Session 2
AGRICULTURAL PRACTICES AND PALAEOECONOMY

Talks

LOCALLY AVAILABLE OR IMPORTED? IDENTIFYING THE PROVENANCE OF NATUFIAN PLANT FOOD AND FUEL RESOURCES AT SHUBAYQA 1 (NORTHEASTERN JORDAN)

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Archaeologists have long investigated the provenance of archaeological artefacts as a way of understanding past subsistence. Provenance analyses of bioarchaeological materials have provided key information on human and animal mobility patterns, territoriality, and economic activities such as pastoralism. Surprisingly, the provisioning of plant resources in prehistory has rarely been examined. Where the plants that served as food, fuel and raw materials were growing has only been inferred indirectly, based on modern ecological analogues and the geological setting of sites. Here we propose a new, inter-disciplinary approach that combines archaeobotany, ecological niche modelling, carbon isotope discrimination and strontium analyses to evaluate hunter-gatherer plant procurement strategies. We identify some of the plant species used as food and fuel by Natufian groups and their likely distribution in the landscape (plant catchment areas) at the site of Shubayqa 1 (northeastern Jordan). The results provide unique perspectives about the degree of mobility of hunter-gatherer groups and the distribution of plant resources in the past.

Key-words: hunter-gatherer, plant procurement, southwest Asia, multi-proxy

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DIFFERENT? THE CONSUMPTION OF PINE NUTS (*PINUS PINEA*) AMONG THE MIDDLE PALEOLITHIC NEANDERTHALS AND THE UPPER PALEOLITHIC MODERN HUMANS OF IBERIA

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Charred remains of *Pinus pinea* from Figueira Brava (Setúbal, Portugal) and Cueva de Nerja (Málaga, Spain) are presented. They demonstrate a systematic and sustainable management of this

pine by Neanderthals and anatomically modern humans' groups.
Human occupations of Figueira Brava are dated to different moments of MIS5, while in Cueva de Nerja they correspond to MIS3, 2 and 1, with some *hiatus* in the sequence. Both caves are located on the coast, but during the Paleolithic, the coastline was farther than today, and coastal dunes developed, where stone pines would grow. In the charcoal assemblage, *Pinus pinea* is accompanied by *Olea europaea* in the warm moments (MIS5 and MIS1) or *Pinus nigra-sylvestris* in the cold stages (MIS3, MIS2). In both sites, the most abundant remains are cone scales (> 50%), followed by wood charcoals and also few pine nut shells, and even needles in Figueira Brava. Regarding nuts, they are absent in this site and only a few has been recovered in Nerja. The composition of the *Pinus pinea* assemblage in both sites suggests that Neanderthals and AMH gathered whole immature cones and roasted them to obtain the nuts. Since they are consumed, they are hardly present in the archaeobotanical record.
Pine nuts are rich in unsaturated fats, proteins, vitamins and minerals. Their nutritional composition, in addition to their high palatability, convert the pine nuts into a high value component of Paleolithic diets.

Key-words: Pine nuts, Pinus pinea, Neanderthals, AMH, Plant food

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A VIEW FROM THE VILLAGES: DISENTANGLING 'MULTI-CROPPING', AGRICULTURAL ADAPTATION AND RESILIENCE IN THE INDUS CIVILISATION

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Past human populations are known to have managed crops in a range of ways. The unique placement of the Indus Civilisation across multiple riverine, rainfall and ecological niches has long been explored as an important factor in its development and decline. This complexity has led scholars to highlight the need to unravel the complexities of Indus cropping strategies as a fundamental challenge for South Asian archaeology. This paper endeavours to unpack the oft cited agricultural concept of 'multi-cropping' by considering diversity and variation in the cropping practices of the populations of the Indus Civilisation. This paper argues that 'multi-cropping' as a concept has been oversimplified, and the range of adaptive strategies that Indus populations exploited has thus been underplayed. Nuanced interpretations of the evidence provided by the combinations of crop seeds and weeds present in specific contexts and phases of occupation can reveal much about Indus cropping strategies. Data from sites situated in an array of ecological niches demonstrate how Indus farmers successfully exploited a variety of strategies to survive social and environmental diversity and change.

Key-words: agriculture, Indus Civilisation, South Asia, multi-cropping, diversity

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25 YEARS OF ARCHAEOBOTANY AT ÇATALHÖYÜK: WHAT WE HAVE LEARNED

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Systematic archaeobotanical recovery and analysis at Çatalhöyük, central Anatolia, has produced a high-resolution picture of plant use and management in a long-lived established farming community. 25 years of work by a large archaeobotanical team has opened up unparalleled opportunities to assess the ecology and sociality of early farming and long-term landscape management. We take this opportunity, at the conclusion of the Çatalhöyük Research Project (1994-2017), to draw out some key findings of the archaeobotanical work, including new results from excavations since 2009. The long-term story is one of broad spectrum plant use, incorporating more than 20 food plants, and near continual shifts in favoured cereal and pulse crops. Biodiversity and innovation were rooted in the activities of individual households, and linked to culinary practice as well as to local environmental conditions. Far from a static picture of a canonical farming 'package', the Çatalhöyük dataset reveals the dynamism and contingency of early farming strategies, resulting in remarkable resilience and sustainability over 1500 years. In methodological terms, the scale and richness of the assemblage creates opportunities to tease out different taphonomic pathways and sources of material, including dung-derived plants and arable weeds. In this way we can track both sheep(/goat) herding through the landscape and crop growing conditions, bringing together the two major components of this mixed economy.

