancient Scripture, Brigham Young University, Provo, United States
Minor Outlying Island*

³*Royal Belgian Institute of Natural Sciences. Brussels, Quaternary Environments and Humans, Brussels, Belgium*

Phytoliths are plant microfossils. Despite extensive research during the last decades, their botanical attribution remains a critical issue. While being challenged since the 90's, the principles of multiplicity and redundancy (Rovner 1971) are still used as a justification to deny any possibility for taxonomical attribution.

Nevertheless, the development and expansion of reference collections confirm that some taxa produce very distinctive phytoliths at different taxonomic levels. However, things become more complex when considering closely related taxa. Phytoliths found in domesticated taxa deriving from wild relatives provide one of the best illustrations of it. Indeed, such taxa, especially at the species level, typically produce phytoliths of similar shapes and types difficult to distinguish from each other. In such cases, morphometric analyses (measurements of size and shape) may allow us to discriminate taxonomically closely related species. However, the application of morphometric criteria is not straightforward, in particular for archaeological contexts. Not only large samples of similar phytolith types are needed, but the phytoliths from an archaeological context shall all originate from a single taxon and plant part. So far, only some primary archaeological contexts, such as ceramic jar contents, provide such conditions. By focusing on one cereal phytolith known as Elongate dendritic, we are highlighting in this presentation how some of these issues can be overcome by the development of reference collections and the integration of phytolith analysis together with soil micromorphology (Vrydaghs et al. 2016).

Reference:

Rovner, I. 1971. Potential of opal phytoliths for use in paleoecological reconstruction. *Quaternary Research* 1(3): 343-359.



Vrydaghs, L., Ball, T., & Devos, Y. Beyond redundancy and multiplicity. Integrating phytolith analysis and micromorphology to the study of Brussels Dark Earth. *Journal of archaeological science*, 68: 79-88. doi:10.1016/j.jas.2015.09.004.

216 - Rice $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Values as Indicators of Watering and Manuring Regimes

Rubi Wu¹, Eric Belfield², Yu Dong³, Shangzong Feng⁴, Xiangdong Fu⁵, Nicholas Harberd², Fan Yang⁶, Michael Charles¹, Amy Bogaard¹

¹University of Oxford, School of Archaeology, Oxford, United Kingdom

²University of Oxford, Department of Plant Sciences, Oxford, United Kingdom

³Shandong University, Institute of Cultural Heritage, Qingdao, China

⁴Linyi Municipal Bureau of Agriculture and Rural Affairs, Agricultural Technology Centre, Linyi, China

⁵Chinese Academy of Sciences, Institute of Genetics and Developmental Biology, Beijing, China

⁶China National Centre for Archaeology, Archaeology Lab and Preservation Research Institute, Beijing, China

Previous work has shown that stable carbon and nitrogen isotope analysis of cereal grains and pulses seeds is useful for indicating their water status and soil nitrogen composition in modern experiments and farming systems in Europe and West Asia. Rice is an important cereal crop in East, South and Southeast Asia from prehistory until today. The aim of the present study was to test whether stable carbon and nitrogen isotopes in rice grains can provide an independent line of evidence for rice management, including irrigation and manuring. Three heritage and four commercial landraces were cultivated under various watering conditions in the glasshouse at the Department of Plant Sciences, Oxford. The results show that paddy conditions have a significant negative effect on the $\delta^{13}\text{C}$ values of heritage rice compared with saturated soil conditions, but a variable effect on faster growing, commercial varieties. Watering had an inconsistent effect on $\delta^{15}\text{N}$ values. Meanwhile, field experiments in Shandong, China also show a significant negative effect of paddy versus dry conditions on the $\delta^{13}\text{C}$ values of rice. Variable manuring practices and in some cases use of chemical nitrogen complicated an investigation into effects of watering and manuring on $\delta^{15}\text{N}$ values in field experiments in the Shandong and Shanghai region. Overall, this study indicates that $\delta^{13}\text{C}$ values are useful for identifying rice water regimes in the Neolithic China.

IWGP22-0117 - Late Bronze Age Kuckenburg, Germany: A unique site from the Urnfield culture in Central Europe

Barbara Zach^{1,2}, *Eleftheria Orfanou*^{1,2,3}, *Ricardo Fernandes*^{1,4,5}, *Robert Spengler*¹, *Enrico Paust*², *Florian Schneider*², *Patrick Roberts*⁶, *Wolfgang Haak*³, *Peter Ettl*²

¹Max Planck Institute for the Science of Human History, Archaeology, Jena, Germany

²Friedrich-Schiller-Universität Jena, Institut für Ur- und Frühgeschichte, Jena, Germany

³Max Planck Institute for Evolutionary Anthropology, Archaeogenetics, Leipzig, Germany

⁴Masaryk University, Faculty of Arts, Masaryk, Czech Republic

⁵University of Oxford, School of Archaeology, Oxford, United Kingdom

⁶The University of Queensland, School of Social Science, St Lucia QLD 4072 Brisbane, Australia

The Kuckenburg site in Sachsen-Anhalt, Germany, is unique for the coexistence of different mortuary practices. Both inhumations and cremations ascribed to the Urnfield period are present at a time period when cremations were, elsewhere, usually the main form of mortuary practice. Continuously occupied from the Late Palaeolithic until the Early Middle Ages, the site enables the study of diets, demography, and environment through time.

In a collaborative study involving several departments we apply a multidisciplinary approach, including archaeobotany, ancient DNA, stable isotope analysis, osteoarchaeology, and material culture analysis to get a better understanding of the experiences and identities of Urnfield related groups in the Late Bronze Age (LBA) of Central Europe.

Archaeobotanical results show a broad spectrum of crops, collected useful plants and weeds. Broomcorn millet *Panicum miliaceum* is present in some of the structures and the strong stable isotope signal for the consumption of broomcorn millet (signal for C₄-plant consumption) in only some of the individuals raises questions about the tempo and nature of the appearance of *Panicum miliaceum* in Central Europe. Analysis of genome-wide data from 18 inhumated individuals indicate that different mortuary practices at Kuckenburg were not the result of a new genetic group coming in but rather variation within a local population. With this study we show that the combination of multiple lines of evidence, such archaeobotany, aDNA, archaeology, and isotope studies, proves to reconstruct a more complete picture of the past at a critical Central European site.

IWGP22-0121 - Linking Archaeobotany and Micromorphology on Bronze Age tells in the Carpathian Basin

Tanja Zerl¹, Astrid Röpke¹, Mirijam Zickel¹, Marian Lie¹, Alexandra Gavan¹, Klára Pusztainé Fischl², Tobias L. Kienlin¹

¹University of Cologne, Department of Prehistoric Archaeology, Köln, Germany

²Miskolc University, Department of Prehistory and Archaeology, Miskolc, Hungary

The analysis of plant residues from archaeological sediments can reveal plenty of information not only on past diet, but also on architectural techniques, spatial and temporal changes of settlement activity and palaeoenvironmental conditions. In order to obtain more detailed information on these aspects, linking archaeobotanical macro-remain analysis with micromorphological investigations has proven to be particularly useful. It gives the opportunity to study archaeological layers from the macro and micro perspective. Using thin section, original parts of the archaeological material can be analysed with their complex interactions between organic and mineral material, and thus provide important information on the depositional history of the macro-remains and the matter in which they were embedded. The potential of this method combination is illustrated by two case studies in the Carpathian Basin.

During excavations of the Middle Bronze Age tell settlements of Toboliu-Dâmbu Zănăcanului (Romania) and Borsodivánka-Nagyhalom (Hungary), correlated samples for archaeobotanical and micromorphological analyses were collected from different archaeological contexts such as house floors, domestic waste and destruction layers. The different sample types were analysed in the same laboratory and the results were subsequently combined. It has been shown that the composition of the macrobotanical record and the micromorphological features can be associated with various anthropogenic activities such as cooking, cleaning, production processes, architectural building details, as well as waste disposal and management with dung input. The respective results complement each other to provide a more comprehensive picture of living patterns on Bronze Age tells.

Topic 1.5: Round table: Dissemination of archaeobotany

IWGP22-0188 - Black diamonds - a short film on bucket floatation for archaeobotanical investigations

Wiebke Kirleis¹

¹*Christian-Albrechts-University Kiel, Institute for Prehistoric and Protohistoric Archaeology, Kiel, Germany*

A German-English educational film documenting archaeobotanical sample preparation was produced at Kiel University. The film accompanies the sample extraction on an excavation of a Bronze Age settlement site in northern Germany. It explains the relevance of archaeobotanical investigations for archaeological research that allow deciphering the diet of the time and reconstruct ancient agricultural practices, in this case expanding the knowledge about everyday life in the northern Bronze Age.

The short film introduces archaeobotanical sample preparation, gives helpful and practical advice on safely handling archaeobotanical material. The 11-minute short film shows the individual steps that each archaeobotanical sample has to go through - step by step and explained in detail, understandable for professionals and laymen. With this educational film, a digital format is now available that can be used to prepare practical archaeobotanical trainings and archaeological excavations at universities and beyond, and can also be used for museum education, contributing to the dissemination of archaeobotany.

IWGP22-0086 - Finding the Balance: Teaching Archaeobotany to Non-Science Students

Erica Rowan¹, Jessica Feito²

¹Royal Holloway, University of London, Classics, Egham, United Kingdom

²Koc University, Research Center for Anatolian Civilizations, Istanbul, Turkey

Increasingly, students are looking for ever more flexibility with respect to degree paths and course choices. While this promotes interdisciplinary learning, it also means that archaeobotany classrooms and labs are filled with students coming from a range of backgrounds (ex. Classics, History, Anthropology, Geography). Many of these students have little to no prior knowledge of archaeobotany or the sciences. Full semester archaeobotany courses have multiple classroom hours to teach students both the basic and more complex methodological and scientific aspects of the discipline. Today, course design must take this array of backgrounds into consideration. Such full semester courses, however, remain a rarity at universities and more often than not, students are only exposed to archaeobotany during a single lecture or seminar, if at all. This lack of exposure is particularly evident in the field of Classical Archaeology where archaeobotany is often overlooked in favour of discussions of more traditional material types such as coins, statues or ceramics. The scientific nature of the discipline means that academics outside the field often do not feel comfortable teaching it. If a lecture on archaeobotany is provided then many students become distressed by the more scientific aspects, resulting in fear rather than enhanced curiosity. This paper will firstly discuss the experience of teaching archaeobotany to non-science students before suggesting some solutions to this two-fold problem; how do we ensure archaeobotany is discussed in relevant courses (Introductory Greek or Roman Archaeology, Food and Drink, Ancient Economy and Ecology etc.) and how do we minimize that fear of the sciences when we have students from diverse backgrounds and limited classroom hours? These students are the next generation of field archaeologists, site directors and educators and it is vital that archaeobotany appears regularly on course syllabi.



19th Conference of the International Workgroup for Palaeoethnobotany



MACRO-THEME 2:

ORIGINS AND EXPANSION OF CULTIVATED PLANTS



MACRO-THEME 2: ORIGINS AND EXPANSION OF CULTIVATED PLANTS**Topic 2.1. Current evidence for domestication and post-domestication crop evolution****IWGP22-0232 - Seed size, competitive selection and the landscape of domestication: New insights into the population genetics of domestication**

Robin Allaby¹, Chris Stevens², Dorian Fuller³

¹*University of Warwick, School of Life Sciences, Coventry, United Kingdom*

²*University of Cambridge, McDonald Institute of Archaeology, United Kingdom*

³*UCL, Institute of Archaeology, London, United Kingdom*

Insights from archaeobotanical and genomic data require rethinking domestication processes, and how domesticated morphologies were selected for. These new models must account for processes over time as well as over space. This talk will present new frameworks of competitive selection and the importance of seeing local population undergoing domestication in the framework of a larger landscape of geneflow. Among those traits that slowly changed during domestication was seed size increase, which is now documented across a growing number of crop species across various world regions, including cereals, legumes and other taxa. Unlike the changes in seed dispersal that occurred with domestication, that can be reasoned to be selected for by their increased ability to be harvested, and a low number of causal mutations, seed size is affected by both more genetic loci and is less obviously connected to cycles of human harvesting. We present a model of competitive selection in which larger seeded plants have a small advantage in acquiring resources that reduces resources available to smaller seeded plants. The shape of this model suggests episodes of selection that will accelerate in intensity and then plateau, a different shape from models for the evolution of non-shattering. While both of these traits may have been evolving they did so under different pressures, at different rates, and not necessarily equally in all early populations. A landscape perspective too takes into account geographical variation in selection intensity and gene flow is proposed to move forward insights into domestication processes.

IWGP22-0012 - PalaeOrigins: Tracing the Epipalaeolithic origins of plant management in southwest Asia

*Amaia Arranz Otaequi*¹

¹*Consejo Superior de Investigaciones Científicas, Instituto de Historia, Madrid, Spain*

This work presents the recently funded ERC Starting Grant project “Palaeorigins”, which addresses the transition from foraging to farming, one of the most transcendental shifts in the history of humanity. Decades of research in southwest Asia have shown that this process culminated with the development of Neolithic agricultural systems c. 10 ka cal. BP. Yet, how it started, that is, how hunter-gatherers became, for the first time, engaged with the management of plants, continues to be largely undetermined. Palaeorigins aims to fill this major gap of knowledge. Benefiting from the exceptional Epipalaeolithic archaeobotanical materials that are now available (c. 23-11 ka cal. BP), it will ask: To what extent were Epipalaeolithic hunter-gatherers managing the land and the plant resources around them? Did climatic factors trigger plant resource intensification, or were cultural dynamics, like the need for specific foodstuffs, that first motivated plant-food production?. To achieve such an ambitious aim PalaeOrigins will pioneer a holistic and high-resolution approach to study the plant-based subsistence. It will use a unique combination of traditional and most novel archaeobotanical materials, state-of-the-art stable isotope analyses, computational science, and theoretical models to: 1) Reconstruct the distribution and availability of plant resources during the environmental shifts of the late Pleistocene and the early Holocene; 2) Determine how plant procurement strategies, land uses and management activities articulated during the Epipalaeolithic period; and 3) Define hunter-gatherers' food culture, assessing their plant-food selection, processing and consumption practices. Taken together, PalaeOrigins will move beyond traditional Neolithic-centred paradigms to explain the origins of plant-food production. It will open up new research horizons, merging science and theory, to elucidate the nature of the human-environment interactions that paved the way to agriculture, and ultimately, changed the course of our history.

IWGP22-0181 - Direct evidence of incipient grape domestication from Southern Italy during the Bronze Age

Francesco Breaglia¹, Laurent Bouby², Girolamo Fiorentino¹

¹*Università del Salento, Laboratory of Archaeobotany and Palaeoeconomy- Cultural Heritage Department, Lecce, Italy*

²*Université Montpellier, Institut des Science de l'Evolution - ISEM, Montpellier, France*

We present the oldest direct evidence of grape domestication in southern Italy through the study of pips assemblages from two different sites. These are 56 waterlogged pips from Grotta di Pertosa, in the south of the Italian peninsula, and 56 charred pips from Filo Braccio, in the Aeolian archipelago. Both sites, although presenting different characteristics, are settlements dated to the Middle Bronze Age. Direct radiocarbon dating on pips were carried out both in Filo Braccio (1890-1630 BCE) and in Grotta di Pertosa (1400-1200 BCE), confirming the chronological coherence of the samples with their archaeological contexts. Morphometric analysis were performed on all the grape seeds, which involved the photographic acquisition of the dorsal and lateral views, the extrapolation of the outlines and their transformation into geometric coordinates using EFT and therefore the conversion into numerical coefficients describing the geometry of the seeds. The PCA showed that the two samples are clearly distinguishable, although partially overlapping: Pertosa pips tends to have more cultivated-like features compared to that of Filo Braccio, which are more wild-type. This data is not surprising if we consider that the Aeolian sample is slightly older, however the different state of preservation should be taken into account. The LDA, carried out by comparing the archaeological samples with a modern reference collection of domestic and wild pips of various origins, confirmed that a minor proportion of Pertosa pips have a clearly cultivated morphotype, highlighting an incipient stage of domestication and probably already an advanced spread of viticulture in continental southern Italy at the end of the Middle Bronze Age.

IWGP22-0088 - Comparative morphometric study of post-domestication evolution of trans-Eurasian cereals crops

Rita Dal Martello¹, Basira Mir Makhamad¹, Rob Spengler¹, Dorian Fuller²

¹Max Planck Institute for the Science of Human History, Department of Archaeology, Jena, Germany

²Institute of Archaeology, Institute of Archaeology, London, United Kingdom

Morphometric analyses on archaeological seeds have been a crucial part of archaeobotanical research in the past decades. Measurements on several cereal grains have shown that in their region of origin, these have evolved to produce larger seeds across time. An increase in seed size is also taken as one of the so-called domestication traits that help differentiate domesticated forms from their wild counterparts.

With most morphometric studies focused on specific regions, in this talk, I will take a broader approach comparing morphometric data across multiple parts of the Eurasian continent, focusing on the main trans-Eurasian cereals; bread wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), broomcorn (*Panicum miliaceum*) and foxtail millets (*Setaria italica*). The main purpose of this study is to investigate whether these cereal crops have evolved to produce larger seeds in isolation across different lineages, tracing seed size from initial cultivation (c. 10th/8th millennium BP) to spread and adoption into novel environments into early historic periods.

A large dataset of unpublished measurements from over ten sites on bread wheat, barley, broomcorn and foxtail millets from Central Asia and China, has been collected for this study and it's compared to published data from Europe, Central and East Asia. This comparative analysis allows us to discuss rates of evolution of cereals in relation to their seed size, and highlight parallel, independent evolution of some of the most important cereal crops across the Eurasian continent.

IWGP22-0078 - Wheat's diversity in the Southern Caucasus

Alexia Decaix¹, Margareta Tengberg²

¹CNRS, UMR 7209 - Archaeozoology- archaeobotany : societies- practices and environments - MNHN-CNRS, Paris, France

²Muséum national d'Histoire naturelle, UMR 7209 - Archaeozoology- archaeobotany : societies- practices and environments - MNHN - CNRS, Paris, France

The Southern Caucasus, identified by N. I. Vavilov as a centre of domestication, is one of the richest areas of the world in terms of biodiversity. Nevertheless, in this region, the first Neolithic occupations are dated from the end of the VIIIth millennium-beginning of the VIth millennium BC, a few thousands of years later than in the Levant or in Mesopotamia. The analysis of macrobotanical remains from several sites located in the Kura and Araxes valley in Southern Caucasus and dated from the Neolithic allows us to identify several crops since the first levels of occupations. Indeed, besides barley, several wheats, hulled and naked, were identified as well as pulses. This paper aims at define those wheats and their proportions as well as their evolution trough time thanks to the comparison with sites dating from the Chalcolithic and Early Bronze Age. Several questions will be asked, as for example, was *T. timopheevii* already cultivated in the region during those periods? What about the free-threshing wheats? We will explore the morphological and anatomical diversity of wheat that formed the basis of Neolithic cultures in the Southern Caucasus. This diversity reflects both the resources available in the environment around the sites, and the Southern Caucasus is well-known for the richness of its biodiversity, and the human activities concerning them. This will allow us not only to explore the evolution of a botanical genus but also to discuss the possible origins of agriculture in the regions and to reconstruct the human practices related to subsistence in their economic, social and demographic context.

IWGP22-0138 - Toward an investigation of diversity and cultivation of rye (*Secale cereale* ssp. *cereale* L.) in Germany - first methodological insights

*Sofia Filatova*¹, *Benjamin Claassen*², *Guillermo Torres*³, *Ben Krause-Kyora*³,
*Eva Holtgrewe Stukenbrock*², *Wiebke Kirleis*⁴

¹*Groningen Institute of Archaeology, Bioarchaeology, Groningen, Netherlands*

²*Max Planck Institute for Evolutionary Biology, Environmental genomics, Plön, Germany*

³*Institute of Clinical Molecular Biology, ancient DNA Laboratory, Kiel, Germany*

⁴*Institute of prehistoric and protohistoric archaeology, Environmental archaeology and archaeobotany, Kiel, Germany*

Rye (*Secale cereale* ssp. *cereale* L.) is a secondary domesticate, considered to have originated as a weed in wheat fields and to have developed traits of domestication by evolving similar physiological and morphological characteristics to those of wheat. Although it migrated into Europe as a weed possessing domestication traits, it became one of the most significant crops grown in large parts of Europe from the medieval period onward. Within the modern borders of Germany, rye was grown using at least two divergent cultivation practices: eternal rye monoculture (Ewiger Robbenanbau) and three-field rotation. The straw of rye was used to produce Wellerhölzer (i.e. construction components in traditional half-timbered houses), which has enabled a desiccated preservation of the plant remains. In our project, we aim to assess the impact of cultivation practices, local environmental conditions and genetic variation on the genetic diversification of rye after domestication. The material starting point of our investigation are desiccated plant remains obtained from Wellerhölzer from various regions throughout Germany. In this paper, we present a proof of concept based on an integrated archaeobotanical and genetic analysis of rye from a Wellerholz from the Old Town Hall of Göttingen (Germany). We apply different methods of arable weed ecology to reconstruct cultivation practice and local environmental conditions and present a first phylogenetic analysis. Our investigation shows that the plant remains from the Göttingen Wellerholz form an excellent basis for the integration of arable weed ecology and genetics of rye, and it further emphasises the relevance of these plant remains for future considerations of crop diversification after domestication.

IWGP22-0204 - Crop evolution of *Vicia faba* L. in southern Italy during the Middle Ages

Anna Maria Grasso¹, Girolamo Fiorentino¹, Silvia D'aquino²

¹Università del Salento, Dipartimento di Beni Culturali, Lecce, Italy

²Università degli Studi di Padova, Dipartimento di Beni Culturali, Padova, Italy

The fava bean (*Vicia faba* L.) was one of the first plants to be domesticated. The cultivation of this legume made it possible for man to have readily available a high protein food, animal fodder and a natural fertilizer for the fields. These features, along with the ease with which it could be grown and the production cycle in alternative to grains, determined its wide use for millennia and its broad geographic range.

The archaeobotanical data show that only a small grain fava bean circulated from the earliest phases of domestication to thousands of years later (Fig. 1a), but recently we have identified a probable evolution process for this crop in southern Italy: starting in the early Middle Ages, there was a shape evolution and a significant increase in the size of the bean (Fig.1b) and later, from the Late Middle Ages to the early Modern Era, there was a new phase of varietal improvement (Fig. 1c).

Analyses of charred remains of specimens are enable recognition of any improvements/ enhancements suggested by the shape and/or size of the crop investigated, so the purpose of this study is to collect these archaeobotanical remains and also to compare them with a modern reference collection in order to recognize the possible affinity to the modern *V. faba* var. *minor*, *V. faba* var. *equina*, *V. faba* var. *major*.

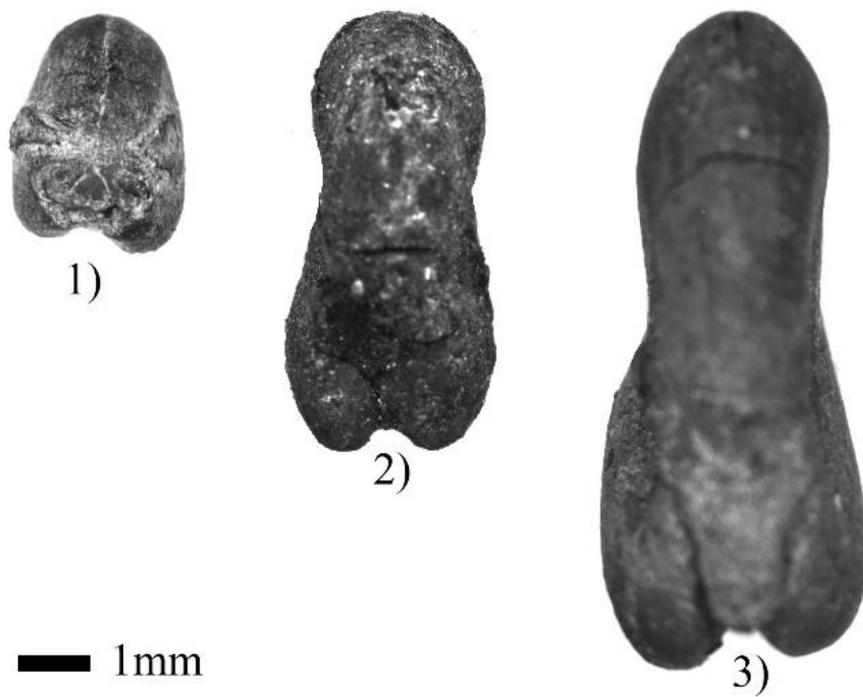


Figure: *Vicia faba* L. remains from: 1) Roca (LE) dated to the 13th-12th centuries BC); 2) Colmitella (AG) dated to the 8th centuries AD; 3) Castro (LE) dated to the first half of the 16th century AD.

IWGP22-0143 - Bringing insight into wheat domestication through the genomic analysis of modern and ancient emmer wheat

*Alice Iob*¹, *Laura Botigué*²

¹CRAG - Centre for Research in Agricultural Genomics, Plant and Animal Genomics - Genomics of ancient crops and domestication, Barcelona, Spain

²CRAG - Centre for Research in Agricultural Genomics, Plant and Animal Genomics - genomics of ancient crops and domestication, Barcelona, Spain

Wild emmer wheat (*Triticum turgidum* subsp. *dicoccoides*) was one of the first plants to be domesticated in southwest Asia. It was a staple crop up to the Bronze Age, being subsequently replaced by its free-threshing descendants tetraploid durum and hexaploid bread wheat. The archaeological record indicates that wild emmer management first started in the Southern Levant, while early genetic evidence pointed at the Northern Levant as the center of origin of domestic emmer. Nevertheless, recent studies demonstrated a non-negligible contribution of the Southern Levant to the domestic gene pool. Whether this is a consequence of gene flow (hybridization) after domestication or a genetically reticulated origin (i.e. from an already admixed wild population) of the domestic pool has not been clarified yet. Moreover, relationships between modern domestic populations are puzzling, especially concerning African and Asian emmer. In this study, we combine whole-genome data from wild and domestic modern emmer with a 3,000-year-old emmer sample from Egypt, to interrogate the phylogenetic relationships between wild populations and early and present-day domesticates. Moreover, we investigate the genetic makeup of different populations aiming to bring insight into the dispersal patterns of domestic emmer. Our data shows that all domestic populations share more affinity with the Northern Levant wild population, which is geographically more restricted and genetically less diverse than the Southern Levant one. Domestic emmer from Ethiopia and Oman belong to the same genetic cluster, which is differentiated from all other domestic populations and received genetic input (gene flow) from the Southern Levant. Interestingly, the ancient sample from Egypt resembles this modern population. Considering that emmer was introduced in Egypt two millennia before being introduced in Ethiopia and that it was likely introduced to Oman from Iran, this evidence points to a connection between these two routes of dispersal, which need further study.

IWGP22-0214 - The appearance of broomcorn millet in the oldest archaeological contexts of the Lusatian culture in Poland

Maria Lityńska-Zajg¹, Marta Korczyńska², Krystyna Wasylikowa², Anna Gawlik³, Magdalena Moskal-del Hoyo⁴

¹Polish Academy of Sciences, Institute of Archaeology and Ethnology, Kraków, Poland

²Polish Academy of Sciences, W. Szafer Institute of Botany, Kraków, Poland

³Institute of Archaeology- Jagiellonian University, Department of Bronze Age Archaeology, Kraków, Poland

⁴W. Szafer Institute of Botany, Palaeobotany and Palaeoenvironment Group, Kraków, Poland

Broomcorn millet *Panicum miliaceum* L. has been an important staple crop and belongs to the earliest domesticated plants. The oldest archaeological finds of this species came from China, suggesting that this was the place of its domestication. In Poland, there were a few findings of this cereal from the Neolithic, although its presence in its chronological layers were not confirmed by radiocarbon dating results. On the contrary, in the light of new AMS dating results, broomcorn millet appeared in Poland around the XV century BC, mainly in the context of the Trzciniec culture. Numerous finds of *Panicum miliaceum* remains were detected in two archaeological sites from southern Poland of the Lusatian culture: Janowice, site 106-65-61, and Witów, site 12. The AMS dating results showed that the preserved specimens, dated to XIV-XII century BC, belong to the group of oldest finds of the mentioned species at the sites of the Lusatian culture. These data are very important for understanding the history and spread of broomcorn millet in prehistory. In addition, new finds will also be presented in the context of other plant macro-remains from the two above-mentioned archaeological sites.

IWGP22-0094 - Predynastic and Early Dynastic plant economy in the Nile Delta: archaeobotanical evidence from Tell el-Iswid

*Elena Marinova*¹, *Sidonie Preiss*², *Elshafaey A. E. Attia*³, *Nathalie Buchez*⁴, *Beatrix Midant-Reynes*⁵

¹Baden-Württemberg State Office for Cultural Heritage, Laboratory for Archaeobotany, Hemmenhofen-Gaienhofen, Germany

²Royal Belgian Institut of Natural Sciences, Archaeosciences Unit, Brussels, Belgium

³Helwan University, Department of Botany, Cairo, Egypt

⁴Institut National de Recherche en Archéologie Préventives INRAP, Préhistoire Récente du Bassin Méditerranéen, Amiens, France

⁵Université Toulouse Jean Jaurès Maison de la Recherche 5, Laboratoire TRACES – UMR 5608, Toulouse, France

The large-scale excavation at the prehistoric site of Tell el-Iswid made it possible to undertake a systematic archaeobotanical study of different structures from a large area of the site covering the Predynastic and Early Dynastic period (Lower Egyptian Cultures to Naqada Culture). In the current paper we present the results of the analysis of carpological remains preserved mostly in the charred state and coming from totally 54 processed by manual flotation samples, with total volume of 566 liter and containing totally 16421 identifiable and quantifiable items. Further ca. 650 wood or woody plant remains were subject to anthracological analysis. Besides the aim of overall characterising and exploring the plant economy of the site, the study also considers the composition of the macrobotanical samples in relation to the structures from which they were obtained. The study revealed that the agricultural economy of both periods relied on emmer, barley, lentils, and pea, but from the Early Dynastic times onwards also flax and condiments (like dill (*Anethum graveolens*) and possibly oregano (cf. *Origanum* sp.)) played a certain role. Together with the cultivated fields also the surrounding wetlands were an important part of the utilized at site plant resources. The stems of reeds are also the most common among the anthracological remains, with a small proportion of *Tamarix* and *Acacia* charcoal fragments. The fact that ca. 1/2 of the samples are coming from combustion structures (ovens) is a hint that here we are dealing mostly with the remains of the fuel used at the site. The overall composition of the plant assemblages (charred and mineralised chaff, small weed or wild growing seeds capable to pass the herbivore digestion, dung fragments, awns) suggest that the major source of the found plant remains was dung fuel.

IWGP22-0236 - ArqueoGen-Olea: Origin and evolution of Olive Tree in the Iberian Peninsula based on morphometry and DNA of archaeological remains

Eva María Montes Moya¹, Paloma Muriel¹, Martín Moret², Manuel José Lucena³, José Manuel Fuertes¹, Angjelina Belaj⁴, Raul de la Rosa⁴, Francisco Luque², David Duque⁵, Elena Grau⁶, Maria Oliva Rodríguez-Ariza¹

¹University of Jaén, University Research Institute for Iberian Archaeology, Jaén, Spain

²University of Jaén, Genetics Area. Department of Experimental Biology., Jaén, Spain

³University of Jaén, Computer Science and Artificial Intelligence, Jaén, Spain

⁴Junta de Andalucía, Andalusian Institute for Research and Training in Agriculture-Fishery- Food and Ecological Production IFAPA, Córdoba, Spain

⁵University of Extremadura, Department of History., Jaén, Spain

⁶University of Valencia, Department of Prehistory- Archaeology and Ancient History., Valencia, Spain

DNA studies have made possible to characterize and identify the different varieties of current olive trees. The study carried out by a team from the University of Jaén about the olive tree genome over 43 varieties from the Mediterranean basin, groups the different varieties into two main groups who distributed themselves in two different areas:

- The northern and western area of the Mediterranean: including Greece, Italy, the South of France and the Spanish Levantine area, reaching Andalusia.
- The southern and eastern area of the Mediterranean: from Syria, North Africa, also reaching Andalusia.

Therefore, currently in Andalusia we find olive varieties related to those of the Northwester Mediterranean, along with others that come from the Near East and North Africa. Also, in this first study it has been possible to extract DNA from 4 olive pits from 4 Andalusian sites with chronologies from the 1st century B.C. until the 3rd-4th century AD., and that have been studied in the Paleoenvironment Laboratory of the University Institute of Research in Iberian Archaeology of the University of Jaén. The results of these four specimens relate them to the group of varieties from the Northwester Mediterranean, which would indicate that the introduction of the olive tree took place by the Greeks and/or Romans and not by the Phoenicians. Currently, we have formed an important collection of more than 1.200 archaeological olives stones from different chronologies and contexts (50 sites) from the south and east of Spain, which have been analysing by the use of DNA together with morphology, which will allow us to define the period and routes of entry of the olive tree in the Iberian Peninsula.

IWGP22-0177 - Georgia: the cradle of hulled and naked hexaploid wheat

Marine Mosulishvili^{1,2}, Zaal Kikvidze³, Nana Rusishvili⁴, David Bedoshvili⁵, Ineza Maisaia^{6,7}

¹*Ilia State University, Institute of Ecology, Tbilisi, Georgia*

²*Georgian National Museum, Herbarium TGM, Tbilisi, Georgia*

³*Ilia State University, Institute of Ethnobiology and Socioecology, Tbilisi, Georgia*

⁴*Georgian National Museum, Institute of Archaeology, Tbilisi, Georgia*

⁵*Agricultural University of Georgia, Institute of Crop Science, Tbilisi, Georgia*

⁶*Ilia State University, Institute of Botany, Tbilisi, Georgia*

⁷*Georgia National Botanical Garden of Georgia, Department of Ethnobotany, Tbilisi, Georgia*

The South Caucasus is one of the most prominent centers of wheat domestication. Georgia, in particular, is known as a repository of ancient, endemic, and original forms of wheat: the only country in the world where all five wheat genomes (AA, AABB, AAGG, AAGGAA, AABBDD) and as many as 15 wheat species (s. str.) coexist; these include one wild (*Triticum boeoticum*) and 14 domesticated species, seven hulled (*T. palaeocolchicum*, *T. macha*, *T. timopheevii*, *T. zhukovskyi*, *T. monococcum*, *T. dicoccum*, *T. spelta*) and seven naked (*T. durum*, *T. turgidum*, *T. carthlicum*, *T. turanicum*, *T. polonicum*, *T. compactum* and *T. aestivum*). The endemism rate is unusually high: five out of these wheats are endemic to Georgia [*T. carthlicum*, *T. palaeocolchicum*, *T. timopheevii*, and two hexaploids: *T. macha* (AABBDD), *T. zhukovskyi* (AAGGAA)]. In no country other than Georgia is the wheat D genome progenitor *Aegilops taushii* present with all three lineages (TauL1, TauL2, TauL3).

Archeological materials unequivocally depict Georgia as a place where wheat was domesticated since the Neolithic. At archeological sites of the 6th millennium BC (Arukhlo, Shulaveri, Khramis Didi-Gora, Gadachrili Gora), seeds of at least seven wheat species (*Triticum boeoticum*, *T. monococcum* (both AA diploids), *T. dicoccum*, *T. carthlicum* (AABB tetraploids), *T. spelta*, *T. compactum*, *T. aestivum* (AABBDD hexaploids) were identified alongside with barley (*Hordeum vulgare*, *H. distichum*), flax (*Linum bienne*), lentils (*Lens esculenta*), peas (*Pisum sativum*) and bitter vetch (*Vicia ervilia*). Most of these macrofossil remains were the same as the ‘founder’ crops of the Fertile Crescent and the Levant.

The coincidence of the ancient and relict hulled endemic wheats in Georgia represents all directions and transition stages in the phylogeny of domesticated wheat from diploid to tetraploid to hexaploid species, including the earliest

naked forms, indicates the particular role of these wheats in the evolution of the genus *Triticum*.

IWGP22-0015 - Pioneer crops in the high-altitude mountain zones of Central Asia in light of the latest archaeobotanical findings

*Giedre Motuzaitė Matuzevičiūtė*¹

¹*Vilnius University, Archaeology, Vilnius, Lithuania*

Multi-directional translocation of domesticated plant species across Eurasia played a major role in past cultural, demographic, and environmental transformations. The mountain chains that stretch across Central Asia are especially intriguing for studying prehistoric food network formation systems across Eurasia, as mountains present a particular set of physical challenges to the movement of cultivars. By acting as geographical filters, mountain ranges influence when and what plant species were dispersed to trans-range regions of Eurasia, and how related networks of interaction formed.

In the light of the newest archaeobotanical research results we will trace the earliest episode of crop cultivation in the central Tien Shan and the role of both mountain communities, their cultural preferences and environment in crop species distribution across the wider regions of Central Asia. We will discuss human subsistence strategies in these high-altitude zones in prehistory, identifying species selection due to marginal climates, formation of certain crop morphotypes, pinpointing their unique characteristics resulting from environmental stress in the high-altitude mountains. Along the same paths the dispersal of technological innovations can also be documented, such as irrigation and bread making oven technologies.

