Session 1
ORIGINS AND DIFFUSION OF CULTIVATE PLANTS

Talks

PARALLEL WORLDS IN THE NEOLITHIC: COSTAL HUNTER-GATHERERS IN SOUTHERN SCANDINAVIA. AN INTERDISCIPLINARY INVESTIGATION OF THE PITTED WARE CULTURE

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A millennium after the Neolithic way of life was introduced to Southern Scandinavia, a group of people, named the Pitted Ware Culture, apparently reverted to a hunter-gatherer lifestyle, where subsistence economy seemed to have been primarily based on hunting, gathering, fishing and to a smaller extent husbandry.
For a long time, many issues about the Pitted Ware Culture and its economy has remained unsolved. In 2014 the interdisciplinary project "Contact" set out to solve some of these questions by looking at archaeobotanical, osteological and archaeological material both involving traditional methods but also involving isotopic analysis, DNA analysis etc.
The question the archaeobotanical analysis set out to answer was whether agriculture also played a part in the economy in the Pitted Ware Culture or if it had been completely abandoned. The evidence for agriculture had previously only been indirect based on findings of quern stones etc.
The archaeobotanical analysis of large amounts of archaeobotanical material and the associated 14C-datings has now for the first time clarified that agriculture played a part in the Pitted Ware economy but have also shown that analysis of material from multi-period sites needs to be closely collaborated with 14C-datings even when situated in a closed context under thick layers of seashells.

Key-words: Neolithic, Hunter-gatherer, Agriculture, Interdisciplinary study

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EARLY FARMERS IN THE SOUTHERN ALPS: RESULTS OF THE ARCHAEOBOTANICAL INVESTIGATIONS OF THE LAKESHORE SITE OF ISOLINO VIRGINIA (VARESE, LOMBARDY)

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Isolino Virginia is an artificial island on Lake Varese (Italy) with deposits from multiple occupations since the early Neolithic period. It is to date the earliest lakeshore settlement known around the Alps and, since 2011 it is a UNESCO World Heritage site. In the framework of the SNSF-funded AgriChange Project (PP00P1_170515) we conducted a sampling programme at the site, where monolith samples from an open trench were combined with cores taken at different points of the site. The goal of this work was to obtain environmental evidence of early farming practices at the site and their evolution over time, considering factors such as climate and crop pests. We will focus this presentation on the first results of archaeobotanical analyses and radiocarbon dates from different waterlogged deposits from the Neolithic period that allow a first detailed approach to the agricultural practices at the site and how they changed over the Neolithic period.

Key-words: pile-dwelling, early Neolithic, agriculture, radiocarbon dating, coring programme

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ABSOLUTE CHRONOLOGY OF COTTON DISPERSAL IN ARABIA AND AFRICA

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Increasing evidence of cotton (*Gossypium herbaceum/arboreum*), both seeds of cotton and textile fragments in cotton, sheds light on the distribution of this tropical plant in the Arabian Peninsula and Africa. Some of these discoveries come from archaeological contexts dated between the 4th and 2nd mill. BC. They have been interpreted as early importation of textile products from India, where cotton (*G. arboreum*) is attested since the 6th-5th mill. BC, or early presence of African cotton (*G. herbaceum*). None of the evidence which exist so far is based on direct dating. The bulk of cotton finds belong to later archaeological layers, from Antique, Late Antique and Islamic times. A set of radiocarbon dating was obtained for cotton seeds and fibres coming from various archaeological contexts. The results show that cotton is definitely present from the end of the 1st century BC onwards in Nubia and Egypt and during the 1st century AD in Central Sudan. In Arabia, one textile fragment dates back to the end of the 1st c. BC-1st c. AD but most of the data is comprised between the end of the 1st c. and the 3rd c. AD. The examination of direct radiocarbon dating combined to the analysis of the distribution of the cotton finds and the textual evidence allow us to better characterise the trade routes and the introduction of cotton cultivation in local agrosystems.

Key-words: Cotton, dispersal, radiocarbon dating, Arabia, Africa

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AGRICULTURAL TRANSITIONS IN PREHISTORIC SOUTHEAST ASIA: SWITCHING FROM DRYLAND TO WETLAND RICE CONOMIES

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This paper presents the latest research on archaeological rice in Southeast Asia. Foxtail millet and rice were introduced into Mainland Southeast Asia from China in the Neolithic period. Their routes of dispersal are still poorly understood due mainly to lack of data from the southern Chinese provinces. At present, the archaeobotanical evidence shows that foxtail millet arrives earlier than rice by at least a millennium in Central Thailand. In other regions of Southeast Asia, rice shows up in the record but not foxtail millet and once rice is introduced, it is the dominant cereal in Southeast Asia.
Analyses of weed assemblages associated with cereals demonstrate that the earliest cultivation systems were dryland. Rice grain metrics suggests the rice from the Neolithic to the Early Iron Age was the Chinese originated subspecies *Oryza sativa* ssp. *japonica*. An aDNA study of rice grains from these early periods corroborates the morphometric analyses. This is particularly important, given that in the Early Iron Age, some of the sites provide evidence of contact with South Asia including the introduction of Indian economic crops such as mungbean (*Vigna radiata*) and cotton (*Gossypium*) but not of the Indian rice, *O. sativa* ssp. *indica*. *Indica* rice is today the variety of rice cultivated across most of Mainland Southeast Asia. The introduction of *indica* rice to Mainland Southeast Asia probably occurs in the fist millennium AD although more archaeobotanical evidence is still needed to establish a better chronology.
Finally, I will present new evidence from sites in Northeast Thailand which span a long chronology (Early Bronze to Late Iron Ages) and shows a transition in rice farming towards wetland cultivation. This evidence suggests that this transition took place in the Iron Age, at a time of increasingly arid climate, and when a number of broader societal changes become apparent in the archaeological record.