Key-words: Neolithic, Chalcolithic, Anatolia, resilience, agroecology

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INTERPRETING MILLET AND BITTER VETCH IN IRON AGE-ROMAN CENTRAL ITALY

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Few plants are less evocative of Central Italian cuisine, either modern or ancient, than millet or bitter vetch. While the culinary credentials of emmer wheat and naked wheat are frequently lauded by modern scholars and ancient authors, millet and bitter vetch are understood to be either a crop consumed mostly by those in dire straits or fodder for animals. However, the association of both taxa with other common cereals and legumes in elite domestic contexts at Gabii shows that this claim is inaccurate. Given the importance of foodways in the presentation and embodiment of identity in antiquity, understanding the presence of these taxa in their archaeological context, and within the broader archaeobotanical assemblage is vital. In order to investigate the variable roles millet and bitter vetch might have played from the birth of Latin culture in the Iron Age to the rise of the Roman Empire, various contexts, both published and otherwise, from Gabii, Rome, and elsewhere have been re-examined through this lens.

Key-words: Millet, Bitter vetch, Iron Age, Roman, Italy

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THE ADOPTION OF SUMMER CROPS IN THE ARABIAN PENINSULA: A CRITICAL REVIEW OF THE EVIDENCE

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Since the announcement of the discovery of sorghum on the late 3rd millennium BC site of Hili 8 (U.A.E.) in the 1980s, the introduction of summer crops into the Arabian Peninsula has been the subject of much debate. Their presence has long been considered as significant regarding species translocation which occurred since Protohistoric times. However, a critical review of the current archaeobotanical evidence leads us to reconsider the introduction patterns of summer crops in this region, strategically situated between India and eastern Africa. During the last decades, archaeobotanical investigations have produced new data on the conditions and the timing of the use and the possible local introduction of summer crops in Arabia, including finger millet (*Eleusine coracana* ssp. *coracana*), cotton (*Gossypium* sp.), Asian rice (*Oryza sativa*), sesame (*Sesamum indicum*), sorghum (*Sorghum bicolor* ssp. *bicolor*), mung bean (*Vigna radiata*), urd bean (*Vigna mungo*) and cowpea (*Vigna unguiculata*). This data shows that, except for sesame, most of the summer crops are probably latecomers with an introduction dating to the Classical or Islamic periods. The consideration of the agro-ecological requirements of summer crops, their abundance in the archaeological assemblages as well as textual and ethnographic evidence allows us to discuss their status as imported products resulting from long-distance trade versus their acclimatization in pre-existing local agrosystems.

Key-words: Arabian Peninsula, summer crops, acclimatization, importation

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DJERBA ISLAND (S TUNISIA) ABOUT 2000 YEARS AGO: MORE THAN PURPLE AND FISHES - LOCAL HORTICULTURE

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Ongoing archaeological excavations revealed archaeobotanical material out of two different sites on the Island of Djerba, southern Tunisia: Meninx, a habour city flourishing during Roman times and famous for its purple production and Bourgou, an autochthonous settlement in the interior of the island.
Steppic to semi-desert formations dominated by Amaranthaceae, *Artemisia* and other Asteraceae and grasses are documented as regional vegetation in the southern Tunesian plains (Jaoudi et al. 2016). According to written sources wild olive trees have been managed since the 4th century BCE (Periplus of Pseudo-Scylax). However, archaeobotanical investigations documenting agriculture relying on this emblematic Mediterranean fruit tree is missing up to now, as well as possible differences and interrelations between a Roman (Meninx) and an autochthonous, contemporary 'inland'

settlement (Bourgou).
Our analysis on charred seeds and fruits as well as charcoals gives first clues. Fruit trees, such as figs, grapes and dates as well as annual crop plants are recorded, and animal dung seems to be used as fuel. In both sites charred remains of olive dominate the spectra, in other respects the plant spectra of the two sites indicates marked differences.

Key-words: Olea, North-Africa, Punic/Roman

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MAS DE VIGNOLLES XIV (NIMES, GARD, SOUTHERN FRANCE): DIFFERENT PERSPECTIVES ON LAND USE AND MANAGEMENT FROM THE PROTOHISTORY TO THE MIDDLE AGES

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The enlargement of a commercial centre in the vicinity of Nîmes (Southern France) offered evidence on land occupation and exploitation, from the Iron Age to the Middle Ages. The location of the living and working areas, paths and agrarian 'structures' uncovered was conditioned by the problematic topography and environment (humid depression; cyclic flooding) as identified by geomorphology and malacology. The diversity of the plant cover and of land management is also recognized by malacology, which emphasizes the importance of animal husbandry and pasture during the whole sequence, in agreement with data from pollen, beetles and domestic fauna. Concentrations of cattle remains rekindle the idea of a hypothetical link between significant consumption of cattle meat and humid areas. The impact of human activities on the plant cover is recognized in the low frequencies of arboreal pollen recorded since the Iron Age; however, fuelwood was apparently readily available as suggested by charcoal data. Further information on economic activities is provided by archaeobotany. The importance of *Cannabis sativa* and *Linum usitatissimum* may explain why this "ecologically problematic" area was exploited. Access to water is essential for the processing of plant fibres. Cereal cultivation, better recognized by palynology than by archaeobotany, appears to suffer fluctuations through time. The remains of *Vitis* constitute the first material proof of local vine cultivation during the Middle Ages.

