

# 18<sup>TH</sup> CONFERENCE OF THE INTERNATIONAL WORKGROUP FOR PALAEOETHNOBOTANY

*Lecce, 3<sup>rd</sup> - 8<sup>th</sup> June 2019*



## PROGRAM AND ABSTRACTS

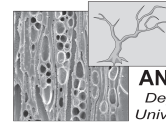


**UNIVERSITÀ  
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BENI CULTURALI



LABORATORY OF  
ARCHAEOBOTANY  
AND PALAEOECOLOGY  
*Department of Cultural Heritage  
University of Salento (Le - ITALY)*

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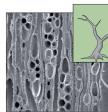
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2019

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Laboratory of Archaeobotany and Palaeoecology



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*Department of Cultural Heritage  
University of Salento (Le - ITALY)*

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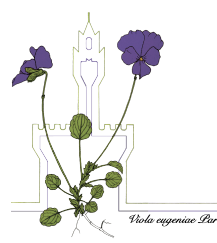
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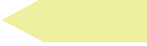
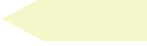


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# 18<sup>TH</sup> CONFERENCE OF THE INTERNATIONAL WORKGROUP FOR PALAEOETHNOBOTANY

*Lecce, 3<sup>rd</sup> - 8<sup>th</sup> June 2019*

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## Conference Program

### MONDAY 3<sup>rd</sup> JUNE 2019

08.30 - 09.30 *Reception*

09.30 - 10.30 Introduction and welcome

10.30 - 11.00 *Coffee break*

11.00 - 12.00 In Memory of M. Follieri & G. Hillman

#### **Session 1: ORIGINS AND DIFFUSION OF CULTIVATED PLANTS (Building 6, Room 7)**

12.00 - 12.15 FULLER D. Q.

Secondary domestication of grain crops: parallelisms evolving under entrenched farming

*pp. 29-30*

12.15 - 12.30 GOPHER A., ABBO S.

The cultural distinction between plant domestication and crop evolution: The question of Resolution

*pag. 30*

12.30 - 12.45 WEIDE A., RIEHL S., ZEIDI M., CONRAD N. J.

Pre-agricultural subsistence strategies in the Early Neolithic of the Zagros Mountains: moving beyond a focus on the “wild progenitor species”

*pp. 42-43*

12.45 - 13.00 LONGFORD C., STEWART K., JONES G., WALLACE M., BROWN T.

ADAPT: Spread of Crops in Neolithic Europe

*pag. 33*

13.00 - 14.30 *Lunch*

- 14.30 - 14.45 ENDO E., NASU H., GASKEVYCH D., YANEVICH A., *et alii*  
Ukraine as the crossroad for agricultural dispersal in Eurasia pag. 27
- 14.45 - 15.00 FILIPOVIĆ D., MEADOWS J., DAL CORSO M., EFFENBERGER H., *et alii*  
*Ex Oriente seges*: the arrival and establishment of broomcorn millet in Europe pp. 28-29
- 15.00 - 15.15 TENGBERG M., WILLCOX G., ROUSOU M., DOUCHE' C., PARES A.  
Vegetation and plant exploitation at Pre-Pottery Neolithic Ayios Tychonas-Klimonas with special focus on the introducing of crop plants from the continental Near East pag. 40
- 15.15 - 15.30 MOSULISHVILI M., BEDOSHVILI D., RUSISHVILI N., MAISAIA I.  
Georgia, the South Caucasus as the Origin Place of *Triticum spelta* pag. 35
- 15.30 - 15.45 CASTILLO C.  
Agricultural transitions in Prehistoric Southeast Asia: switching from dryland to wetland rice economies pag. 26
- 15.45 - 16.00 HUNT H., KRZYZANSKA M., CREMA E., JONES M.  
Crops, Pollinators and People: constraints on the origins and spread of buckwheat pag. 31
- 16.00 - 16.15 MARTIN L., HERRSCHER E., RUSISHVILI N., LEBEDEVA E., *et alii*  
Was millet domesticated in the Caucasus? First appearance of *Panicum miliaceum* and *Setaria italica*: an archaeobotanical and isotopic approach pp. 33-34
- 16.15 - 16.45 *Coffee break*
- 16.45 - 17.00 JESUS A., BONHOMME V., EVIN A., IVORRA S., *et alii*  
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 pag. 32
- 17.00 - 17.15 SALAVERT A., ZAZZO A., ANTOLÍN F., MARTIN L., *et alii*  
New Radiocarbon dates for the early dispersal of Opium poppy (*Papaver somniferum* L.) in Western Europe pag. 37-38
- 17.15 - 17.30 PAGNOUX C., BOUBY L., BONHOMME V., IVORRA S., *et alii*  
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 pag. 37
- 17.30 - 17.45 EL DORRY M.A., BOUCHAUD C., PAGNOUX C., REDON B., *et alii*  
Agriculture-Viticulture in the New Kingdom-Early Roman Egyptian Delta pp. 26-27
- 17.45 - 18.00 NASU H.  
Domestication of soybean, azuki, and barnyard millet in Japan pag. 36



- 18.00 - 18.15 BOUCHAUD C., DABROWSKI V., DAL-PRÀ P., *et alii*  
Absolute chronology of cotton dispersal in Arabia and Africa *pag. 25*
- 18.15 - 18.30 SPENGLER III R. S.  
Shifting Seed-Dispersal mechanisms during Early plant domestication *pag. 39*
- 18.30 - 18.45 WALLACE M., MARTIN P., RUSSELL J., BONHOMME V., *et alii*  
Going beyond barley: adaptation and importation of barley varieties to Northern Scotland *pag. 42*
- 18.45 - 19.00 ANDREASEN M. H.  
Parallel worlds in the Neolithic: Coastal hunter-gatherers in Southern Scandinavia. An interdisciplinary investigation of the Pitted Ware Culture *pag. 24*

## **TUESDAY 4<sup>th</sup> JUNE 2019**

### **Session 1: ORIGINS AND DIFFUSION OF CULTIVATED PLANTS (Building 6, Room 7)**

- 08.30 - 08.45 STEVENS C.  
Identifying the processes of selection in the evolution of domesticated millets in Northern China *pag. 39*
- 08.45 - 09.00 HOVSEPYAN R.  
On plant economy in the Middle Bronze age in the South Caucasus *pp. 30-31*
- 09.00 - 09.15 MUELLER-BIENIEK A., KAPCIA M., MOSKAL-DEL HOYO M., NOWAK M.  
Plant used by people of the Funnel Beaker culture at Mozgawa site, S Poland *pp. 35-36*
- 09.15 - 09.30 MINKEVICIUS K.  
From Hilltops to Hillforts: Archaeobotany of Prehistoric settlements in the South-East Baltic *pag. 34*
- 09.30 - 09.45 ANTOLÍN F., STEINER B. L., MARTÍNEZ-GRAU H., ROTTOLI M., *et alii*  
Early farmers in the Southern Alps: results of the Archaeobotanical investigation of the lakeshore site of Isolino Virginia (Varese, Lombardy) *pp. 24-25*
- 09.45 - 10.00 TOULEMONDE F., DAOULAS G., BONNAIRE E., RIQUIER V., *et alii*  
A brief history of plants in a region of Northeastern France: 6,000 years of crop introduction in the Plain of Troyes, Champagne, France *pp. 40-41*
- 10.00 - 10.15 KREUZ A., POMÁZI P., OSZTÁS A., OROSS K., *et alii*  
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) *pp. 32-33*

10.15 - 10.30 SARPAKI A.

Neolithic Farming at Knossos: revisiting older archaeobotanical material

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*10.30 - 11.00 Coffee break*

11.00 - 11.15 FAIRBAIRN A.S.

Revision of the crop history of Aceramic Neolithic Canhasan III, Karaman, Turkey

*pag. 28*

11.15 - 11.30 ULAŞ B.

The Contribution of the İstanbul-Yenikapı archaeobotanical remains to the Discussion on Agriculture Origin and Diffusion

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**Session 3: INTEGRATED AND INTERDISCIPLINARY APPROACHES (Building 6, Room 7)**

11.30 - 11.45 BISHOP R. R., CHURCH M. J., TAYLOR B., GRAY-JONES A., WARREN G. M.  
Nuts about the Mesolithic? Experimental and archaeological insights into hazelnut taphonomy

*pag. 102*

11.45 - 12.00 DILKES-HALL I.E., DAVIS J., MALO H.

Using experimental archaeology to understand the archaeobotanical record: a multi-proxy investigation of mid-Holocene fruit processing in Gooniyandi Country, Northwest Australia

*pp. 104-105*

12.00 - 12.15 BERIHUETE AZORÍN M., STIKA H. P., VALAMOTI S. M.

Distinguishing ripe spelt from processed green spelt (Grünkern): Methodological aspects and the case of Hochdorf (Vaihingen a.d. Enz, Germany)

*pag. 101*

12.15 - 12.30 VALAMOTI S. M., PETRIDOU C., HEISS A. G., *et alii*

Sitos: an interdisciplinary investigation of 'cereal food' in the ancient Greek world integrating literary sources, experimentation, food science, archaeobotany and scanning electron microscopy

*pp. 113-114*

12.30 - 12.45 AGUIRRE C., PARRA L., PIQUÉ R.

Ethnoarchaeology of agroecological farming systems in the Equatorial Andes: from the system context of agrobiodiversity to the formation of archaeobotanical carpological contexts

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12.45 - 13.00 BUFFINGTON A.

Pastoral Economies in the Old World Tropics and millet exploitation

*pag. 102*

*13.00 - 14.30 Lunch*

14.30 - 14.45 VIGNOLA C., MASI A., SADORI L.

Three-thousands-years record of climate and agriculture in Turkey: the isable isotopes approach to plant remains from Arslantepe *pag. 115*

14.45 - 15.00 MCCLATCHIE M.

Investigating places of assembly in later prehistoric Ireland through isotopic analysis of charred cereal grains *pag. 109*

15.00 - 15.15 STROUD E., BOGAARD A., MCKERRACHER M.

Investigating the emergence of Early Medieval English open field agriculture using crop stable isotopes and functional weed ecology *pag. 112*

15.15 - 15.30 BOARETTO E., EHRLYCH Y., REGEV L.

The potential of charred olive pits from archaeological sites in reconstructing Mediterranean climate *pp. 115-116*

15.30 - 15.45 POKORNÁ A., KOČÁR P.

Immigration history of synanthropic flora in Central Europe - Implication for better understanding of changes in agricultural system *pp. 110-111*

15.45 - 16.00 FUKS D., DUNSETH Z. C., LANGGUT D., BUTLER H., *et alii*

Dung in the dumps: a comparative study of seeds, phytoliths and pollen in dung pellets and refuse deposits at Early Islamic Shivta, Negev, Israel *pag. 105*

16.00 - 16.15 TOLAR T., GALIK A., ROSENBERG E., LE BAILLY M., *et alii*

What infos can we get from the analyses of the Late Neolithic dog (*Canis familiaris*) excrements? *pag. 113*

16.15 - 16.45 *Coffee break*

16.45 - 17.00 Introduction to Laboratories (Introduction by Karl Hammer)

17.00 - 19.00 PARALLEL LABORATORIES:

Free Laboratory (Building 6, Room 6)

Naked wheat (Building 6, Room 4)

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Legumes (Building 6, Room 5)

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20.00 *Welcome Cocktail (Monastery of Olivetani)*

**WEDNESDAY 5<sup>th</sup> JUNE 2019**

**Session 3: INTEGRATED AND INTERDISCIPLINARY APPROACHES (Building 6, Room 7)**

08.30 - 08.45 KARG S.

Interwoven – Archaeology, botany and the technical know-how of producing plant fibres in the Neolithic *pp. 106-107*

08.45 - 09.00 ANDONOVA M.

Archaeobotany of Baskets of South-east Europe? *pp. 100-101*

09.00 - 09.15 CARTWRIGHT L., CROWTHER A., FAIRBAIRN A., *et alii*

Ancient starch analysis at Neolithic Boncuklu *pp. 103-104*

09.15 - 09.30 MARRERO C.S., LANCELOTTI C., MADELLA M.

Plant foodways at Çatalhöyük – a multi-proxy perspective *pag. 112*

09.30 - 09.45 KINGWELL-BANHAM E.

Phytoliths as indicators of irrigation across Asia. Paper in memory of Dr Alison Weisskopf *pag. 107*

09.45 - 10.00 HAGENBLAD J.

The history of barley cultivation in the Canary Islands as told by ancient and extant DNA *pag. 106*

10.00 - 10.15 WEISS E., DRORI E.

Wine fit for a king: Identifying ancient grape varieties using a novel morphological 3D key *pag. 117*

10.15 - 10.30 BOUBY L., WALES N., JALABADZE M., RUSISHVILI N., *et alii*

Tracking the history of cultivated grapes (*Vitis vinifera*) in Georgia combining archaeobotany, geometric morphometrics and ancient DNA *pag. 103*

*10.30 - 11.00 Coffee break*

11.00 - 11.15 OUT W., MIETH A., PLA RABES S., KHAMNUEVA-WENDT S., *et alii*

Prehistoric pigment production at Rapa Nui (1200-1650 AD) *pag. 110*

11.15 - 11.30 LE MOYNE C., BLEASDALE M., DESIDERI J., BESSE M., *et alii*

Use of Dental Calculus to discern plant use amongst pastoralists from Kadruka 1 and 21, Sudan *pp. 107-108*

11.30 - 11.45 ROWAN E.

Eating in the Italian countryside: a reconsideration of Roman literary sources in light of the archaeobotanical evidence from rural sites in Italy *pag. 111*

11.45 - 12.00 VAN AMERONGEN Y.F., KROONEN G.J.  
The introduction and distribution of cultivated plants and their accompanying weeds in Europe from ca. 8000 – 800 BCE based on linguistics and archaeobotany *pag. 114*

12.00 - 12.15 LIVARDA A., PICORNELL-GELABERT L., ORENGO H., *et alii*  
Foodways, plant and landscape management in Minoan Crete: Palaikastro in context *pag. 108*

12.15 - 12.30 DEMICOLI M.  
The invisible fruits: the presence of fruit and nut trees in Chinese Neolithic sites as identified from anthracology *pag. 104*

12.30 - 12.45 NORYSKIEWICZ A.M., BADURA M., OSIPOWICZ G., *et alii*  
Humans in the Environment: Plants and Landscapes in Mesolithic in the Paliwodzizna (Dobrzyń Lakeland, Northern Poland) *pp. 109-110*

12.45 - 14.30 *Lunch*

#### **Session 4: PLANTS AND SOCIETY (Bulding 6, Room 7)**

14.30 - 14.45 DIFFEY C., BOGAARD A., CHARLES M., NEEF R.  
'Farming the city': Agriculture and storage in the Bronze Age *pp. 138-139*

14.45 - 15.00 ALONSO N., LÓPEZ D., CARDONA R., MORER J.  
Wheat and Vine, Flour and Wine: Crop Storage and Plant Food Processing at the Iron Age Iberian settlement of Els Estinclells (Verdú, Catalonia, Spain) *pp. 134-135*

15.00 - 15.15 BADURA M., NORYSKIEWICZ A. M., KOSMACZEWSKA A., *et alii*  
Plants for the final journey - archaeobotanical exploration of the 18th c. children's burials in the Holy Trinity church (sanctuary of the Divine Mother Queen of Krajna) in Byszewo (Poland) *pp. 135-136*

15.15 - 15.30 SEABRA L., SANTOS F., VAZ F.C., TERESO J.P.  
Fortified storage areas in the Late Iron Age in NW Iberia: evidence for surplus production and controlled redistribution? *pp. 148-149*

15.30 - 15.45 REUTER A. E.  
Is the storage running out? New approaches on the security of supply from the 6th century granary of the early byzantine city Caričin Grad (Serbia) *pag. 147*

15.45 - 16.00 MARGARITIS E.  
The Dawn of Urbanisation in Europe: mobilising the recourses of the marginal landscapes of the Aegean Bronze Age *pag. 145*

16.00 - 16.15 DECKERS K., TUMOLO V., GENZ H., RIEHL S.  
On the significance of olive arboriculture in the Early Bronze Age Levant *pag. 138*

**Session 2: AGRICULTURAL PRACTICES AND PALAEOECONOMY (Building 6, Room 7)**

16.15 - 16.30 MELAMED Y.

Underground Storage Organs as a food resource in the Paleolithic Hula valley, Israel *pp. 76-77*

16.30 - 17.00 *Coffee break*

**17.00 - 19.00 POSTER SESSION (Building 5, ground floor)**

**THURSDAY 6<sup>th</sup> JUNE 2019**

**Session 4: PLANTS AND SOCIETY (Building 6, Room 7)**

08.30 - 08.45 HEISS A. G., GALIK A., GONZÁLEZ CESTEROS H., LIEDL H., *et alii*

One Man's Leftovers Is Another Man's Feast: Plant material from a votive pit in Terrace House 2 in Ephesus, Turkey *pag. 142*

08.45 - 09.00 AUERLECHNER M., PUTZER A., STEINER H., OEGGL K.

Plant use and rites at burnt-offering sites in inner-alpine areas of Northern Italy during the Bronze and Iron Age *pag. 135*

09.00 - 09.15 FRUMIN S., WEISS E.

The archaeobotanical connection between Hera and the Philistines: Iron Age Samos and Tell es-Safi/Gath *pp. 140-141*

09.15 - 09.30 CAPPARELLI A., LÓPEZ M. L.

Ceremonial maize of the south-Central Andes: a picture of variability and processing at Inka expansion times on the base of charred macroremains *pag. 137*

09.30 - 09.45 VANDORPE P.

Food for the afterlife? Contribution of the archaeobotanical evidence in Roman cremation graves to burial practices in Switzerland *pag. 150*

09.45 - 10.00 MONTES MOYA E. M.

Plants-derived remains in ritual context in Qubbet el-Hawa, Aswan, Egypt *pag. 146*

10.00 - 10.15 LAGERÅS P.

A fragrant grave – the well-preserved plants of a mummified 17th century bishop *pag. 144*

10.15 - 11.00 *Coffee break*

11.00 - 11.15 MARIOTTI LIPPI M., GIACHI G.  
Pollen Content of a Roman Medical Remedy (Pozzino, Italy, II cent. BC) *pp. 145-146*

11.15 - 11.30 BEYDLER K.  
From Farm to Pharmacy: *Lolium temulentum* in Roman agriculture and medicine *pag. 136*

11.30 - 11.45 LANGGUT D.  
Early Roman royal gardens: an archaeobotanical comparison between east and west Mediterranean gardens *pp. 144-145*

11.45 - 12.00 RYAN P.  
Lessons from the past; contextualising underutilised crops, a case study from the middle Nile valley *pag. 148*

12.00 - 12.15 EICHHORN B., NEUMANN K., WOTZKA H. P.  
The late Iron Age persistence of pearl millet in the Inner Congo Basin (ICB): Beer or food – was millet ever a staple in the African lowland rainforest? *pag. 139*

12.15 - 12.30 ABDEEN M., HAMDEEN H. M.  
Some Plants Drinking and their Religious and Social Meaning in Sudan Case study: Hulu-Mur, Abreha and Sherbot *pag. 134*

12.30 - 12.45 STIKA H. P., MARINOVA E., HEISS A.G., ANTOLIN F., *et alii*  
Advances in the knowledge of ancient beer brewing and reconstruction of its taste *pag. 149*

12.45 - 13.00 DAVID M., WEISS E.  
Slaves or artisans? A miner's diet in the Southern Levant *pp. 137-138*

13.00 - 13.15 HAAS J. R.  
Community Identity and Culinary Traditions-Foodways in the Western Great Lakes, North America *pag. 141*

13.15 - 14.15 *Lunch*

14.15 - 14.30 WASYLIKOWA K., MOSKAL-DEL HOYO M., CZARNOWICZ M., *et alii*  
Early Bronze Age plant assemblages from the Tel Erani site, Israel *pag. 151*

14.30 - 14.45 PREISS S., CHEVALIER A., COURT-PICON M., GOFFETTE Q., *et alii*  
They all smell the same (though...) but their content may be different: looking at Late Medieval human excrements and garbage pits in the County of Hainaut, Southern Low Countries *pp. 146-147*

14.45 - 15.00 WALSHAW S.

Food and Trade at Ancient Kilwa, Tanzania: archaeobotanical and historical evidence from the ninth to fifteenth centuries *pp. 150-151*

15.00 - 15.15 ERGUN M., OZBASARAN M.

Inferring plant-related activities and food plant processing at an early Neolithic settlement in Central Anatolia, Aşıklı Höyük *pp. 139-140*

15.15 - 15.30 FILATOVA S., KIRLEIS W.

Food production in the Bronze Age Danube River region: the case of Kakucs-Turján, Hungary *pag. 140*

15.30 - 15.45 TOUWAIDE A.

Textual Archaeobotany. Written and Iconographic Sources for Archaeobotanical Research *pp. 149-150*

15.45 - 16.15 *Coffee break*

16.15 - 16.45 Introduction to Workshops

16.45 - 19.00 PARALLEL WORKSHOPS:

ERC projects (Building 6, Room 2) *pag. 175*

National and international archaeobotanical networks (Building 6, Room 7) *pag. 176*

Public archaeobotany (Building 6, Room 3) *pag. 177*

20.00 *Social dinner (Torre del Parco)*

## **FRIDAY 7<sup>th</sup> JUNE 2019**

### **Session 2: AGRICULTURAL PRACTICES AND PALAEOECONOMY (Building 6, Room 7)**

09.30 - 09.45 WIETHOLD J., SCHAAL C.

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- 09.45 - 10.00 DABROWSKI V., BOUCHAUD C., TENGBERG M.  
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- 11.30 - 11.45 ORENDIA A.  
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- 13.00 - 13.15 CEMRE USTUNKAYA M., WRIGHT N., NATH SINGH R., PETRIE C. A.  
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08.45 - 09.00 DINIES M., PODSIADLOWSKI V., NEEF R.  
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09.00 - 09.15 RÖSCH M., FISCHER E., LECHTERBECK J., SILLMANN M., *et alii*  
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09.15 - 09.30 OEGGL D. K., AUßERLECHNER M., ZAGERMANN M.  
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09.30 - 09.45 GKATZOGIA E., VALAMOTI S. M.  
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10.15 - 10.30 KÜHN M., WICK L., ANTOLIN F., BERIHUETE M., *et alii*  
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2 AKERET O., KUHN M., WICK L.

Plant remains from the Early Bronze Age lakeshore settlement of Beinwil am See Ägelmoos: the first archaeobotanical results from Lake Hallwil, Switzerland

3 ALONSO N., LOPEZ O., TARONGI M., VILA S.

Waterlogged wood, seeds and fruit in the well-cistern of the fortress of Els Vilars (Catalonia, Spain): expanding knowledge on plant resources and their use during the Iron Age

4 BALCI H.

A preliminary and comparative study on crop plant selection from the beginning of agriculture to the Late Ottoman Period in Northwest Anatolia

5 BELLI C., CARACUTA V., WEINSTEIN-EVRON M., YESHURUN R., *et alii*

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6 BENATTI A., BAL M., ALLEE P., BOSI G., MERCURI A. M.

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7 CASTANEIRA-PEREZ N.

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8 CIANI F., ATTOLINI D., BELLINI C., PALLECCHI P., MARIOTTI LIPPI M.

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9 DAL CORSO M., PASHKEVICH G., FILIPOVIC D., MEADOWS J., *et alii*

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11 DECAIX A., NEEF R.

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12 DEIANA A., MILANESE M.

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13 DELLE DONNE M., COSTANTINI L., DAN R., VITOLO P.

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14 DOUCHE C.

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15 FILIPOVIC D., OBRADOVIC D.

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16 GRIKPEDIS M.

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17 HAMDEEN M. H.

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18 HRISTOVA H., POPOVA T.

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19 JESUS A., FOLLMANN F., JACOMET S., VAN WILLIGEN S., ANTOLIN F.

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20 KISIELIENE D., MINKEVICIUS K.

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21 KOTSACHRISTOU D.

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22 LITINSKA-ZAJAC M., MOSKAL DEL HOYO M.

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23 MALTAS T.

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24 MARKLE T., NELLE O., MARINOVA-WOLFF E.

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26 MOTUZAITE MATUZEVICIUTE G.

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- 40 ZHAO Z.  
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- 41 CARACUTA V., BOARETTO E., KHALAILY H., VARDI J.  
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- 44 CANTO' A., CARRION Y., LOPEZ DE PABLO J. F.  
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- 47 CIUTA B.  
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- 48 DIJKSHOORN M., MOOLHUIZEN C., GOUW-BOUMAN M., *et alii*  
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50 GLEMAN J.

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51 HASSLINGER N.

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52 HRISTOVA I., OSTMAN S., MARINOVA E., HEISS A. G.

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64 PENGFEI S., TIAN X., WU Y.

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65 PEREGO R.

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66 RUSTEIKYTE A.

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67 SPELEERS L., DEVOS Y., DE CUPERE B., DEFORCE K., MODRIE S.

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68 WESTLING S.

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69 ZECH-MATTERNE V., DERREUMAUX M., PRADAT B.

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72 CAGNATO C., HAMON C., ELLIOTT M., SALAVERT A.

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87 RIECKHOFF S., ROSCH M.

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100 GUSTAFSSON S., HJULSTROM B.

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121 BREGLIA F., SELLITTO A., FIORENTINO G.

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## 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**

Marianne Høyem Andreasen

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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**

Charlène Bouchaud<sup>1</sup>, Vladimir Dabrowski<sup>1</sup>, Patricia Dal-Prà<sup>2</sup>, Fleur Letellier-Willemin<sup>3</sup>, Marie Millet, Juliette Milon<sup>1</sup>, Laila Nehmé<sup>4</sup>, Gaëlle Tallet<sup>3</sup>, Margareta Tengberg<sup>1</sup>, Antoine Zazzo<sup>1</sup>

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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**

Cristina Castillo

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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 first 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 millennium 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**

Andrew S. Fairbairn

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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 Emmeroides 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 scrobiculatum*), 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.,  $\pm 50/100$  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 Syndrome 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**

Roman Hovsepyan

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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 absent 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 used 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 cereal 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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3. *University of Manchester, UK.*

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**

Lucie Martin<sup>1-2</sup>, Estelle Herrscher<sup>3</sup>, Nana Rusishvili<sup>4</sup>, Elena Lebedeva<sup>5</sup>, Roman Hovsepian<sup>6</sup>, Catherine Longford<sup>7</sup>, Erwan Messager<sup>2</sup>

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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) 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**

Karolis Minkevicius

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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***Marine Mosulishvili<sup>1-2</sup>, David Bedoshvili<sup>3</sup>, Nana Rusishvili<sup>2</sup>, Ineza Maisaia<sup>4-5</sup>

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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 Arukhló site of Lower Kartli: *Triticum baeoticum*, *T. monococcum*, *T. dicoccum*, *T. carthlicum*, *T. durum*, *T. spelta*, *T. compactum*, *T. aestivum* and *T. sphaerococcum*. It is the only country where 3 species of hulled hexaploid wheat *T. macha*, *T. spelta* (AABBDD) and *T. zhukovskiyi* (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 Arukhló 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**Aldona Mueller-Bieniek<sup>1</sup>, Magda Kapcia<sup>1</sup>, Magdalena Moskal-del Hoyo<sup>1</sup>, Marek Nowak<sup>2</sup>

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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 CO<sub>2</sub> 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

Anaya Sarpaki

*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

Françoise Toulemonde<sup>1</sup>, Geneviève Daoulas<sup>2</sup>, Emmanuelle Bonnaire<sup>1</sup>, Vincent Riquier<sup>2</sup>, Julian Wiethold<sup>2</sup>, Véronique Zech-Matterne<sup>1</sup>

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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**

Burhan Ulaş

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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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## Session 1 ORIGINS AND DIFFUSION OF CULTIVATE PLANTS

### Posters

#### **FARMERS OR GATHERERS? THE FIRST ARCHAEOBOTANICAL STUDY ON THE MESOLITHIC SOUTH CAUCASUS**

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The increased archaeological and archaeobotanical evidence during the last twenty years revealed that plant cultivation was introduced to the South Caucasus at around 6000 cal. BC at the latest. However, there was no site in which we could observe the shift from hunter-gathering to farming, and the neolithization process in this region still needs much investigation.

In this paper, we focus on the transitional phase from gathering to farming based on the macrobotanical remains excavated from Damjili Cave and Hacı Elamxanlı, west Azerbaijan. We discuss the intercourses between indigenous populations and immigrants in this period.

*Key-words: Azerbaijan, Neolithization, Damjili Cave, Hacı Elamxanlı Tepe*

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#### **PLANT REMAINS FROM THE EARLY BRONZE AGE LAKESHORE SETTLEMENT OF BEINWIL AM SEE ÄGELMOOS: THE FIRST ARCHAEOBOTANICAL RESULTS FROM LAKE HALLWIL, SWITZERLAND**

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The site of Beinwil am See Ägelmoos is only the third Early Bronze Age lake shore settlement in Switzerland, from which archaeobotanical material (micro- and macrofossils) was studied. The site lies today under the lake surface and the archaeological layers were threatened by erosion. Before covering them with textiles and gravel deposits, sediment samples were taken by an underwater archaeology team. The sediment and the remains contained in it are generally well preserved, but heavily penetrated by roots. Some layers are mainly composed of animal dung. Barley (*Hordeum vulgare*) and emmer wheat (*Triticum dicoccon*) are the main cereals of the samples, and spelt wheat is also regularly present. There is also a small number of finds of broomcorn millet (*Panicum miliaceum*), but it is unclear if that species was already cultivated. Flax (*Linum*

*usitatissimum*) is present in good numbers, together with two typical weed species associated with it: *Silene cretica* and *Cuscuta epilinum*. A small number of remains of gold-of-pleasure (*Camelina sativa*) indicates that this oilseed crop was possibly in use in the Early Bronze Age.

*Key-words: Early Bronze Age, Switzerland, lake shore settlement, Camelina sativa*

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## **WATERLOGGED WOOD, SEEDS AND FRUIT IN THE WELL-CISTERN OF THE FORTRESS OF ELS VILARS (CATALONIA, SPAIN): EXPANDING KNOWLEDGE ON PLANT RESOURCES AND THEIR USE DURING THE IRON AGE**

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The Iron Age Fortress of Els Vilars (775 cal.BC - 300 BC) represents a clear model of the process of economic and social transformation taking place in the northeast of the Iberian Peninsula during the Iron Age. Its last phases of occupation are the least known due to modern destruction. They are only preserved in certain features such as the well-cistern (converted into a rubbish tip toward 300 BC). This study focuses on the archaeobotanical remains it contained, notably the waterlogged materials but also the charred and mineralised remains. These waterlogged finds add to the understanding of the data from the rest of the site where the plant remains are mostly charred.

The finds comprise a great variety of wood remains ranging from 1 cm to 1 m in length. The nature of certain can be identified (e.g., a decorated comb of boxwood), while others suffered high depositional and postdepositional fragmentation. They correspond basically to architectural and other elements of utility that are unique to the northeast of the Peninsula in this timeframe. The taxa of the waterlogged material coincide with the carbonised finds (Aleppo pine, scots/black pine, evergreen and deciduous oaks, Lamiaceae) except for certain species such as elm.

The assemblage also comprises seeds and fruit, and taxa and parts of plants that are unknown elsewhere. These include the domes of acorns, flax capsules and seeds, many weeds, as well as oak and rosemary leaves.

*Key-words: Waterlogged remains, manufactured wood, weeds, Iberian culture*

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## **A PRELIMINARY AND COMPARATIVE STUDY ON CROP PLANT SELECTION FROM THE BEGINNING OF AGRICULTURE TO THE LATE OTTOMAN PERIOD IN NORTHWEST ANATOLIA**

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This research aims to understand and document the crop range in Northwest Anatolia between the Late Neolithic and the Late Ottoman periods and to model the differences between crop plants. Barcın Höyük, a site containing the earliest agricultural data (ca. 6600 BC) in the region, constitutes the key settlement of this research. The first farmers, settling in Barcın Höyük brought most of

the economic plants with them upon their initial arrival in the region. Similar agricultural practices were found in the settlements of Menteşe, Ilıpınar X-IX, Aktopraklık C (Northwest Anatolia), Fikirtepe, Pendik, Yenikapı (Marmara Region). The people living in these settlements had a similar material culture and shared common traits regarding their plant subsistence economy. Northwest Anatolia related geographically to Eastern Thrace, the Marmara Region and the Eskişehir Corridor yields coastal, lowland and highland settlements throughout the Neolithic, Chalcolithic, Bronze Age, Iron Age periods showing variable economies regarding plant use. The main question of this research concerns the question: How did crop selection change through time and is it possible to create a sophisticated comparative economic plant chart for the region?