Key-words: cereals; Southeast Asia; cereals, weeds, agricultural transitions

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AGRICULTURE - VITICULTURE IN THE NEW KINGDOM - EARLY ROMAN EGYPTIAN DELTA

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Excavations at Plinthine on the north coast of Egypt have revealed both settlement and industrial spaces, especially those related to wine production. The contexts date to the New Kingdom (2nd half of the 2nd millenium BC) all the way to Early Roman period (1st c. AD).

Analysis of the archaeobotanical macro-remains show the presence of local agrosystems. Remains include cereals, mostly barley (*Hordeum vulgare*) and wheat (*Triticum turgidum* subsp. *dicoccon*), pulses (mainly lentil, *Lens culinaris*), and a rich corpus of grape (*Vitis vinifera*) pips and grape by-products confirming a specialisation in viticulture at Plinthine.
Geometric morphometric analysis carried out on grape pips from Saito-Persian (7th-mid 5th c. BC) and Ptolemaic (4th-1st c. BC) periods revealed a wide morphological diversity throughout time, and a difference between Saito-Persian and Ptolemaic Periods. Additionally, the pips, whatever the period, correspond to morphotypes close to wild grapes, perhaps related to cultivars that have undergone a low selective pressure and/or grapes that have been grown from seedlings.
Seed and fruit study, geometric morphometric analysis of grape pips as well as charcoal analysis will be used to explore agricultural land and viticulture in the Nile Delta, especially between the New Kingdom and Early Roman period. A special focus point will be looking at the switch between the Saito-Persian Periods to the Ptolemaic Period.

Key-words: Egypt, Viticulture, Macroremains, Geometric Morphometry

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UKRAINE AS THE CROSSROAD FOR AGRICULTURAL DISPERSAL IN EURASIA

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With remarkable progress of archaeobotany in decades, we should reconsider the dispersal of agriculture in Eurasia as multi tiered, multi directional, and long term movements. The territories to the north of the Black Sea, mainly the present Ukraine, are one of the key area to discuss the East-West movements. There are comparatively many archaeobotanical dataset derived from impressions in pottery, and have been quoted often. In particular, exceptionally early start of agriculture compared to the neighbouring region has been predicted based on the early cereals prior to 6000BC. In addition, there are many reports of *Panicum miliaceum* dating back to Neolithic in Ukraine. However, from today's perspective, many archaeobotanists are warning of the identification and dating from pottery impressions. Uncertain evidence seems to complicate the problem more than the absence of evidence. Therefore, re-evaluation is high- priority issue to reconstruct the dispersal of agriculture. To make clear the timing and the route of dispersal of crops in Ukraine, the authors analyzed pottery with impressions again, and re-identified using refining impression method with scanning electron microscopy. As a result, none of more than 12,500 observed Neolithic potsherds, including ones already published as having cereal impressions, contains clearly defined impressions of cultivated plants at present. Abrupt appearance of numerous *Panicum miliaceum* was recognized only from the Late Bronze Age.

Key-words: The dispersal of agriculture, Ukraine, Food globalization, Panicum miliaceum, impression in pottery

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REVISION FOR THE CROP HISTORY OF ACERAMIC NEOLITHIC CANHASAN III, KARAMAN, TURKEY

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Aceramic Neolithic Canhasan III is located in the southern region of the Konya Plain, predating nearby Çatalhöyük East being occupied between 7,500-7,000 cal BC. One of the first sites in southwest Asia to apply flotation, archaeobotanical research by the late Gordon Hillman demonstrated the presence of a broad range of crops including emmer, einkorn, legumes and, significantly, domesticated rye and free-threshing wheat. Re-analysis of the assemblage, including AMS dating of key specimens, demonstrates that Canhasan's upper levels (1-3) were heavily contaminated by intrusive Ottoman period plant remains. Domesticated rye, hulled barley, tetraploid and hexaploid free-threshing wheat species, including *Triticum carthlicum* (all identified as chaff), are confirmed as intrusive and were not generated in the Neolithic. The verified crop assemblage from Aceramic Neolithic levels is in fact narrow, lacking cultivated barley and being dominated by emmer wheat (*Triticum dicoccum*), forms consistent with New Type/Striate Emmeroide finds elsewhere and smaller quantities of Einkorn (*Triticum monococcum*). In the earlier levels (4-9) lentil (*Lens culinaris*) and bitter vetch (*Vicia ervilia*) are dominant and wild fruits are present in large quantities, especially wild almond. These results fit well with recent analyses at the nearby 9th and 8th millennium sites of Pınarbaşı and Boncuklu, as well as Çatalhöyük East.