Key-words: Southern France, Late Iron Age - Middle Ages, Environment, Economy

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65,000 YEARS OF PLANT FOOD USE AT MADJEDBEBE, NORTHERN AUSTRALIA

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Madjedbebe is a rockshelter, on Mirarr country, in northern Australia, which provides a sequence of human occupation dating from the first colonisation of Sahul, 65kya (±3.7, 5.7kya), to present. Its recent re-excavation, in 2012 and 2015, not only confirmed its antiquity, but also included the application of an array of scientific techniques to explore the nature of occupation at the site (Clarkson et al. 2017). This paper discusses one such technique, presenting the results of the analysis of the plant macrofossil assemblage from the rockshelter, recovered through systematic flotation of all features and two one-metre-squared trenches during excavation. The assemblage includes the remains of plant foods (e.g. underground storage organs (USOs), fruits, nuts and seeds) from all layers of human occupation. This paper will present the results of its analysis, considering questions of diet breadth, landscape use and past plant processing over this 65,000-year sequence of human-environment interaction.

Key-words: Australia; hunter-gatherer; human-environment interaction; plant processing

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A MICROBOTANICAL APPROACH TO PLANT PREPARATION AND CONSUMPTION IN THE PREHISTORIC AEGEAN

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How food is cooked and the reasons underlying this choice are one of the main ways in which human communities identify themselves. The study of culinary practices can also inform on past socio-ecological dynamics in terms of food acquisition strategies and agricultural choices.Intensive archaeobotanical research in Greece and other circum-Mediterranean regions over the last two decades has demonstrated an extensive spectrum of domestic and wild plants consumed by Neolithic and Bronze Age communities. However, macrobotanical remains are seldom associated with the artefact in which they were cooked, and therefore we know the list of ingredients but not what ingredients were cooked together or how were they cooked. By focusing on remains recovered from food-related artefacts (grinding stones and cooking vessels), this study explores the culinary practices of the inhabitants of three Neolithic and Bronze Age settlements in the Aegean through combined starch grain and phytolith analyses: late Middle and early Late Neolithic Stavroupoli (ca. 5600-5000 cal. BC, Thessaloniki), Early Bronze Age Daskalio (c. 2750-2300 BC, Cyclades) and Middle-Late Bronze Age Knossos-Gypsades (c. 1700-1100 BC, Crete). The results highlight the importance of domestic crops for the inhabitants of the prehistoric Aegean but also the culinary significance of weedy and wild plant resources, which is rarely attested in the macrobotanical record.

Key-words: Foodways; Aegean; starch grains; phytoliths

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ARCHAEOBOTANICAL INVESTIGATIONS OF DIETARY HABITS AND SUBSISTENCE STRATEGIES IN NORTHERN GREECE DURING THE IRON AGE

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Plant subsistence in Northern Greece during Iron Age (ca. 11th- 6th c. B.C.) constitutes a research field explored through the archaeobotanical record. This study is attempting to untangle identities, differentiations and similarities among communities of the historical era in the North Aegean in relation to plant products. Primary material comes from sites systematically studied for plant remains from the littoral part of Central Macedonia. Some are inhabited by indigenous population in the Thermaic Gulf (Karabournaki, Toumba Thessalonikis and Polichni) and others by southern Greek colonists (Olynthus and Argilos). In this region of Greece, a variety of cultural and socioeconomic transformations was being fashioned, leading to a new hybrid cultural *taskcape* evidenced by archaeological data. A wide diversity of plant species was been used, the majority of them already known and cultivated since Neolithic and Bronze Age times. Though some common traditions and continuities with the past as far as plant use were maintained, some differences in the more pronounced role of some cereals and fruits are observed. Crop choices, usages of plants and movement of foodstuff are being revealed though this study, in a landscape which was fundamentally changing especially with the appearance in late archaic/early classical period of well-organized Greek cities, the increase of contacts and a more organized trade with the rest of the Aegean.

Key-words: Iron Age, plant subsistence, dietary habits, North Aegean

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BAKING *VS* BOILING: THE ANALYSIS OF ARCHAEOLOGICAL FOOD PRODUCTS FROM WEST AND EAST ASIA

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Building on the proposed contrasting culinary traditions by Fuller and Rowlands (2011) this paper shows new archaeobotanical evidence on the different prehistoric *cuisines* from North Africa, West Asia and East Asia. Thanks to the development of the new methods for the analysis of archaeological cereal products at the site of Çatalhöyük in Turkey (Gonzalez Carretero et al. 2017), new analysis into other areas of the world show promising results for the disentanglement of prehistoric recipes. This paper shows evidence for differences not only in the choice of plant ingredients for the elaboration of prehistoric meals, but also in cooking techniques from a variety of geographical areas. Preliminary results from the analysis of archaeological amorphous charred food remains derived from the preparation of bread, porridges and beer-like products from Sudan, Turkey, Iraq, India and China are presented on this paper and will shed light on prehistoric food preparation and cooking from the Neolithic to Iron Age.

