Session 3
INTEGRATED AND INTERDISCIPLINARY APPROACHES

Talks

ETHNOARCHAEOLOGY OF AGROECOLOGICAL FARMING SYSTEMS IN THE EQUATORIAL ANDES: FROM THE SYSTEMIC CONTEXT OF AGROBIODIVERSITY TO THE FORMATION OF ARCHEOBOTANICAL CARPOLOGICAL CONTEXTS

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This investigation discusses original information on the ethnoarchaeology of agro-ecological farming systems in the community of Nizag, located in the Andes of Ecuador. Suggesting hypotheses for the interpretation of archaeo-botanical record, on how Andean Kichwas societies are organized for the management of their subsistence vegetable economy. The research shows the probability of identifying certain cropping systems and agroecological practices, based on the biostatistical analysis of the taxonomic composition of carpological assemblages. It also shows how these Andean societies have developed a model of "agro-ecological diversification" for the management of their subsistence vegetable economy, in which the production of their crops goes beyond agriculture and the domestication of plants, because societies appropriate their agrobiodiversity according to the realities of their own needs, in addition to the regularities that these exercise over contingencies socio-ecological materialized in its agrarian landscape.

Key-words: Ethnoarchaeology, farming systems, ethno-archaeobotany, Andean agriculture, carpology

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ARCHAEOBOTANY OF BASKETS OF SOUTH-EAST EUROPE?

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This presentation aims at proposing a new methodology that will help identify and analyse archaeobotanical remains of archaeological basketry. The study includes three case studies on archaeobotanical remains from basketry, originating from three archaeological sites of South-east Europe

(located in present Bulgaria, the Greek-Bulgarian border and Greece) with main phases dated during the Late Neolithic, Late Bronze Age and Late Iron Age and with three different stages of preservation – desiccated, charred and mineralised. The proposed approach challenges the classical tools of the archaeobotanical sub-disciplines, such as anthracology, when we are dealing with minimalistic sample size and extremely brittle material. Firsts a set of diagnostic tools are provided, aiming at a non-destructive approach and better sample-understanding, but also at approving successful experimental approaches, such as contemporary x-ray techniques and advanced visualisation. The diagnostics and analysis of the archaeological basketry are then compared with existing and primary ethno-botanical observations, dedicated to the studied regions. At this study, archaeobotany, state-of-art technology and ethnography are interwoven into an attempt to create a universal and versatile approach towards the identification and srudy of botanical remains of ancient basketry, aiming at providing further insights into the diagnostics and analysis of plant remains subject to human choice into the past societies.

Key-words: Archaeobotany, Baskets, Prehistory, Integrated Approach

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DISTINGUISHING RIPE SPELT FROM PROCESSED GREEN SPELT (*GRÜNKERN*): METHODOLOGICAL ASPECTS AND THE CASE OF HOCHDORF (VAIHINGEN A.D. ENZ, GERMANY)

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During the last decades, experimental archaeology has developed as a reliable tool to understand and interpret archaeological data. In archaeobotany, an important part of this experimentation consists of the creation of charred material comparable to archaeological specimens, in order to better understand which taphonomic and/or anthropogenic processes they suffered. Charring is the most common preservation state of plant remains at archaeological sites and in order to generate comparison material, it is necessary to follow a proper laboratory protocol. In our work, physical changes in ripe spelt (*Triticum spelta* L.) and *Grünkern* grains have been recorded and compared. The generation of reference material by the present experiments, undertaken under the framework of the ERC project PLANTCULT, aims a) to be widely used in routine archaebotanical identification practice and b) to explore a specific, well preserved assemblage from the Celtic Iron Age site Hochdorf (Germany) to evaluate the grain treatment in the past, as part of a special culinary preference.

Key-words: Spelt, Grünkern, Methods, Iron Age, Hochdorf

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NUTS ABOUT THE MESOLITHIC? EXPERIMENTAL AND ARCHAEOLOGICAL INSIGHTS INTO HAZELNUT TAPHONOMY

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Deposits of charred hazelnut shell are frequently recovered from European sites of Mesolithic and Neolithic date, but the taphonomy of hazelnut shell in the archaeological record is little understood. There are two main types of charred hazelnut assemblages in the archaeological record: high density nutshell deposits and low frequency nutshell finds. It is commonly assumed that high density nutshell deposits derive from roasting pit accidents and that low frequency finds derive from discarded waste material after the nuts have been consumed raw. This paper will explore the taphonomy of hazelnuts on archaeological sites using a series of hearth experiments to explore the parameters effecting the survival and preservation of hazelnuts in the archaeological record. The results will be compared to case-studies of hazelnut shell recovered from Mesolithic sites to explore whether hazelnut roasting can be recognised in the archaeological record from the fragmentation and preservation of the nutshell.