Key-words: Anatolia, Neolithic, origins of agriculture, contamination

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EX ORIENTE SEGES: THE ARRIVAL AND ESTABLISHMENT OF BROOMCORN MILLET IN EUROPE

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Cultivation of broomcorn millet (*Panicum miliaceum L.*) was a widespread practice in later European prehistory. When and how this 'crop from the East' was introduced to the continent and spread across it has not been determined. So far, based on the relative chronology of millet finds and a small set of radiocarbon-dated caryopses, it has been suggested that millet did not arrive in Europe during the Neolithic and that this happened in the Mid-Late Bronze Age. It has not been clear why and how millet was integrated into the pre-existing crop spectrum and what effect this had on the crop husbandry routine. The economic and socio-cultural contexts of the adoption of millet have not been closely examined. The 'Millet Dating Programme' recently completed at Kiel University produced 100+ radiocarbon dates on charred grains of broomcorn millet recovered from Neolithic and Bronze Age layers of sites located in different parts of Europe. Collectively, the absolute dates suggest that millet reached most of SE, central and NW Europe in the period 15-13th century BC. Using these high-precision data, we can now build a link between the start of millet cultivation and the coeval changes in subsistence economy potentially resulting from the adoption of the new crop. We present the results of this research project and discuss possible mechanisms by which millet was distributed, as well as the potential agro-ecological causes-and-effects of the establishment of millet cultivation in Europe.

Key-words: spread of broomcorn millet, radiocarbon dates, Europe, agricultural innovation

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SECONDARY DOMESTICATION OF GRAIN CROPS: PARALLELISM EVOLVING UNDER ENTRENCHED FARMING

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Plant domestication studies tend to be closely linked to the study of agricultural origins, and parallel evolution of a domestication syndrome over a protracted period is increasingly documented across a range of cereal and pseudo-cereal taxa. This presentation will consider the case of secondary domestications, that is the evolution of new domesticates, often from weed species, in the

context of well established agricultural traditions. Such secondary domesticates can be documented from several world regions, from the well-recognized case of oats (*Avena sativa*), domesticated in Late Bronze Europe, to the less well-known cases of Asian chenopod (*Chenopodium album*), Indian kodo millet (*Paspalum scorbiculatum*), and west Africa fonio (*Digitaria exilis*). This paper will first define the ecological and economic context in which these new crops rose to prominence, as catch crops and reliable fall back resources, and then consider whether the selection pressures from domestication syndrome traits are the same or different from those of primary grain crop domestications, and whether the rate of evolution of such domesticates was quicker as a result of being selected in systems of well-established agriculture by practiced farmers.

Key-words: Domestication syndrome, Parallel Evolution, weeds, Bronze Age, Iron Age

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THE CULTURAL DISTINCTION BETWEEN PLANT DOMESTICATION AND CROP EVOLUTION: THE QUESTION OF RESOLUTION

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The pace of plant domestication (PD) is a "well-known" disagreement in plant domestication research (PDR) in the Near East. Its long history notwithstanding, the two debated views are: 1). A protracted (millennia long) unconscious process and 2). A short event within the resolution of Neolithic chronology in the Near East, i.e., ± 50/100 years. The distinction between plant domestication and crop evolution which we consider major in contributing parsimony to the core area-one event domestication model was presented recently (Abbo et al. 2014, TIPS) as a means enabling a better distinction between Domestication Syndrom traits and in the service of a higher resolution in PDR. It was based on biological considerations. Yet, a major reservoir of direct data on plant domestication originates in archaeological sites. Archaeology, has developed in the last century to turn into a high resolution discipline both by developing higher resolution archaeological analyses (of sites and finds) and by using radiometric absolute dating (e.g., C-14). These developments contributed options for the accurate dating of finds in sites relevant to PD. It also contributed a potential of reconstructing how archaeological finds (materials, ideas) spread through the geography and in the case of PDR this was accompanied by genetic studies of polymorphisms of relevant plant populations. Surprisingly, archaeologists (and to a certain extent archaeobotanists too) studying PD of the Near East tend to undermine these achievements by lowering their resolution and blurring the quite evident cultural processes. This presentation will discuss these trends in PDR in the Near East and attempt offering some explanations to these trends in research.

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ON PLANT ECONOMY IN THE MIDDLE BRONZE AGE IN THE SOUTH CAUCASUS

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Middle Bronze Age (MBA) in the South Caucasus is dated with the 24th-15th centuries BC. This period is characterized by the cultural diversity and domination of nomadic lifestyle in the region. Archaeological sites of MBA period in the region are predominately burials where, in general,

archaeobotanical material is very scarce or absents at all. As there are very few MBA settlements in the region and only some of them are studied for plant remains, our knowledge of plant economy, particularly agriculture of this period remains poor. Recent archaeobotanical investigations at several MBA settlements and burials in the territory of Armenia (Arteni-1, Karmir Sar, Shaghat-1, Nerkin Naver, etc) complement our knowledge and give some image on the plants use in the MBA in the region. As for the entire Early Bronze Age – Early Iron Age period, practically only cereals and grape were recorded for MBA sites and contexts in the South Caucasus and, apparently, free-threshing wheat and hulled barley predominated (naked barley and emmer were recorded as well). The presence of cultivated cereals grains in the sites situated in different environmental conditions up to the high mountainous zone (e.g. Karmir Sar, 2800 m a.s.l.) may attest about the importance of cereal-based food. Meanwhile, the absence of threshing residues in middle and high mountain zone temporary stations allows assuming that maybe those plants were cultivated somewhere else, possibly in lower altitudes.