This presentation shows that the mountains zones were not marginal territories of little import, but densely populated regions that anchored diverse agricultural economies and fuelled long-distance exchange networks.



Figure: Agropastoral landscape of the Central Tien Shan Mountains at 2000 masl that contains hundreds of archaeological sites dated from the Bronze Age (2500 BCE) onwards, identified through land and UAV-based surveys. The stone line, seen in the foreground of the photograph, represents an ancient irrigation channel that used to distribute water to the agricultural fields.

IWGP22-0161 - Hemp (*Cannabis sativa* L.) and other plant remains from Dedoplis Gora site in the Shida Kartli region of Georgia

Aldona Mueller-Bieniek¹, Nana Rusishvili², Iulon Gagoshidze³

¹Faculty of Archaeology- University of Warsaw, Department of Bioarchaeology, Warsaw, Poland

²Georgian National Museum, Palaeoantropology and Palaeobiology Research Institute, Tbilisi, Georgia

³Georgian National Museum, Department, Tbilisi, Georgia

The site is located on the left bank of the Kura river (Mtkvari), and was excavated since the early 20th century AD by several Georgian teams but regular archaeological studies were carried out there since 1985 by I. Gagoshidze and his team (Furtwängler, Gagoshidze, Löhr, & Ludwig 2008). The site was occupied from the Early Bronze Age until the Early Medieval period (https://mizar.unive.it/erovaweb/shidakartli/report2013_p1.html, access 11.01.2022). The plant material presented here was collected from a layer dated to the 1st century AD. In the layer very abundant charred carpological remains were found including crops like hulled barley (*Hordeum vulgare*), naked wheat with admixture of rye (*Triticum aestivum/durum* with *Secale cereale*), proso millet (*Panicum miliaceum*). Among other plants, fragments of walnuts (*Juglans* sp.) and diaspores of *Cephalaria syriaca* (L.) Schrad. are remarkable, the latter is a weed known also from its use as a bread preservative. In the layer a large amount of hemp diaspores (*Cannabis sativa* L.) was preserved in charred condition and the finds will be presented in detail.

Reference:

Furtwängler A., Gagoshidze I., Löhr H., Ludwig N. (Eds.) (2008), Iberia and Rome. The excavations of the palace at Dedoplis Gora and the Roman influence in the Caucasian Kingdom of Iberia, Langenweissbach : Beier & Beran.

IWGP22-0031 - Domestication process of soybean and azuki bean by Jomon sedentary hunter-gatherers in Japanese archipelago

*Hiroo Nasu*¹, *Seiji Nakayama*², *Takashi Sano*³, *Tatsuya Ota*⁴

¹Okayama University of Science, Center for Fundamental Education, Okayama, Japan

²Teikyo University, Research Institute of Cultural Properties, Fuefuki, Japan

³Hokuto City, Board of Education, Hokuto, Japan

⁴The Graduate University for Advanced Studies- SOKENDAI, Department of Evolutionary Studies of Biosystems, Hayama, Japan

This talk will present recent archaeobotanical, experimental, and genetic data on the domestication of soybean (*Glycine max*) and azuki bean (*Vigna angularis*) and discuss how the domestication of soybean and azuki bean has progressed in the Japanese archipelago since the Jomon period. Soybean and azuki bean are important legumes in East Asia. The domestication of both species has been thought to have originated in China, but archaeobotanical data suggest that larger seeds occurred first in the Japanese archipelago during the Middle to Late Jomon period (ca. 5000-4000 cal yrBP), a sedentary hunter-gatherer society. Our new observation of seed coat structure of Late Jomon soybean seeds show that the large seed still had hexagonal membranous tissues which have modern wild soybean. The hexagonal membranous tissues are made of hydrophobic proteins, which have a water repellent effect and are thought to be related to seed dormancy. This means that the Jomon soybean seed size enlarged before loss the seed dormancy trait, and the species was still in the process of domestication at the 4,000 years ago. The rapid increase in seed size without systematic farming by hunter-gatherers was probably caused by hybridization of different bean populations maintained in each settlement. It is possible that the slightly larger seeds of each settlement in the Middle to Late Jomon period, hybridized each other through inter-regional exchange, resulting in a rapid increase in seed size.

IWGP22-0252 - The domestication and diffusion of tetra- and hexaploid wheats: genomic data from wild and heirloom varieties

Hugo Oliveira¹

¹*University of Algarve, Interdisciplinary Center for Archaeology and Evolution of Human Behaviour ICArEHB, Faro, Portugal*

Emmer wheat, a tetraploid species, was one of the first plants domesticated by humans, later followed by the emergence of the hexaploids bread wheat and spelt. Debates still rage concerning the place(s) of origin and the pace of domestication of these different species. Likewise, the roles of crop adaptation and cultural choices in shaping the spread of different wheat species are still disputed. The diffusion of varieties after the Neolithic, via trade, movement of peoples or state imposition (p.ex. during Roman and Islamic periods) are also largely unknown.

Here we present genomic data for 645 heirloom and wild wheat varieties from Eurasia and North Africa, using the 35K Axiom® SNP array. Included in the panel were 6 *Ae. tauschii*, 7 wild timopheevii, 5 timopheevii, 56 wild emmer, 185 emmer, 15 durum, 323 bread wheat, 3 compactum, 5 sphaerococcum and 41 spelt.

These genetic variations in the genomes allowed a detailed picture of wheat domestication and the relationship between different species. The routes by which wheat spread in Eurasia and Africa, during the Neolithic and afterwards, can be tentatively inferred from the geographic distribution of genetic diversity. Finally, analysis of varieties with the same name but different regional provenances provided clues on how farming communities maintained genetic diversity in their fields.

IWGP22-0053 - Early rice cultivation in Bangladesh: recent results from Wari-Bateshwar in the Old Brahmaputra valle

Mizanur Rahman^{1,2}, Amy Bogaard³, Michael Charles⁴

¹University of Oxford, School of Archaeology, Oxford, Bangladesh

²Jahangirnagar University, Archaeology, Dhaka, Bangladesh

³University of Oxford, School of Archaeology, Oxford, United Kingdom

⁴University of Oxford, Archaeology, Oxford, United Kingdom

The three phylogenetically distinct forms of Asian rice (*Oryza sativa*) have separate geographical distributions: *japonica* in China, *indica* in India and *aus* in Bangladesh. *Japonica* originated from the wild progenitor *O. rufipogon* (*sensu stricto*) and appears to have been domesticated around 4000BC. *Indica* originated from *O. nivara* and is believed to be domesticated by introgressive hybridization with *japonica* after 2000BC. The origins of *aus* are, however, less clear, with domestication possibly occurring through introgressive hybridization with *japonica* and *indica* in the second half of the 1st millennium BC. Preliminary analysis of new directly dated rice assemblages from the site of Wari-Bateshwar, an Early Historic period urban centre (first millennium BC) in the Old Brahmaputra valley, shows a substantial increase in the percentage of domesticated spikelet bases through time, suggesting a shift from morphologically wild to domesticated rice. Pilot archaeobotanical work at Wari-Bateshwar support the hypothesis that *japonica* rice, from China, arrived in the 1st millennium BC. Modern genetic studies suggest that *japonica* crossed with local wild rice to produce *proto-aus* rice which, perhaps later in the mid 1st millennium BC, hybridized with *indica* rice and finally produced domesticated *aus* rice. Published rice data have documented *japonica* at Wari-Bateshwar, while the presence of the other rice varieties, *indica* and *aus*, in the new archaeological rice assemblages has yet to be established. Comparison of the Wari-Bateshwar rice with experimentally charred grains from multiple accessions of the three Asian varieties, combined with GMM and potentially aDNA, is needed to assess this hypothesis further.

IWGP22-0010 - What can geometric morphometrics tell us about the origins and trajectories of free-threshing wheats?

Tina Roushannafas¹, Amy Bogaard¹, Michael Charles¹

¹*University of Oxford, School of Archaeology, Oxford, United Kingdom*

Current knowledge of the origin and trajectories of both tetraploid and hexaploid free-threshing wheats (FTWs) across Western Asia and Europe remains imprecise. With the notable exceptions of whole ears recovered at Alpine lakeshore settlements, archaeobotanical distinction of ploidy-level in FTWs is often dependent on sparsely recovered rachis segments. Beyond this level, further identification to species using either grain or chaff is generally considered unreliable and usually avoided. The study presented here offers an alternative approach by employing geometric morphometric (GMM) analysis of grain shape to assess ploidy, species and varietal-level distinctions in archaeobotanical FTW remains. In doing so, we seek to demonstrate the potentially wide-ranging applications of GMM to archaeobotanical studies of wheat grains, as well as offer methodological insights which may aid future studies. Case studies addressed so far include the analysis of substantial and well-preserved assemblages of Neolithic FTW grains from Çatalhöyük (central Anatolia) and Kouphovouno (southern Greece) which shed light on the cultivation of different species of naked wheats in these early agricultural societies. A parallel study of early medieval England has sought to investigate the potential introduction of a new species of wheat into late Anglo-Saxon agricultural systems. Across the studies, a comparison of a diverse range of modern FTW specimens suggests that GMM analysis of grain outlines can be used to distinguish FTWs to ploidy- and species-level. Comparison of archaeological material with modern wheat accessions may also suggest long-term preservation of regional variations in grain-form, highlighting the value of using reference material from 'traditional' cultivars originating in areas geographically-proximate to the site studied.

IWGP22-0085 - Early farmers in the Pelagonia Valley (Central Balkans): new research in plant economy ca. 6000-5800 BC

Amalia Sabanov¹, Ferran Antolín², Raül Soteras², Goce Naumov³

¹*Faculty of Philosophy, University of Belgrade, Laboratory for Bioarchaeology, Belgrade, Serbia*

²*German Archaeological Institute, Natural Sciences Unit, Berlin, Germany*

³*Center for Prehistoric Research, Skopje, North Macedonia*

The earliest evidence for the start of the Neolithic in the Central Balkans is dated to the last several centuries of the 7th millennium BCE. One region which was densely occupied by early farming communities is Pelagonia, a valley spreading in North Macedonia and Greece. Most settlements were formed in the later phases of the Early Neolithic in terms of Balkan chronology, and were in use for several centuries, developing into tell sites where charred plant remains got preserved in excellent conditions. New research which involves archaeobotanical analysis is being conducted at three sites- Vrbjanska Čuka, Veluška Tumba and Vlaho. This has facilitated the understanding of the crop cultivation and the utilization of wild plants by the prehistoric settlers in the area, thus providing new and valuable data for a region close to the first focus of spread of farming in Europe. It is apparent that the economy and the diet of these communities principally relied on cultivated plants, even though they exploited a vast array of wild resources as well. The crop spectrum resembles the one in the surrounding areas like northern Greece and Bulgaria, with the predominance of hulled cereals- einkorn, emmer, *Timopheevi* wheat and barley (naked and hulled). Naked wheat was encountered in very small quantities. Furthermore, pulses like lentil and pea had a prominent role. Amid the plants which could have been gathered from the wild and brought to the settlement for consumption are various species with edible fleshy fruits, nuts, berries, seeds and leaves, such as sloe, bramble, cornelian-cherry, elderberry, hazel and fathen. In this presentation we will attempt to give a first regional synthesis about the onset of farming in the study area, including a discussion of domestication traits in cereals and pulses in the studied material.

IWGP22-0019 - A new interdisciplinary project to investigate the origin, domestication and early diffusion of opium poppy

*Aurélie Salavert*¹, *Hugo Rafael Oliveira*², *Ferran Antolín*³

¹*MNHN-CNRS, UMR7209 AASPE MNHN-CNRS, Paris, France*

²*ICArEHB, University of Algarve, Faro, Portugal*

³*German Archaeological Institute, Department of Natural Sciences, Berlin, Germany*

In contrast to cereals and pulses, the domestication of opium poppy has not been studied in detail. Yet, it is likely to be the sole plant species domesticated in Neolithic western Europe, during the end of the sixth millennium. The project aims to investigate the early history of *Papaver somniferum* L. using complementary interdisciplinary studies. This project is based on pilot studies conducted on the potential application of radiocarbon dating and geometric-morphometric methods on opium poppy seeds (Salavert et al. 2020, Jesus et al. 2021).

Co-founded by the French National Research Agency (ANR) and the Portuguese Fundação para a Ciência e a Tecnologia (FCT), the project (2022-2025) brings together about 20 researchers from France, Germany, Portugal and Switzerland (Fig. 1). This poster communication aims to present the methodologies involved in the project that will address three specific issues: (1) Which species was the opium poppy's wild progenitor? (2) Where and when was it domesticated? (3) How did its cultivation spread? Using archaeological materials, as well as sampling of modern/historical biodiversity kept in seed banks and herbarium, this pioneering project involves several disciplines – archaeobotany, dating techniques, genomics, geometric morphometrics, and spatial analyses – to elucidate the role of the opium poppy in Europe's natural and cultural heritage.

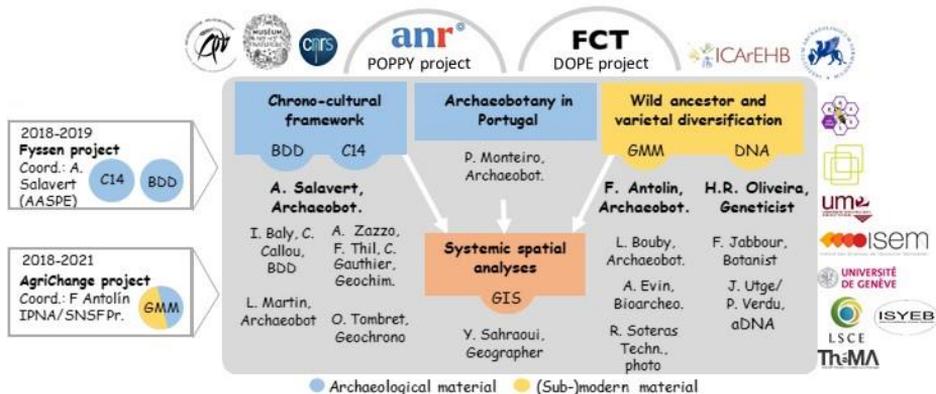


Figure: Workpackages and collaborators involved in the project.

Reference:

Jesus A., Bonhomme V., Evin A., Ivorra S., Soteras R., Salavert A., Antolín F., Bouby L. (2021) – A morphometric approach to track opium poppy domestication, *Scientific Reports*, 11, 1, p. 111.

Salavert A., Zazzo A., Martin L., Antolín F., Gauthier C., Thil F., Tombret O., Bouby L., Manen C., Mineo M., Mueller-Bieniek A., Piqué R., Rottoli M., Rovira N., Toulemonde F., Vostrovská I. (2020) – Direct dating reveals the early history of opium poppy in western Europe, *Scientific Reports*, 10, 1, p. 20263.

IWGP22-0129 - Exploring Culturally-Determined Approaches to the Introduction and Subsequent Domestication of Novel Plants: The Case of Chinese Brassica rapa

Kateřina Šamajová¹, Ondřej Kučera¹

¹*Univerzita Palackého v Olomouci, Katedra asijských studií, Olomouc, Czech Republic*

Studying the entanglements of past societies enables us to compare the approaches to governing large-scale countries, such as China. Its rich written history, well-documented accounts of preserving (ethno)botanical knowledge and specific features of its ideologies and state management, represent a perfect specimen for observing the manner in which plants enter culture and become widely cultivated. Correlating notable (yet from the perspective of traditionally linear historical record marginalized) occurrences of various man-made or natural crises such as drought, flood or famine, introduces a unique perspective on exploring the relationship between plants and society, and initiate a debate whether the latter may have served as the key to solving civilisation crises, or whether this cultural appropriation of plants itself was motivated by the efforts of solving them. The past patterns of botanical knowledge distribution in China suggest that a unique approach was employed to tackle the issue, leading us to question whether plant cultivation was influenced by push factors, a consequence of pull factors, or a culturally determined amalgam of both. By studying Chinese primary sources, we may gain insight into the causes of introducing new plants into the official canon, as well uncover the ideological mechanism through which knowledge about plants was communicated to the masses/disseminated, ensuring/resulting a successful cultural appropriation. Owing to its solid status as the most economically salient and widely productive plant species, this presentation will focus on introducing interdisciplinary methods on tracing the sources for the domestication of *Brassica rapa* in Chinese history. In this paper, the specific and oftentimes problematic conditions of the plant's taxonomy in Chinese will be introduced and subsequently used as a basis for establishing general hypotheses focusing on the manner and conditions under which plants become parts of culture.



Figure 1: 11th century Chinese cabbage

IWGP22-0170 - Knossos Crete: the Aceramic and the Early Neolithic revisited

*Anaya Sarpaki*¹

¹retired, Independent Scholar, Chania- Crete, Greece

Several publications have tackled the archaeobotany of the Aceramic and the Early Neolithic of Knossos in Crete (2009 & 2013) but the majority was all founded on the Greek excavation from the Central Court of the Palace. A very summary table was provided by the first scholar, Hans Helbaek, who, partly, studied the material excavated in the late 1950s and 1960s by John Evans and summary notes were published by the excavator. As the material was spread out in three countries, Britain, Denmark, and Greece, since Helbaek's death, detective work had to be conducted in order to retrieve what had not been studied.

Here, we shall try to present this 'old' material which had been left in storage but its study is very important as it will shed more light on the initial stages of the Neolithic in Crete. Furthermore, they present the outcome of different contexts, contrary to the results from the Greek excavation and the published material by Helbaek and do provide more insight into the crops and their weed infiltration.

IWGP22-0087 - The arrival and evolution of rye in Northwest Iberia: The panorama through different lenses

Luís Seabra¹, Andrés Teira-Brión², María Martín-Seijo³, Rubim Almeida-da-Silva^{1,4,5}, João Pedro Tereso^{1,5,6}

¹CIBIO- Research Center In Biodiversity and Genetic Resources- InBIO Associate Laboratory, BIOPOLIS Program in Genomics- Biodiversity and Land Planning, Vairão, Portugal

²University of Oxford, School of Archaeology, Oxford, United Kingdom

³Universidad de Cantabria, Departamento de Ciencias Históricas, Santander, Spain

⁴Faculty of Sciences- University of Porto, Department of Biology, Porto, Portugal

⁵University of Porto, Natural History and Science Museum, Porto, Portugal

⁶School of Arts and Humanities- University of Lisbon, UNIARQ- Centre for Archaeology, Lisbon, Portugal

Rye has barely been studied in comparison with other Old World cereals. The history of rye cultivation has seldom focused on the chronological, environmental, cultural, and dissemination approaches, while its evolutionary changes under cultivation has been even more disregarded. The scarcity of rich archaeobotanical assemblages in Prehistory and the apparent consolidation of its farming in more recent periods may have contributed to this background among European research.

Until recently, rye was considered a Late Roman introduction in the Iberian Peninsula, but data from archaeological sites of the Northwest is challenging this assumption. Instead of isolated sites with few grains, new and still unpublished finds of *Secale cereale* in several settlements in the last centuries BC suggest that this grass, although not common, was present throughout the region. However, the chronological context of its introduction and increasing historical relevance in Iberian agriculture remains poorly understood.

This presentation will provide an overview of recently discovered carpological assemblages of rye from northwest Iberia, dating to the Late Iron Age/Early Roman and Medieval periods – 2nd/1st century BC to the 10th century AD. Grains have been radiocarbon dated and characterized biometrically to trace the chronology and the grain evolution of *Secale cereale* through time. The results obtained will be discussed in articulation with other archaeobotanical and archaeological data in order to address issues such as the role of indigenous and Roman agency, the weedy or domesticated character of early finds and the context of its later dissemination. The Iberian data will then be contextualised in the framework of the history of rye cultivation in Europe and the Mediterranean.

IWGP22-0045 - Seed dormancy and pod dehiscence as the key domestication traits in legumes

Petr Smýkal¹, Jana Balarynová¹, Oldřich Trněný², Barbora Klčová¹, Monika Zajacová-Cechová³, Petra Krejčí³, Petr Bednář³, Denisa Konečná¹, Pavel Hanáček⁴, Veronika Sedláková⁴, Azalea Guerra Garcia⁵, Abraham Korol⁶, Matthew Nelson⁷, Kirstin Bett⁵, Eric von Wettberg⁸

¹Palacky University, Department of Botany, Olomouc, Czech Republic

²Agricultural Research Ltd., Plant Genetic Resources, Troubsko, Czech Republic

³Palacky University, Department of Analytical Chemistry, Olomouc, Czech Republic

⁴Mendel University, Plant Biology, Brno, Czech Republic

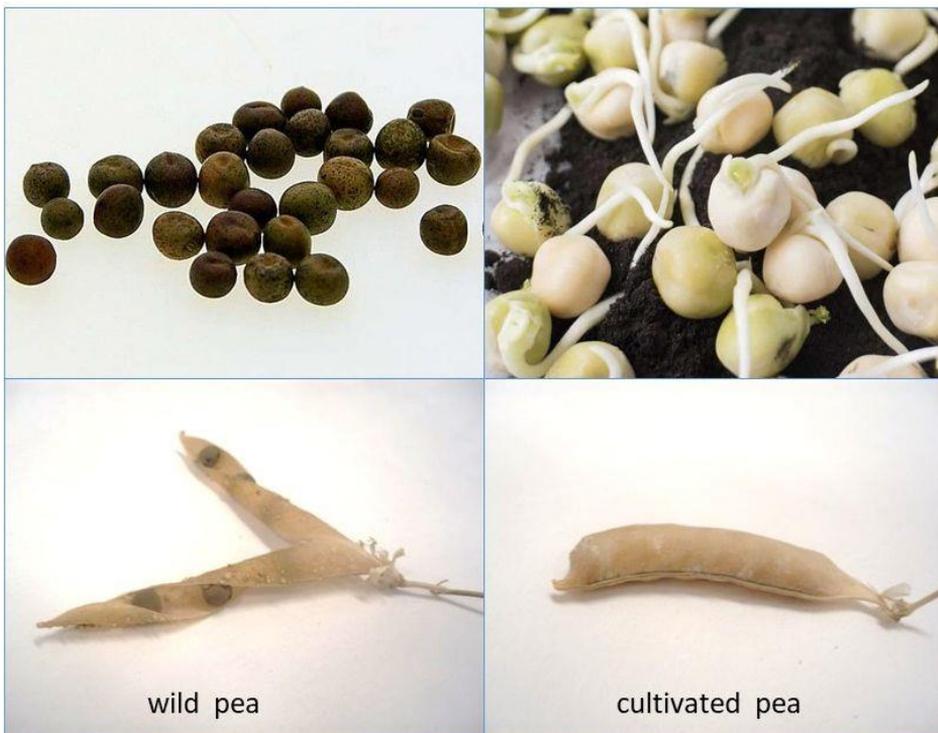
⁵University of Saskatchewan, Plant Sciences, Saskatoon, Canada

⁶University of Haifa, The Institute of Evolution and Department of Evolutionary and Environmental Biology, Haifa, Israel

⁷CSIRO Agriculture and Food, Agriculture and Food, Wembley, Australia

⁸University of Vermont, Department of Plant and Soil Science and Gund Institute for the Environment, Burlington, USA

The origin of the agriculture was one of key points in human history, and a central part of this was the evolution of new plant forms, domesticated crops. The transformation of wild plants into crop plants can be viewed as an accelerated evolution, the result of human and natural selection. These processes led to the so-called domestication syndrome, including changes in plant structure, plant defensive and palatability. However there are two traits considered crucial: reduced dispersal ability and eliminated seed dormancy. The loss of fruit shattering has been under selection in most seed crops, to facilitate seed harvesting, while in wild plants, shattering is a fundamental trait to assure seed dispersal. Similarly, in the wild, many seeds will only germinate after certain conditions have passed, while crops tend to germinate as soon as they are wet and planted. In legumes, seed dormancy is executed by seed coat permeability, e.g. physical type.



We have used an integrated view combining comparative anatomy, metabolomics, genetic mapping and transcriptome profiling of wild progenitor and respective crop in order to identify genes associated with loss of seed dormancy and pod dehiscence in pea, lentil and chickpea. Genetic mapping identified 2 to 3 loci involved in seed dormancy and single locus governing pod dehiscence. Transcriptome profiling identified genes of the phenylpropanoid pathway significantly enriched and upregulated in dormant wild progenitors, and lignification pathway in case of pod dehiscence, supported also by metabolomics analysis. Notably, loss of seed pigmentation has been selected during domestication. There is no clear picture if this is accidental, the result of direct selection due to presence of anti-nutritional compounds affecting digestion, the palatability of the seeds, or the result of cultural behaviour favouring white colour as symbol of purity. We will discuss our findings in context of various independently domesticated legume crops.

IWGP22-0030 - Insularity and Early Domestication: Anthropogenic Ecosystems as Habitat Islands

*Robert Spengler*¹

¹Max Planck Institute for the Science of Human History, Department of Archaeology, Jena, Germany

Archaeobotany is uniquely poised to engage in the question of plant domestication, the data are able to demonstrate when, where, and over what time periods the evolution of domestication traits unfolded. Over the past decade, the origins of agriculture debates and research into early domestication have been transformed by the genomics revolution and increased archaeological investigation. Despite clarification of the timing, locations, and genetic processes, the ecology of the early domestication is still largely immersed in a legacy of humanist models. Most scholars envision evolutionary responses to direct human actions, such as sickle harvesting, hunting, selection for docility, or directed breeding. Stepping away from anthropocentric models, evolutionary parallels in the wild can provide case studies for understanding what ecological pressures drove the evolution of the first domestication traits. In this talk, I contrast evolutionary trends seen among plants and animals confined on oceanic islands with the changes seen in the first cultivated crops and animals. Specifically, plants isolated on oceanic islands trend towards an increase in overall mass, thought to be linked through pleiotropy to an increase in seed size and a loss of seed-dispersal traits. I argue that the earliest sedentary villages served as habitat islands, applying parallel selective pressures to those of oceanic islands. In this view, the collective assemblage of parallel evolving traits that some scholars refer to as either an Island Syndrome or Domestication Syndrome results from similar ecological pressures of insularity, notably ecological release.

IWGP22-0077 - Early cereal diversity on the Iranian Plateau and the eastern diffusion of Neolithic farming economies

Marqareta Tenqberg¹, Alexia Decaix², Müge Ergun³

¹Muséum national d'Histoire naturelle, Archaeozoology- archaeobotany: societies- practices and environments UMR 7209- MNHN-CNRS, Paris, France

²CNRS, Archaeozoology- archaeobotany: societies- practices and environments UMR 7209- MNHN-CNRS, Paris, France

³University of Oxford, School of Archaeology, Oxford, United Kingdom

While the Neolithic diffusion towards the West, from the Near East to the European continent has been the subject of numerous studies, our knowledge of the spread of early farming economies across the Iranian Plateau remains to a large extent speculative and based on a very limited amount of data. The present paper proposes a first summary of the available evidence obtained by the systematic revision of cereal assemblages, in particular wheat (*Triticum* spp.) from a dozen Neolithic sites in Iran dating from the late 8th until the mid-5th millennia BC and situated in different parts of the country (northwest, southwest, northeast, southeast, Central Plateau). Special attention will be given to the identification of New Glume Wheat (NGW), together with emmer and einkorn, in crop assemblages from early agricultural settlements in Iran. First identified from late 9th millennium BC settlements in central and eastern Anatolia, this relatively rare wheat species, usually associated with *Triticum timopheevii* and for which identification criteria are now firmly established, appears in north-eastern Iran in the late 8th millennium BC. Tracking its presence across the Iranian Plateau and comparing the data with information on wheat diversity on early farming sites in neighbouring regions (Near East, southern Caucasus, Anatolia, southern Central Asia, Indo-Iranian borderlands) allow us to propose possible diffusion paths of crops that can be compared to recently published studies on the diffusion of people and raw materials across the Iranian Plateau.

IWGP22-0146 – Origins and spread of viticulture in Italy: A preliminary study on the grape seeds of Terramary di Montale (Emilia)

Mariano Ucchesu¹, Laurent Bouby¹, Sarah Ivorra¹, Anna Maria Mercuri², Assunta Florenzano², Giovanna Bosi², Rossella Rinaldi², Andrea Cardarelli³

¹*ISEM- Université Montpellier- CNRS- IRD- EPHE, Institut des Sciences de l'Évolution ISEM, Montpellier, France*

²*Università degli Studi di Modena e Reggio Emilia, Dipartimento di Scienze della Vita- Laboratorio di Palinologia e Paleobotanica, Modena, Italy*

³*Università "La Sapienza" - Roma, Dipartimento Scienze dell'Antichità, Roma, Italy*

Traditionally, the introduction of domestic grape in Italy is traced back to the early Iron Age in relation with the Greek colonization in southern Italy during the 8th–6th centuries BC. However, recent findings of grape seeds in Middle and Recent Bronze Age contexts suggest that the beginning of grape cultivation in Italy may be anticipated by several centuries. During the excavations in Terramara di Montale large quantities of grape seeds were recovered from two stratigraphic contexts dated to the MBA and to beginning of the LBA (1430 – 1290 BC).

A morphometric comparison of archaeological pips and modern wild and domestic grape pips was performed using two methods. First, digital images of archaeological and modern samples were acquired through a flatbed scanner, processed using the software ImageJ and 26 morphometric features were measured for each pip. In parallel, each pip was individually photographed in dorsal and lateral views, outline coordinates extracted, normalized and converted into Fourier coefficients (EFT) using the package Momocs. All morphometric descriptors were analysed separately for both methods, using PCA and LDA, to compare archaeological seeds among them and to the modern collections.

The results show that the majority of the archaeological pips found in the two stratigraphic contexts are morphologically more similar to domestic grapes and that only a small percentage can be assigned to wild grapes. These results confirm the presence of the domestic grape in Central Italy already at the end of the 14th and the beginning of the 13th century BC. This study raises new questions about the domestication processes of grapevine and about the origins and spread of viticulture in the western Mediterranean.

This study is part of the project VITALY which deals with one of the big knowledge gaps in prehistory in Italy regarding the evidence of grape domestication and adoption of winemaking.

IWGP22-0209 - Early Holocene plant management in the southern Levant: New insights from recent archaeobotanical and stable isotope analyses

Jade Whitlam¹, Pascal Flohr², Amy Bogaard¹, Michael Charles¹, Bill Finlayson¹, Cheryl Makarewicz²

¹*University of Oxford, School of Archaeology, Oxford, United Kingdom*

²*Christian-Albrechts-Universität zu Kiel, Institute for Prehistoric and Protohistoric Archaeology, Kiel, Germany*

The Pre-Pottery Neolithic sites of Sharara (PPNA: 9250 cal BC) and el-Hemmeh (PPNA-LPPNB: 9100–7000 cal BC) are located 25 km apart in the Wadi Hasa, southern Jordan. The recovery of well-preserved assemblages of charred plant remains from both sites has provided us with an opportunity to investigate plant management and consumption at a local level, across the transition to farming. In this paper, we present the results of recent archaeobotanical and stable isotope analyses. These results shed new light on relationships between growing conditions, management practices and ‘domestication’ status.

Topic 2.2. Textile and fibre production – as documented by archaeological and archaeobotanical records

IWGP22-0201 - Fibre production among the coastal hunter-gatherers of South America's west coast: stories from 'invisible technologies'

Camila Alday¹, David Beresford-Jones²

¹University of Cambridge, Archaeology, Cambridge, United Kingdom

²University of Bonn / University of Cambridge, Bonn Center for Dependency and Slavery Studies / Department of Archaeology, Bonn / Cambridge, Germany

This study investigates fibre technologies among the people of the Coastal Andean Preceramic Period (10,000–3,500 BP) by studying the technological production process of bast fibre artefacts from five Preceramic archaeological sites in Peru and Chile. The raw materials, technological processes and manufacturing techniques were identified through archaeobotanical, structural and morphological analyses to create a dataset that allowed us to reconstruct the *chaîne opératoire* of fibre production. The function of the fibre artefacts in coastal activities is also crucial for understanding the social dimensions of the marine subsistence strategies that developed during this period. By analysing fibre materials from sites of different ages and locations, this study finds the dominant use of wild gathered plants in the production of marine tools such as nets and gathering bags, as well as clothing, mats and yarn. Bast fibres from the *Typhaceae* and *Cyperaceae* plant families were mainly used to make these artefacts, although bast fibres from *Apocynaceae* plant family were used in a few artefacts. The careful analysis of the morphology and manufacturing techniques of the artefacts indicate a long-term 'technological tradition' among the coastal hunter-gatherers of the Preceramic Period. Remains of the 'epidermis' of bast fibres in the artefacts indicate the use of decortication to extract the bast fibres from the plants, while the presence of cut marks reveals that sharp tools were used to process the fibres. Splicing was also used to produce thread and for the patterns of manufacturing techniques, which remained fairly consistent at the sites found along the Pacific coast. Together, these features suggest a fairly standardised production method for fibre artefacts in the Preceramic Period that can arguably be indicated as the origin of the Andean textile industry.

IWGP22-0057 - First evidence of *Isatis tinctoria* in the Iberian Peninsula. Finds from the Els Vilars Fortress (4th century BC, Catalonia, Spain)

Natàlia Alonso¹

¹University of Lleida, History, Lleida, Spain

A considerable number of woad (*Isatis tinctoria*) fruits and seeds were recovered among the assemblage of materials preserved in the well-cistern at the Iron Age Fortress of Els Vilars d'Arbeca (Catalonia). This species today in the east of the Iberian Peninsula is very rare in the wild as it grows only in specific areas of the mid-continental mountains, in certain grasslands and in more or less ruderal pastures. The finds from the well-cistern are the only cases of the *Isatis* genus in this region. As it is not native to the Western Catalanian Plain, its presence in the Fortress suggests it must have been introduced to be used as dye.

The same stratigraphical unit (SU 7158) also yielded flax seeds and capsules, as well as other elements related to textile production such as terracotta *pondus* (loom weight). Another unit (SU 7113) of the structure also contained an assemblage of 9 spindle whorls.

The manufacture of flax fabrics by the Iberians is confirmed through ancient written sources (e.g., Strabon and Polybius), archaeobotanical remains (seeds and fibres) and related archaeological structures and artefacts. Furthermore, the use of blue dyes to colour garments is evidenced, for instance, by decorative elements of celebrated Iberian female sculptures, notably the blue borders of the veil of the Dama de Baza and the blue lower tunic of the Dama de Elche.

IWGP22-0230 - How specific? “Grasses” and tree bark for the Late Neolithic coiled baskets of the Lake Constance (Germany)

Mila Andonova¹, Sebastian Million²

¹Institute of Biodiversity and Ecosystem Research, Division of Palaeobotany and Palynology, Sofia, Bulgaria

²State Office for Cultural Heritage Preservation in the Stuttgart Regional Council, Laboratory for Dendrology, Gaienhofen-Hemmenhofen, Germany

Were specific plants chosen for making specific baskets in a specific environment along the shores of Late Neolithic Lake Constance? The archaeological and archaeobotanical investigations suggest a positive answer to all those questions. This study focuses on presenting a range of raw plant material chosen for the creation of an assemblage of coiled basketry items, originating from several pile dwellings of Late Neolithic Lake Constance (Germany). Choosing specific plants with a set of physical properties from the immediate surrounding environment for particular basketry designs, sizes and uses in the Past is a pattern that this paper addresses through an integrated analysis of several types of archaeobotanical material.

IWGP22-0225 - Iron Age weaving and twisting plant-based materials in the Western Mediterranean: the INTERTWINED project

María Martín-Seijo¹, Marian Berihuete-Azorín²

¹Universidad de Cantabria, Departamento de Ciencias Históricas, Santander, Spain

²Institut Català de Paleocologia Humana i Evolució Social, UCO Archaobotany, Tarragona, Spain

Plant-based material culture has been ubiquitous, widely available, and multi-purpose, but its ephemeral nature has masked its relevance for past communities, and this is particularly evident in the archaeological record dated between c. 9th-8th centuries BCE to 4th century CE. Objects and structures made using basketry techniques as well as cordages, strings, or ropes are amongst the less known and most fragile archaeological evidence. INTERTWINED will procure, date, and summarise direct and indirect evidence of basketry and cordage is necessary to deepen our understanding of these plant craftworks closely related to daily activities such as processing, storing, and transporting different materials (e.g., cords, containers), hunting and fishing (e.g. nets, fish traps) or even caring people and resting (e.g. basket cradles, mats). Moreover, their relevance in extractive activities such as mining has been attested by multiple evidence obtained from Mazarron, Aljustrel and other Roman mines. Up to date, knowledge about the range of plants used in the Iberian Peninsula during IA and ERE for producing objects and structures through basketry and cordage techniques has focused on few taxa, *Corylus avellana* (hazel), Fabaceae shrubs, and *Stipa tenacissima* (sparto grass). Despite this, ethnobotanical research has attested that a wide range of cultivated, managed and wild plants was used in the past for weaving and twisting (e.g. *Triticum monococcum* and *Ampelodesmus mauritanicus* and some species of the Thypaceae, Cyperaceae, Juncaceae or Sparganacea). In this paper we present the INTERTWINED project focused on direct and indirect archaeological evidence of basket- and cordage-making using plant-based materials from the Western Mediterranean, dated between the Iron Age (IA) and Early Roman Empire (ERE). By focusing on these craftworks, we will deepen our understanding of the intertwined relationship among people, plants, and crafts. This multi- and interdisciplinary project integrates archaeological, ethnographical, and ethnobotanical evidence with the experimentation developed by artisans.