*Key-words: Archaeobotany, Early Farming, Northwest Anatolia, Barcın Höyük*

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### **MACROBOTANICAL REMAINS FROM RAQEFET CAVE, A LATE NATUFIAN BURIAL SITE IN MOUNT CARMEL, ISRAEL**

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The Archaeobotany of Epipalaeolithic communities in Mount Carmel was commonly limited to studies of microscopic remains such as pollen, phytoliths and starch, as charred macro-botanical remains are scarce. However, in recent years a new approach based on retrieval, identification and dating of charred seeds and charcoal fragments provides new insights into environmental fluctuations and past use of plants by local hunter-gatherers and sedentary/semi-sedentary groups. This study focuses on Raqefet Cave, a site used by the Late Natufians as a burial location. Excavations revealed the graves of ca. 30 individuals, some buried on a layer of green and flowering plants, as interpreted by the identification of dozens of imprints. Previous studies of phytoliths and starch remains from graves and stone mortars indicate the use of cereals and other species at the site, including inferred beer brewing and storage in fiber baskets. Here we present and discuss macro-botanical remains from the site. These include several specimens of legumes (i.e. *Lens* sp. and *Vicia* sp.), cereals (*Hordeum* sp.) and weeds. Identified specimens of oak (*Quercus calliprinos* and *Quercus ithaburensis*) and almond (*Amygdalus* sp.) suggest that these Mediterranean species grew around the site during the Late Natufian. Stable Isotope analysis are therefore to be applied to the Raqefet Cave remains together with absolute <sup>14</sup>C dating to reconstruct paleoenvironmental changes in the Carmel area at the end of the Pleistocene.

*Key-words: Epipaleolithic, Natufian, Mount Carmel, Anthracology, Isotope Analyses*

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## LATE HOLOCENE PLANT EXPLOITATION FOR CHARCOAL PRODUCTION AND GRAZING IN NORTHERN APENNINES INFERRED FROM CHARCOALS ANALYSIS

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Monte Cimone and Corno alle Scale are two protected mountains included in the Natura 2000 Network. The top of these mountains is characterized by *Vaccinium* and *Nardus* meadows and the timberline, formed by coppice beech forest, reaches 1600-1700 m a.s.l. Historical sources show the importance of these mountains for pastoral activities, which have been practiced until the 1950s, and then decreased drastically. Many pastoral structures, found (but not dated) in the current grassland of Monte Cimone, are witness of the ancient pastoral activity. Charcoal analysis provided information on the past wood vegetation changes in response to climate change and human impact, with details at the scale of the slope. Two altitudinal transects were carried out for the pedoanthracological study: nine pits were excavated and sampled from 1650 to 2078 m a.s.l at Monte Cimone, and eight pits from 1600 to 1860 m a.s.l. at Corno alle Scale. Moreover, an anthracological study was carried out on eight charcoal platforms. A total of 14 taxa were identified (e.g. Ericaceae and *Fagus sylvatica*). Almost all radiocarbon dates refer to the Late Holocene. Charcoal analysis data suggest that the inhabitants of the two mountain areas have exploited the natural physical conformation of the territory to use and manage the natural resources through the sylvo-pastoral activities, thus using the wood on the steep slope for charcoal production and the plateau for grazing activity.

*Key-words: Anthracology, Pedoanthracology, Tuscan-Emilian Apennines, Charcoal kilns, forest*

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## CARPOLOGICAL STUDY AT SAN CRISTÓBAL ROCK-SHELTER (BASQUE COUNTRY, SPAIN)

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The San Cristóbal rock-shelter is located in Rioja Alavesa (Basque Country, Spain) at 900 m above sea level in the Sierra de Cantabria. The rock-shelter contains 13 prehistoric levels which range from the end of the Ancient Neolithic to the Bronze Age. During this period, the stratigraphy of the rock-shelter shows episodes of seasonal and cyclical stabling, and cleaning practices after the end of the period, by burning dung and waste generated during the stay of the animals. In the Middle Ages, the site was used for the construction of a hermitage and the dug of a burial pit.

The use as a pen from the Ancient Neolithic to the Chalcolithic reaffirms the occupation of the rock-shelter by farmers; this situation indicates an exploitation of plant resources to animal feeding. The carpological study shows the presence of synanthropic vegetation and domesticated plants (*Triticum*, *Setaria italica/Panicum miliaceum*) which confirm the existence of agricultural practices possibly in the plain; and the transfer of the synanthropic plants to the rock-shelter for animal feeding. Small legume seeds are the most abundant seeds in this site and have provided information regarding animal feeding. And, perhaps, the first evidence of *Papaver* in the Basque Country is an extraordinary find in north of the Iberian Peninsula.

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**POLLEN ANALYSIS IN THE EARLY MIDDLE AGES FLORENCE (ITALY)**

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In the summer of 2018, during the repaving works of *Piazza della Repubblica* in Florence (Italy), the excavations revealed anthropized levels from the Roman age up to today.

The modern *Piazza* lies upon the ancient *foro* of *Florentia*, a roman colony founded in 59 BC. The *foro* was a paved square adorned with monumental buildings, among which the Capitoline Temple. In the Middle Ages the square became the “Old Market” of the city, surrounded by the towers of the most prominent Florentine families.

The excavation works in the square offered the opportunity to collect pollen samples from a stratigraphic sequence dated to the Early Middle Ages (6th-7th centuries), a moment of severe instability in the city. The analysis revealed rather good pollen preservation and high absolute pollen frequencies. Most part of the grains belonged to herbaceous plants, with a constant presence of primary (mainly cereals) and secondary anthropogenic indicators and a noticeable amount of hygrophilous plants (Cyperaceae and Poaceae *Glyceria* type), suggesting the possible presence of puddles of stagnant water on the ground.

*Key-words: Archaeobotany, Florentia, anthropogenic indicators, Urban palynology*

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**TRACING THE INTRODUCTION AND FIRST DISPERSAL OF MILLET IN UKRAINE**

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The present contribution shows the results of newly radiocarbon-dated charred broomcorn millet (*Panicum miliaceum*) grains from different sites in Ukraine. Based on macro-remain record compared to isotopic evidence known from literature, this study aims at identifying the moments of first known adoption and widespread use of this C4 cereal in an area that lies geographically at the westernmost Asiatic and the easternmost European borders. The radiocarbon dates come from archaeological sites spanning from the Chalcolithic and the Bronze Age through to the Iron Age. The new dates indicate that first evidence of millet occur in the mid-second millennium BC (17th–15th century BC), at the site of Vinogradnyi Sad of the Sabatinovka culture in the Southern Bug steppe area. The Ukrainian millet dates are discussed in the frame of on-going research about the spread of millet across Asia and its introduction in Europe.

*Key-words: Broomcorn millet, Panicum miliaceum, Ukraine, Bronze Age*

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**EARLY AGRICULTURE AT THE CROSSROAD OF CHINA AND SOUTHEAST ASIA:  
NEW INSIGHTS FROM ARCHAEOBOTANY, ECOLOGY AND CLIMATE**

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Very little is known about the timing and trajectories of the beginning of an agricultural lifestyle in Yunnan province, Southwest China. Combining previously unstudied archaeobotanical datasets, with ecology and paleoclimate data, this paper presents an overview of the early agricultural system in the region between the late 3rd and 1st millennia BC. Particular focus will be given to comparative morphometrics analyses of crop remains (i.e. rice, millets, soybean and buckwheat) from sites in Yunnan and already published datasets from Central and East China. This will plot the evolution of the crops and their adaptation to the specific environmental conditions of Southwest China. This study will help us gain a deeper understanding of early human-environment interactions in the adoption of agriculture, and provide proxies for the spread of agriculture to Southwest China and beyond.

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**THE BEGINNINGS OF AGRICULTURE IN THE SOUTHERN CAUCASUS: NEW PERSPECTIVES BETWEEN THE ARAXES AND KURA VALLEYS**

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The beginnings of agriculture in the Southern Caucasus are still poorly known. Recent excavations of Neolithic sites in the Kura and Araxes valley allow us to present a synthesis for this period. Two sites, among the oldests for that period in Azerbaijan, are of particular interest: Kіçik Tepe in the Kura Valley and Kūltepe I in the Araxes Valley. This paper will aim at summarizing the main results of their archaeobotanical studies and will then be compared with the results from other Neolithic sites in the area (Mentesh Tepe, Gadachrili Gora, the Mil Plain sites and Aruchlo) in order to present a general synthesis for this period in the Southern Caucasus. Through a multidisciplinary approach, including the study of seeds, fruits and charcoal fragments, we will try to answer several questions, like which plants were cultivated or collected by the first farmers. Nowadays these sites are located in slightly different climate zones. In this light we will discuss the differences between agriculture and fire wood management visible in the material from the sites and in a wider perspective between the two valleys.

*Key-words: Caucasus, Neolithic, seeds and fruits study, anthracology*

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## SPATIAL DISTRIBUTION OF ARCHAEOBOTANICAL REMAINS AND ARCHAEOLOGICAL INTERPRETATION IN A MEDIEVAL VILLAGE IN NORTHWESTERN SARDINIA

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The paper illustrates the informative potential of analyzing the spatial distribution of archaeobotanical remains in the abandoned medieval village of Geridu (Sorso, Sardinia). The case study chosen is a house in the rural village, destroyed by fire in the mid-fourteenth century: the collapse of the tiled roof on the floor, which occurred during the fire, caused a partially anaerobic combustion of the roof beams, which are they are partly charred. The survey of the spatial distribution of high concentrations of carbon allowed to interpret the orientation of the roof beams and, subsequently, the tree species to which they belong. The documentation of other coal concentrations has allowed us to interpret significant aspects of the simple furnishing of this country house. A wooden trunk, present inside the room, was leaning against a wall: in the excavation a concentration of coals was identified in adherence to a wall of the house, in addition to the metal closing parts of the trunk. The analysis of the coals made it possible to determine that the settle was made of chestnut wood: the metal closing element had a gilding and the decoration of a lily. The cross-study with the contemporary archival documentation suggests that this chestnut wood furniture was imported from Tuscany and was therefore the most representative object of this house.

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## ARCHAEOBOTANICAL RESEARCHES IN ORUMIYEH LAKE BASIN: HAJJI FIRUZ AND PISDELI

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During '50s and '70s the sites of Hajji Firuz and Pisdeli were excavated in the frame of the *Hasanlu Project* developed by the University of Pennsylvania Museum, the Metropolitan Museum of Art, and the Archaeological Service of Iran. These sites, dated to Neolithic and Chalcolithic periods, are located in the south-western shore of the Orumiyeh Lake, in the Iranian province of West Azerbaijan. That project saw also an Italian partnership for the archaeobotanical analysis, preliminary presented in a brief report published in *East and West* journal. This contribution is intended to present new archaeobotanical data, in the frame of the recent environmental studies of the region. Plant remains were retrieved through flotation of samples collected in the sites. The collection was composed of 10 samples from Hajji Firuz and 4 samples from Pisdeli. More than 500 plant remains from Hajji Firuz and 100 plant remains from Pisdeli, occurred in the examined samples, in which cereal grains and spike remains of einkorn/emmer and barley were the dominant remains. Few remains of pulses, like *Lens* sp., and weed seeds were present. The results of this investigation provided useful information about the agrarian economy and ecology of this region of Iran, between prehistory and protohistory.

*Key-words: Hajji Firuz, Pisdeli, plant remains, Neolithic, Chalcolithic*

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**LATE NATUFIAN AND EARLY NEOLITHIC RYE EXPLOITATION IN THE EUPHRATES VALLEY. NEW EVIDENCES FROM THE ACERAMIC NEOLITHIC SITE OF DJA'DE EL-MUGHARA**

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During the Aceramic Neolithic hunting and gathering gave way to new subsistence strategies represented by herding and cultivation and then domestication. Rye is one of the cereals recovered on archaeological sites during this period particularly in the Euphrates valley but its status as to being cultivated/gathered, domesticated/wild, introduced/imported remains uncertain. Rye spikelet bases can be easily identified but this is not the case for wild rye grains which are difficult to distinguish from wild two-grained einkorn. In this paper I will provide new biometric data from Dja'de el-mughara in northern Syria to allow us to reassess previous studies and gain a better understanding of the use and the sudden disappearance of rye at the end of the Early PPNB in the Euphrates valley.

*Key-words: Pre-Pottery Neolithic, Levant, Rye, plant exploitation*

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**SIDELINER OR PROTAGONIST? ECONOMIC STATUS OF 'NEW TYPE' GLUME WHEAT IN THE NEOLITHIC AND BRONZE AGE CENTRAL BALKANS**

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Einkorn, emmer and 'new type' wheat constitute the hulled/glume wheat repertoire in prehistory of the central Balkans. Additionally, spelt wheat was tentatively reported for few Neolithic sites; more substantial and more secure record of this type derives from the Late Bronze and Early Iron Age sites. Based on the current evidence, 'new type' glume wheat is rare in the Neolithic assemblages from this region. Usually, only small amounts of grain and/or glume bases are detected in the deposits dominated by einkorn or emmer. It seems that, in the very early days of prehistoric farming in the Balkans, 'new type' glume wheat was only a random, accidental accompaniment to the staple crop – a 'sideliner'. This may have changed in the Bronze Age, if judging by the more frequent presence of this wheat type in the analysed assemblages, and the large, high-density deposit of pure 'new type' glume wheat (grain+chaff) derived from the Late Bronze Age layer at Feudvar, northern Serbia. The Bronze Age was the time when some other crops were introduced in, or became more prominent components of, the cultivated crop spectrum – not only in the Balkans, but across Europe. This likely had multiple ramifications to the farming economy. Our poster discusses the apparent shift through time in the economic role of 'new type' glume wheat in the prehistoric central Balkans and how this articulated with other coeval developments in the agrarian system.

*Key-words: 'new type' glume wheat, major crop, minor crop, prehistoric Balkans*



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## **IN THE SEARCH OF THE EARLIEST CULTIVATED PLANTS IN BELARUS – SEM ANALYSIS OF GRAIN IMPRINTS IN POTTERY**

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Plant impressions in pottery is an important source of information for the use of wild and cultivated plants in prehistoric societies. However, in most of the cases it is difficult to accurately identify species of the impressed plants using only naked eye or stereomicroscope. The application of SEM to investigate silicon replicas of plant impressions allows to inspect and evaluate not only the shape and size of the imprint but also the surface elements of the objects, therefore, allowing the precise identification of the impressed objects. In this study more than 7000 pottery shards from Southern Belarus Neolithic and Bronze Age sites were examined for the imprints which visually resembled grains of cultural plants. Next step was to make silicon casts of the imprints. Finally it was photographed using SEM, producing high quality images for the analysis and identification of the impressed objects. Here it is presented the first results of method application to study the plant impressions on pottery from prehistoric settlements in river Prypiat basin, Belarus.

*Key-words: SEM, Belarus, plant imprints in pottery*

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## **ARCHAEOBOTANICAL INVESTIGATIONS FOR *TRITICUM* SP AND *HORDEUM* SP DURING CHRISTIAN PERIODS IN SUDAN**

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Wheat *Triticum* sp and barley *Hordeum* sp appears from Prehistoric, New kingdom, Kushite, Christian and Islamic periods as one of important economical plants in Sudan. This paper will focus on the evidences of *Triticum* sp and *Hordeum* sp during Christian periods from three Archaeological site El Ga'ab depression, Nauri and Soba (500-1500 BC) with comparison with that evidences from historical sources 823- 1525 A.D “ Arab texts and documents”. The method were adopted in this research include comparative analysis for the Archaeobotanical methods were done on the three archaeological sites sieving, flotation, positive cast and microscope examinations, add to analysis the historical texts. The results show that *Triticum* sp and *Hordeum* sp play a major role in Christin economy depending on archaeological and historical evidences, and also the positive cast of *Triticum* sp and *Hordeum* sp from El Ga'ab depression consider the first recorded of impressions for that both plants come from the Christian sites in Sudan.

*Key-words: Triticum sp, Hordeum sp, Christian, El Ga'ab, Positive cast, historical texts*

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## ARCHAEOLOGICAL AND ARCHAEOBOTANICAL APPROACH IN THE STUDY OF AGRICULTURAL PRACTICES AT EARLY BRONZE AGE SETTLEMENT MOUND “HIMITLIYATA”, BULGARIA

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Settlement mound “Himitliyata” is located in Upper Thracian, Southeastern Bulgaria. The available paleobotanical data indicates that during the Early Bronze Age local environmental conditions were favorable and probably affected the agricultural potential. A reconstruction of field management, storage, processing and consumption of plants is proposed mainly on the basis of archaeological evidence and archaeobotanical remains recovered from recent excavations at the site. In this current case, the study of routine activities and practices involves systematic and probabilistic sampling within representative features, located in the central area of the settlement. These include stationary grain storage facilities, *pithoi*, hearths and ovens. All charred plant macroremains are recovered by the means of manual water flotation. Laboratory methods include quantitative measures, light microscope and SEM examinations. The archaeobotanical assemblage is comprised of annual cereal crops and legumes. Several common ruderal species, widespread in the crop fields, represent the probable field management and crop processing methods. However, among the most interesting archaeobotanical finds are the charred bread remains and a big amount of desiccated and agglutinated grains. These findings provide a good opportunity for more-detailed analyses of cereal food processing during the Early Bronze Age and contribute to raising the awareness of such finds within the archaeological record.

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## MIDDLE NEOLITHIC FARMING IN SE FRANCE: ARCHAEOBOTANICAL INVESTIGATIONS OF THREE WELLS FOUND AT THE SITE OF LES BAGNOLES (ISLE-SUR-LA-SORGUE, DÉP. VAUCLUSE, FRANCE)

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The Middle Neolithic site of Les Bagnoles has more than a thousand negative features, among which three were identified as wells. These wells reached below the current groundwater table. Consequently, the plant remains are extremely well preserved, in a waterlogged state. Large amounts of sediment were sieved with the wash-over method to retrieve fragile waterlogged plant remains. More than 100 taxa (mostly wild plants) have been so far identified, including several domestic crops, such as naked and glume-wheats, barley, flax, pea and opium poppy. These results show more diversity and insight into plant economy when compared with other Middle Neolithic sites in Southern France. Additionally, they offer a better intra-site comparison since the chronology of the wells indicates that they were not contemporaneously but sequentially used and abandoned. The first one (Structure 250) was filled at the end of the 5th millennium BCE and then abandoned, the second (Structure 990) covers the transition to the 4th millennium BCE while the third seems to date to the early 39th century BCE. We can thus observe changes in crop choice in one settlement through three small time-windows within a period of ca. 300 years. The results obtained will be put into the context of the current state of knowledge on Neolithic farming in this period in SE France.

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## **CROPS CULTIVATION IN THE VIKING AGE: CASE STUDIES FROM NW LITHUANIA**

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Until the last several decades systematic archaeobotanical studies were not included in the East Baltic archaeological research. This resulted in severely limited our understanding of the development of agricultural practices in the region. In this paper we attempt to summarize the evidence of carbonized plant macrofossils recovered from three major Viking Age (8th – 11th c. AD) hillforts from NW Lithuania. The datasets represent the final stages of hillfort development in prehistoric Lithuania and shed some light on variety of domestic plants and possible farming strategies. The project primarily focused on revision and reassessment of soil samples taken during legacy excavations. Over eight taxa of cultivated plants were identified. Our findings suggest that barley and rye were the dominant crops in the coastal Lithuania, while emmer was of lesser importance. Remains of bread wheat and pea were also recorder, however never in significant quantities. Small amount cultivated oat (*Avena sativa*) grains were reported in two cases. The lack of preserved floret bases in the last one did not allow to identify the remains of *Avena* sp. down to species level. In all cases oats alongside broomcorn millets constituted a negligible portion of botanical samples. The results of this study present a relatively uniform picture of plants cultivated in NW Lithuania throughout the Viking age. While it is similar in sites located in eastern Lithuania, some regional variations can be observed.

*Key-words: crop, Viking Age, hillfort, Lithuania*

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## **PRELIMINARY ANALYSIS OF CHARRED PLANT REMAINS FROM THE EARLY NEOLITHIC SETTLEMENT OF PONTOKOMI-SOULOUKIA IN KOZANI REGION, NORTHERN GREECE**

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This poster describes the results of the preliminary analysis of charred archaeobotanical remains retrieved during rescue excavations 2014-2017 at Pontokomi-Souloukia, a low tell in the area of Kozani, Northern Greece, dating to the early Neolithic period. Their study in combination with the archaeological finds will provide the opportunity to consider plant-related practice and their socio-economic implications at the site.

A large number of soil samples (1070) were taken systematically from all the excavated units include a residential area with burnt houses as well as a non-residential area with pits and a ditch. Plant remains are represented by a remarkable variety of cereal and pulse species as well as fruits and seeds of weed species indicating the importance of their cultivation in the area. What is more important is that these charred plant remains will shed significant light on the nature of plant use during the early Neolithic period in kozani region, adding more information to the few known material from this period.

*Key-words: Northern Greece, Kozani region, early Neolithic, plant use*

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## EARLY NEOLITHIC PLANT REMAINS FROM THE CARPATHIAN FOOTHILLS: NEW DATA FROM THE SETTLEMENT OF GWOŹDZIEC, SITE 2 (SOUTH-EAST POLAND)

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The aim of this presentation is the study of charred plant remains obtained from archaeological features of the Linear Pottery culture at Gwoździec, site 2, located in the Carpathian Foothills. The settlement is dated to two chronological phases: I –5400-5300 BC and II –5000-4900 BC. During the field excavations of this settlement, more than 300 archaeobotanical samples were collected. Cereal remains recovered from this settlement suggest that the early Neolithic inhabitants cultivated glume wheats, mostly *Triticum dicoccon* and less frequently *T. monococtum*. Other cultivated plants were scarcely represented, and included flax *Linum usitatissimum* and Fabaceae. Most of the wild grown herbaceous plants represented field and ruderal weeds (e.g. *Bromus* sp., *Echinochloa crus-galli*, *Fallopia convolvulus* and *Chenopodium album*). In the charcoal assemblages, 12 taxa of trees and shrubs were recognized. The most common taxon is oak *Quercus* sp. followed by *Corylus avellana*. Other frequently found taxa were *Acer* sp., *Fraxinus excelsior*, *Ulmus* sp. and Maloideae. Taxonomic composition and quantity proportions of charcoals indicate the presence of mid-Atlantic oak forest communities. During the second occupation phase, an increase of Maloideae was observed, which could be related to the human impact on local woodlands. The occurrence of more open forests and hedges might have favored the spread of fruit trees (e.g. Maloideae, *C. avellana* and *Quercus*), which likely were important food sources in the ancient diet. This might be suggested by the findings in Gwoździec of the oldest Neolithic remains of crab apple *Malus sylvestris*. This study was financially supported by the National Science Centre in Poland through grant No. 2014/15/B/HS3/02460, headed by A. Czekaj-Zastawny.

*Key-words: cereals, flax, charcoal, Neolithic, Poland*

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## AGRICULTURE AND THE ORIGINS OF URBANISM IN WESTERN ANATOLIA

Tom Maltas

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Results are presented from the first year of doctoral research into the social and economic implications of agricultural strategies employed in Late Chalcolithic to Late Bronze Age western Anatolia. The research is based on a primary analysis of a large archaeobotanical assemblage from Çeşme-Bağlararası, Liman Tepe, Bakla Tepe, and Kocabaş Tepe, Izmir province. Together, the sites present a sequence of marked changes in settlement organisation from village to fortified citadel with a lower town. The latter settlement form is characteristic of Bronze Age urban centres within the region.

As such, the sites are uniquely placed to develop a focused case study into how populations were supported and shaped by agricultural practices associated with specific forms of urbanism and socio-political hierarchy. Two hypotheses will be tested: that early western Anatolian urbanisation was associated with increasingly labour efficient (and land intensive) agricultural practices as population pressure pushed agricultural land further from settlements, and that intra-population differences in agricultural production contributed to the formation of socio-political inequality. The hypotheses will be addressed through an intensive suite of archaeobotanical analyses, including FIBS and stable isotope analysis, utilised to reveal trends in crop cultivation and consumption within and between communities.

*Key-words: archaeobotany, agriculture, urbanism, hierarchy, western Anatolia*

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## **LBK AGRICULTURE AND LAND USE IN THE AMMERTAL, SW GERMANY**

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*State Office for Cultural Heritage Management Baden-Württemberg, Germany.*

A collaboration project of the University of Tübingen and the Cultural Heritage of Baden-Württemberg is investigating an area in Southwest Germany where already archaeological sites of LBK, beginning with the oldest phase are known. Until now little archaeobotanical evidence is available from the Upper Neckar area and the analysis of two early Neolithic sites from Ammertal fills this gap. Numerous finds of charred plant macrofossils throw light on the agricultural practices and land use in the area. The systematic sampling of the pits and ditches excavated revealed not only “settlement noise” but also mass finds of hulled wheat and peas. Further crops proven are lentils and flax. The evidence of wild growing vegetation in the macrobotanical record is dominated by indicators of synanthropic habitats (weeds and ruderals). Wood charcoal analysis complements information on the land use of the surrounding area. The results of the study are considered in a broader context of the neolithisation of the Neckar region.

*Key-words: LBK, Agriculture, South-West Germany, Neolithic, mass finds of crop*

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## **BRONZE AGE EVIDENCE OF MILLET CULTIVATION IN THE CARPATHIAN MOUNTAINS**

Laura Motta

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Charred remains of broomcorn millet have been found at two sites, Teius-Fantana Viilor and Petelca-Cascada, in the Apuseni Mountains (SW Transilvania). These sites have been investigated as part of the Bronze Age Transylvanian Survey (BATS) Project aimed at understanding settlement patterns and socio economic change in an important mining district of the Carpathian Mountains. The seeds have been radiocarbon dated to the second half of the second millennium BCE. While millet has been attested in the Carpathian basin since the Neolithic, the Transylvanian finds add to our knowledge of the increasing importance of this plant during the late BA and carry interesting implications for interregional contacts with the Asian steppes through the Mureş river corridor.

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## **PLANT ADAPTATION IN GEOGRAPHICAL MARGINS: CASE STUDY FOR HIGHLANDS OF KYRGYZSTAN**

Giedrė Motuzaitė Matuzevičiūtė

*Vilnius University, Lithuania.*

The array of animal and plant species domesticated in southwest Asia or China started to colonize the highland valleys of Central Asia only from the middle of the 3rd millennium BC. This is several thousands of years later after their domestication. Little research has been done on understanding the adaptation strategies by humans and their domesticates in the new environmental niches of continental climate of Central Asian highlands. In this presentation I evaluate the rate of prehistoric agriculture expansion and crop species selection for the establishment of successful agriculture in mountain landscapes (2000 masl). I will discuss on variation in crop species morphotypes that could have developed in mountainous settings as well as what the weed assemblage can tell us about landscapes and crop management in the highlands.

*Key-words: Naked barley, hulled barley, irrigation, compact crop varieties, highlands*

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## **AGRICULTURAL SETTING AT THE BRONZE AND IRON AGE FORTRESS OF TEL LACHISH/ISRAEL (PRELIMINARY RESULTS OF THE 2017 AND 2018 SEASONS)**

Marco Nicoli

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Lachish is situated in the Shephelah region, approximately 40 km south-west of Jerusalem. It was one of the most prominent urban centers and significant garrison town during the Bronze Age and the Iron Age.

In 2018 a total of 41 archaeobotanical samples, accounting to 1300 liters of sediment, have been collected and processed using a flotation machine. Despite significant modern contamination, the macro-remains are well preserved and show differences in terms of taxa composition and preservation between two areas of sample origin: Area P with the Judean palace-fort zone and Area S, a trench on the western edge of the tell that was originally excavated during an expedition between the years 1973 and 1987. The number of taxa is high and diverse including economic plants such as *Olea europaea*, *Vitis vinifera*, *Hordeum vulgare*, *Triticum dicoccum*, *Triticum aestivum/durum*, *Linum usitatissimum*, *Lens culinaris*, *Ficus carica* but also wild plants such as *Lolium* sp., *Phalaris* sp., *Cephalaria syriaca* or *Chenopodium album*. The currently practiced systematic approach provides new information about plant economy at the site and contributes to our understanding of cultural history of such type of influential cities in the Southern Levant.

*Key-words: Lachish, Bronze Age, Iron Age, Southern Levant economy, Agriculture*

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## **PALAEOLITHIC PLANT USE IN THE EASTERN FERTILE CRESCENT: THE CASE STUDY OF GHĀR-E BOOF**

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Beside its chorological importance for understanding the Neolithization process the Zagros Mountains region has attracted attention for its role as a probable migration route of anatomically modern humans. At least since the 1960s archaeological research addressed the character of the evolution of the Upper Palaeolithic (UP) of the Zagros Mountains, leading to differentiation of two main cultural groups, the early UP Baradostian and the late UP or Epipalaeolithic Zarzian and a number of other regional typological groups.

Ghār-e Boof, a cave site in Iran (Fars Province), and situated in the southern Zagros has been excavated by the Tübingen-Iranian Stone Age Research Project (TISARP) starting in 2005. The lithic assemblage has been determined as UP Rostamian, according to similarity to the Dasht-e Rostam assemblages.

A rich archaeobotanical assemblage has been extracted from the Upper Palaeolithic stratigraphic sequence at Ghār-e Boof. While previous analysis focused on the younger layers (II-IV) dating between 36-31 kyr BP, recent excavations resulted in assemblages older than 36.000 BP (layer V). The taxa diversity of the layers is generally very high with considerable numbers of small-seeded grasses and large-seeded legumes.

Preliminary data on seed remains from the older layers of site Boof are discussed for their functional and environmental meaning, with the aim to improve our understanding of the behavioral repertoire of late Pleistocene hunter-gatherer groups in the southeastern region of the Fertile Crescent.

*Key-words: Upper Palaeolithic, southeastern Zagros, pulses, grasses*

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## **ARCHAEOBOTANY IN URBAN SITES: THE MIDDLE AGE OF MODENA (NORTHERN ITALY)**

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This contribution refers to the palaeoenvironmental reconstruction of the Modena town (northern Italy) in the Medieval Age. The archaeobotanical study of ten archaeological sites provided useful information to reconstruct palaeoethnobotany, history and plant landscape of the area from the 7th century to the 13th century AD.

A total amount of 250,000 carpological remains has been isolated (sieved from more than 600 l of soil), corresponding to more than 350 taxa, from the eight study sites (two of them are still under study).

The taphonomic diversity of the deposits allowed to obtain information on: - availability of voluptuary products, as abundant and diversified fruit; - availability of plant products to be a luxury item, and some condiments; - evidence of cultivation traditions typical of the area; - evidence of a wide range of cereal crops; - evidence of plant and care of ornamental species. Paleoecological reconstructions show the presence of wetland environments, peculiar to the area, in fact the medieval Modena was a “water city” characterized by an extended network of canals, considered as the main vector of commerce.

Finally, the floristic list suggests that in the Medieval period the biodiversity was higher than in the modern city; such floristic richness is also supported by the findings of numerous wild species worthy of attention, some of them unknown in earlier sources, others that disappeared during the 20th century and many considered rare.

*Key-words: Middle Age, seed/fruit, biodiversity, ethnobotany, northern Italy*

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## **BIOGEOGRAPHY AND USE OF PISTACHIO (*PISTACIA* SPP.) IN PRE-POTTERY NEOLITHIC CYPRUS**

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Besides cultivated pistachio, the genus *Pistacia* L. comprises more than ten wild species, among them the three emblematic trees of the modern Cypriot flora: *Pistacia atlantica*, *P. lentiscus* and *P. terebinthus*. The frequent occurrences of pistachio endocarps and charcoal on Pre-Pottery Neolithic sites excavated on the island indicate that pistachio trees constituted a currently used resource during the Neolithic period. Due to the the absence of systematic studies of the morphology of endocarps, the archaeobotanical remains of pistachio have so far seldom been identified to the species level, a lack of precision that has deprived us of important information on their past geographical distribution and uses. This poster presents the first results of the study of seed and anthracological material from the sites of Ayios Tychonas-*Klimonas* (ca. 9500 BC), Parekklishia-*Shillourokambos* (ca. 8400-7000 BC) and Khirokitia-*Vounoi* (ca. 7000-5500 BC). Morphological and morphometric approaches are used to explore, describe and identify the archaeobotanical material. The results obtained allow us for the first time to identify the pistachio remains (*Pistacia* spp.) to the species level and thus to discuss their presence in terms of the composition of the local vegetation cover and the various uses of tree resources in early Neolithic Cyprus.