Key-words: Middle Bronze Age, South Caucasus, agriculture, cereals, nomads

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CROPS, POLLINATORS AND PEOPLE: CONSTRAINTS ON THE ORIGINS AND SPREAD OF BUCKWHEAT

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The pseudocereal common buckwheat (*Fagopyrum esculentum*, Polygonaceae) originated in China and has been cultivated there for at least 5500 years, although details of the geography and chronology are obscure. It subsequently spread across much of northern Eurasia, putatively from 4000 years ago, but the archaeobotanical record is very scant and largely based on pollen data. Its distribution limits are often assumed to be set by frost sensitivity, but other abiotic factors, such as daylength and flowering time response, and biotic factors, in particular pollinator availability, were probably also important. We have synthesised datasets on present and past cultivation of buckwheat across the northern hemisphere.
We first discuss the archaeobotanical evidence for the origins and spread of buckwheat in the past, and the challenges of existing data in relation to preservation, taphonomy, identification, and chronology. Secondly, we will present the preliminary results of Species Distribution Modelling (SDM) used to estimate the relative importance of factors restricting the spread of buckwheat and delineate the fundamental ecological niche of the species on the map of Eurasia in the context of past climatic conditions. We will also evaluate the validity of the model with reference to the archaeobotanical and archaeogenetic evidence and will discuss its implications regarding the relationship between the presence of buckwheat and the abundance of its main pollinator – the honeybee.

Key-words: buckwheat, species distribution modelling, insect pollination, globalization, pollen

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THE STATUS OF *PAPAVER SOMNIFERUM* AS A CROP IN NEOLITHIC EUROPE. FIRST RESULTS OF THE APPLICATION OF GEOMETRIC MORPHOMETRICS TO DISTINGUISH BETWEEN WILD AND DOMESTIC SEEDS

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Opium poppy (*Papaver somniferum* L.), unlike the other so-called founder crops, was not brought into Europe from Southwest Asia during the Neolithic period. Based on the current distribution of its putative wild ancestor (*Papaver setigerum* DC.), this plant could have been domesticated in the Western and Central Mediterranean and then spread to other regions. The main limitations in the study of the origin of opium poppy are that we do not know the actual spread of *Papaver setigerum* in the early Holocene, and there are also no clear morphological criteria to distinguish the wild form from the domestic seeds in the archaeological record.
In order to understand the status of this crop in the Neolithic, Elliptic Fourier transforms (EFT), a morphometric method applied for outline analysis, was used to characterize seed shape and to quantify morphological diversity in *Papaver setigerum* and related species.
First, we created a protocol and tested the repeatability of it. After, we applied the protocol to several modern accessions from different poppy species. Error and statistical analysis were run in R software with the package MOMOCS. Finally, modern specimens will be compared among themselves, to see how species can be discriminated and to the archaeological seeds from several Neolithic waterlogged sites. This approach provides a starting point of our understanding of the history of poppy.

Key-words: opium poppy, Identification, Archaeobotany, geometric morphometry, domestication

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AGRICULTURAL AND DIETARY STRATEGIES AS CULTURAL DECISIONS? Archaeobotanical results from 58 Neolithic sites of the Linearbandkeramik, Late Starčevo, Late Körös, Alföld Linearbandkeramik and Szakálhát distribution areas (D, AU, HUN)

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Archaeobotanical investigations have been carried out in the context of an archaeobotanical research project concerning Neolithic agriculture and land use in Hungary. The results from 21 archaeological excavation sites have been collected and archived with the database program *ArboDat*

2016. The synthesis to be presented is based on the determinations of 143.737 botanical remains sorted out from 430 samples out of 241 archaeological features. The Hungarian data will be compared with the archaeobotanical results from 37 further Bandkeramik sites from Austria and Germany. The different crop spectra of the Late Starčevo, Late Körös, Transdanubian and Alföld Linearbandkeramik and Szakálhát distribution areas (D, AU, HUN) will be discussed in the context of their Balkan roots, their possible role in human diet as well as their reflection of the different archaeological cultures.

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ADAPT: SPREAD OF CROPS IN NEOLITHIC EUROPE

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The ADAPT project is investigating how crops from the Near East adapted or failed to adapt to new environmental conditions as agriculture spread across Europe using genetic, ecological and archaeobotanical data. The archaeobotanical element of this project entails the creation of a database of crop assemblages from the European Neolithic (7000-2400BC) including both site phase and sample-by-sample data from over 1000 sites. This presentation will highlight the main patterns in crop distribution across Europe during the Neolithic using multivariate statistical and GIS analytical techniques in relation to geographical, temporal, cultural and environmental parameters. In particular, this paper will focus on zones of agricultural contraction within Europe, notably the Lower Danube and Northwest European Plains, where taxa were lost from the original Near Eastern crop package. The influence of cooler climatic conditions and cultural preferences on the range of crops cultivated as agriculture spread across Europe will be explored.