Key-words: Food, Cuisine, Archaeobotany, Prehistory

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RICE AND THE FORMATION OF COMPLEX SOCIETY IN EAST ASIA: RECONSTRUCTION OF COOKING THROUGH POT SOOT- AND CARBON DEPOSIT PATTERN ANALYSIS

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This paper presents reconstruction of East Asian Neolithic social transformation from the scope of daily cooking. Rice, the staple food in South China and Japan, has not only been the source of nutrition but a vital part of social organization in those areas. The pot soot- and carbon deposit pattern analysis method used for this research, which has been developed by Kobayashi, is one of the most useful method to reconstruct how rice was cooked in pottery-rich East Asian prehistoric society. The emergence of a special rice-cooker pot and its spread must indicate rice becoming the staple food of the society, and thus the control of rice circulation became the core of social organization. As the result of the analyses, it turned that, at the Tianluoshan site (5,000-3,500 BC) of the earliest rice farming society in China (Hemudu culture), rice became the staple food a few hundred years after the introduction of rice farming, whereas in Japan, rice was the staple food from the beginning of rice farming society (Yayoi culture, 1,000 BC-AD 300). Rice farming was introduced from the Continental Asia to Japan, so it can be considered that the perception of 'rice as the staple food' was also introduced at the same time, and that may have been a reason why social transformation in Yayoi happened rather rapidly. The result shows that the study of ancient cooking is a very useful scope for social archaeology.

Key-words: East Asia, Neolithic, rice, cooking, social transformation

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WHAT WOULD HAVE BEEN THE ARCHAEOBOTANICAL SIGNALS OF LUXURY STATUS OF THE SITE WITHOUT DISCOVERING THE AMERICAS? THE CASE OF PRAGUE CASTLE IN THE EARLY MODERN PERIOD AND ETHNOBOTANIC MEANING OF THE NEW USEFUL PLANTS

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With the discovery of America in 1492, Europe has been enriched with new species. Plants, especially economic ones, played specific role in contacts between Europe and Americas. They were presented at royal courts and monasteries in the early modern centers of Europe. First users of peculiar and exotic plants are recorded in the highest societies due to direct contact thanks with the

discoverers of the New World. Ethnobotanical meaning of particular plant comprises not only their economic value, but prestige role, magic meaning and medicinal power as well. The first users of luxury plants as cacao, vanilla … was the privilege of kings, other plants as e.g. potato, tobacco are recorded and used in monasteries as decoration flowers. As the case study we present new evaluation of luxury assemblage from Prague castle, where several species from Americas were recorded in the early modern period. Comparison between Prague castle assemblages and surrounded medieval/early modern city as well as among other European centers is in the focus of our attention. Finally, the mental experiment is suggested, based on reasoning which species and why should be used in former high society without discovering of Americas.

Key-words: Prague, America, useful plants, ethnobotany

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PLANT BASED DIET AND LANDSCAPE MANAGEMENT AT THE LATE IRON AGE (150-80 BC) PROTO-URBAN SETTLEMENT OF BASEL-GASFABRIK (SWITZERLAND) AND ITS HINTERLAND

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The late Iron Age (150-80 BC) proto-urban settlement of Basel-Gasfabrik, Switzerland, covered an area of about 150'000 square meters. Different types of pits yielded over 30'000 charred plant macro remains up to now. The most important cereals were *Hordeum vulgare* and *Panicum miliaceum*, together with *Triticum* species and *Setaria italica*. Furthermore pulses, oil and fibre plants as well as vegetables and herbs were cultivated. Within the settlement, the composition of the cereal spectrum is heterogeneous. This might indicate the presence of humans with different geographic origin and/or social status. The ecological requirements of the weed taxa point to intensive tillage and manuring. The broad spectrum of grasland taxa from various habitats indicate not only the importance of animal husbandry, but in addition, that the settlement was surrounded by a diverse and structured open landscape. This is in accordance to palynological data, which show a marked increase in human impact in the upper Rhine valley with the beginning of the Iron Age.

Key-words: La Tène period, central site, staple food plants, land use, settlement structure

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PREHISTORIC FOODWAYS IN NORTHERN GUJARAT, INDIA

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This study uses a holistic approach to the reconstruction of past foodways by considering evidence of food production, distribution, preparation and consumption of plant foodstuffs by Chalcolithic communities in northern Gujarat, western India. We present here the combined results of charred plant macroremains, plant microremains and chemical residue analyses from three settlements. Our research explores the transformation of plant resources into meals, focusing on how different foodstuffs were processed and mixed together by these communities from northern Gujarat. The macro- and microbotanical evidence suggests that the cultivation of fast-maturing monsoon crops (small millets and, to a lesser degree, tropical pulses and sesame) formed the basis of the subsistence, whereas winter cereals such as wheat and barley played a complementary dietary role. Chemical and microbotanical evidence further shows that small millets were virtually absent from pottery vessels, suggesting that they were used for flour-based meals but not incorporated into porridge-style dishes, unlike pulses and winter cereals. Microbotanical evidence also suggests the use of ginger-type spices as flavour enhancers. The combination of these techniques provided unique insights into how these communities chose to process specific plant products for their meals.