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PASTORAL ECONOMIES IN THE OLD WORLD TROPICS AND MILLET EXPLOITATION

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Millets, a large group of small-seeded cereals from twelve genera of two sub-families of C4 grasses, are commonly cultivated by nomadic pastoral societies, particularly in the tropics. These grains are highly tolerant to drought conditions and they can be productive with low levels of management, ideally suited to mobile populations. Archaeologically, it appears the wild progenitors of *Sorghum bicolor, Pennisetum glacum* and *Eleusine coracana* were all cultivated and in some cases may have been domesticated by herding populations. In this broader region, pastoralism often preceded crop agriculture sometimes by millennia, and millet exploitation and in some cases, cultivation may represent a common stage in later transitions to mixed economies. Eurasian and African millet domestication histories are complex, sometimes involving translocations, and often they are among the first adopted crops by pastoralists even in cases where a tradition of wild millet cultivation is absent. This paper attempts to define the strength of the correlation between millet exploitation and animal husbandry by using statistical analyses on an accumulated comparative dataset of ethnographic case studies and archaeobotanical assemblages.

Key-words: Pastoralism, Millets, Cultivation, Domestication, Tropics

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TRACKING THE HISTORY OF CULTIVATED GRAPES (*VITIS VINIFERA*) IN GEORGIA COMBINING ARCHAEOBOTANY, GEOMETRIC MORPHOMETRICS AND ANCIENT DNA

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The Near East and the Caucasus are commonly regarded as the original domestication centre of grapevine. Georgia is home to a high diversity of wild and cultivated grapevines. The earliest chemical evidence for wine making was recorded in Georgian Neolithic sites (6000-5800 BC). It is however unclear whether early wine was made from wild or cultivated grapevine and when domesticated grapes first appeared.
We systematically investigated charred and uncharred grape pip samples from Georgian archaeological sites. Their chronology was thoroughly assessed by direct radiocarbon dating. More than 450 seeds from 12 sites, from the Early Bronze Age to Modern times, were selected for Geometric Morphometric studies. The shape of ancient seeds was compared to hundreds of modern wild individuals and cultivated varieties. Ancient DNA was isolated from individual uncarbonized seeds and converted to Illumina libraries for Next Generation Sequencing.
The domesticated seed morphotype is identified from the Iron Age (8th-6th c BC) onwards and is generally predominating in the samples. A strong diversity of domesticated shapes is regularly identified in the samples. Most are close to modern cultivars from the Caucasian and Aegean areas, which suggests that the modern local diversity is deeply rooted in the early times of viticulture. DNA was successfully recovered from historic pips and genome-wide analyses found these specimens were closely related to modern Georgian cultivars.

Key-words: Viticulture, Domestication, Diversity, Outline analysis, Palaeogenomics

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ANCIENT STARCH ANALYSIS AT NEOLITHIC BONCUKLU

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The spread of agriculture beyond the Fertile Crescent is variably attributed to the colonization of new regions by established farmers or adoption by local foragers. The data from Boncuklu, Central Turkey suggests that the latter was the case for the Konya Plain, where herding and cultivation was practiced by indigenous Anatolians by 8300 Cal BC. This is of greater interest as material culture continuities and DNA evidence shows that Boncuklu is a direct antecedent of Çatalhöyük, an early agricultural city. Cultivation is evident at Boncuklu based on examples of domesticated glume

wheats and legumes. Foraged plants such as nut shell and tuber are also present, however, tuberous bulrush (Bolboschoenus glaucus) cannot be definitively linked to subsistence, with use for fuel another explanation. Cultivated crops make up a small portion of the archaeological record of Boncuklu, as do domestic animals, signifying low-level food production which existed for c. 500 yearsup to 7800 Cal. BC. To understand this regime in more detail, contexts directly related to diet must be analysed. Analysis of microfossils in dental calculus has come to prominence as a valuable source of data in recent decades and this is combined here with analysis of human coprolites and grindstone residues to gain a full picture of the plant food economy of a village experiencing the transition to agriculture. The first results of this study based on one season of samples will be reported at IWGP 2019.