Key-words: Neolithic, Europe, Crop diversity, Lower Danube Plain, Northwest European Plain

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WAS MILLET DOMESTICATED IN THE CAUCASUS? FIRST APPEARANCE OF *PANICUM MILIACEUM* AND *SETARIA ITALICA*: AN ARCHAEOBOTANICAL AND ISOTOPIC APPROACH

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Two millets, broomcorn (*Panicum miliaceum*) and foxtail millet (*Setaria italica*), were domesticated in North-West China, around 6000 BC. Although the earliest evidence for millets is in Asia, for many years it has been suggested that these species may possibly have been domesticated in the Caucasus. In order to prove or disprove this hypothesis, a research program of the French National Research Agency program "ORIMIL" aimed to identify the first evidence of millet in this region. The project includes on the one hand an inventory of the occurrence of archaeological millet in Eurasia, up to Antiquity, and on the other hand, a combination of new radiocarbon dates made directly on millet seeds, and isotopic analyses on animal and human bones, from archaeological contexts dated from the Early Bronze Age (3500-2500 BC BC) to the 1st Century BC in Georgia, Armenia, Azerbaijan, Russia and North-East Turkey.
This paper presents the results of this multidisciplinary study aims to redefine the appearance of millet in the Caucasus and its modality of its diffusion from Central Asia to Europe.

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FROM HILLTOPS TO HILLFORTS: ARCHAEBOTANY OF PREHISTORIC SETTLEMENTS IN THE SOUTH-EAST BALTIC

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The paper explores the history of farming in the prehistoric south-eastern Baltic region. Archaeobotanically this area is still relatively unfamiliar, especially when compared to other parts of the northern Europe. It is evident that the first farmers in Europe (The Linear Pottery culture) did not reach the territory on the SE fringes of the Baltic Sea. Over the last several years the concept of Neolithic farming has been called into question over numerous occasions. It has also recently come to light that farming here was adopted significantly later than animal husbandry. Evidently, current data suggests that it did not emerge in the region before the beginning of the Bronze Age (ca. 1800 BC). Therefore, it is still debatable how does the SE Baltic region fit into the broader history of agricultural development of northern Europe.
This study presents current archaeobotanical evidence from Lithuania covering the time span from the Late Bronze Age (ca. 1100-900 BC) until the beginning of the Medieval period (mid 13th c. AD). Using primarily plant macrofossils it aims to illustrate the origins and development of farming in the SE Baltic. Finally, it suggests that settlement dynamics and changes in settlement patterns were closely linked to the developments in agriculture since at least the emergence of hilltop settlements at the start of the Late Bronze Age.

Key-words: Baltic Sea region; settlement archaeology; Bronze Age; Iron Age

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GEORGIA, THE SOUTH CAUCASUS AS THE ORIGIN PLACE OF *TRITICUM SPELTA*

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Georgia is one of the oldest centers of agriculture, where the Neolithic revolution began in the 8th millennium BC. The archeological findings of the Neolithic and Bronze period sites suggest that wheat diversity was high in Georgia. The following 9 species were identified in the Arukhlo site of Lower Kartli: *Triticum baeoticum*, *T. monococcum*, *T. dicoccum*, *T. carthlicum*, *T. durum*, *T. spelta*, *T. compactum*, *T. aestivum* and *T. spaerococcum*. It is the only country where 3 species of hulled hexaploid wheat *T. macha*, *T. spelta* (AABBDD) and *T. zhukovskyi* (AAGGAA) occurred and also 3 free-threshing hexaploids (*T. aestivum*, *T. compactum*, *T. sphaerococcum*) were found in Neolithic sites. The D-genome donor *Aegilops tauschii* subsp. *strangulata* with all 3 lineages is presented only in Georgia. Spelt was described from Germany. It was common in Spain (Asturias). Later it was discovered in Iran, other places in Asia and in the South Caucasus. It is remarkable that spelt samples were found in the early Neolithic sites of Arukhlo and Khramis Didi Gora and *T. spelta-macha* showed up in the Bronze period sites: Namcheduri, Pichori, Ergeta, Digomi in Georgia. According to Dorofeev, "the presence of great diversity of spelt forms in the South Caucasus provides basis for considering this region as the homeland of the hexaploid wheat prototype, which can be west Georgian wheat makha (*T. macha*). The first hexaploid wheat penetrated to Iran, other regions of Asia and Europe from the South Caucasus".

Key-words: T. spelta, T. macha, T. aestivum, birthplace, Georgia

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PLANTS USED BY PEOPLE OF THE FUNNEL BEAKER CULTURE AT MOZGAWA SITE, S POLAND

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The Mozgawa site is located on a loessic hill in the Nida basin, in SE Poland. The Mozgawa site was occupied almost solely by the Funnel Beaker culture settlers (TRB, the Middle Neolithic) from ca. 3600 cal. BC to ca. 3000 cal. BC. The settlement covered an area of ca. 35 ha, which is exceptional for that time and region compared to a typical settlement of ca. 1-3 ha. The site was well sampled for archaeobotanical analyses. 557 samples of average 5 litres volume were collected, water sieved and sorted. In the paper we will present new carpological data obtained from detailed analyses of 240 samples from 26 archaeological features. The seeds were preserved as charred, mineralized and uncharred (recent contamination) items. Among the cultivated plants, grains of *Triticum dicoccum* were the most numerous, while *T. monococcum* were scarce (15:1).