*Key-words Pre-Pottery Neolithic; Cyprus; Pistacia; endocarps; wood*

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**USAGE OF PLANTS IN THE NORTHERN PART OF THE XIONGNU EMPIRE: ARCHAEOBOTANICAL STUDY ON THE IVOLGA FORTIFIED SETTLEMENT (TRANSBAIKALIA, RUSSIA)**

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Fortified settlement Ivolga is the only known site of the nomadic Xiongnu Empire with signs of a city, locates on the left bank of Selenga River in 150 km to the south from Baikal Lake. It was an administrative, craft, cultural center in the northern part of the Empire.

The water flotation conducted in 2017, 2018 provided the numerous macro botanical remains (seeds, nuts and chaff) from several storage and rubbish pits. Their analysis is continued. We have gotten 2470 seeds and 1138 pieces of chaff. 1432 seeds (or 60% of the remains) belong to cultigens of 5 species - *Hordeum vulgare* var. *nudum*, *H. vulgare* var. *vulgare*, *Triticum aestivum*, *Panicum miliaceum* and *Setaria italica* subsp. *italica*. The seeds of broomcorn millet (973) are dominant. Almost of 45% of them are immature. Seeds of other cultural plants are not so numerous: 201 caryopses of 6-row hulled and naked barley, 102 seeds of foxtail millet and 3 caryopses of bread wheat. The chaff is represented by fragments of various remains – glumes, fragments of spikelets and their bases, awns, nodes etc. Many weed seeds (960) indicate a strong contamination of crops. Our results show the high role of plant food in the subsistence system of Ivolga population, who was engaged in the local cultivation of two species of millet, naked and hulled barley and probably bread wheat. The main plants were broomcorn millet and barleys. Foxtail millet played a smaller role, obviously. The value of wheat has not yet been precisely determined. The data have greatly enhanced knowledge about the agriculture of sedentary population in the northern periphery of the Xiongnu Empire.

*Key-words: Xiongnu, multicultural local agriculture*

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**ARCHAEOBOTANICAL EVIDENCE FROM THE NEOLITHIC SITE OF TEPE GAVKOSHI: ESFANDAGHEH PLAIN, SOUTHEASTERN IRAN**

Zohreh Shirazi

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This article aims to present the results of archaeobotanical studies of Tepe Gavkoshi located in the Esfandagheh plain in the Halil Rud basin. The site is dated back to the Neolithic period (6700 BC) and is the oldest settlement identified so far in the southeastern part of Iran. It is very important to collect as more as possible data about the bio-archaeological conditions in this part of Iranian plateau. Moreover, these data could be compared with similar evidence from other Indo-Iranian Borderlands sites to obtain an exhaustive image of agriculture evolution and vegetation cover in a larger zone. The preliminary archaeobotanical results from Tepe Gav Koshi indicate that the inhabitants of the site had access to a wide range of vegetal resources such as planted and wild species, like cereals (Einkorn, Emmer and barley), wild grasses (brome grasse and eremopyrum), oil seeds

(sesame), wild fruits (pistachio), wild pulses (milkvech and clover), wild plants (goat's head, borage family, seepweeds, goosefoot family, buckwheat family, smartweed, pink family, nightshades family, bindweed family, sedges family and cruciferae family) and trees like tamaris (*Tamarix*), willow or poplar (*Salix/Populus*), locust (*Robinia*) pistachio (*Pistacia khinjuk/atlantica*), junipers (*Juniperus*), oleaster family (Elaeagnaceae) and gossefoot family (chenopodiaceae). These plant remains were used as food, fodder and fuel by the people during the Neolithic period. The obtained results are comparable to the data already collected from other adjacent Neolithic sites such as Tepe Yahya, Tepe Gaz Tavileh in Kerman region, Tepe Rahmat Abad, Tol -i Jari, Tol-I Bashi and Tol-i Mushki in Fars as well as Mehrgarh in the Kachi plain. The archaeobotanical data are completely in concordance with zooarchaeological data (bone remains of goat, cattle, wild sheep, gazelle, wild ass, boar and turtle). Other archaeological finds such as obsidian tools, grindstone/millstone and retouched blades found in the ancient layers of Gavkoshi may also indicate agricultural activities. For collecting more data about the cultivation of the plants and the evolution of agriculture, it is necessary to realize more detailed and systematic archaeobotanical studies in the region.

*Key-words: Archaeobotany, Vegetal resources, Neolithic, Esfandagheh Plain, south-eastern Iran.*

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### **FARAGLIONI VILLAGE (MBA): FIRST RESULTS OF THE BOTANICAL ANALYSES FROM USTICA ISLAND (PALERMO, SICILY)**

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Ustica is a small island off the coast of Palermo city (Sicily, Italy). It was occupied by human settlements since Neolithic times. During the Middle Bronze Age (half of 2nd millennium BC) it was interested by the presence of an important fortified village (Spatafora F., Ustica tra il Tirreno e la Sicilia, in BTCGI, XXI, Pisa-Rome-Naples 2012, 427-439). First analyses on the samples (both charcoals and seeds) coming from the vases and the soils of the cultural area of the village are here presented, discussed and contextualized in the framework of 2nd millennium BC analyses from Thyrranian area.

*Key-words: Middle Bronze Age; Island archaeobotany; cultural site*

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### **THE ARCHAEOBOTANY OF MUTAMBA, A THIRTEENTH CENTURY MAPUNGUBWE SETTLEMENT IN NORTHERN SOUTH AFRICA**

Bianca Steyn

*University of Pretoria, South Africa.*

This paper presents a report on the results of archaeobotanical analysis of macrobotanical (carpological) material from Mutamba, a 13th century Middle Iron Age settlement located in the Soutpansberg Mountain of northern South Africa. It provides base-line data concerning the variety

and utilisation of plants found at the settlement, a period in which the role of plants is poorly understood in southern Africa. Through the analysis of 100 randomly selected domestic context samples, 11 species and 2 genera were identified. These were *Sorghum bicolor* (Sorghum), *Pennisetum glaucum* (pearl millet), *Eleusine coracana* (finger millet), *Vigna radiata* (mung bean), *Vigna unguiculata* (cow pea), *Sclerocarya birrea* (Marula/ Moroela), *Gossypium herbaceum* (Cotton), *Adansonia digitata* (Baobab), *Ziziphus zeyheriana* (Dwarf Buffalo thorn), *Brachiaria deflexa* (False signal grass), *Brachiaria nigropedata* (Spotted signal grass), *Grewia* and *Acacia*. A tentative crop package composing of *E. coracana* (finger millet), *S. bicolor* (sorghum), *P. glaucum* (pearl millet), *V. unguiculata* (cowpea) and *V. radiata* (mung bean) was identified and all Poaceae taxa were subjected to the Hubbard and Al Azm's (1990) preservation and distortion index. Additionally not only does Mutamba provides the first documented case of *V. radiata* forming part of a crop package but it also offers a cautious indication of beer brewing in the form of malted grains and a more substantial link between *Gossypium herbaceum* and the practise of cotton spinning, formerly based only on ethnography.

*Key-words: Agriculture, Archaeobotany, Mutamba, Middle Iron Age, South Africa*

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### THE ARCHAEOBOTANY OF MEDIEVAL BARDA, AZERBAIJAN

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'The Landscape of Medieval Bərdə, Azerbaijan 6th - 13th Centuries AD' project is an environmental archaeological research initiative aiming to chart the history of the medieval Caucasian regional capital of Bərdə, Azerbaijan through the study of archaeobotanical material. In studies of medieval Azerbaijan, traditional approaches to archaeological recording are mainly employed, focusing on artefacts and structures, with few environmental analyses occurring. This has resulted in a lack of archaeobotanical material for regional analysis, and consequently little research has been conducted in the field of archaeobotany. This project will bring scientific approach, pioneering the use of modern environmental techniques, previously undeveloped in medieval archaeology in Azerbaijan, and apply them to Bərdə to understand the social, agricultural and economic practices of the region in this period. This project will generate new archaeobotanical data through analysis of plant remains from a current fieldwork project, The Archaeological Exploration of Bərdə (AEB), based at the Faculty of Oriental Studies, University of Oxford. This research will draw from and feed into the larger AEB project, revealing new insights into agriculture, society and urban rural interactions in the region.

*Key-words: Azerbaijan, medieval, Islamic, Sassanian*

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### IRON AGE SETTLEMENTS IN MAVROPIGI, NORTHERN GREECE: AN ARCHAEOBOTANICAL INVESTIGATION

Charoula Stylianakou

*Ephorate of Antiquities of Kozani, Greece.*

Archaeological research in the site of Mavropigi, near the city of Kozani in Northern Greece, the last few years has revealed an area of dense settlement complex dated to Prehistoric Ages. Four

Iron Age settlements are being investigated for archaeobotanical remains: Varkaris, Dasos, Kouri and Agios Ni-kolaos. All of these sites are situated near the area called Kitrini Limni, on 680-740 m above sea level and generally are neighboring each other. Clay constructions, post-holes, storage vessels and pits were revealed during the excavation. It remains possible that seeds and other species detected in the soil samples were used as food since archaeobotanical research so far has demonstrated the presence of crop plants at all four sites. Plant remains are represented by pulses, cereals, fruits and nuts while the significant presence of grapes, that it is likely to be stored in some storage vessels, is under discussion.

*Key-words: Iron Age, settlements, Mavropigi, Greece, crops*

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## **WINEPRESS DATING BACK TO 3000 BCE SHOWS THE EARLIEST WINEMAKING TECHNOLOGY IN THE WESTERN MEDITERRANEAN**

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*3. Independent researcher, Cagliari, Italy.*

During the archaeological excavations conducted in the Bronze Age archaeological settlement of Monte Zara in southern Sardinia (Italy), a sandstone pressing machine was found. The 14C data were able to date this artefact to the Late Bronze Age (1401–1112 cal BC, 2σ).

Chemical analysis of ancient organic compounds absorbed in the winepress by liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS) and mass spectrometry analysis (GC-MS) allowed the detection of two wine biomarkers related to tartaric and syringic acids. These results prove that this winepress was used to extract juice from crushed black grapes during winemaking production in the Bronze Age period. Moreover, this machine represents the oldest technology used for winemaking in the western Mediterranean.

*Key-words: Vitis vinifera; winemaking; mass spectrometry; tartaric acid; syringic acid*

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## **REVIEW OF PREHISTORIC PLANT CULTIVATION IN FINLAND BASED ON MACROFOSSIL FINDS**

Santeri Vanhanen

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A systematic review of the finds of cultivated plants in Finland is presented in this paper. The review is based on AMS-radiocarbon dated plant remains and assemblages of plant remains. The review shows that naked barley and free-threshing wheat were cultivated on the Åland islands during 3300–2600 BC by seal hunters of the Pitted Ware Culture. No cultivated plants have been found at Corded Ware culture (2800–2300 BC) sites. Cultivated barley occurs in mainland Finland

first time during the second millennium BC and continuously after this. Knowledge of cultivated plants BC is very limited and richer assemblages have been discovered only from AD 0–550. These show that cultivation focused on barley, both hulled and naked, with minor cultivation of rye, emmer, hemp and flax. During AD 550–1200 barley remained the main crop, whereas rye increased in the end of this period. Naked barley and emmer, however, phased out. In addition, naked wheat, oat, flax, hemp and gold-of-pleasure were cultivated during this period. The development of plant cultivation follows similar lines as in the surrounding regions. The earliest cultivation on Åland derives from East-Central Sweden. Corded Ware culture spread via eastern Baltic where domestic animals have been traced, but only few cultivated plants appear. During the Bronze Age we have again influence from Sweden, but also from Russia. Appearance of hemp during the Roman Iron Age shows that Finland was part of continental networks.

*Key-words: Cultivation history, Finland, Stone Age, Bronze Age, Iron Age*

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### **SUPPLIES FOR THE MINERS - INVESTIGATING FOOD AND WOOD RESOURCE MANAGEMENT AT THE LATE BRONZE AGE MINING SITE OF PRIGGLITZ-GASTEIL (LOWER AUSTRIA)**

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2. Institute of Archaeologies, University of Innsbruck, Austria.

Due to their high degree of specialisation, mining communities rely on external resources: Food, tools, timber and fuel wood need to be provided from outside in presumably highly organised supply chains. The excavation of an opencast copper mine at Prigglitz-Gasteil “Cu I” revealed two Late Bronze Age (11th–9th c. BCE) settlement/workplace terraces unearthing a massive waste heap rich in refuse from various human activities (tools, pottery, bronze finds, animal bones, charcoal). Flotation samples were taken in a high-resolution approach in order to allow for the reconstruction of spatial and temporal patterns in the occurrence of possibly important plant species, basing on both charcoal and other charred plant macroremains. The rare finds of cultivated crops are primarily represented by millet grains (*Panicum miliaceum* and *Setaria italica*) and processed foodstuffs based on barley (*Hordeum vulgare*), accompanied by potentially gathered wild fruit such as *Rubus idaeus*, *Malus/Pyrus* sp. and *Rosa* sp. However, the most abundant macroremains are vast numbers of fir (*Abies alba*) and spruce (*Picea abies*) needles. While these might suggest burning of mainly two coniferous species, charcoal analyses reveal a much larger spectrum of burned woody taxa. Hence combined analyses and comparison to previously analysed mining sites will allow for a further comprehensive reflection of the prehistoric environment of Prigglitz-Gasteil, and enable generating plant-based supply management models for the people living and working at the copper-mine.

*Key-words: Urnfield culture, copper mine, eastern Alps, subsistence patterns, supply chains*

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**WHEN AND HOW DID WHEAT COME INTO CHINA**

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After being introduced into China from West Asia, wheat gradually replaced such varieties of millet as *Setaria italica* and *Panicum miliaceum* to become the main dry-land farming crop in northern China, forming China's current agricultural production pattern of rice in the south and wheat in the north. To date, there have been dozens of reported archaeological discoveries about early wheat remains. According to those newly unearthed findings, wheat was introduced into China through at least two routes between 4500 and 4000 years ago. One is the grassland route from West Asia, through Central Asia, the Bronze Age cultures of the Eurasian Steppe, Northern Cultural Zone in northern China to the middle and lower reaches of the Yellow River. The other is the oasis route from West Asia, through Central Asia, the Pamir's, oases on both sides of the Tarim Basin, Hexi Corridor and to the Loess Plateau of northern China.

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**LENTIL SOUP, HUMMUS OR FABA BEANS? THE PROTEIN DIET OF THE EARLY FARMERS OF THE JUDEAN HILLS. NEW ARCHEAOBOTANICAL DATA FROM THE PRE-POTTERY NEOLITHIC SITE OF MOTZA (ISRAEL).**Valentina Caracuta<sup>1</sup>, Elisabetta Boaretto<sup>2</sup>, Hamoudi Khalaily<sup>3</sup>, Jacov Vardi<sup>3</sup>*1. Institute of Evolution Sciences of Montpellier (ISEM), France.**2. Kimmel Center for Archaeol. Science and D-reams Radiocarbon Lab., Weizmann Inst. of Science, Rehovot, Israel.**3. Israel Antiquities Authority, Jerusalem, Israel.*

The rescue excavation carried out in Motza (Israel) in 2018 brought to the discovery of a new massive Pre-Pottery Neolithic (PPN) site on the Judean hills. The site, which is very well distinct from the previous site identified in the Motza district in the early 2000's and dated to the Early PPNB, yielded a rich archaeobotanical assemblage.

The macroremains come from a silo and present the typical traits of legumes, such as two cotyledons, hilum print and radicle. Among the finds, lentils (*Lens* sp.) was the most attested and accounts for 95% of the assemblage. Other legumes were chickpeas (*Cicer* sp.), faba bean (*Vicia faba*), and unidentified big legumes. Altogether chickpea, faba and the unidentified legume correspond to the 4% of the entire assemblage. The remaining 1% was made of by hulled wheat (*Triticum dicoccum/dicoccoides*).

Lentils and chickpeas' morphology was analyzed under a binocular microscope (Leica M80), and seed's size (i.e. length, breadth, thickness and diameter) was measured using an imaging analysis program (LAS V 3.8). The lentils were found to be significantly larger than those from Ahihud, the Early PPNB site in Lower Galilee (Israel) that provides unique information about the onset of farming legumes and is the closest comparable case-study.

The biometric study of the chickpea revealed a similar trend. The seeds were found bigger than those found in Early PPNB site of Tell el Kherk (Syria), the closest comparable case-study.

In the light of the new study, the finds from Motza offer new insights into the process of domestication of staple legume and the role of protein food as meat substitute for the early farmers.

The present study received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement N.792373.

## 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)**

Amaia Arranz-Otaegui<sup>1</sup>, Joe Roe<sup>1</sup>, Alexis Pantos<sup>1</sup>, Jonathan Santana-Cabrera<sup>2</sup>, Jose Luis Araus<sup>3</sup>, Petrus Le Roux<sup>4</sup>, Tobias Richter<sup>1</sup>

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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**

Amy Bogaard, Michael Charles, Müge Ergun, Andrew Fairbairn, Dragana Filipović, Dorian Fuller, Lara Gonzalez Carretero, Laura Green, Christine Hastorf, Glynis Jones, Ceren Kabukcu, Carla Lancelotti, Alexandra Livarda, Marco Madella, Carlos Santiago Marrero, Elizabeth Stroud, Petra Vaiglova

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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 harbour 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**

Isabel Figueiral<sup>1-2</sup>, Pascale Chevillot<sup>3</sup>, Mona Court-Picon<sup>4</sup>, Vianney Forrest<sup>5-6</sup>, Sophie Martin<sup>1-7</sup>, Herve Pomarède<sup>1-7</sup>, Philippe Ponel<sup>8</sup>, Christophe Tardy<sup>5</sup>

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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 ( $\pm 3.7$ , 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 socio-economic transformations was being fashioned, leading to a new hybrid cultural *taskscape* 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 grassland 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)

Claire Malleson

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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 PALAEOOLITHIC 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**

Yoel Melamed

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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**

Juliette Milon<sup>1</sup>, Charlène Bouchaud<sup>2</sup>, Thomas Cucchi<sup>2</sup>, Mariec Millet<sup>3</sup>, Antoine Zazzo<sup>2</sup>, Marie-Pierre Ruas<sup>2</sup>

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2. National Center of Scientific Research (CNRS), Paris, France.

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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 sediments has 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, TRENTO (ITALY)**Klaus Oegg<sup>1</sup>, Marlies Außerlechner<sup>1</sup>, Marcus Zagermann<sup>2</sup>

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2. Bayerische Akademie der Wissenschaften, München, Germany.

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), *Secale cereale*, *Panicum miliaceum*, *Triticum 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**

Manfred Rösch<sup>1</sup>, Elske Fischer<sup>2</sup>, Jutta Lechterbeck<sup>3</sup>, Marion Sillmann<sup>2</sup>, Gegeensuvd Tserendorj<sup>2</sup>, Lucia Wick<sup>4</sup>, Tanja Märkle<sup>2</sup>, Elena Marinova<sup>2</sup>

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3. *University of Stavanger, Norway.*

4. *Universität Basel, Switzerland.*



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 were 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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3. *MHNC - UP - Natural History and Science Museum of the University of Porto, Portugal.*

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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3. *Banaras Hindu University, Varanasi, India.*

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**

Jade Whitlam, Amy Bogaard, Michael Charles

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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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## Session 2

# AGRICULTURAL PRACTICES AND PALAEOECONOMY

### Posters

#### **CROP MANURING DURING THE SECOND IRON AGE IN NORTHERN FRANCE, PRELIMINARY RESULTS**

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2. Inrap, CNRS/Université Paris 1, Paris, France.

A new form of rural settlement, known as the "enclosed farm", emerged in Celtic Europe during the Second Iron Age (5th-1st century BC) accompanied by a settlement densification and materializing a change in agricultural practices. In northern France, regional disparities were observed in the longevity of these farms, varying from less than 100 years to over several centuries. The reasons for these disparities are explored in terms of agricultural practices. Indeed, soil depletion is an inherent risk in agriculture: harvesting implies that the nutrients taken up by the crops are not returned to the soil. Crop rotation or the use of fertilizers are therefore required for the sustainability of the system; otherwise soil exhaustion could even lead to lands abandonment.

About 30 sites from the Paris Basin, Brittany and Champagne have been selected to investigate the fertility regime of soils cultivated with four cereals (*Triticum turgidum* ssp. *dicoccon*, *Hordeum vulgare* ssp. *vulgare*, *Triticum aestivum* ssp. *spelta* and free-threshing wheats). These three regions are distinguished by different aspects: soil types, crop types and longevity of settlements. The cereals come from stock remains, or at least from concentrations, which potentially reflect a single harvest. Manuring is traced using  $\delta^{15}\text{N}$  analysis of charred cereal grains in order to investigate the links between soils fertilization and habitats/networks longevity as well as differences in agricultural practices between cereals.

*Key-words: stable nitrogen and carbon isotopes, cereal grains, manure, Second Iron Age, northern France*

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#### **PHYTOLITH ANALYSIS OF A MATERIAL FROM THE NEOLITHIC SITE RADČICE IN SOUTH BOHEMIA (CZECH REPUBLIC)**

Kristýna Budilová, Michaela Ptáková

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The poster presents results of phytolith analysis of soil samples excavated from sunken features belonging to Linear Pottery culture and dated by <sup>14</sup>C AMS dating to 5200-5000 B.C. Two vertical sections were analyzed in order to get a comparison of phytolith spectra deposited in different space and time.

The results show an unexpected homogeneity of phytolith composition in the analyzed soil samples and thus provide some better understanding of the infill genesis mechanisms and origin of the material (probably an anthropogenic layer surrounding the features). Beside that, a quality of phytoliths points to certain plant species deposited in the archaeological sediment, which were probably exploited and used by the neolithic people for some purposes, or at least were present at the site (or it's vicinity) in a time close to the occupation phase. The samples contain a large amount of phytoliths belonging to Poaceae family, but residues which could be attributed to cereals were not found.

*Key-words: phytoliths, neolithic, LBK culture, central Europe*

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### **FIRST PALAEOETHNOBOTANICAL EVIDENCES FROM OPEN-AIR MESOLITHIC SITES IN SE IBERIA**

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Current knowledge on subsistence practices of Post-glacial hunter-gatherers in southern Europe is based towards the zooarchaeological and malacological records, mostly from rockshelter-oriented research. In this context, the study of paleobotanical materials from open-air mesolithic sites holds a great potential to decipher paleoeconomic and domestic activities.

In this paper we report the first paleoethnobotanical evidences from the Mesolithic site of Arenal de la Virgen (Villena, Alicante), excavated within the context of the ERC project PALEODEM (Ref. 683018). This site contains a rich record of domestic structures -mostly fire-related features- and cultural layers dated to two different chronological phases at 9.3-9.1 kya and 8.6-8.4 kya, during the Early Holocene. Despite the poor preservation of organic materials in this kind of archaeological contexts, the application of systematic sampling protocols and screening procedures have allowed the first documentation of carpological remains. We have recovered wild seeds and pine cone scales, that suggest the use of some plants with alimentary aims. Also, a fungus rest of *Cenococcum*, likely carbonized, has appeared. Our results suggest a variety of gathering strategies of vegetal resources at the site, providing a valuable source of qualitative paleoethnographic information for the Mesolithic period in Iberia.

*Key-words: open-air sites, Mesolithic, carpological remains, sampling, gathering*

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### **CARPOLOGICAL REMAINS BETWEEN THE END OF THE PLEISTOCENE AND THE BEGINNING OF THE HOLOCENE IN ITALY: ACQUIRED KNOWLEDGE AND NEW DATA**

Marialetizia Carra, Emanuela Cristiani

*DANTE - Diet and Ancient Tecnology laboratory, Sapienza University, Rome, Italy.*



Traditionally, paleocarpological research in Italy has primarily focused on agricultural settlements, as plant finds at these sites are generally abundant. The present contribution intends to examine the state of the art of Italian carpological findings in pre-agricultural contexts and to discuss new paleocarpological data related to these periods.

At Paleolithic and Mesolithic excavations sifting of the soil is preferred to flotation activity as the latter method is particularly time and money wasting. Nevertheless, Central European Palaeolithic contexts where flotation was extensively applied revealed the potential to recover abundant carpological remains even in pre-agricultural sites. In the frame of the HIDDEN FOODS - ERC Starting Grant project (PI: EC) aimed at understanding the role of plant foods in Palaeolithic and Mesolithic societies of Italy and the Balkans, we examined the results of an extensive flotation activity carried out between the 2016 and 2018 at 7 sites of Italy. The sites selected are located in different environmental contexts of northern, central and southern Italy both at high-altitude and coastal areas. A systematic manual flotation was applied to the excavated sediments. Such method allowed the recovery of abundant vegetal remains, underlining the potential of such recovery technique if applied to Palaeolithic and Mesolithic contexts to provide important about the role of plant foods in ancient diet.

*Key-words: Carpology, Pleistocene, Holocene, Italy*

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### **STARCH GRAINS DESCRIPTION OF THREE TAXA WITH UNDERGROUND ORGANS FROM PATAGONIA AND ANCIENT USE IMPLICATIONS THROUGH MICROBOTANICAL STUDIES**

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Underground organs were frequently reported by written documentary evidence from XVIth century onwards to have been an important food source for Patagonian original people. They were usually cooked in ceramic bowls. Their archaeobotanical evidence, however, is still limited to a very few macroremains. The objective of this paper is to develop skills for the identification of Patagonian underground organs from archaeological artifacts through microremains analysis, specifically starch grains, and to contribute to the understanding of the history of used of these plants in the region. Starch grains of two tubers (*Tropaeolum porifolium*, *Diposis patagonica*) and one rhizome (*Alstroemeria* sp.) were described along transversal section of each organ following standard methods and international nomenclature. Shape, size and polarization cross were the most diagnostic variables and allowed distinguishing *Diposis patagonica*'s as the smallest (mostly up to 15 µm in the major diameter) and most shape diverse starch grains. On the other hand, *Alstroemeria* and *Tropaeolum porifolium* had larger starch grains (mostly between 15 and 30 µm), predominantly spherical and oblong in both *taxa* but also triangular in the latter. Results were applied to the residue analyses of a Late Holocene pot sherd from Monte Loaysa (Santa Cruz, Argentina) from which starch grains affine to *Tropaeolum* were identified. Prehistoric use implications of this genus and underground organs in general are discussed.

*Key-words: Underground organs, Patagonia, Starch grains, Microremains analysis, Pot residues*

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## **ARCHAEOBOTANICAL EVIDENCE REGARDING THE DIET OF BRONZE AGE COMMUNITIES FROM TELEAC HILLFORT (ALBA COUNTY, ROMANIA)**

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We present the archaeobotanical results from the last three years when were been made important discoveries regarding the diet of communities who inhabited here. These results are part of a major interdisciplinary project which is developing during 2016-2018 (LOEWE Project) involving the new technologies in archaeology in order to facilitated the interpretation of results.

The Teleac hillfort is located in the southeastern of Transylvania on the top of hill near to Mures River. The settlement from Teleac is classified as a princely one due to the archaeological discoveries made inside of the fortification.

One of the most important discoveries regarding the vegetal diet of Late Bronze Age communities from Transylvania was made in Teleac in 2017 in a domestic space (kitchen?) containing a lot of goods and seeds preserved by fire. There were been a lot of jars full with seeds most of them belonging to *Panicum miliaceum* and *Triticum spelta*. The archaeological artifacts discovered are belonging to Gava culture which is dated from Late Bronze Age.

We presume that the firing was the cause of abandonment of the house and also the cause of the perfect preservation of the domestic space which we may assume that was a kitchen typically for the LBA.

*Key-words: macroremains, diet, Late Bronze Age, Transylvania, Romania*

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## **ROTSELAAR-WIJNGAARD: THE DEVELOPMENT OF A FLEMISH CITY IN THE LATE MIDDLE AGES BASED ON $\delta^{13}C$ AND $\delta^{15}N$ ISOTOPES, AMS $^{14}C$ -DATING AND MACROBOTANICAL ANALYSIS**

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The site of Rotselaar-Wijngaard (Flanders, Belgium) has been excavated on account of a future allotment. Most features, structures and botanical samples dated from the Early to High Middle ages. A research grant from the Belgian government has provided the possibility to continue the archaeobotanical investigation and examine the development of the city in the 12th to 14th cent.

The medieval site Rotselaar was first mentioned in written accounts in 1044 and is located at the convergence of the rivers Demer and Dijle. This particular site can be used as a case study for the development of southern urban centers in the Low Countries during the Middle Ages. In comparison to other development centers in the low countries (eastern Hanseatic cities and northwestern Hollandic cities), the southern cities grew and prospered relatively early, from the 12th century onwards. Many towns in Flanders profited from the flourishing textile industry. For the site of

Rotselaar, we will examine the consequences of this development and increasing population pressure on the agricultural surroundings of the town. A combination of macrobotanical analysis, AMS 14C-radiocarbon dating, and nitrogen analysis ( $\delta^{13}C$  and  $\delta^{15}N$ ) will be used to investigate the following themes:

-*Transitions within the available set of cereal species*: Changes of cereal crops available to the city's inhabitants will be established by macrobotanical analysis and AMS 14C-dating of carbonised cereal grains.

-*Demographic pressure indicated by increased fertilisation of crops*: The carbonised remains of cereals will be used for nitrogen isotope research. The isotope measurement will provide an indication to whether or not fertilisation took place on the fields surrounding the city in the consecutive periods. Fertilisation of the fields should lead to increased  $\delta^{15}N$  values in the grown crops. With the dated cereal remains at our disposal, we aim to distinguish chronological changes.

*Key-words: Rotselaar, Medieval, Demographics, Fertilising, Isotopes*

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### **THE RECONSTRUCTION OF THE FOOD ECONOMY, TRADE RELATIONS AND THE USE OF PLANTS IN THE TEXTILE INDUSTRY: A RESEARCH USING BOTH MACRO-REMAINS AND POLLEN ANALYSIS**

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At Leiden (the Netherlands), an archaeological excavation was carried out in the historic city center of Leiden; the Garenmarkt. Samples were taken for archaeobotanical research from a large amount of cess- and manure pits, dating from 1350 to 1700. By using both macrobotanical and pollen analysis the food economy, trade relations and further use of plants by the residents of Leiden could be reconstructed.

Research of the plant remains from these cess- and manure pits showed that the diets of the residents of Leiden were quite variable, and included grains such as buckwheat (*Fagopyrum esculentum*) and millet (*Panicum miliaceum*), different types of fruit, nuts and vegetables. Also indications for import were found, this is reflected in the rather unique find of pomegranate (*Punica granatum*) seeds. Pomegranate, originating from Western Asia and Northeastern India, was imported from the 15th century onward in the Netherlands. Next to the pomegranate seeds, the presence of peach (*Prunus persica*) and cucumber (*Cucumis sativus*) remains indicate the wealth of the inhabitants. Both were cultivated in vineyards and gardens from the 16th century onward in the Netherlands.

Furthermore, botanical remains from plants from which colorants were extracted for dyeing were found. Dyer's rocket (*Reseda luteola*) and safflower (*Carthamus tinctorius*) were presumably used to dye textiles, and also flax (*Linum usitatissimum*) and hemp (*Cannabis sativa*) could have been used. This corresponds to the history of the square, since the Garenmarkt ('Yarn Market') was originally used for wool spinning and weaving. The botanical remains correspond with other artefacts from this site, such as spindles and a metal needle-case.

*Key-words: Leiden, Dyeing, Import, Wealth, Pomegranate*

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## **BEHIND THE BREW: A MULTIDISCIPLINARY APPROACH TO EARLY MEDIEVAL ALCOHOL FERMENTATION**

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In early medieval Ireland (AD 400-1100), alcohol, particularly ale, was central to social gatherings and ceremonies, from the inaugurations of kings to the payment of labourers. This begs the question: how was ale made, presented and shared in Ireland's past? International studies on fermentation have developed useful scientific approaches and cultural understandings on the production and consumption of ale, but these approaches have not been applied to Irish material. This project will develop an international, multidisciplinary approach to better understand brewing and associated material culture in early medieval Ireland.

The project will examine evidence for fermentation in early medieval Ireland, drawing upon archaeobotany, material culture, historical writings, folklife and international ethnographies, along with scientific analysis to identify evidence for brewing in the archaeological record, analyse how fermentation affects the vessel and vice versa, and investigate the overall materiality of alcohol fermentation. In contemporary society, the emergence of the craft-beer movement demonstrates a new appreciation of the brewer and their creative outlet. This project will investigate choices made by early medieval brewers, in particular material selection, and the wider concept of the crafts-person.