Key-words: Konya Plain, Anatolia, Cultivation, Ancient Starch, Phytoliths

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THE INVISIBLE FRUITS: THE PRESENCE OF FRUIT AND NUT TREES IN CHINESE NEOLITHIC SITES AS IDENTIFIED FROM ANTHRACOLOGY

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Although archaeobotanical research in China is seeing ever-increasing interest, identifications of fruit and nuts in archaeobotanical assemblages remain scarce. Wood charcoal is another proxy for detecting the presence of fruit-bearing trees. Moreover, wood charcoal can provide data on wood selection and tree management practices. Unfortunately, anthracology in China has so far seen very limited application and interest especially from international researchers. This study aims to bridge that gap, by creating a database resource for Chinese wood-charcoal identification and then applying it in selected case studies. Preliminary data from Neolithic sites in Shanxi province show a surprising variety of fruit bearing taxa which were not noted in the corresponding archaeobotanical assemblages. This paints a new picture not just of the surrounding landscape but also of the possible diet, highlighting the importance of including anthracological data in archaeobotanical reconstructions.

Key-words: Anthracology, fruit trees, nut trees, wood anatomy, Chinese Neolithic

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USING EXPERIMENTAL ARCHAEOLOGY TO UNDERSTAND THE ARCHAEOBOTANICAL RECORD: A MULTI-PROXY INVESTIGATION OF MID-HOLOCENE FRUIT PROCESSING IN GOONIYANDI COUNTRY, NORTHWEST AUSTRALIA

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The most common macrobotanical type recovered from archaeological sites in the Kimberley region of northwest Western Australia are remains of *Vitex glabrata* R. Br. (Lamiaceae). *Vitex glabrata* is a large woody fruiting tree endemic to Australia's tropical north that produces sweet, fleshy drupaceous fruits. Fruiting of this species is restricted to the last months of the wet season (December-February) and during this period fruits are produced in great abundance. Historic records document that surplus fruits were managed by Aboriginal groups by drying and pounding

whole fruits into cakes for storage and transport, but these records lack exact details of the steps involved in the post-harvest processing sequence. To gain a deeper understanding of the economic use of *V. glabrata* and to help interpret fruit processing in archaeobotanical archives, collaborative ethnobotanical survey and experimental studies were conducted with Gooniyandi traditional owners. Experimental materials were then compared with archaeological specimens recovered from Riwi, an archaeological site located on Gooniyandi ancestral lands. We conclude that fruit processing using similar techniques as those used today is clearly discernible in Riwi's mid-Holocene record documenting a 7,000 year old tradition of fruit processing.

Key-words: Vitex glabrata, fruit processing, macrobotanical remains, Palaeoethnobotany, Australian archaeobotany

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DUNG IN THE DUMPS: A COMPARATIVE STUDY OF SEEDS, PHYTOLITHS AND POLLEN IN DUNG PELLETS AND REFUSE DEPOSITS AT EARLY ISLAMIC SHIVTA, NEGEV, ISRAEL

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We present a systematic methodological comparison of three archaeobotanical proxies: seeds, pollen and phytoliths. These were applied to an assemblage of dung pellets and corresponding archaeological refuse sediments from Early Islamic Shivta (6th-9th c. CE) in Israel's Negev desert. Our research goals were to:
1) evaluate strengths, weaknesses and compatibility of the three methods regarding archaeobotanical interpretations of dung;
2) infer on-site herding practices; and
3) assess the relative input of botanical remains from dung in archaeological refuse assemblages.
Methodologically, we attain incomplete reconstructions from each individual method, with each proxy possessing its own advantages and limitations. However, using the combined approach we were able to distinguish between autumn-winter grazing without foddering, and late-spring grazing supplemented by domestic cereal chaff/hay. In addition, our combined results demonstrate that Shivta's Early Islamic refuse middens are only partially composed of dung remains and originated primarily from domestic trash.
This study's significance lies both in its methodological contribution to archaeobotany, and in lasting discussions regarding the influence of dung remains on the composition of archaeological deposits. We offer a rigorous method for determining whether deposits derive from dung alone, contain no dung, or are mixed. This has important ramifications for archaeological interpretation, generally.

Key-words: multiple-proxy method, dung, seeds, phytoliths, pollen, Early Islamic, Shivta

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THE HISTORY OF BARLEY CULTIVATION IN THE CANARY ISLANDS AS TOLD BY ANCIENT AND EXTANT DNA

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The Canary Islands were settled in the first millennium AD and the settlers developed a farming economy with barley as the main crop. Archaeological evidence suggests the islands then remained isolated until the 15th century. On Gran Canaria, harvests were stored in grain silos excavated from the volcanic rock. The practice of using silos for long-term grain storage was abandoned shortly after the Hispanic conquest, but the exceptional preservation capabilities mean archaeological grains can be analysed genetically.
We have analysed archaeological barley seeds and compared them with extant landrace barley from the Canary Islands and the Western Mediterranean. The results show that, although the human genepool has been almost completely replaced, Canarian farmers have stayed true to the local barley for millennia and still cultivate the same landraces as in pre-Hispanic times. Comparisons with mainland barley support original colonization from present day Morocco. Extant Moroccan barley has, however, probably not descended from the barley from which Canarian settlers brought their seed. The results support pre-Hispanic barley cultivation on Lanzarote, in spite of an absence of archaeological findings. The study thus illustrates how archaeological and genetic analyses can complement each other to increase our understanding of past human practices.