Wheat chaff remains were not numerous and barley grains were absent. *Linum usitatissimum* and *Lens culinaris* were very abundant, which is not common in the settlements of the TRB culture. In the site several hundred artefacts connected with weaving were documented which can explain the abundance of flax seeds. Lentils are very rare in Neolithic assemblages from that part of Europe. Among other taxa, *Fragaria* sp. was very abundant, even more numerous than *Chenopodium* sp. and *Bromus* sp. Diaspores of *Lithospermum arvense* (=*Buglossoides arvensis*) were numerous but their state of preservation was not always clear. Some seeds of *Agrostemma githago* and other field weeds were also found as well as seeds and fruits of plants growing in grasslands, forests and ruderal places. Interestingly, nuts of *Corylus avellana* were absent, although in charcoal assemblages from the site its wood was rather uncommon.

Key-words: emmer; frax; lentils; wild strawberry; Middle Neolithic

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DOMESTICATION OF SOYBEAN, AZUKI, AND BARNYARD MILLET IN JAPAN

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This paper will presents new evidence of temporal morphological domestication of soybean (*Glycine max*), azuki (*Vigna angularis*) and barnyard millet (*Echinochloa esculenta*) by Jomon hunter-gatherer in prehistoric Japan. Gathering and use of wild soybean (*G. max* subsp. *soja*), wild azuki (*V. angularis* var. *nipponensis*) and wild barnyard millet (barnyard grass, *E. crus-galli*) have started from Early Holocene (ca.10,000 years ago) in the wide area of Japanese archipelago by sedentary hunter-gatherer groups. Seed size enlargement episode of these beans and the grass have been seen around Mid-Holocene (around 6000-4000 years ago) in the different core areas. For the soybean and azuki, seed size enlarged in the central highland and western Kanto regions where territory of "Moroiso-katsusaka" type pottery group. On the other hands, seed size enlargement of barnyard grass can be seen in the northern Tohoku and southern Hokkaido regions where territory of "Ento" type pottery group. These seed size change have linked with population growing in these regions. However, from the Late Holocene (after 4000 years ago), the enlarged seed species were disappeared in these regions with the population decline. The large seed of soybean and azuki appear again from 3000 years ago in the western part of Japanese archipelago and the large seed of barnyard grass (barnyard millet) appear again from 1000 years ago in the wide area of East Asia.

Key-words: domestication, sedentary hunter-gatherer, soybean, azuki, barnyard millet

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GRAPEVINE (*VITIS VINIFERA* L.) DOMESTICATION AND VITICULTURE HISTORY IN GREECE FROM NEOLITHIC TO THE ARCHAIC PERIOD: INSIGHTS FROM GEOMETRIC MORPHOMETRIC ANALYSES OF ARCHAEOLOGICAL GRAPE SEEDS

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Grapevine (*Vitis vinifera* L.) is one of the emblematic crops of Greece. Grapevine cultivation is thought to have been brought from South-Western Asia, where it would have been first domesticated. The beginning of viticulture and wine-making is thought to be related to the emergence of the hierarchical societies in Crete and Peloponnese during the Bronze Age. However, evidence of wine making dated to the Neolithic and the Early Bronze Age question this hypothesis. This study aims to investigate the grape cultivation history in prehistoric and archaic Greece: when did the shift from wild to domesticated grapevine occur? Did the development of trade and exchanges have an influence on this diversity?
Since the shape and size of grape pips have long been used as criteria to discriminate wild and domesticated archaeological seeds, new geometric morphometric analyses allow to go beyond this dichotomy: shape variation provide accurate criteria to identify groups of varieties.
Geometric morphometric (elliptic Fourier transforms) combined to the length of the pips are used. Grape pips dated from Late Neolithic (5th millennium BC) to the Archaic period (7th c. BC) from 12 archaeological sites located in continental Greece are analysed. This material is then compared to an extended set of reference.
Our study is expected to shed new light on the domestication process, past diversity in the cultivated compartment, and explore the relationship between past diversity and present-day cultivars.

Key-words: domestication, past diversity, viticulture, geometric morphometry

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NEW RADIOCARBON DATES FOR THE EARLY DISPERSAL OF OPIUM POPPY (*PAPAVER SOMNIFERUM* L.) IN WESTERN EUROPE

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Numerous sites from the early Neolithic have provided opium poppy remains in the Western Mediterranean and Temperate Europe. These, constitute the earliest secure evidence of this plant in archaeological records. A one-year project, funded by the Fyssen Foundation, aims to trace the origin of opium poppy and its spread across Western Europe through a solid chronological approach. AMS dating has been performed on annual plants seeds recovered in the same sieving fraction as poppy, using the AGE 3 graphitization system together with the mini radiocarbon dating System ECHo-MICADAS. In addition, for selected sites, poppy seeds were directly dated. In order to measure the radiocarbon activity of these very small samples (between 15 to 80µgC), their CO2 has been extracted off-line and introduced into the ECHo-MICADAS via a Gas Interface System (GIS). Until now, 22 dates (14 sites), including 13 dates on poppy have been obtained. The earliest appearance of opium poppy is dated to the middle of the 6th millennium cal BC on the pile-dwelling site of la Marmotta (Central Italy), in the area where the putative wild ancestor (subsp. *setigerum*) of the cultivated opium poppy (subsp. *somniferum*) originated from. Another group of dates, centred around 5100 calBC, corresponds to Cardial (Mediterranean area) and LBK (Temperate area) sites. The Alpine area is thereafter reached at the very beginning of the 5th millennium cal BC showing the rapid dispersal of the plant during early Neolithic.