*Key-words: Material Culture, Archaeobotany, Ale/Beer, Foodways, Early medieval*

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## **ARCHAEOBOTANICAL STUDIES OF LA TÈNE AND ROMAN SITES IN THE *CIVITAS TREVERORUM* (*GALLIA BELGICA*, SOUTHWESTERN GERMANY)**

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The described archaeobotanical studies of La Tène and Roman sites in Rhineland-Palatinate and Saarland in southwestern Germany are part of the author's dissertation project on agriculture and plant food in these part of eastern Gaule. The principal goals can be summarized by three main questions: Can the Romanization in these area traced by archaeobotanical results? Are there differences among the archaeobotanical spectra of each site? Is the different natural environment of these sites reflected by the archaeobotanical results? In order to answer these questions four sites were selected: The late Republican military camp on the Petrisberg (Trier) represents a key site for archaeobotanical studies of the important transition period between Caesar and Emperor Augustus in the later *Gallia Belgica*. During these early period Roman troops with their own Mediterranean or romanized food habits came in these area. First results of the Petrisberg are evidencing new romanized food habits around 30 BC. The sites Wederath-*Belginum*, Kastel-Stadt and Borg give evidence of permanent settlements from the La Tène period to the late antiquity. These three sites are demonstrating the development from subsistence agriculture to surplus production to supply fortified central settlements (*oppida*) and, finally, to Roman agriculture with a huge surplus to

supply military, villages and towns. The poster is enabling a first view on the archaeobotanical results and outlines answers to these questions.

*Key-words: Iron Age, Roman period, Food supply, Romanization, southwestern Germany*

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## **HOW TO DISTINGUISH DUNG FROM FOOD REMAINS - A CASE STUDY FROM TWO SCANDINAVIAN IRON AGE SITES: ÅKER GÅRD AND SANDSERYD**

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Dung and plant based food remains are not uncommon in archaeological samples, yet they are difficult to recognize and often end up in the very general group of amorphous charred objects. Interpretation of such remains is quite problematic as no standardized methodology and classification exists yet. The current presentation provides evidence for amorphous charred objects from two Iron Age sites: Åker gård and Sandseryd 396 (1st – 8th century AD) which will be discussed in the light of their possible interpretations as food or dung remains.

Preserved porous matter attached to some of the cereal grains was found in a posthole sample in Åker gård, west Norway. In most of the fragments, seed pericarp and traces of stems are visible. A seed of *Linum usitatissimum* was identified in one of the porous fragments. The only found cereal in the house is *Hordeum vulgare* var. *vulgare*. The weeds are represented by *Chenopodium album*, *Galium* cf. *spurium* and *Fallopia convolvulus*.

Similar amorphous remains were found in a fire pit at the site Sandseryd, southeast Sweden. The botanical material is dominated by stems and other vegetative plant parts, but it also contains cereals, mainly hulled barley and a few weeds (*Persicaria lapathifolia* and *Chenopodium album*).

Using different scientific approaches, we will use those case studies to propose criteria for distinguishing dung from food remains. Moreover, we would like to go further in the study of such remains.

*Key-words: dung remains, food remains, Scandinavia, SEM analysis, Iron Age*

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## **FOOD AND FARMING BEYOND ALPINE LAKE DWELLINGS - ARCHAEOBOTANICAL EVIDENCE FROM THE LATE NEOLITHIC SETTLEMENTS LENZINGBURGSTALL AND ANSFELDEN–BURGWIESE (BOTH UPPER AUSTRIA)**

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An international research project (“Beyond Lake Villages”, FWF I 1693, PI Timothy Taylor) is currently investigating settlements in the hinterland of the well-known pile dwellings of lakes Mondsee and Attersee in Upper Austria, with the goal of reconstructing the spatial networks of late Neolithic and early Bronze Age (agri-) cultural landscapes in the region. Charred plant macroremains from the two hinterland sites of Lenzing–Burgstall (1,517 plant macrofossil finds in total) and Ansfelden–Burgwiese (28,811 total finds) originating from Late Neolithic/Chalcolithic cultural layers were analysed as a contribution towards elucidating agricultural practices and food choices of the former inhabitants. In spite of the overall bad state of preservation at Lenzing–Burgstall, a decent spectrum of cultivated crops (hulled barley, einkorn and emmer wheat, lentil) together with surprisingly high quantities of hazel shell fragments was identified. The site of Ansfelden–Burgwiese, on the other hand, contributes not only additional taxa (free-threshing wheat, bitter vetch, “new” glume wheat) to the spectrum, but also allows for a preliminary differentiation of contexts indicating cleaned cereal stocks vs. places of cereal processing activities. Apart from archaeological contextualisation, the ongoing work will contrast these results with the waterlogged finds from the neighbouring lakeshore settlements of Seewalchen and Weyregg II, and place them within their regional palaeoecological contexts.

*Key-words: late Neolithic lakeshore dwellings, plant macrofossil analysis, agricultural systems, cereal processing*

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### **ARCHAEOBOTANY OF THE POLYCULTURE SITES. RAKOVICE (SOUTH BOHEMIA): ROMAN PERIOD OR EARLY MEDIEVAL?**

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Postdeposition processes are one of the important factors of the formation of the archaeological record. Ignoring them may caused a misinterpretation of the data. Dating of the infill of archaeological features only based on artefacts analysis may not always be sufficient. There are same cases where a feature contains in addition to the primary material (both artefactual or archeobotanical) an earlier residue or a later intrusion.

As an example we present research on a polycultural site in Rakovice, where a superposition of two archaeological features of apparently various age was detected and then excavated. The stratigraphically later feature contained artifacts that could be classified as the Early Middle Ages. In the earlier feature only the finds of the Early Roman Period were present, with the combination (residue?) of artifacts of the Iron Age (final La Tène Period). Such a combination of the Early Roman and concluding La Tène Period is repeating on various sites in Bohemia. A representative set of plant macroremains, a similar spectrum of botanical taxa, was obtained from both features. Radiocarbon dating of the seed, however, showed the likely occurrence of both sets of plant remains in the Early Middle Ages. Particular answer from a single site opens the possibilities of interpretation in similar cases.

*Key-words: Early Roman Period, Early Medieval Period, Postdeposition Processes*



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**AGRICULTURAL PRACTICES IN LATE 2ND MILLENNIUM BC MAINLAND GREECE**

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The archaeobotanical record of LBA Greece comprises a variety of crops, in northern Greece grown under an intensive garden type regime, as indicated by weed and isotopic data. The same regime was tentatively proposed for non-palatial Mycenaean agriculture, in the absence of vast evidence from rural settlements in the South. On the other hand, Linear B texts, exclusively geared to palatial interests, envisaged crop specialization along with records of large land-holdings and oxen-teams, all taken by Halstead in the early '90s as suggestive of extensive agriculture. Archaeobotanical assemblages from palatial sites, though available, were inherently of limited dynamic, mainly due to the sampling methods (handpicking), not favoring recovery of small-sized wild seeds. This paper discusses charred remains recovered through flotation from two non- and one palatial Mycenaean settlements, and from a tell-site in Northern Greece. The new datasets verify crop diversity throughout Greece. Weed analysis shows great variability featuring species characteristic of both modern gardens and fields, while the application of intensive techniques is confirmed by isotopic analysis in two of the sites studied. Bringing together evidence from recently published assemblages, the ongoing discussion regarding the application of agricultural practices in settlements of different sociopolitical and economic organization in late 2nd mil. mainland Greece, is further enriched.

*Key-words: weeds, crop husbandry, isotopic analysis, Late Bronze Age, Greece*

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**OUTSTANDING FIND OF MELEGUETA PEPPER FROM MEDIEVAL LAYERS IN TURKU (ÅBO) FINLAND**

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Turku (in Swedish: Åbo) is the oldest town in Finland and despite its rural character in early 14th century, it had international contacts overseas. Parts of this medieval town are well preserved, and the archaeological layers are often rich in archaeobotanical remains due to the moisture and clayey soil. In the heart of the medieval town of Turku, excavations were conducted at the Cathedral Gymnasium and a well-preserved latrine and a yard for animals were revealed. Due to the good preservation conditions, archaeological latrines are usually an excellent source of information e.g. on past diet and waste disposal.

Botanical (seed, pollen, moss) and zoological (animal bones, invertebrates) remains from the latrine fill and from the yard at the Cathedral Gymnasium were analysed and, as expected, material shows evidence of everyday dietary, usage of local resources, true imports and local vegetation. Most outstanding macrofossil find was Melegueta pepper (*Aframomum melegueta* K. Schum.). Melegueta pepper originates from West Africa, and to Finland it most probably arrived through the

Hanseatic League. In medieval Turku, usage of melegueta pepper indicated high status of the inhabitants. More than 80 plant taxa were identified from the latrine and the yard, and from the latrine most part of the taxa is imported, while the material from the yard is mainly of local origin.

*Key-words: Aframomum melegueta, pepper, medieval, Finland*

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## EARLIEST EVIDENCE OF *CITRUS* FRUIT IN THE IBERIAN PENINSULA

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The cultivation of *Citrus* fruit in the Mediterranean basin is recorded since Classical times. Several Roman sites in Egypt and Italy offer evidence of seed and pollen remains of *Citrus* species. Yet, to date, archaeological evidence of *Citrus* species is nowhere to be found in sites of the Western Mediterranean. Historical texts suggest that they were introduced in the region in the Middle Ages by new populations linked to the Islamic occupation of the Iberian Peninsula. There is, nonetheless, no material record of its cultivation in this period.

The paper presents the results of new archaeobotanical analyses carried out at several Islamic sites in the Iberian Peninsula, notably the sites of Lorca (Spain) and Mértola (Portugal). Both yielded a large number of well-preserved seeds and fruits in a carbonised and mineralised state. Fruit remains are particularly abundant, especially in the context of latrines, where more than 60,000 seeds were identified. Among them are several *Citrus* seeds, the first cases in the Iberian Peninsula unearthed in levels spanning the 9th to the 11th century AD. This evidence confirms the written sources that indicate that *Citrus* fruits were introduced in this region by the Arabs in medieval times.

*Key-words: Al-Andalus, Medieval, Islamic, Agriculture, Citrus*

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## ARCHAEOBOTANY AT MOTYA (ITALY)

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The archaeobotanical analyses carried out at the archaeological site of Motya (Sicily, Italy), a small island found in the Marsala Lagoon, in Western Sicily (Italy), are presented. Although the Phoenician-Punic period (late 8th century BC – 397 BC) represents the main occupational phase of the archaeological settlement, the island was occupied by indigenous populations since the 17th century BC and continued to be inhabited after the Siege of Motya (397/6 BC). The multidisciplinary study, which includes anthracology and carpology, aims at reconstructing the diet, land use

and exploitation of natural resources on the island. Analyses focus mostly on the western slopes of the Acropolis, where a big disposal pit, dated from the end of 8th to the 6th century BC, was identified. Preliminary analyses reveal a vast assemblage of cereals (including *Hordeum vulgare*, *Triticum monococcum*, *T. dicoccum* and *T. aestivum/durum*), pulses (*Cicer arietinum*, *Lathyrus* sp., *Pisum sativum*, *Vicia faba* and *V. ervilia*) and fruits. These include *Vitis vinifera*, represented both by seeds and pedicels, and *Punica granatum*, whose spread to the Western Mediterranean is attributed to Phoenicians. Also weeds (*Agropyron repens*, *Lolium perenne*, *Poa* sp. and others) were found. In terms of charcoals, the most represented species are *Olea europaea* and *Quercus ilex*. This study, along with palynological analyses, should give a complete overview of the plant cultivation and plant use of the Phoenicians at Motya.

*Key-words: Phoenicians, Sicily, carpology, anthracology, palynology*

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## WOODEN PESTLES FOR RICE PROCESSING IN EAST ASIA

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So many wooden artifacts, dating from the early Neolithic to Han period had been excavated in South China, Korea and Japan. Wooden tools had been used in various subsistence activities including food processing. In East Asia, wet-rice cultivation started in the Yangtze River Valley and then spread gradually to surrounding area with many tools as well as pestles and mortars. In this article, the author shows various changes in shape, size, conversion of timber and usage of pestles that occurred in diffusion of wet-rice cultivation to the east. In the Middle Yangtze River Valley, a small pestle which is 22cm long was found in Bashidang site. It was single-head pestle (using only one edge) with edge wear marks. When this short pestle was used, user sit on the ground. And in the Lower Yangtze River Valley, much longer pestles (about 90cm long) were used in Hemudu cultre sites (Hemudu site, Tianluoshan site). They were also single-head pestles but used by standing users. As mortars, stone or hardened ground was used probably. Afterwards, this type of pestles were assumed to change into two types: double-head pestles (using both edges) and pestles worked by treading. The former type of pestles were excavated from Bronze Age sites in South Korea. They are more than 120cm long and have drum-shaped protrusion at the middle of pestles. This type of pestles were brought to Japan at the beginning of Yayoi Period with many wooden tools (hoes, wet paddy smoothers, weaving tools and so on).

*Key-words: pestles and mortars, wet-rice cultivation, spread eastwards and changes*

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## AGRARIAN PRACTICES AND CHANGES BY INVESTIGATING WEED FLORA IN NORTH-WESTERN FRANCE FROM THE BRONZE AGE TO THE IRON AGE

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The lack of archaeobotanical datas in North-Western France was highlighted by several papers and national studies conducted by the National Institut of Preventive Archaeology. Most of the first

analysis were carried out in Calvados, where the major crop seemed to be pulses. The archaeobotanical data also confirmed the presence of cultivated oat and pulses in storage pits in these dwellings during Late Iron Age.

The first aim of this research was to conduct new studies and collect data in Brittany, Normandy and Loire region. The data base includes 29 sites and 510 samples from 327 structures. The issue of this PhD focus on agrarian systems, crop production and its changes. The agrarian practices were investigated by inferring the weed flora composition and its ecological characteristics. The chronological frame covers a time span from the Bronze age until the Roman period.

The results reveal common trends and dynamics with the Northern France and Europe. For example a diversification process of the cultivated species is confirmed from the Late Bronze Age. Moreover several components are identified as being specific to these regions during Late Iron Age. For example: the abundance of pulses in Calvados; the limited rate of naked wheat; the rise of Oat and Spelt; hulled Barley or Emmer as the main crop of sites from Armorican Massif or Paris Basin. The results indicate intensive cultivation practices and diversified crops. During Iron Age, there are more differences between sites and cultural systems.

*Keywords: Iron Age, Bronze Age, Weed flora, Crop production, North-Western France*

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## **THE LATE HOLOCENE FOREST TRANSFORMATION IN SANDSTONE LANDSCAPES OF THE CZECH REPUBLIC**

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We studied transformation of the forest vegetation using fossil charcoal from rockshelters. As a study area, we chose sandstone landscapes that appear to be an exceptionally suitable for archaeobotanical research due to the fact that many rockshelters offer long-term anthracological archives. The anthracological research was carried out in the context of parallel archaeological investigations. Our research is focused on the comparison of the macrocharcoal records from rockshelters with different geomorphological positions. The site-specific records provide insights into long-term changes within different local habitats, since the Early Holocene to the present.

The distribution of individual arboreal species was clearly related to the position within local environmental gradients. Our research documented remarkable differences between species-rich assemblages from rockshelters situated in the humid valley bottoms and species-poor assemblages from rockshelters located in the dry upper parts of the slopes. Anthracological results recorded relatively fragile equilibrium of local forest ecosystems in the Middle Holocene. Their deep transformation occurred at the onset of the Late Holocene (around 4 ka BP) when species-rich, productive forest communities were replaced by low productive, acidic forests with a smaller species pool. Our study documented the effects of increased human activities. We assume that especially pastoral ones played an important role in the forest transformation.

*Key-words: charcoal analysis, sandstone rockshelters, human impact, forest transformation*

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**EXPLORING NEOLITHIC SUBSISTENCE AND AGRICULTURE IN CENTRAL MACEDONIA, NORTHERN GREECE: RECENT EVIDENCE FROM THE SITES OF KYPARISSI AND KORONEIA (MIDDLE- FINAL NEOLITHIC)**

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During the last decade, a large number of prehistoric sites have come to light in Central Macedonia, Greece, due to large scale construction work and rescue excavations. Two of these excavations, Kyparissi and Koroneia, invested time and resources towards the retrieval of archaeobotanical material. Its study allows us to explore the relationship between humans and the environment, the ways of transforming it for fields, pastures. At the same time this material offers insights into daily lives, crop-processing activities, food habits and special events. The material from Koroneia originates from an extended site and the content of pits. The material from Kyparissi, a huge low mound, originates from hearths, floors, food related constructions, pits and vessels. The two sites present us with two distinct archaeobotanical assemblages in terms of composition and context and allow insights into daily activities, special events and processes leading to differential archaeobotanical assemblages between tells and flat sites.

*Key-words: Cereals, pulses, wild plants, Neolithic, Northern Greece*

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**APPROACHES TO MEDIEVAL AGRICULTURE IN IBERIA: NEW DATA ON CROPS AND STORAGE**

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This contribution presents results from recent archaeobotanical work in Medieval Iberia from a variety of contexts including Christian, Islamic and Jewish sites. A great diversity of cereals and legumes together with the evidence of fruit and herb consumption and the presence of wild plants likely to have been consumed summarize the evidence found in the archaeobotanical record of Medieval Iberia. Data suggest also some degree of variability across regions which need to be better understood. An interesting aspect of the study of medieval agriculture relates to the variability of storage systems. It is particularly in the context of large-scale storage, that we explore an intriguing feature that can be found in often-forgotten corners in several regions of Iberia (Andalucía, central Spain, Valencia, upper Ebro Valley), the so-called perched or cliff granaries, also known as window caves. These have remained unexplored despite their potential for providing crucial information not only on the variety of crops stored but also on other aspects of the medieval society (storage practices, agricultural production, but also on the identity of their users). This poster will present data on some of archaeobotanical material found here and their potential for gaining insights into medieval agriculture.

*Key-words: Agriculture, crops, storage, medieval, Iberia*

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## INVESTIGATION OF CEREAL REMAINS DISCOVERED FROM THE DEFENSIVE CITY SITE OF SHICHENGZI (~4-75 AD) ON THE SILK ROAD, XINJIANG, NW CHINA

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The Shichengzi site is a remnant of an important defensive city of the Han Dynasty along the Silk Road in the northern part of Xinjiang, China, that dates to ~4-75 AD. New archaeobotanical data recovered from the site was evaluated to gain a better understanding of the agricultural economy and living conditions of that military fortress of Han Empire in the Western Regions of China. Here, we investigated the cereal remains discovered from the Shichengzi site, four types of grains were identified in total: *Hordeum vulgare* var. *coeleste*, *Triticum aestivum*, *Panicum miliaceum*, and *Setaria italica*. It showed that the naked barley and bread wheat were the dominant species in crop structure. These findings revealed essential clues to the agricultural pattern and diet of the Han immigrants who farmed on the northern slopes of the Tianshan Mountains around 2,000 years before.

*Keywords: Archaeobotany, Han Dynasty, Silk Road, City site, Xinjiang*

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## EVIDENCE OF ACORN 'CONSUMPTION' IN NORTHERN ITALY DURING THE BRONZE AGE

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Edible wild plants are still a relevant food source during Bronze Age, complementary to food production. Among these, acorns have received far less attention than other plant food. This might be due to taphonomic reasons as claimed by some authors. Starch-rich seeds are rarely preserved unless charred, thus their abundances are probably underestimated in archeological sites. Furthermore, acorn finds have been perceived for long as being gathered exclusively for feeding animals in the agrarian societies, due to their bitter taste. Human consumption was considered to be restricted to periods of famine. Nevertheless, there are several reasons to reconsider the role of acorns as staple food in prehistoric economy: their nutritive high value, their easy storing for long periods and the numerous ethnographic evidences. This paper considers acorn remains and pottery fragments with charred acorns fixed in the crust sticking to the inner side from different Bronze age sites in Northern Italy. Archaeobotanical and chemical analyses were carried out on these cooking residues. Furthermore, we add some hints about the taxonomical variability in acorn properties from modern oak stands in Northern Italy. Based on these results the potential use of acorns in human consumption is discussed. Hypothesis for additional usage of acorns are also explored.

*Key-words: Acorn consumption, Quercus, Bronze Age, Northern Italy*

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**STUDY OF AMORPHOUS CHARRED FOOD REMAINS FOUND IN LITHUANIA**

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Food is essential to our everyday existence, therefore paleo diet studies enables the recreation of various aspects of human behavior and identity. Study of ancient charred food remains has recently become quite popular among archaeologists. The identification of plants that amorphous charred food remains contain, the food form they embody and the techniques used to create them let archaeologists provide exclusive information about ancient cuisine and daily food preparation and cooking traditions.

The objects of the study are charred organic amorphous remains from Apuolė and Mažulonys hillforts, Bekesh hill in Vilnius and experimental comparative material. The chronology of studied material - 11-14th c. AD.

The study represented here was the first attempt to examine charred organic amorphous materials found in Lithuania by applying new methods that were never used in Lithuania before and try to identify what kind of processed food they are. Three methods were applied: scanning electron microscopy – in order to see the structure of the material and to determine preparation and cooking techniques; (2) ancient starch extraction – in order to identify what kind of cereal grains could have been used; (3) the comparison of archaeological material with experimental reference material.

Preliminary results showed that charred amorphous pieces examined are definitely a plant based food, most probably, bread made with sourdough.

*Key-words: charred food remains, scanning electron microscopy, experimental archaeology, starch*

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**INTERDISCIPLINARY STUDY OF HORTICULTURAL PRACTICES IN LATE MEDIEVAL BRUSSELS**Lien Speleers<sup>1</sup>, Yannick Devos<sup>2</sup>, Bea De Cupere<sup>1</sup>, Koen Deforce<sup>1</sup>, Sylvianne Modrie<sup>3</sup>

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Over the last decades a series of sites attesting the presence of ancient crop fields and gardens were discovered in the historical center of Brussels. Well aerated crop field and garden soils with a high biological activity, are often not suitable for the preservation of organic plant remains. In most cases, their studies yielded only small quantities of more resistant seeds and fruits. The identification of the cultivated plants relied therefore mainly on phytolith analysis.

Recently, a Holocene peat sequence was excavated in the lower part of the city in a quarter that is historically documented as a horticultural area (*rue des Boiteux, BR295*). Micromorphology showed that the upper layers of the peat sequence were drained during the late Middle Ages and subsequently converted into horticulture. In this poster the potential of studying these contexts will be discussed. Thanks to the prevailing wet conditions of the soil, higher densities of waterlogged macrobotanical remains could be analysed. Remains of diverse cultivated plants and garden weeds were found, most probably partly from the local vegetation and local cultivated crops. The archaeobotanical and archaeozoological studies also shed light on manuring practices.

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**SURVIVAL OF THE FITTEST? AN ARCHAEOBOTANICAL APPROACH TO THE 6TH CENTURY CRISIS IN SOUTHWESTERN NORWAY**

Sara Westling

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An apparent decline in population and economy is seen in the archaeological material in Rogaland, southwestern Norway, from the mid-6th century AD. Many farms were abandoned and specialised crafts fell out of use. Some studies suggest that it took at least 500 years before the population reached the same levels as before the crisis. This decline has been much discussed in archaeology and put in connection with a climate deterioration following the dust veil of AD 536, the Justinian plague, starting in 542, or various economic or social transformations or disturbances. Palynological studies of this period have been conducted and interpreted in terms of agricultural abandonment, in Scandinavia and elsewhere, but plant macrofossils are still largely unexplored in this connection. In my PhD project, I study the agricultural development in relation to the crisis. I compile plant macrofossil data from the 5th to the 9th century AD in Rogaland, and discuss vulnerability and resilience strategies that could have been employed to cope with climatic, demographic, economic or social challenges. I will present results from a comparison between two settlements – one that was abandoned in the late 6th century and one that prevailed. Local conditions and choice of economic strategy contributed to the settlement's different fates, and the introduction of a new crop, rye, on one of them may have contributed to its survival.

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**SHOULD RYE BROME BE CONSIDERED A CROP? CAN BROME-RICH ASSEMBLAGES, FOOD-PROCESSED GRAINS AND TEXTUAL REFERENCES HELP US TO CLARIFY THE PERCEPTION OF THE PLANT, ITS USES AND STATUS IN NORTHERN FRANCE, DURING THE IRON AGE AND HISTORICAL PERIODS?**Véronique Zech-Matterne<sup>1</sup>, Marie Derreumaux<sup>2</sup>, Bénédicte Pradat<sup>3</sup>*1. CNRS, Archéozoologie, archéobotanique, sociétés, pratiques, environnements, MNHN, Paris, France.**2. CRAVO, Archéozoologie, archéobotanique, sociétés, pratiques, environnements, MNHN, Paris, France.**3. INRAP, Archéozoologie, archéobotanique, sociétés, pratiques, environnements, MNHN, Paris, France.*

Rye brome, a winter-annual acidophile arable-weed of the Poaceae family, is a commensal species of crops, predominantly growing on sandy soils. Common in the carpological assemblages of northern France, the species is occasionally found in large quantities at different times, in proportions equivalent to that of a cultivated plant. In the Laténian site of Arpents aux Chevaux in the commune of Plessis-Gassot, located north of Paris, residues of food treatment or food preparation, in the form of amalgamated seed-cakes, with the exception of any other species, have even been found. This raises the question of the status of the plant and its uses. Some bromes are currently grown as fodder, and livestock show a high appetite for their consumption. However, the old uses of the plant are much more difficult to discuss. It is usually considered a weed that proliferates in nitrogen-enriched loamy soils. Has it been occasionally tolerated in the fields or even cultivated? Has it been the subject of an abortive attempt at domestication? Was it perceived as a species distinct from cereals or as a degeneration of them? These are all questions that we will try to address in our contribution, based on the contexts that have delivered seed concentrations.

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## Session 3 INTEGRATED AND INTERDISCIPLINARY APPROACHES

### Talks

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

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

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

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#### **ARCHAEOBOTANY OF BASKETS OF SOUTH-EAST EUROPE?**

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

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

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

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

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

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

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

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

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## PASTORAL ECONOMIES IN THE OLD WORLD TROPICS AND MILLET EXPLOITATION

Abigail Buffington

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

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

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

Laurent Bouby<sup>1</sup>, Nathan Wales<sup>2</sup>, Mindia Jalabadze<sup>3</sup>, Nana Rusishvili<sup>3</sup>, Vincent Bonhomme<sup>1</sup>, Sarah Ivorra<sup>1</sup>, Allowen Evin<sup>1</sup>, Elisabetta Boaretto<sup>4</sup>, Roberto Bacilieri<sup>5</sup>, Tom M. Gilbert<sup>6</sup>, Jean-Frédéric Terral<sup>1</sup>, Davia Lordkipanidze<sup>3</sup>, David Maghradze<sup>7</sup>

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The Near East and the Caucasus are commonly regarded as the original domestication centre of grapevine. Georgia is home to a high diversity of wild and cultivated grapevines. The earliest chemical evidence for wine making was recorded in Georgian Neolithic sites (6000-5800 BC). It is however unclear whether early wine was made from wild or cultivated grapevine and when domesticated grapes first appeared.

We systematically investigated charred and uncharred grape pip samples from Georgian archaeological sites. Their chronology was thoroughly assessed by direct radiocarbon dating. More than 450 seeds from 12 sites, from the Early Bronze Age to Modern times, were selected for Geometric Morphometric studies. The shape of ancient seeds was compared to hundreds of modern wild individuals and cultivated varieties. Ancient DNA was isolated from individual uncarbonized seeds and converted to Illumina libraries for Next Generation Sequencing.

The domesticated seed morphotype is identified from the Iron Age (8th-6th c BC) onwards and is generally predominating in the samples. A strong diversity of domesticated shapes is regularly identified in the samples. Most are close to modern cultivars from the Caucasian and Aegean areas, which suggests that the modern local diversity is deeply rooted in the early times of viticulture. DNA was successfully recovered from historic pips and genome-wide analyses found these specimens were closely related to modern Georgian cultivars.

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

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## ANCIENT STARCH ANALYSIS AT NEOLITHIC BONCUKLU

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



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

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

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

Marvin Demicoli

*University of Liverpool, UK.*

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

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

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

India Ella Dilkes-Hall, June Davis, Helen Malo

*University of Western Australia (UWA), Gooniyandi Traditional Owner, Muludja Community, Australia.*

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

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

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

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

Daniel Fuks<sup>1</sup>, Zachary C. Dunseth<sup>2-3</sup>, Dafna Langgut<sup>4-5</sup>, Don H. Butler<sup>2</sup>, Xing Yan<sup>6</sup>, Elisabetta Boaretto<sup>6</sup>, Yotam Tepper<sup>7</sup>, Guy Bar-Oz<sup>7</sup>, Ruth Shahack-Gross<sup>2</sup>, Ehud Weiss<sup>1</sup>

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7. Zinman Institute of Archaeology, University of Haifa, Israel.

We present a systematic methodological comparison of three archaeobotanical proxies: seeds, pollen and phytoliths. These were applied to an assemblage of dung pellets and corresponding archaeological refuse sediments from Early Islamic Shivta (6th-9th c. CE) in Israel's Negev desert. Our research goals were to:

- 1) evaluate strengths, weaknesses and compatibility of the three methods regarding archaeobotanical interpretations of dung;
- 2) infer on-site herding practices; and
- 3) assess the relative input of botanical remains from dung in archaeological refuse assemblages.

Methodologically, we attain incomplete reconstructions from each individual method, with each proxy possessing its own advantages and limitations. However, using the combined approach we were able to distinguish between autumn-winter grazing without foddering, and late-spring grazing supplemented by domestic cereal chaff/hay. In addition, our combined results demonstrate that Shivta's Early Islamic refuse middens are only partially composed of dung remains and originated primarily from domestic trash.

This study's significance lies both in its methodological contribution to archaeobotany, and in lasting discussions regarding the influence of dung remains on the composition of archaeological deposits. We offer a rigorous method for determining whether deposits derive from dung alone, contain no dung, or are mixed. This has important ramifications for archaeological interpretation, generally.

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

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

Jenny Hagenblad

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The Canary Islands were settled in the first millennium AD and the settlers developed a farming economy with barley as the main crop. Archaeological evidence suggests the islands then remained isolated until the 15th century. On Gran Canaria, harvests were stored in grain silos excavated from the volcanic rock. The practice of using silos for long-term grain storage was abandoned shortly after the Hispanic conquest, but the exceptional preservation capabilities mean archaeological grains can be analysed genetically.

We have analysed archaeological barley seeds and compared them with extant landrace barley from the Canary Islands and the Western Mediterranean. The results show that, although the human gene pool has been almost completely replaced, Canarian farmers have stayed true to the local barley for millennia and still cultivate the same landraces as in pre-Hispanic times. Comparisons with mainland barley support original colonization from present day Morocco. Extant Moroccan barley has, however, probably not descended from the barley from which Canarian settlers brought their seed. The results support pre-Hispanic barley cultivation on Lanzarote, in spite of an absence of archaeological findings. The study thus illustrates how archaeological and genetic analyses can complement each other to increase our understanding of past human practices.

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

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

Sabine Karg

*Institute for Prehistoric Archaeology, Free University of Berlin, Germany.*

Numerous objects were made of plant fibres in the past: strings, ropes, containers, nets, sails, clothes etc. The amount of raw material that was needed for the production of these objects is enormous and very labour intensive. What about the consequences of the withdrawals of raw materials from nature and the environmental impact of the cultivation and processing of textile plants? Can this impact be recognised in pollen diagrams and/or extrapolated by calculating the dimension of former textile crop cultivation?

Textile tools are frequently excavated at archaeological excavations but not always recognised as those. All kinds of combs are interpreted as hackles that were used for wool and/or plant fibre processing. In order to shed light on the efficiency of these objects, we performed experiments with reconstructed combs. The help of different tools or even without any tools can produce threads made of plant fibres. By using a wooden hook or a spinning whorl spliced threads can be plied into extremely strong and tear-resistant yarn. Evidence from the excellent preserved Neolithic lake dwellings sites in the Alpine area shows that yarn was even produced from tree bast in such a

technique.

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

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

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

Eleanor Kingwell-Banham

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Phytoliths are useful plant microfossils, especially for the identification of taxa that are not preserved in the macrobotanical record. Their role as palaeoenvironmental proxies is also increasingly recognised. This paper presents the results of extensive research into the use of phytoliths to identify rice cultivation systems in Asia. Data from 20 sites from China, Southeast Asia and South Asia has been examined in order to try and pinpoint when irrigated deep water rice fields developed. This phytolith data has been correlated with macrobotanical wild-weed data and climate indices, highlighting the strengths and weaknesses of the phytolith approach.

This talk is in memory of Dr Alison Weisskopf, who collected most of the data in this talk and sadly passed away in January 2018. Alison was one of the key figures in developing the use of phytoliths as indicators of ancient field ecology in Neolithic China and her work has been highly influential to those studying the development of agricultural irrigation and social complexity in the prehistoric Yangtze.