IWGP22-0218 - Domestication processes and dispersal in Old World cottons: a morphometric analysis of materials from North East Africa and central India

*Anna Den Hollander*¹, *Dorian Fuller*¹

¹*University College London, Institute of Archaeology, London, United Kingdom*

This poster considers the issue of domestication processes and dispersal in Old World cottons (*Gossypium arboreum* and *G. herbaceum*) through a morphometric analysis of cotton seeds recovered from contemporaneous but geographically distant archaeological sites in North East Africa and central India, dated between 0 BCE/CE and 400 CE. The study includes a basic morphometric analysis of 339 modern seeds (*Gossypium arboreum*, n=175, *G. herbaceum*, n=84) and *G. herbaceum* var. *africanum*, n=80), in order to identify whether potential distinguishing characteristics of domestication can be established. It then considered archaeological cotton seed metrics drawn from sites in India, Sudan, Ethiopia and Senegal. In the comparison with modern reference material, the established charring factor for cotton (~5%), was taken into consideration. Efforts are also made to estimate relevant measurements from fragmented seeds. Modern comparisons suggest that domestication is expressed in cotton in the form of longer, more attenuated seeds, but these features may have evolved slowly and continued long after the start of cultivation. The archaeological material is significantly smaller, and less strongly attenuated, than the modern reference material, albeit larger and more attenuated than potential wild progenitors, which suggests that the evolution towards larger seeds was still ongoing in the early centuries AD.

IWGP22-0113 - Plant fibres and splicing: archaeological finds and state of the art in recent research

*Marqarita Gleba*¹

¹*University of Padua, Department of Cultural Heritage, Padova, Italy*

Plant fibres constitute the earliest raw materials used for producing textiles. Recent research into prehistoric fibre technology indicates that in the earliest known textile products plant fibres were worked into threads by splicing, rather than draft spinning. Previously, this technique was only recognised in ancient Egypt, Israel and the Far East, but archaeological finds demonstrate that splicing was the original plant fibre technology in Europe, Asia and even South America going back at least to the Mesolithic period. The proposed paper summarises the results of recent investigations that identify splicing of plant fibres across Europe. Particular focus is on the Late Bronze Age site of Must Farm in the UK, where various stages of splicing have been documented recently, allowing to reconstruct the entire *chaîne opératoire* of this technology. The paper also highlights the importance of Scanning Electron Microscopy for splicing identification in charred, mineralised or otherwise degraded archaeological textile finds.

IWGP22-0215 - Where are the dye plants? A compilation of pre-medieval macrobotanical finds of plants used in textile dyeing from the Netherlands

Radoslaw Grabowski¹

¹*independent researcher, Amsterdam, Netherlands*

Recent chemical analyses of archaeological textiles have confirmed that dye pigments were in the past extracted from several plant species. Macrobotanical finds related to dyeing are however rare. For example, chemical analysis of a gown from an inhumation at Slabroek in the east of the Netherlands show that *Isatis tinctoria* was used for dyeing as early as during the Early Iron Age (800–500 BC), while the only macrobotanical find of Woad in an unequivocally anthropogenic setting originated from the 2nd century AD. On the whole, the current knowledge about the collection, management and possible cultivation of dye plants in times with few or no written sources is practically non-existent. This poster explores why dye plants are rarely reported in Dutch archaeobotanical studies. I present an overview of macrobotanical finds of species which may have been utilised in pigment production. Some of these are archaeophytes that were introduced in the region in pre-medieval times, such as *Isatis tinctoria*, *Reseda luteola* and *Reseda lutea*. Others are native, such as *Tripleurospermum maritimum/inodorum*, *Rhamnus cathartica*, *Genista tinctoria*, and species of the *Galium*-genus. The compilation is based on a review of local archaeobotanical databases and reports, and the chronological framework is prehistory until the end of the 1st millennium AD, i.e., the part of the past for which few or no written sources are available. Based on the results of the compilation, I evaluate the earliest occurrences of the non-native (archaeophyte) dye plants. This may shed light on the beginnings of their utilisation in textile coloring. I also assess the contexts and forms in which natively occurring potential dye plants are encountered in archaeobotanical samples, and explore whether previously reported finds indeed indicate collection for pigment procurement, which has previously been overlooked given that these plants are a natural part of the local flora.

IWGP22-0200 - Plant fibres and the production of cords in the Neolithic site of La Draga (Girona; 5324–4977 cal BC)

Maria Herrero Ota¹, Raquel Piqué Huerta¹

¹Autonomous University of Barcelona UAB, Prehistory Department, Bellaterra, Spain

Fibre-based artefacts are considered one of the first technologies used in human populations. They are related to daily life purposes and have played an important role in all societies. Due to the lack of preservation in most of the archaeological contexts, the knowledge of these technologies is limited. And so, they have been generally not systematically studied because of the lack of standardization methodologies regarding the conservation conditions. The Early Neolithic site of La Draga (Girona, Spain; 5324–4977 cal BC) is a dwelling settlement located in the north-eastern part of the Iberian Peninsula. It has provided one of the oldest sets of vegetal fibres-based objects as baskets and ropes from southern Europe preserved in waterlogged conditions. The fibre-based implements from La Draga have been systematically studied. The raw materials of baskets and cordage productions were identified as monocots and dicots families. Preferences in their selection are visible depending on the implement typology. The aim of this paper is to present the different plants used in cordage production as well as their contextualisation regarding other plant fibre implements documented in the site. The selection of the families reveals a botanical comprehension, environmental knowledge, and natural resources management from the inhabitants of La Draga, as well as their technological properties.

IWGP22-0028 - Local plants as raw materials for ancient and historical textile production in the Near East, in Northern Europe and in Russia

*Sabine Karg*¹

¹*Free University of Berlin, Prehistoric Archaeology, Berlin, Germany*

The interface between the disciplines archaeology, history, palaeoethnobotany and ethnobotany delivers new insights into the cultural history of textiles, as well as into the complex productional methods of plant fibres, such as winning the raw material from wild growing plants and their processing. Recent analysis of the oldest woven textiles from Çatal Höyük revealed the use of local tree bast for textile production during the 7th millennium BC. The oldest textiles detected in archaeological contexts in Europe were all made of tree bast. This material was easy accessible but needed a work intensive preparation. In my lecture I will present experiments with winning and treating bast from lime trees growing in Denmark. The discussion since when and where these trees could be used for fibre bast winning will be included.

Historical sources document that many objects made of tree bast were until recently produced in Southern Scandinavia. Still today one active community in Russia is specialised in tree bast winning and further processing. New studies report about the impact of such activities on the environment. This new insight might help to trace back environmental impact of textile production on prehistoric landscapes.

IWGP22-0029 - New plants, new people, new technologies? The link between Neolithic evidence of textile plants and the use of archaeological tools

*Sabine Karg*¹

¹*Free University of Berlin, Prehistoric Archaeology, Berlin, Germany*

Extraordinary good preservation conditions of archaeological wetland sites in the European pre-Alpine region allow studying botanical macroremains of fibre plants, textile finds and textile tools. Such finds from two fourth-millennium BC pre-Alpine sites will be presented: Arbon-Bleiche 3 in Switzerland and Bad Buchau-Torwiesen II in southern Germany. At both sites huge numbers of flax remains and spindle whorls were found. The comparison of the spindle whorls from these two settlements with a contemporaneous east-central European dataset suggests that multiple culture-historical groups with distinct technological signatures inhabited Neolithic Central Europe. The spatial distribution of conical spindle whorls within the pre-Alpine sites suggests the immigration of both people and technology from the east, thereby illuminating the wider themes of mobility and innovation in prehistoric Europe. But is it actually possible to connect the botanical flax finds with the use of the hundreds of spindle whorls at these sites? The interrelationship between fibre production and textile tools will be discussed.

IWGP22-0110 - Mesolithic textile finds from Europe – old finds, new thoughts

Sabine Karg¹, Terttu Lempiäinen²

¹*Free University of Berlin, Prehistoric Archaeology, Berlin, Germany*

²*Biology, Biodiversity Unit of the University of Turku, Turku, Finland*

Textiles are basic commodities since prehistoric times. Strings and cords were used to fix artefacts and other things, but also for the production of nets used for transporting goods or for fishing. In our lecture we are going to discuss two net finds that date to the Mesolithic period in Europe. Both nets were made of tree bast, a sustainable material that was available everywhere around the camps.

Nevertheless, tree bast from the various tree species offers different properties. Bast that is suitable for fishing nets need to be strong, should not soak too much water and should not shrink when drying. For the Neolithic period it was shown that flax fibres were preferable used for fishing nets because flax fibres offer the mentioned properties. In addition to the choice of the suitable raw material, the technique in which ancient nets were made reveal about their former usage. Movable knots were never used when making fishing nets, as the prey animals would then easily escape. Fishing nets need to be made with fixed knots.

Experiments with the raw materials that were used for the two Mesolithic Friesack and Antrea nets adumbrate, how time consuming the production of such nets had been, and how advanced the know-how of ancient workmanship was.

IWGP22-0107 - Use of rootwood as weaving materials of the Jomon period in Japan

Shuichi Noshiro¹, Sasaki Yuka², Kobayashi Kazutaka³, Suzuki Mitsuo³

¹Meiji University, Center for Obsidian and Lithic Studies, Tokyo, Japan

²Kanazawa University, Center for the Study of Ancient Civilizations and Cultural Resources, Kanazawa, Japan

³Tohoku University, Botanical Gardens, Sendai, Japan

Besides stems of vines, wood splints of trees were used for basket weaving at the Higashimyo site of the initial Jomon period between ca. 8000 to 7400 cal BP. At this site we found that most weaving techniques used in Japan have already been developed, and that basketry techniques such as plain weave, uneven weave, herringbone weave, even 2/2 twill, herringbone twill, diamond twill, hexagonal weave, simple twining, and three-ply twining were used variously. Since then, various materials were used for weaving throughout Japan, and material selection was found to have regional characteristics that continued through the Jomon period. One exceptional use of weaving materials was rootwood of vines and trees found in Kyushu and the Japan Sea side of Honshu. In Kyushu, besides wood splints and vines, adventitious roots of *Ampelopsis leoides* were used for baskets made with twining of the early to late Jomon periods. *Ampelopsis leoides* is a large woody vine of Vitaceae and occasionally shoots out adventitious roots. Use of these adventitious roots is found from Fukuoka in the north to Kagoshima in the south. In the Japan Sea side of Honshu, roots of *Cryptomeria japonica* of Cupressaceae were used for baskets made with twining of the late to final Jomon periods. At present we cannot obtain comparable rootwood of *Cryptomeria japonica* in present Japanese forests, but this coniferous species is known to have formed extensive lowland forests along the seashore of the Japan Sea. Thus, although weaving techniques of the Jomon period seem to have been passed down to the present Japan, selection of weaving materials during the Jomon period far exceeded the selection of weaving materials presently carried out in Japan.

IWGP22-0185 - Fibre choices and textile production in the Late Neolithic central Balkans

Djurdja Obradović¹, Ivana Dimitrijević¹

¹*Institute of Archaeology, Department of Prehistory, Belgrade, Serbia*

In this presentation, we will provide an overview of various lines of evidence related to fibre and textile production during the Late Neolithic in the Central Balkans (Vinča culture, 5300–4500 BC). It will include a discussion on possible plant fibre sources, i.e. plants identified in charred archaeobotanical assemblages and as fibres, with special reference to flax (*Linum usitatissimum*). Another aspect of this presentation is related to the technologies of fibre and textile production. While the remains of textile are rarely found at Neolithic settlements in the Balkans, its production and use has been documented indirectly at the majority of them – in the form of spinning implements, loom weights, bone tools, textile impressions in pottery and clay objects. Such finds have been examined by different specialists as part of routine material and typological studies; however, comprehensive analysis of their use in spinning and weaving, making of clothes or any other related activity has been lacking. Recently, there has been a change in the analytical approach and an increase in the level of attention paid to different forms of evidence of textile production. As a result, the story of technological know-how of textile making in Vinča communities is slowly beginning to emerge. By summing up the available records and information, we will reconstruct the process of textile making – from procurement of fibre plants to the final product – in the Late Neolithic of the Central Balkans. This will allow us to assess the role of textile production in the socio-economic life of the Vinča communities, to infer how this activity shaped everyday life as well as how it contributed to the transfer of knowledge and social interactions.



Figure: Concentration of loom weights in the Late Neolithic house (site of Drenovac, central Serbia)

IWGP22-0166 - Archaeobotanical finds textile and fibre production on the territory of Ukraine

*Galina Pashkevich*¹

¹*independent scientist, Kyiv, Ukraine*

The first archaeobotanical data on the use of plants to create tissue were found in the burial of the catacomb culture of the II millennium BC. in the north of the Crimya peninsula. The bag filled with the spikelets of *Triticum monococcum* and *Tr. dicoccum* was woven from fibers of *Stipa* sp. and stems of *Juncus* sp. and *Eleocharis* sp. Plants used for clothing appeared in the Old World in the early stages of cultivation. Flax (*Linum usitatissimum* L.) is considered to be the oldest of them. He played a major role among those plants that were used to make textiles and to obtain oil from the Neolithic to the early twentieth century. In archaeological materials of Ukraine the earliest traces of cultivated flax are known in the layers of the culture of linear-strip ceramics. The findings of flax seeds are insignificant, but the fact that it was grown is evidenced by numerous weavers and sinkers from the loom. Clay spiers are known from the settlements of Trypillia culture. The number of seeds increased in the Bronze Age. There are known finds of about a hundred seeds in the settlements early Iron Age Ivan Puste (781–511 BCE) and Zalissyia (771–431 BCE). Flax seeds are almost always present in the materials of Kiev Russ (XI - XII centuries). Finds of hemp seeds are quite common in ancient Russian settlements also. They are presented in large numbers in the materials of the settlements Kolodyazhyn (481ml of hemp nuts), Raikovets settlement – 1390 nuts. About 700–300 BC hemp was known to the Scythians and Sarmatians. Here is how Herodotus wrote about it: "Hemp grows in their country. It grows by itself and sown".

IWGP22-0106 - Plant use during the Jomon Period seen in Materials and Techniques of Baskets Excavated from Torihama Shell Mounds in Japan

Yuka Sasaki¹, Mitsuo Suzuki², Kazutaka Kobayashi², Shuichi Noshiro³, Mayumi Ajimoto⁴

¹Kanazawa University, Center for the Study of Ancient Civilizations and Cultural Resources, Kanazawa, Japan

²Tohoku University, Botanical gardens, Sendai City- Miyagi Prefecture, Japan

³Meiji University, Center for Obsidian and Lithic Studies, Tokyo, Japan

⁴Wakasa History Museum, Wakasa History Museum, Obama City- Fukui Prefecture, Japan

Baskets excavated from the initial and early Jomon periods in Japan show an extensive use of techniques such as weaving, twilling, and twining, probably inspired by zigzag and diamond-shaped patterns in nature. In the Hokuriku region on the Japan sea side, vines such as *Actinidia* and coniferous material were reported to be used, but the relationship between the technique and material plants has not been examined. We studied the material plants and techniques of woven baskets excavated from the Torihama shell mound in the early Jomon period. In this shell mound, the technique used for the baskets and material plants was clearly related. For the twining technique, splints of coniferous or broad-leaved trees were selected. For twill with close wefts and warps and weave with loose warps and close wefts, culms of the bamboo subfamily were selected.

In baskets woven with the twining technique, splints were made by splitting wood of cypresses, maples, and an oak, *Quercus serrata*, and were used alone or in combination with weaving. In baskets woven with weave and twill techniques, only bamboo species were used. From knot characteristics, the bamboo species were presumed to be small slender ones such as *Sasa kurilensis*. Round wood pieces of *Pinus densiflora* were used for additional materials such as crosspieces or ears.

For the best surviving weaved cage 75P-013-B, different techniques were used for the lower and upper parts of the body. In the lower part, the weave direction changed in the herringbone twill section and showed a strong similarity to a Jomon shallow bowl of the same period with the herringbone patterns. There seems to be strong similarities in technique and form between different utensils made with different materials such pottery and baskets during the Jomon period.

IWGP22-0049 - Colourful rivers: archaeobotanical remains of dye plants from fluvial deposits in late medieval towns

Lien Speleers¹, Ina Vanden Berghe², Julie Timmermans^{3,4}, Valérie Ghesquière^{3,4}, Stephan Van Bellingen³, Marc Meganck³, Yannick Devos⁵

¹Royal Belgian Institute of Natural Sciences, OD Earth and History of Life, Brussels, Belgium

²Royal Institute for Cultural Heritage KIK-IRPA, Textile research lab, Brussels, Belgium

³urban.brussels, Cultural Heritage Department, Brussels, Belgium

⁴Art & History Museum, Département de l'archéologie nationale, Brussels, Belgium

⁵Vrije Universiteit Brussel, Maritime Cultures Research Institute MARI, Brussels, Belgium

During the late medieval period, the southern low countries were among the most densely urbanised areas in Europe. The towns owed part of their growth and prosperity to the flourishing cloth industry, in which dyestuffs played an essential role. Throughout this period dye plants were intensively cultivated, traded on a large scale, and widely used by specialised craftsman organised in guilds. Due to the need for constant water supply and wastewater discharge, dyeing activities were often concentrated in the proximity of rivers. Although dyeing practices are well documented in late medieval historical sources, material evidence remains scarce. The aim of this presentation is to describe and discuss archaeobotanical finds of dye plants, recently found in urban fluvial deposits from Brussels and to put these in perspective with finds from other towns in the area.

In 2019 a large excavation in the city centre of Brussels revealed the remains of the late medieval port. Besides the discovery of impressive quay walls, meters thick excellently preserved fluvial deposits were excavated and extensively sampled. One of the most remarkable characteristics of the macrobotanical assemblages dating from the 13th to the 15th century is the presence of numerous weld (*Reseda luteola*) seeds and madder (*Rubia tinctoria*) root fragments, found in nearly all studied samples. Several samples also contained woad (*Isatis tinctoria*) pod fragments. These three species are considered as the most important medieval dye plants in the region. Additionally, fruits and flower head fragments of fuller's teasel (*Dipsacus sativus*) were observed in most samples. Most likely all these plant remains must be interpreted as waste from textile working, discarded in the urban waters.

IWGP22-0133 - Applying microscopy, WAXS and micro-CT methods to studying archaeological bast fibres, case study of Ravattula Ristimäki, Finland

Jenni Suomela¹, Krista Wright²

¹University of Helsinki, Department of Education, Helsinki, Finland

²Kalevala Women's Association, Kalevala Women's Association, Helsinki, Finland

Most of the prehistoric textile remains in Finland are from the Late Iron Age (800–1150/1300 AD). Preservation of these textile finds has three main factors. First, the burial habits changed due to Christian influences and inhumation practises mainly replaced cremation as a burial practise. Second, the textiles were protected from soil's micro-organisms by copper oxidation of bronze burial goods and jewellery. Third, acidic soil conditions are suitable for protein fibres but leads to poor preservation of plant materials.

In Finnish context, the earliest remains of a Christian church and cemetery date to the Late Iron Age and have been excavated in Ravattula Ristimäki, in Kaarina, southwestern Finland. As case study, seven assumingly plant fibre textile samples from individual inhumation graves were analysed to identify their materials. The aim of the study was to investigate the possibilities of identifying archaeological plant fibre samples using a three-stage procedure by observing the surface characteristics, microfibrillar orientation and cross section of the fibres via transmitted light microscopy (TLM). The identification process was based on such a TLM characterisation. Both flax and nettle were found in the samples, indicating a preference for these two fibre plants in Late Iron Age Finland.

Additionally, a few of the samples were studied with X-ray microtomography (micro-CT) and Wide-Angle X-Ray scattering (WAXS) to test the possibilities of using the X-ray methods in the research of bast fibre textile material. This presentation will focus on the novel methods in fibre studies and their possibilities in an archaeological context. WAXS or micro-CT might not have contribution for bast fibre identification, but these methods provide useful imaging and measuring techniques especially when non-invasive methods are concerned.

IWGP22-0195 - What can a bundle of flax tell us about flax processing? A find from Yerseke-Schelpkreek, The Netherlands

*Liesbeth van Beurden*¹

¹*BIAX Consult, Archaeobotany, Zaandam, Netherlands*

In 1530 and 1532, heavy storm surges covered the small village of Tolsende in the province of Zeeland, The Netherlands, with a thick layer of clay and sludge. Nowadays, the remains of this drowned 16th century village are visible during low tide, and are threatened by weathering and erosion. Recently, archaeologists have discovered a layer near the outer side of a former wall, which they describe as grass/hay/straw. Apart from the foundations and the remains of the walls, no other features, such as pits or ditches, have been found. Analysis of a sample from this layer at the BIAX laboratory has revealed that it consists of the remains of a bundle of flax. It contains no flax fibres, but the woody cylinder of the flax stem as well as the fragments of flax capsules, flax seeds, weed seeds and pollen are present. Quite unusual is the fact that mainly the base part of the flax capsules have been found. Also present among the flax remains are hundreds of ivy-leaved duckweed leaves. Can this find provide some clues about flax processing in the 16th century village of Tolsende?



19th Conference of the International Workgroup for Palaeoethnobotany



MACRO-THEME 3:

**LANDSCAPE CHANGE AND HUMAN TRANSFORMATION
OF ECOSYSTEMS**



MACRO-THEME 3: LANDSCAPE CHANGE AND HUMAN TRANSFORMATION OF ECOSYSTEMS

Topic 3.1. Agricultural expansion and diversification

IWGP22-0050 - Interlinking the 4.2 ka event, agricultural productivity and population density: a case study on Haidai Longshan societies in China

Jingping An¹, Wiebke Kirleis¹, Guiyun Jin²

¹Kiel University CAU, Institute of Pre- and Protohistoric Archaeology, Kiel, Germany

²Shandong University, Institute of Cultural Heritage, Qingdao, China

The Haidai region in northern China reached its prehistoric population peak while entering the Longshan period (~ 4400 BP). However, since the Late Longshan (4100/4000-3800 BP), a marked drop in the number of settlements and the disappearance of most regional centers suggests a decrease in population density and political complexity in east Haidai, whereas a gradual increase in settlement numbers and the lasting function of regional centers sets a different scene in west Haidai. These different population changes, particularly when encountering the abrupt cool and drought 4.2 ka BP event, provide an excellent opportunity for exploring the interlinks between agriculture, paleoclimate and population size: how some societies, under environmental deterioration, successfully sustained their agricultural productivity to support a large-scale population, and to the opposite, how the others “failed”. Our analyses of macrobotanical remains from 25 Longshan sites support that different choices in staple crops and cultivation regimes have evident impacts on crop yields, and moreover, population sizes.

Under extreme physical conditions, west Haidai societies engaged in drought-resistant millet farming have an advantage, over those in the east that were primarily occupied with climatic-sensitive rice farming, in maintaining crop yield. Furthermore, significant proportional changes in annual/perennial arable weeds, fertile-soil indicator species and nitrogen-fixing pulse species since 4100/4000 BP demonstrated a shift to less intensity in management and the expansion of farmlands in west Haidai. Thus, extensive cultivation with less time and labor investments was likely adopted to sustain food and population stabilities in west Haidai. Contrastingly, similar analysis on weed remains implies relatively

intensive agriculture in east Haidai. However, as indicated by the loss of soil fertility since 4100/4000 BP, the maintenance of intensive agriculture was challenged by the loss of labor, and which can be related to the population migration caused by the reduction of rice production under unfavorable climate.

IWGP22-0226 - An isotopic glimpse into 2000 years of Neolithic agricultural practices around Lake Zurich

Ferran Antolin¹, Héctor Martínez-Grau², Raül Soteras¹, Claudia Gerling², Christoph Brombacher², Bigna L. Steiner², Irka Hajdas³, Jaggi Madalina⁴, Stefano M. Bernasconi⁴, Niels Bleicher⁵, Stefanie Jacomet²

¹German Archaeological Institute, Department of Natural Sciences, Berlin, Germany

²IPNA/IPAS- University of Basel, Department of Environmental Sciences, Basel, Switzerland

³Laboratory of Ion Beam Physics- ETH, Department of Physics, Zurich, Switzerland

⁴Geological Institute- ETH, Department of Earth Sciences, Zurich, Switzerland

⁵Office for Urbanism, City of Zurich, Zurich, Switzerland

Neolithic and Bronze Age pile dwellings in Lake Zürich have been intensively studied since the late 70s of the 20th century and hundreds of thousands of uncharred and (less frequently) charred plant macroremains have been investigated. During the Neolithic (between ca. 4300 and 2500 BC), several wheat species, barley, pea, flax and opium poppy were cultivated in variable proportions and formed an important part of the economy and diet of the inhabitants of the area. Associated arable flora indicate the use of permanent fields and their intensive management, but we have a limited knowledge of water and nutrient availability to crops growing in the area, of how climatic variability affected crop dynamics and about the specific growing conditions of crops in each chronological phase.

In this study, we applied carbon and nitrogen stable isotope analysis of 369 grains of barley naked wheat and emmer from 11 radiocarbon-dated concentrations of charred grains from so-called burnt layers found in 5 sites in Zurich (Kleiner Hafner, Mozartstrasse, Parkhaus Opera, Kanalisationssanierung and Mythenschloss). Lower carbon isotope fractionation ($D^{13}C$) -particularly in naked wheat- suggest lower spring-summer precipitation in Egolzwil and Cortaillod investigated episodes while $\delta^{15}N$ -levels indicate a decrease of nutrient availability (possibly meaning progressive extensification of farming practices) from the late 4th millennium BC onwards.

The site of Zurich-Parkhaus Opera (dated to the late 4th millennium BC) was recently studied in greater detail and ca. 180 stable isotope measurements will be used to discuss potential differences in crop husbandry within the settlement.

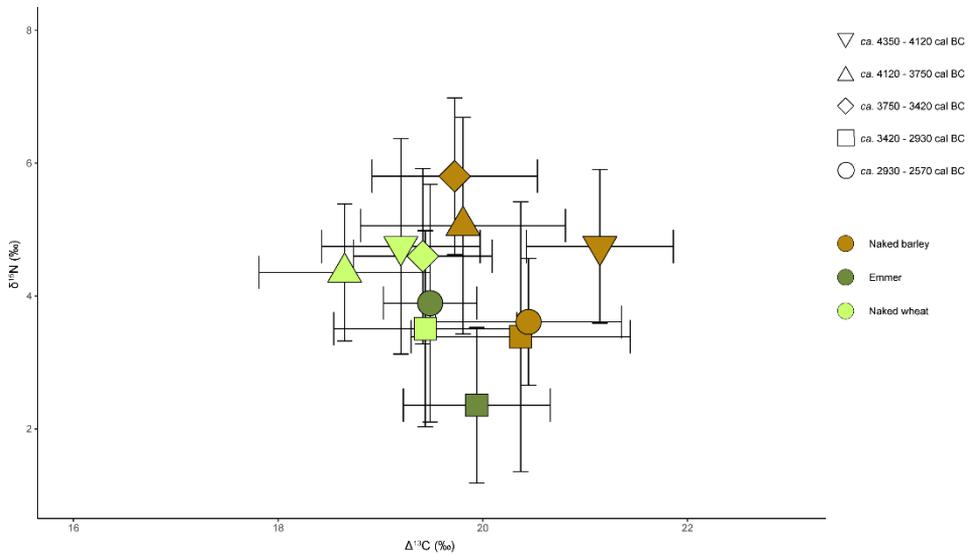


Figure: Average $\delta^{15}\text{N}$ and $\Delta^{13}\text{C}$ values for chronocultural phases at Lake Zurich according to crop type. Higher $\delta^{15}\text{N}$ values in this region usually correlate with higher nutrient availability (except in arid conditions), while higher $\Delta^{13}\text{C}$ indicate more water availability (spring/early summer precipitation).

IWGP22-0122 - Continuity or change in cultivation practices in South-west Norway from the Neolithic to Iron Age?

Rosie Bishop¹, Erik Daniel Fredh¹

¹Arkeologisk Museum, Universitetet i Stavanger, Stavanger, Norway

The development of agriculture in Norway is commonly described as stepwise, in relation to both population growth and changing agricultural practices. The earliest cultivation has been suggested to have been carried out on virgin soils, which would require little or no manuring, perhaps involving shifting as well as some more permanent cultivation. In contrast, from the Early Iron Age, regular manuring is usually inferred, which is often considered to be associated with the widespread introduction of fully permanent fields, the infield/outland system, and the expansion of hay-meadows. This is supported by various lines of evidence, including pollen, archaeobotanical and physical agricultural evidence. However, these shifts have not been tested directly through the stable isotope analysis of cereal grains. In this presentation we will investigate the evidence for changing crop management practices over time in South-west Norway using new stable isotope analyses of charred cereal grains dating from the Neolithic to the Iron Age. The analyses will shed light on whether there was an increase in manuring during the Iron Age agricultural expansion or whether manuring remained constant over time, suggesting whether or not soil amendment was already a well-established practice in the earliest farming communities.

IWGP22-0027 - Diversity of crops, weeds and cultivation practices during the Bronze Age and First Iron Age in south-eastern France

*Laurent Bouby*¹, *Manon Cabanis*², *Geneviève Daoulas*³, *Frédérique Durand*⁴, *Allowen Evin*¹, *Isabel Figueiral*⁵, *Laurie Flottes*⁶, *Flora Garcia*¹, *Charlotte Hallavant*⁷, *Angèle Jeanty*¹, *Philippe Marinval*⁸, *Lucie Martin*⁹, *Rachel Pinaud*⁸, *Jérôme Ros*¹, *Nuria Rovira*⁸

¹ISEM Université Montpellier/CNRS/EPHE/IRD, ISEM, Montpellier - cedex 5, France

²Institut national de recherches archéologiques préventives Inrap, Inrap, Clermont-Ferrand, France

³Institut national de recherches archéologiques préventives Inrap, Inrap, Saint-Martin-sur-le-Pré, France

⁴Institut national de recherches archéologiques préventives Inrap, Inrap, Toulouse, France

⁵Institut national de recherches archéologiques préventives Inrap, Inrap, Montpellier, France

⁶Archeodunum SAS, Archeodunum, Lyon, France

⁷Hades, Hades, L'Union, France

⁸ASM Univ Paul Valéry/CNRS/MCC/Inrap, Asm, Montpellier, France

⁹Université de Genève/EDYTEM, Laboratoire d'archéologie préhistorique et anthropologie, Genève, Switzerland

The Bronze and First Iron Ages represent a period of great change concerning the diversity of cultivated plants, with the arrival and spread of various species, in particular hulled barley (*Hordeum vulgare* var. *vulgare*), spelt (*Triticum spelta*) and millets (*Panicum miliaceum*, *Setaria italica*). The adoption of these new crops is often considered as part of a real mutation of the agrarian systems, towards a diversification of productions and agrarian practices. This diversity would allow a better scattering of cultivated plots in the land and a better annual distribution of the workload; furthermore, diversification would lessen the risks of crop failure and would give agrosystems greater resilience to social and environmental disruption.

However, in South-Eastern France, this alleged increase in crop and weed diversity has yet to be thoroughly assessed and described. This is why we build up a detailed dataset of archaeobotanical data, covering the Bronze Age and the First Iron Age, to analyze the ecological characteristics of weeds and their implications in terms of agricultural practices, as well as to investigate the

variations in the diversity of cultivated plants and weeds according to time, space and site contexts.

This study is part of the ongoing research program DEMETER (ERC Starting Grant; PI A. Evin). It is built on and extend a previous database of 80 sites (100 site phases) (Bouby et al. 2017), which is analyzed in much detail.

Reference:

Bouby L. *et al.* (2017). Ressources et économie agricole en France à l'âge du Bronze et au Premier âge du Fer : les données carpologiques. In: L'habitat et l'occupation des sols à l'âge du Bronze et au début du Premier âge du Fer. Paris, Inrap/CNRS: 299-326.

IWGP22-0196 - Agrobiodiversity and plant trade dynamics in the Northwestern Arabia (~2500 BCE –1200 CE): New evidence in the oasis of Al Ula

Vladimir Dabrowski¹, Charlène Bouchaud², Alexia Decaix³, Xavier Desormeau^{4,5}, Michèle Dinies⁶, Christelle Kabboul⁴, Michel Lemoine⁷

¹*Muséum national d'Histoire naturelle / CNRS, UMR 7209 Archéozoologie et Archéobotanique: Sociétés- Pratiques et Environnements, Paris, France*

²*Muséum national d'Histoire naturelle / CNRS, UMR 7209 Archéobotanique et Archéozoologie: Sociétés- pratiques et environnements, Paris, France*

³*Muséum national d'Histoire naturelle / CNRS, UMR 7209 Archéozoologie et Archéobotanique : Sociétés- pratiques et environnements, Paris, France*

⁴*Muséum national d'Histoire naturelle / CNRS, UMR 7209 Archéozoologie et Archéobotanique : Sociétés- pratiques et environnements, Paris, France*

⁵*CNRS, UMR 8167 Orient et Méditerranée : Textes- Archéologie- Histoire, Ivry-sur-Seine, France*

⁶*Deutsches Archäologisches Institut, Referat Naturwissenschaften, Berlin, Germany*

⁷*Muséum national d'Histoire naturelle / CNRS, UMR 7209 Archéozoologie et Archéobotanique : Sociétés- pratiques et environnements, Paris, France*

Oasian agrobiodiversity in Northwestern Arabia has a long and deep history which reflects adaptation strategies to arid climatic conditions and intense trade activities. New archaeobotanical investigations from two major ancient cities of the oasis of Al Ula, namely Dadan and Hegra, and other satellite sites offer a unique opportunity to reconstruct the long-term evolution of the plant economy on more than 3500 years, integrating agro-sylvo-pastoral system and medium- and long-distance trade activities. Our communication aims to present the latest results of the plant macro-remains analyses (seeds & fruits, charcoal) encompassing a large dataset of radiocarbon dating providing new insights into the diachronic evolution of oasian agriculture economies from the end of the Bronze age to the Islamic times (~2500 BCE –1200 CE). We'll discuss the first evidence for crops that are cereals during the second half of the 3rd mill. BCE, then date palm at the end of the 2nd mill. BCE, and the emergence of several additional cultivated plants in the Late Iron age and Antiquity, with a special focus on fruit trees (*Vitis vinifera*, *Olea europaea*, *Ficus carica*) and cotton (*Gossypium* sp.). The new data from the Medieval period finally reveals the cultivation of a wide diversity of fruit trees - in particular from the Prunoidae and Maloidae tribes - in the oasis, some of them attested for the first time on the Arabian Peninsula. Comparison with the few other botanical data available in Northwestern Arabia for contemporaneous periods (e.g. Tayma and Kilwa) will

highlight the common trends and local particularities in order to attempt a first regional overview.

IWGP22-0258 - Fruit tree cultivation in the Near East from the 4th till 2nd millennium BC

Katleen Deckers¹, Simone Riehl², Valentina Tumolo³, Michelle de Gruchy³, Dan Lawrence³

¹*University of Tübingen, Institute for Archaeological Sciences, Tübingen, Germany*

²*University of Tübingen, Institute for Archaeological Sciences and Senckenberg Center for Human Evolution and Palaeoenvironment HEP, Tübingen, Germany*

³*Durham University, Department of Archaeology, Durham, United Kingdom*

Fruit tree cultivation largely appears to have started after the establishment of agriculture and has been argued to have played an important role in the development of urban societies. In this presentation, we will investigate the development of fruit tree cultivation from the 4th till 2nd millennium BC in the Near East, using the seed and charcoal ADEMNES database that has been updated as part of the ERC-funded CLaSS project (“Climate, Landscapes, Settlement and Society in the Ancient Near East”) under the direction of Dan Lawrence. Within this project also an enormous settlement database has been collected that allows us to investigate population density as a factor in the choices towards intensification and extensification. Moreover, we will investigate whether intense fruit tree cultivation is related with specific dietary and economic priorities as well as with particular environments suitable for growth.

ADEMNES. The GRF (German Research Foundation) and University of Tübingen funded Archaeobotanical Database of Eastern Mediterranean and Near Eastern Sites, last update 2015. www.ademnes.de.

IWGP22-0139 - Plants and Power – New evidence for urban food production from the Hittite capital of Hattusha

*Charlotte Diffey*¹

¹*University of Oxford, School of Archaeology, Oxford, United Kingdom*

The Late Bronze Age (2nd millennium BC) of the Eastern Mediterranean saw the significant expansion of urban settlements, the rise of new empires and the extension of trade links within and beyond the heartlands of early states. This growth in urban settlements and accompanying rapid socio-economic re-organisation was fuelled by corresponding developments in arable production, including the dissemination of labour-saving technology and the cultivation of spatially expansive agricultural systems. Towards the end of the Late Bronze Age (LBA), however, the urban landscape changed dramatically with the collapse of several states in the Eastern Mediterranean region. Reconstructing systems of urban food production and the fluctuation of large-scale agro-economies during the LBA is essential to understanding both the development of these urban societies and their subsequent collapse. To date, however, a lack of empirical evidence has prevented detailed examination of the relationship between agriculture and the growth and collapse of urban society in the LBA.