Key-words: Early Neolithic, Cardial, Linearbandkeramik, 14C dating, plant dispersal

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NEOLITHIC FARMING AT KNOSSOS: REVISITING OLDER ARCHAEOBOTANICAL MATERIAL

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Independent scholar

The focus of the paper is to present the archaeobotanical remains of Neolithic Knossos which was dug in the 1957-1960 & 1970 but left unstudied to this date in order to discuss issues relating to the development of farming in Crete. Some issues were tackled when a different area of the site of Neolithic Knossos had been excavated in 1997 and it is interesting to see how does these areas compare to each other and how they can fill for the gaps of the other. These results will try to shed light on the range of crops and their agricultural know-how as well as will elucidate our understanding of the beginnings of agriculture, contacts in the Eastern Mediterranean and its diachronic development –changes or stability- as reflected in Knossos.
The early appearance of naked wheat will be discussed in its context and the finds of their by-product will be presented so as to reach a better understanding of whether we are dealing with a hexaploid (*Triticum aestivum*) or a tetraploid (*T. turgidum*).
Identification of hulled barley, *Hordeum distichum* (2-row) and *H. hexastichum* (6-row) as well as their naked varieties (*nudum*), will be discussed but so far no rachis of the naked barley has been found at Knossos.
Methods of retrieval of archaeobotanical have changed since those early excavations but these will be discussed in view of more recent excavations which had taken place in 1997.

Key-words: Neolithic, Knossos, agriculture, archaeobotany

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SHIFTING SEED-DISPERSAL MECHANISMS DURING EARLY PLANT DOMESTICATION

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Scholarship is reframing the study of plant evolution under cultivation to focus on the effects of complex human harvesting practices (seed predation), increased human population size, and sedentism, while turning away from conscious human selection. Research has pointed out that parallelism in domestication is linked to seed-dispersal mechanisms, but few of these studies look beyond the role of tough rachises in large-grained cereals or non-dehiscent pods in legumes. Gene flow through seed dispersal is one of the most prominent drivers in plant evolution in the wild and appears to have been under early cultivation as well. Hundreds of thousands of plant species have evolved mutualistic bonds with seed dispersers; these evolutionary changes are driven by the selective advantage of strong gene flow and often evolve from a predatory relationship. Additionally, few scholars have discussed the fact that most crop progenitors were endozoochoric dispersed. In order to understand the earliest traits of domestication in these crops, we need to understand seed-dispersal-based mutualism before human intervention. Evolution under cultivation is no different than the evolution of mutualism or anti-herbivory defenses as a response to heavy herbivory in nature and is simply an example of keeping pace with the Red Queen.

Key-words: Domestication; Arboriculture; Archaeobotany; Paleoethnobotany

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IDENTIFYING THE PROCESSES OF SELECTION IN THE EVOLUTION OF DOMESTICATED MILLETS IN NORTHERN CHINA

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While there are many traits associated with domestication, two archaeobotanically have received more attention than others; shattering and grain size. While some progress has been made towards studying both the genetics and chronological evolution of shattering and grain size traits there is perhaps less investigation into the selection criteria which drives this evolution. This paper specifically examines archaeobotanical and archaeological evidence for millet domestication in China as means by which to explore the evolution of these traits, where changes within grain size are visible but those associated with shattering are often not. Can we assume, as seen for rice, wheat and barley, that such changes are broadly contemporary? Or is it possible that selection forces could promote one trait and not the other? The exploration of the specific selection criteria, associated with the management, harvesting and cultivation, and the evolution of specific traits form one part of our understanding of the domestication process for these crops. The second is identifying the original selection processes that led to the evolution of such traits in the wild progenitor's natural habitats and how natural selection processes would be impacted upon when crops are brought into a managed or cultivated habitat. Something that can be explored through examination of ethnographic accounts of the management and exploitation of closely related species within Australia and northern America.

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VEGETATION AND PLANT EXPLOITATION AT PRE-POTTERY NEOLITHIC AYIOS TYCHONAS-KLIMONAS WITH SPECIAL FOCUS ON THE INTRODUCTION OF CROP PLANTS FROM THE CONTINENTAL NEAR EAST

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Six excavation seasons conducted at the site of Ayios Tychonas-Klimonas (Limassol District) in southern Cyprus from 2009 to 2016, have revealed the spatial organisation and material culture of the earliest sedentary village known so far on the island. During the first half of the 9th millennium BC this Neolithic community, showing cultural affinities with the late PPNA horizon of the Levant, constructed dwellings and communal buildings at a strategic location situated 2 km from the sea and with access to various natural resources. This paper considers the results obtained by recent archaeobotanical studies in order to understand how the early inhabitants interacted with their milieu and exploited its potential for food, fuel and building materials. Analysis of charcoal and wild fruits gives us a glimpse of the early Holocene vegetation cover framing the first settlement of the island and brings out new information on the biogeography of some of the Mediterranean fruit trees. Seeds, fruits and imprints on earthen building materials inform us on collecting and cultivating practices. The presence of cereal remains (barley and wheat) raises in particular the question of the role of crop cultivation in this early Neolithic community where hunting wild boar constituted the main source for animal proteins. Special attention will also be given to the possible introduction from the mainland of crops, in particular emmer wheat (*dicoccum/diccocoides*) identified from several contexts.