Key-words: Food, culinary practices, macro-remains, starch grains, organic residue analysis, South Asia

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THIRTY YEARS OF ARCHAEOBOTANY AT THE PYRAMIDS (GIZA, EGYPT)

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Since 1988 Ancient Egypt Research Associates has been conducting excavations at Old Kingdom settlement sites on the Giza Plateau, Egypt. We have systematically collected samples for macrobotanical analysis for the duration of the project excavations, and recently conducted a major over-haul of our botanical database, publishing all the results via Open Context. Our dataset of charred plant macro-remains is now exceptionally large, in terms of number of samples and the duration of the project, making this assemblage a unique and vital resource. Based on my analysis of this major assemblage in conjunction with archaeological and textual evidence, I am developing a hypothesis that ancient Egyptian economic 'success' in the Early Bronze Age depended upon highly localized agricultural diversity, making full use of a range of cultivated / domesticated /

wild plants. Agrarian, and plant processing strategies varied greatly across Egypt and through time, depending on which institution owned the land, and who used the agricultural products. Rather than revealing the generally assumed 'top-down' system of highly managed cultivation as the foundation of a grain-based tax economy, my analysis of this assemblage is leading me towards a conclusion that ancient Egyptian national stability may have instead been dependent upon diversity and adaptability in a highly flexible agricultural system, with decisions being made at a local level.

Key-words: Egypt, Database, Macro-botanical, Agriculture, Diversity

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FRUITS TO EAT, LEAVES TO WEAVE. ARCHAEOBOTANICAL ANALYSIS OF UPPER PALAEOLITHIC LEVELS OF COVA DE LES CENDRES (ALICANTE, SPAIN)

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Foraging fruits, seeds and leaves, harvesting firewood, and gathering fibres and stems to weave were daily activities for the hunter-gatherer groups that lived in Cova de les Cendres (Teulada-Moraira, Alicante, Spain) during Upper Palaeolithic. In this site, human occupations from Aurignacian to Final Upper Magdalenian have been documented. This archaeological deposit is rich in lithic tools and archaeozoological remains, but also a diverse archaeobotanical assemblage has been preserved.
Here we present the results of the carpological analysis of the Gravettian levels, dated between 29,170 and 25,340 cal BP. More than 30,000 reproductive remains and nearly 300 non-woody vegetative remains have been recovered. Among them, the by-products of fruit consumption stand out, as *Corema album* pyrenes and *Sambucus* sp. seeds. Gathering of legumes has been also documented, as well as other edible species like some Lamiaceae. Some plant parts discarded probably during basket weaving have been preserved, as *Stipa tenacissima* rhizomes, Monocotyledon leaves and Cyperaceae seeds. Medicinal use, dyeing or bedding construction could explain the presence of other archaeobotanical remains. The Palaeolithic human groups of Cendres found these plant resources in several biotopes placed even more than 10 km away.

Key-words: Hunter-gatherers; Gravettian; plant food; basketry; Cova de les Cendres

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UNDERGROUND STORAGE ORGANS AS A FOOD RESOURCE IN THE PALEOLITHIC HULA VALLEY, ISRAEL

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The Hula valley is located in the Dead Sea Rift, part of the so-called out-of-Africa corridor. The earliest hominin presence in the valley has been recorded at the Acheulian site of Ghesher Benot

Ya'aqov (GBY, 780 kyr) on the Jordan River banks. Northward on the same river banks, the Mousterian site Nahal Mahanayim Outlet (NMO, 60 kyr) and the Epipaleolithic site Jordan River Dureijat (JRD, 20-10 kyr) were excavated. The botanical assemblages at these sites include remains of plants which have Underground Storage Organs (USO) – a significant source of food during the Paleolithic period.
Most of these are of wet habitat species such as *Butomus umbellatus* (GBY, NMO), *Lycopus europaeus* (GBY, NMO, JRD), *Nuphar lutea* (GBY), *Sagittaria sagittifolia* (GBY), *Scirpus lacustris* (GBY, NMO, JRD), *Typha domingensis* (GBY, NMO). Some of the common USO plants of the Hula valley, such as *Calystegia sepium*, *Phragmites australis*, and *Scirpus maritimus*, which are not recorded among the archaeological plant remains will be considered as "missing food".
It appears that, as in the present-day, ancient Hula Valley USO plant were common mainly in the wetter habitats. They were available almost throughout the year, and by controlling fire, hominins could increase the spectrum of such food plants in their diet. Moreover, the multiregional character of these plants could have been a contributing factor in the way out of Africa. The characteristics of USO and their role in Hula Valley Paleolithic foodways will be discussed.