This poster will present the preliminary results of a new project at the site of Hattusa which aims to create an agricultural biography of the city from its establishment (c. 1650 BC) until its collapse and abandonment (c. 1190 BC). This study will combine high-resolution analysis of the exceptional archaeobotanical assemblage recovered from the site, with crop stable isotope analysis, functional weed ecology and seed morphometrics to provide new insights into the social dynamics of urban agricultural production throughout the 2nd millennium BC in the Eastern Mediterranean.

IWGP22-0099 - Early agricultural practices and land use in Northern Greece and the South-west Balkans: Preliminary archaeobotanical results from the EXPLO Project

Müge Ergun¹, Rachel Ballantyne¹, Amy Holquin¹, Eugenia Gkatzogia², Ferran Antolín³, Soultana-Maria Valamoti², Mike Charles¹, Amy Bogaard¹

¹*University of Oxford, School of Archaeology, Oxford, United Kingdom*

²*Aristotle University of Thessaloniki, Department of Archaeology, Thessaloniki, Greece*

³*German Archaeological Institute, Natural Sciences Unit, Berlin, Germany*

As a key geographical area between western Asia and central-western Europe, the rich and diverse landscapes of northern Greece and the southern Balkans play a vital role for understanding the introduction of agriculture and its evolution in the European continent. Nevertheless, our knowledge of early agricultural practices and their impact on the environment in this region is still limited, in part due to patchy organic preservation. The ERC-funded synergy project EXPLO ('Exploring the dynamics and causes of prehistoric land use change in the cradle of European farming') aims to address this knowledge gap by focusing on the prehistoric pile-dwelling lakeshore settlements in the uplands of northern Greece and the south-west Balkans (present-day Albania and the Republic of North Macedonia) through the Neolithic and Bronze Age. The project is a collaboration between Universities of Bern, Thessaloniki and Oxford, and combines archaeological, palaeocological and bioarchaeological approaches.

Within the context of the EXPLO project, this paper presents and compares preliminary results of macrobotanical analysis for waterlogged assemblages from new excavations at three lakeshore settlements (later 6th-mid 5th millennia BC): Dispilio (Lake Orestias, Greece), Lin (Lake Ohrid, Albania) and Ploča Mičov Grad (Lake Ohrid, North Macedonia). Here we consider new results on crop spectra, fruits and nuts, weed flora and 'food' remains. We assess the implications of these emerging results for understanding the adaptation of Neolithic subsistence strategies and agricultural practices to these lakeshore settings, including long-term trajectories.

IWGP22-0194 - Which factors shaped the spatial structure of the historical field patterns in the Czech Republic?

*Václav Fanta*¹

¹*Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Praha, Czech Republic*

Historical field systems are an important part of the traditional agricultural landscape. Their structures affect cultural, productional, ecological, hydrological, ecological and aesthetical values of the cultural landscape. The historical field systems can form complex spatial structures and forms. In our paper, we focused on identifying the environmental and cultural/historical driving forces possibly affecting the origin and development of various field pattern types. We analysed 523 settlements in the western part of the Czech Republic. These settlements were established during the medieval and early modern period. We have determined the proportion of field pattern types and compared them with environmental and cultural/historical variables, e.g. altitude, terrain undulation, soil fertility, age of the settlement, cadastre size etc. The preliminary results indicate a strong influence of environmental factors as well as the impact of specific historical events and cultural predictors. More detailed results will be discussed in the presentation, together with ecological adaptations of various field pattern types.

Reference:

Fanta, V., Beneš, J., Zouhar, J. et al. Ecological and historical factors behind the spatial structure of the historical field patterns in the Czech Republic. *Sci Rep* 12, 8645 (2022). <https://doi.org/10.1038/s41598-022-12612-8>

IWGP22-0119 - Agricultural niche building in the Neolithic central Balkans

Dragana Filipovic¹, Djurdja Obradović²

¹Kiel University, Institute for Pre- and Protohistory, Kiel, Germany

²Institute of Archaeology, Institute of Archaeology, Belgrade, Serbia

Agronomic studies emphasise that agriculture is modelled by different groups of factors that form complex and dynamic socio-ecological systems of agricultural production. Biological by nature, this form of production is influenced by natural environment, many aspects of which are not under farmer's control, such as, for instance, species suitability, (micro-)regional climate, pests and diseases. Farming decisions are further shaped by economic goals, including ensuring dietary sustenance and generating income. Finally, agricultural activities are embedded in the social contexts created and reproduced by the farming households and societies.

This presentation is concerned with plant-based agricultural production in the Neolithic in the central part of the Balkan Peninsula. It observes how crop cultivation practices varied between the settlements and how they changed through the c. 1700-year long period (6200-4500 BC). Two transformational developments punctuate this sequence: (1) transmission in the late 7th millennium BC of the Early Neolithic farming practices northwards from the Aegean and into the continental parts of the Balkan Peninsula. We track adaptations that these practices underwent, as evidence of adjustment to local environments and climate; such adaptations underpinned creation of the regional socio-economic context known as the Starčevo culture; (2) emergence of a new socio-economic context, the Vinča culture, in the 2nd half of the 6th millennium BC, accompanied by new pottery technology and settlement pattern, an apparent increase in the population size, and followed by the beginning of extractive metallurgy at the turn of the millennia; we illustrate how changes in crop production were one additional element of this general economic growth. For archaeobotanical inferences on the adaptations and modifications in plant production, we rely on the analysis of crop and wild diversity (=the range of species and their relative abundance) in the assemblages from Starčevo and Vinča culture sites in Serbia.

IWGP22-0104 - Plant macro remains and stable isotopes help reconstructing early agricultural dynamics in the Neolithic northwestern Mediterranean

Franziska Follmann¹, Bigna L. Steiner², Héctor Martínez-Grau², Raúl Soteras¹, Ferran Antolín¹

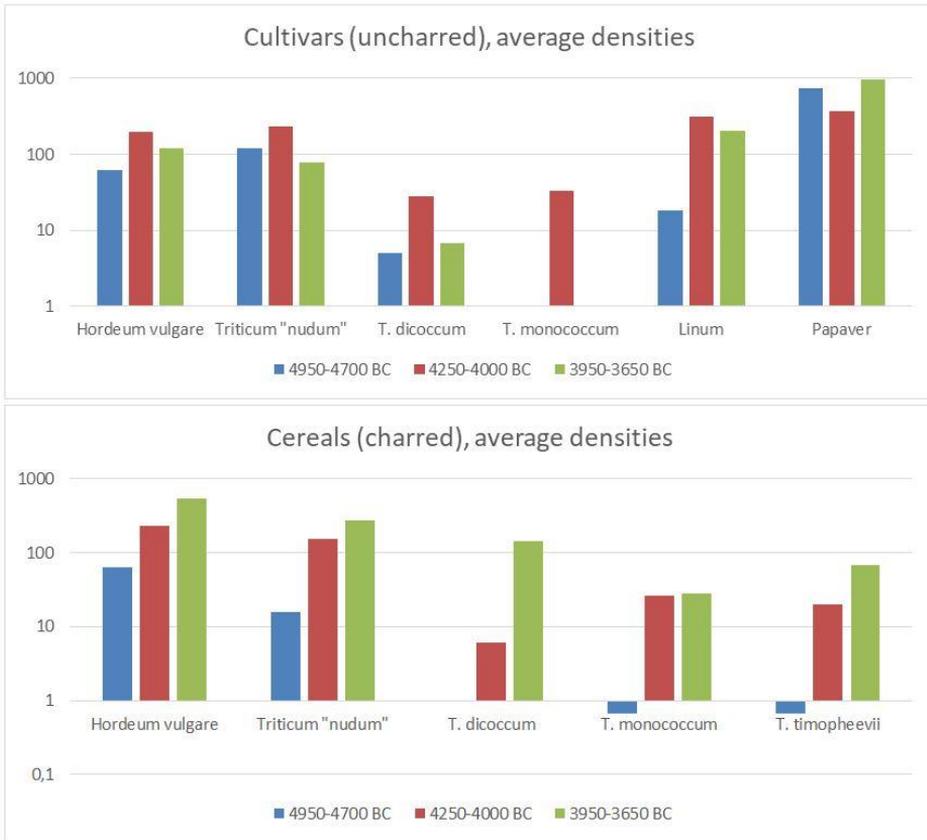
¹*Deutsches Archäologisches Institut, Naturwissenschaftliches Referat, Berlin, Germany*

²*Universität Basel, Integrative Prähistorische und Naturwissenschaftliche Archäologie, Basel, Switzerland*

Agricultural dynamics in the northwestern Mediterranean with a strong focus on free-threshing cereals differed from other areas in Europe where glume wheats were prioritized from the Early Neolithic onwards. Yet contacts between the Balkan farming tradition and the Western Mediterranean have been detected in northeastern Italy. This talk observes potential implications of these contacts further West during the Neolithic period.

The current state of research suggests that in Neolithic southern France free-threshing wheat was the most important crop before an economic threshold around 4000 BC when glume wheat gained in importance (Martin et al. 2016, Jesus et al. 2020). To what extent the shift in the crop spectrum represents a local or a supra-regional phenomenon has not yet been clarified due to a lack of well-dated and well-preserved sites.

The waterlogged plant remains from Isolino Virginia (Comune di Varese, Italy) provide the opportunity to take a first step toward answering this question. Based on our investigations, three economic phases have been distinguished. In phase 1 free-threshing wheat was predominant, probably due to good growth conditions. The settlers of this early phase likely came from the Western Mediterranean region, where free threshing wheat was popular. Phase 2 is characterized by barley as the main cereal while free threshing wheat does not seem to have been fertilized systematically. Increasing precipitation might have caused problems for its cultivation, so the focus shifted to barley. In phase 3 a further increase in summer precipitation presumably along with a social influence from the Balkans might have led to a preference of glume wheat. These preliminary results confirm the finds from southern France and indicate that networks might have been essential for the adoption of resilient farming strategies in the Neolithic.



IWGP22-0131 - A multi-scalar approach to archaeobotanical reconstruction of agricultural expansion, diversification and sustainability: a case study from the Negev Highlands, Israel

*Daniel Fuks*¹

¹*University of Cambridge, McDonald Institute for Archaeological Research, Cambridge, United Kingdom*

This paper presents a multi-scalar approach to agricultural change, employing a modified Braudelian classification of time at which archaeobotany informs on agricultural systems. Plant remains from rubbish middens at mid-first millennium CE sites in Israel's Negev Highland desert provide the case study:

(1) Long-term, millennial-scale influence of crop diffusion is attested to by qualitative changes in crop baskets. This includes early evidence for eggplant introduction in the Levant, supporting the Islamic Green Revolution thesis. Yet the full plant assemblage suggests a greater role for Roman agricultural diffusion, which appears as a peak period of post-Neolithic, pre-modern crop diffusion in southwest Asia.

(2) Medium-term, decadal-centennial economic trends are reconstructed using quantitative changes in key crops. These reveal the rise and fall of commercial viticulture in the Negev Highlands centered on the mid-6th century CE, in tandem with ceramic evidence for changing involvement in Mediterranean trade. This exemplifies a globalizing ancient economy's vulnerability to external shocks like plague and climate change.

(3) Sub-annual seasonal rhythms of ancient agropastoral activity are encapsulated in plant remains within herbivore dung pellets. A multi-proxy archaeobotanical study of pellets' seed/fruit, phytolith and pollen remains demonstrates this approach's potential for reconstructing ancient agropastoral seasonality, mobility, and landscapes.

This multi-scalar model adds depth and dimension to reconstructing ancient agricultural systems, offering broader and more nuanced understandings of agricultural expansion, intensification, diversification and sustainability. On the millennial scale, crop diffusion had only a gradual effect at the time but long-lasting ultimate consequences for local foodways and agricultural routines (1). On the decadal-centennial scale, a major crisis wrecked Byzantine Negev commercial viticulture and settlement (2). Yet, although the intensification and abrupt decline of viticulture made a lasting impression on the archaeological landscape, its long-term economic impact was limited by a lack of resilience in the face of climate change, plague and socio-political instability.

IWGP22-0136 - Identifying agricultural intensification as seen through the debate on Negev viticulture and Gaza Wine in Late Antiquity

*Daniel Fuks*¹

¹*University of Cambridge, McDonald Institute for Archaeological Research, Cambridge, United Kingdom*

One hundred fifty years after the first published reference in modern Western scholarship to ancient wine production in Israel's Negev desert, two recent studies reached opposite conclusions on the extent and intensity of Byzantine Negev Highland viticulture and its relationship to contemporaneous 'Gaza wine'. This raises wider questions on how to evaluate apparently conflicting archaeological evidence for ancient microregional production and trade, and how to effectively gauge ancient agricultural intensification. This poster addresses these issues by historiographic survey of evidence for Negev Highland viticulture. Early interpretation of Byzantine Negev winepresses, and scant textual evidence, as representing commercial production of the acclaimed 'Gaza wine' of Late Antiquity, was overly optimistic. Yet criticism based on winepress output and wine consumption calculations suggesting that the Negev Highlands could not have supported commercial-scale viticulture was overly pessimistic. This is demonstrated by problems of divergence and equifinality in the calculations-based approaches upon which those conclusions were based. Changing frequencies of archaeobotanical grape pips relative to cereal grains revealed the rise and fall of commercial-scale viticulture in the Negev Highlands, while corresponding changes in relative frequencies of amphorae sherds demonstrated a connection to Mediterranean trade. This profoundly exemplifies the penetration of Roman-Byzantine intensification into dryland ecosystems, while indicating how archaeobotany in collaboration with other disciplines can reconstruct agricultural intensification and extensification. Further research in this vein from additional sites and regions will help fine-tune understandings of these processes, as will biomolecular identifications of the diversity and evolutionary pathways of this ancient industry's cultivars.

Identifying agricultural intensification as seen through the debate on Negev Viticulture and Gaza Wine in Late Antiquity

Daniel Fuks

McDonald Institute for Archaeological Research, University of Cambridge

Over the past 150 yrs, research has suggested that the Byzantine Negev Highlands...

Future research may reveal...

grew grapes and produced wine	produced export 'Gaza wine'	could not have produced export wine	could have produced export wine	had commercial viticulture linked to Mediterranean trade	more precise consumption and production patterns, identity of Negev grape varieties, & whether Negev wine = Gaza wine?
based on...	winepresses ¹ and Nessana papyri ^{2,3}	calculations of demand & (winepress) supply potential ²	calculations of demand & (winepress & landscape) supply potential ⁶	quantitative archaeobotanical and ceramic data from rubbish mounds ⁷	biomolecular, economic and field archaeology



© Gideon Avni



© Mogen Library & Museum

Variable	Seligman 2020	Fuks et al. 2021	Difference
Harvest length	30 days	90 days	× 1.8
Vin refill time	3-4 days	2 days	× 1.5 to 2
Winepress count	## discovered	## expected	× 3
Consumption/yr	109-274 litres	25-30 litres	÷ 4 to 11



From Fuks et al. 2020



© Joshua Schmidt



¹ Palmer, E.H. 1871. *The desert of the Esodias: Journals on foot in the wilderness of the forty years' wandering*. Cambridge.

² Mayeron, P. 1962. The ancient agricultural regime of Nessana and the Central Negev. In: Colt, D., ed. *Excavations at Nessana, Vol. I*.

³ Mazar, G. 1981. The winepresses of the Negev. [Hebrew]. *Qadmonim* 14.

⁴ Mayeron, P. 1985. The wine and vineyards of Gaza in the Byzantine period. *BASOR* 237.

⁵ Seligman, J. 2020. Were the central Negev settlements suppliers or importers of Gaza Wines? *JR* 433.

⁶ Fuks, D., Avni, G. and Bar-Oz, G. 2021. The debate on Negev viticulture and Gaza Wine in Late Antiquity. *Tel-Aviv* 48.

⁷ Fuks et al. 2020. The rise and fall of viticulture in the Late Antique Negev Highlands reconstructed from archaeobotanical and ceramic data. *PNAS* 117.



© Eli Poiner, Israel Museum

Wikimedia commons 1354176534

IWGP22-0222 - Meta-archaeobotany, cerealization rates, and crop diversity: new metrics and new questions on agricultural origins in the age of databases

*Dorian Fuller*¹

¹*University College London, Institute of Archaeology, London, United Kingdom*

The growth of archaeobotanical datasets and databases in recent years begins to allow us to ask new questions or to frame old questions in new ways. In particular we can explore processes that take place across a large geographical and temporal canvas, i.e. a meta-archaeobotany. We can ask quantitative questions about how far and how fast crops spread once they were brought into cultivation and once they were domesticated; I refer to this as a cerealization rate, the maximum land area over which a cereal had become a cropping option. When calculated for Chinese millets, rice, wheats, barley, sorghum and pearl millet, we find that more productive cereals (wheat, rice, barley) spread very slowly in contrast to lower productivity millets that spread orders of magnitude faster. We see this in the case of rice too, when dispersal rates increase after transitioning from wetland rice to less productive rainfed rice cultivation. Another question we ask is about longer-term regional trends in crop diversity. In most regions crop diversity tends to increase over time. Taken together we can characterize different regional pathways to agriculture in terms of their productivity, diversity and proclivity for crop dispersal. These provide a new framework for comparing parallel developments of early farming.

IWGP22-0221 - Reconstructing agriculture in Central Tyrrhenian Italy from the 10th to the 6th century BCE: stable isotopes analysis and archaeobotany

Fanny Gaveriaux¹, Laura Motta², Mauro Brilli³, Laura Sadori⁴

¹*Sapienza University of Rome, Department of Earth Sciences, Rome, Italy*

²*University of Michigan, Kelsey Museum of Archaeology, Ann Arbor MI, USA*

³*CNR, Institute of Environmental Geology and Geoengineering, Rome, Italy*

⁴*Sapienza University of Rome, Department of Environmental Biology, Rome, Italy*

From the 10th to the 6th century BCE the populations of Central Tyrrhenian Italy underwent social, political and economic transformations leading to the rise of the first city-states. These changes were associated in literature with a demographic growth as well as a significant shift in settlement patterns and size that dramatically restructured life across the region. Scholarship postulated that inhabitants would have therefore intensified and modified their agricultural practices to meet their growing needs. However, little is known about agriculture during this period with new datasets only recently becoming available. In order to investigate this theme, a multi-proxy approach is proposed which integrates archaeobotanical data with carbon and nitrogen stable isotope analysis ($\Delta^{13}\text{C}$ and $\delta^{15}\text{N}$) on charred cereal grains (barley and emmer). The first method allows for an overview of crop production whereas the second characterizes the cultivation practices by investigating the water availability in which the plant grew and the detection of animal manure. The archaeobotanical material was retrieved from three archaeological sites, Tarquinia, Rome and Gabii, which all underwent this phase of urbanization. The results show that differences in crop production can be identified through time in some archaeological sites. Moreover, some local specificities are also detected in the crop assemblages which can be interpreted either as an adaptation to a specific environment or as a cultural or economic choice. The $\Delta^{13}\text{C}$ shows that water availability was not constant through time with inter-site differences also identified. Different hypothesis, taking into consideration agricultural practices, fields locations and environmental changes, can be drawn from these results and could explain the variations observed. The $\delta^{15}\text{N}$ does not suggest any application of manure at any of the sites across all time periods. These innovative results offer an insight into agricultural practices, building a foundation for a region and period thus far underrepresented.

IWGP22-0175 - Bronze and Iron Age food and fodder production in North-Western Alps (Canton du Valais/Kanton Wallis, Switzerland)

Ludovic Gesset¹

¹University of Basel, IPNA, Basel, Switzerland

The canton of Valais is on the crossroad of Mediterranean and central Europe both culturally and ecologically. Bronze and Iron Age sites in the Upper Rhone Valley offer us a perspective on human exploitations of the vegetation in a mountainous area. Well-preserved archaeobotanical remains discovered in sites like Brig-Glis Waldmatte in structures well understood both chronostratigraphically and functionally produced a wide diversity of crops, weeds and other wild species. This richness and understanding of the archaeological contexts are allowing us a glimpse of both agricultural practices and exploitation of wild plants.

The spectrum of cultivated species seems, for now, with no parallel in the Alps in Protohistory with millets (both *Panicum miliaceum* and *Setaria italica*) and barley as main cereals, *Lens culinaris* and *Pisum sativum*, and in a case, *Vicia ervilia* as legumes and very few attestations of *Triticum spelta*, *T. dicoccon* and *T. monococcum* before the Roman Era. This spectrum is similar to the one in traditional Himalayan agriculture. The similarities could allow us to compare both the agricultural practices and transformation chain from harvest to storage and food preparation.

The wild flora shows us exploitation of different areas as coniferous and deciduous forests, or meadows.

The presence of some species as *Abies alba* and *Picea abies* in association with hay, fruit remains and straw inside storage facilities and stables allows us to reconstruct fodder/litter practices in connection with the keeping of domesticated livestock.

IWGP22-0240 - Changes in crop assemblages in the fifth millennium BC in the South-eastern part of Romania

*Mihaela Golea*¹

¹*Institute of Archaeology `Vasile Pârvan` - Bucharest- Romania, Bioarchaeology, Bucharest, Romania*

The Fifth millennium BC in the South-eastern part of Romania is represented by the Boian-Maritsa (5000-4600 cal. BC) and the Kodjadermen-Gumelnița-Karanovo VI (KGK VI) (4600-3900 cal. BC) cultures. These cultural developments were the last to expand the *tell*-type settlements and to have a general stability of their socio-economical systems due to the climatic optimum. Beginning with the KGK VI culture, the utilisation of metallurgy in the area was in its infancy. Both cultures are chronologically framed within the Late Neolithic-Calcolithic periods.

The crop assemblages were identified in more than 18 archaeological sites extracted from across the Northern Lower Danube River Catchment Area. This data is mainly published but also, some sites will benefit from unpublished data. Semi-quantitative methods and a multivariate statistical method (Correspondence Analysis) will be used in order to comprehend the importance of specific plant species and to track changes in plant crop practices.

This presentation wishes to be an overview of plant crops used by the Boian-Maritsa and KGK VI communities, with an emphasis on cereals and pulses. In addition, a reanalysis of old identifications will be made, in order to underline potential new plant species from the Lower Danube River area (such as new glume wheat). The diachronic overview between the Boian-Maritsa and KGK VI cultures will be the basis of this work. After establishing the role played by different crops in the agricultural economy, a comparison between the communities of the Northern part and the Southern part of the Danube river will be synthesized. This work will bring forward the agricultural crop assemblages that are specific to this part of the prehistoric world. Furthermore, the differences between the plant assemblages will emphasize the plant choices of human communities around the Lower Danube Area.

IWGP22-0128 - Fodder, Forage, and Food: Investigating Diverse Agropastoralism at Late Bronze Age Luanzagangzi, Xinjiang

*Sullivan Heywood*¹

¹*University of Queensland, Archaeology- School of Social Science, Brisbane, Australia*

Agropastoral communities inhabiting the mountain/steppe ecozones of Central Eurasia are hypothesised to have facilitated the movement of staple cereal crops across the continent in prehistory. These interactions are particularly under-investigated in the Junggar Basin of Xinjiang during the Late Bronze Age, despite the region having been a likely route between the east and west for millennia. This study explores the agricultural economy and interregional connections at the site of Luanzagangzi (3300- 2950 cal. BP) located on the interface between the Junggar Basin and the eastern Tianshan Mountains. The plant macrofossils extracted from the site revealed the likely cultivation of bread wheat, six-row naked barley, foxtail millet, and possibly broomcorn millet. This multi-crop repertoire was part of an agricultural economy that was further supplemented by the foddering of wild small-seeded legumes, with shifts in the weed ecology reflecting changes in pastoral landscape interactions overtime. A decline in agriculture over the sites occupation closely aligned with a material culture change that mirrored broader regional trends in Central Eurasia. Interregional contact was further indicated by the identification of a rice grain that was potentially exchanged through the Hexi Corridor to the east, and represents some of the earliest evidence for rice in Central Eurasia. The archaeobotanical research outlined in this presentation establishes that diverse agropastoralism was the main economic adaption at the site of Luanzaganzi and reveals that people in the Junggar Basin had wide-ranging geographic connections during the Late Bronze Age.



Figure: a) dorsal, b) ventral, c) lateral view of an *Oryza sativa* ssp. *japonica* caryopsis dating to approximately 3100 BP, representing some of the oldest rice outside of Eastern Asia.

IWGP22-0283 - Archaeobotany of the Early Middle Ages on the border of the South and Central Bohemian region

Tomáš Hiltcher¹, Jaroslav Jiřík^{1,2}, Tereza Šálková³

¹Prácheň museum in Písek, Archeology, Písek, Czech Republic

²Charles University in Prague, Faculty of Arts- Department of Archaeology, Prague, Czech Republic

³University of South Bohemia in České Budějovice, Faculty of Arts- Institute of Archaeology, České Budějovice, Czech Republic

Thus far, little attention has been paid to the early medieval agriculture of South Bohemia, restricting itself primarily to the artefactual part of archaeology. The presented area located on the border of the South and Central Bohemian region contains a hierarchised settlement structure. Rakovice settlement is, in the presented study, a representative of a common agricultural settlement. Kožlívka settlement was, based on metal finds, interpreted as a distribution site (probably an emporium). Počaply fortified settlement then represents an administrative centre of the area.

The remains of cultivated cereal show that the economy of the area was based on growing common wheat (*Triticum aestivum*), barley (*Hordeum vulgare var. vulgare*), and common millet (*Panicum miliaceum*); with additional cultivation of rye (*Secale cereale*). Legumes (*Lens culinaris*, *Pisum sativum*), however, were present in the assemblages only in small quantities. Essential for the area was presumably the cultivation of common flax (*Linum usitatissimum*). The geographical proximity of the research sites helps to eliminate natural conditions such as climate and soil fertility. It was possible to reconstruct a partly different structure of the cultivated plants in various social environments. The research should serve as an elemental initiative for intensive data collection in the examination area and a more complex evaluation of the forms and development of agriculture in a broader context.

IWGP22-0054 - Archaeobotanical data from aggregated cells type archaeological sites in Armenia

Roman Hovsepyan¹

¹*Institute of Archaeology and Ethnography, Research group of Archaeo- and Ethnobiology, Yerevan, Armenia*

The Neolithic and Chalcolithic periods in the South Caucasus were followed by major environmental and cultural changes that resulted also in lifestyle and economic changes for the local communities in the Bronze Age: a part of the communities shifted to nomadic or transhumant lifestyles. New archaeological constructions appeared in the region including so-called ‘aggregated cells’ and “desert kites”, which are usually attached or neighbouring archaeological stone-walled constructions. These constructions are mostly found in desert or mountainous areas of the Middle East and Southwest Asia. In Armenia, these constructions start to appear mostly in the Bronze Age (mainly in MBA). Various functions, almost always related to the funneling of wild or domestic animals, are ascribed to the “kite” constructions - mostly V-shape converging long and low stone walls. Meanwhile, the functions of the ‘aggregated cells’ were less clear and can be interpreted also through archaeobotanical data. The visible parts of the studied archaeological sites of Karmir Sar, Arteni-1 and Aragatsavan represent ‘aggregated cells’ type constructions. The present archaeobotanical studies of macroscopic organic remains, such as remains of coprolite and seeds recovered during excavations of the Middle and Late Bronze Age layers of these sites, suggest that the investigated constructions were mostly used as pens for animals, but people also sometimes lived in the same place for shorter periods. Morphologically identifiable parts of the coprolites recovered from the sites (Arteni-1, Aragatsavan) resemble droppings of sheep and goat. The recovered archaeobotanical findings include remains of cultivated cereals: hulled and naked (free-threshing) barley (*Hordeum vulgare*), naked wheat (possibly bread wheat, *Triticum* cf. *aestivum*) and emmer (*Triticum dicoccum*), which presumably are remains of food. Seeds of several taxa (species of *Setaria*, *Hordeum*, *Lolium*, *Galium*, *Buglossoides*, *Salsola*, *Chenopodium*, *Vaccaria*, *Thymelea*, etc), representing local wild and weedy flora, also were recovered from these sites.

IWGP22-0055 - Was cereals-based agriculture in the prehistory of the Lesser Caucasus caused by shortage of water resources?

*Roman Hovsepyan*¹

¹*Institute of Archaeology and Ethnography, Research group of Archaeo- and Ethnobiology, Yerevan, Armenia*

Changes in agriculture in the South Caucasus during prehistorical periods was an asymmetric sequence of diversifications and specializations. Agriculture was recorded in this region starting from the beginning of the VI millennium B.C. (Neolithic) onwards and it was comparably diverse (cereals, pulses, oil-plants, grape) in its beginning, during the Neolithic-Chalcolithic period: tetraploid and hexaploid naked wheats, naked and hulled six-rowed and two-rowed barleys, emmer, einkorn, lentil, pea, bitter vetch, camelina, alyssum, etc. were cultivated. Then, starting from the Early Bronze Age, the local agriculture was specialized almost exclusively to three species of cereals (bread wheat (*Triticum aestivum*), hulled barley (*Hordeum vulgare*) and emmer (*Triticum dicoccum*)) production until the appearance of the Van Kingdom in the I millennium B.C., when large-scale irrigational systems were constructed and the agriculture became more diverse than it ever was (cereals, pulses, oil-crops, grape, fruit-trees, vegetables, condiments, etc.). The specialization of agriculture in the South Caucasus during the Early Bronze Age - Early Iron Age period (IV-I millennia B.C.) down to the cultivation of several species of cereals coincided with global rapid climatic changes and large scale occupation of mountainous areas. The above-mentioned three cereals are the most adapted and productive food crops for cultivation in mountains, where they usually may be watered only by rainfall. We suggest a working theory that people moved to the mountains in EBA and started agriculture there following water sources and or rainfalls. Nowadays, the local population practices mostly rainfed agriculture in the mountains of the Caucasus and the main crops there remain the same - bread wheat, hulled barley and emmer.

IWGP22-0164 - Archaeobotany from a Graeco-Roman mountain settlement in Tuna el-Gebel, Middle Egypt

Jessica Izak¹, Ferran Antolin², Marlu Kühn³, Mélanie Flossmann-Schütze⁴

¹*University of Basel, Altertumswissenschaften, Basel, Switzerland*

²*Deutsches Archäologisches Institut, Referat Naturwissenschaften an der Zentrale, Berlin, Germany*

³*Integrative Prähistorische und Naturwissenschaftliche Archäologie IPNA, Archäobotanik, Basel, Switzerland*

⁴*Freie Universität Berlin, Fachbereich Geschichts- und Kulturwissenschaften, Berlin, Germany*

In the winter season of 2021 the Joint Mission of the Universities of Cairo and Munich carried out in cooperation with the DAI Berlin their first archaeobotanical investigations at Tuna el-Gebel. Large quantities of archaeobotanical material were found during the excavation of a Graeco-Roman tower house on the mountain settlement in the desert area of this region. The botanical remains were found in large piles of domestic waste lying in and around the courtyard area of the house. They contain a rich archive of everyday life at the settlement, from papyri and ostraca, potsherds, fragments of glass vessels, remains of clothing, charcoal and ashes from the hearths, to food and fodder remains such as animal bones, seeds, fruit stones, nutshells, grain and chaff. The aim of the study is to provide a first assessment of the cultivated and wild plants present at the courtyard and to interpret them in the context of settlement archaeology, in order to help characterize the nature of the mountain settlement, which to date remains elusive. The reconstruction of the way of life and the everyday life of the inhabitants of the houses at that time is hence the main focus of the investigation. The excellently preserved plant remains under desiccation allowed a first stratigraphic approach to this rubbish heap and the analysis of dung remains. A large diversity of cultivated plants (including cereals, pulses, oil plants and fruit trees) were identified, while specialized foddering practices were also observed.

IWGP22-0243 - Feeding early cities: Agricultural dynamics and urbanization in the Indus Valley Bronze Age

Carolina Jiménez-Arteaga¹, Marco Madella¹, Carla Lancelotti¹, Ghualm Mohiuddin Veesar², Tasleem Alam Abro², Óscar Parque¹, Ameen Chandio²

¹*Universitat Pompeu Fabra, Humanities, Barcelona, Spain*

²*Shah Abdul Latif University, Department of Archaeology, Khairpur, Pakistan*

The Indus Civilisation is the earliest known urban culture of South Asia (2600–1900 BCE). While archaeological research has been conducted in the region for a century, systematic archaeobotanical analyses are still not widespread, and those carried out have concentrated mostly on the geographical edges of the Civilisation, particularly Gujarat and the eastern Harappan region.

However, the Indus floodplain is an area of special interest as it was the core of an unprecedented urban development. Located in the transition zone between the winter and the summer monsoon systems, it is precisely the area where both systems are most irregular. In fact, archaeological evidence suggests that the people of the Indus Civilization adapted and exploited a variety of environments and they were resilient to climate change and variable hydrologic regimes through diverse agricultural strategies and water-supply management. Therefore, studying the relationship between agricultural dynamics and urbanization in the Indus Valley is key to understand not only the role of the environment in Indus societal transformation, but also the economic basis that allowed the rise of the Civilisation.

We present preliminary archaeobotanical data from Bhandu Qubo, a medium-size settlement located in the alluvial plain of the lower Indus Valley. Multi-proxy analyses provide data on the cropping regimes and what appears to be an agricultural intensification process in the transition from the pre-urban to the urban period at the site.

IWGP22-0207 - Archaeobotany: A multidisciplinary tool for understanding development of dietary and nutritional health background of contemporary Indian Population

*Mukund Kajale*¹

¹*K11 School of Fitness Sciences, Nutrition & Exercise Science, Pune, India*

The global development of agricultural evolution suggests the addition of new cereals, pulses, roots, tubers, fruits, oil crops, etc. in addition to animal domestication, dairy, poultry farming, etc. resulting in the development of civilization. And the incorporation of distinct vegetarian patterns of eating into the prevailing animal food cultures is prominently seen in Indian contexts, especially during the 1st millennium BC. his papers tries to assess complex Indian palaeoethnobotanical data sets derived from varied agro-climatic zones in light of their dietary and nutritional implications during protohistoric, historical, medieval and modern periods. Distinct changes in food habit occurred during the 20th century in terms of the dominance of carbohydrate-rich foods, and the easy availability of excess ries;; they appear to be largely responsible for development of the metabolic syndrome. The archaeobotanical records (in conjunction with zoological data) provide much needed ancient wisdom for understanding causes of the recent upsurge in metabolic health issues and possibly also offer an antidote (with lifestyle reversal) to curtail/contain health and fitness related issues in the contemporary Indian population.

IWGP22-0235 - Plant remains from the Early Neolithic settlement at Biskupice located in the Carpathian foothill zone (southern Poland)

Magda Kapcia¹, Magdalena Moskal del Hoyo¹, Marta Korczyńska¹, Agnieszka Wacnik¹, Kenig Robert², Nowak Marek²

¹*W. Szafer Institute of Botany- Polish Academy of Science- Kraków- Poland, Palaeobotany and Palaeoenvironment Group, Kraków, Poland*

²*Institute of Archaeology, Jagiellonian University, Kraków, Poland*

Loess-mantled areas of southern Poland belong to the first regions occupied by the Neolithic communities, represented by the Linear Pottery Culture (ca. 5400/5300-5000/4900 BC). Since a few decades, it has been demonstrated that these groups also settled some areas of the Carpathian Foothills. This presentation will be focused on a case study site from Biskupice, site no. 18, located in the Wieliczka Foothills, where the remains of five so-called longhouses were discovered in the years 2020-2021 (within the framework of NCN project no. 2018/30/E/HS3/00867). This recently excavated site with well-preserved archaeological features has provided an excellent opportunity to obtain archaeobotanical material in the form of plant macro- and micro-remains. Thus, a high number of samples were taken, having represented various contexts of different types of structures (e.g., typical so-called clay extraction pits, features with hearths at their bottoms, post-holes). The data obtained from all features associated with two completely excavated houses will be especially discussed as they differ in chronology, although both represent the youngest Źeliezovce phase of the studied culture (ca. 5100-5000 BC), as demonstrated by the pottery finds and a series of radiocarbon-dated caryopses of cereals. Both houses showed different sizes as the older house is a typical building exceeding the length of 30 meters, while the younger one is quite unique, reaching only 11 meters in length. Interestingly, the total number of plant macro-remains and their distribution investigated with the help of statistical tools also vary between these two houses. In this work, we will characterize the plant economy of this settlement situated in the foothill zone, based not only on farming practices associated with domesticated plants but also on the use of wild taxa. This model observed in Biskupice will be additionally compared with archaeobotanical data from southern Poland.

IWGP22-0244 - Reconsidering the Iron Age: New evidence from two Initial Early Iron Age sites in Southern Zambia

*Andrea Kay*¹

¹*Max Planck Institute for the Science of Human History, Archaeology, Jena, Germany*

The introduction of herding, farming, and metallurgy to southern Africa caused profound and long-lasting socio-economic changes. However, both the timing of these introductions and their associated environmental impacts remain topics of debate. Zambia is of particular significance to this narrative, as it was likely a locus of genetic, economic, and cultural exchange between the eastern, central, and southern populations of Africa in prehistory. Despite this importance it remains largely under-studied, particularly from an archaeobotanical perspective. In order to address this lacuna, we targeted previously investigated Early Iron Age (EIA) sites with the specific aim of recovering organic remains for various lab analyses. This paper will present the results from Chundu Farm and Kumadzulo, where the recovered archaeobotanical remains, in addition to faunal and other cultural materials, are helping to define the nature of subsistence practices at the earliest known Iron Age sites in Southern Zambia as well as better constrain the dates of the introduction of farming to the region.