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

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

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

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

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

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

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

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

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

Meriel McClatchie

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

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

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

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At the site 29 in Paliwodzizna the unique Mesolithic stone structures were discovered. Archaeological survey indicates that some of them could have a ritual origin or was a part of wood tar pits complex. The main purpose of multifaceted project connected with this site (NCN 2016 23 B HS3 00689) is the recognition of the scope of human activity and the comprehensive reconstruction of the natural environment in the vicinity of camp.

Botanical analyses concerned materials obtained from the Mesolithic camp complex, area of former lake (currently peatbog) and between the camp and the paleolake borderline. In the features of the camp complex plant macroremains (seeds, fruits, charcoal), which indicate the presence and



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

*Key-words: archaeobotany, paleoecology, Mesolithic camp complex*

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

Welmoed Out<sup>1</sup>, Andreas Mieth<sup>2</sup>, Sergi Pla Rabes<sup>3</sup>, Svetlana Khamnueva-Wendt<sup>2</sup>, Marco Madella<sup>4</sup>, Stefan Dreibrodt<sup>2</sup>, Carolin Langan<sup>5</sup>, Hans-Rudolf Bork<sup>2</sup>

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

*Key-words: Rapa Nui, Prehistoric pigments*

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

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

Period, mainly: (I) technological progress in agriculture and increasing range of crops cultivated; (II) increasing complexity of cultural landscapes; (III) immigration of alien plants. Our aim was to gain a better insight into the basic trends of archaeophytic migrations in central Europe from the Neolithic to the Medieval Period. We summarised data on macroremains from the Archaeobotanical Database of the Czech Republic, as well as data from other European countries published in international journals and monographs. In some cases we were able to identify groups of species with characteristic migration directions (e.g., *Adonis aestivalis* and *Asperula arvensis* came from the west, *Fumaria officinalis* and *Silene latifolia* from the east). Still, we need to further test these preliminary results using more robust data.

Analysis of the weed seeds accompanying ancient crop remains is generally used for the reconstruction of ancient crop cultivation practices. However, we demonstrate here that the migrations of diagnostic species followed various patterns, which differed between territories. We need to keep in mind that although the presence of a species is conditioned by the existence of suitable biotopes, there are still other important factors (like propagule pressure and competition).

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

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

Erica Rowan

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

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

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## PLANT FOODWAYS AT ÇATALHÖYÜK – A MULTI-PROXY PERSPECTIVE

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

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

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

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During the 8th to 13th centuries AD a major expansion in arable cereal farming occurred in parts of England and Europe, developing into open field agriculture. Three key innovations allowed for the dramatic increase in cereal production during the early medieval period: three-field crop rotation, the spread of the mouldboard plough and the extensification of cultivation. Yet the critical questions of when, where and how these innovations developed remain unanswered despite decades of historical research. This presentation will explore for the first time the possibilities of detecting crop husbandry regimes shifts through stable carbon and nitrogen crop isotopes and functional weed ecology.

Stable carbon and nitrogen isotopes from crop remains provide information on arable soil conditions (soil N and moisture availability), allowing inferences regarding the ‘compatibility’ of crops potentially grown in rotation. Such evidence is complemented by functional weed ecology which provides an indication of the intensity of cultivation (soil fertility and mechanical disturbance). This paper presents results from case studies from England and Germany, showing how the integration of isotopes and weed ecology can provide information to help understand when, where and how this ‘cerealisation’ occurred.

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

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

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More than 5000 years old presumably dog's coprolites were found during rescue excavations at *Stare gmajne* and *Črnelnik*, two late Neolithic pile-dwelling sites in Slovenia. Although human and dog diets may overlap considerably, the content of the consumed and digested plant and/or animal food remains, biologically diverse. The digested content will be presented in a multidisciplinary approach investigating testing biomarkers and genetic, palynological, palaeoparasitological, archaeobotanical and archaeozoological features.

Beside the origin (dog/s or human), daily diet and nutritional habits of the individual in the Late Neolithic, the analyses of coprolite provide more important information, for example: the time of the year of deposit, the environmental conditions there, the size and the health of the animal as well as the care for (or the status of) domesticated animal.

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

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

Soultana Maria Valamoti<sup>1-5</sup>, Chryssi Petridou<sup>1-5</sup>, Andreas G. Heiss<sup>6</sup>, Marian Berihuete Azorin<sup>7</sup>, Hans-Peter Stika<sup>7</sup>, Girolamo Fiorentino<sup>8</sup>, Milena Primavera<sup>8</sup>, Costas G. Biliaderis<sup>2</sup>, Athina Lazariidou<sup>2</sup>, Vasileia Sereti<sup>2</sup>, Vassilis Fyntikoglou<sup>3</sup>, Konstantinos Symponis<sup>3</sup>, Lambrini Papadopoulou<sup>4</sup>

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

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

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

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

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2. *Leiden University Centre for Linguistics (LUCL), The Netherlands.*

Europe has been populated by different groups of people since the Upper Palaeolithic. At ca. 8000 BCE, the agricultural spread from Anatolia into Europe has provoked many changes in subsistence, interaction and diet: the so-called Neolithic Revolution. At ca. 3500 BCE, a new wave of people and innovations entered Europe from the east, bringing agro-pastoralist subsistence, new plant and animal species, and a language that can be reconstructed based on historical-comparative linguistics (i.e. Proto-Indo-European).

The impact of these new people on the existing cultural groups of Europe is profound and seems to not only change subsistence and burial practices, but also language. These changes will only really become apparent when historical linguistic and archaeological evidence are combined to link them to moments in time.

With this paper we want to inform and discuss about historical linguistics as a tool in combination with palaeoethnobotany to create a more complete and detailed understanding of mobility, subsistence and diet in the past. We will show sequences of maps, based on hundreds of archaeological sites, that follow the distribution of cultivated plants and their crop weeds throughout European prehistory, and their names within the different language groups. This will form the basis for a future international database that can be used to create overviews of the distribution of innovations, plants, animals, people, and language throughout prehistory.

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

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

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Based on the merely quantification of archaeobotanical remains, i.e. seeds, fruits and charcoals, palaeoecological reconstructions could lead to misleading conclusions. Thanks to the study of the stable isotopes, plant remains have been disclosed as a powerful tools to explore the role of climate in the evolution of both the environment and human communities and the past growing conditions of plants.

The high-resolution isotope records from the long-lived archaeological site of Arslantepe in the Near East have been produced. The characterising features of Arslantepe (Turkey) are the long-term occupation, from 4700 to 2000 BCE, and the huge amount of plant remains preserved *in situ*. The improvement of the chronological framing by new <sup>14</sup>C-AMS dates has been the base for building up the stable carbon and nitrogen isotope records from both charcoals and cereal grains. Deciduous *Quercus* and *Juniperus* isotopic signals have revealed that climate was wetter than nowadays, with regional fluctuations involved in the local cultural changes. The past crop management system has been reconstructed using the isotopic values of *Hordeum vulgare*, *Triticum dicoccon* and *T. aestivum/durum* grains, considering the relationship with social and cultural transformations.

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

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

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The olive tree and the olives have been present in archaeological sites in the Mediterranean region for the past 6500 years. In particular olive pits, as they represent a single year growth, have been used for radiocarbon dating of the archaeological level where they were deposited. However, the stable isotopes of carbon in olive pits have been mostly ignored. As the ratio between <sup>13</sup>C and <sup>12</sup>C ( $\delta^{13}\text{C}$ ) is widely used as a climate of proxy, the abundance of olive pits from many archaeological sites in Israel represents a rich source of information, that can provide a higher resolution of climate information both in time and in space, which is imperative for this area, as the water regime varies greatly across a small geographical gradient.

We investigated both the olive trees in Israel today to better understand the correlation between  $\delta^{13}\text{C}$  of olive pits to environmental conditions. This correlation is not necessarily straightforward, as the  $\delta^{13}\text{C}$  signal is likely dampened between the photosynthates produced in the leaf, and the



olive pit structural material. Furthermore, olive pits are generally preserved as charred remains, presenting potential additional fractionation relative to the original signal. Therefore, we analyze the effect of charring on  $\delta^{13}\text{C}$  of whole olive pits compared with fresh material and  $\alpha$ -cellulose, as well as the correlation of the  $\delta^{13}\text{C}$  of  $\alpha$ -cellulose from modern olive pits to environmental conditions. Then we compile the  $\Delta^{13}\text{C}$  values from hundreds of charred olive pits found in more than 20 sites across Israel, spanning more than 5000 years, and discuss their contribution for reconstructing past climate. We have found a general agreement between the climate indications from the  $\Delta^{13}\text{C}$  from archaeological olive pits and other known proxies.

*Key-words: climate reconstruction, stable isotopes,  $\delta^{13}\text{C}$ , climate proxy, olive pits*

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

Gemma Warham

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Ancient plant remains recovered from early farming sites in western Asia provide the primary evidence for the domestication of crop species. This evidence is key to the understanding of the processes and selective pressures acting on plants during their domestication as crops, which resulted in the establishment of a new ecological niche, the crop field, and which formed the basis for the subsequent plant-based economies of urban society.

This research aims to identify the selective pressures associated plant domestication in south-west Asia, using an ecological approach, and so improve our understanding of the types of human activities and environmental conditions that led to the emergence of agriculture in this region. Plant strategies, identified as functional traits of the gathered wild plant species, the crop progenitor species and domesticated crop species are explored, and the interactions between these attributes (functional groups) are analysed. The functional differences between domesticated cereals and pulses, their wild progenitors and wild grasses and legumes are examined, and on this basis, a systematic model is presented of the types of human behaviour which gave rise to the processes conventionally associated with plant domestication.

This has involved the selection of a wide range of wild and cultivated grasses and legumes for field and laboratory measurement and both collection from the wild and from agricultural stations, in the Near East and Europe.

*Key-words: Functional ecology, archaeobotany, domestication*

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

Ehud Weiss, Eliashiv Drori

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

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

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

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

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## Session 3

### INTEGRATED AND INTERDISCIPLINARY APPROACHES

#### Posters

#### **HOW TO PRODUCE A NATUFIAN MORTAR? AN EXPERIMENTAL ARCHAEOLOGY RESEARCH**

Hadar Ahituv

*Botanical Archaeology Lab, Bar Ilan University, Israel.*

The Natufian culture was a dominant culture at the Levant during the final stages of the Epipalaeolithic Period. The Natufians used new techniques and complex tools as part of the transition from hunter-gatherers to more sedentary societies. Ornaments and pendentive objects are commonly found as well as organic and inorganic findings. Among these finds, many ground stone tools were found. These tools are processing implements for plants and minerals, typically comprise of two stone objects. Stone tools' usage was already analyzed and reconstructed, yet their production technique stays unclear. It was commonly accepted that the production of a massive ground stone tool (mortar) includes drilling and require some 4-6 months of work. In this poster we will show our experimental archaeology research, aimed to reconstruct the production of those ground stone tools with ancient techniques.

Our results indicated that the most efficient technique to produce stone mortar is by pecking and battering, using compact basalt chisels, and that drilling tools are unnecessary. Also, the average production time is between 10-14 hours of working.

These results shade new light not only on the production technique but also on the craft specialization within the Natufian society.

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#### **WEEDING THROUGH JORDAN'S PREHISTORY: WEED ECOLOGY REGIMES AT KHIRBAT AL-MUDAYNA, WADI ATH-THAMAD**

Julia Arnold, Abigail Buffington

*The Ohio State University, Columbus, USA.*

The Iron Age period in the southern Levant saw multiple shifts in political and social dimensions that potentially correlate to changes in the agricultural economies of the region. Under conditions of empire in later phases of the period, intensification of production may result from tributary systems. Archaeobotanical assemblages have the capability of revealing changing management strategies for agricultural landscapes in prehistory. Boserup's (1965) model of intensification vs.

extensification is a useful tool in framing the agricultural production and its relationship to a developing economy of dependence. Weed ecology is a particularly salient analytic tool based on the macroremains that potentially reveal the intensity of anthropogenic impacts associated with food and fodder production. In this research project, we defined the weed taxa of Khirbat al-Mudayna, an Iron II (800 - 550 BC) settlement with industrial and fortification architecture, by ecological habitat type. We compared our assemblage qualitatively with those of contemporary sites in the broader region, finding our site features an anomalous pattern. Field weeds were dominant at Khirbat al-Mudayna, so we created an index of non-field to field weeds, roughly corresponding to extensive vs. intensive management. Based on the quantitative data, we applied multivariate statistical tests to the samples based on architectural category with context considered for intra-site analysis.

*Key-words: Weed Ecology, Paleoethnobotany, Jordan, Iron Age, Statistical Analysis*

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## **THE POTENTIAL OF STARCH GRAIN ANALYSIS IN UNDERSTANDING EARLY FARMING PRACTICES IN WESTERN EUROPE**

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Starch grain analysis is a well-established methodology used in archaeology to address issues related to the exploitation of plants and food in the past. Although widely used in certain parts of the world, material from Early Neolithic (around 5200-4700 BC) sites in north-western Europe, and more specifically those located in the Paris Basin, have yet to be systematically studied. This poster presents preliminary data recovered from both grinding stones and ceramics from various sites across this area (e.g., Menneville, Ath, Loison-sous-Lens). This research will thus not only address issues related to food processing and preparation, but also regarding the function of different tools. By considering data obtained from other archaeobotanical remains, and from other disciplines such as use-wear and chemical analyses of residues in ceramic vessels, the data obtained through the study of starch grains could complement or even modify the vision we currently have on the dietary practices of the first agricultural populations in north-western Europe.

*Key-words: Early Neolithic, reference collection, north-western Europe, grinding stones, plant use*

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## **ADONIS ANNUAL IN THE UK: PALAEOETHNOBOTANY, HISTORY AND CONSERVATION**

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Arable weeds are the fastest declining group of plants in the UK with almost 60 species under threat and 7 regarded as extinct. These plants are now the subject of increased conservation efforts

including the ‘Colour in the Margins’ project, which aims to conserve 10 arable weed species as part of preserving arable cultural heritage (<https://naturebftb.co.uk/the-projects/colour-in-the-margins/>). *Adonis annua* L. (pheasant’s eye) is one of the plants included in the project, partly because it is regarded as an Iron Age introduction. Pheasant’s eye is currently classed as endangered in the UK and has been listed under section 41 of the Natural Environment and Communities Act 2006.

This poster will explore the history of *Adonis annua* in Britain. There is only a single archaeobotanical record, 2 seeds from an early Iron Age pit fill at Danebury hillfort. There have been no further finds, either from subsequent work in and around Danebury, or from Iron Age, Roman and medieval sites nationally. This would imply that *Adonis annua* was only ever a rare arable weed and that its treatment as archaeophyte needs revisiting. The historical evidence is more compelling, but still suggests that this plant was a relatively late recruit to the British flora. As well as growing as a cereal weed, people planted pheasant’s eye in their gardens and it was sold as a cut flower London in the eighteenth century under the name “red Marocco”.

*Key-words: archaeophyte, weed, Iron Age, conservation*

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### **THE SUCCESSO-TERRA PROJECT: A LESSON OF SUSTAINABILITY FROM THE TERRAMARE CULTURE, MIDDLE BRONZE AGE OF THE PO PLAIN (NORTH ITALY)**

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The SUCCESSO-TERRA Project (Human societies, climate-environment changes and resource exploitation/sustainability in the Po Plain in the mid-Holocene: the Terramare culture; PRIN-20158KBLNB) is a research program aiming at reconstructing landscape and land-use transformations that occurred during the Terramare period in the southern-central Po Plain of Northern Italy. The project joints experts on Geoarchaeology, Palynology and Archaeobotany to study high-resolution archaeological sediments with an interdisciplinary ecological perspective.

The Terramare settlements were banked and moated villages of the Middle and Recent Bronze Ages (1550–1170 cal yr BC). According to the plant record (both micro- and macro-remains), agricultural economy was based on cultivation and exploitation of forests. Pollen analysis suggests wood management, including coppicing, and fruit collection on the wild, the existence of crop fields with different types of cereals and the intercropping with legumes. The most of the open landscapes around the villages were used for pastures as suggested by pasture indicators in pollen spectra.

Our interdisciplinary study will disclose the natural (environmental aridification) and anthropic (overexploitation of natural resources) reasons of the collapse of the Terramare culture, by investigating the environmental changes in the region and their relationships with the different land-use adopted by the Terramare people.

*Key-words: land-use, climate change, Terramare, mid-Holocene, interdisciplinarity*

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## “FROM THE EARTH TO THE PLATE”: AN ARCHAEOBOTANICAL APPROACH TOWARDS UNDERSTANDING AGRICULTURAL SYSTEMS AND FOODWAYS OF PRE-COLUMBIAN PUERTO RICO.

Jose Julian Garay-Vazquez

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There is little archaeobotanical data from tropical locations due to notions of poor preservation. More so, in locations where the past peoples' subsistence consisted on tuber crops which are scarcely identified from the archaeological record. My research project focuses on the identification of botanical culinary practices of the pre-Columbian societies of Puerto Rico to identify subsistence practices, and ethnic identity through the analysis of archaeobotanical assemblages. The questions that guides this project is: *What changes in subsistence practices on tropical archipelagos can be identified on the subsistence-resource archaeobotanical assemblage of macro and micro-remains through the analysis of seeds, fruits, parenchyma tissues, possible charred food fragments, phytoliths and starches through time?* Currently, samples from 6 pre-Columbian archaeological sites of Puerto Rico are being analysed, and the presence of charred seeds, food fragments, and possible tuber fragments has been identified. Assessment of unpublished archaeobotanical reports from Puerto Rico have shown that the notions of poor preservation of archaeobotanical remains is related to inconsistencies in methodology. Now the project is on its earliest stages, and future avenues of research will focus on developing a methodology for sampling in tropical contexts, enhance recovery methodologies, and identify the effects of taphonomical effects on archaeobotanical materials.

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## AT THE ORIGINS OF ROME: URBANIZATION, AGRICULTURE AND CLIMATE IN IRON AGE

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The beginning of Iron Age in Central Italy witnessed increasing social complexity, urbanization processes and climatic instability. However, understanding the mutual relations of these events as well as their effects on past agriculture is still a complex matter. This research aims at investigating changes in agricultural systems and environmental variability through the analysis of macrobotanical samples retrieved from multiple archaeological contexts dating between the late 8th and the 6th century BCE. Recent excavations at the site of Gabii, situated at the outskirts of Rome, provided charred carpological material (seeds, fruits and woods) coming from different Iron Age and Archaic levels. As Gabii was an important Latin city which experienced this phase of urbanisation such data are crucial for the understanding of its socio-economic development. Preliminary results show the presence of several cultivated cereals, mainly represented by caryopsis of *Hordeum vulgare* and *Triticum dicoccum* but also by few *T. monococcum*. Pulses include *Vicia faba* and *V. ervilia*. Some weeds are also attested, such as *Lolium*. In addition, the analysis of the stable



isotopes of carbon and nitrogen of both charred fruits and woods will allow the study of the past water availability as well as the crops growing conditions and farming practices, informing us, to a certain extent, about the possible effects of climate fluctuation on the development of these ancient societies and their agriculture.

*Key-words: Archaeobotany, Urbanization, Rome, Iron Age, Agriculture*

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### **CARPOLOGY AND XYLOLOGY, ARCHEOBOTANICAL STUDY OF A 4TH CENTURY BC WELL AT TARANTO “TORRE MONTELLO”, SALENTO, ITALY**

Lou Godefroy

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In 2010 rescue excavations at Taranto “Torre Montello” (Salento, Italy) brought to light a settlement situated in the Chora Tarantina. The excavated area revealed an occupation from the Archaic to Hellenistic periods. The campaign reflects the singularity of the site: several sectors revealed traces possibly belonging to an agricultural holding. A well structure contained a high concentration of plant macro-remains whose importance was quickly established. Indeed, it constitutes the only waterlogged context that we have for the Apulia Region and for this particular period.

In my lecture I will present the main results of my study of the macro-remains from strata belonging to the late classical period. These form an important addition to the existing archaeobotanical spectrum for Southern Italy. The main goal is to create a parallel between the corpus, the occupation and use of neighboring areas. Seeds spectrum demonstrate an agricultural area near the well structure. Its span invites to interpret the well as a supply structure.

I will also discuss the difficulties in interpreting this kind of context and at the same time open the dialogue about the potentialities of morphometric observations (wood diameter considerations, cutting marks) as parameters to reconstruct and understand the use of this type of organic material, before its deposition.

*Key-words: Salento, Magna Grecia, carpology, xylology, waterlogged*

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### **MORPHO- AND MOLECULAR GENETIC ANALYSIS OF GRAPE SEED REMAINS FROM TOKAJ/HUNGARY**

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According to literary sources in Tokaj wine region – its wines especially the noble sweet Tokaji Aszú widely known all over the world – were more than fifty cultivated grape varieties in the Early New Age, however we know little about the diversity of wine-grape. Currently we produce less than 10 varieties of them (70% is Furmint, 20% is Hárslevelű, 5% is Sárga muskotály and the rest 5% is the others). All for this could be interesting the analysis of those half-peated winegrape seed material (approx. 10 thousand), what was found in 2016 of March next to the ‘Rakoczi’ cellar in

Tokaj. The samples were 5 meters deep in the ground at the bottom of a trash hole. These are the oldest archaeobotanical grape seed remains from this area, the age of the seeds is based on radiocarbon dating: cal AD 1654-1808. The morphological measurement of seeds was graduated by Fovea Pro 4.0 software and using all the 33 parameters the cluster analyses represents which seeds could belong to one variety. The molecular genetic part of our research is based on comparing SSR markers from samples to Hungarian Vitis Microsatellite Database. Our aim is with this research is by using morphological and molecular genetic methods we could provide explanation and give reconstruction of the original wine grape diversity at the Early New Ages.

*Key-words: Archaeobotany, Grape Seeds, Fovea Pro 4.0, SSR markers*

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## **HUMANS AND THEIR ENVIRONMENT IN EPHESUS AND THE EPHESIA – A COMPARISON OF ON-SITE AND OFF-SITE PALAEOECOLOGICAL DATA**

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During the past seven millennia, huge environmental changes have occurred in the environs of the (later) city of Ephesus (W Turkey) due to the delta progradation of the Küçük Menderes and its tributaries within an extended former marine embayment. In addition, an ever increasing human influence on the landscape (settlements, agriculture, herding) has been documented for the area with an emphasis since the beginning of the 1st millennium BCE. For the first time, various environmental signals from the Roman harbour and harbour canal of Ephesus have been compared to synchronous data from the (supposedly unchanged) natural lake of Belevi in the hinterland of Ephesus. The results of palynological, microfaunal, parasitological, geochemical, sedimentological, mineralogical and tephrochronological analyses from both areas were evaluated in order to study the interactions between the antique city and its surroundings.

In contrast to the natural site of Belevi, sources of pollen influx other than pollen rain and surface runoff water have to be considered in addition for the Roman harbour basin and canal of Ephesus. During the period when the harbour was in operation, several pollen types increased significantly, several of them probably related to harbour and naval activities such as the unloading of ships. The clearly changing pollen spectra after the intensive use of the harbour may be due to the damage of parts of Ephesus during an earthquake and declining settlement activities thereafter.

*Key-words: paleoecology, human impact, harbour activity, hinterland, Western Turkey*

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## **ESTABLISHING A RAINFALL/TEMPERATURE ISOTOPIC BASELINE FOR NORTH-WEST SOUTH ASIA**

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Establishing the monsoon variability during the Holocene is paramount to understand the social dynamics of prehistoric societies in northwest South Asia. In this study we have designed a transect cutting the diverse rainfall zones from the Gulf of Cambay (Gujarat) to the Thar Desert (Rajasthan) and sampled a set of arboreal species at ca. 20 km steps. The isotopic information will be then used to assess the isotopic signal of charred wood recovered from three Holocene hunter-gatherer and agro-pastoral settlements from North Gujarat.

*Key-words: Isotopes; Climate, Rainfall; Temperature; South Asia; Holocene*

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## **THE FRIKIEH, ANOTHER PRODUCT OF HARD WHEAT IN PALESTINE**

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Frikieh is one of the traditional dishes in Palestine; the first mention of it historically was in 13th century AD, in the cookery book (Kitab al-Tabikh) of Al Baghdadi, the processing of wheat, for producing Frikieh is long-hard process, but it is important to document the whole process, for understanding the byproducts presence and the verities of wheat species that could be found in archaeological samples.

As a part of ethnographic work of Ph.D. thesis research, we was documented the frikieh production, in Ajaa village, Jenin governorate in the north of the West Bank/Palestine. This documentation that contains sampling also, gave us a good possibility to compare those samples with archaeobotanical remains of hard wheat whom came from the archaeological sites which concerning to our thesis such as Qasr Hisham in Jericho which is belonging to 8th century AD (Umayyad period).

*Key-words: Frikieh, Ajaa, Qasr Hisham, Umayyad period*

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**PLANTS AND ANIMALS TOGETHER: A DIACHRONIC PERSPECTIVE ON THE SUBSISTENCE ECONOMY OF LATE NEOLITHIC DRENOVAC, SERBIA**

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This study investigates subsistence economy of the large Neolithic settlement in Drenovac in central Serbia, located in the Morava river valley that served as a major communication route in Balkan prehistory. The site was occupied during the Early and Late Neolithic (6-5th mill BC); the Late Neolithic settlement lasted 500-700 years and was uninterrupted. The paper focuses on the Late Neolithic occupation and takes advantage of the evidence offering a diachronic perspective on subsistence strategies and food economy on a local, single-settlement scale. The aim is to detect patterns of plant and animal use through time and explore their correlation and interdependence that likely contributed to the duration of the settlement. The faunal and botanical data from Drenovac suggest that, the subsistence of the Late Neolithic community was based primarily on farming (of mainly hulled wheats and lentil) and herding (of cattle, caprines and pigs); hunting and gathering were practiced to a lesser extent. We note minor shifts in animal exploitation and greater diversity of plant species in the later phases of the occupation, but the core strategies, and the close integration of plant and animal husbandry, did not change. The long occupation, the large size of the settlement and its substantial architecture support the impression gained from the archaeobotanical and faunal data about the stable and resilient subsistence economy through the several centuries of the site's history.

*Key-words: plant and animal husbandry, subsistence, Late Neolithic, Drenovac, Serbia*

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**CAN WE RECOGNISE *SITOPHILUS GRANARIUS* INFESTATION IN CHARRED CEREALS? AN EXPERIMENTAL APPROACH**Ruth Pelling<sup>1</sup>, David Smith<sup>2</sup>, Gill Campbell<sup>1</sup>

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The granary weevil, *Sitophilus granarius* (L.) is one of the most commonly encountered and numerous granary insect pests in Roman Britain, along with the saw-toothed granary beetle (*Oryzaephilus surinamensis* (L.)) and the rust-red grain beetle (*Laemophloeus ferrugineus* (Steph.)). These strongly synanthropic beetle species are not native to the British Isles and there are no archaeological records of them in Britain before the arrival of the Roman army despite being present in Northern Germany from the Early Neolithic. While the absence of grain storage insect pests in the pre-Roman Iron Age is well documented, it is also true that there is a paucity of archaeological insect assemblages from appropriate deposits associated with storage facilities. Grain assemblages from the Iron Age are, however, abundant, including from storage structures (4-post structures, pits) and large scale disposal contexts. The recognition of granary insect pests therefore relies on the archaeobotanists to accurately and systematically record damage to grain caused by the various beetles. This paper presents a first attempt to use charring experiments to determine whether it is possible to characterise the results of the activities of *Sitophilus granarius* in grain as opposed to other effects resulting from the charring process or other types of damage. In particular, it will discuss whether it is possible to develop a set of criteria to reliably identify insect damage in charred grain.

*Key-words: Sitophilus granarius, Roman Britain, experimental approach*

## THE VEGETABLE MACROREMAINS IN THE INTERPRETATION OF FORMATION PROCESSES AND CHRONOLOGY OF ARCHAEOLOGICAL SITES. THE CASE OF EL COLORADO, YOCAVIL VALLEY, NORTHWEST ARGENTINA

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The aim of this paper is to analyse the processes of site formation by integrating into the evaluation the vegetable macroremains recovered in an housing area (E3) from the archaeological locality El Colorado, Yocavil Valley in northwest Argentina (NOA). The locality has an extension of 60 ha., with evidence of occupation since the Formative Period (ca. 2000 BP) to the present. In the excavation of E3 was observed an overlap of four occupation moments, defined from use surfaces and associated features. Space remodeling was recorded, both before and after the construction of the enclosure, from the beginnings of Late Period to the Early Colonial Period. The identified macroremains belong to wild and domesticated native species, and domesticated non-native species such as *Triticum* sp. and *Hordeum* sp., the latter were introduced in the Americas in the colonial era and their finding in this archaeological site is the first reported for an indigenous domestic context in the NOA. This information together with the detailed stratigraphy, the analysis of the ceramic styles with chronological value, radiocarbon dating and the presence of seeds with chronological information (charred wheat and barley grains and dried seeds of *Trichocereus* sp.) in the different occupation deposits and post-abandonment strata allowed us to evaluate the vertical migration of ecofacts, considering the different processes involved in the sedimentation and disturbance of cultural deposits in the site.

*Key-words: Argentinian northwest, seeds with chronological information, process site formation*

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## THE DYNAMICS OF A NON-FORESTED AREA IN THE KRUŠNÉ MTS.: THE EFFECT OF A SHORT-LIVED MEDIEVAL VILLAGE ON THE LOCAL ENVIRONMENT

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Spindelbach was a short-lived medieval village in Krušné Mts., North-west Bohemia, Central Europe. It was located above 800 m a.s.l. and it was founded in 2nd half of the 13th century. Analyses of pollen, macro remains, micro- and macro- charcoals, diatoms and concentrations of microelements was done using a sediment profile originating from the wet-stand located in the centre of the former village to study medieval vegetation-human-climate interactions. One of our aim was



to specify the vegetation background and reconstruct the dynamics of local vegetation cover driven by this village and describe the vegetation succession after its collapse.

Because of the village was founded in time of Medieval Warm Period, it is assumed arable farming (self-sustaining cultivation of winter cereals) was enabled even at such elevations. Collapse of the village in 15th century had several reasons. It could be caused by socioeconomic stagnation in the Czech Lands, by exploitation of the surrounding forest and by weather fluctuation at the onset of the Little Ice Age.

Human and grazing impacts drove *Calthion palustris* montane wet meadows and the dynamics of wet stand vegetation. *Filipendula ulmaria* and *Salix stands* replaced annual and biennial herbaceous species that peaked immediately after abandonment of village. The secondary forest was composed of *Picea* stands and later was developed mesic montane meadows of medium tall grasses combined with *Meum athamanticum* and mountain dry pastures.

*Key-words: deserted medieval village, environmental reconstruction, peripheral mountain area, Central Europe, succession*

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## **FROM HUNTER-GATHERERS TO FOREST HERDERS: A MULTI-PROXY STUDY OF A HOLOCENE SEQUENCE CONTAINING ANIMAL DUNG AT THE ROCK-SHELTER SITE VELKÝ MAMUŤÁK, NORTHERN BOHEMIA**

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The unique geographical setting of North Bohemian sandstone region, with its extremely varied topography rich in caves and rock-shelters, has always been studied with special focus on the Late Paleolithic and especially Mesolithic hunter-gatherer communities. However, rock-shelters and caves were frequently used also as pens in the European prehistory. The site Velký Mamuťák represents one of the largest Bohemian rockshelter with a continuous, uninterrupted sequence of sediments recording almost permanent human presence throughout the Holocene. The most interesting settlement phases, especially with respect to forest land use, are dated to the Late Bronze Age, Hallstatt, La Tène and Early Medieval period, providing strong evidence of livestock penning. Using pollen and plant macroremain analyses, grazing practices are documented by the presence of extra-local species, which reflects livestock roaming over long distances and importing pollen grains and macroremains from different environments by defecating under the rock-shelter. Such interpretation is confirmed by finds of well-preserved dung pellets. Their analysis proved the presence of several animal species (likely pigs, goats and/or sheep) grazing in forests as well as ruderal habitats and foddering with twigs and crops.

*Key-words: Holocene, forest grazing, animal dung, sandstones*

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**LAND ABANDONMENT AND MIGRATION DURING THE IRON AGE IN CENTRAL EUROPE - ARCHAEOLOGICAL AND BOTANICAL EVIDENCE**Sabine Rieckhoff<sup>1</sup>, Manfred Rösch<sup>2</sup>1. *Universität Leipzig, Germany.*2. *Universität Heidelberg, Germany.*

Reforestation on abandoned fields is first dominated by *Betula* and clearly visible in the pollen record. This stage lasts between 20 and 100 years, from the first flowering to the suppression of *Betula* by other trees, or it is terminated earlier by fresh human impact and re-opening of the landscape. *Betula* peaks are visible in most central European pollen profiles if examined completely in close intervals, thus resulting in periods of less than 20 years. They indicate local land abandonment during all periods, their frequency increasing from the Bronze Age onwards. Beyond local events, nearly all profiles in southern Germany show an accumulation of land abandonment in the Late Iron Age (2nd/1st centuries B.C.). In the same period, at the beginning of the 1st century B.C., due to archaeological finds the settlements of the so-called “Celtic” peoples were abandoned whereas the Roman colonization did not start at least 150 years or more later. Yet the whole time gap cannot be closed by *Betula* peaks which were terminated by the resuming of intensive land use. We must therefore consider that immediately after the Celtic collapse new immigrating groups, identifiable by faint archaeological traces (Caesar’s “Germanic peoples”?), settled the land for a while. The question if and when these immigrants disappeared, so that the Romans found a waste land, we try to answer with a new research project looking for a more precise radiocarbon dating of pollen profiles and particularly its *Betula* peaks.