Key-words: Canary Islands, barley, agriculture, aDNA, genetic analyses

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INTERWOVEN – ARCHAEOLOGY, BOTANY AND THE TECHNICAL KNOW-HOW OF PRODUCING PLANT FIBRES IN THE NEOLITHIC

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Numerous objects were made of plant fibres in the past: strings, ropes, containers, nets, sails, clothes etc. The amount of raw material that was needed for the production of these objects is enormous and very labour intensive. What about the consequences of the withdrawals of raw materials from nature and the environmental impact of the cultivation and processing of textile plants? Can this impact be recognised in pollen diagrams and/or extrapolated by calculating the dimension of former textile crop cultivation?
Textile tools are frequently excavated at archaeological excavations but not always recognised as those. All kinds of combs are interpreted as hackles that were used for wool and/or plant fibre processing. In order to shed light on the efficiency of these objects, we performed experiments with reconstructed combs. The help of different tools or even without any tools can produce threads made of plant fibres. By using a wooden hook or a spinning whorl spliced threads can be plied into extremely strong and tear-resistant yarn. Evidence from the excellent preserved Neolithic lake dwellings sites in the Alpine area shows that yarn was even produced from tree bast in such a

technique.
By combining the results from archaeobotanical textile plant analyses, the products that were made of the different raw materials, and the textile tools that were used, we could show that Neolithic textile producing techniques and the preferred materials were closely tied and connected to specific cultural traditions.

Key-word: Neolithic, Central Europe, textile production, human impact

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PHYTOLITHS AS INDICATORS OF IRRIGATION ACROSS ASIA. PAPER IN MEMORY OF DR ALISON WEISSKOPF

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Phytoliths are useful plant microfossils, especially for the identification of taxa that are not preserved in the macrobotanical record. Their role as palaeoenvironmental proxies is also increasingly recognised. This paper presents the results of extensive research into the use of phytoliths to identify rice cultivation systems in Asia. Data from 20 sites from China, Southeast Asia and South Asia has been examined in order to try and pinpoint when irrigated deep water rice fields developed. This phytolith data has been correlated with macrobotanical wild-weed data and climate indices, highlighting the strengths and weaknesses of the phytolith approach.
This talk is in memory of Dr Alison Weisskopf, who collected most of the data in this talk and sadly passed away in January 2018. Alison was one of the key figures in developing the use of phytoliths as indicators of ancient field ecology in Neolithic China and her work has been highly influential to those studying the development of agricultural irrigation and social complexity in the prehistoric Yangtze.

Key-words: Phytoliths, India, China, Southeast Asia, Irrigation

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USE OF DENTAL CALCULUS TO DISCERN PLANT USE AMONGST PASTORALISTS FROM KADRUKA 1 AND 21, SUDAN

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Saharan pastoral communities migrated toward the Nile River valley in response to increasing environmental deterioration from 7,300 BP onwards. Predictable water availability and fertile soils were conducive to herding practices during the Neolithic (7,000 – 5,000 BP) and Kerma (4,500 – 3,000 BP) periods, however, the ephemeral nature of pastoral habitation sites limits our understanding of dietary breadth and interaction with local vegetation. The analysis of plant

microfossils embedded within dental calculus recovered from pastoral cemetery sites can provide a primary source of data documenting changes in the range of plants utilised over time. The calculus results of 73 individuals from the Neolithic and Kerma period sites Kadruka 1 and Kadruka 21, northern Dongola Reach, Sudan, will be presented here.

Key-words: Neolithic, Kerma, Calculus, Plant Use

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FOODWAYS, PLANT AND LANDSCAPE MANAGEMENT IN MINOAN CRETE: PALAIKASTRO IN CONTEXT

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Agricultural surplus production and subsistence economy have been at the core of the debates on the development of social complexity in Minoan society. However, primary archaeobotanical and bioarchaeological data in general have not contributed substantially to these debates so far, while landscape surveys have focused in their vast majority on the location of sites. A new research programme, PALAP, that started in 2011 and focussed on the Bronze Age town at Palaikastro and its surrounding territory, in east Crete, has provided new insights into these issues and human-landscape interactions. The project included for the first time in Crete systematic sampling of all excavated units, and allowed an examination of both presence and absence of archaeobotanical and all other bioarchaeological remains. More importantly, it combined this on-site sampling with targeted paleoenvironmental and geoarchaeological coring around the town, and landscape survey designed specifically to investigate plant and animal resource management. This holistic approach that we have termed inside-out and outside-in has provided unique insights into socio-economic organisation of this Bronze Age society. Our results showed an integrated farming and tree tending system alongside diverse strategies of resource management, that were rooted in the history of the area's cultural landscape, and conditioned the town's position in broader economic networks and ultimately the demise of the town itself.