Key-words: Underground Storage Organs, Hula Valley, Ghesher Benot Ya'aqov, Out of Africa

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AGRICULTURAL ECONOMY AND THE DEVELOPMENT OF COTTON CULTIVATION DURING THE MEROITIC PERIOD (4TH C. BC – 5TH C. AD) IN CENTRAL SUDAN: SEED, FRUITS AND MORPHOMETRIC ANALYSES AT MOUWEIS

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Mouweis (Central Sudan) is located on the bank of the Nile, 50km south from the ancient Meroe. The region is characterized by an arid climate with irregular monsoons. The excavation conducted by the Musée du Louvre and the Sudanese Antiquities since 2007 show that Mouweis is occupied from the 4th c. BC to the 5th c; AD, which correspond to the emergence and decline of the Meroitic kingdom. The site presents all the characteristic structures of a Meroitic town such as a palace, a temple, living/handcraft quarters, etc. Systematic dry-sieving of the excavated sedimenthas been done in order to get botanical macroremains and to define past agricultural dynamics and plant exploitation. The study of archaeobotanical macroremains (1stc. BC to 5thc. AD) highlights the importance of tropical crops growing during summer, such as sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*) and cotton (*Gossypium* sp.). Winter crops are less numerous, mostly represented by barley (*Hordeum vulgare*) and wheat (*Triticum* cf. *turgidum* subsp. *dicoccon*). The presence and diversity of many small Panicoideae suggest that they were exploited for different uses as Human food and feed, forage, medicine. Frequent finds of cotton seeds, radiocarbon dated, highlight the important role of this new textile plant into the Meroitic economy from the 1st c. AD onwards. Geometric morphometric analyses carried out on cotton seeds give new taxonomical information. The results, together with evidence from other Meroitic sites, help us to better define the agricultural economy and figure out the role of tropical crops into the Meroitic society.

Key-words: Meroitic, agriculture, Mouweis, archaeobotany, cotton

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FOOD SUPPLY OF A LATE ROMAN CASTRUM (450 – 800 AD) IN GUIDICARIE ESTERIORI, TRENTINO (ITALY)

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In the course of archaeological excavations of a castrum on the Monte San Martino di Lundo/Lomaso (Trento), soil samples of a storage warehouse, fireplaces, and debris horizons were collected for archaeobotanical analyses. The samples contain charred remains of crops, gathered and wild plants. Legumes (*Vicia faba, Pisum sativum, Lens culinaris, Lathyrus sativa, Vicia ervilia*) predominate the crops. Furthermore, *Hordeum vulgare* (both hulled and naked forms), S*ecale cereale, Panicum miliaceum, Tritcum dicoccum*, and *T. spelta* have been important sources of carbohydrates. Alternative food supplies have been fruits and nuts like *Corylus avellana, Juglans regia, Rubus idaeus*, and *Vitis vinifera*. This crop inventory is compared and discussed with plant findings from other contemporaneous Roman sites in Northern Italy.
Wild plants are recorded at a considerably lower quantity, which refers to a thorough cleaning of the stored staple food. Plants of fields and rural environments predominate amongst the weeds. *Bromus secalinus* and *Asperula arvensis* prove two characteristic species of cereal fields deficient in lime, which suggest a local cultivation on the valley bottom. Moreover, *Aphanes arvensis* and *Asperula arvensis* are low growing weeds, which refer to a harvest close to the soil surface. The ecological indicator values of these wild plants are indicative of stands with moderate brightness and middling nitrogen supply on slightly acid to alkaline soils.

Key-words: archaeobotany, fortification, Alps, Late Antiquity, Middle Ages

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CULTIVATION OF FLAX (*LINUM USITATISSIMUM* L.) AT TEL BURNA, ISRAEL

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Flax is one of the first founder crops of the Near East. Still, the cultivation of *Linum usitatissimum* L. in the southern Levant is not comprehensively investigated. A close examination of linseed finds from Bronze and Iron Age (3600 – 586 BCE) sites, however, reveals interesting developments in the cultivation of this crop. While the finds of flax remains decreased from the Early Bronze Age IV to the Late Bronze Age (2400 – 1200 BCE), there is an increase of linseed finds starting in the final phase of the Late Bronze Age again (from 1300 BCE onward). On the one hand, the shifts in flax cultivation are climate induced and on the other hand affected by sociocultural changes.
The archaeobotanical finds from Tel Burna complement the record of linseed finds. The site dates

to the Late Bronze and Iron Age and is located in the Shephela. This fertile region is known as the breadbasket of ancient Palestine. Indeed, archaeobotanical analyses resulted in a high variety of crop species including demanding crops like *Linum usitatissimum* L. The cultivation of this crop is not only attested by carbonized linseed finds but also by seeds of the flax parasite *Cuscuta* sp. Last year's season the excavation works concentrated on early Iron Age strata (1200 – 975 BCE) outside the enclosure wall in which hundreds of carbonized linseeds were exposed in proximity to complete storage vessels.
This paper wants to present the new archaeobotanical material concentrating on the flax finds. The storage find will be put into the wider context of flax cultivation of the southern Levant. Moreover, it is planned to establish a method to distinguish if the carbonized linseeds are residues of flax cultivation intended for oil or for textile production.