*Key-words: Land use - migration - archaeobotanical indicators – archaeological interpretation*

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**PRELIMINARY ARCHAEOBOTANICAL AND MICROMORPHOLOGICAL INVESTIGATIONS ON THE BRONZE AGE TELL OF TOBOLIU (ROMANIA)**Astrid Röpke<sup>1</sup>, Tanja Zerl<sup>1</sup>, Alexandra Gavan<sup>1</sup>, Marian Lie<sup>2</sup>, Tobias L. Kielin<sup>1</sup>1. *Institute of Prehistoric Archaeology, University of Cologne, Germany.*2. *Iași Institute of Archaeology, Romania.*

The Middle Bronze Age (ca. 1880–1530 BC) tell settlement from Toboliu *Dâmbu Zănăcanului* (Bihar County, Western Romania) with its outer settlement is located in the Great Hungarian Plain between the Crișul Repede floodplain and the high plain of Miersig. The tell forms a mound rising approximately 4 meters above the surrounding plain and a diameter of approximately 95 meters. According to the archaeological investigations seven occupation phases (corresponding to architectural construction, use and destruction sequences) were documented in the 4 m thick stratigraphic sequence. Complete sequences of houses have been preserved as well as wooden planks could be discovered.

Correlated archaeobotanical and micromorphological samples were taken from different contexts of the tell sequences such as floors, domestic waste and destruction levels. This integrated approach intends to reconstruct aspects of household practices, diet, subsistence strategies and might also reveal palaeoenvironmental conditions. Micromorphological features can be associated to

different anthropogenic activities such as cooking, cleaning, production processes as well as architectural construction details. The analysis of plant macro-remains provided mostly remnants of cultivated plants. In addition to several cereals, "new glume wheat" was also found. The spectrum is supplemented by *Pisum sativum* and *Camelina sativa*; as collected plants *Cornus mas* and *Prunus cf. insititia* were documented.

*Key-words: macro remains, micromorphology, tell, archaeology*

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### CHARRING-INDUCED FRACTIONATION OF $\delta^{13}\text{C}$ AND $\delta^{15}\text{N}$ IN COTTON (*GOSSYPIUM ARBOREUM*) SEEDS: IMPLICATIONS FOR RECONSTRUCTING ARCHAEOLOGICAL ENVIRONMENTS

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The ancient diffusion of cotton (*Gossypium* sp.) across the Old World is one of the most outstanding examples of social, environmental, technical and economic entanglement. The various trajectories of cotton products, including raw and processed seeds and fibres, are relevant markers of the circulation of knowledge, goods and people. However, understanding cotton diffusion in the past is limited by the fact that cotton products could have been produced locally and/or imported from different regions. Furthermore, cotton seeds and to a lesser extent, cotton fibres, are generally only found in charred form in archaeological contexts and this can be problematic as in some cases, the charring of plant remains results in an offset of the biogenic isotope values. In this study, the isotope composition of modern uncharred and experimentally charred cotton seeds that were grown in irrigated fields in Seville, Spain and greenhouses in Montpellier, France, was measured to establish the range of isotope fractionation that takes places across several parameters (temperature range: 50, 100, 150, 200, 225, 250, 275, 300, 325 and 350°C; time range: 2, 4, 8 and 16 hours). The results provide information on the extent to which carbonization effects measured  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values and if such values can be used successfully to reconstruct the nature of the local growing environment.

*Key-words: carbon isotopes, nitrogen isotopes, cotton (Gossypium arboreum), carbonization*

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## **WEAVING LOOMS, INTENTIONAL DEMOLITIONS, BURNT OFFERINGS...? TRENCHLIKE FEATURES OF THE URNFIELD PERIOD IN CENTRAL EUROPE BY THE WIEV OF ARCHAEO-ENVIRONMENTAL ANALYSIS**

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Archaeological excavation in the Late Bronze Age settlements in southern and western Bohemia, southern Germany and the Austrian Land Salzburg have repeatedly provided examples of an unusual type of settlement features: long narrow pits or trenches, mostly typical not only for their shape but also orientation according to cardinal points, their arrangement on the site, and contents of finds. The largest number of these features was found in Březnice in south Bohemia. The aim of this paper is to provide information about archaeo-environmental analyses of the sediment from trenchlike features from Březnice, and to indicate the ways we intend to proceed in their interpretation.

A significant set of plant macroremains and charcoals was obtained. The presence of proteins was investigated using antibody detection and protein mass spectrometry. Samples were also analysed for the presence of diatoms, starches and phytoliths.

On the basis of the analysis we assume that the filling of the trenches was formed by the waste of different composition. Construction wood, utility plants and waste after their processing, vegetation from different environment, meat etc. were recorded. The human activities that had led to the storage of this material of various kinds had to have a complex structure.

*Key-words: Late Bronze Age, weaving looms, burnt offerings, waste*

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## **MICROBOTANICAL APPROACH TO EXPLORING THE ORIGINS OF JAPANESE HISTORICAL PAPERS**

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In Japan, the study of starch grain assemblages in an archaeological context has become more common in the last decade. Emphasis has been placed on utilizing starch grains to determine the functions of stone and wooden tools, plants cooked in pottery, and past plant food consumption reconstructed by human dental calculus. Such methods are now applied to analyse historical documents. The preliminary studies have mentioned fibres and tried to identify paper types and quality. Historical materials basically require non-destructive surveys, and no botanical or mineralogical

analyses have ever been conducted or emphasised. In this study, historical papers were examined through detailed microscopic observations. Experimental DNA analysis of modern plants used for making papers such as kozo (*Broussonetia kazinoki* × *B. papyrifera*) were also conducted to identify the original compositions of historical papers. Differences in surface conditions and fibre arrangements showed different materials, and the quantity and density of the mixtures such as fibres, plant tissues, starch grains, and minerals may have been created by paper-making techniques or conservation processes. The taxonomic identification of components enables to reconstruct the origins of papers, which can lead to interpreting their historical and environmental backgrounds of documents. Biomarkers of kozo were extracted from the modern samples, and their sex markers can show the areas where they were possibly produced.

*Key-words: DNA marker, fibre, origins of historical papers, mixture, starch grains*

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### **GONE WITH THE WATER. THE INFLUENCE OF FLUVIO-LAGOON ENVIRONMENTS AND HUMAN ACTIVITIES ON THE VEGETATION OF THE ANCIENT PORT CITY OF LATTARA (LATTES, FRANCE)**

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Previous experience in lakeshore environments in central Europe proved that the use of modern analogue botanical data was helpful in order to establish water level changes and detecting flooding episodes in archaeological stratigraphies. For this reason, it is important to expand this type of approach to new amphibious environments, such as lagoon areas. This project aimed to reconstruct water agency in the sedimentation processes of the Gallic-Roman port city of *Lattara* (Lattes), one of the most important commercial enclaves in the area during Antiquity (5th cent. BCE - 2nd cent. CE). For this, modern analogue botanical macroremains were gathered from different wetland habitats around the Mediterranean wetland observatory and nature reserve Tour du Valat (Arles), where conditions might still be close to *Lattara*'s environment in the past. The sampling points were chosen in order to represent different natural agents that could have influenced *Lattara*, which was founded at the mouth of the river Lez on the edge of a lagoon, almost completely surrounded by water. In the modern analogue botanical data, we found differences between saline and brackish water samples compared to fresh water ones as well as differences between submerged samples compared to samples taken from landwards of the shoreline. The modern analogue data was then used for the reconstruction of formation processes in samples of *Lattara* to determine how strongly different water sources have influenced the site.

*Key-words: modern analogue data, functional ecological groups, experimental approach*

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**A NEW WAY OF SEEING PULSES. PRELIMINARY RESULTS OF GEOMETRIC MORPHOMETRIC ANALYSES OF ARCHAEOLOGICAL PULSE SEEDS IN LA FONT DE LA CANYA (CATALONIA, SPAIN)**

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La Font de la Canya (Catalonia, Spain) is a storage area of the Iron Age (625-150 BC). Its important archaeobotanical record is dominated by cereals together with fruit seeds and legumes. The good state of conservation of these remains allowed rather straightforward identifications.

This study is part of a project that investigates the role of legumes in the Western Mediterranean during the Iron and Bronze ages. This work is a pilot study for the application of geometric morphometrics (outline analyses) to pulse seeds. Geometric morphometrics has been successfully applied to archaeological seeds of cereals and fruit trees but not to legumes. Our objective is to quantify morphological differences, if any, of seeds between and within the species identified in La Font de la Canya: *Lathyrus sativus*, *Lens culinaris* and *Vicia faba*.

Here, morphometrics is used to compare different samples and different phases of the site: five samples of the 1st Iron Age (625-575 BC), one of the Iberico Antiguo (575-450 BC) and three of the Iberico Pleno (450-180 BC). We study possible significant morphometric and biometric changes that may evidence changes in agrobiodiversity (cultivated varieties) or in environmental and technical cultivation conditions. The similarity between patterns of variations between the three species are discussed, as well as usefulness of predictive approaches to relieve current taxonomical doubts on some remains.

*Key-words: Morphogeometrics, Iron Age, Lathyrus sativus, Lens culinaris, Vicia faba*

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**THE LCHF (LOW CARB HIGH FAT) DIET IN RELATION TO ARCHAEOBOTANICAL AND ARCHAEOZOOLOGICAL EVIDENCES FROM INDIA: SOME PRELIMINARY OBSERVATIONS**

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The paper discusses possibility of exploring interconnections amidst LCHF (Low Carb High Fat) dietary pattern and the archaeobotanical and archaeozoological findings and development of vegetarianism in Indian sub-continent. The LCHF is often loosely and interchangeably called as ketogenic or paleo diet and sometimes termed as Cave-Man's diet. It was prevalent during palaeolithic periods and based upon hunting –gathering subsistence strategies, prior to the evolution of plant food production and agricultural economies during terminal Pleistocene – Holocene periods, about ten to eight thousand years before the present. The exact time framework varied regionally, depending upon local factors, availability of wild progenitors and cultural influences, etc. During the pre-neolithic period the Man depended essentially upon hunting of wild animals

(predominantly lean/fatty muscle proteins, bone marrow fats and blood for salts) and occasional consumption of seasonal wild fruits, seeds, leaves, tubers, rhizomes and forest honey as carbohydrates. Preservation of animal bones with cutting, splitting marks and charring( for extraction of marrow ) is much better in most of the stone age sites worldwide, as compared to plants which get sparsely preserved under restrictive conditions, mainly due to gradual accidental carbonization and slow charring activities, waterlogging, etc.

The paper reviews archaeobotanical evidence of cereal grains, pulses and fruits visa-vis zoo-archaeological finds of wild and domestic animals and suggests evolution of vegetarianism and veganism much later during later protohistorical - historic times in India, It could be due to the influence of religious and cultural practices.

*Key-words: Lchf Diet, Archaeobotany, Archaeozoology, Health, vegetarianism*

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## Session 4 PLANTS AND SOCIETY

### Talks

#### **SOME PLANTS DRINKING AND THEIR RELIGIOUS AND SOCIAL MEANING IN SUDAN CASE STUDY: *HULU-MUR, ABREH AND SHERBOT***

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This paper will discuss the plants drinking as one of the indigenous fermented drinking of the Sudan, research will focus on three types of these drinking related with two religious and social ceremonies. *Hulu- Mur* and *Abreh* are drinking prepared from the sorghum for special occasion of *siam Ramandan* “month of fasting for muslims”, and *Serbot* prepared from date palm it also strongly linked to the religious occasion of the “*Eid- Kebir*” big barium when rams are slaughtered as a sacrifices. The methodology with focus on three aspects; the preparation and production process, microbiology and nutritional aspects for *Hulu-mur*, *Abreh* and *Sherbot*.

*Key-words: Hulu-mur, Abreh, Sherbot, Sudan, Plants drinking.*

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#### **WHEAT AND VINE, FLOUR AND WINE: CROP STORAGE AND PLANT FOOD PROCESSING AT THE IRON AGE IBERIAN SETTLEMENT OF ESTINCLELLS (VERDÚ, CATALONIA, SPAIN)**

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The excavation of the Iberian settlement of Els Estinclells unveiled a single level of occupation ranging between 300 and 200 BC with a final layer linked to events associated with the Second Punic War. Layers revealing fires were in four of the houses probably due to looting after their abandonment. The sudden destruction and the systematic sampling of sediments led to the discovery of a series of compelling archaeobotanical assemblages linked to production and storage. The main crop at this site, both in terms of the number and ubiquity, is naked wheat. It is followed by hulled barley and vine. Hulled wheat and legumes, although poorly represented, are also present. Most of the remains are in two of the burned structures: House 9 and Building 15. The first had a semi-clean storage space while the second, in turn, housed a beam wine press with an in situ

base and vats. Finds of grape pips among the archaeobotanical analyses are nonetheless scarce, whereas remains of naked wheat, chaff and weeds are abundant.

These finds lead to the hypothesis that the building was polyvalent serving both as a wine press and a grain warehouse. Moreover, its potential volume of grain storage, as well as that of other silos at the site, suggests it played more than a domestic role. Furthermore, two other buildings reveal bases of Iberian rotatory pushing mills suggesting a centralised grinding of flour. The number of remains in these buildings, however, is very modest.

*Key-words: Cereals, chaff, weeds, crops, wine, storage*

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## **PLANT USE AND RITES AT BURNT-OFFERING SITES IN INNER-ALPINE AREAS OF NORTHERN ITALY DURING THE BRONZE AND IRON AGE**

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Burnt-offering sites were characteristic hot spots for the expression of the inner-alpine human living in a physical and spiritual way during Bronze and Iron Ages. The characteristic records and findings provide information about the society, its faith, skills, and economic behavior. In this study, we focused on the plant use and rites at 18 burnt-offering sites located in the inner-alpine areas of Northern Italy and adjacent regions during the Bronze and Iron Age. Wood was basis for the implementation of the rite and the transformation. It was collected adjacent to the offering site, whereby the selection of wood quality depended on the local availability. The remaining charred wood together with economic plants were ritually deposited in pits. Cremation and deposition rites reveal a deep spiritual connection to nature and an intentionally high appreciation for plants as raw materials and energy sources. The proved main crops were *Hordeum vulgare* (hulled barley), *Panicum miliaceum* (broomcorn millet), and *Vicia faba* (faba bean). They seemed to have a superior role in local food. Moreover, gathered plants like *Corylus avellana* (hazel), *Prunus spinosa* (sloe), and *Sambucus* (elder) were also offered and underline the importance of gathered food. The remaining observed wild plants reflect a more or less anthropogenically influenced environment, but some probably were also offered due to their edible, medicative, or symbolic background.

*Key-words: Plant use, rite, burnt-offering sites, inner-alpine areas, Bronze and Iron Age*

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## **PLANTS FOR THE FINAL JOURNEY - ARCHAEOBOTANICAL EXPLORATION OF THE 18TH C. CHILDREN'S BURIALS IN THE HOLY TRINITY CHURCH (SANCTUARY OF THE DIVINE MOTHER QUEEN OF KRAJNA) IN BYSZEWO (POLAND)**

Monika Badura<sup>1</sup>, Agnieszka M. Noryskiewicz<sup>2</sup>, Agata Kosmaczewska<sup>1</sup>, Marta Jarosińska<sup>1</sup>, Sebastian Nowak<sup>2</sup>, Jakub Michalik<sup>2</sup>, Małgorzata Grupa<sup>2</sup>

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In the Holy Trinity church in Byszewo (Poland), numerous children's burials dating to the 1st half of 18th c. were discovered. Apart from human bones, relics of robes and metal objects, accumulation of botanical remains were recognized as well. Archaeobotanical analysis (seeds, fruits, flowers, pollen, woods) allowed to determine plants species and describe their role in the funeral rites in the past (task No 499 and 502; 530-L145-D581-19). Individual plants could play a symbolic role, provide food for the deceased on his journey to the afterlife or be a simple decoration. To fill the pillows on which deceased's head rested, plants such as *Humulus lupulus*, *Satureja hortensis* or *Artemisia* spp. were used. Interesting is that pollen, flowers and twigs of *Artemisia* appeared both in the fillings of pillows and coffins (mattress). Research confirmed that ornamental flowers *Tagetes* sp. were placed in graves, however an artificial equivalent of *Tagetes*, which was made of felt/silk, was recognized in some of the coffins. The analysis of the wood showed that the basic parts of the coffins were made of oak/pine and only pegs presented a greater taxonomical spread in the use of the raw material. The results obtained from the crypts of the church in Byszewo already constitute a valuable source of knowledge about the 18th c. funeral practices and have become a starting point for further discussion on the selection of plants depending on the wealth of the deceased or the season during which the funeral has been organized.

*Key-words: archaeobotany, children's burials, funeral practices*

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## **FROM FARM TO PHARMACY: *LOLIUM TEMULENTUM* IN ROMAN AGRICULTURE AND MEDICINE**

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In this paper I examine the mimic weed *Lolium temulentum*, darnel, in different social and cultural contexts in the Roman world. Darnel was a by-product of agriculture throughout antiquity. Its negative health effects made it a dangerous weed- consumption of darnel causes dizziness, nausea, and blindness. Coupled with the difficulty of removing it from the harvest due to its similarity to wheat, it was a particularly problematic form of agricultural waste.

I first discuss the prevalence of darnel in the archaeobotanical record in Italy from the Archaic Period forward, focusing on the contexts in which it is found and its frequency, including in unpublished data from the site of Gabii in Central Italy. I will compare this archaeological portrait to the one apparent from ancient literary sources. Darnel appears in a negative light in agronomic writings, like those of Pliny and Columella; it's also used as a sign of ill-omen in Roman poetry, showing that the conception of darnel as a dangerous weed had significant cultural penetrance. However, the cultural porosity between literature and agriculture existed in another genre: darnel was also a medical ingredient in Roman pharmaceutical texts. It has been assumed in modern scholarship that, as an ergotized weed, its medicinal value was hallucinogenic, and therefore for ritualized or religious medical contexts. However, no sources support this conjecture. By using its status as a poisonous weed to frame its medicinal applications, I argue for the impact of darnel's agricultural characteristics on its pharmaceutical ones. It is through a consideration of its role in daily life, accessible through paleoethnobotany as well as text, that it is possible to understand darnel's use in the ancient world.

*Key-words: medicine; crop processing; weeds*

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## **CEREMONIAL MAIZE OF THE SOUTH-CENTRAL ANDES: A PICTURE OF VARIABILITY AND PROCESSING AT INKA EXPANSION TIMES ON THE BASE OF CHARRED MACROREMAINS**

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The goal of this presentation is to understand commensality of public ceremonies in south-Central Andes immediately before and after the Inka conquest through the characterization of the maize involved. Most of the knowledge about ancient maize of this region comes from dairy life middens and domestic areas. In contrast, ritual contexts were rarely studied. Circa of one thousand of charred corn macroremains (kernels and cobs) recovered from two ceremonial platforms are analyzed. They belong to Los Amarillos and to El Shincal de Quimivil archaeological sites (NW Argentina). The former presented its maximum occupation during the Regional Development Period, drastically disrupted since the Inka conquest. The latter was an Inka Administrative/Ceremonial Center resembling a little Cuzco. Morphometric (i.e. shape and dimensions; endosperm types, pericarp aspect) and experimental variables (i.e. shrinkage, expansion, endosperm extrusion, pericarp changes) were registered in order to recognize different maize types and processing techniques (i.e. pounding, boiling, toasted) as well as charring conditions. Main results show a great maize intra-specific variability and diverse culinary preparations in both sites which can be related with offerings coming from different local communities; continuity in the use of local landraces through time; but differences in plant parts recovered and practices involved. Symbolism, empowering and believes of local cosmovisions are discussed.

*Key-words: archaeobotany, maize, Inka conquest, ceremonial context, South-Central Andes*

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## **SLAVES OR ARTIANS? A MINER'S DIET IN THE SOUTHERN LEVANT**

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In the western Arabah valley, copper mining focused in two main centers: the Timna valley during the Early Iron Age (11th-10th centuries BCE), and Nahal 'Amram during the Roman-Byzantine period (1st-5th centuries CE). These areas, located in the climatically extreme arid desert, were inhabited by several human populations. Plant remains from a variety of contexts (mines, workshops, and dwelling caves) in different sites of the Timna valley and Nahal A'mram, shed new light on the miners of the Arabah.

The archaeological assemblage from these sites includes textiles, animal and fish bones, and plant remains which preserved via desiccation. The plant remains represent all the major food categories: carbohydrates, proteins, fats, vitamins and minerals. Furthermore, each category is varied and includes several species. In addition, remains of fruits and vegetables that are not grown in the vicinity of these sites were found, possibly served as luxury items.

These archaeobotanical assemblages attest to the socioeconomic level of local miners and copper

smiths. Despite our initial conception, their food pyramid does not have characteristics of slave's diet. All food groups are well- represented, including several species which must have been imported from afar. In light of the archaeobotanical evidence for socioeconomic status, we propose a re-identification of the Arabah copper slaves as skilled artisans.

*Key-words: Copper, Mines, Food, Timna*

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## **ON THE SIGNIFANCE OF OLIVE ARBORICULTURE IN THE EARLY BRONZE AGE LEVANT**

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The Early Bronze Age Levantine sites of Tell Fadous-Kafarbida (Lebanon) and Zeraqon (Jordan) show evidence for intensive olive arboriculture as found by high fragment percentages of olive charcoal as well as high percentages of olive stones and other indications for olive oil production. Within this presentation, the two sites will be placed in a regional perspective; demonstrating the sites match the general picture of intensive olive cultivation in the Levantine region during the Early Bronze Age.

*Key-words: olive, Levant, charcoal, olive oil production, Early Bronze Age*

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## **‘FARMING THE CITY’: AGRICULTURE AND STORAGE IN THE BRONZE AGE**

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The growth and development of large urban societies in Western Asia (c.2500-1200 BC) saw the emergence of many new forms of social behaviour including the establishment of large-scale sustainable agricultural systems. These systems would have utilized resources from the taxation of domestic producers as well as state-run estates to ensure food for daily consumption as well as a storable surplus for periods of instability. Archaeological research into the establishment of these agricultural systems, however, has been restricted due to the lack of direct archaeobotanical evidence recovered from primary contexts (e.g. storage) in these early cities. Instead, scholars have tended to rely mainly on documentary evidence, which provides a biased and partial picture at best.

This paper will seek to address this issue by presenting archaeobotanical results from the Bronze Age cities of Tell Brak in north-east Syria and the Hittite capital of Hattusha in Central Anatolia. At both sites, very large, intact charred cereal stores have been discovered providing a unique snapshot into the harvest of each city. This material has been interpreted through the use of crop



stable isotope analysis and functional weed ecology as a means of inferring crop husbandry conditions and agricultural practices. This work sheds light on the wider nature of Bronze Age farming and provides a link between the rural environment and the urban landscape of the city.

*Key-words: Bronze Age urban agriculture, stable isotope analysis, functional weed ecology*

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## **THE LATE IRON AGE PERSISTENCE OF PEARL MILLET IN THE INNER CONGO BASIN (ICB): BEER OR FOOD – WAS MILLET EVER A STAPLE IN THE AFRICAN LOWLAND RAINFOREST?**

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Today exotics, New World crops and plantains, constitute the dominant starch staples in the Inner Congo Basin rainforests. However, the advent of ICB rainforest agriculture was characterized by African savanna crops, pearl millet and pulses, introduced from outside during the late first millennium BC. Today, their cultivation is mainly restricted to areas with a pronounced dry season. We thus assumed initially, that rainforest pearl millet cultivation was an interlude only, linked to a period with distinctly seasonal climate.

We have new evidence that pearl millet was still present in the ICB rainforests much later, at least until the arrival of the New World crops. Cultivation experiments at a low latitude ICB site were successful, proving that pearl millet also thrives under the current all-year round humid climate. Storage is yet connected with high risk of loss due to fungal decay.

Significant questions arise from the ICB persistence of pearl millet: What was its role for rainforest subsistence, was it ever a staple crop, and why was it eventually abandoned?

The better-adapted and high yield New World crops finally outcompeted the savanna species *Pennisetum glaucum*. Even before, it was certainly not the main staple in the area. The adherence to pearl millet in an environment marginal for its cultivation indicates that it rather represented a valued cultural heritage. In this context, we discuss modifications of charred caryopses possibly pointing to millet beer production.

*Key-words: Pearl millet, New World crops, rainforest subsistence, staple, beer*

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## **INFERRING PLANT-RELATED ACTIVITIES AND FOOD PLANT PROCESSING AT AN EARLY NEOLITHIC SETTLEMENT IN CENTRAL ANATOLIA, AŞIKLI HÖYÜK**

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Agriculture is a pivotal transition in the history of humanity, profoundly affecting the lives of communities in many aspects. This paper investigates the process of the adoption of agriculture at the formative site of Aşıklı Höyük (8400-7300 cal BC), Central Anatolia-Turkey, by focusing on plant-based activities.



Throughout its long, uninterrupted occupation the inhabitants at Aşıklı transitioned from a mobile to a sedentary way of living, increasingly engaging in animal management and agricultural production. This paper discusses recent archaeobotanical results, which reveal Aşıklı inhabitants' various behaviors by focusing on food plant preparation, processing, and consumption throughout the 9th millennium BC occupation. It also explores the collective aspects of plant-related activities within the settlement. The methodology involves comparing similarities and differences among macrobotanical assemblages from different buildings and external spaces. Buildings with communal and/or special uses as well as those that represent houses will also be reconsidered on the basis of their plant assemblages. Consequently, the paper provides insights into the socio-cultural life of the Aşıklı community, which is crucial for assessing the adoption of an agricultural way of life both in local and regional contexts.

*Key-words: Food plant processing, plant use, early Neolithic, Central Anatolia, Aşıklı Höyük*

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### **FOOD PRODUCTION IN THE BRONZE AGE DANUBE RIVER REGION: THE CASE OF KAKUCS-TURJÁN, HUNGARY**

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The Bronze Age in the Hungarian Danube River region is characterised by various transformations in settlement patterns, including the reappearance of (fortified) tells and the emergence of centralised settlement structure. Cultural groups (distinguished on the basis of specific ceramic styles) characterising the beginning of the period were replaced by succeeding groups through the Middle Bronze Age. The fortified settlement of Kakucs-Turján mögött (Hungary) is a multi-layered settlement that was occupied for nearly 1000 years, spanning the entire Early and Middle Bronze Age. The excavations uncovered several phases of activity and habitation, including two successive household structures of an MBA Vanya group and remnants of a preceding EBA Nagyrév group. The analysis of nearly 500 samples containing carbonised botanical remains has revealed that the plant-food economy was founded on a wide variety of cultivars. Contextual and stratigraphic analysis of the remains allows for a reconstruction of (i) spatial and temporal distribution of plant-related activities, and (ii) dis/continuity of plant husbandry practices at the site. Seen from the perspective of individual households, this study seeks to synthesise archaeobotanical and archaeological evidence of change. It thereby aims to contribute to the understanding of the role of plant-food production within the major socio-cultural transitions taking place in the region during the Bronze Age.

*Key-words: food production, crop cultivation and processing, household, Bronze Age, Hungary*

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### **THE ARCHAEOBOTANICAL CONNECTION BETWEEN HERA AND THE PHILISTINES: IRON AGE SAMOS AND TELL ES-SAFI/GATH**

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Despite the difficulty of reconstructing ancient peoples' faith from archaeological finds, plant remains from cultic contexts can contribute important data to the archaeology of religion. Here, we present new data on ritual plant use in Tell es-Safi/Gath, Israel, connecting Philistines with the Aegean cult of Hera. These plants were discovered in two successive early Iron Age Philistine temples, dated to the tenth and ninth centuries BCE, respectively.

The assemblages include sweet fruits and wild plants with relatively large and bright-coloured flowers, including Chrysanthemum (*Chrysanthemum coronaria*), and the first significant finding of lilac chaste tree (*Vitex agnus-castus*) fruits. This is the earliest evidence for the association of these widespread and ethnobotanically well-known Mediterranean plants with a cultic context. Notably, this Philistine cultic plant assemblage resembles garland offerings used in the cult of Hera at Samos island (seventh century BCE). In addition, chaste tree fruits are described among the cargo of the Ulu-Burun ship, associated with Late Bronze Age circum-Mediterranean trade.

We propose a relationship between Philistine ritual and the modalities associated with Hera – the goddess of married women and symbol of seasonality. The new archaeobotanical finds thus suggest a link between the Philistine cult and the Aegean goddess of the first Olympian generation, which cult goes back to the Mycenaean culture of the Late Bronze Age.

*Key-words: ritual plants; 9th century BCE; Philistines Temple; Hera's wreath; Vitex agnus-castus*

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## **COMMUNITY IDENTITY AND CULINARY TRADITIONS-FOODWAYS IN THE WESTERN GREAT LAKES, NORTH AMERICA**

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This paper uses culinary traditions and foodways to examine substantial changes in community creation and identity among the indigenous people occupying the western Great Lakes (North America) region from circa 100 BC to AD 400. The selection, preparation, and consumption of food serves to constitute and distinguish individuals as members of a cultural group, and, as an integral part of the cultural fabric, is sensitive to changes in traditional practices. Culinary traditions and foodways encompass multiple aspects of commensal behavior that are archaeologically accessible through multiple lines of material evidence. Implementing a multi-proxy approach, this study integrates traditional plant macrobotanical studies, faunal analyses, ceramic morphological and use wear analyses, and absorbed chemical residue analyses to provide a comprehensive overview of the intersection between food and culture in this region of North America. The Finch site, an open air Early to Middle Woodland (ca 100 BC to AD 400) era pre-contact American Indian habitation site located in the western Great Lakes region provides a case study for examining changing culinary traditions and foodways at the community level. The rich data set resulting from the complementary nature of these diverse methods reveals a wealth of data about the ways consumption practices create and maintain communities, underscoring the potential application of such an analytic suite to comparable archaeological contexts worldwide.

*Key-words: Culinary traditions and foodways, Western Great Lakes (North America), Early Woodland, Middle Woodland, Havana/Hopewell*

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## **ONE MAN'S LEFTOVERS IS ANOTHER MAN'S FEAST: INTERDISCIPLINARY ANALYSES ON THE MATERIAL FROM A ROMAN VOTIVE PIT IN TERRACE HOUSE 2, EPHEBUS, TURKEY**

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In 2004, excavations in Dwelling Unit 5 (WE5) of Terrace House 2 (HH2) in Ephesus unearthed a large flat pit beneath room 12a, partially dug into the bedrock. The pit had been filled in the mid-1st c. CE and was later sealed by a mosaic floor. Its filling lacks stratification and, together with the narrow temporal range of the ceramics found therein, points towards deposition within a short period of time. Pottery finds are dominated by high quality tableware. Among the other ceramic finds, a cooking tripod shall be highlighted, as shall amphorae for wine, olive oil and fish products originating from at least four regions of the Roman Empire. The animal remains derive from a huge variety of organisms, but are mostly dominated by pig, cattle, and various fish and mollusk species. Few bones show burning traces. The botanical spectrum, mostly charred material, is to a large extent characterized by fruit and nuts such as grape, olive, pine nut, fig, hazel, pear, and Cornelian cherry. Cleaned as well as processed cereals were found, as were large amounts of mineralized fig seeds. Vegetative remains from kermes oak, rock-rose, pine and heather constituted another large group of charred plant macroremains. Charcoal analysis did not show any clear hints on fuelwood selection. In the presentation, the whole find assemblage is discussed as probably originating from a private feast – maybe connected to construction activities – involving sacrificial aspects such as libations and burnt offerings, the remainders of which were deliberately deposited.

*Key-words: Eastern Aegean coast, Roman Imperial period, feasting, domestic offerings, food spectra*

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## **THE CONTRIBUTION OF THE GRANARIES OF PRE-HISPANIC GRAN CANARIA (SPAIN, 500-1500 AD) TO THE STUDY OF PAST METHODS OF PLANT FOOD STORAGE**

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Long-term strategies of food storage are key to cope with seasonal and annual shortages. They allow populations access to food for longer periods after the harvest and minimise the risks of famines provoked by unpredictable environmental fluctuations. This type of storage requires knowledge of different techniques to control temperature, humidity, and quantity of oxygen, as well as means of protection from insects and other pests. Moreover, although granaries and storage containers are not uncommon in archaeological contexts, identifying plant storage methods and techniques is generally complicated due to poor content preservation.