Key-words: Farming, tree-tending, resource management, Bronze Age, Crete

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INVESTIGATING PLACES OF ASSEMBLY IN LATER PREHISTORIC IRELAND THROUGH ISOTOPIC ANALYSIS OF CHARRED CEREAL GRAINS

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This paper presents results from the first-ever Irish study of ancient farming practices based upon isotope analysis of plant remains. It is anticipated that this approach will enable ground-breaking discoveries into how people farmed in the past and how food supplies were amassed. The paper reveals results from analysis of charred cereal grains from the hillfort at Haughey's Fort, Co. Armagh. Haughey's Fort is one of the largest hillforts in Ireland, dating to the Late Bronze Age (c. 1200-700 BC). Excavations revealed the presence of thousands of cereal grains, found mainly in pits (McClatchie 2014). Analysis of charred arable weeds suggests the crops were harvested from a variety of environments or farms, perhaps representing the labours of different communities and signalling the bringing together of crops to a centralised location. Isotope analysis of cereal grains was undertaken to test this hypothesis, focusing on Nitrogen and Carbon (13C and 15N) isotopes. 13C and 15N isotope analyses are often undertaken on human bone in Archaeology to provide insights into dietary choices. In recent years, researchers have begun to undertake analysis of archaeological plant remains, such as charred cereals, to identify farming practices, including intensity of farming, manuring and irrigation (Bogaard *et al.* 2016). Isotope analysis of the Haughey's Fort material provides a new approach to detecting differing management practices and identifying places of assembly.

Key-words: Bronze Age, Isotope, Ireland, Cereal, Storage

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HUMANS IN THE ENVIRONMENT: PLANTS AND LANDSCAPES IN MESOLITHIC IN THE PALIWODZIZNA (DOBRZYŃ LAKELAND, NORTHERN POLAND)

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At the site 29 in Paliwodzizna the unique Mesolithic stone structures were discovered. Archaeological survey indicates that some of them could have a ritual origin or was a part of wood tar pits complex. The main purpose of multifaceted project connected with this site (NCN 2016 23 B HS3 00689) is the recognition of the scope of human activity and the comprehensive reconstruction of the natural environment in the vicinity of camp.
Botanical analyses concerned materials obtained from the Mesolithic camp complex, area of former lake (currently peatbog) and between the camp and the paleolake borderline. In the features of the camp complex plant macroremains (seeds, fruits, charcoal), which indicate the presence and

activity of human beings, were identified. Most of all these were fruits of *Chenopodium album* with traces of burning. Materials (pollen, plant macroremains, charcoals) from the trench on the paleolake borderline (fire stratification, numerous flint artefacts) showed the presence of well-preserved plant remains. This allows to trace the intensity of environmental changes during the functioning of Mesolithic camp and enables correlation with results from the core of the peatbog. Palynological data from the peatbog show plant succession from the Late Glacial to Mesoholocene. In the part from Eoholocene the *Urtica* show the presence of nitrophilous plant communities visited by animals and humans as well. During the same period, traces of burning rushes were noted.

Key-words: archaeobotany, paleoecology, Mesolithic camp complex

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PREHISTORIC PIGMENT PRODUCTION AT RAPA NUI (1200-1650 AD)

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Since 2007, the German Archaeological Institute and Kiel University have undertaken archaeological excavations on Rapa Nui (Easter Island, Chile). Excavations in 2011 and 2014 revealed pits at various locations on the island that contained alternating thin layers of reddish iron oxide, phytoliths and charred material, representing a new type of archaeological feature that had not been observed on the island before. 14C-dating, geochemical analysis, phytolith analysis and diatom analysis have been applied to date some of these pits and to understand their function and formation. The results shed new light on the use of geogenic material and plants for ochre production, performed at industrial scale. The phytolith and diatom analyses resulted in revision of the initial hypothesis about the type of environment where the plant material originated from.