IWGP22-0059 - Agriculture, fruit tree cultivation and trade in Medieval Afghanistan Archaeobotanical and archaeoentomological study of 13th century Shahr-e Gholgholah, Bamiyan

Ella Kempf¹, Margareta Tengberg¹, Jean-Bernard Huchet¹, Julio Bendezu-Sarmiento²

¹MNHN-CNRS, UMR 7209- Archéozoologie- archéobotanique : Sociétés- pratiques et environnements AASPE, Paris, France

²MNHN-CNRS-Université de Paris, UMR 7206- Anthropologie biologique et Bio-archéologie ABBA, Paris, France

Excavations conducted in 2014 by the French Archaeological Delegation in Afghanistan (DAFA) at the medieval fortified site of Shahr-e Gholgholah in the Bamiyan valley of the central afghan highlands revealed a concentration of exceptionally well preserved organic remains in a large, stone-lined pit associated with a wealthy residence. The citadel was abandoned in the 13th century after having been besieged and finally destroyed by the troops of Gengis Khan in 1221.

The desiccated remains of wood, seeds and fruits allow us to reconstruct a diversified crop spectrum including cereals of temperate and subtropical origins, various legumes and aromatic herbs, fibre and psychotropic plants as well as a wide array of fruit trees such as mulberry, walnut, pistachio, apricot, peach and pomegranate. In addition to local agricultural and horticultural productions, the plant assemblage contained wild perennial and herbaceous species allowing us to reconstruct the local environment and landscapes where cultivated spaces co-existed with natural plant communities. A few plant items of exotic origin, such as rice and cotton, further bear witness to the strategic position of the Bamiyan valley on major trade routes across Asia, linking China and India to Central Asia and the Iranian Plateau.

The first study of the numerous insect remains shows a large taxonomic and ecological diversity that allow us to approach environmental and hygienic conditions and complete the picture provided by the archaeobotanical analysis. Most of the taxa attested at Shahr-e Gholgholah are identified for the first time in Afghanistan where archaeobotanical and archaeoentomological studies are still very rare.

IWGP22-0105 - The role of plant economy within the Trypillia megasite phenomenon

Wiebke Kirleis¹, Marta Dal Corso¹, Galyna Pashkevych², Mihaela Golea³, Robert Hofmann¹, Andreea Terna¹, Vitalii Rud⁴, Mykhailo Videiko⁵, Johannes Müller¹

¹*Christian-Albrechts-University Kiel, Institute for Prehistoric and Protohistoric Archaeology, Kiel, Germany*

²*National Museum of Natural Sciences, National Academy of Sciences in Ukraine, Kyiv, Ukraine*

³*Institute of Archaeology "Vasile Pârvan", Romanian Academy, Bucharest, Romania*

⁴*National Academy of Sciences of Ukraine, Institute of Archaeology, Kyiv, Ukraine*

⁵*Boris Grinchenko University, Laboratory of Archaeology, Kyiv, Ukraine*

After agriculture was established in the Danube region in the Neolithic, in southeastern Europe, a flow of agropastoral populations towards the forest-steppe region is observed. After the first establishment of agropastoral sites in the Northpotic, this led to the establishment of Copper Age Trypillia megasites which represent exceptional population agglomerations of more than 10.000 people, at a time when elsewhere in Europe people lived in single farmsteads or small villages. Explanations of the megasite phenomenon built upon different socio-economic models, varying from sites with seasonal occupation peaks to agrarian towns and state-like proto-cities. However, the role of the Trypillia agropastoral megasite economy is still debated.

Here we present empirical data on Trypillia plant economy focusing on multi-proxy archaeobotanical investigations combining macrobotanical studies with stable isotope and phytoliths data showing the dependency on crop cultivation, and contribute to characterise the rise and fall of the Trypillia megasites phenomenon. Besides critically assessing issues of find taphonomies we will provide a geographic and diachronic contextualisation of the megasite phenomenon. First finds of new-glume-wheat for the western Trypillia megasite Stolniceni link with the Danubian crop assemblages while towards the East the cultivar spectrum is reduced. We will discuss the hypotheses that the rise of Trypillia megasites in the forest steppe region went along with a restriction in the crop spectrum if compared with Neolithic assemblages in the Danube region. Possible reasons behind this selection include agricultural specialization that next to an interest for grain yields is driven by the need for cereal by-products like straw and glumes serving as animal fodder and temper for daub. The collapse of the megasite phenomenon however is mainly triggered by political changes and likely happened independently from environmental and economic constraints.

IWGP22-0233 - Archaeobotanical insight into the ancient city in Mustis (N Tunisia)

Magdalena Moskal-Del Hoyo¹, *Monika Badura*², *Piotr Makowski*³, *Tomasz Waliszewski*⁴

¹*W. Szafer Institute of Botany- Polish Academy of Sciences, Palaeobotany and Palaeoenvironment Group, Kraków, Poland*

²*University of Gdańsk, Faculty of Biology- Department of Plant Ecology, Gdańsk, Poland*

³*Jagiellonian University, Institute of Archaeology, Kraków, Poland*

⁴*University of Warsaw, Faculty of Archaeology, Warsaw, Poland*

The city of Mustis was established at the end of the 2nd century BC, as a Roman municipality. Its good location was connected not only with the fertile alluvial valley in the area, but also with the strategic route connecting Mustis with Carthage, Dougga and other important places of *Africa Proconsularis*. At the beginning, the city was inhabited presumably by veterans of the Roman army coming from units commanded by the famous general Marius. Despite these data, the entire history of Mustis and the region is practically still unknown. One of the aims of the archaeobotanical research at this site, carried out under the AFRIPAL Project (NCN 2020/37/B/HS3/00348), is to acquire knowledge about the plants used by the inhabitants of this ancient city. Preliminary results show a number of plants used mainly for food purposes. In a time between Late Antique and Early Islamic period *Hordeum vulgare*, *Ficus carica*, *Vitis vinifera*, *Papaver somniferum* and *Linum usitatissimum* were used in Mustis. Finds of *Olea europea*, one of the most popular species in Tunisia, are not numerous. At the same time, wood charcoal fragments of this taxon are also found in various samples and contexts of the site, indicating its possible local growth. The wood charcoal assemblages are dominated by *Pinus* sp. cf. *P. halepensis* and *Pistacia* sp. Among other taxa, remains of *Phillyrea* sp./*Rhamnus* sp. and *Quercus* sp. were noted. The majority of wood represent twigs and branches. Archaeobotanical research in Mustis has just been initiated, but already at this stage we can see the great potential of the site and an opportunity to enrich the cultural heritage of Tunisia with data representing past local environment.

IWGP22-0237 - Archaeobotanical and palaeoenvironmental analyses from the easternmost Early Neolithic sites

*Magdalena Moskal-Del Hoyo*¹, *Magda Kapcia*², *Aldona Mueller-Bieniek*³, *Witold Paweł Alexandrowicz*⁴, *Lembi Lõugas*⁵, *Monika Dębiec*⁶, *Maciej Dębiec*⁷, *Thomas Saile*⁷

¹*W. Szafer Institute of Botany- Polish Academy of Sciences, Palaeobotany and Palaeoenvironment Group, Kraków, Poland*

²*W. Szafer Institute of Botany- Polish Academy of Science, Palaeobotany and Palaeoenvironment Group, Kraków, Poland*

³*University of Warsaw, Faculty of Archaeology, Warsaw, Poland*

⁴*AGH University of Science and Technology, Department of General Geology and Geotourism, Kraków, Poland*

⁵*Tallinn University, Archaeological Research Collection, Tallinn, Estonia*

⁶*Pracownia Archeologiczna, Obsydian, Zaczernie, Poland*

⁷*Universität Regensburg, Institut für Geschichte Lehrstuhl für Vor- und Frühgeschichte, Regensburg, Germany*

Recent archaeological excavations at two settlements of the Early Neolithic culture at Kamyane on the Southern Bug (Ukraina) and at Nicolaevca in the Răut catchment (Moldova) provided new archaeobotanical samples. They belong to the Linear Pottery culture (LBK) and represent the easternmost settlements of this cultural unit. In these regions, plant macro-remains are still very rarely investigated and the results may shed light on the plant-based economy of the first farmers that reached their eastern periphery. Both sites are located in the loess-mantled area, in the forest-steppe zone. In Kamyane and Nicolaevca, a dominance of *Triticum monococcum* remains is visible, preserved both as grains and chaff. The presence of *T. dicoccum* was marked only by a few remains identified. In Kamyane, a fragment of rachis of *Hordeum vulgare* was documented. Also, *Chenopodium album* type, *Fallopia convolvulus* and *Stipa* sp. were noted at both sites. In Nicolaevca, also *Chenopodium hybridum*, *Fallopia dumetorum* and *Lapsana communis* were found, while in Kamyane grasses from the Panicoidae subfamily were present (*Setaria viridis/verticillate* and *Echinochloa crus-galli*). The charcoal assemblages are dominated by a few taxa, such as *Fraxinus* sp., *Quercus* sp., and *Prunus* sp. in Kamyane, and *Cornus* sp., *Fraxinus* sp., and *Quercus* sp. in Nicolaevca. The selected specimens were radiocarbon dated and their results show that the settlement was occupied during the middle and late phases of the LBK, ca. 5200 - 5000BC. The research results, carried out under the German Research Foundation project (DFG

394525779), were also compared with the archaeobotanical data coming from newly excavated LBK sites from south-eastern Poland (Łańcut site 3 and Rzeszów-Zwięczyca site 3). This is the easternmost region of the LBK occupation in Poland, which has lacked representative plant assemblages. In addition, faunal and malacological remains were also studied from the above-mentioned settlements and provided important palaeoenvironmental data.

IWGP22-0245 - The use of plants at Sarakenos Cave (Boeotia, Greece) from the late Palaeolithic to the early Neolithic

*Magdalena Moskal-Del Hoyo*¹, *Angeliki Karathanou*², *Maria Ntinou*², *Małgorzata Kaczanowska*³, *Janusz K. Kozłowski*⁴, *Antonia Tsourouni*⁵, *Jarosław Wilczyński*⁶, *Adamantios Sampson*⁵

¹*W. Szafer Institute of Botany- Polish Academy of Sciences, Palaeobotany and Palaeoenvironment Group, Kraków, Poland*

²*University of Thessaloniki, LIRA Laboratory- Department of Archaeology- School of History and Archaeology, Thessaloniki, Greece*

³*Polish Academy of Arts and Sciences, Commission on the Prehistory of the Carpathians, Kraków, Poland*

⁴*Jagiellonian University, Institute of Archaeology, Kraków, Poland*

⁵*Aegean University, Department of Mediterranean Studies, Rhodes, Greece*

⁶*Polish Academy of Sciences, Institute of Systematics and Evolution of Animals, Kraków, Poland*

Sarakenos Cave (Boeotia, Greece) lies on the eastern slope of the former Kopais lake basin and offers rich cultural layers dated to the Late glacial and the Holocene. The study presents new archaeobotanical data coming from Trench F, which preserves a sequence of archaeological deposits spanning the Late Palaeolithic to the Neolithic. The results of wood charcoal analysis show changes in the vegetation around the cave through time. During the Lateglacial open parkland vegetation with *Juniperus* sp., *Amygdalus* and *Ephedra* sp. prevailed in the area, while the beginning of the early Holocene was marked by the spread of deciduous woodland with *Quercus* sp., *Pistacia* sp. and *Amygdalus*. During the 7th millennium cal BC thermophilous evergreen *Quercus* sp. appeared in the study area. Among the charred plant macro-remains, a variety of herbaceous plants were recovered. The late Paleolithic assemblage contained mostly remains of the Leguminosae (including *Vicia ervilia*, cf. *Lens* sp. and cf. *Pisum sativum*) and to a lesser degree the Graminae families. Also, seeds assigned to the Polygonaceae/Cyperaceae, Cruciferae, Boraginaceae, Labiatae and Compositae families were identified. One seed of cf. *Pisum sativum* was radiocarbon dated to c. the end of the 11th millennium cal BC and thus confirming the use of this species during the late Pleistocene.

IWGP22-0274 - Agriculture in the Middle/Recent Neolithic (5000- 3500 cal B.C.) in northern Italy: a review.

Barbara Proserpio^{1,2}, Sara Parise¹, Mauro Rottoli¹

¹*Musei Civici di Como, Laboratorio di Archeobiologia, Como, Italy*

²*Università degli Studi di Milano, PrEclab - Laboratorio di Preistoria- Protostoria ed Ecologia preistorica del Dipartimento di Beni Culturali e Ambientali Milano, Milano, Italy*

New plant macroremains' data and a recent update about the cultural and chronological setting of the Square Mouthed Pottery Culture (SMP) allowed for a revised summary of Middle/Recent Neolithic agriculture in northern Italy (5000- 3500 cal B.C). Throughout this period there was a widespread occupation in Po plain and the Alpine area and a gradual process of cultural homogenization in a geographical area among Piemonte and Liguria in the West, Friuli in the East, southern Austria in the North and central Tuscany in the South. The development of a single cultural facies seems to have promoted a certain uniformity in the exploitation of resources in the area. Agriculture appears at this stage fully developed, based on polyculture and focused on cereals, which, for the most, are hulled grains instead of free-threshing ones. Then, in order of finds, we have wild fruits. Pulses and other crop species (flax and poppy) are present with a restricted number of remains. The reconstruction of a detailed picture of agriculture in the different stages of SMP Culture is complex due to insufficient data and scarce or inadequate samples. Statistical evaluations (applied to the few sites with more than 100 finds) show that the "crop homogeneity" seems to be a general trend but actually, it is more complex and multifaceted, revealing specific livelihood needs or adaptations to specific climatic or environmental conditions, or merely food preference. Data from SMP culture sites were compared with those of the Late Neolithic period sites of the same geographic area and the transalpine ones. The aim was to observe if the influence of the western Cultures (Chassey and Cortaillod), which led to the end of SMP Culture, had modified the livelihood systems spread in northern Italy.

IWGP22-0145 - Rise and fall of the medieval city of Aghmat (Morocco): Interdisciplinary view on agro-pastoral productions and landscape evolution

Jerome Ros¹, Fatima-Ezzahra Badri², Amandine Cartier³, Benoit Marie³, Leïa Mion⁴, Ilham Bentaleb⁵, Laurent Bouby⁶, Sandrine Canal⁷, Violaine Heritier-Salama⁸, Chloé Capel⁹, Abdallah Fili¹⁰

¹*Institut des Sciences de l'Evolution de Montpellier, CNRS umr 5554, Montpellier, France*

²*Institut National des Sciences de l'Archéologie et du Patrimoine, Archéologie des Périodes Historiques, Rabat, Morocco*

³*Université de Montpellier, Institut des Sciences de l'Evolution de Montpellier, Montpellier, France*

⁴*CNRS, umr 7269, Aix-en-Provence, France*

⁵*Université de Montpellier, Institut des Sciences de l'Evolution, Montpellier, France*

⁶*CNRS, Institut des Sciences de l'Evolution, Montpellier, France*

⁷*EPHE, Institut des Sciences de l'Evolution de Montpellier, Montpellier, France*

⁸*Université Paris IV Sorbonne, umr 7186- umr 8167, Paris, France*

⁹*CNRS, umr 8167, Paris, France*

¹⁰*University Chouaib Doukkali, Faculté des lettres et des sciences humaines de l'Université, Al Jadida, Morocco*

Since 2005, the Archaeological Mission of Aghmat (Morocco) has aimed to study, protect and enhance this vast archaeological site, whose state of conservation is exceptional. To date, the programme has focused on the monumental area of the town, where the Great Mosque and its ablutions fountain, the public baths, an elite residence and a wealthy residential area with riads are located. Although the first phases of occupation (at least from the 10th century) are still poorly documented, the main phase of development of this district seems to date back to the 11th-12th centuries, which coincides with the time when the city became the ephemeral capital (around 1056-1070) of the Almoravid empire. The site then experienced a strong urban dynamism, until the city was rather abruptly abandoned by its elites (mid-14th century) and reoccupied by populations that gradually ruralized its activities and economic balance (15th-16th century). The monumental center of the city would then have gradually disappeared, evolving into a space entirely dedicated to agriculture, which it has remained until today. Since 2016, the MAA has been developing a line of research dedicated to paleoenvironments and ancient agrarian systems, questioning the role played by different socio-economic dynamics on resource and landscape management. Based on the study of archaeobotanical samples (seeds, charcoal) extracted from

various contexts (hearths, dumps, plantation pits), dated between the 11th and 17th centuries, this work has made it possible to propose an assessment of agricultural dynamics through time. The awarding of a First Support Exploratory Project (PEPS INEE-NOURANAT) in 2020 made it possible to strengthen this approach and to implement isotopic studies (Carbon, Nitrogen) on four taxa (*Hordeum vulgare*, *Triticum aestivum/durum*, *Olea europaea*, *Vitis vinifera*), in order to shed light on the existence of certain practices (irrigation, fertilisation) and their evolution over time.

IWGP22-0111 - Food for the weather god of Nerik: The archaeobotanical remains of Hittite Oymağac Höyük

Corinna Rössner¹, Simone Riehl²

¹*Archäobotanik Labor Rössner, Universität Tübingen- Institute for archaeological sciences, Laaber, Germany*

²*SenckenbergCenter for Human Evolution and Palaeoenvironment, Institute for Archaeological Sciences- Eberhard-Karls-University, Tübingen, Germany*

Complex urban states are based on an extensive ecological and economic foundation. Beside water and natural resources, agriculture was the basis for the development and prosperity of the Hittite state. The Hittites had a very strict system of impost and taxes and the processing of agriculture was strictly specified. From Hittite written archives we get a limited insight into the use and processing of the natural resources, but the combination with archaeobotanical research helps us to understand agricultural economy and environmental history. Several archaeobotanical investigations are available in the Hittite core area. As the Central Anatolian plateau is a key region of cultural development throughout prehistory, especially the Late Bronze Age with its Hittite culture, there is only little known about the Central Black Sea region in North Anatolia.

7 km north of the city Vezirköprü, next to the village Oymağaç lays a small mound with finds from the Hittite empire period. Through archaeobotanical sampling of the entire excavated area of Oymağaç Höyük, an insight into Hittite agricultural development from the Late Bronze Age to the Middle Iron Age is given. In this paper we present archaeobotanical results on Hittite agriculture and Late Bronze Age vegetation at the edge of the Hittite core area. The agricultural and vegetation basis of Oymağaç Höyük, lying as an island outside the Hittite core area, will be compared to the different sites with Late Bronze Age and Hittite contexts in Anatolia and Syria.

IWGP22-0197 - New results of Palaeoethnobotanical investigation of Neolithic settlement of Mashaveras Gora, Georgia

*Nana Rusishvili*¹, *Inga Martkopishvili*¹, *Marine Mosulishvili*²

¹*Georgian National Museum, Palaeoantrpology and Palaeobiology Research Institute of Georgian National Museum, Tbilisi, Georgia*

²*Georgian National Museum, Herbarium, Tbilisi, Georgia*

The first palaeoethnobotanical survey of the Neolithic settlement of Mashaveras Gora was carried out in 2020-2021. Mashaveras Gora, as well as Arukhlo, Khramis Didi Gora, Gadachrili Gora, and others, are among the Neolithic cultural monuments of Shulaveri culture, widespread in the South Caucasus, which are characterized by settlements in villages, circular vaulted mud-brick homes and farm buildings. Agriculture is based on primitive farming tools and a wide range of cultivated crops. Radiocarbon date of Mashaveras Gora is 6th millennium BC, as well as other Shulaveri culture settlements. The obtained results expanded our knowledge about the agriculture of the Caucasus Neolithic period. Among the cultivated plants identified are bread wheat (*Triticum aestivum* L.), compact wheat (*Triticum compactum* Host.), emmer (*Triticum dicoccum* Schrank), einkorn (*Triticum monococcum* L.), naked and hulled barley, lentils, and bitter vetch. From wild plants identified *Aegilops*, and others. We quantified hulled and naked wheat, also compared palaeoethnobotanical material with other Neolithic settlements of the Shulaveri culture and the Near East. Fifteen soil samples were extracted from Mashaveras Gora archaeological site, for palynological analysis. Samples were obtained from buildings, pottery, grinding stones, and bricks. Almost all samples are dominated by cultivated cereals and their weeds, such as *Cerealia*, *Triticum*, *Carduus*, *Artemisia*, *Chenopodiaceae*, *Chenopodium album*, and others. NPP analysis was also performed on these samples, which also confirms the development of agriculture. In addition to *Triticum* pollen grains from the NPP group, phytoliths of wheat husks were observed. According to the results obtained, agriculture was well developed in Georgia in the Neolithic period, which is evidenced by the presence of Cereals in almost all samples and weeds of their crops.

IWGP22-0217 - Agricultural terraces of the North Caucasus

Idris Idrisov¹, Natalia Ryaboqina², Alexey Afonin³, Alexander Borisov⁴

¹*Dagestan Scientific Centre RAS, Institute of Geology, Makhachkala, Russian Federation*

²*Tyumen Scientific Centre SB RAS, Institute of problems of Northern Development, Tyumen, Russian Federation*

³*Tyumen Scientific Centre SB RAS, Institute of problems of Northern Development, Tyumen, Russian Federation*

⁴*Pushchino Scientific Center RAS, Institute of Physical- Chemical and Biological Problems of Soil Science, Pushchino, Russian Federation*

Agricultural terraces are widespread in the North Caucasus, they occupy more than 2,000 square kilometres in the mid-mountain Dagestan and vast areas in the Central Caucasus, separate isolated areas are also found in the Caucasian ridge. The uneven distribution of terraces is due to both environmental reasons (terraces are almost absent in areas with high humidity and forests) and the development history of the region. After terracing, people created new agro with specific soils, and microclimates and changed conditions for growing plants in the mountains. Terraces were created for cultivating cereals, but their composition still has not been established, there is only pollen of Cerealia type in the peat sequence and archaeological agricultural tools. We are going to present the first preliminary results on the study of flotation material from soils of several terrace complexes of the Caucasus and the AMS dating of grains in order to discuss the chronology of the terraces appearance and the specific composition of cereals. People cultivated barley, wheat, rye and millet on terraces, direct dating of grains and coal from the paleosoils fall to 6-19 centuries AD. Thus, all of these points indicate a major stage in the terracing of the mountainous Caucasus in the Middle Age, mainly 10-12 centuries AD and do not confirm the initial versions of the more ancient age of the terraces. In general, the time of the construction of the terraces is consistent with the period of maximum population density in the mountains and falls during the period of the emergence of large political and state centres in the Caucasus. Probably such a large-scale creation of terraces in the Middle Ages destroyed most of the traces of earlier agricultural development of the Caucasus. The study was supported by RFBR grant 19-29-05205mk

IWGP22-0241 - Expansion of agriculture to the Volga-Urals during the Migration Period: the archaeobotanical perspective.

*Yulia Salova*¹

¹*Tyumen Scientific Centre SB RAS- IPOS- 86 Malygina str.- Tyumen 625026- Russia, Department of Archaeological and Environmental Reconstructions, Tyumen, Russian Federation*

²*Laboratory of Archaeobotany and Paleoecology, Faculty of Science, University of South Bohemia, Na Zlaté stoce 3, České Budějovice, Czech Republic*

The Migration period in Eastern Europe began in the 3rd c. CE by the Gothic and Alanic invasions that started permanent displacement of local populations, and ended in the 8th-9th c. by the establishment of Early Medieval states that stabilized ethnic and cultural patterns. In the Volga-Urals region, this period (200-700 CE) included several eastward and northward migrations. During 200-300 CE the sparsely populated region was occupied by Pre-Slavonic groups that were replaced by the Baltic-Finnish newcomers from the deciduous forests of Central Russia by 450 CE. During the same time period, some agricultural techniques were introduced to the local populations of the Kama Finns in the Cis-Urals. Finally, in the 8th century CE different Turkic, Slavonic, and Finno-Ugrian groups repopulated the Volga-Urals during the last major migration wave. The migrants were familiar with agriculture, as indicated by finds of cultivars and agricultural implements in some archeological sites of this period. However, the sets of cultivated plants and farming techniques could vary according to the agricultural experience of the migrants, their contacts with other agriculturalists, and local environmental constraints, e.g. geomorphological positions of sites of various cultures. Social and cultural dynamics in the area could be also affected by climatic changes. The Migration Period began during the Roman Warm Period (0-300 CE) and continued during the cool and wet Dark Ages Cold Period (410-775 CE) that ended by the Medieval Warming. These changes could be crucial to contemporary agriculture in the forest-steppe zone. It was hypothesized that during 200-300 CE the Mid-Volga populations practiced some forms of floodplain agriculture, replaced later by slash-and-burn cultivation and, even later, by plowing agriculture with permanent fields. This hypothesis can be tested by the means of archaeobotany.

IWGP22-0035 - Archaeobotanical evidence of early agriculture in the Amur River valley (Russian Far East)

*Elena Serqusheva*¹

¹*Institute of History- Archaeology and Ethnology of the Far Eastern Branch of the Russian Academy of Sciences, Department of Prehistory Archaeology, Vladivostok, Russian Federation*

Reconstruction of early agriculture in Priamurye is difficult due to the lack of data. Finds of tools associated with agriculture are rare, furthermore they are multifunctional. Seeds of cultivated plants obtained by flotation thus provide more reliable data on the local agriculture. The presence of millet agriculture in Primorye, south of Priamurye, has been archaeobotanically proven since Late Neolithic. But attempts to obtain the remains of cultigens on Late Neolithic sites in Priamurye are still unsuccessful. The most ancient seeds of broomcorn and foxtail millets were obtained at Nizhnetambovskoe site of Uril culture (Early Metal Age) and sites of Poltse culture (Iron Age) — Poltse-1, Malmyzh-1, Malmyzh-5. The set of cultigens increased in the Early Middle Ages due to the introduction of naked barley. Seeds of three cultivated plants were found at Chernigovka-5 site of Mikhailovka culture and at Osinovoye Ozero site of Mohe culture. The westernmost site of the region with cultivated plants is Ust'-Chyornoe settlement. Its seed collection differs from that of other sites. Buckwheat and hemp are dominant, broomcorn millet seeds and a seed of bread wheat are present. Archaeologists believe site belonged to Mohe community that originated from the Amur valley. But archaeobotanical data demonstrate the influence of another, presumably Mongol-speaking culture. Available archaeobotanical data from Priamurye show existence of agriculture based on cultivation of broomcorn and foxtail millets at least from the Early Metal Age. Naked barley was added to them later. Archaeobotanical and archaeological data show agriculture in Priamurye was small-scale and unlikely to have played a leading role in local economies at least until the Middle Ages. Apparently, Priamurye was the northernmost limit of millet farming zone in East Asia. Only in the far west of the region the dominance of other cultivated plants was detected, which could be due to the cultural influence of Mongol-speaking people.



Caption: The location of archaeological sites with finds of cultural plants seeds in the Amur River basin

IWGP22-0279 - Ustica, Sicily and the spread of farming in the Central Mediterranean Islands

*Claudia Speciale*¹

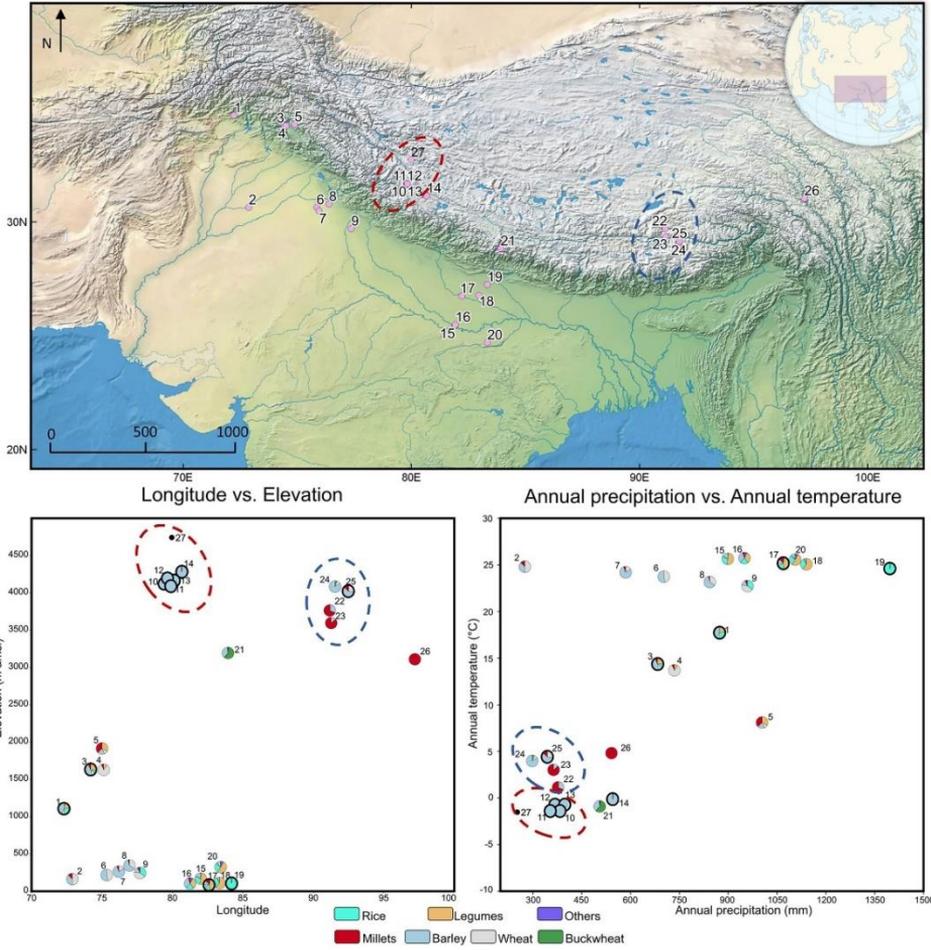
¹*University of Gothenburg, Historical Studies, Goteborg, Sweden*

Ustica is a small volcanic island of 9 sqm, at around 60 km from the Northern coast of Sicily. The first human occupation happened during the Middle Neolithic (mid-5th millennium BCE), as testified by the site of Piano dei Cardoni. The first results of the zooarchaeological and archaeobotanical analyses provide new insight into the exploitation of plant and animal resources by the earliest inhabitants of the small island. Our results also highlight the earliest effects of the human impact in shaping the island's environment in terms of forest degradation. Beyond the representation of cereal cultivation in the archaeobotanical record, agricultural activities are inferred by the high number of volcanic stone tools for cereal processing. On the whole, even if being very distant from the coast, quite reduced in size and temporarily isolated during the winter season, Ustica offered fertile and plan lands that easily provided an agropastoral background for Neolithic communities. Ustica can be analysed within the bigger framework of the spread of Neolithic in Sicily Island, comparing the paleodemographic, paleoenvironmental and archaeobotanical data available for the 6th and 5th millennium BCE. Finally, a parallel with the spread of Neolithic communities in Sardinia is presented, to give some insights on the differences of the impact of agricultural practises on small and big islands.

IWGP22-0037 - Prehistoric agriculture on the Tibetan Plateau*Li Tang*¹

¹*Max Planck Institute for the Science of Human History, Department of Archaeology, Jena, Germany*

The Tibetan Plateau represents one of the most extreme environments for plant cultivation; however, a lack of archaeobotanical data has heavily limited our understanding of how ancient agriculture was spread and adapted into local high-altitude mountains. We present new archaeobotanical data from seven sites (ca. 1263 BC–AD 541) in central and western Tibet, and synthesize them with published data from other sites across the plateau. We argue that a transition from a millet-barley-mixed farming to a barley-based system started to develop at least 3000 years ago in central Tibet, then this unique agricultural system was widely adopted across the plateau, and has fed thousands of generations of Tibetans until today. Additionally, our research indicates that ancient agropastoralists in differing ecological and social settings of the plateau chose slightly different patterns of agricultural adaptations. Quantitative archaeobotanical assemblages in this research, newly studied sites circled with the dashed lines.



IWGP22-0046 - Autofluorescence of phytoliths in tropical regions: A new archaeobotanical proxy?

Marc Testé¹, Aline Garnier², Luc Vrydaghs³

¹UMR.7130 - Laboratoire d'Anthropologie Sociale, École des Hautes Études en Sciences Sociales, Paris, France

²UMR.8591 - Laboratoire de Géographie Physique, Université Paris Est Créteil Val de Marne- Département de Géographie, Créteil, France

³Maritime Cultures Research Institute MARI, Vrije Universiteit Brussel- Department of Art Studies and Archaeology, Brussel, Belgium

Tracking past evidence for fire is crucial in tropical palaeobotany. Just to cite one issue: detecting slash and burn practices relating to expanding agricultural landscape.

In such anthromes, phytoliths yielded generally good preservations and provided local signals. However, the different approaches to identifying burn phytolith turned out rarely adequate apart from their development contexts (Evet & Cuthrell, 2017).

The recent study on autofluorescent phytoliths (Devos et al., 2021) opens new perspectives. However, so far, the exploration of fluorescent archaeological phytoliths is limited to the European temperate regions. The present contribution intends to further explore this technique. within the tropics.

This poster introduces test series conducted on modern and Holocene material from two tropical contexts: the Guatemala Peten forest and the sudano-sahelian savanna (West Africa). The first series concerns natural and cultivated modern surface soils and late Holocene swamp sediments of Maya's site of Naachtun (Testé et al., submit.). The West African series documents different anthropized modern surface samples (Senegal) as well as the Yamé's fluvial middle to late Holocene deposits (Dogon Country, Mali) (Garnier et al., 2013).

This comparative process permits an evaluation of the relevance of autofluorescence phytoliths as a new paleobotanical proxy.

Reference:

Devos, Y., Hodson, M. J., & Vrydaghs, L. (2021). Auto-fluorescent phytoliths: a new method for detecting heating and fire. *Environmental Archaeology*, 26(4), 388-405.

Evet, R. R., & Cuthrell, R. Q. (2017). Testing phytolith analysis approaches to estimate the prehistoric anthropogenic burning regime on the central California coast. *Quaternary International*, 434, 78-90.

Garnier, A., Neumann, K., Eichhorn, B., & Lespez, L. (2013). Phytolith taphonomy in the middle-to late-Holocene fluvial sediments of Ounjougou (Mali, West Africa). *The Holocene*, 23(3), 416-431.

Testé, M., Castanet, C., Garnier, A., et al., (submit.). A comparative study of bioindicators in the *bajo* of Naachtun (Petén, Guatemala). *Review of Palaeobotany and Palynology*.

IWGP22-0095 - Reconstruction of agricultural practices at Medieval Paykend, Uzbekistan, using carpological and anthracological evidence

Madelynn Von Baeyer¹, Basira Mir-Makhamad¹

¹*Max Planck Institute for the Science of Human History, Archaeology, Jena, Germany*

Paykend, located in the southwest of the Bukhara Oasis in present-day Uzbekistan, provides an ideal case study to examine how agricultural practices enabled and/or shifted in response to increased transregional trade opportunities. The site was occupied from the third century BCE to mid-twelfth century CE during which Paykend held several different roles within the regional settlement patterns and culture. Paykend is most known for being a merchant city on the Silk Road but the residents of Paykend only really started to engage with trade between China and Central Asia beginning in the early sixth century. Before then, from the third century BCE through the fifth century CE, Paykend was a fortified Zoroastrian ritual center.

This paper will present archaeobotanical and anthracological evidence from 10 samples from the earliest period of settlement in the third century BCE through the period right before trade became the primary economic activity, circa fourth–fifth century CE. Specific attention will be paid to the change in agricultural practices that enabled the residents of Paykend to focus on trade shortly after the periods in question. The seed and wood data will be compared using correspondence analysis to find any patterns hidden in the data, especially diachronic and spatial patterns. The data will also be used to reconstruct the ecology around Paykend to better understand agricultural practices during the Late Roman and Early Medieval periods in Central Asia.

Topic 3.2: Combining onsite- and offsite data for a better understanding of the history of land use and landscape change

IWGP22-0191 - How man transformed the Zwin landscape (northern Belgium) during Roman and Medieval time: A diatom and palynological approach

Coralie André¹, Wim De Clercq², Dante De Ruijsscher², Vanessa M.A. Heyvaert^{1,3}, Frieda Bogemans³, Stephen Louwye¹

¹*Ghent University, Geology, Gent, Belgium*

²*Ghent University, Archaeology, Gent, Belgium*

³*Royal Belgian Institute of Natural Sciences, Geological Survey of Belgium, Brussels, Belgium*

In northern Belgium, the extreme flooding event in 1134 created a large tidal inlet called the Zwin Gully. Via the construction of canals and dikes man also transformed this landscape into a major artery of maritime connectivity, linking a network of harbors along the inlet to the maritime Europe. However, after its medieval heyday, the gullies of the Zwin silted up and the harbors fell in disuse. The study aims to unravel the human-landscape interaction through time, based upon cpt-e, corings, archaeological excavations and historical research. Diatoms, pollen, spores and non-pollen palynomorphs are used for the reconstruction of the past landscape of the greater Zwin area. The research focuses on the study of three lost harbors: Aardenburg, Hoeke and Mude. At Aardenburg, saltmarsh taxa and diatoms clearly indicate a marine influence. The Romans inhabited this occasionally flooded saltmarsh that presumably evolved into a mudflat by ever increasing flooding, making it uninhabitable. In the upper marine layer, saltmarsh taxa decrease while Poaceae and Cerealia-type sharply increase indicating human activity. At Hoeke, pollen records point to a regional signal dominated by trees. The upper marine sediments hold saltmarsh taxa (a.o. Chenopodiaceae, *Senecio*-type), marine (a.o. dinocysts) and freshwater palynomorphs (a.o. *Pediastrum*). Diatoms are dominated by marine/brackish species (a.o. *Cymatosira belgica*, *Paralia sulcata*). A coastal environment is reflected with the presence of a peat layer incised by tidal activity. At Mude, an embankment was built in a coastal environment. Pollen in the lower sandy layer reveal a regional signal dominated by trees and a mixed signal of freshwater (a.o. *Salix*, *Sparganium*-type) and marine (a.o. Chenopodiaceae, Plumbaginaceae) inputs. The upper silty clay layer holds anthropogenic indicators. In the sandy layer, marine diatoms are dominant while upwards towards the anthropogenic

layer brackish/freshwater taxa (*Amphora coffeaformis*, *Nitzschia capitellata*) are dominant.