The study of granaries dating to the Pre-Hispanic period (ca. 500-1500 AD) in Gran Canaria, an island of the Canarian archipelago, offers new and unique insight into former methods for long-term food plant storage. The island's indigenous populations were farmers that cultivated most of their foodstuffs and built many granaries whose respective silos offer excellent conditions of preservation for organic materials. In certain cases they still preserve desiccated archaeological remains of crops as well as other plants such as leaves, wood and cordages. They also contain insect pests. This study therefore aims to identify both the plants stored in the granaries of Gran Canaria as well as their insect pests, and attempt to evaluate the past storage methods from data gleaned from the fields of archaeobotany and archaeoentomology.

*Key-words: Canary Islands, Pre-hispanic, Storage, Plants remains, Insect pests*

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### **THE COMMON AND THE RARE: AN OVERVIEW OF EARLY MODERN DUTCH FOOD CONSUMPTION BASED ON ARCHAEOBOTANICAL CESSPIT DATA**

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Past food consumption has been studied diachronically and spatially for many Dutch settlements. However, research into the food consumption by Early Modern Dutch inhabitants of urban settlements is somewhat underrepresented in the scientific archaeobotanical literature. To fill this knowledge-gap, archaeobotanical data from the Dutch Relational Archaeobotanical Database was analysed. This overview of Early Modern urban food consumption is based on cesspit-records which date between 1500 and 1850. First, the edible plant taxa were distinguished from medicinal plants and potentially edible weeds. Subsequently they were quantified to form an overview of plant taxa consumed per urban settlement. The resulting overview provides an insight into regional and time related changes in plant-food availability and preferences. All in all, the archaeobotanical data consisting of cesspit material from 51 cities yielded a list of 97 edible plant taxa. Interestingly, 20 taxa are continuously present in 50-100% of all settlements in the 350 years under study. The overall food consumption of Early Modern Dutch city inhabitants did not seem to change that much over time.

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### **PROCESSING GRAIN AND APPLES AT THE EARLY NEOLITHIC SWIFTERBANT SITES IN THE NETHERLANDS**

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The Swifterbant culture is a Late Mesolithic and Early Neolithic group of which remains are found in the Dutch wetlands, and are dated between 6000–3400 cal BC. The archaeological sites are as a rule embedded in Holocene sediments, and usually located on the levees in a creek landscape in the central part of the country or on the river dunes in the Rhine-Meuse delta in the western part of the country. Thanks to the wetland environment in which the sites have been preserved, there is

detailed knowledge of many aspects of the Swifterbant occupation. Well-preserved and finely stratified refuse deposits allow to define incorporation of ceramics (from c. 5000 cal BC), domestic animals (from c. 4700 cal BC) and cereals (from c. 4300 cal BC).

The remains of food processing and consumption are well detected on some of the Swifterbant sites –particularly on two recently excavated sites - Tiel Medel De Roeskamp and Nieuwegein het Klooster - and those will make a main objective of this contribution.

Cooking food left several types of organic fingerprints in ceramic vessels, which were detected as organic residues encrusted on sherds. These food crusts provide an optimal source of information about how people prepared their everyday meals, what foods were cooked and (in the most ideal cases) what pots were used for what kind of foods. In addition to food crusts, isolated finds of processed cereal food suggest that bread-like food might have been also prepared at Swifterbant sites. In addition to cereal meals, various wild plants were collected and some were processed for later use.

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### **A FRAGRANT GRAVE – THE WELL-PRESERVED PLANTS OF A MUMMIFIED 17TH CENTURY BISHOP**

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When the coffin of bishop Peder Winstrup was to be removed from the crypt of Lund Cathedral, it was discovered how amazingly well the body was preserved. Despite the time elapsed since his death in 1679, skin, hair and clothes were perfectly preserved. It also turned out that the body rested on a rich plant material, stuffed in two pillows and a mattress and lining the bottom of the coffin. This material has now been examined and provides interesting insights into the use of plants in a high-status Christian burial. Indirectly, it also let us glimpse a 17th century garden, probably Winstrup's own. The date of death was December 7 and the plants available would have been those that were kept dried and stored in the household. For the burial they have chosen aromatic herbs, like hops, lavender, lemon balm, hyssop, dwarf everlast, absinthium and southernwood, to add a pleasant smell to the funeral or to disguise the stench of the dead body. Some of the species also have preservative, antiseptic or insect-repelling properties and may have contributed to the preservation. In addition, there were symbolic meanings. For instance, one of the pillows was stuffed with hop catkins. For the living, hops placed in pillows were supposed to induce good sleep. In this case it may have intended to guarantee the bishop a deep sleep after death, and perhaps to stop him haunting those he left behind.

*Key-words: Burial rituals, aromatic herbs, mummy, garden*

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### **EARLY ROMAN ROYAL GARDENS: AN ARCHAEOBOTANICAL COMPARISON BETWEEN EAST AND WEST MEDITERRANEAN GARDENS**

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Herod the Great (74/73-4 BCE), the Roman client king of Judea, is known as the most important builder in ancient Jewish history, and a patron of a number of colossal building projects throughout



his realm and abroad. Archaeological excavations have revealed the presence of gardens in Herod's palaces and monumental buildings; however, as is often the case, the plants of these royal gardens remain an enigma. I applied the technique of pollen extraction from plaster in several of Herod's gardens. In order to complete the picture, pollen has also been collected from contexts other than plaster (e.g. planting pots, garden soils); charcoal remains have been identified as well in cases that they were present. The charcoal spectrum features great resemblance to the pollen assemblage. A palynological investigation has also been conducted at the garden of Villa Arianna – Stabiae. In general, the identified pollen and charcoal remains from the eastern Mediterranean gardens show some similarity to other Roman gardens, indicating that Herod was displaying plants popular in the Western Roman Empire. So far, the eastern assemblages include local trees such as cypress, pine, olive and palm, but also hazelnut, a non-local tree; and widely-popular ornamental plants like laurel, myrtle and rose. This investigation provides archaeobotanical techniques of how to explore garden's vegetation in various archaeological contexts. The study also has the potential to shed light on questions such as the use of plants as a status symbol, elite behavior, importation of plants for royal display, and planting and horticultural techniques.

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### **THE DAWN OF URBANISATION IN EUROPE: MOBILISING THE RECOURSES OF THE MARGINAL LANDSCAPES OF THE AEGEAN BRONZE AGE**

Evi Margaritis

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Prior to the inception of urbanisation in the Aegean on Crete after 2200BC, its antecedents may be recognised at a number of sites where a constellation of elements makes them stand out from their contemporaries. In recent years the most interesting of these sites is found on the small island of Keros in the Cyclades. In the period 2750-2300BC of the Aegean Bronze Age a number of factors combine in a unique foreshadowing of the processes of urbanisation. This paper will present the recent finds at the island of Keros focusing first on monumental architecture and metallurgy and will explore changes in agriculture, patterns of consumption and landscape exploitation related to increased centralisation. Undamaged by later occupation layers, we can examine the rise and demise of a third-millennium proto-urban centre, which stands out among its peers as what we expected to be the largest and most complex site within a now well-defined site hierarchy. The talk will present new evidence on agricultural regimes of the Early Bronze Age Cyclades, focus on grape and olive cultivation. The work undertaken at Keros for the first time provides a blue print for social change and economic organisation at the dawn of urbanisation of Europe.

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### **POLLEN CONTENT OF A ROMAN MEDICAL REMEDY (POZZINO, ITALY, II C. BC)**

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In 1989, numerous tin pyxies were found on the seabed of the Gulf of Baratti (Leghorn, Italy), in front of the Pozzino cove. The pyxies were at the depth of 18 meters, near the remains of a small hull dated to the II century BC. They were close to other objects, which presumably were part of



the professional equipment belonging to a physician travelling on the ship. One of the pyxies, which was hermetically sealed by the oxidation products of tin, contained six tablets, which presumably were a medical remedy. Chemical analysis revealed that inorganic components – mainly based on zinc hydroxy carbonate – constituted more than 80% of this tablet. The organic components were animal and plant lipids, beeswax, starch and resin. Pollen grains were present in large amounts. Most of the pollen grains belongs to *Olea*, but the long list of morphotypes suggests a multisource origin of the grains, in agreement with the presence of the above-mentioned ingredients. Many grains belong to plants that produce showy flowers commonly preferred by bees, confirming the identification of a bee-product as an ingredient of the tablet. As a whole, the plants listed in the pollen spectrum hint to the Eastern or North-Eastern Mediterranean basin as the area of origin of the medical remedy, in agreement with the archaeological hypothesis that the ship had been coming from the Greek coasts or islands, as indicated by the objects which constituted most of the cargo.

*Key-words: archaeobotany, palynology, shipwreck, Olea*

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## **PLANTS-DERIVED REMAINS IN RITUAL CONTEXT IN QUBBET EL-HAWA, ASWAN, EGYPT**

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Qubbet el-Hawa in Aswan, Egypt, is the necropolis where the governors of the city of Elephantine were buried. University of Jaen has been working there for ten years, excavating the tombs from Middle Kingdom. The excellent preservation of the remains as well as the systematic recovering of samples have provided a large number of carpological material. At the same time, the high quality of that material has allowed us to document unique findings such as the germinated seeds of *Hordeum vulgare* found inside a *Ptah-Sokar-Osiris*, in the main tomb of the necropolis. We present here the preliminary results of the carpological study that shows the corpus of plants used in funeral rituals at the South of the Nile Valley.

*Key-words: Carpology, Egypt, Middle Kingdom, Ritual Context, Germinated seeds*

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## **THEY ALL SMELL THE SAME (THOUGH...) BUT THEIR CONTENT MAY BE DIFFERENT: LOOKING AT LATE MEDIEVAL HUMAN EXCREMENTS AND GARBAGE PITS IN THE COUNTY OF HAINAUT, SOUTHERN LOW COUNTRIES**

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Human excrements and garbage pits of two archaeological sites in the County of Hainaut (Southern Low Countries, Belgium) have been studied by the interdisciplinary team “Archaeosciences” of the RBINS. Stone walled latrines dating from the 14th century have been uncovered

at the site of Chièvres, while several garbage pits dating from the 12th to the 16th century were excavated at the site of “rue des Bouchers-Saint Jacques” in the city of Tournai. We are presenting the 14th century composition of the waste contexts for the two sites and a diachronic composition’s evolution for the garbage pits of “rue des Bouchers-Saint Jacques”.

Archaeobotanical (seeds and fruit, wood and wood charcoal, pollen, spores and NPPs) and archaeozoological studies show that, in the majority, they contain digested food residues, food scraps and also some scarce remains of other non-food residues. The most common taxa found are vegetables, condiments, wild and/or cultivated fruits, cereals, fish and mammal remains. But if we look more closely, some cesspits contain outstanding elements such as honey (the first mention in Wallonia for the medieval period), waste of cereal processing that may have been used for the sanitation of such structures.

This paper aims at:

- 1 / highlighting late Medieval period human food intake of the Southern Low Countries
- 2 / comparing data between two 14th century waste contexts and finally,
- 3 / showing differences in pit fillings, indicating different structure maintenance and/or different social status.

*Key-words: Southern Low Countries, latrines, late Middle Ages, human diet, honey, sanitation*

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## **IS THE STORAGE RUNNING OUT? NEW APPROACHES ON THE SECURITY OF SUPPLY FROM THE 6TH CENTURY GRANARY OF THE EARLY BYZANTINE CITY CARIČIN GRAD (SERBIA)**

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The early byzantine city of Caričin Grad was built in the first quarter of the 6th century on an unoccupied hill in the Leskovac-basin in southern Serbia. In the 6th century, a time marked by natural disasters, epidemics, war and conflicts, in particular the Balkans suffered from barbarian invasions. In this situation an organized storage and supply system was of great importance to secure the supply of the population and the soldiers on the frontier. In this system the *horrea*, granaries with large capacities, were an important key element. Also Caričin Grad, one of the new foundations within Emperor Justinian I. building program, was equipped with a large granary in the upper town on the north plateau. As storage activities in Caričin Grad were mostly known from private contexts, the building is in focus of archaeobotanical investigations since 2017, to shed new light on the public storage system and the role of the state within the supply of the city. The short time of use and destruction by a conflagration towards the end of the 6th century, as well as the already great amount of 150,000 identified crops, weeds and wild plants, provide an excellent basis to get insights into the storage of food and animal fodder as well as crop processing activities carried out inside the building. The ongoing research will yield important information to expand the knowledge on the development of storage and supply in unstable times of war and conflicts in the early byzantine Balkans.

*Key-words: storage, granary, weeds, crops, byzantium*

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**LESSONS FROM THE PAST; CONTEXTUALISING UNDERUTILISED CROPS, A CASE STUDY FROM THE MIDDLE NILE VALLEY**

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Several crops that were important in northern Sudan during the mid-twentieth century have become minor crops in recent decades. Changes have been related to commercialisation, mechanisation and attitudes towards crops. This paper compares the advantages or disadvantages of the local crops versus newer cash crops. Whilst some of these ‘minor’ crops have less market value, they are more low-input and heat tolerant than the newer cash crops. These local crops also have a long history in the archaeological record further suggesting their environmental suitability. Farmer interviews were conducted as part an AHRC funded project ‘Subsistence and sustainability in a changing Sudan’ (2013-2016) which combined ethnographic information with archaeological datasets. As part of a GCRF AHRC project ‘Lessons from the past; Nubian agricultural knowledge and agricultural resilience, crop choices and endangered cultural heritage’ (2017 – 2018) a book was co-produced with local communities to document and preserve this endangered local knowledge for future generations. Fieldwork during early 2019 is further exploring the impact of agricultural development on natural capital within traditional agroecosystems, including about useful wild plants. This paper will also discuss more broadly how ethnobotanical and archaeobotanical approaches can highlight the potential future role of increasingly little-used cereals and pulses, and the importance of local knowledge to future agricultural resilience.

*Key-words: Traditional ecological knowledge, food security, ethnobotany*

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**FORTIFIED STORAGE AREAS IN THE LATE IRON AGE IN NW IBERIA: EVIDENCE FOR SURPLUS PRODUCTION AND CONTROLLED REDISTRIBUTION?**

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Storage is a need common to hunter-gatherers and agricultural communities. Besides the primary requirement to keep, unspoiled, the necessary food to feed a group of people in multiple time-spans, in some societies storage became a relevant issue in the social organization and even in the display of power among different individuals or groups acting on the community or regional level. These practices are seldom identified archaeologically.

Archaeological interventions in the Sabor valley (Northeast Portugal) due to the construction of a dam system, led to the largest archaeobotanical investigation ever carried out in Portugal. In the Iron Age sites of Quinta de Crestelos (Mogadouro) and Castelinho (Torre de Moncorvo) concentrations of storage facilities – *horrea* – were identified. These were used to store mostly clean grains of naked wheat, millet and barley but grapes have also been found regularly. At Castelinho, *horrea* were protected by massive defensive structures that incorporated abundant rock art and no relevant domestic structures were found within walls.

It is now clear that, on a wider regional perspective, these sites seem to reflect a period of change in which the concentration of storage facilities - pits, wattle and daub structures and *horrea* -

became common, making it necessary to assess the eventual capacity of Late Iron Age communities to produce surplus and the social implications of grain accumulation.

*Key-words: Carpology, Late Iron Age, Northwest Iberia, Storage, Surplus*

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## **ADVANCES IN THE KNOWLEDGE OF ANCIENT BEER BREWING AND RECONSTRUCTION OF ITS TASTE**

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Within the scope of ERC Project PLANTCULT we organized an international workshop “Ancient beer: multidisciplinary approaches for its identification in the archaeological record” at the University of Hohenheim in Stuttgart. At the IWGP, we want to present a summary and the results of the discussions during this workshop. Traditionally, malt finds in combination with special installations, features and finds indicating beer production and consumption are considered as hints/proof for ancient beer brewing (e.g. Bronze Age Archondiko Giannitson in Greece, Iron Age Eberdingen-Hochdorf in south-western Germany and Roquepertuse in France). Beer has been known as the drink of the big civilisations of the Near East, Sumerians and Egyptians, with many artefactual, pictorial and textual evidence confirming the widespread practice of beer making, both as a staple and a ritual drink. As we have seen both in Egypt (Predynastic Tell el-Farkha and Hierakonpolis as well as New Kingdom Amarna) and in Mesopotamia (Bronze Age Tall Bazi in Syria), we have to cross-check artefactual, pictorial and textual evidence with archaeobotanical macro- and micro-remains (e.g. Neolithic Can Sadurní Cave in Spain, Early Iron Age Heuneburg in Germany and Mont Lassois in France) to fully understand the production of ancient beer. Especially residue analysis of ceramic vessels is a line of evidence which methodology is still being developed and controversies often arise over the methods used for the detection of beer. Using the background of historical and craft beer brewing methods together with macro-remain and residue analyses as well as contextual information we can try to reconstruct past brewing processes and the taste of ancient beer.

*Key-words: ancient beer, archaeobotanical macro-remains, archaeochemical residue analysis, Egyptian beer residues, experimental brewing, traditional brewing*

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## **TEXTUAL ARCHAEOBOTANY. WRITTEN AND ICONOGRAPHIC SOURCES FOR ARCHAEOBOTANICAL RESEARCH**

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The plants used for therapeutic, alimentary, cosmetic and also veterinary purposes in Classical Antiquity have been described and studied by Theophrastus, Dioscoride, and Galen in the Greek World, and by Columella, Celsus, and Pliny in the Roman World. In several Byzantine manuscripts of Dioscorides' text many of these plants have been represented. All this textual and iconographic material has been the object of multiple scholarly studies. However significant and helpful it might be, particularly as a reference for archaeological and archaeobotanical research, this corpus has rarely, if at all, been approached in a comprehensive way thus far.

To compensate for this lacuna, ancient texts, plant representations, and the relevant scholarly and scientific literature (including reports of archaeobotanical excavations and laboratory analyses, together with identifications of plants according to modern botanical taxonomy) have been systematically collected and databased in a standardized format in relational tables allowing to virtually collect and retrieve all the available information on any plant attested in ancient texts or represented in Byzantine manuscripts according to changing parameters.

This presentation will describe the general elements of this major research programme and discuss specific case studies so as to illustrate how all this sum of material can be used to interpret the data resulting from archaeobotanical remains and analysis in the hopes that it will contribute to cross-disciplinary collaborations.

*Key-words: literary sources, plant iconography, plants in medicine, ethnobotany, taxonomy*

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## **FOOD FOR THE AFTERLIFE? CONTRIBUTION OF THE ARCHAEOBOTANICAL EVIDENCE IN ROMAN CREMATION GRAVES TO BURIAL PRACTICES IN SWITZERLAND**

Patricia Vanderpe

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In the present study, all available archaeobotanical data from Roman cremation burials in Switzerland were compiled and evaluated. The aim was to shed light on the current state of research regarding funeral rites North of the Alps from an archaeobotanical perspective. The current database includes 580 cremation burials. Cross-site analyses based on multivariate statistics provided further information on various aspects of the cremation ritual. From these, it could be concluded that the local character of the choice of vegetable grave goods in the individual sites is striking. In addition, it is observed that cross-site evaluations cannot reveal any socially, age- and/or gender-specific differences in vegetable grave goods. The latter should be studied for each burial ground or location separately (site-specific).

*Key-words: Roman, cremation, plant offerings, Switzerland, plant macro remains*

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## **FOOD AND TRADE AT ANCIENT KILWA, TANZANIA: ARCHAEOBOTANICAL AND HISTORICAL EVIDENCE FROM THE NINTH TO FIFTEENTH CENTURIES**

Sarah Walshaw

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Medieval Swahili mercantile towns were connected to inland African communities and far-flung ports in the Indian Ocean sphere through vast trade networks. The ability to use trade partnerships and commercial routes for economic gain and political clout may have supported not only towns but perhaps city-states. The Swahili stonetown of Kilwa was a southern Tanzanian port famous for exchanging gold, possible all the way from Great Zimbabwe, and it may have been a regional centre of power, with influence over neighboring towns. Excavations by Chittick in the 1960s did not pursue wide botanical sampling, and only one store of sorghum was identified at the site. Recent excavations undertaken by Mark Horton as part of the Songo Mnara Project co-directed by Stephanie Wynne Jones and Jeff Fleisher have led to systematic sampling of a trench and a botanical record spanning the ninth to the fifteenth centuries (and possibly even more recent.) The analysis presented here focuses on staple crops, local vs exotic species, and culinary traditions evidenced by macrobotanicals at Kilwa Kisiwani and its neighboring site of Songo Mnara. In particular, I am interested in noting how botanical patterns reflect power relations between these two towns in the Kilwa archipelago.

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## EARLY BRONZE AGE PLANT ASSEMBLAGES FROM THE TEL ERANI SITE, ISRAEL

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Recent archaeological excavations at the archaeological site of Tel Erani in Israel included an exhaustive sampling to maximize the number of macroscopic plant remains, which indeed revealed very rich plant assemblages. This site is one of the most important Early Bronze Age settlements of southern Levant and one of the first sites with the presence of Egyptians. New excavations from 2018 revealed the remains of a gigantic defensive wall dated to a pre-Egyptian phase. Plant macro-remains were analysed from pre-Egyptian and Egyptian phases and were taken from various archaeological contexts. Among cultivated plants, remains of *Triticum dicoccon* Schrank. and *Hordeum vulgare* L. or *H. distichon* L. predominated. A high percentage of cereals were preserved as broken grains, which might suggest its use as food or some special remnants of grinding activities. Pulses were commonly found and, mainly consisted of *Lens culinaris* Medik. and *Vicia ervilia* (L.) Willd. Among fruit trees only *Olea europaea* L. occurred frequently, but also fruits of *Pistacia* sp. and *Vitis vinifera* L. appeared. Rich assemblages of wild herbaceous plants contained several species including grasses (mainly *Lolium* cf. *temulentum*).

Charcoal assemblages were dominated by *Olea europaea*. Other frequent taxa included *Pistacia* sp., *Prunus* sp., evergreen *Quercus* sp., and *Tamarix* sp. The preliminary results do not show any differences in the taxonomic lists of both cultivated and wild plants remains between two chronological phases at the site. This research was supported by the National Science Centre in Poland (grant number: UMO-2016/23/B/HS3/01886).

*Key-words: cereals, pulses, wild plants, olive, anthracology, Early Bronze Age, Israel*

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## Session 4

# PLANTS AND SOCIETY

### Posters

#### **GARDENS AND ORCHARDS IN NORTHERN ITALY DURING THE MIDDLE AGES**

Giovanna Bosi<sup>1</sup>, Marta Mazzanti<sup>1</sup>, Luisa Forlani<sup>1</sup>, Paola Torri<sup>1</sup>, Elisabetta Castiglioni<sup>2</sup>, Mauro Rottoli<sup>2</sup>

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The contexts of gardens (of various kinds) are rare and problematic in archaeology. Often the faint traces of these structures are misunderstood and, consequently, many findings are lost. From the archaeobotanical point of view, an exemplary case for the Middle Ages of Northern Italy is the Duchess Garden in Ferrara (15th c.): thanks to an accurate excavation, it returned valuable data for the reconstruction of a fine “green corner” of the Este family. In Modena, a small space of the Bishop’s Palace (12th-13th c.) has unveiled fruit trees and herbs available to the curia of the city. In the rural village of Nogarà (9th-11th c.) archaeobotanical analysis provided elements to describe small kitchen gardens. In Ferrara, a study on peri-urban vegetable gardens and orchards (11th c.) is in progress: in a systematic manner, numerous samples of pollen, seeds/fruits and woods were taken. Preliminary data are meaningful and provide an interesting list of cultivable taxa. Among the fruit trees: *Cydonia oblonga*, *Morus nigra*, *Prunus avium*, *Pyrus communis*, *Vitis vinifera*,.... Among the vegetables/aromatics: *Anethum graveolens*, *Anthriscus cerefolium*, *Beta vulgaris*, *Cannabis sativa*, *Capparis spinosa*, *Crocus sativus*, *Cucumis melo*, *Cynara cardunculus*, *Linum usitatissimum*, *Papaver somniferum*, *Pastinaca sativa*, *Pimpinella anisum*, *Vicia faba*,.... Ornamental plants like columbines, iris, roses, violets and vervain are also found. The finds of woods reveal that the fences were built especially with oak and ash.

*Key-words: Gardens reconstruction, Medieval Period, N Italy, ethnobotany*

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#### **TASTES OF HOME AND TASTES OF POWER: AN EXPLORATION OF FOOD PLANT CONSUMPTION IN COLONIAL SETTINGS**

Julie-Anne Bouchard-Perron, Alexandra Livarda

*University of Nottingham, UK.*

Food consumption is grounding and situating people into social landscapes while constituting a means of appropriation of these landscapes through the physical incorporation of some of their

components. Taste, thus, constitutes a disputed arena of individual and collective power that interferes and contributes in the building of both identities and social organisations like empires. In colonial contexts, where the notion of ‘home’ is challenged, displaced and redefined, taste is an especially important medium that helps understand how colonial communities perceived themselves, others and their place within an empire. This paper explores the mechanisms behind the development of 'colonial tastes', using case studies from the Roman provinces and post-medieval French and English Canada.

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### **IT IS USELESS TO SWEEP IT UNDER THE CARPET: SOONER OR LATER SOMEBODY WILL FIND IT! UNCOVERING DOMESTIC CLEANING PRACTICES FROM A LATE MEDIEVAL WOODEN FLOOR IN SOUTHERN LOW COUNTRIES**

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Revogne is a city created in the thirteenth century and destroyed in August 1466 by the troops of the Duke of Burgundy, Philip the Good; it belonged to the Principality of Liège and controlled the Wimbe Valley. Thanks to a well-preserved stratigraphy the remains discovered allow to reconstruct the evolution of a neighborhood built against the rampart. One context from house dated from the 15th century is of specific interest. A burned wooden floor uncovered numerous plant remains trapped between its planks representing both discarded foodplants and incidental wild plants brought from outside, but we think also plants used to sweep and clean the floor. We will compare our results with other 15th century plant assemblages from Middle Belgium in order to highlight our finds and back our interpretations.

*Key-words: Belgium, Middle Age, seed, wild plant, domestic activity*

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### **POLLEN AND MACROREMAINS FROM THE SITE “VASCA DI NOCETO”: AN ARTIFICIAL BASIN FOR VOTIVE PRACTICES DURING THE BRONZE AGE IN NORTHERN ITALY**

Eleonora Clò<sup>1</sup>, Marta Mazzanti<sup>1</sup>, Paola Torri<sup>1</sup>, Rossella Rinaldi<sup>1</sup>, Barbara Proserpio<sup>1-2</sup>, Maria Chiara Montecchi<sup>1</sup>, Giovanna Bosi<sup>1</sup>, Andrea Zerboni<sup>3</sup>, Anna Maria Mercuri<sup>1</sup>, Mauro Cremaschi<sup>3</sup>

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This research is part of the national-funded interdisciplinary SUCCESSO-TERRA Project (Human societies, climate-environment changes and resource exploitation/sustainability in the Po Plain in the mid-Holocene: the Terramare culture; PRIN-20158KBLNB) and discusses biological information of the archaeological site “Vasca di Noceto”, an artificial wooden basin dating to the Bronze Age and discovered in 2004 in the central Po Plain, near Parma.

Geoarchaeological, geochronological and dendrochronological data suggest that the basin was used for ritual practices for about one hundred years (ca. 1420–1320 BC) from the inhabitants of the nearby Terramara village, which was completely removed in the nineteenth century because of quarry activities. The waterlogged anoxic clay-bearing infilling of the basin preserved the wooden architectonic structure and many biological findings submerged until their recovery.

The abundance of botanical records (pollen, seeds and fruit remains) in an extraordinary state of preservation permits to investigate the use of plants in ritual contexts and to reconstruct the local plant cover influenced by the interaction with human activities near the site. Cereals and fruits were possibly used as votive offerings during ritual activities together with flowers and inflorescences, probably deposited into the water according to the observation of the preservation state of pollen from several entomophilous species.

*Key-words: pollen, macroremains, archaeobotany, Bronze Age, Po Plain*

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**“DI QUELLA PIRA...” (“OF THAT DARK SCAFFOLD” G. VERDI, *IL TROVATORE*): PLANT REMAINS OF FUNERAL PYRE FROM NECROPOLIS OF VIA TIEPOLO, PADOVA (ITALY): TOMB 62 C**

Alessandra Forti<sup>1</sup>, Fiorenza Bortolami<sup>1</sup>, Mariolina Gamba<sup>2</sup>, Giovanna Gambacurta<sup>1</sup>, Angela Ruta Serafini<sup>2</sup>

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2. Soprintendenza per i beni archeologici del Veneto, Padova, Italy.

The Necropolis of Via Tiepolo (Padua, north-east Italy) is a huge sepulchral area (4100 mq) in use since the IX cent. BC. to the I-II cent. A.D. It was excavated in 1990-91 and due to building needs large wooden crates were collected for a detailed archaeological indoor excavation: 40% of 302 tombs were taken with their stratigraphic context (Gambacurta et al. 1998a, 1998b).

The necropolis presents mound structures, mostly earthly filled, surrounded by wooden fences. Cremation burials are the most occurring tomb structure in the area though burials are also present (Gambacurta, 2014). Distinctive characteristic of the funerary ritual is the reopening of burials in order to reunite the cremation remains of two or more individuals (probably relatives). Here we present preliminary analysis on charred remains collected on pyre debris from tomb n.62C. This tomb, excavated in 2017 and currently being studied, is preliminarily dated at the beginning of VIII cent. BC.

The stratigraphy shows two distinctive reopenings and a complex sequence of rituals performed during funerals.

G. Gambacurta, A. Ruta Serafini, 1998a, *Il rituale funerario: nuovi spunti metodologici*, in ...*"Presso l'Adige ridente"...*Recenti rinvenimenti archeologici da Este a Montagnana, a cura di E. Bianchin Citton, G. Gambacurta, A. Ruta Serafini, Catalogo della mostra, Padova, pp. 75-99.

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Gambacurta G., Ruta Serafini A., 2014, *La necropoli orientale tra Via Tiepolo e Via San Massimo*, in Gamba M., Gambacurta G., Ruta Serafini A., (a cura di), *La prima Padova. Le necropoli di Palazzo Emo Capodilista-Tabacchi e di via Tiepolo-Via San Massimo tra il IX e l'VIII secolo a.C.*, Archeologia Veneto 3, La Tipografica srl., 121-128.

*Key-words: charred remains, pyre debris, Iron Age, north-East Italy, rituals*

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## **FOOD, DRINK AND DRUGS IN AN ELITE SETTLEMENT IN EASTERN MIDDLE SWEDEN DURING 5TH-10TH CENTURY**

Stefan Gustafsson, Björn Hjulström

*Arkeologikonsult*

Elite settlements have with one exception been excavated in nearly every province of political importance in Sweden during the early medieval period 5th-10th century. The province of Östergötland was the sole exception up until our recent excavations in Ströja. The result from the excavations show that Ströja was a central place in this region. We suggest that the extravagant feasting and ritual activities at the site were important tools to define the residence as a regional elite settlement and that the founders used new ideas about how the elite should behave and look. In this process the food culture and the use of different plants were important instrument. What you eat depends largely on who you are and which social group you belong to in the society. It is the type and rank of the social community that determines what ends up on the dinner table. Food culture is always about identification and different social groups have consciously made an effort to eat in a way that's similar to others in same position.

The cereal cultivation was based on hulled barley for larger scale beer brewing and wheat and rye for fermented bread. The use of hops *Humulus lupulus* as herbal beer additives in Ströja is one of the oldest finds in Sweden. It is possible that it was local hops that was used.

There are several traces of ritual use of plants in Ströja such as baked flax seed cakes and seeds from henbane *Hyoscyamus niger* was used as a drug.

*Key-words: food culture, beer, drugs, herbs*

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## **A RARE FIND: ONION IN IRON AGE DENMARK**

Mette Marie Hald, Peter Steen Henriksen

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During excavations at the Iron Age site of Nørre Sandegaard in Denmark, a copper-alloy box containing an onion clove and a ball of string was found in a woman's grave dated to c. 650 A.D. Onions are very rarely encountered in archaeological contexts in northern Europe due to their high moisture content, and this is the earliest find of onion in Denmark. We discuss the unusual and distinctly non-culinary context of the onion, which ties in with the use and significance of this plant – practical as well as ritual – in Iron Age Denmark. Onion features in several of the Norse sagas, where it plays a role in the treatment of wounded soldiers, in neutralizing poisons, and in fertility rituals. The find of onion in the role of an amulet serves as a reminder that not all food products had a strictly dietary value.