Key-words: Rapa Nui, Prehistoric pigments

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IMMIGRATION HISTORY OF SYNANTHROPIC FLORA IN CENTRAL EUROPE. IMPLICATION FOR BETTER UNDERSTANDING OF CHANGES IN AGRICULTURAL SYSTEMS

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The diversity of synanthropic flora observed in archaeobotanical data increases over time, which is a result of several interrelated processes, taking place between the Neolithic and the Modern

Period, mainly: (I) technological progress in agriculture and increasing range of crops cultivated; (II) increasing complexity of cultural landscapes; (III) immigration of alien plants. Our aim was to gain a better insight into the basic trends of archaeophytic migrations in central Europe from the Neolithic to the Medieval Period. We summarised data on macroremains from the Archaeobotanical Database of the Czech Republic, as well as data from other European countries published in international journals and monographs. In some cases we were able to identify groups of species with characteristic migration directions (e.g., *Adonis aestivalis* and *Asperula arvensis* came from the west, *Fumaria officinalis* and *Silene latifolia* from the east). Still, we need to further test these preliminary results using more robust data.
Analysis of the weed seeds accompanying ancient crop remains is generally used for the reconstruction of ancient crop cultivation practices. However, we demonstrate here that the migrations of diagnostic species followed various patterns, which differed between territories. We need to keep in mind that although the presence of a species is conditioned by the existence of suitable biotopes, there are still other important factors (like propagule pressure and competition).

Key-words: Archaeobotany, Central Europe, Database, Species migrations, Synanthropic flora

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EATING IN THE ITALIAN COUNTRYSIDE: A RECONSIDERATION OF ROMAN LITERARY SOURCES IN LIGHT OF THE ARCHAEOBOTANICAL EVIDENCE FROM RURAL SITES IN ITALY

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In Roman literature the countryside is often presented as an idyllic place whereby one can reconnect with traditional Roman values and practice dietary self-sufficiency. The agronomists (Cato, Columella,Varro) emphasize the importance of producing a wide range of agricultural goods on both a farm and at a villa. In recent years there has been an increase in the archaeobotanical sampling of material from rural farms and villa sites in Italy including the Roman Peasant Project. In light of this growing body of evidence, we are now in a position to reconsider agrarian ideologies and notions of self-sufficiency as they are presented in the ancient texts. Taking an interdisciplinary approach, the paper will begin with a brief overview of the literary evidence. The paper will then look at the archaeobotanical evidence for the production and consumption of foodstuffs at rural sites throughout Italy, presenting new carbonized assemblages from the Republican to mid-Imperial Villa of Vacone (Lazio) and the late Samnite to early Imperial period site of Matrice in the Molise. Vacone's importation of cereals and Matrice's questionable status as a villa challenge long held assumptions regarding villa life in Italy and force us to reflect upon the diversity of rural foodways.

Key-words: Roman, Italy, rural, literature, Molise

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PLANT FOODWAYS AT ÇATALHÖYÜK – A MULTI-PROXY PERSPECTIVE

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The exceptional level of preservation of macrobotanical remains at Çatalhöyük has allowed to expose the complexity of plants processing activities, consumption, and other uses at the site. However, there are different aspect related to plant foods preparation that cannot be evidenced on the macrobotanical record. In order to address this problem, starch and phytoliths analyses were performed on grinding stones coming from the Middle Neolithic level at Çatalhöyük. This study manifests the potential of the combination of macro-remains together with starch and phytolith analyses to investigate how food processing practices can be identified and understood using a multi-proxy approach. Furthermore, phytoliths and starch allow identifying other edible plants that normally do not survive as charred remains in the archaeological record. Therefore, the results of this approach allowed us to provide a dynamic image of the past foodways and the different steps involved in food processing practices at Çatalhöyük.

Key-words: Food, culinary practices, starch grains, phytoliths, Near East, Neolithic

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INVESTIGATING THE EMERGENCE OF EARLY MEDIEVAL ENGLISH OPEN FIELD AGRICULTURE USING CROP STABLE ISOTOPES AND FUNCTIONAL WEED ECOLOGY

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During the 8th to 13th centuries AD a major expansion in arable cereal farming occurred in parts of England and Europe, developing into open field agriculture. Three key innovations allowed for the dramatic increase in cereal production during the early medieval period: three-field crop rotation, the spread of the mouldboard plough and the extensification of cultivation. Yet the critical questions of when, where and how these innovations developed remain unanswered despite decades of historical research. This presentation will explore for the first time the possibilities of detecting crop husbandry regimes shifts though stable carbon and nitrogen crop isotopes and functional weed ecology.
Stable carbon and nitrogen isotopes from crop remains provide information on arable soil conditions (soil N and moisture availability), allowing inferences regarding the 'compatibility' of crops potentially grown in rotation. Such evidence is complemented by functional weed ecology which provides an indication of the intensity of cultivation (soil fertility and mechanical disturbance). This paper presents results from case studies from England and Germany, showing how the integration of isotopes and weed ecology can provide information to help understand when, where and how this 'cerealisation' occurred.