Key-words: Flax, Linum usitatissimum L., southern Levant, Bronze Age, Iron Age

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A TASTE OF EMPIRE: RECONSTRUCTING FOODWAYS IN ROMAN PANONNIA

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Since agriculture began, food systems have constantly evolved and the Roman Empire in particular marks a period of greater diversity and complexity, where the food system was re-organised on a grand scale to feed larger cities and fuel local economies. As the food system expanded across the Middle East and Asia, settlements in Europe began to gain access to a wide range of 'exotic' foods that could not be grown locally. This is the case here, where evidence of 'exotic' plants were recently recovered from *Colonia Aelia Mursa* (modern day Osijek, Croatia), on the Danube frontier in Roman Pannonia. Rice (*Oryza* cf. *sativa*), black and white pepper (*Piper nigrum*) and pomegranate (*Punica granatum*), along with a range of other herbs and fruits not previously seen in the region, were discovered from cess pits dated to the first levels of the settlement c.120-130 AD. Its close proximity to the Danube *Limes*, where established military trade networks existed, probably facilitated the quick integration of Mursa into the Roman food system providing the town with a wide range of goods.

Key-words: Exotics, Trade, Danube Limes, Asia, Croatia

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FIELD-GRASS-ECONOMY AND MANURING IN SOUTHWEST GERMANY BETWEEN BRONZE AGE AND MODERN TIMES ACCORDING TO ON-SITE AND OFF-SITE ARCHAEOBOTANICAL EVIDENCE

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The field-grass economy, practised in temperate Europe since the Bronze Age, led to higher productivity of the plots, but also to stronger human impact on the landscape. The extensive field-grass cultivation is the initial form of this kind of economy. It involves several years lasting fallow periods. This leads to regeneration of the topsoil humus, which can later be mobilized by tillage. Apart of this the nutrients needed for agriculture can also be provided by manuring. This means the production of manure and implies shorter fallow periods. However, still it is not known when the extensive field-grass agriculture shifted to more intensive agricultural systems. In order to explore this, the current paper considers the diachronic change in abundance of weeds from on-site records as indicators for different field systems. Moreover, we assume that before the Late Medieval period the meadows and pastures on arable land had minor importance, and the changes in the relation between Cerealia- and *Plantago lanceolata*-pollen can be used as index reflecting the relative extend of arable and fallow lands. The fluctuations of this index, observed in high resolution off-site pollen records from southwest Germany indicate that more intensive cultivation systems, involving shorter fallow periods and systematic manuring, were established at different locations between the late Latène and the High Medieval time depending on region and perhaps social circumstances.

Key-words: field-grass economics, three-field-system, weeds, cereals, agricultural productivity

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ANCIENT AND MEDIEVAL AGRICULTURE OF THE NORTH CAUCASUS, RUSSIA

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In this talk, we will discuss our work on the terraced complexes and present the new data on the development of ancient and medieval agriculture in two microregions in the mountainous Dagestan and Kislovodsk basin (Eastern and Central parts of the North Caucasus). Despite large-scale agricultural terraced landscapes that are visible in satellite photographs, the age, environmental background, crops, and agro-techniques on the mountain slopes remain is not adequately investigated. We have focused on the impact of climate on the agricultural development of these regions. In the history of agriculture in the North Caucasus, there is a long stage that preceded terracing, and it also remains mostly unexplored, in contrast to the much-studied adjacent Transcaucasian regions.

We turned to the history of the agricultural practice in Dagestan since that isolated area presents the oldest agricultural evidence in the North Caucasus. We received the first information on the climate from the Neolithic to the Middle Ages, including all periods of occupation, including extensive terracing in the Middle Ages in the Eastern part of the North Caucasus. Different sets of wheat and barley were found in the composition of macro remains since the Neolithic.

In another part of North Caucasus, in the Kislovodsk basin, the most significant expansion of the terraces squares was in the Bronze Age, but there is no reliable evidence on the composition of farmed cereals. The ploughed areas ware redundant, and it led to paleoecological disaster in the first millennium BC, and the territory fell into disuse for about five hundred years. In the second stage of terraced farming, millet was the most commonly occurring cultivated plants, as well as in 2-4 centuries AD people grew rye.

Key-words: North Caucasus, terraced agriculture, environmental background

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TO BE OR NOT TO BE ROMAN: INDIGENOUS, ROMAN-INDIGENOUS AND ROMAN IMPACT IN AGRICULTURE AND FOOD CONSUMPTION IN NW IBERIA

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Past reviews focusing Roman agriculture in NW Iberia have stressed the high level of continuity regarding Iron Age crops and an incipient Romanization of agricultural strategies, at least in the early phases of the incorporation of the region in the Empire. At the same time, some possible biases have been documented, namely preservation issues and the great focus of archaeobotanical studies in hillforts.
After several years of new archaeobotanical investigation, it is clear that this scenario needs to be reassessed. Recent carpological studies carried out in Roman cities such as *Aqua Flaviae* and *Bracara Augusta* and farms such as Foz da Ribeira do Poio and Quinta de Crestelos shed some light on this subject and confirmed the existence of the above-mentioned biases. Here we will present the available carpological data and results from new unpublished sites that confirm the role these new settlements had in the Romanization of food consumption and agricultural practices in the region, attesting, for instance. the incorporation of newly introduced fruits in typically Roman rituals.
With a larger and more diversified array of data it is now possible to discuss the Roman impact in agriculture in NW Iberia and the assimilation of new crops by indigenous communities, while integrating it in the social and political history of the region.