Key-words: Insular Neolithic, Cyprus, crop introduction, early Holocene vegetation

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A BRIEF HISTORY OF PLANTS IN A REGION OF NORTHEASTERN FRANCE: 6,000 YEARS OF CROP INTRODUCTION IN THE PLAIN OF TROYES, CHAMPAGNE, FRANCE

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The plain of Troyes is a territory spanning approximately 20 km around the city of Troyes, situated in Champagne (Grand-Est region, France). It is crossed by the Seine valley, and it comprises lands with varied agricultural characteristics, including fertile river terraces, clayed heavy soils and light and chalky lands. Farming communities have been attracted to this micro-region since the beginning of agriculture. This can be explained by its strong and diverse agricultural potential, its gentle

relief, easy access, and its strategic location along the Seine river, a privileged route of trade and innovation. Over the last twenty years, numerous rescue excavations have been conducted on this territory, generating a vast amount of archaeological and archaeobotanical data. These results have been synthesized within the framework of a Collective Research Project (PCR). The archaeobotanical section is based on the study of 24 sites, 99 occupation phases and 585 samples yielding archaeobotanical remains. It reveals the history of 6000 years of agriculture in northeastern France, from the Neolithic to the early Middle Ages, with communities introducing new domestic plants specimens, passing the northern Alps during the Neolithic and Bronze Ages, and through the southern regions during the romanization. Our research traces the rise of these plants, the role they occupy in regional agronomic systems and food habits, their decline or resilience over time, linked with natural or socio-economic conditions.

Key-words: Champagne, France, Crop diffusion, Neolithic to early medieval period

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THE CONTRIBUTION OF THE İSTANBUL-YENIKAPI ARCHAEOBOTANICAL REMAINS TO THE DISCUSSION ON AGRICULTURE ORIGIN AND DIFFUSION

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The Marmara Region, with its geographical location and archaeological discoveries, is deemed to be one of the most appropriate regions for the comparison of the "expansionist" and "indigenous" models proposed on the transition of the Neolithic culture to Europe as well as the check-out of the validity of these. The non-existence of the wild plant progenitors of the first species that were used in agriculture (such as *Gramineae* and *Leguminosae*) in the natural vegetation of Europe paves the way for the idea that the origins of the tamed specimens found in the Neolithic settlements of Europe need to be traced to the Near East and Anatolia. The causes, mechanisms, and models of this spread are still important up-to-date matters of discussion in the science of archaeology. The recent archaeobotanical research has not only made great contributions to the scientific discussions on this complicated issue involving economic factors as well as social, cultural, technologic and religious/symbolic elements, but it has also initiated new discussions. Within this perspective, this study aims at presenting the preliminary findings of the İstanbul-Yenikapı archaeobotanical research. The Neolithic settlement in question, which dates back to nearly 6400s B.C., was discovered in 2004 during the construction of the underwater tube in the Sea of Marmara through which public transport vehicles can pass.

Key-words: Neolithic, Anatolia, Istanbul, Diffusion, Triticum

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GOING BEYOND BARLEY: ADAPTATION AND IMPORTATION OF BARLEY VARIETIES TO NORTHERN SCOTLAND

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The spread of agriculture relied on crops adapting to newly encountered environments that differed greatly from those under which they were originally domesticated. These adaptations involved the emergence of an array of locally-adapted crop varieties: landraces. Following the development of a geometric morphometric approach to the recognition of different landraces from charred barley grains (Wallace et al 2018, *Journal of Archaeological Method and Theory*, doi:10.1007/s10816-018-9402-2), in this talk we will present results of morphometric analysis of barley grains from prehistoric and historic sites in northern Scotland. Particular focus will be on Orkney and Shetland, where island-adapted varieties were (and continue to be) important for sustainable agriculture. By tracing the morphometric signature of different landraces in the archaeobotanical record it is possible to chart the appearance of distinctive landraces, and begin to explore the driving forces behind crop changes.

Key-words: Geometric morphometrics, archaeobotany, agriculture, Scotland

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PRE-AGRICULTURAL SUBSISTENCE STRATEGIES IN THE EARLY MEOLITHIC OF THE ZAGROS MOUNTAINS: MOVING BEYOND A FOCUS ON THE "WILD PROGENITOR SPECIES"

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Bioarchaeological research during the last twenty years demonstrated that agriculture did not emerge in a single core-area within the Near East. Most scholars rather see the Neolithization as a mosaic-like process, to which each sub-region within the Fertile Crescent contributed in its own way. By using Chogha Golan in the central Zagros Mountains as a case study, we demonstrate that early farmers of the region cultivated a set of plants, which does not represent an introduced package from an adjacent region. Instead, early farming was embedded in a traditional hunter-gatherer subsistence economy, which made use of a high diversity of wild resources available in

the local environments. Among them, wild grasses represent staples at many sites of the region and were only gradually replaced by the emerging domesticates. This regional pattern in the Zagros Mountains is unique among early Neolithic landscapes of the Fertile Crescent. Moreover, a meta analysis of the temporal development of wild grasses in Near Eastern archaeobotanical assemblages suggests that many arable weed species have been gathered since the Epipalaeolithic (e.g. *Aegilops* spp., *Stipa* spp.), whereas other taxa (e.g. *Lolium* spp.) only became abundant with the establishment of crop cultivation in the aceramic Neolithic. This further highlights that we need to move beyond a focus on the wild progenitor species in order to understand subsistence developments throughout the Neolithization process in the Near East.

Key-words: Near East, Neolithic, Gathering, Domestication, Wild Grasses

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