IWGP22-0262 - Looking for historical rural practices through pollen and archaeological data: the case of Perlezzi, Ligurian Apennines (N-Italy)

Davide Attolini¹, Carlo Montanari¹, Anna Maria Stagno¹

¹*Laboratory of Environmental Archaeology and History DAFIST-DISTAV - University of Genova, Department of Antiquities- Philosophy- History DAFIST, Genova, Italy*

In the last three centuries, important changes in the management of environmental resources interested most of the Ligurian Apennines (N-Italy), leading to a widespread abandonment of the historical land management practices. Previous rural archaeology investigations and archival sources shed new light on the causes underlying the abandonment of rural areas, showing that these changes are linked with the transformations related to access rights to commons. These investigations allowed to reconstruct how that space was organised, and the key role played by practices related to the co-sharing of environmental resources happening to this day. However, the micro-analytical characterization of agro-forestry-pastoral activities, mainly through the analysis of pollen and other microremains, remains to be explored.

This paper focuses on the process of construction of the agro-forestry-pastoral system of a small hamlet of the municipality of Borzonasca (Genoa, Italy), in the Ligurian Apennines, where some of the historical land management practices are still in use. To better characterize these practices under a palynological point of view, high-resolution pollen analyses were carried out. For this purpose, we have selected two peat-bogs in the common lands of Perlezzi, about 2 km apart: “Moglia del Fango”, located in an open area at the end of a steep slope (1000 m a.s.l.) and “Pian delle Moglie”, on the edge of a beech forest (1300 m a.s.l.). The two sites were sampled for pollen analysis: data show differences in land management, such as the use of fire, as suggested by microcharcoal analysis.

Data were then compared with studies carried out in the same valley, and in neighboring ones, to reach a clearer picture of land use in the area, and of the relationship between local changes in the social organization of space and the management of environmental resources.

IWGP22-0270 - From on-site to off-site and viceversa: Land use, landscape change and common-lands at the “Montagna di Fascia” (Genova, Ligurian Apennines)

Anna Maria Stagno¹, Bruna Ilde Menozzi², Riccardo Santeramo², Carlo Montanari², Giulia Bizzarri¹, Davide Attolini², Chiara Molinari², Alessandro Panetta¹, Ivano Rellini²

¹*Università degli Studi di Genova, Dipartimento di Antichità- Filosofia- Storia - Laboratory of Environmental Archaeology and History DAFIST-DISTAV, Genova, Italy*

²*Università degli Studi di Genova, Dipartimento di Scienze della Terra e della Vita - Laboratory of Environmental Archaeology and History DAFIST-DISTAV, Genova, Italy*

The paper will reflect on the relationship between onsite and offsite investigation and about the difficulties in building analytical and comparable periodisations from different kind of sources. The selected case study (“Montagna di Fascia”) is located in eastern Ligurian Apennines, just outside of Genova. Studies carried out between 1970's and 1990's demonstrated the continuous agro-forestry-pastoral use of the area since the Middle Ages and the centrality of animal husbandry as the main driver for the organisation of space, until the abandonment in the last decades. Since 2019, archaeological and historical ecological surveys have documented the last phases of the agro-pastoral use and a large number of completely abandoned “seasonal” settlements, while the study of archival documentation allowed to reconstruct the process of privatisation of the common lands which characterised the area until the second half of the 19th c. Research showed how environmental resource management practices (e.g. short & long distance transhumance, permanent & temporary cultivation, management of wood-lands and chestnut groves, etc.) and their correlation changed through time, also in relation to the organisation of local social groups and the ownership and access rights to common-lands. This contribution will clarify at an analytical level the environmental consequences of these changes, as it will discuss a series of environmental archaeological investigations carried out in different sample sites. These data were compared with landscape, rural archaeological, and archival investigation. In particular, here we will discuss the results of samples taken in a historical sweet chestnut grove today mostly abandoned with few veteran trees. The soil was sampled for geomorphological, pedological and palynological analyses, while two old-centuries chestnut trees were sampled for dendroecological and dendro-chronological analyses. Furthermore, the research will allow to consider the

relationship between changes in environmental resources management and their social and cultural - not only economic - implications.

IWGP22-0257 - Before the flood: Archaeobotanical record from the prehistoric waterlogged sites at the Lake Ohrid, North Macedonia

Jaromír Beneš^{1,3}, Marek Verčič², Nevenka Atanasoska³, Veronika Komárková¹, Jan Hošek⁴

¹*University of South Bohemia, Laboratory of Archaeobotany and Palaeoecology, Ceske Budejovice, Czech Republic*

²*Faculty of Arts, Charles University Prague, Institute of Classical Archaeology, Prague, Czech Republic*

³*Faculty of Arts, University of South Bohemia, Institute of Archaeology, České Budejovice, Czech Republic*

⁴*Czech Geological Survey, Czech Geological Survey, Prague, Czech Republic*

The settlement remains in lakes and bogs represent one of the most significant sources of information on the prehistory of the southwestern Balkan lakes region. Present-day research in Albania, Greece, and North Macedonia offers a limited set of environmentally suitable sites. To date, only a small number of bioarchaeological and paleoenvironmental investigations have been studied in the region. They would shed light on the complex interrelation between the landscape and the cultural-historical development during the dynamic period at the end of the 2nd millennium BC. A recent Czech-Macedonian research expedition at the northern shore of Lake Ohrid in North Macedonia revealed new significant records, originating from waterlogged sites. Overlying by thick alluvial and lacustrine sediments, the remains of plant macrofossils and wood dated to the Late Bronze Age and the Early Iron Age were found in an excellent state of preservation. The composition of macrofossils provided valuable information on plant cultivation, vegetation and land use along the shores of the lake. In addition to livelihood information, the recorded vegetation change may complement the reconstruction of economic strategies before the settlement shifted to higher altitudes in the lake hinterland. Current research has recorded evidence of a catastrophic earthquake in the Ohrid region shortly after 1214 BC. This earthquake caused coseismic subsidence of the terrain by several meters and the area settlements were flooded by the lake waters.

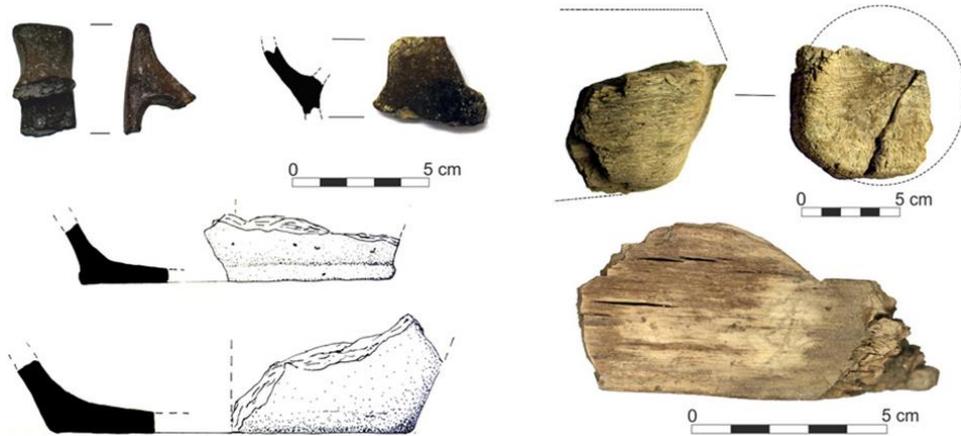


Figure: The Late Bronze age ceramics and wooden artefacts from the lake shore site Grašnica (depth –570 cm)

Reference: Hošek, J., Verčík, M., Pokorný, P., Beneš, J., Komárková, V., Radoměřský, T., . . . Ardjanliev, P. (2021). Geoarchaeological evidence on a Late Bronze age earthquake, Ohrid basin (North Macedonia). *Journal of Quaternary Science*, 36(6), 1003-1012. doi:10.1002/jqs.3325

IWGP22-0287 - Human-induced deforestation and the landscape history. Pollen, macroremain and sedimentological record from Šumava Mountains

Alexandra Bernardová¹, Jaromír Beneš¹, Tomáš Bešta¹, Ivana Šitnerová¹, Michael Daniels²

¹Laboratory of Archaeobotany and Palaeoecology, Faculty of Science- University of South Bohemia in Ceske Budejovice, Ceske Budejovice, Czech Republic

²University of Denver, Department of Geography and the Environment, Denver, USA

Late Holocene anthropogenic landscape change in central Europe has been widely documented by palaeoecological techniques. Deforestation related with agriculture represents the most common mode of landscape change, though the timing and intensity of these changes vary dramatically both across and within established cultural landscape. In contrast to many other regions in which agricultural land clearance resulted in widespread increases in hillslope soil erosion rates and downstream sedimentation rates, fluvial drainage systems within the foothills of Sumava Mountains reflect only a limited influence of agricultural intensification. Part of the reason for this decoupling of fluvial channels from hillslopes lies in the specific patterning of land clearance into linear fields separated by hedgerows. These hedgerow networks act as sediment sinks for containing entrained materials in hillslope-proximal settings. Pollen and macro-fossil evidence can explain further details about the timing of landscape change. This paper presents results from three peat cores from the area of Sumava Mountains' foothills to document the magnitude and timing of the late Holocene changes in forest composition and agricultural land use. Human presence affecting the environment could be assumed since the Eneolithic period. Landscape opening and deforestation is recorded in the Early Medieval period, connected probably with summer pasture that was continuous since 7/8th century. Crops start to appear later in the High Medieval period.

IWGP22-0109 - New palynological off-site data from the Terramara S. Rosa di Poviglio: A long-term natural and anthropic environmental shaping

Eleonora Clò¹, Andrea Zerboni², Mauro Cremaschi², Anna Maria Mercuri¹

¹*Laboratory of Palynology and Palaeobotany - University of Modena and Reggio Emilia, Department of Life Science, Modena, Italy*

²*University of Milan, Department of Earth Sciences "A. Desio", Milano, Italy*

The Terramara S. Rosa di Poviglio (Northern Italy) is a Middle Bronze Age settlement and has been investigated for more than 35 years thanks to archaeological excavations directed by M. Bernabò Brea, M. Cremaschi and, in recent years, A. Zerboni. Many investigations have contributed to the geomorphological reconstruction of the area, but archaeobotanical studies have always been carried out within the site. In this context, three terrestrial cores were drilled at different distances from the settlement with the aim of investigating local and regional land cover changes that occurred in the Po Plain as a twofold result of climate changes and human actions during the Holocene. Pollen spectra describe a long-term picture of large-scale vegetation changes. At the same time, independent evidence from cores allows to investigate different features and local variations, including decreased anthropogenic pressure at greater distances from the settlement. This ultimately suggests a specific distribution of human activities around the influence of the Terramara at least during the Bronze Age. Climatic oscillations and human overprints are preserved in pollen spectra as a single complex dynamic system. We notice a shift from times when climate and ecosystem dynamics were the main factors of vegetation changes to others in which human communities played an increasingly important role with a permanent and extensive impact on the landscape. The integration of new off-site datasets to knowledge already acquired from other Terramara settlements provides evidence useful to achieve a wide picture of human shaping of environments in a long-time perspective.

This research is included in the PhD Project of E. Clò, carried out for the PhD Course in Models and Methods for Material and Environmental Sciences (UNIMORE). The core has been part of the SUCCESSO-TERRA Project (PRIN-20158KBLNB). All authorizations have been released by the SABAP-BO (MiC) to the Department of Earth Sciences (UNIMI).

IWGP22-0180 - Prehistoric and Romano-British on-site and off-site environmental proxies reveal complex relationships between land-use, land-cover and biodiversity

Anne De Vareilles¹, Jessie Woodbridge², Ruth Pelling¹, David Smith³, Ralph Fyfe²

¹Historic England, Investigative Science, Portsmouth, United Kingdom

²School of Geography, Earth and Environmental Sciences, Plymouth, United Kingdom

³Environmental Archaeology, Classics- Ancient History & Archaeology, Birmingham, United Kingdom

The onset of farming brought unprecedented changes to landscapes and their biodiversity. The Biodiversity and Land-use Change in the British Isles project has been investigating such changes throughout the Holocene, using records of fossil pollen, ancient insect remains and charred plant macro-remains. The combination of these three environmental proxies has allowed us to analyse patterns in land-use and land-cover, using novel analytical approaches. Investigating long-term on-site and off-site environmental data has enabled detailed observations into the relationships between agricultural land-use and changes in land-cover, evident from fossil pollen. Our data-driven approach allows these observations to be made at different spatial and temporal scales, helping us to demonstrate the complexities of scale in agricultural land-use and its effects on pollen and insect diversity. For example, our results show that deforestation and farming in early prehistory was beneficial to biodiversity, creating a wider range of habitats. Our results also suggest that it was during the Roman period when agricultural land-use may have first had a detrimental effect on plant diversity in Britain.

This presentation focuses on a case-study area in the south-east of England from the Neolithic to the Roman period. We present results from fossil pollen, insect remains and charred plant macro-remains and their individual contributions to understanding changes in land-use, land-cover and diversity change. Fossil pollen and archaeobotanical data are examined in conjunction, to reveal details on the relationships between land-cover and arable land-use. Our analytical framework includes novel procedures for combining different environmental proxies and highlights the importance and benefits of multidisciplinary approaches.

IWGP22-0190 - Landscape characterisation and evolution of the alluvial plain in the hinterland of Ravenna (Italy): evidence from archaeological and off-site contexts

Celeste Fiorotto^{1,2}, Marco Cavalazzi^{3,4}, Michele Abballe^{1,2}

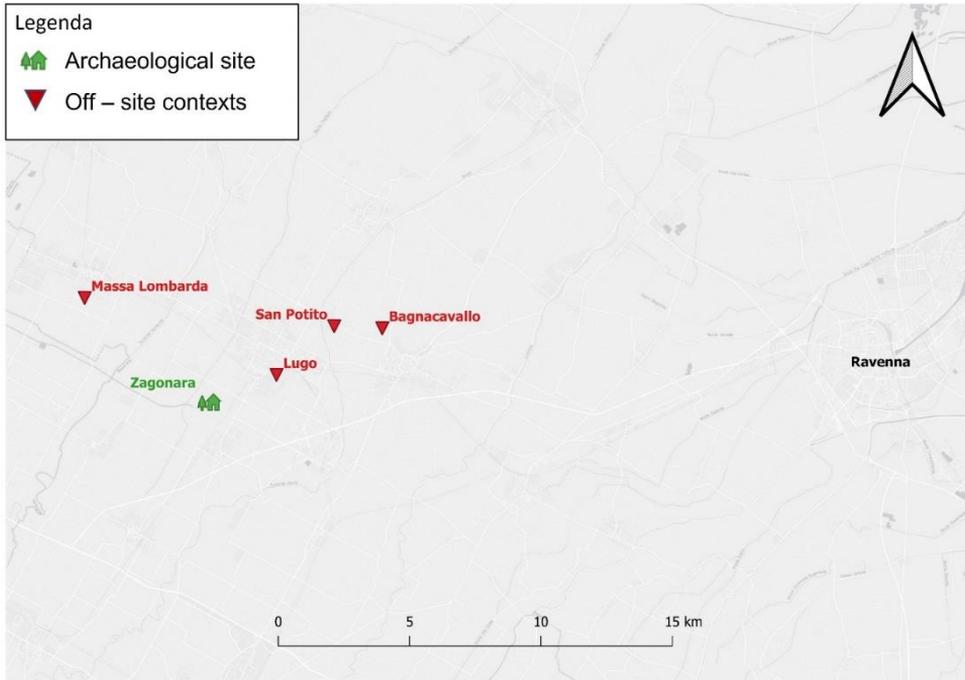
¹*University of Verona, Cultures and Civilisations, Verona, Italy*

²*Ghent University, Archaeology, Ghent, Belgium*

³*Alma Mater Studiorum - University of Bologna, History and Cultures, Bologna, Italy*

⁴*Michigan University, Classical Studies, Ann Arbor, USA*

The hinterland of Ravenna is geologically defined as an alluvial plain characterised, since the Roman period, by an intense history of land reclamation, meant to contrast the natural tendency of its rivers to develop wetlands. The present landscape is the result of these intense transformations, which have almost completely wiped out the environmental heterogeneity that must have characterised the area in the past. In the last two decades, the Ravenna Landscape project (RA.LA.) of the University of Bologna mainly focused on mapping and reconstructing the evolution of rural settlement's dynamics. In recent years it extended its interest in understanding the impact of past local communities on the surrounding landscape. So far, most of the data about the ancient environment come from documentary records, which provide copious information about the presence of rivers, woodlands, marshes, and types of cultivation. But it is archaeobotany that, together with geoarchaeological and archaeological data, offers the opportunity to shed some light on the land-use evolution of the area from Roman times to the Middle Ages. This study crosses archaeobotanical information coming from the archaeological site of Zagonara (11th-15th centuries, Ravenna, Italy), and several off-site contexts, investigated through mechanical cores. Combining both on-site/off-site datasets on different scales of interpretation and resolution may be the best strategy to better understand the human-environment dynamics of the area and its land-use history (fig. 1 iwgp 2022_case studies_FIOROTTO).



IWGP22-0152 - Use and management of vegetal resources in the Coves del Fem (Catalonia, Spain) between 4941–4545 cal BC

Blanca Garay Palacios¹, Marian Berihuete-Azorín², Raquel Piqué¹

¹*Universitat Autònoma de Barcelona, Department of Prehistory, Barcelona, Spain*

²*Institut Català de Paleoecologia Humana i Evolució Social, Department of Prehistory, Tarragona, Spain*

The present work provides information on the management and use of plant resources during the early Neolithic occupations of Coves del Fem site, Spain (4941–4545 cal BC). The aim of this research is to shed light on the forms of organization of this population settled in a mountain area. The base of this study has been the carpological analysis of the remains recovered at one pit interpreted as a storage structure. Even with the limitations of the assemblage, such as the limited number of plants remains and their poor state of preservation, we were able to determine cultivars, forest, riverside, and other taxa. The study of over 1500 plant remains has provided a total of eleven taxa with different ecological characteristics, although cereals are the most representative taxa. It is a very clean assemblage, without chaff remains, or ruderal plants and the number of wild taxa is relatively low. Different processing techniques of cereals have been observed, evidenced by different levels of erosion and carbonization, which indicate that we are probably looking at cereals that are already in the late steps of their preparation for human consumption. It is therefore likely that the gathering of wild plants was a secondary food source or, that both practices were part of the same strategy. The recovery of taxa with different ecological characteristics allows us to ensure that the inhabitants of the site exploited the woods and the riverside in vicinity of the site. All in all, this study goes beyond the case of Coves del Fem site, adding to the local understanding of the transition from an economy based on hunting and gathering to the first farmer communities and the characteristics of neolithization of mountain areas.

IWGP22-0186 - Three millennia of land-use history of a Western Carpathian Mountain region (Slovakia)

Mária Hajnalová¹, Eva Jamrichová², Lucia Benediková³, Peter Barta⁴

¹*Constantine the Philosopher University Faculty of Arts, Department of Archaeology, Nitra, Slovakia*

²*Institute of Botany of the Czech Academy of Sciences, Department of Paleoecology, Brno, Czech Republic*

³*Institute of Archaeology of the Slovak Academy of Sciences, Department of Protohistory, Nitra, Slovakia*

⁴*Comenius university, Faculty of Arts, Department of Archaeology, Bratislava, Slovakia*

Territory of Slovakia on the crossroads of the main long-distance trade and migratory routes connects the South with the North and the East with the West of Europe. For plants, animals and people moving along these routes in the past the mountain ranges, valleys and basins of the Carpathians were barriers but also refugia and for some became home. Archaeology documents that the prehistoric and early medieval settlement of these mountains is specific and differs from the adjacent lowlands in Slovakia and Poland. Mountains saw their heydays during the second and the first millennia calBC, when people also fortified extreme hilltop locations. Prior and after this time the settlement was sporadic. To find out if the prehistoric dynamic was induced by environmental, cultural or other drivers, we have focused on one microregion and correlated the research of a pollen archive with distribution of archeological sites around it and with charred plant macroremians from the excavated sites. Our results indicate that it was mostly cultural drivers what influenced the presence of man in the landscape, the way he interacted with it and shaped it. The correlation of well understood and dated different sources of evidence enabled us to verify earlier knowledge but also extract novel information. Namely, that prior to human settlement there were grasslands and open forest in the basin, that in some periods the humans were present in the area albeit they remain invisible if looked for through the archaeological artefacts, and that the extreme upland sites were used in more than one period and way.

IWGP22-0072 - Environmental roots of the transition to agriculture: integration of onsite and offsite data

*Dafna Lanqgut*¹

¹*Tel Aviv University, Archaeology, Tel Aviv, Israel*

This study provides a solid background for the dramatic cultural changes that occurred in the Mediterranean-Levant during the Late-Pleistocene/Early-Holocene boundary. The study is based on a well-dated, high-resolution pollen record recovered from the waterlogged archaeological site Jordan River Dureijat (JRD), located on the banks of Paleolake Hula. JRD's continuous sequence enabled to build a pollen-based paleoclimate model. The modeling of temperatures, precipitation and seasonality was fine-tuned by taxonomic identification of the waterlogged wood assemblage collected from the JRD site. The chronological framework is based on radiocarbon dating and the typology of archaeological findings. The wettest and warmest period was identified between ~14.9-13.0 ka cal.-BP, synchronized with the global warm and moist Bølling-Allerød interstadial and with the onset of the Natufian culture and the emergence of sedentism. The Younger-Dryas began around 12.9 ka cal. BP and was identified as an exceptional period by the JRD sequence with low temperatures and minimal climatic seasonality contrast. Until this study, it was unclear whether and to what extent there was any expression of this period in the region. The reconstructed vegetation suggests the presence of Mediterranean open field vegetation, rich with annuals, which probably increased the opportunities for plant gathering and familiarity with annual plants on the eve of agriculture. Since the Early-Holocene, the region is characterized by seasonal stress, with long, hot dry summers. It is proposed that the significant vegetation and climate changes at the late Pleistocene-Holocene boundary contributed to the development of agriculturally-based subsistence communities in the Mediterranean-Levant. Undoubtedly, environmental changes similar to those of the Younger-Dryas/Early-Holocene transition occurred previously during earlier phases of the Pleistocene. But, for the first time, these ecological changes were accompanied by sedentism, more complex social organization, increase in familiarity with annuals and technologies for harvesting and for food storage (mostly developed by the Natufians).

IWGP22-0179 - Settlements and Agricultural Practices in the 5th Millennium BC in Central Germany

Hannah Lindemann¹, Astrid Stobbe², Tanja Zerl³, Astrid Roepke³, Silviane Scharl⁴

¹*Goethe University Frankfurt, Archaeology- Archaeobotany Lab, Frankfurt, Germany*

²*University Frankfurt, Archaeology- Archaeobotany Lab, Frankfurt, Germany*

³*University of Cologne, Archaeology- Archaeobotany Lab, Cologne, Germany*

⁴*University of Cologne, Archaeology, Cologne, Germany*

In previous research, the Middle Neolithic in Central Germany was regarded as a transitional phase, although various innovations, which are placed in the Young and Late Neolithic, already began in the Middle Neolithic. Within the framework of our interdisciplinary research project "Diversification and change - Analysing settlement patterns and agricultural practice during the 5th mil. BC in Central Europe", the analysis of on- and off-site features is conducted alongside archaeological research. The on-site features reveal the emergence of new cereals such as naked wheat and naked barley, which can thrive on different sites and under different cultivation conditions than emmer and einkorn. Harvesting methods and weeds, on the other hand, do not seem to change. The off-site features show the introduction of livestock farming in certain regions and the colonisation of previously unused areas. The archaeological evidence shows settlements outside the core areas with favourable site specifics. Changes in the archaeological find spectrum indicate specialisations of the individual communities. The exact beginning and development of these phenomena is not yet known due to the research situation, nor is their cause. Long-distance contacts or environmental changes may have been important.

Through the parallel investigation of off- and near-site finds in the immediate and wider surroundings, the development of settlement structure and agriculture will be investigated in our key regions Main-Franconia, Wetterau, Rhineland and Westphalia. Plant macro remains from archaeological features will be evaluated as well as pollen profiles from the settlement vicinity. Furthermore, the following questions will be addressed:

Is there a relationship between environmental conditions and the choice of crops or working techniques? Is there a spatial differentiation of agriculture and animal husbandry? What influence did climate and soil type have in the cultivation of cereals? Did soil quality deteriorate and were soil melioration methods used?

IWGP22-0293 - Overlooked sources of palaeoenvironmental data in arid North Africa: Case study from Sudan

Ikrama Madani¹, Adéla Pokorná², Yahia Tahir¹, Petr Pokorný³

¹*Khartoum University, Department of Botany- Faculty of Science, Khartoum, Sudan*

²*Czech Academy of Sciences, Institute of Archaeology, Prague, Czech Republic*

³*Charles University, Center for Theoretical Study, Prague, Czech Republic*

Macroremains and pollen of wild and domestic plants have only rarely been documented in Sudan. Compared to more humid areas, there are no palaeoenvironmental archives like peatbogs and lake sediments at disposal for archaeobotanists. However, we present two examples of promising sedimentary and archaeological contexts which proved to be useful for reconstruction of vegetation cover and domestic plant resources. We studied *tarbools* (vegetation hillocks) in El-Gaab area in the desert zone of northern Sudan, and a tumulus in Sabaloka Mountains in the scrub zone of central Sudan. Both studies are connected to Meroitic and Christian era archaeological sites. Detailed studies of current vegetation in both areas were used for environmental interpretation of macro-remain and pollen finds. Our aims is to encourage other scientists to analyse more samples from similar contexts, as well as to demonstrate unique examples of environmental changes connected with human activities in arid North Africa over past centuries.

IWGP22-0048 - Land abandonment, migration and forest succession between Early Bronze Age and Early Middle Ages in Southwestern Germany

*Elena Marinova*¹, *Manfred Rösch*², *Sara Saeidi*¹, *Sabine Rieckhoff*³, *Günther Wieland*⁴

¹*Baden-Württemberg State Office for Cultural Heritage, Laboratory for Archaeobotany, Hemmenhofen-Gaienhofen, Germany*

²*University of Heidelberg, Institut für Ur und Frühgeschichte und Vorderasiatische Archäologie, Heidelberg, Germany*

³*University of Leipzig, Pre- and Early History, Leipzig, Germany*

⁴*Baden-Württemberg State Office for Cultural Heritage, Survey- documentation and archaeobiosciences, Esslingen, Germany*

Betula peak, following a phase of rather open, anthropogenically shaped vegetation in a given pollen record can be considered as an indicator for the development of pioneer vegetation and initial reforestation of abandoned fields. It is a short event of less than one century (ca. 30 to 80 years), because either *Betula* is replaced by stronger competitors like *Fagus*, or the fields are taken again in use starting with clearing of the birch woodland. An evaluation of 12 high-resolution pollen profiles from lake sediments and peat bogs from southwestern Germany shows an accumulation of land abandonment phases from ca. 2500 BCE onwards. An accumulation indicated by *Betula*-peaks land abandonment occurs from the 4th century BCE to the 1st century CE, covering the Late Iron Age until the Roman occupation. This coincides with the so-called Celtic migration around 400 BCE and the invasion of the Cimbri at the end of the 2nd century BCE. Numerous *Betula*-peaks, suggesting land abandonment, occur between the 2nd and 3rd century CE, which points to 260 CE when the Romans left southwestern Germany and Alemannic tribes took over. This evidence is combined with radiocarbon dating obtained from plant macrofossils taken from contemporary destruction layers at corresponding archaeological sites close to the pollen profiles.

Even, if both migrations are historical facts and certainly impacted the settlement and land-use dynamics in the region, several driving forces have to be considered behind the observed *Betula*-peaks, i.e. abandonment phases. Such driving forces were certainly the societal dynamics, demographic growth, disease, but also the modes and limits of food production and resulting from this over-exploitation of resources, soil depletion, and possibly famines. The paper will evaluate the significance of combining *Betula*-peaks and on-site signals for

abandonment, concerning the suitability of the proposed approach to deal with land abandonment detection in general.

IWGP22-0082 - The Horti Lamiani: The archaeobotanical and palynological analyses reconstruct a sumptuous garden of private residence in the heart of Rome

Alessia Masi^{1,2}, *Cristiano Vignola*^{1,2}, *Alessandro Lazzara*¹, *Antonio F. Ferrandes*³, *Mirella Serlorenzi*⁴

¹*Sapienza University of Rome, Department of Environmental Biology, Rome, Italy*

²*Max Planck Institute for the Science of Human History, Palaeo Science and History Group, Jena, Germany*

³*Sapienza University of Rome, Department of Science of Antiquities, Rome, Italy*

⁴*Special Superintendence of Rome, Special Superintendence of Rome, Rome, Italy*

Horti Lamiani is the only example of imperial garden recently excavated in Rome with the methodological tools of nowadays stratigraphic archaeology. It was used for centuries (1st BC-3rd cent. AD) and constituted by both buildings and open spaces. The findings are impressive: thousands of frescoes, marble, glasses, pottery have been recovered. The site is even more interesting for the data obtained from the archaeobotanical investigation carried out on plant remains coming from holes and vessels used for plantation in the open areas. Charred seeds, fruits and woods, along with mineralized seeds, have been recovered. Moreover, palynology has been carried out on the sediment taken from flowerpots.

Archaeological investigation describes a regular arrangement of the garden with lines of holes where shrubs should have been settled. On the other side, the archaeobotanical data attests the richness of the plant assemblage: 35 wood *taxa*, 9 carpological *taxa* and 12 pollen types. The *Horti* were rich in trees: e.g. *Fagus sylvatica*, *Quercus* deciduous and evergreen that were probably part of the Esquiline hill natural vegetation. Other trees, such as *Carpinus*, *Corylus*, *Castanea*, *Populus*, *Ulmus*, could have been planted to form pleasant clusters or isolated to enhance their shape. The lines were probably made by Rosaceae, *Buxus*, *Cistus*, *Phillyrea*, *Rhamnus*. Carpological remains confirm the presence of *Celtis australis* and *Olea europaea*, but also enrich the *taxa* list with *Pinus*, *Vicia faba* and *Lathyrus*. pollen analysis is essential to describe the herbs that otherwise would not have been preserved. Ranunculaceae, Brassicaceae and Caryophyllaceae, for example, induce us to imagine a colourful flower garden.

All the findings of *Horti Lamiani* are on display in a new museum set up for this purpose. The archaeobotanical remains are exhibited here and help visitors to reconstruct the glories of the past (Fig 1).



Figure: Plant remains exhibited in the museum *MuseoNinfeo*
 (<https://www.museoninfeo.it/>)

IWGP22-0173 - A thousand-year long history of land use in eastern Anatolia: the archaeobotanical research at Arslantepe

Marco Giardini¹, Francesca Balossi Restelli², Alessia Masi^{1,3}, Cristiano Vignola^{1,3}, Laura Sadori¹

¹Sapienza University of Rome, Department of Environmental Biology, Rome, Italy

²Sapienza University of Rome, Department of Science of Antiquities, Rome, Italy

³Max Planck Institute for the Science of Human History, Palaeo Science and History Group, Jena, Germany

The archaeological site of Arslantepe (eastern Anatolia) was inhabited almost continuously from the 5th millennium BCE to the Byzantine period. Excavations of Sapienza University of Rome have been carried out uninterruptedly since 1961, bringing to light a huge amount of archaeological materials. Systematic archaeobotanical research has been carried out from 1978 onwards. The complementary study of different plant remains, such as wood and fruits/seeds, turned out very precious in unveiling past plant use. Moreover, stable carbon and nitrogen isotope data have been obtained from cereal grains providing information on water and nutrient availability in the cultivated fields. This dataset, integrated by the stable carbon isotope analysis on charcoals, provides a more complete picture of the past hydrological variability.

Added to this, palynology can be a very useful tool for evaluating some environmental features of the past, providing both onsite and offsite clues. It can highlight the extent of land use and reconstruct the landscape changes. New pollen data comes from a stratigraphic sampling at the site covering about 2500 years, from the Late Chalcolithic 1-2 (4700 BC) to the Middle Bronze Age (1750 BC). The pollen analysis has showed the presence of 41 *taxa*, among which 17 arboreal plants. Noteworthy is the presence in all samples, with the exception of the uppermost level, of cereal pollen, i.e. *Hordeum* type and *Avena/Triticum*. The cultivation of barley (*Hordeum vulgare*) is attested by abundant charred grains from the investigated levels; few oat (*Avena*) and thousands of wheat (*Triticum*) grains have also been found. Differences in the isotopic signals reveal that during specific periods different cereal crops may have been favoured.

The multi-methodological study performed at Arslantepe confirms that the integration of palaeoenvironmental and archaeobotanical evidence contributes to our knowledge of past plant husbandry and human shaping of the landscape.

IWGP22-0168 - Archaeology of climate change between Sistan (Iran) and the Thar Desert (Pakistan): lessons from protohistoric civilizations for a sustainable future?

Ignazio Minervini¹, Milena Primavera¹, Marco Madella^{2,3}, Girolamo Fiorentino¹

¹LAP - Laboratory of Archaeobotany and Palaeoecology - University of Salento, Department of Cultural Heritage, Lecce, Italy

²CaSEs Research Group - Universitat Pompeu Fabra, Department of Humanities, Barcelona, Spain

³ICREA - Passeig Lluís Companys 23, Department of Humanities, Barcelona, Spain

The *Archaeology of Climate Change* approach (Buke *et al.* 2021) is the result of an interdisciplinary approach between Archaeology and Natural Sciences that provided the research community with a set of data on past climate events in connection to cultural dynamics. This PhD project aims at investigating the interaction between past population dynamics and climate change using macro and micro-remains from plants as indicators of human response to a changing environment. The research focuses on prehistoric societies located in arid areas. Drylands are key settings to understand resilient dynamics set in place by human groups facing the ecological results of climate change in fragile environments.

Three Bronze Age settlements spanning eastern Iran and the Indus Valley in Pakistan are the focus of this research. One is the UNESCO site of *Shahr-i Sokhta*, dating to 3200-1800 BC and located in the arid region of Sistan (Iran). Previous archaeobotanical investigations have highlighted the presence of plant species linked to both the steppe and more humid environments (Costantini 1977; Shirazi, Shirazi 2012; Fiorentino, Minervini 2019, 2021). Two more sites are Bhandu Qubo and Taloor Je Bhatt (2800 – 1900 BC), both located in Pakistan.

This contribution will present the preliminary data recovered from the archaeobotanical analysis carried out during the first excavation activities at *Shahr-i Sokhta*.

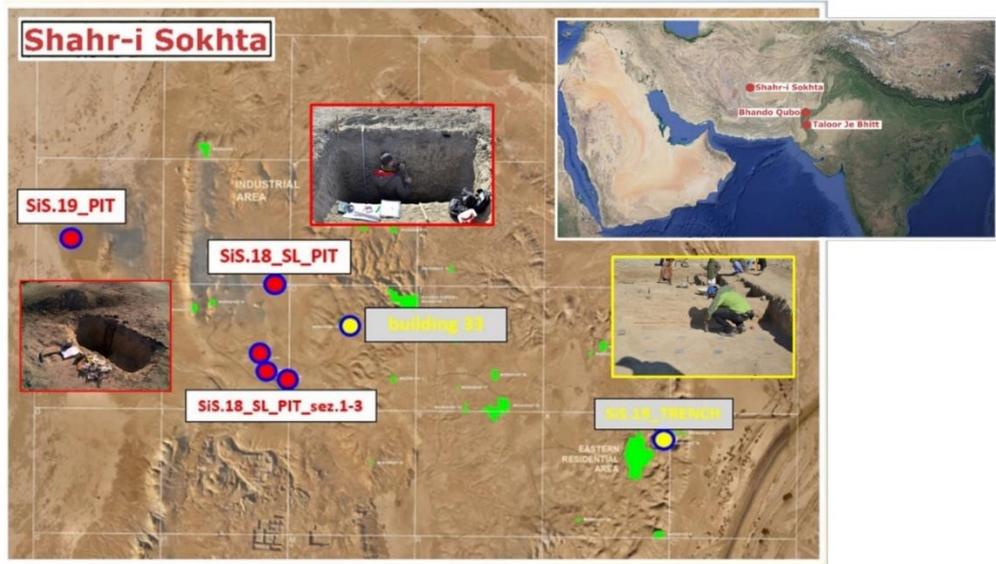


Figure 1. Geographical location of the three sites under investigation (top right). Geographical distribution of samplings activities (*off-site, on-site*) carried out inside and outside the site (left).