Key-words: Romanization, Agriculture, NW Iberia

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ENVIRONMENTAL CHOICES OF INDUS PEOPLE

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The Indus Civilisation developed in a climatically challenging and environmentally diverse region, and provides a range of opportunities to obtain new insight into early agricultural and land management practices in ancient South Asia. The exploration and analysis of botanical remains from small- and medium sized agricultural sites provide useful comparison to large-scale, urban sites, and particularly provides insights into dynamics of resilience and sustainability in the rural

sector. This study utilises data from the sites of Khanak, Lohari Ragho I and Masudpur I in north-west India, to develop an understanding of subsistence choices and plant management strategies made by the inhabitants of those settlements between 4500 and 4000 years ago. These sites are distributed across an environmentally and climatically diverse region, which ranges across arid, semi-arid and temperate climatic zones. A combined analysis of macro-botanical and wood charcoal material from these sites makes it possible to investigate choices relating to differential use of space within sites, fuel selection, management of the landscape, the impact of seasonality and climate change. These factors will in turn will inform our understanding of how resilient Indus subsistence practices were in the face of the 4.2 ka BP climate event.

Key-words: Indus civilization, agriculture, 4.2 ka BP event, wood charcoal

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LOCAL VARIABILITY IN PLANT MANAGEMENT AND CONSUMPTION AT EARLY HOLOCENE SITES IN THE SOUTHERN LEVANT: NEW INSIGHTS FROM PPNA SHARARA

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The PPNA site of Sharara is located on a remote hilltop in the wadi-el Hasa, Jordan. Beginning in 2016, excavations at the ca. 0.5 ha site have revealed an intriguing series of structures, including a semi-subterranean passageway with upright cuphole mortars set into the wall. Sampling and flotation have produced a well-preserved assemblage of charred plant remains that permit a reconstruction of plant management and consumption at the site. In this paper, we present preliminary results from analyses of the macrobotanical remains, which indicate that inhabitants were exploiting a range of wild (and potentially cultivated) taxa, including barley, pulses and figs. We compare our findings to contemporary assemblages across the southern Levant, but with a particular focus on PPNA-LPPNB el-Hemmeh, where archaeobotanical evidence documents the pre-domestication cultivation of wild barley. Located 25 km upstream from Sharara, el-Hemmeh shares a broadly similar climate and environment with the site. Here we consider in more detail the specific socio-ecological contexts of Sharara and el-Hemmeh and the extent to which variation in local conditions can help to explain variation in plant management and consumption at the two sites.

Key-words: Origins of agriculture, Pre-Pottery Neolithic, southwest Asia, pre-agricultural plant management, wild barley

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MELON (*CUCUMIS MELO* L.) – A MARKER OF THE ROMANIZATION PROCESS IN NORTHERN AND NORTHEASTERN GAULE AND THE ROMAN PROVINCES? DETERMINATION, AGRICULTURAL HISTORY AND ARCHAEOBOTANICAL EVIDENCE

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Seeds of melon (*Cucumis melo* L.) are frequently observed from Gallo-Roman waterlogged contexts in north-eastern Gaule, mainly wells, cesspits and other waste deposits like wooden basins. The seeds are either waterlogged or mineralized. Correct determination and especially differentiation from cucumber *Cucumis sativus* L., can be tricky and should be checked carefully. In the archaeobotanical literature we can find quite often a determination *Cucumis melo/C. sativus* due to these determination problems and sometimes bad preservation of the seeds, but J. Janick *et al.* (2007) suggested that the *cucumis* of Columella and Pliny was not cucumber, as commonly translated, but *Cucumis melo* subsp. *melo*, flexuosus Group (snake melon or vegetable melon). A first publication by H. Küster (1989) gave some determination criteria. *Cucumis melo* seeds are slightly longer and the side of the *hilum* is slightly irregular in seed shape. The hilum itself is sunken, deviated from the central seed axis. The lines of cells in the hilum part of the seed are parallel to each other. In contrast, cucumber seeds are always very symmetrical, also the hilum seems to be always placed in the central seed axis. The cell lines near the hilum are not parallel, but arranged in form of a gothic arc. A review of *Cucumis*-seeds from eastern France shows that all well preserved seeds could be attributed to *Cucumis melo*. Older determination as *C. sativus* are doubtful. Melon was principally cultivated in warmer climates, due to high requirements in sunshine, temperature and water supply. The use of melon during Antiquity is still not completely understood: melons from the flexuosa-group could have been used as vegetables, but eating the seeds as snack seems also possible. Do we have to consider the import of melons as preserved vegetables or in form of oil-rich seeds? On the other hand, is it possible to grow melons in north-eastern Gaule? The total absence of melon during Late Celtic times suggest that melon is a suitable indicator to trace the Romanization process and the establishment of Roman trade networks and food habits.

Key-words: Cucumis melo, Romanization, gallo-roman period, wells, import products, trade

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