Key-words: Early Medieval agriculture, crop stable isotopes, functional weed ecology, crop rotation, extensification

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WHAT INFOS CAN WE GET FROM THE ANALYSES OF THE LATE NEOLITHIC DOG (*CANIS FAMILIARIS*) EXCREMENTS?

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More than 5000 years old presumably dog's coprolites were found during rescue excavations at *Stare gmajne* and *Črnelnik*, two late Neolithic pile-dwelling sites in Slovenia. Although human and dog diets may overlap considerably, the content of the consumed and digested plant and/or animal food remains, biologically diverse. The digested content will be presented in a multidisciplinary approach investigating testing biomarkers and genetic, palynological, palaeoparasitological, archaeobotanical and archaeozoological features.
Beside the origin (dog/-s or human), daily diet and nutritional habits of the individual in the Late Neolithic, the analyses of coprolite provide more important information, for example: the time of the year of deposit, the environmental conditions there, the size and the health of the animal as well as the care for (or the status of) domesticated animal.

Key-words: dog coprolites, Late Neolithic, pile-dwellings, Slovenia

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SITOS: AN INTERDISCIPLINARY INVESTIGATION OF 'CEREAL FOOD' IN THE ANCIENT GREEK WORLD INTEGRATING LITERARY SOURCES, EXPERIMENTATION, FOOD SCIENCE, ARCHAEOBOTANY AND SCANNING ELECTRON MICROSCOPY

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Different ways have been used by human societies to transform cereals into food: gruels, porridges, soups, breads, alcoholic beverages are examples of the rich variability observed in ancient and modern culinary practice. Our presentation explores the possible ways in which cereals could have been consumed in antiquity, integrating ancient written sources and experimental preparations

generated in the context of ERC project PLANTCULT. A detailed examination of ancient Greek texts has revealed a wealth of cereal food preparations and contexts of consumption. This, combined with archaeobotanical knowledge on cereal food preparations from Greece has formed the basis for the preparation of a selection of experimental cereal-based processed products, mainly breads and porridges. These have been analysed using scanning electron and optical microscopy, calorimetry, rheometry and mechanical analysis; they form the basis for comparisons to a selection of archaeological, cereal based food remains from Greece and southern Italy. Our approach aims to contribute towards a better understanding of the transformation of cereal ingredients into food products in the context of past culinary practice.

Key-words: Archaeological cereal food remains, ancient Greek texts, experimental cereal food preparations

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THE INTRODUCTION AND DISTRIBUTION OF CULTIVATED PLANTS AND THEIR ACCOMPANYING WEEDS IN EUROPE FROM CA. 8000 – 800 BCE BASED ON LINGUISTICS AND ARCHAEOBOTANY

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Europe has been populated by different groups of people since the Upper Palaeolithic. At ca. 8000 BCE, the agricultural spread from Anatolia into Europe has provoked many changes in subsistence, interaction and diet: the so-called Neolithic Revolution. At ca. 3500 BCE, a new wave of people and innovations entered Europe from the east, bringing agro-pastoralist subsistence, new plant and animal species, and a language that can be reconstructed based on historical-comparative linguistics (i.e. Proto-Indo-European).
The impact of these new people on the existing cultural groups of Europe is profound and seems to not only change subsistence and burial practices, but also language. These changes will only really become apparent when historical linguistic and archaeological evidence are combined to to link them to moments in time.
With this paper we want to inform and discuss about historical linguistics as a tool in combination with palaeoethnobotany to create a more complete and detailed understanding of mobility, subsistence and diet in the past. We will show sequences of maps, based on hundreds of archaeological sites, that follow the distribution of cultivated plants and their crop weeds throughout European prehistory, and their names within the different language groups. This will form the basis for a future international database that can be used to create overviews of the distribution of innovations, plants, animals, people, and language throughout prehistory.

Key-words: Proto-Indo-European language, prehistory, cultivated plants, subsistence, mobility

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THREE-THOUSANDS-YEARS RECORDS OF CLIMATE AND AGRICULTURE IN TURKEY: THE STABLE ISOTOPES APPROACH TO PLANT REMAINS FROM ARSLANTEPE

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Based on the merely quantification of archaeobotanical remains, i.e. seeds, fruits and charcoals, palaeoecological reconstructions could lead to misleading conclusions. Thanks to the study of the stable isotopes, plant remains have been disclosed as a powerful tools to explore the role of climate in the evolution of both the environment and human communities and the past growing conditions of plants.
The high-resolution isotope records from the long-lived archaeological site of Arslantepe in the Near East have been produced. The characterising features of Arslantepe (Turkey) are the long-term occupation, from 4700 to 2000 BCE, and the huge amount of plant remains preserved *in situ*. The improvement of the chronological framing by new 14C-AMS dates has been the base for building up the stable carbon and nitrogen isotope records from both charcoals and cereal grains. Deciduous *Quercus* and *Juniperus* isotopic signals have revealed that climate was wetter than nowadays, with regional fluctuations involved in the local cultural changes. The past crop management system has been reconstructed using the isotopic values of *Hordeum vulgare, Triticum dicoccon* and *T. aestivum/durum* grains, considering the relationship with social and cultural transformations.