IWGP22-0250 - The disappearance of a glacial mountain lake in Central Europe: Autogenic succession or external drivers?

Alice Moravcová^{1,2}, Helena Svobodová-Svitavská³, Daniel Vondrák⁴, Přemysl Bobek³, Dagmar Dreslerová¹, Petr Kuneš²

¹Institute of Archaeology of the CAS- Prague, Department of Information Sources and Landscape Archaeology, Praha, Czech Republic

²Faculty of Science- Charles University, Department of Botany, Prague, Czech Republic

³Institute of Botany- Czech Academy of Sciences, Laboratory of Paleoecology, Průhonice, Czech Republic

⁴Faculty of Science- Charles University, Institute for Environmental Studies, Prague, Czech Republic

Using plant macrofossils and local pollen taxa, we reconstructed infilling processes of Stará jímka paleolake situated in a temperate mid-mountain range in Central Europe (Bohemian Forest, Czechia). Because lakes are sensitive to environmental changes, we assess how disturbances (climate, fire, erosion, human activities) affect the paleolake's dynamic during the Holocene by comparing local community reconstruction based on plant macrofossils and pollen with climatic proxies, macro-charcoal, geochemical data, and anthropogenic indicators. Our results show that following two erosion events, the transition from aquatic to terrestrial environment started ~7500 cal yr BP and progressed until ~ 5500 cal yr BP, reflecting gradual water lowering during the Holocene climatic optimum. Low concentrations of macrofossils and pollen of aquatic macrophytes evidence that the paleolake shrank after ~ 5500 cal yr BP yet still existed during the Late Holocene and finally disappeared after 1937 AD, which contradicts the previous investigations at that site dating lake disappearance ~ 4 000 cal yr BP. An increase of anthropogenic indicators and macro-charcoal accumulation rates ~ 2500 cal yr BP suggests that paleolake level fluctuations were affected by human activities during the Late Holocene.

This work was supported by OP RDE, MEYS, under the project "Ultra-trace isotope research in social and environmental studies using accelerator mass spectrometry", Reg. No. CZ.02.1.01/0.0/0.0/16_019/0000728

IWGP22-0264 - Vegetation history of lowland forest in the prehistory of the Czech Republic

Jan Novák¹, Vojtěch Abraham², Romana Kočárová², Petr Kočár³

¹Faculty of Sciences- Charles University in Prague- Benátská-2- CZ-128 01 Praha 2- Czech Republic, Department of Botany, Prague, Czech Republic

²Faculty of Science- Charles University- Benátská 2- CZ- 128 01 Praha 2- Czech Republic, Department of Botany, Prague, Czech Republic

³Institute of Archaeology of the CAS- Praha- v. v. i.- Letenská 4- CZ-118 01 Praha 1- Czech Republic, Institute of Archaeology of the CAS, Prague, Czech Republic

The vegetation history of lowland woodlands in Central Europe is closely related to human activities. Our study is focused on the evaluation of a large archaeo-anthralogical dataset from a large-scale territory. Our research focuses on the reconstruction of the woodland history in the surroundings of archaeological sites from the Neolithic (7600 BP) to the Migration Period (1450 BP) and reveals distribution of woodland vegetation types among territories of the Czech Republic. A comparison of long-term charcoal records from regions with a different presence of human activities has allowed for an evaluation of vegetation trends. Environmental conditions in the regions are not uniform and our study detects the variability of charcoal assemblages and different vegetation histories among the localities. We distinguish 7 different types of woodland vegetation, which are based on a cluster analysis of the charcoal composition. The results of our study show that abundant archaeo-anthracological records from many sites and periods can rectify the generally discontinuous character of charcoal samples.

IWGP22-0075 - Discarded plant remains from an industrial area

*Guillem Pérez Jordà*¹

¹*Universitat de València, Departamento de Prehistoria- Arqueología e Historia Antigua, Valencia, Spain*

During the 5th-4th centuries BC there was an intense commercial traffic of different products of vegetable (wine, oil, cereals, etc.) and animal (meat and fish) origin on the coasts of the Iberian Peninsula. Many of these products were originated around sites linked to the Punic and Iberian cultures.

This paper presents data recovered from the industrial area around the site of Tossal de les Basses (Alicante). This area was dedicated to the production of ceramics and metallurgical processing. Charred and waterlogged archaeobotanical material has been preserved in various structures (wells, pits and kilns).

The archaeobotanical record highlights the importance of fruit production, mainly grapes for wine, which was packed in amphorae and marketed. Olives, pomegranates, figs and almonds were also grown. The reduced presence of cereals and leguminous plants is noteworthy, in contrast to what is usually observed in the record of habitation areas.

* This work is part of the project FRUITCOM (PID2019-105921RJ-100)

IWGP22-0052 - Managing wilderness? Holocene-scale, human-related disturbance dynamics as revealed in a remote, forested area in the Czech Republic

Petr Pokorný¹, Přemysl Bobek², Petr Šída³, Jan Novák⁴, Michaela Ptáková⁵, Matthew Walls⁶

¹*Charles University, Center for Theoretical Study CTS, Praha, Czech Republic*

²*Institute of Botany- Czech Academy of Sciences, Laboratory of Paleoecology, Průhonice, Czech Republic*

³*University of Hradec Králové- Philosophical Faculty, Department of Archaeology, Hradec Králové, Czech Republic*

⁴*Charles University- Faculty of Science, Department of Botany, Praha, Czech Republic*

⁵*Faculty of Science- University of South Bohemia, Laboratory of Archaeobotany and Palaeoecology, České Budějovice, Czech Republic*

⁶*University of Calgary, Department of Anthropology and Archaeology, Calgary, Canada*

In the lowlands and uplands of Central Europe, which were inhabited continuously from the very start of the Holocene to the present times, it is difficult to find territories suitable for the investigation of natural baselines. For this reason, we picked the complicated rocky terrain of one upland area in NE Bohemia called *Adršpach* because it was supposed to have never been deforested or managed by people. The remote and inhospitable character of this particular area and the absence of prehistoric archaeological findings encouraged this assumption. To our great surprise, however, high-resolution pollen analyses, supplemented by analysis of non-pollen palynomorphs and microscopic charcoals reveal that the local forest ecosystem had a dynamic development over the entire Holocene. We were able to correlate this high-resolution understanding of vegetation successions with repeated fire disturbances. Was this fire disturbance dynamic or natural? Subsequent archaeological exploration and excavation in the area brought unexpected evidence, pointing to rather continuous human presence throughout most of the Holocene. From the Early Mesolithic to the Late Neolithic, available evidence suggests a hunter-gatherer mode of resource management. From the start of the Late Holocene (ca 4 ka BP), the occurrence of coprophilous fungal spores and secondary anthropogenic pollen indicators suggest this area was impacted by recurrent domestic animal grazing. Testing this approach also in other remote forested areas of Central Europe, we argue, can have far-reaching implications for understanding long term human-environment agency by transforming our understanding of alternative subsistence and land use strategies during prehistory. At the same time, this can significantly alter existing concepts used in

Central European nature conservation strategies, which tend to be based on an underlying assumption that our work challenges – the survival of little impacted wilderness at the Holocene scale.

IWGP22-0271 - European swiddens on Canada's east coast

*Elena Ponomarenko*¹, *Ekaterina Ershova*², *Mikhail Blinnikov*³

¹*University of Ottawa, Geography, Ottawa, Canada*

²*Moscow State University, Biology, Moscow, Russian Federation*

³*St Cloud State University, Geography and Planning, Saint Cloud, USA*

During soil surveys of the Prince Edward Island (PEI) north coast, we encountered buried soil profiles that differ drastically from the forest soils of the area, Podzols, but match a description of slash-and-burn horizons in Europe and Russia (Ponomarenko et al. 2019, Ponomarenko et al 2021). The soils were found within 0.5km from the modern coastal line in several settings: (1) buried beneath aeolian deposits in dune fields, (2) preserved under a peat layer superposed by fluvial deposits, (3) immediately under the forest duff, and (4) beneath the plough layer in modern farmlands. The soils were developed on sand deposits and had a dark-grey "humus" horizon typical for grassland soils, but of a small thickness (3 to 6cm), with the dark coloration caused by numerous rounded/isometric charcoal fragments. The horizon is evenly colored, with charcoal fragments distributed within the layer uniformly, without obvious clustering. The lower boundary of the pyrogenic horizon (Apyr) appeared as a fringe of in-filled insect constructions, 1 to 1.7cm in diameter, identified as those of sweat bees (Halictidae). *Betula* and *Quercus* were dominant taxa in charcoal spectra of Apyr, with bark, vitrified charcoal and *Cenococcum sclerotia* contributing <10% of fragments each.

The layers contained pollen of European cereals and weeds (e.g., *Carduus*-type) and single grains of maize pollen. Finally, dendritic phytoliths of cereals and the IRP form of *Zea* were found in the layers, attesting for *in situ* cultivation of cereals. The people who practiced swidden cultivation here planted European crops but were familiar with such native crops as maize.

Radiocarbon dates of charcoal from the Apyr range from the mid-1400 to the late 1500-s, coinciding with reemergence of swidden cultivation in Europe due to cooling and with the Age of Discovery, when the PEI coast was visited by the Basques and, possibly the Bretons (Barkham 1982).

IWGP22-0278 - Typology of charcoal assemblages in the forest-steppe soils

*Elena Ponomarenko*¹, *Ekaterina Ershova*², *Pille Tomson*³, *Yulia Salova*^{4,5}

¹*Ecosystem Archaeology Services, consulting soil scientist, Ottawa, Canada*

²*Moscow State University, Biology, Moscow, Russian Federation*

³*Estonian University of Life Sciences, Landscape Management and Nature Conservation, Tartu, Estonia*

⁴*Tyumen Scientific Centre- Siberian Branch of the Russian Academy of Sciences, Archaeological and Environmental Reconstructions, Tyumen, Russian Federation*

⁵*Laboratory of Archaeobotany and Paleoecology, Faculty of Science, University of South Bohemia, Na Zlaté stoce 3, České Budějovice, Czech Republic*

We analyzed macrofossils in the Holocene paleosols buried under colluvial fan deposits, alluvial deposits, and anthropogenic embankments of the forest-steppe zone of Europe and Russia. Not only paleosols, but also deposits dividing them were included in the analysis of the dataset that included over 200 layers.

Despite the diversity of situations and a highly variable species composition of fire-affected plant communities, soil charcoal assemblages can be ordinated into several groups based on proportions of certain fuel fractions. These are (charred) wood, bark, vitrified charcoal, charcoal-cored concretions, components of crown (buds, leaves), roots, *Cenococcum* sclerotia, thorny shrubs, herbaceous plants, and seeds of cultivated plants. In addition to proportions of certain fuel fractions, the type of coating of charred particles (e.g., silt vs unsorted mud coating), and size range of charcoal fragments are group specific.

To interpret soil charcoal assemblages in terms of disturbance history, we collected reference macrofossil assemblages from the sites with well-documented history of land use. Most layers sampled for the macrofossil analysis were subsampled for the soil pollen analysis. The reference sites included permanent fields, sites affected by the slash-and-burn cultivation system, pastures, several types of forest fires, roads/drove ways, and archaeological hearth features. Description of macrofossil assemblages from these sites showed that uncharred seeds of Chenopodiaceae, insect remains, and mineral inclusions are important land use indicators that must be added to the description key.

The reference assemblages were compared with the type assemblages from the paleosols to single out diagnostic signatures of each type of land use in soil macrofossil assemblages. Finally, the interpretations based on the macrofossil

analysis were verified by comparing them with the results of palynological analysis. The preliminary result of this project is a list of type assemblages with approximate proportions of fuel fractions in each group, linked to certain disturbance types.

IWGP22-0187 - Land use and environmental change during the dark ages in south-west Germany according to botanical offsite and onsite data

*Manfred Rösch*¹

¹Universität Heidelberg, Institut für Ur- und Frühgeschichte und vorderasiatische Archäologie, Heidelberg, Germany

On-site botanical data from southwestern Germany document subsistence agriculture with many different cereals and other crops after the Roman period (260 CE) until 700 CE, as well as gardens and orchards with cultivated species, inherited from the Romans, but with lower diversity. Agriculture meant field-grass economy, ploughing with the ard, and no systematic manuring. According to pollen profiles, population and human impact by land use were rather weak from the 3rd to the 7th century CE, increasing fast afterwards. From the 7th century onwards, the Roman achievements, short fallow, manuring and ploughing with mouldboard plough, came back, leading to the medieval three-field crop rotation system. Together with the growth of population and economy, a strong deforestation as well as a change of the remaining forests happened: Beech, Fir, and Hornbeam were successively replaced by Oak, Birch and Hazel. This development shows local patterns and differences, dependent on the aptitude of climate and soils for agricultural use.

IWGP22-0231 - Sedentary versus mobile lifestyles in the Russian Trans-Ural steppe. Tracing the Late Bronze Age transition

Lisa Rühl¹, Maren Gumnior¹, Eliza Stolarczyk¹, Ludmila Koryakova², Rüdiger Krause¹, Astrid Stobbe¹

¹Goethe University Frankfurt, Dpt. of Archaeological Sciences- Institute of Pre- and Early History, Frankfurt am Main, Germany

²Russian Academy of Sciences, Institute of History and Archaeology, Ekaterinburg, Russian Federation

Starting with the fortified Sintashta-Petrovka settlements around 2000 BC, the Russian Trans-Urals were a centre of economic and sociocultural innovations in the Bronze Age. Our previous archaeological and archaeobotanical investigations as well as isotope analyses revealed that the fortified settlements were erected during a relatively humid phase with high biomass production and ideal conditions for the sedentary pastoralists and their livestock. In contrast to some neighbouring regions where cereal cropping was already practised regularly, the settlers did not engage in plant cultivation. The combination of palynology, plant macro-remains analyses and micromorphology on good features in the e Kamennyi Ambar settlement allowed for a more in depth assessment of the Bronze Age vegetation, and possible plant use scenarios (fodder), water management and on-site sedimentation history.

In the Late Bronze Age, the settlements were smaller and not fortified anymore. For the Final Bronze Age, there are almost no settlements known in the area and a more mobile lifestyle has been postulated. Our palynological and sedimentological data provide the first indications that the observed changes in settlement behaviour can be interpreted as a reaction to climatically induced environmental changes.

Currently, new on-site (well features and cultural layers) and off-site archives are subject to palynological, sedimentological and plant macro-remains investigations to further explore the environmental background and impact of the steppe inhabitation in the Late and Final Bronze Age.

IWGP22-0219 - The role of fire in medieval and early modern landscape development in Bad Waldsee

Sara Saeidi Ghavi Andam¹, Lucia Wick², Manfred Rösch³, Claudia Lemmes⁴, Kristin Haas⁵, Elena Marinova⁶, Oliver Nelle⁷, Matthias Hinderer⁸

¹*Baden-Württemberg State Office for Cultural Heritage- Regierungspräsidium Stuttgart, Archaeobotany, Gaienhofen-Hemmenhofen, Germany*

²*University of Basel, Integrative Prehistory and Archaeological Science IPAS, Basel, Switzerland*

³*Universität Heidelberg, Institut für Ur- und Frühgeschichte und Vorderasiatische Archäologie-, Heidelberg, Germany*

⁴*Eberhard Karls Universität Tübingen, Institut für Geschichtliche Landeskunde und Historische Hilfswissenschaften, Tübingen, Germany*

⁵*Institute of Geosciences, Department of Applied Sediment Geology- Technical University of Darmstadt, Darmstadt, Germany*

⁶*Baden-Württemberg State Office for Cultural Heritage- Regierungspräsidium Stuttgart, Archaeobotany, Gaienhofen-Hemmenhofen, Germany*

⁷*Baden-Württemberg State Office for Cultural Heritage- Regierungspräsidium Stuttgart, Tree-Ring Lab, Gaienhofen-Hemmenhofen, Germany*

⁸*Institute of Geosciences, Department of Applied Sediment Geology at the Technical University of Darmstadt, Darmstadt, Germany*

In southwestern German Alpine foothills, the Bad Waldsee town is enclosed with two lakes of ice-age origin: Stadtsee and Schlossee. Previous research showed that the Stadtsee primarily contains seasonally laminated deposits up to modern time. Therefore, it provides a unique archive to investigate the environmental history of the lake catchment and therein located town. This sedimentological archive also serves as a unique tool to correlate the historical written sources of Bad Waldsee with environmental signals in high accuracy. In the presented here paleo fire record was obtained in the frame work of the multi-disciplinary project of Bad Waldsee, which aims to investigate the impacts of urban development on the lake during the medieval to the early modern period (1200-1800), as well as the human-environment interaction, emphasizing climatic and historical events (famine, fire, wars, etc.). Bad Waldsee has been an urban center and a flourishing center for industry and economy since ~13th century. A recent high-resolution palynological investigation provided information on vegetation and landscape development in the lake catchment and the town surroundings showing clear episodes of high anthropogenic pressure on the environment, landscape change, and deforestation that coincide with soot particle accumulation episodes and micro charcoal peaks. Apart from micro charcoal accumulation peaks, as burning

episode signals in the catchment, large city-fire events are recorded in the written archives. To clarify the history of fire and understand its role in a human-environment nexus in the study area, a macroscopic charcoal analysis and quantification are undergoing as a part of the current project. The results are to be interpreted using and in relation to the palynological and historical data and presented internationally in close cooperation with the other working groups.

IWGP22-0254 - The Phenomenon of Bohemian Sandstone Region: Towards a Complexity of Human and Plant History

Petr Šída¹, Petr Pokorný², Michaela Ptáková³, Jan Novák⁴, Kristýna Hošková⁴

¹*University in Hradec Králové- Philosophical faculty, Department of archaeology, Hradec Králové, Czech Republic*

²*Charles University, Center for theoretical studies, Prague, Czech Republic*

³*South Bohemian University in České Budějovice, Faculty of Sciences, Laboratory of Archaeobotany and Palaeoecology, České Budějovice, Czech Republic*

⁴*Charles University, Faculty of Sciences- Institute of Botany, Prague, Czech Republic*

The northern sector of Bohemia is characterized by large areas of block sandstones, which create a specific relief with extreme diversity. These regions were rather unsuitable for agriculture in prehistoric times and so until recently remained out of the interest of archaeological research. The high diversity of rocky landscapes led to the emergence of many types of sedimentary records during the Holocene, so that these areas become an excellent natural archive. Moreover, it turns out that the human presence in these areas has never been marginal; it has only been different from the traditional agricultural character. Most importantly, continuous sedimentation in numerous overhangs under sandstone rocks creates some of the best stratigraphies available for the archaeological research in the Central European context. Overhangs are in themselves excellent source for understanding vegetation history, as they contain charcoals, plant macro-remains, pollen and phytolites. We will demonstrate what long-term comprehensive research of such an area can bring to our knowledge of the evolution of plant communities and their interactions with humans.

IWGP22-0176 - Finding suitable grounds: Multiproxy archaeobotanical studies of the mesolithic-neolithic transition in the Dutch lowlands

Ana Smuk¹, Hans Huisman¹, Lucy Kubiak-Martens², Marco Madella³, Mans Schepers⁴

¹*University of Groningen, Groningen Institute for Archaeology, Groningen, Netherlands*

²*Biological Archaeology & Environmental Reconstruction, BIAx Consult, Zaandam, Netherlands*

³*Universitat Pompeu Fabra, Department of Humanities and ICREA, Barcelona, Spain*

⁴*University of Groningen, Centre for Landscape Studies, Groningen, Netherlands*

The change from hunter-gatherer to agriculture-based subsistence is, and has been, a major theoretical and research topic in archaeology. The project “*Finding suitable grounds*” studies the setting and speed of adoption of crop cultivation in the lowlands of the Netherlands during the Mesolithic to Neolithic transition. The aim of the project is to understand the activities related to human subsistence in the fluvial landscapes of the Flevoland area and the Rhine-Meuse delta during the time period between 6000 BC and 4000 cal. yr. BC. Instead of a classical approach focusing on settlements, our research is bringing the wider surroundings and landscape management to the forefront. An important issue is the suitability of the now buried and submerged fluvial landscapes for early crop cultivation.

Besides high-precision ¹⁴C dating and soil micromorphology, multiple palaeobotanical proxies (macro-remains, phytoliths, charred particles of herbaceous tissues and pollen) are going to be used. The purpose of this multiproxy approach is to define the general vegetation characteristics and diversity within the landscape, changes in vegetation cover and which are of due to human management, indications for crop cultivation, and exploring the possibility of intensification and wider dispersal of crop cultivation during this time. This set of off-site data will provide new understanding of landscape changes and of the human-environment relationship in the Dutch lowlands since the onset of the Neolithic.

IWGP22-0025 - Exploring agro-pastoralist landscape modification in the Kashmir Valley using off-site records

Michael Spate¹, Mumtaz Yattoo², Dan Penny³, Alison Betts¹

¹University of Sydney, Archaeology, Sydney, Australia

²University of Kashmir, Centre of Central Asian Studies, Srinagar, India

³University of Sydney, School of Geosciences, Sydney, Australia

The Kashmir Valley in the Western Himalayas holds a large number of Neolithic agricultural villages where both East and West Asian crops are directly dated to before 4000 BP. These sites are typically located on loessic terraces on the valley floor between 1600-1700m ASL. Following this prehistoric period, archaeobotanical data indicates a diversification of crop types and a greater emphasis on summer rice cultivation, while preliminary survey results also suggest an expansion of settlement patterns to middle altitudes above 2200m ASL. This presentation explores patterns of land use at these higher elevations using sediment core data from pastures (*margs*) that have been opened within coniferous forest belts, as well as from sub-alpine meadows.

We test hypotheses that these are partially anthropic landscapes, through observed changes in pollen and spore abundances, charcoal influxes and sediment distributions. Results indicate several periods of likely human impact and modification of the study areas from around 4000 BP onwards. These periods of intensification are spatially and temporally discontinuous across our three observed records indicating shifting emphases of middle- and high-altitude land use. These changes also appear to correlate with regional climate shifts such as weakening Summer Monsoon or Westerly precipitation, as well as periods of social reorganisation on the valley floor. Based on these data, we argue that upland herding in the Kashmir Valley is well placed to respond to past and future climate deteriorations. Evidence long-term co-evolution of humans and landscape in the study area also have implications for the ongoing management of environments generally perceived as “pristine” or “wilderness”.

IWGP22-0065 - Long-term dynamics in landscape and agriculture from the Bronze Age to the Roman Period in northeast Portugal

João Tereso¹, Filipe Vaz², Luís Seabra², María Martín-Seijo³

¹*CIBIO- Research Center In Biodiversity and Genetic Resources- InBIO Associate Laboratory, BIOPOLIS Program in Genomics- Biodiversity and Land Planning, Vairão, Portugal*

²*CIBIO- Research Center In Biodiversity and Genetic Resources- InBIO Associate Laboratory, BIOPOLIS Program in Genomics- Biodiversity and Land Planning, Porto, Portugal*

³*Universidad de Cantabria, Departamento de Ciencias Históricas, Santander, Spain*

The construction of a dam in Sabor river (northeast Portugal) led to the excavation of dozens of sites and the implementation of the most extensive archaeobotanical study in Portuguese archaeology. Analyses were carried out in 14 Mesolithic, Bronze Age, Iron Age and Roman sites, shedding light on 8000 years of plant exploitation and 2500 years of agriculture, documenting changes related to the history of human occupation in the valley and broad palaeoenvironmental trends.

In this presentation, the extensive carpological record from Sabor valley will be contrasted with archaeological and palaeoenvironmental data. Current data demonstrates naked wheat was the main crop from the Bronze Age to the Roman Period, but common millet became increasingly relevant since the Iron Age. Massive storage areas from the 2nd-1st century BC testify for an increasing agricultural production and farms from the 1st-3rd centuries AD suggest changes in production strategies and the expansion of vine and/or olive.

Wood charcoal from sites in the valley provide the main source of palaeoenvironmental information. It documents the expansion of scrubland and soil degradation. Abundant sequences from northwest Iberian mountains and eastern Iberian Central System allow for a proper integration of archaeobotanical data in the broad ecological dynamics of the region. These are characterized by increasing deforestation and expansion of pioneer taxa in the Bronze and Iron Ages and decreasing resilience in regional landscapes from the Roman period onwards.

Research conducted in the Sabor valley displays how the interpretation of carpological data is improved when other paleoenvironmental data is taken into consideration. This dataset provides a regional integration for the local archaeobotanical information and make grounded tendencies which are only understood at broader chronological and spatial scales.

IWGP22-0239 - Archaeobotany (pollen, macroremains) and land use history of the Copper and Bronze Age site at Gardolo di Mezzo (Trento, Italy)

*Jessica Zappa*¹, *Paola Torri*¹, *Mauro Rottoli*², *Elisabetta Castiglioni*², *Michele Bassetti*³, *Anna Maria Mercuri*¹, *Elisabetta Mottes*⁴

¹*Università degli Studi di Modena e Reggio Emilia, Dipartimento Scienze della Vita, Modena, Italy*

²*Musei Civici di Como, Laboratorio di Archeobiologia, Como, Italy*

³*Cora Società Archeologica, Cora Società Archeologica, Trento, Italy*

⁴*Soprintendenza per i Beni Culturali, Ufficio Beni Archeologici, Trento, Italy*

The research carried out by the Archaeological Heritage Office of Trento Autonomous Province at Gardolo di Mezzo (Trento) brought to light an extensive multi-layered site. The settlement's evidence covers a period between the Copper and the Recent Bronze Age (Italian chronology). Close to the settlement (Garm 3), a cult area (Garm 2) has been documented, in particular two monumental tumuli, renovated several times between the Early and the Recent Bronze Age. Pollen and macroremains analyses aimed at reconstructing regional to local vegetation and land-use. Macroremains (charcoal, seeds) derived from 47 SSUU covering the entire chronological period. Carpological remains (ca. 15000) document the cultivation, from the Copper Age, of *Triticum monococcum*, *Tr. dicoccum* and, to a lesser extent, of *Tr. spelta*, *Tr. timopheevii* type, *Tr. aestivum/durum* and *Hordeum vulgare*. In the most ancient phases einkorn dominates, from the recent Bronze Age emmer takes over. Millets appear in the Middle Bronze Age. Pulses (*Pisum*, *Vicia sativa*) are scarce. Hazelnuts, Cornelian cherries and acorns are the most harvested fruits. Grape is occasionally documented.

Charcoal remains (ca. 1400) have a rather varied composition; deciduous oak and scots/mountain pine dominate; beech and high-altitude conifers are poorly exploited. Anthracological data do not indicate variations of the forest composition; riparian species are better represented in the ancient phases.

Palynological analyses were performed on 39 samples (Garm 2), mostly belonging to 21 SSUU. They show a forest cover mainly composed of *Betula* during ancient phases. Then, a significant forest reduction took place together with an increase of synanthropic plants, anthropogenic and local pastoral pollen indicators (*Aphanes/Alchemilla*, *Orlaya grandiflora*, *Plantago*). A major environmental change occurred under human impact in the site. Interesting is the presence, at the sequence top, of *Avena/Triticum* group (indicating near-site

fields) and Cichorieae (indicating pasturelands), mirroring the differentiated land-use by local population.

Topic 3.3: Arable weed flora: origins, dispersal, diversification and evolution

IWGP22-0174 - Functional ecological analysis of arable weed flora in the northeast Iberian Peninsula: from present-day organic agriculture to protohistoric farming

*Natàlia Alonso*¹, *Jordi Recasens*², *Xavier Solé*², *Charles Michael*³, *Amy Bogaard*⁴

¹*University of Lleida, Department of History, Lleida, Spain*

²*University of Lleida, Department of Horticulture- Botany and Gardening, Lleida, Spain*

³*University of Oxford, School of Archaeology, Oxford, United Kingdom*

⁴*University of Oxford, School of Archaeology, Oxford, United Kingdom*

The Western Catalanian Plain is part of the Ebro Depression, in the NE Iberian Peninsula, having distinctive physiographic and archaeological characteristics. It is a low plain (120-500m) with a xeric bioclimate and a marked continental tendency. Today it is a relatively flat landscape that has been subjected to agricultural activity for centuries. Winter cereals, almond and olives trees are the most important crops in the rainfed areas. In these agricultural systems, the arable weed flora is representative of some Mediterranean chorological elements and characteristics of the *Ruderali-Secalietae* phytosociological class. In terms of archaeology, the area shows a unique indigenous pattern of settlement evolution and urbanism, with a transformation of segmentary societies (from the end of the 3rd millennium BC) into complex societies (the Iberian “Ilergetes” society of the Iron Age in the 1st millennium BC). The hypothesis is that this process may have been accompanied by an evolution in agricultural systems, which we intend to investigate.

Functional ecological analysis of the arable weed flora informs interpretation of the dynamics of farming systems, and so a project has been initiated for its application. A survey of the weed flora of rainfed organic fields of winter cereals and pulses was carried out in spring, 2021, in order to establish a reference for the same geographical area that is being studied archaeologically, and in order to compare it with other existing current weed surveys (e.g. in Haute Provence and Asturias). Here we compare these modern reference data with the archaeobotanical record of various sites in the region.

IWGP22-0098 - Prehistoric arable weed flora reconsidered from exceptional waterlogged settlement deposits

Rachel Ballantyne^{1,2}, Mike Charles¹, Alan Clapham², Müge Ergun¹, Amy Holguin¹, Amy Bogaard¹

¹University of Oxford, School of Archaeology, Oxford, United Kingdom

²University of Cambridge, McDonald Institute for Archaeological Research, Cambridge, United Kingdom

Most data on arable weed seeds derives from the fragmentary and partial charred plant assemblages of terrestrial archaeological sites. But waterlogged assemblages, in exceptional circumstances, have exquisite preservation of both uncharred and charred plant remains. Waterlogged plant assemblages from settlements thus provide crucial evidence for the harvesting, storage, and handling of crops, including the diversity of deposition pathways for arable weed flora.

This paper contrasts putative arable weed flora from the later prehistoric pile-dwelling settlements of the oligotrophic Lake Ohrid, Albania/North Macedonia, and the eutrophic Fenland, UK. The Middle to Late Neolithic settlements of Lin and Ploča Mičov Grad (late 6th–5th millennia BCE) have highly anthropic waterlogged plant assemblages where wild seeds are well-suited to analysis using established crop processing models. In contrast, abundant riparian vegetation at the Late Bronze Age settlement of Must Farm (c.850 BCE) precludes the straightforward application of crop processing models; however, a conflagration deposit there offers dramatic insights into wild seed pathways. Cross-comparison of these very different settlement assemblages illuminates arable practices in both regional communities and reveals traits of wider significance for the understanding of prehistoric arable ecology.

IWGP22-0292 - Invasive species from Eurasia do not perform better under agropastoral disturbance in early life stages than invaders from other continents

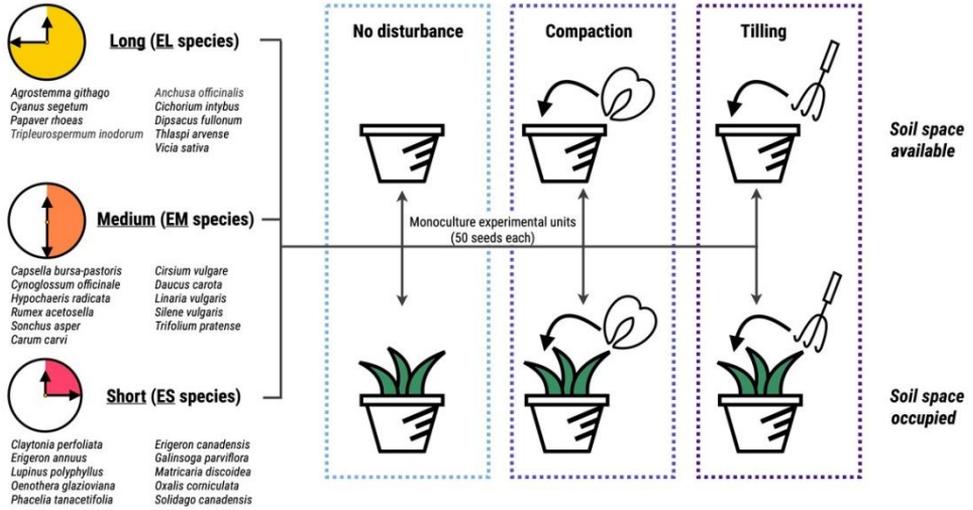
Ginevra Bellini^{1,2}, Alexandra Erfmeier^{1,2}, Karin Schrieber¹

¹Kiel University, Department of Geobotany- Institute for Ecosystem Research, Kiel, Germany

²Kiel University, Cluster of Excellence ROOTS, Kiel, Germany

Pre-adaptation to disturbance is an important driver of biological invasions in human-altered ecosystems. Agropastoralism surged 12,000 years ago in Western Asia and it was then imported to Europe starting 8,000 years ago. The Neolithic Plant Invasion hypothesis suggests that Eurasian plants invade agroecosystems worldwide thanks to their adaptation to agropastoralism, which derives from these species' long co-evolution with such practice. Plant species from Western Asia would have the highest degree of adaptation to agropastoralism, since they have co-evolved with such practice for longer than European plants, and non-Eurasian species should be poorly adapted due to their relatively short exposure. However, this Eurocentric perspective largely ignores that several other cultures around the world independently developed agropastoralism, which challenges this hypothesized superior adaptation of Eurasian species. Here, we tested whether the early-life performance of invasive plants under disturbance depends on their geographical origin and the associated assumed exposure time to agropastoralism. We selected 30 species divided into three groups: exposure long, native to Western Asia; exposure medium, native to Central Europe; exposure short, native to America. Three soil disturbance treatments (control/compaction/tilling) combined with two space occupancy levels (available/occupied) were applied to monospecific experimental units, each containing 50 seeds. We predicted that Eurasian species would benefit more from disturbance in terms of germination and seedling performance than species with shorter assumed exposure to agropastoralism, and that this effect would be stronger when space is occupied. Contrary to these expectations, all species groups profited equally from disturbance, while non-Eurasian species were most hampered by space occupancy. For germination success and speed, exposure long species had higher values than exposure short species, regardless of the disturbance treatment. These results do not support that Eurasian species possess a higher adaptation to agropastoralism, but rather that non-Eurasian species can cope just as well with the associated disturbances.

Length of exposure to agropastoralism



IWGP22-0108 - A new open-access resource on the functional traits of arable weeds for archaeobotanists and plant ecologists

Amy Boqaard¹, Mike Charles¹, Glynis Jones², John Hodgson^{1,2}, Elizabeth Stroud¹, Alex Weide¹

¹*University of Oxford, School of Archaeology, Oxford, United Kingdom*

²*University of Sheffield, Department of Archaeology, Sheffield, United Kingdom*

In this talk we introduce a new open-access database of functional trait values for 800+ weed/ruderal species, with related packages for comparing archaeobotanical weed assemblages with modern weed flora developed under known conditions, and with the weed composition of samples from stages in a traditional cereal processing sequence. We will demonstrate this new resource in an associated workshop during the conference. At the workshop, participants will be encouraged to bring archaeobotanical weed data they wish to analyse, and there will also be some demonstration of the measurement of functional traits. The initial functional trait data to be released are focused on Europe and western Asia, but there are some data from other regions (such as north Africa) and scope to expand the database geographically in the future.

IWGP22-0248 - Cultivated fields and uncultivated fields: weeds role of medieval landscapes reconstruction in northern Apulia (South Italy)

Valeria Della Penna¹, Pasquale Favia², Roberto Goffredo², Girolamo Fiorentino³

¹*Università di Foggia - Università del Salento, Dipartimento di Studi Umanistici - Laboratorio di Archeobotanica e Paleoecologia- Dipartimento di Beni Culturali, Foggia, Italy*

²*Università di Foggia, Dipartimento di Studi Umanistici, Foggia, Italy*

³*Università del Salento, Dipartimento di Beni Culturali, Lecce, Italy*

Often present in the archaeobotanical record, weeds macroremains are an important resources to landscape reconstruction, agricultural systems and land management by a community. The archaeobotanical data from two medieval archaeological contexts in the north of Apulia region (Southern Italy), focus on this direction. These analyses are part of the program research of LAP (Laboratory of Archaeobotany and Palaeoecology, University of Salento, Lecce, Italy) works in cooperation with the University of Foggia.

The first site is the Roman town of Salapia (Cerignola, Foggia), a lagoon settlement, towards the Adriatic coast, founded in the 1st century. B.C. Already in the mid-5th c. A.D., the remains of what was a Roman structure were re-inhabited by a series of huts and a village occupation continued into the 7th – 8th c. A.D., until its abandonment in 9th c. A.D. In the 6th -7th century A.D., archaeological data shows a transformation of the Roman town in favor of less structured settlement and carpological samples reveals weeds/wild species increase. Plants remains are probably indicators of the ruralization process of the town and increase of uncultivated areas associated with cultivated fields.