Key-words: stable carbon and nitrogen isotopes, radiocarbon, palaeoclimate, agriculture, Ancient Near East

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THE POTENTIAL OF CHARRED OLIVE PITS FROM ARCHAEOLOGICAL SITES IN RECONSTRUCTING MEDITERRANEAN CLIMATE

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The olive tree and the olives have been present in archaeological sites in the Mediterranean region for the past 6500 years. In particular olive pits, as they represent a single year growth, have been used for radiocarbon dating of the archaeological level where they were deposited. However, the stable isotopes of carbon in olive pits have been mostly ignored. As the ratio between 13C and 12C (δ13C) is widely used as a climate of proxy, the abundance of olive pits from many archaeological sites in Israel represents a rich source of information, that can provide a higher resolution of climate information both in time and in space, which is imperative for this area, as the water regime varies greatly across a small geographical gradient.
We investigated both the olive trees in Israel today to better understand the correlation between δ 13C of olive pits to environmental conditions. This correlation is not necessarily straightforward, as the δ13C signal is likely dampened between the photosynthates produced in the leaf, and the

olive pit structural material. Furthermore, olive pits are generally preserved as charred remains, presenting potential additional fractionation relative to the original signal. Therefore, we analyze the effect of charring on δ13C of whole olive pits compared with fresh material and α-cellulose, as well as the correlation of the δ13C of α-cellulose from modern olive pits to environmental conditions. Then we compile the Δ13C values from hundreds of charred olive pits found in more than 20 sites across Israel, spanning more than 5000 years, and discuss their contribution for reconstructing past climate. We have found a general agreement between the climate indications from the Δ13C from archaeological olive pits and other known proxies.

Key-words: climate reconstruction, stable isotopes, δ13C, climate proxy, olive pits

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FUNCTIONAL ATTRIBUTES AS A TOOL FOR UNDERSTANDING THE PROCESS OF CEREAL AND PULSE DOMESTICATION

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Ancient plant remains recovered from early farming sites in western Asia provide the primary evidence for the domestication of crop species. This evidence is key to the understanding of the processes and selective pressures acting on plants during their domestication as crops, which resulted in the establishment of a new ecological niche, the crop field, and which formed the basis for the subsequent plant-based economies of urban society.
This research aims to identify the selective pressures associated plant domestication in south-west Asia, using an ecological approach, and so improve our understanding of the types of human activities and environmental conditions that led to the emergence of agriculture in this region. Plant strategies, identified as functional traits of the gathered wild plant species, the crop progenitor species and domesticated crop species are explored, and the interactions between these attributes (functional groups) are analysed. The functional differences between domesticated cereals and pulses, their wild progenitors and wild grasses and legumes are examined, and on this basis, a systematic model is presented of the types of human behaviour which gave rise to the processes conventionally associated with plant domestication.
This has involved the selection of a wide range of wild and cultivated grasses and legumes for field and laboratory measurement and both collection from the wild and from agricultural stations, in the Near East and Europe.

Key-words: Functional ecology, archaeobotany, domestication

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WINE FIT FOR A KING: IDENTIFYING ANCIENT GRAPE VARIETIES USING A NOVEL MORPHOLOGICAL 3D KEY

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Viticulture in Ancient Israel was rich in grape varieties, which produced fine wines for local use and international trade. However, following the 7th century CE Islamic conquest, Levantine viticulture slowly deteriorated, resulting in a loss of winemaking expertise and grape varieties. With the renewal of viticulture in modern Israel only European varieties were cultivated, as is still the case today

For several years we surveyed Israel for feral and landrace grapevine specimens. At present, we hold ca. 65 unique domesticated, and ca. 180 wild varieties, most of which we have genetically proved to be local. However, the historical development and use of these varieties throughout the ages remains unknown.

To shed light on this issue, we are developing variety-level identification of both fresh and archaeological grape pips from a variety of periods and regions in Israel. Our method is to construct a morphological key using 3D geometric morphometrics, in addition to aDNA sequence analysis. As a test-case, we will present first results from two of King Herod's palaces, Masada and Herodium. There, both local and foreign grape varieties were identified – providing a new source of evidence for this king's cosmopolitan nature.

Key-words: Vitis vinifera, 3D analysis, grape varieties, Israel, genetics

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