The second site is a little town walled of Montecorvino (Pietramontecorvino, Foggia), a hilly settlement within the region, which lives between the 11th until the mid-16th century A.D. Weeds species, identified in the archaeobotanical records, are related to the cereal vocation of the site and provide important information to agricultural practices reconstruction and land management.

IWGP22-0202 - Weeds and taphonomic processes in archeology: the application of the soil seed bank as an analysis tool

Matilde Stella¹, Girolamo Fiorentino¹, Anna Maria Grasso¹

¹Università del Salento, Laboratorio di Archeobotanica e Paleoecologia- Dipartimento di Beni culturali, Lecce, Italy

Soilseedbank is typically defined as all the surviving seeds existing in the soil and its most superficial layers. The soilseedbank is an important method of plant recognition and regeneration and a tool for biodiversity conservation. In archaeobotany, seeds stored in a given soil level provide precious information about agricultural systems, crop seasonality and weed management. Studies conducted on the soilseedbank have shown that the movement of seeds in the soil is slow and that the seeds infiltrate the soil according to the ratio between surface and volume, as well as according to their shape. The aim of this work is to show how the soilseedbank can be an important instrument of the taphonomic processes recognition involving the archaeological levels, and consequently a useful tool for the interpretation of archaeobotanical data.

IWGP22-0051 - Weed flora evolution at the origins of Egyptian agriculture

Claire Malleson¹, Giulio Lucarini²

¹American University of Beirut, History and Archaeology, Beirut, Lebanon

²National Research Council of Italy ISPC-CNR University of Naples L'Orientale, Institute of Heritage Science, Naples, Italy

In this paper, we will focus on the value of the study of 'weed flora' in investigations into the transition from gathering / pastoralism to fully-fledged agriculture in Egypt, based on data from sites in the Eastern Sahara, Nile Valley, and Nile Delta. The fact that domestic cereals (and animals) were introduced to Egypt from the eastern Mediterranean between the 7th – 5th millennia BCE during the transition out of the 'Green Sahara' phase has now been well-established. The data available for weed flora assemblages from Egyptian Bronze Age sites (3rd-2nd Millennium BCE), is rather uneven both geographically and temporally, but generally reveals some broad consistencies. For example, *Lolium* sp. and *Phalaris* sp. are invariably the most ubiquitous and numerous 'weed' taxa, but whilst *Phalaris* sp. appears from the prehistoric onwards, *Lolium* sp. seems to 'arrive' with the domestic cereals, and become increasingly ubiquitous over time.

Here we compare data from a range of mid-Holocene sites in order to start establishing which 'weed' taxa were brought into Egypt alongside emmer and barley, and which plants potentially migrated into the Nile Valley from the Eastern Sahara with the pastoral communities. We then look at the ways in which the Egyptian flora evolved as a result of the combined effects of the natural consequences of adoption of a formal agricultural system, and introduction of 'foreign' species.

IWGP22-0272 - Endangered weed species – last century occurrence changes and related current conservation problems in the Czech Republic

Jindřich Prach^{1,2,3}

¹Center for Theoretical Study, Charles University and the Czech Academy of Sciences, Jiřská 1- 11000 Prague 1

²Nature Conservation Agency, Protected Landscape Area Administration Český kras, Czech Republic

³ Department of Botany, Faculty of Science- Charles University, Benátská 2, Prague 2, Prague, Czech Republic

Important species of old arable weeds such as *Adonis flammea*, *Conringia orientalis*, *Bifora radians*, *Nigella arvensis*, *Ajuga chamaepitys* and others still grow rarely in the Czech Republic. The poster presents declines of their occurrences over the last century (based on the species occurrence database of the Nature Conservation Agency of The Czech Republic), their current localities, the considerations of what could have affected where such habitats survived, and the problems of its current conservation, mostly based on examples from Czech Karst Protected Landscape Area near Prague.



Figure: *Adonis flammea* at one of its last localities in Central Bohemia

IWGP22-0126 - Arable weeds on Wadden Sea salt marshes as evidenced by terp archaeology (600 BC- AD 1500) and modern field experiments

Mans Schepers¹, J.f. Scheepens², Chris Smit³

¹*University of Groningen, Centre for Landscape Studies, Groningen, Netherlands*

²*Goethe-Universität Frankfurt, Institute for Ecology- Evolution and Diversity, Frankfurt am Main, Germany*

³*University of Groningen, Groningen Institute for Evolutionary Life Sciences, Groningen, Netherlands*

From 600 BC onwards, people colonized the marshes along the Wadden Sea coast. They settled on man-made dwelling mounds, known as ‘terps’. These salt-marsh dwellers moved in from higher Pleistocene soils, taking with them an agriculture-based subsistence strategy, which included both animal husbandry and arable farming. Traditionally, the vast grazing grounds offered by the salt-marsh landscape are considered the primary reason for the colonization of the marshes. From a ‘nomen est omen’ perspective, the potential of salt marshes for agriculture can be considered low due to it being ‘salt’ and ‘wet’. This view, combined with a limited understanding of the capacity of crops to cope with abiotically extreme conditions at present, resulted in little research focussing on how and why historical salt-marsh farming worked and what the interplay between the ecosystem and crop cultivation in this landscape meant for arable weed vegetation.

The composition of arable weed vegetation can be partly explained by general environmental conditions in an area. Thus, past arable farming carried out in ecosystems not normally used for that function is likely to result in an arable weed vegetation unlike anything occurring today. In general, a trait shared by salt-marsh and weed vegetation is the relatively high proportion of pioneer species.

Archaeobotanical samples from terp mounds do indeed show direct associations of crops, classic arable weeds, and salt-marsh species. This combination also occurred in experimental plots laid out on a salt marsh for a period of three consecutive years (2016-2018). In this talk we will present the findings from (old and new) archaeobotanical analyses, as well as the mentioned experimental research, and discuss the implications for past, and future, arable weed vegetation in temperate coastal environments.



IWGP22-0253 - The wanted and unwanted: How does a weed become a crop? Or a crop become a weed of itself?

Chris Stevens¹

¹University of Cambridge, Department of Archaeology, Cambridge, United Kingdom

The definition of a weed as a plant that grows where it isn't wanted does not hold true for all situations. At certain times in the past the very definition of weeds, enters a gray area that is as much defined by their own evolutionary status as by the crop in which they grew.

A number of cultigens began as weeds of domesticated crops; including oats and rye as weeds of wheat and barley in Europe; kodo millet as a weed of rain-fed rice in South Asia, and gold of pleasure as a weed of flax. To this we might add barnyard millet, *Echinochloa*, which has cultivated and weedy varieties in East Asia, South Asia and Russia. In many of these cases these weedy forms evolved in a similar manner to domesticates, by mimicking the crop, including becoming non-shattering.

Vice-versa a number of crops have what Jack Harlan termed "companion weed races". These might be attributed to later evolutionary adaptation or the persistence of the wild progenitor as a weed. Examples of the former include a shattering weedy rice that evolved from domesticated rice in the U.S. A possible example of the latter might include wild barley (*Hordeum spontaneum*). While de Candolle and Vavilov favored the persistence of the progenitor as a weed, Harlan thought it more likely that weed and crop evolved from a single ancestor. Archaeological evidence for foxtail and broomcorn millets strongly supports this theory, and suggest that aspects such as grain size and shape evolved alongside domestication, perhaps beginning prior to the onset domestication. This begs the question of whether weed and crop evolved under the same selection pressures, or whether such divergence might be associated with the temporary abandonment of fields, or the creation of niche habitats such as found at the field edge.

IWGP22-0116 - Using functional weed ecology to reconstruct disturbance regimes associated with pre-domestication cultivation in southwest Asia

Alexander Weide¹, John G. Hodgson², Amy Bogaard¹

¹*University of Oxford, School of Archaeology, Oxford, United Kingdom*

²*University of Sheffield, Department of Archaeology, Sheffield, United Kingdom*

The predominant model for the emergence of agriculture in southwest Asia posits that wild cereals were cultivated over millennia prior to the appearance of domesticated cereals in the archaeological record. These ‘pre-domestication cultivation’ (PDC) activities are often understood as entailing annual cycles of soil tillage and sowing, and expected to select for domestic traits such as non-shattering ears. However, the reconstruction of these practices is mostly based on indirect evidence, raising the question whether PDC created arable environments through anthropogenic disturbances that would select for domestic traits. We developed a novel functional ecological model that distinguishes modern arable fields from wild cereal habitats in the Levant using plant functional traits related to mechanical soil disturbance. We applied this model to seven archaeobotanical datasets and found that soil disturbance levels associated with PDC are distinctly lower than those of established Neolithic farming systems. Our results show that wild cereal exploitation practices at key PDC sites maintained ecological conditions similar to untilled wild cereal habitats. This demonstrates that PDC did not entail regular soil tillage but reflects low-input exploitation practices, possibly oriented on the ecological strategies of the competitive large-seeded grasses themselves. As a consequence, the regeneration of the exploited populations would have been based on high proportions of shattering spikelets, which helps to explain why domestic cereals with non-shattering ears were not selected for during this millennia-long exploitation phase.

Topic 3.4: Grassland flora and systems: origins, dispersal, diversification and evolution

IWGP22-0284 - Holocene history plays an important role in forest-steppe formation at the biogeographical and cultural crossroads between Central and Eastern Europe

Petra Hájková^{1,2}, Libor Petr², Michal Horsák², Jan Roleček^{1,2}

¹*Academy of Sciences of the Czech Republic, Department of Paleoecology- Institute of Botany, Brno, Czech Republic*

²*Masaryk University, Faculty of Science- Department of Botany and Zoology, Brno, Czech Republic*

The Western Podolia (western part of Ukraine) represents the biogeographical crossroads between the temperate forest and the continental steppe biomes. Biologists have postulated the refugial character of the local steppes, but modern palaeoecological reconstruction of the environmental history of the region has been lacking. We fill this gap with a multi-proxy study (pollen, plant and mollusc macrofossils, microcharcoal, geochemistry) of two profiles sampled in calcareous fens adjacent to species-rich steppe grasslands. The analysed profiles together cover the entire Holocene and the end of the last glacial period. All studied proxies support the hypothesis of Holocene persistence of open or semi-open landscape. The complete absence of wood remains in the Holocene sediments, and the persistence of fen specialists showed exceptional long-term stability of open wetlands. The continuous presence of light-demanding pollen taxa, the low abundance of closed-canopy trees compared to open-canopy trees, and stable concentrations of geochemical indicators of erosion suggests a semi-open landscape with a mosaic of forests, steppe grasslands, and other open habitats. Multivariate analysis showed the similarity of pollen assemblages to sites located in the forest-steppe zone at the interface of the Pannonian Basin and the Western Carpathians. The continuous presence of non-woody microcharcoal in high abundance suggests a role of fire in maintaining open habitats. The archaeological record provides the evidence of human activities throughout the Holocene near the study sites. Comparison with modern pollen spectra suggests that the landscape was probably somewhat more forested in the past than today, but rather by open-canopy trees. Our results show that the Western Podolia has become a biogeographical crossroad not only because of its position on the border between Central and Eastern Europe, but also because of the unusual combination of a relatively humid climate and continuity of open or semi-open landscape since the Last Glacial Maximum.

IWGP22-0224 - Grass phytolith shape analysis in soils under species-rich meadows of the Bílé Karpaty Mountains

Kristýna Hošková¹, Jan Novák¹, Pavel Šamonil², Petra Hájková³, Michal Hájek⁴, Ivo Světlík⁵, Jan Roleček³

¹*Faculty of Sciences- Charles University in Prague- Benátská-2- CZ-128 01 Praha 2- Czech Republic, Department of Botany, Prague, Czech Republic*

²*The Silva Tarouca Research Institute for Landscape and Ornamental Gardening- Lidická 25/27- CZ-602 00- Brno- Czech Republic, Department of Forest Ecology, Brno, Czech Republic*

³*Institute of Botany- Academy of Science of the Czech Republic- Lidická 25/27- CZ-602 00- Brno- Czech Republic, Department of Paleoecology, Brno, Czech Republic*

⁴*Faculty of Science- Masaryk University- Kotlářská 267/2- CZ-611 37 Brno- Czech Republic, Department of Botany and Zoology, Brno, Czech Republic*

⁵*Institute of Nuclear Physics- Academy of Science of the Czech Republic- Na Truhlářce 39/64- CZ-180 00 Praha 8- Czech Republic, crl, Prague, Czech Republic*

Phytoliths are microscopic particles of silica formed in certain plants that have great potential to track grassland dynamics. Composed mainly of biogenic opaline silica ($\text{SiO}_2 \cdot n\text{H}_2\text{O}$), phytoliths are preserved in various sedimentary environments, even when other grass fossils are not. Moreover, grass phytoliths vary in shape at multiple taxonomic levels (subfamilies, tribes and sometimes even genera), whereas, for example, grass pollen is not taxonomically informative below the family level. By applying techniques of biological shape analysis to grass phytoliths, we can distinguish grass taxa diagnostic of specific grassland vegetation.

Our study on soil phytoliths contributes to testing of Holocene continuity of species-rich meadows of the Bílé Karpaty Mountains on the Czech-Slovak border. We analysed the shape of grass phytoliths from six soil profiles using semilandmark-based geometric morphometrics. The presence of taxa diagnostic of grasslands throughout the profile suggested the persistence of open vegetation at the lowest elevations of the Bílé Karpaty Mountains. Our study shows the application of grass phytolith shape analysis in soils and its potential to address hypotheses related to grassland development and dynamics.

IWGP22-0047 - Microhistological analyses of botanical remains from ruminant dung in the late Neolithic pile dwelling Mooswinkel (Mondsee, Austria)

Thorsten Jakobitsch¹, Marlu Kühn², Sabine Rosner³, Andreas G. Heiss¹

¹*Austrian Archaeological Institute/Austrian Academy of Sciences, Environment and Human Impact in Historical Societies, Vienna, Austria*

²*University of Basel, Integrative Prähistorische und Naturwissenschaftliche Archäologie IPNA, Basel, Switzerland*

³*University of Natural Resources and Life Sciences, Department of Integrative Biology and Biodiversity Research - Institute of Botany, Vienna, Austria*

Due to the excellent preservation of waterlogged organic material, prehistoric wetland settlements offer a deep insight into environment and subsistence strategies of prehistoric farming communities. The dung of goats, sheep and cattle sometimes appears in high abundance in the archaeological layers of these settlements. A microhistological analysis of plant remains from dung can provide information about which plants were consumed by the domestic animals. The case study with dung material from the Late Neolithic wetland settlement Mooswinkel at Mondsee in Austria shows that animals were fed during winter season with leaf hay and herbaceous plants, which were precautionary collected in summer, with fresh green plant material from evergreen species and with catkin bearing branches of winter flowering shrubs and trees.

IWGP22-0285 - Grassland flora and systems: origins, dispersal, diversification and evolution

*Peter Poschlod*¹

¹*Botany, Ecology and Conservation Biology, Regensburg, Germany*

Grassland ecosystems are probably the most species-rich habitats and belong to the most ancient agricultural systems in man-made landscapes. The history of the grasslands, however, is compared to other agricultural habitats such as arable fields not well studied. This may be due to the reason that the pollen of grasses cannot be differentiated and pollen of other typical grassland plants are poorly represented. Therefore, there is a need to combine all available palaeobotanical and -ecological methods such as pollen and macrorest analyses (especially a pedoanthracological approach) as well as phylogeographic studies of representative species. For the modern times, historical cadaster maps in combination with more recent air photographs, vegetation relevées and measurements of soil parameters allow a detailed reconstruction of the history. Such a more holistic approach allows us an increasingly better interpretation of grassland history and therefore, should not be ignored by palaeoethno- or archaeobotanists.

I will present selected studies concerning dry and mesic grasslands to show how this interplay of different approaches allows the reconstruction of grassland history and how manifold this landuse history was.





19th Conference of the International Workgroup for Palaeoethnobotany



List of presenting authors

Name	Company	Department	Country
Allaby Robin	University of Warwick	School of Life Sciences	United Kingdom
An Jingping	Kiel University (CAU)	Institute of Pre- and Protohistoric Archaeology	Germany
André Coralie	Ghent University	Geology	Belgium
Antolin Ferran	German Archaeological Institute	Department of Natural Sciences	Germany
Atanasoska Nevenka	Institute of Archaeology	Faculty of Philosophy, University of South Bohemia	Czech Republic
Attolini Davide	Laboratory of Environmental Archaeology and History (DAFIST- DISTAV), University of Genova	Department of Antiquities, Philosophy, History (DAFIST)	Italy
Bates Jennifer	Seoul National University	Department of Archaeology and Art History	Korea
Belli Chiara	University of Haifa	Zinman Institute of Archaeology	Israel
Bishop Rosie	Arkeologisk Museum	Universitetet i Stavanger	Norway
Bittmann Felix	Lower Saxony Institute for Historical Coastal Research	Natural Sciences	Germany
Bogaard Amy	University of Oxford	School of Archaeology	United Kingdom
Breglia Francesco	Università del Salento	Cultural Heritage Department	Italy
Brinkkemper Otto	Cultural Heritage Agency of the Netherlands	Landscape	Netherlands
Clò Eleonora	Laboratory of Palynology and Palaeobotany	Department of Life Science, University of Modena and Reggio Emilia	Italy
Dabrowski Vladimir	Muséum national d'Histoire naturelle / CNRS	UMR 7209 Archéozoologie et Archéobotanique: Sociétés, Pratiques et Environnements	France
Dal Martello Rita	Max Planck for the Science of Human History	Department of Archaeology	Germany
De Vareilles Anne	Historic England	Investigative Science	United Kingdom
Deckers Katleen	University of Tübingen	Institute for Archaeological Sciences	Germany
Dilkes-Hall India Ella	University of Western Australia	Archaeology, School of Social Sciences	Australia
Ergun Müge	University of Oxford	School of Archaeology	United Kingdom
Filipovic Dragana	Kiel University	Institute for Pre- and Protohistory	Germany
Fiorentino Girolamo	University of Salento	Department of Cultural Heritage	Italy
Florin Anna	St John's College	St John's College	United Kingdom
Follmann Franziska	DAI	Naturwissenschaftliches Referat	Germany
Fuks Daniel	University of Cambridge	McDonald Institute for Archaeological Research	United Kingdom
Fuller Dorian	University College London	Institute of Archaeology	United Kingdom
Garay-Vazquez Jose Juli	University College London	Institute of Archaeology	United Kingdom

Gleba Margarita	University of Padua	Department of Cultural Heritage	Italy
Godefroy Lou	Vrije Universiteit	Faculty of Humanities, Art, Culture, History and Antiquity	Netherlands
Hamza Nagmeldeen	Sapienza - University of Rome	Earth Sciences	Egypt
Henkel Carly	The Cyprus Institute	Science and Technology in Archaeology and Culture Research Center (STARC)	Cyprus
Herrero Otal Maria	Autonomous University of Barcelona (UAB)	Prehistory Department	Spain
Höhn Alexa	Goethe-Universität	Institut für Archäologische Wissenschaften, Archäologie und Archäobotanik Afrikas	Germany
Holguin Amy	Universty of Oxford	School of Archaeology	United Kingdom
Hovsepyan Roman	Institute of Archaeology and Ethnography	Research group of Archaeo- and Ethnobiology	Armenia
Iob Alice	CRAG - Centre for Research in Agricultural Genomics	Plant and Animal Genomics - Genomics of ancient crops and domestication	Spain
Jakobitsch Thorsten	Austrian Archaeological Institute/Austrian Academy of Sciences	Archaeological Sciences	Austria
Jeanty Angele	Institute for Evolutionary Sciences of Montpellier	Dynamics of Biodiversity, Anthro-po-ecology	France
Jiménez-Arteaga Carolin	Universitat Pompeu Fabra	Humanities	Spain
Karg Sabine	Free University of Berlin	Prehistoric Archaeology	Germany
Kay Andrea	Max Planck Institute for the Science of Human History	Archaeology	Germany
Kirleis Wiebke	Christian-Albrechts-University Kiel	Institute for Prehistoric and Protohistoric Archaeology	Germany
Klug Helmut W.	University of Graz	Centre for Information Modelling	Austria
Kubiak-Martens Lucy	BIAX Consult Biological Archaeology & Environmental Reconstruction	Biological Archaeology & Environmental Reconstruction	Netherlands
Langgut Dafna	Tel Aviv University	Archaeology	Israel
Le Moyne Charles	The University of Queensland	School of Social Sciences	Australia
Lopez Maria Laura	National Council for Scientific and Technical Research - National University of	Archaeology Div.	Argentina
Majerovičová Tereza	University of South Bohemia	Laboratory of Archaeobotany and Palaeoecology- Institute of Archaeology	Czech Republic
Malleson Claire	American University of Beirut	History and Archaeology	Lebanon
Maltas Tom	University of Vienna	Institute for Classical Archaeology	Austria

Martin Lucie	University of Geneva / University of Savoie Mont-Blanc	Laboratory of Prehistoric archaeology and anthropology / UMR 5204 EDYTEM	Switzerland
Martínez Varea Carmen	Universitat de València	Prehistòria, Arqueologia i Història Antiga	Spain
Masi Alessia	Sapienza University of Rome	Department of Environmental Biology	Italy
Mcclatchie Meriel	University College Dublin	School of Archaeology	Ireland
Mir-Makhamad Basira	Max Planck Institute for the Science of Human History	Archaeology	Germany
Motuzaitė Matuzevičiūtė	Vilnius University	Archaeology	Lithuania
Obradović Djurdja	Institute of Archaeology	Prehistoric department	Serbia
Out Welmoed	Moesgaard Museum	Department of Archaeological Science and Conservation	Denmark
Pokorná Adéla	Czech Academy of Sciences	Institute of Archaeology of the Czech Academy of Sciences, Prague	Czech Republic
Pokorný Petr	Charles University	Center for Theoretical Study (CTS)	Czech Republic
Preiss Sidonie	IRSNB	O.D. Earth and Life History	Belgium
Rahman Mizanur	University of Oxford	School of Archaeology	United Kingdom
Ros Jerome	CNRS	Institut des Sciences de l'Evolution de Montpellier	France
Rösch Manfred	Universität Heidelberg	Institut für Ur- und Frühgeschichte und vorderasiatische Archäologie	Germany
Rössner Corinna	Archäobotanik Labor Rössner	Universität Tübingen, Institute for archaeological sciences	Germany
Rousou Maria	UMR 7209: AASPE (MNHN-CNRS) / University of Cyprus	Homme et Environnement / History and Archaeology	France
Rowan Erica	Royal Holloway, University of London	Classics	United Kingdom
Šamajová Kateřina	Univerzita Palackého v Olomouci	Katedra asijských studií	Czech Republic
Smuk Ana	University of Groningen	Groningen Institute for Archaeology	Netherlands
Smykal Petr	Palacky University	Department of Botany	Czech Republic
Spate Michael	University of Sydney	Archaeology	Australia
Spengler Robert	Max Planck Institute for the Science of Human History	Department of Archaeology	Germany
Steiner Bigna L.	IPAS (Integrative Prehistory and Archeological Science)	Department of Environmental Sciences, University of Basel	Switzerland
Stevens Chris	University of Cambridge	Department of Archaeology	United Kingdom
Stika Hans-Peter	University of Hohenheim	Institute of Biology, Molecular Botany (190a)	Germany
Suomela Jenni	University of Helsinki	Department of Education / Craft Studies	Finland
Teira-Brión Andrés	University of Oxford	School of Archaeology	United Kingdom

Tengberg Margareta	Muséum national d'Histoire naturelle	UMR 7209, MNHN-CNRS	France
Tereso João	CIBIO, Research Center In Biodiversity and Genetic Resources, InBIO, Associate Lab	BIOPOLIS	Portugal
Tully Jane	The University of Texas at Austin	Classics	USA
Vandorpe Patricia	IPNA	Dep. Umweltwissenschaften	Switzerland
Vrydaghs Luc	Maritime Cultures Research Institute (MARI) - VUB	Department of Art Studies and Archaeology	Belgium
Weide Alexander	University of Oxford	School of Archaeology	United Kingdom
Whitlam Jade	n/a	School of Archaeology	United Kingdom
Wiethold Julian	Institut national de recherches archéologiques préventives (Inrap)	Inrap Grand Est, Laboratoire archéobotanique	France
Wu Rubi	University of Oxford	Institute of Archaeology	United Kingdom
Alday Camila	University of Cambridge	Archaeology	United Kingdom
Grasso Anna Maria	Università del Salento	Dipartimento di Beni Culturali	Italy
Kajale Mukund	K11 School of Fitness Sciences	Nutrition & Exercise Science	India
Livarda Alexandra	Catalan Institute of Classical Archaeology (ICAC)	Landscape Archaeology Research Group (GIAP)	Spain
Nasu Hiroo	Okayama University of Science	Center for Fundamental Education	Japan
Poschlod Peter	University of Regensburg	Ecology and Conservation Biology	Germany
Akashi Chie	Teikyo University	Institute of Cultural Properties	Japan
Alioune Deme	Université Cheikh Anta Diop	Department of History	Senegal
Alonso Natàlia	University of Lleida	History	Spain
Andonova Mila	Institute of Biodiversity and Ecosystem Research (Bulgarian Academy of Sciences)	Division of Palaeobotany and Palynology	Bulgaria
Aquaro Antonella	Deutsches Archäologisches Institut	Wissenschaftliche Abteilung der Zentrale	Germany
Arranz Otaegui Amaia	Consejo Superior de Investigaciones Científicas	Instituto de Historia	Spain
Außerlechner Marlies	University of Innsbruck	Department of Archaeologies	Austria
Ayipey Patricia	University of South Bohemia	Laboratory of Archaeobotany and Paleoecology	Czech Republic
Ballantyne Rachel	University of Oxford	School of Archaeology	United Kingdom
Baniou Theoni	Catalan Institute of Classical Archaeology (ICAC)	Landscape Archaeology Research Group (GIAP)	Spain
Begemann Lina	University of Regensburg	Faculty of Biology and Preclinical Medicine	Germany
Bellini Ginevra	Kiel University	Department of Geobotany, Institute for Ecosystem Research	Germany

Beneš Jaromír	University of South Bohemia	Laboratory of Archaeobotany and Palaeoecology	Czech Republic
Berihuete-Azorín Marian	Institut Català de Paleocologia Humana i Evolució Social	UCO Archaobotany	Spain
Bernardová Alexandra	University of South Bohemia in Ceske Budejovice	Faculty of Science	Czech Republic
Bianco Sabrina	Catalan Institute of Human Paleoeology and Social Evolution (IPHES-CERCA)	Archaeobotany	Spain
Billings Traci N	Max Planck for the Science of Human History	Archaeology Department	Germany
Bouby Laurent	ISEM Université Montpellier/CNRS/EPHE/IRD	ISEM	France
Bukovsky Ivo	University of South Bohemia in České Budějovice	Department of Computer Science	Czech Republic
Camagny Thomas	Université Côte d'Azur CNRS	CEPAM	France
Cano-Cano Nit	Catalan Institute of Human Paleoeology and Social Evolution (IPHES-CERCA)	Archaeobotany Unit	Spain
Capparelli Aylen	Facultad de Ciencias Naturales y Museo	División Arqueología	Argentina
Carmenati Riccardo	University of Macerata	Department of Humanities	Italy
Carra Marialetizia	Bologna University	Department of History and Cultures	Italy
Decaix Alexia	CNRS	UMR 7209 - Archaeozoology, archaeobotany : societies, practices and environments - MNHN-CNRS	France
Della Penna Valeria	Università di Foggia - Università del Salento	Dipartimento di Studi Umanistici - Laboratorio di Archeobotanica e Paleoeologia, Dipartimento di Beni Culturali	Italy
Den Hollander Anna	University College London	Institute of Archaeology	United Kingdom
Diffey Charlotte	University of Oxford	School of Archaeology	United Kingdom
Douche Caroline	University of Oxford	Institute of Archaeology	United Kingdom
Fanta Václav	Czech University of Life Sciences Prague	Faculty of Environmental Sciences	Czech Republic
Farr Jeremy	University of Queensland	School of Social Science	Australia
Filatova Sofia	University of Groningen	Groningen Institute of Archaeology	Netherlands
Fiorotto Celeste	University of Verona	Cultures and Civilisations	Italy
Forti Alessandra	Università Ca' Foscari	Dipartimento di Studi Umanistici	Italy
Garay Palacios Blanca	Universitat Autònoma de Barcelona	Department of Prehistory	Spain
Gaveriaux Fanny	Sapienza University of Rome	Earth Sciences	Italy
Gesset Ludovic	University of Basel	IPNA	Switzerland

Golea Mihaela	Institute of Archaeology `Vasile Pârvan`, Bucharest, Romania	Bioarchaeology	Romania
Gomes Justine	University Paul Valéry	Doctoral student, UMR5140 "ASM"	France
Grabowski Radoslaw	BIAx	BIAx	Netherlands
Hájková Petra	Academy of Sciences of the Czech Republic	Department of Paleoecology, Institute of Botany	Czech Republic
Hajnalová Mária	Constantine the Philosopher University	Department of Archaeology	Slovakia
Hamdeen Hamad Mohar	University of Al Neelían	Department of Archaeology	Sudan
Hammers Neeke	ADC ArcheoProjecten	Landschapsarcheologie	Netherlands
Harding Makayla	The University of Queensland	School of Social Science	Australia
Henriksen Peter Steen	Nationalmuseet	Environmental Archaeology and Materials Science	Denmark
Hiltscher Tomáš	Prácheňské muzeum in Písek	Archeology	Czech Republic
Hiraoka Nodoka	Okayama University of Science	Graduate School of Biosphere-Geosphere Science	Japan
Hondelink Merit	Groningen University	Archaeology	Netherlands
Hošková Kristýna	Faculty of Sciences, Charles University in Prague, Benátská,2, CZ-128 01 Praha 2, Czech Republic	Department of Botany	Czech Republic
Hristova Ivanka	Umeå university	Department of Historical, Philosophical and Religious studies	Sweden
Izak Jessica	University of Basel	Altertumswissenschaften	Switzerland
Jensen Peter Mose	Moesgaard Museum	Department of Archaeological Science and Conservation	Denmark
Kapcia Magda	W. Szafer Institute of Botany, Polish Academy of Science, Kraków, Poland	Palaeobotany and Palaeoenvironment Group	Poland
Kempf Ella	Muséum national d'Histoire naturelle	UMR 7209	France
Kriti Alexandra	Institut Catala d' Archaeologia Classica	Landscape Archaeology Research Group	Spain
Li Melody	University of Oxford	Institute of Archaeology	United Kingdom
Lindemann Hannah	Goethe University Frankfurt	Archaeology, Archaeobotany Lab	Germany
Lityńska-Zajac Maria	Polish Academy of Sciences	Institute of Archaeology and Ethnology	Poland
Lopez-Doriga Ines	Wessex Archaeology	Environmental Archaeology	United Kingdom
Madani Ikrama	Khartoum University	Department of Botany	Sudan
Manka Idrissa	UNIVERSITE CHEIKH ANTA DIOP DE DAKAR, FLSH	HISTOIRE	Senegal
Marinova Elena	Baden-Württemberg State Office for Cultural Heritage	Laboratory for Archaeobotany	Germany
Matheson Elise	University of Kent	School of Anthropology and Conservation	United Kingdom

Minervini Ignazio	LAP - Laboratory of Archaeobotany and Palaeoecology - University of Salento	Department of Cultural Heritage	Italy
Montes Moya Eva María	University of Jaén	University Research Institute for Iberian Archaeology	Spain
Moravcová Alice	Institute of Archaeology of the CAS, Prague	Department of Information Sources and Landscape Archaeology	Czech Republic
Moricca Claudia	Sapienza University of Rome	Department "Italian Institute of Oriental Studies – ISO"	Italy
Moskal-Dei Hoyo Magda	W. Szafer Institute of Botany, Polish Academy of Sciences	Palaeobotany and Palaeoenvironment Group	Poland
Mosulishvili Marine	Iliia State University	Institute of Ecology	Georgia
Mueller-Bieniek Aldona	Faculty of Archaeology, University of Warsaw	Department of Bioarchaeology	Poland
Noshiro Shuichi	Meiji University	Center for Obsidian and Lithic Studies	Japan
Novák Jan	Faculty of Sciences, Charles University in Prague, Benátská,2, CZ-128 01 Praha 2, Czech Republic	Department of Botany	Czech Republic
Oelbüttel Merle	Christian-Albrechts-Universität	Institut für Ur- und Frühgeschichte	Germany
Oliveira Hugo	University of Algarve	Interdisciplinary Center for Archaeology and Evolution of Human Behaviour (ICArEHB)	Portugal
Pashkevich Galina	independent scientist	N/A	Ukraine
Pérez Jordà Guillem	Universitat de València	Departamento de Prehistoria, Arqueología e Historia Antigua	Spain
Ponomarenko Elena			Canada
Porta Marianna	University of Salento	Cultural Heritage	Italy
Prach Jindřich	Charles University	Center for Theoretical Study, Charles University and the Czech Academy of Sciences	Czech Republic
Proserpio Barbara	Laboratorio di Archeobiologia dei Musei Civici di Como	Musei Civici di Como	Italy
Ptáková Michaela	University of South Bohemia	Laboratory of Archaeobotany and Palaeoecology	Czech Republic
Ranum Caleb	University of Alabama	Department of Anthropology	USA
Reed Kelly	Oxford Brookes University	School of Architecture	United Kingdom
Roushannafas Tina	University of Oxford	Institute of Archaeology	United Kingdom
Rühl Lisa	Goethe University Frankfurt	Dpt. of Archaeological Sciences; Institute of Pre- and Early History; Archaeobotany of Europe and Western Asia	Germany
Rusishvili Nana	Georgian National Museum	Palaeoanthropology and Palaeobiology Research Institute of Georgian National Museum	Georgia

Ryabogina Natalia	Tyumen Scientific Centre SB RAS	Institute of problems of Northern Development	Russian Federation
Sabanov Amalia	Faculty of Philosophy, University of Belgrade	Archaeology, Laboratory for Bioarchaeology	Serbia
Sabato Diego	Universitat de València	Departamento de Prehistoria, Arqueología e Historia Antigua	Spain
Saeidi Ghavi Andam Sarz	Baden-Württemberg State Office for Cultural Heritage, Regierungspräsidium Stuttgart	Archaeobotany	Germany
Salavert Aurélie	MNHN-CNRS	UMR7209 AASPE (MNHN-CNRS)	France
Šálková Tereza	University of South Bohemia	Institute of Archaeology	Czech Republic
Salova Yulia	Tyumen Scientific Centre SB RAS, IPOS, 86 Malygina str., Tyumen 625026, Russia	Department of Archaeological and Environmental Reconstructions	Russian Federation
Sarpaki Anaya	retired	Independent Scholar	Greece
Sasaki Yuka	Kanazawa University	Center for the Study of Ancient Civilizations and Cultural Resources	Japan
Schepers Mans	University of Groningen	Centre for Landscape Studies	Netherlands
Seabra Luís	CIBIO, Research Center In Biodiversity and Genetic Resources, InBIO Associate La	BIOPOLIS Program in Genomics, Biodiversity and Land Planning	Portugal
Sergusheva Elena	Institute of History, Archaeology and Ethnology of the Far Eastern Branch of the Russian Academy of Sciences	Prehistoric Archaeology Department	Russian Federation
Šída Petr	Univerzita Hradec Králové	Department of archaeology	Czech Republic
Šitnerová Ivana	University of South Bohemia	Laboratory of Archaeobotany and Palaeoecology	Czech Republic
Skružná Jarmila	Laboratory of Archaeobotany and Palaeoecology	Faculty of Science, University of South Bohemia	Czech Republic
Speciale Claudia	University of Gothenburg	Historical Studies	Sweden
Speleers Lien	Royal Belgian Institute of Natural Sciences	OD Earth and History of Life	Belgium
Tang Li	Max Planck Institute for the Science of Human History	Department of Archaeology	Germany
Tarongi Miguel	Universitat de Lleida	Departament d'Història	Spain
Testé Marc	UMR.7130 - Laboratoire d'Anthropologie Sociale	École des Hautes Études en Sciences Sociales	France
Tsirsi Kyriaki	The Cyprus Institute	STARC	Cyprus
Ucchesu Mariano	ISEM, Université Montpellier, CNRS, IRD, EPHE	Institut des Sciences de l'Évolution (ISEM)	France
van Beurden Liesbeth	BIAX Consult	Archaeobotany	Netherlands
Van Der Meer Wouter	BIAX Consult	Archaeobotany	Netherlands
Vermeeren Caroline	BIAX Consult	Archaeobotany	Netherlands

Vignola Cristiano	Sapienza University of Rome	Environmental Biology	Italy
Vobejda Libor	Faculty of Arts, University of South Bohemia in České Budějovice	Institute of Archaeology	Czech Republic
Von Baeyer Madelynn	Max Planck Institute for the Science of Human History	Archaeology	Germany
Zach Barbara	Archaeobotanik Labor Zach	Leitung	Germany
Zappa Jessica	Università degli Studi di Modena e Reggio Emilia	Dipartimento Scienze della Vita	Italy
Zerl Tanja	University of Cologne	Department of Prehistoric Archaeology/Lab of Archaeobotany	Germany



19th Conference of the International Workgroup for
Palaeoethnobotany Abstract Book

ISBN 978-80-7394-937-2



9 788073 949372