*Key-words: Onion, Iron Age Denmark, non-culinary plant use, Norse sagas*

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## **RICH REFUGEES? THE ECONOMIC STATUS OF THE BAR KOKHBA REBELS (135 AD) IN THE JUDEAN DESERT**

Anat Hartmann-Shenkman, Ehud Weiss

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The Bar Kokhba revolt against the Roman Empire took part in the Land of Israel during the years 132-135 AD. The Roman Army suffered severely in this rebellion and fought back harshly against the rebels. As a result, many fled from their homes to find refuge in remote and desolated caves of the Judean Desert. The rebels' diet, in light of their refugee condition, is the focus of our research. We gathered the available archaeobotanical assemblages of several Judean Desert caves occupied by these rebels, in order to assess their diet and interaction with local desert environment. Surprisingly, we found luxury food items in some of the caves, in addition to staple foods, weeds, and local wild edible plants. These finds raise questions regarding the Judean cave-dwelling refugees. Where did these food items come from, and is the presence of luxury food suggestive of the rebels' socioeconomic status? In this lecture, we will refer to these questions and will try to differentiate between various patterns in cave use.

*Key-words: Bar Kokhba revolt, caves, Judean Desert, luxury food*

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## **“OUTSTANDING PLANTS?”: AN EXAMPLE OF HENBANE AND VERVAIN IN CHÂTEAUBLEAU IN THE 4TH CENTURY AD (SEINE-ET-MARNE, FRANCE)**

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In this poster, we propose the study of unusual plants (henbane and vervain), some of which have a real toxicological-pharmacological impact while others do not have the properties that antiquity lends them. This contrasted with most common plants those two species have toxicological and pharmacological properties.

Indeed, ancient medicine mostly characterized by practices to popular belief which occupy a central place in the societies of this period. It takes the form of remedies derived from plants that ancient authors consider like medicinal. It is clear that plant medicinal knowledge is recognized.

Beyond their real efficiency, the study of these plants opens a door on the behavior of ancient societies, marked by a phenomenon of ritualization in which these same plants can play an important role.

Finally, the question is whether these plants usually classified as weeds may have been used in antiquity.

*Key-words: Henbane, Vervain, Chateaubleau, Seine-et-Marne*

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## **PALAEOETHNOBOTANICAL ANALYSIS OF THE PLANT REMAINS DISCOVERED IN THE HAIHUN MARQUI'S GRAVEYARD, NANCHANG, CHINA**

Hongen Jiang

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Analysis of 26 plant remains samples obtained in Guodun cemetery (around 59 BC) at Nanchang, China, is presented. Detailed composition of the samples suggests that the fundamental landscape of the graveyard was made up of *Platycladus orientalis*, *Sapium sebiferum*, *Castanopsis sclerophylla* and *Lauraceae*, etc. In addition, weed of Gramineae, Santalaceae, Cyperaceae, and *Broussonetia* sp., etc., accounts for a considerable share. Fruits of *Amygdalus persica*, *Cucumis melo* and *Cerasus* may have been used for food. Stones of *Amygdalus persica* and plants of *Evodia* sp., *Zanthoxylum* sp., *Clematis chinensis*, etc., may suggest their medicine use. The analysis demonstrates the diversified plant use in the Western Han dynasty.

*Key-words: Guodun cemetery, Landscape, plant utilization, Han dynasty, China*

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## **ROPES AND BASKETS MADE OF BANANA FIBERS: CASE STUDIES FROM TAIWAN AND THE PHILIPPINES**

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Plant materials are central to many human activities from those of daily life to the exceptional events. The Philippines, with more than 7000 islands, has numerous plant species, many of them endemic. Taiwan has both tropical and subtropical areas and its plant diversity includes a great variety of fibre-producing species. These islands are isolated by deep sea, which implies a high degree of endemism of plant taxa. Selection made upon textile plants by Ivatan (Batanes) and Yami-Tao (Lanyu) people, especially of those which cannot cross water, could be highly indicative of human-plant relationship through times. This ethnobotanical study aims to provide a better knowledge of basketry traditions and the plant-based raw materials that were used for this craft in the islands either side of the Bashi Channel between the northernmost islands of the Philippines, the Batanes Islands, and the southernmost of Taiwan, Lanyu Island.

This study is based upon plant natural aspects such as its properties or its natural dispersal and cultural facts, such as plant naming or manufacturing process. Both could lead to a deeper understanding of plant and human propagation. The results of this research show that some of the Ivatan and Yami-Tao people's handicraft are made out of Banana or Palm tree fibres possessing qualities such as flexibility, strength, and durability, among others. Ivatan and Yami-Tao people create protective baskets made of Banana fibers, with a unique knowledge: the knotting-tying technique. All banana trees contain useful fibers but only *Musa textilis* (or *Abaca*) gets the longest and strongest fiber without lignification. It is the most resistant fiber for cordage purpose. *Abaca* is native to Mindanao, the southernmost island of the Philippines. The naturalized varieties of *Abaca* found in Batanes and Lanyu islands could be interpreted as evidences of seafaring activities in the past.



## THE WIND THAT SHAKES THE BARLEY: CONSEQUENCES OF THE FOOD GLOBALIZATION IN PREHISTORY

Xinyi Liu

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In the context of recent conversations on food globalisation in prehistory, there has been growing scholarly interests in process of the eastern expansion of the ‘Neolithic founder crops’ from south-west Asia to East Asia. By c. 1500 BC, the geographical distribution of the Fertile Crescent crops, free-threshing wheat (*Triticum aestivum*) and naked barley (*Hordeum vulgare* ssp. *vulgare*), stretched from the Atlantic to the Pacific, north to Scandinavia, and south to the Indian Ocean. In this paper, I shift the focus from the chronology and routes of the eastern journeys to consider the context in which wheat and barley cultivations were adapted to the existing agrarian system established since the Neolithic time in China. We shall consider the environmental, seasonal and culinary drivers of the trans-Eurasian exchange of cereal crops between 5000 and 1500 BC, and emphasize the role played by the primary agents of agricultural production, the ordinary farming communities, whose cultural and culinary choices facilitate not only the adoption of some crops but also the rejection of others.

## HOW MANY OLIVE VARIETIES (*OLEA EUROPAEA* L. OLEACEAE) EXISTED DURING THE ROMAN PERIOD IN ANDALUCIA, SPAIN. FIRST APPROACH TO OLIVE VARIETIES ON THE BASE OF CHARRED MACROREMAINS FROM ERMITA SANTA POTENCIANA SITE (VILLANUEVA DE LA REINA, JAÉN).

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The large quantities of charred olive stones recovered in several archaeological sites from countries that circumscribe the Mediterranean Sea has proven its wide usefulness by the ancient societies that produced them. However, not all olives had (and have) same quality to obtain a good oil or eat “in table”. Some fruits are oilier or fleshier than others. That is why the determination of the olive varieties becomes a tool that can allow closer to a greater knowledge on what olive was preferred to produce oil or consumed as a fruit. Due to endocarps have highly conserved morphological characters, and carbonization does not produce a significant alteration of them, several papers based on geometric morphometric analysis of olive stones have distinguished distinct morphotypes that seem to reflect the use of different varieties of olive in the past. The present proposal is to approach this issue take into account the methodology proposed by the International Oleic Council (IOC) for the identification of varieties through morphological markers. Charred entire endocarps recovered at Santa Potenciana archaeological site (Jaen, Spain), dated on Roman Period, were evaluated through six endocarp descriptors. IOC methodology allowed discriminate 12 morphological groups among archaeological endocarps. Some are similar to several modern

olives stones while others can not be included into a current Spanish varietal. IOC method will be evaluated in pros and cons to archaeobotanical analysis.

*Key-words: Olive endocarps, Varietal characterization, Roman period, Andalucia, Spain*

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## **CONNECTING PEOPLE, CONNECTING DIVINITIES. THE SYMBOLISM BEYOND THE PLANT REMAINS**

Sonia Machause Lòpez

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Plant remains might play an important role to fully understand ritual processes in ancient societies. Despite of their recovery was neglected in old excavations, some of the plant remains and iconographic information collected can shed light on the role played by plants in Iron Age ritual activities. The characteristics of the plants, their color, taste, smell, blooming season and other special features, might have played a decisive role in forming notions about the plants and their role in rituals. Their use in these ceremonies could have made stronger the connection among performers, as well as the connection between the performers and their deads, ancestors and divinities, and their landscape.

Here we report on the study of ritual contexts located on the Mediterranean coast of Spain dating from the 6th to the 1st centuries BC. Many botanical remains and iconographic evidence have been documented in necropolis and other urban and rural sacred spaces, where mainly fruits, but also cereals and wild plants have been recorded. The work presented here is part of the interdisciplinary project *From the real to the imagery: Approaching the Iberian Iron Age Flora* (HUM2004-04939), which has a large record of plant evidence in Iberian Iron Age sites. Combining a multi-proxy paleobotanical approach, based on anthracology, palynology and carpology, as well as iconography, we aim at reconstructing the use of plants and their symbolism in the Iberian societies to further understand their natural and sensorial history.

*Key-words: Rituals, Iron Age, Plant remains, Symbolism, Archaeology of the Senses*

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## **SACRED TREES: RITUAL AND PROFANE RELATIONS BETWEEN TREE AND VILLAGE IN NATIONAL PARK NIKOLO-KOBA, SENEGAL**

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In 1954 was established National Park Niokolo-Koba. After gaining independence and emerging from the state of Senegal the National Park was extended due to the biodiversity and wildlife protection. From this reason, in 1969 local villages had been relocated beyond area of the extended

park. Villages have been linked to ecosystem of the tree savanna for centuries and they have been constituted as living functional unit. Trees in villages are not only the source of the necessary raw materials for local residents. They provide important role for their livelihoods and appropriate shelter from the sun. But their importance is also deeply connected with the healing and animistic tradition. In this beginning project, we study the relations between trees and villages with long-term continuity of settlement, but also with the newly relocated villages after constitution of the park. We identify which tree species are most common in abandoned villages and which can be an identifier of an abandoned settlement. Another goal is to map the use of these trees and find out which trees are sacred to the local people. Another question is, how the environment and structure of newly founded villages are reflected on the composition and the quantity of trees in the immediate vicinity of these villages, which are concentrated along the infrastructure? The research comprises ethnoarchaeology, dendrology, dendrochronology, vegetation ecology and ethnobotany.

*Key-words: trees, villages, Niokolo-Koba National Park, ritual, profane*

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### **CHARRED PLANT REMAINS FROM THE NEOLITHIC LAKESIDE SETTLEMENTS OF AMYNTAIO BASIN, NORTHWESTERN GREECE.**

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3. Ephorate of Antiquities Florina, Greek Ministry of Culture and Sports, Greece

Although much is known about plant use in prehistoric northern Greece, most of the archaeobotanical material derives from tells or extended dry sites. In the Amyntaio basin, rescue archaeological work has brought to light a unique -for Greek standards- case of several neolithic lakeside settlements concentrated along the northern shore of Lake Cheimaditis. Well preserved burnt layers of pile dwellings have been excavated in three of them, yielding rich carbonized archaeobotanical assemblages. The exploited species and their spatial distribution in each house, allowed us to explore plant use and diversity on an intra-household level as well as inter-household variation.

*Key-words: Neolithic, Greece, lakeside settlements, charred plant remains*

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### **FRUITS, WINE AND SOCIAL COMPLEXITY IN IBERIAN PENINSULA IN THE FIRST MILLENNIUM BC**

Guillem Pérez-Jordà, Leonor Peña-Chocarro

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The introduction of fruit cultivation in the Western Mediterranean took place at the end of the 2nd millennium BC., while in the Iberian Peninsula the evidence of goes back to the beginning of the first millennium BC, after the establishment of the first Phoenician colonial settlements in the southern part of this territory.

The introduction of these new crops transformed the agricultural system that had developed in this territory for more than 4000 years that was based on cereal and legume cultivation. The expansion of fruit trees was quite rapid in the Southern and Eastern parts of Iberia which became soon part of the Mediterranean economic system. Their development was linked to processes of social complexity leading to the development of urban communities while in some other cases the rural structures were maintained but these were now characterized by a clear social hierarchy.

Some of the fruits involved, and especially particular products such as wine, began to play a fundamental role in the redefinition of the social relations that accompanied these transformations and, at the same time, the new products led to the development of a significant commercial activity.

*Key-words: Fruit cultivation, social complexity, commercial activity, Iberian Peninsula, Iron Age*

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## **A BRONZE AGE BREWERY AT ARCHONDIKO? RECENT ARCHAEOBOTANICAL AND EXPERIMENTAL EVIDENCE**

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The area of the Aegean has been closely linked with the consumption of wine since the Neolithic and the Bronze Age, based on archaeobotanical and other archaeological as well as textual evidence. The consumption of alcohol by the prehistoric communities of the Aegean and mainland Northern Greece, and its role in forming social relations or its connection with the emergence of local elites have been quite extensively discussed. However, evidence for the presence of other alcoholic beverages, like beer, have so far been scarce and equivocal. This paper discusses the possibility that the inhabitants of Northern Greece prepared and consumed a beverage similar to beer, a suggestion recently put forward by S.M. Valamoti, based on the examination of charred archaeobotanical remains originating from the Early Bronze Age tell site of Archondiko, in the region of western Macedonia, Northern Greece. Archaeobotanical finds of sprouted cereal grains and fragments of ground cereal grains constitute strong evidence for the preparation of a cereal-based alcoholic beverage and are examined in conjunction with experimental data, with the aid of scanning electron microscopy, in order to investigate the possible steps involved in their processing.

*Key-words: Archondiko, Prehistoric beer, sprouted cereal grain, scanning electron microscopy*

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**IMAGING PLANTS IN THE IBERIAN WORLD. VEGETABLE ICONOGRAPHY DURING THE IRON AGE IN EASTERN IBERIA.**

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This study focuses on the Iron Age of the Iberian Peninsula, concretely on the Eastern Iberia between the 6th and 1st centuries BC. In this poster we summarize our *Flora Project* (<http://www.florayfaunaiberica.org/>), in which we related archaeological remains (carpological, anthracological and palynological analysis) to the symbolic perspective and the presence in the Iberian art (pottery, metal, bone, numismatic...). Its *real* location in the archaeological sites allows us to know the ancient flora at two levels: firstly, at a domestic level (cultivated plants, generally for food). Secondly, also at a wild level, with the species that lived in the same ecosystem as the Iberian societies and their possible uses (food, fuel, basketry, cordage, medicine, etc.). However, thanks to Archaeology we can also approach the sphere of the *imaginary*: What view did the Iberians have from the surrounding plants? Did they have a particular symbolism, magical conception or sacred character? Taking into account the impossibility of translating the few Iberian texts, the only way to answer these questions is through iconography.

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**ARCHAEOBOTANICAL EVIDENCE OF FUNERARY RITUALS IN ROMAN NECROPOLIS OF MUTINA (NORTHERN ITALY): A MULTIDISCIPLINARY APPROACH.**Federica Maria Riso<sup>1</sup>, Silvia Pellegrini<sup>2</sup>, Pietro Baraldi<sup>3</sup>, Giovanna Bosi<sup>1</sup>

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An interdisciplinary method involving different disciplines of archeology was carried out on the necropolis of Mutina, in order to have a complete view of the funerary rituals.

Cremation graves coming from Mutina necropolis have been analysed (1st – 2th century AD). In addition to traditional methods, new technologies helped to study offerings presence. For what concerns Via Cesana necropolis, a computed tomography has been performed on 8 urns thanks to TEC-EUROLAB (Modena), in order to carry out a systematic microexcavation. Then soil has been sieved and then archaeobotanical (seeds/fruit) and archaeological findings were collected. Seeds/fruits found mostly belong to cultivated plants or, anyway, plants that can be used as food, as Cereals, Pulses and Fruit plants, even if the analysis are still an ongoing research. These remains of meals left on the graves and of the objects involved in the ceremonies, are evidence resulting from the attendance of the funeral space.

It has been also decided to analyse the dust inside the *balsamari* found among the grave goods of the urns. Raman and XRF analysis have been carried out in order to verify the presence of cosmetic dusts: hematite, cinnabar, malachite marks have been found.

In tomb 15 a grape flower has been found and it could be a residue of the preparation of *oenanthe* or it could also be the evidence of *omphacio*, prepared with unripe grapes.

*Key-words: tomography, rituals, necropolis, raman, seeds/fruits*

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## **WATERLOGGED AND CHARRED MACROREMAINS FROM HITTITE OYMAAĞAÇ HÖYÜK, NORTHERN ANATOLIA**

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The site Oymaağaç Höyük (probably Hittite Nerik) provides an important key place in the middle Black Sea coast area. According to today's research, the site is located on the edge of the Hittite core area in a landscape already inhabited since the early Chalcolithic period.

Agriculture is the basis for the development and prosperity of the Hittites. Through the archaeobotanical sampling of the entire settlement period, an insight into Hittite agriculture from the early Bronze Age to the middle Iron Age is given. From the excavation campaigns 2007-2017, 550 samples are available of which 22 samples can be dated to the Chalcolithic, 232 samples to the Late Bronze Age, 276 samples to the Iron Age and 20 samples to the Roman or Byzantine period. A total of 203 taxa and 122.188 botanical remains could be determined.

Einkorn (*Triticum monococcum*) and Emmer (*Triticum dicoccum*) played an important role in the diet of the early Bronze Age and were replaced by barley (*Hordeum vulgare*) and naked wheat (*Triticum aestivum*) in the late Bronze Age and the Iron Age.

In 2017, an underground water reservoir was examined and hundreds of wooden pieces and tools were rescued. Also a very special sample from the underground tunnel was analyzed. This shows unique preservation conditions and an insight into the whole plant spectrum of the Iron Age apart from the charred remains of the other samples.

*Key-words: Hittite, Nerik, macroremains, waterlogged, charred*

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## **‘THE FIELDS OF ASPHODEL’, OR RATHER ‘THE FIELDS OF OTHER TUBIFEROUS PLANTS’**

Wouter van der Meer

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The contents of about ninety fully sampled prehistoric secondary deposit graves, roughly a cubic metre of sieve residue in total, were assessed to determine the presence of botanical macro remains. The graves are part of a cemetery in use from the Bronze Age to the Roman Iron Age, situated close to the town of Dieren just north of the river Rhine in the central Netherlands. While only a handful of cereal grains, fruit stones and wild nuts are present, more than one third of these samples contain charred archaeological parenchyma, more specifically the remains of roots or tubers. The majority of these seem to fall in three morphological types. These types include the corms of onion couch (*Arrhenatherum elatius*), branching elongated thickened roots, possibly of tormentil or silverweed (*Potentilla erecta/anserina*), and an as of yet unidentified small spherical type of root. The follow up will consist of identification of the parenchyma using a Scanning Electron Microscope. Identification on a high taxonomic level will shed more light on funerary practices in prehistoric northwestern Europe. For now, the preliminary results point to the exploitation of alluvial grassy meadows, either for gathering root foods with possible ritual significance, or simply as a place for cremation.

*Key-words: Parenchyma, Ritual, Cremation, Prehistory, Netherlands*



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## THE DEVELOPMENT OF EARLY MEDIEVAL FIELD AND HORTICULTURE IN THE LIGHT OF ARCHAEOBOTANICAL FINDS OF THE CAROLINGIAN ABBEY OF WERDEN (GERMANY)

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During excavations in the Carolingian Abbey of Werden near Essen (North Rhine-Westphalia, Germany), the associated pond was examined. This pond – probably constructed in connection with a mill – was created immediately after the founding of the abbey (799 AD). After only a few decades of use, it was abandoned in the first half of the 9th century.

For a reconstruction of the immediate environment of the abbey and its wider surroundings, archaeobotanical samples were recovered from the pond sediments. The analyses of both pollen and macro-remains indicate different pathways into the pond.

On the one hand, sediments were deposited by the incoming stream feeding the pond. Due to its considerable gradient, the stream carried both mineral and organic components. The plant remains in the pond layers therefore mainly represent the slope vegetation. On the other hand, waste (including faecal remains) from the abbey itself was also deposited. This spectrum of plants provides evidence of garden plants and fruit trees available in Carolingian abbeys. Moreover, it can be compared with contemporary written sources, notably the "*Capitulare de villis de curtis imperii*", a land estate ordinance attributed to Charlemagne. In this context, the question arises whether there has been a continuity of Roman horticulture or the reintroduction of antique traditions, in which the early medieval abbeys played an important role.

*Key-words: macro remains, pollen, pond, Carolingian abbey*

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## FROM THE GARBAGE TO THE RITUAL: USE OF THE GENUS *CASPICUM* spp. IN THE HUACA PUCLLANA (550-650 AD)

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The "ají" (*Capsicum* spp) native species, has been present in the life of the Peruvian Andean settlers since ancient times, approximately 10,000 years BC .

The genus *Capsicum* spp. (chili pepper) is an endemic group of plants of the New World, This genus has an economic importance for the man that goes back to the pre-Columbian periods. Of the 33 *Capsicum* species identified, five have been domesticated: *C. annum* L., *C. baccatum* L., *C. chinense* Jacq., *C. frutescens* and *C. pubescens* Ruiz & Pav. and integrated into the diet and cultural uses of the Andean-Amazonian man. In the archaeological record of the Andean Area there is evidence of the first domestication practices of this genus dating back to 9000-8500 BC. The place of study corresponds to the Huaca Pucllana archaeological site, it is located in the lower

valley of the Rimac, currently belonging to the district of Miraflores (Lima-Peru). Three periods of archaeological occupation have been recorded: Lima (200-650 a.C), Wari (700-100 a.C) and Ychsma (1000-1470 a.D.C.). The archaeological period that concerns the present study is the Lima Culture (200, -650 d.C), time in which the Huaca Pucllana was erected and was in operation. During this period the site functioned as a ceremonial and administrative center, where different consumption activities were carried out, as well as ritual offerings at the time of remodeling or other celebrations. In the archaeological excavations have recovered rest of diverse cultivations, emphasizes among them *Lucuma* (*Pouteria lucuma*), the chilli pepper (*Capsicum* sp), the paca (*Inga feuillei*), the zapallo (*Cucurbita* sp), between the most important.

The objective of the research is to identify the uses assigned to the genus *Capsicum* spp (chili pepper) from the comparison of two archaeological contexts; a landfill located in the Northeast complex of the III construction phase (550 AD approx.) and a ritual closing event of the IV construction phase located in the monumental area (650 AD approx.). Taking into account the above, a morphometric/morphological analysis of the seeds and fruits was carried out for the identification of the species, in addition, the data obtained were worked on in two statistical programs; SPSS22 and PAST, these provided greater reliability of the results.

The results show an exclusive use of the species *Capsicum baccatum* (yellow pepper) for the realization of the ritual closure event, while in the northeastern landfill there is a diversified use, this repertoire consists of *Capsicum frutescens* (monkey pipi), *Capsicum chinense* (chilli pepper limo/panca) and *Capsicum baccatum*. Then, we can talk about a selection of foods and the status of these are immersed in the system of social organization of the Huaca Pucllana, the valuation of the chili pepper changes from the III to the IV constructive phase, and becomes a member of the offerings that could be interpreted as an indicator of response to the social transformations that the inhabitants of the Huaca Pucllana are going through at the time.

*Key words: Capsicum spp, chilli pepper, Lima Culture, Huaca Pucllana*

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## LABORATORY OF ARCHAEOBOTANY AND PALAEOECOLOGY

### Posters

#### **OFFERS FOR THE GODS: ARCHAEOBOTANICAL REMAINS FROM THE BRONZE AGE CULT BUILDING OF PORTORUSSO (OTRANTO-LE)**

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The fortified settlement of Portorussois located on the peninsula that stands between two bays along the Adriatic coast of Salento, south of Otranto (Le-Italy). The first excavation campaigns showed that during the Middle Bronze Age a violent fire destroyed a part of the village. This traumatic event caused the collapse and the abandonment of a covered building located near the fortification and used as a “cult place”. It is one of the rare examples in southern Italy of cultic building dating back to 1500-1300 BC.

The rituals performed inside the building were concentrated around six hearths, in which were placed various types of offers: small ceramic containers stacked or containing special objects such as pebbles, marine fossil elements, axes or axes in polished stone, bone pins.

As revealed by chemical analysis, some small pots contained drinks from fermented cereals, while others were used to preserve perfumed-oils made of conifer resin. The plants were fundamental elements of the rituals, the vegetal offerings include a great deal of cereal caryopsis, deposited in a small pit next to the supporting pole of the structure, but also acorns and other fruits, that had been laid near the hearths. It is possible that even the fuel used to fire the hearths had been intentionally selected among the species locally available.

*Key-words: Plant offers, Bronze Age, cult building, Apulia*

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#### **HUMAN-ENVIRONMENT INTERACTION IN THE BRONZE AGE PILE-DWELLING CAVE SETTLEMENT OF GROTTA DI PERTOSA (SOUTHERN ITALY)**

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The cave of Grotta di Pertosa (Campania, southern Italy) housed a pile-dwelling settlement during the Middle and Late Bronze Age. A peculiar aspect of this archaeological site is the preservation of protohistoric uncharred plant remains thanks to anoxic underwater conditions. This study shows the result of the archaeobotanical analyses carried out on different types of plant macro remains: wooden artefacts, structural elements of the pile-dwelling and charcoals and seeds from soil samples. The study of the pile-dwelling structural elements and artefacts allowed us to understand both

the choices made in term of selection of raw material and the technological aspect of the carpentry work. The reuse of carpentry waste as fuel has also been taken into account, contributing to the identification of the wood species exploited in this area.

The study of the seeds found in the soil sample raised new questions, particularly regarding the exploitation of *Vitis vinifera*. Throughout the Italian Bronze Age the gathering of wild grapes was gradually replaced by a more or less organized cultivation: the selection, caring and harvesting of local wild vines played a major role during this course.

Using traditional biometric methods we were able to distinguish wild seeds (*Vitis vinifera* L. ssp. *sylvestris*) from the domestic ones (*Vitis vinifera* L. ssp. *sativa*), which in turn provide new information about the domestication of grape in Southern Italy. The date provide a base to trace the spread of viticulture in Italy and add new information about the process in the Mediterranean basin during the Bronze Age.

*Keywords: South-eastern Italy, Pile-dwelling, Bronze Age, wood exploitation, Vitis vinifera, Human-environment interaction*

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## **HUMAN-ENVIRONMENT INTERACTION DURING THE PROTOHISTORY IN THE VALLO DI DIANO (SOUTHERN ITALY): NEW DATA FROM ARCHAEOBOTANICAL ANALYSES**

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The Vallo di Diano is a large intermountain valley located in the southeastern Campania region (Southern Italy). During the Pleistocene the valley was a lake, which progressively dried out during the Holocene. In the late prehistory, the wetland area at the valley bottom certainly influenced the settlement pattern and the land use, pushing human groups to settle along the mountain slopes.

In this study, we use the archaeobotanical data (anthracological and carpological), obtained from recent investigations from two cave sites, Grotta di Pertosa and Grotta di Polla, to identify patterns in exploitation of vegetal resources during Protohistory.

The two caves show different geographical and climatic conditions and they were used for different purposes: Grotta di Pertosa was a pile-dwelling settlement, while Grotta di Polla was used as a burial site.

The study of these caves provide information on fuel procurement – in relation to functional and contextual aspects – and agricultural practices. In particular, the presence of *Vitis vinifera*, pips both in its wild and domestic form, characterizes the sample of Grotta di Pertosa as well as typical fruits of the woodland environment, while in Grotta di Polla the presence of cereals (*Hordeum vulgare* and *Triticum* spp.) is indicative of more open landscapes.

The results from our key study are compared with those from other sites from Vallo di Diano to attempt to identify changes brought by natural factors from those driven by the anthropic factors.

*Key-words: South-Eastern Italy, Vallo di Diano, Protohistory, land use, wood exploitation; Human-environment interaction*

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**STUDY OF PLANT MACRO-REMAINS FROM THE SITE BORGO TERRA (MURO LECCESE – LECCE - ITALY): GRANARIES STRUCTURES BETWEEN XV AND XVII CENTURY**

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The Muro Leccese site, today Borgo Terra (Southern Puglia), is a context of particular importance because it is the only example of planned agro-towns which has been subjected to intensive archaeological excavations. The phenomenon of agro-town is well known and date back to the Late Medieval period, when the owners of the large estates found rural colonies to strength their control on their properties. There are numerous references to other models of new Italian and European foundations. Among the well known examples in literature it is sufficient to mention the new florentine *terre* or the french *bastides*.

Since the XIV century AD, several agro-towns are founded in the southern part of Apulia, following the abandonment of numerous rural villages and in conjunction with the threats of Turkish raids. The foundation of these new centers affected the landscape in a deep way.

The purpose of this investigation is to verify and detect any changes in farming and economy systems using plant remains preserved inside the granaries as indicators. The analysis focused on soil samples collected from some of the many granaries excavated in Borgo Terra. The soil samples(secondary filling) were carefully sampled during the archaeological excavation, and were successively floated and analysed. The plant remains under study are considered important indicators that can increase our understanding of the agricultural economy during the XIV century, the eating habits of the settlers and the natural environment around the site. In addition, the taphonomy of some remains allow to speculate about some aspects of storing techniques and crop processing.

*Key-words: late medieval, granaries, macro-remains, environment, diet*

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**‘OLIVE CULTURE’ IN PUGLIA (SE ITALY) - A REVIEW OF THE EVIDENCE FROM PREHISTORY TO THE MIDDLE AGES**

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This paper presents a comprehensive study, including evidence from various sources, of the history of the olive plant in Puglia from Prehistory to the Middle Ages. The primary source of information is archaeological sites, where the remains of olives, olive presses and furnaces for the production of olive amphorae have been found. The survey also includes palynological sequences from natural records and written documents referring to olive groves.

Our study shows that olive trees have been cultivated since the Early Neolithic, but it is only during the Middle Bronze Age that the domestic-looking type appeared in the region, a consequence of selective cultivation of the wild type.

The domestication of the olive had been completed by the first half of the 1st millennium BC, during the Iron Age-Archaic period, when remains of olive appear outside the plant's area of natural distribution.

The intensification of exchanges with the Greeks during the Hellenistic period favoured the spread of olive cultivation and led to the construction of olive-presses. The Roman conquest incentivized the production of olive oil, which was successfully traded during the Republican and Early Imperial periods. Economic developments and political turmoil led to a crisis of olive production, which did not fully recover until the 10th century AD. Under the Normans and Swabians, olives became a key crop and a major asset for the economy of Puglia.

The present work was part of the project 'ELAION: Storicità dell'Olio Pugliese per la Promozione di un Marchio Territoriale' funded by the Apulian Regional Council and the European Social Fund (FSE) on the measure Future In Research.

*Key-words: Olive culture, Apulia, long-term history*

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### **THE ROMAN VILLA OF VILLAMAGNA (URBISAGLIA, MACERATA - ITALY): PILOT ARCHAEOBOTANICAL ANALYSIS**

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The Roman villa of Villamagna, in the *ager* of the colony of *Pollentia-Urbs Salvia*, covers a long time-span between the 1st century BC and the 7th century AD. Later, on its ruins, on the Hill on which it stands, will be built the castle of *Villamaina*, razed in 1191 and abandoned in 1422. The roman villa is characterised by a *pars massaricia* and a *pars dominica*, due to its monumental structure it is likely that the villa belonged to an important *gens* of the *Pollentia-Urbs Salvia* roman colony. In 2000, the Soprintendenza Archeologica per le Marche began to excavate the site, and it continue to do so in 2007, 2009 and 2010. Lately, in 2017, the University of Macerata took over the excavation and samples for archaeobotanical analysis were collected from the warehouses and a room of *pars dominica* of the villa. Seed and fruit remains were analysed in the Laboratory of Archaeobotany and Palaeoecology of the University of Salento.

Almost three-thousand carpological remains were examined, all the major cereals are attested (*Hordeum* sp., *Triticum* sp., *Avena* sp.), but minor cereals are attested only during the Roman phase. The edible legumes are very few. Two different catchment areas, one dry and one humid, have been proposed. Seven taxa of fruit trees have been recognized. The biometric analysis carried out on the seeds of *Vitis*, the most represented taxa (2248 pips remains), have determine that the specimens are of the wild type, perhaps a cultivated variety of the area.

*Key-words: roman villa, Villamagna, biometric analysis, seed/fruit remains*

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### **THE COMPLEXITY OF AGRICULTURAL PRACTICES IN THE BRONZE AGE IN APULIA (SOUTHEAST ITALY): THE CONTRIBUTION OF THE ARCHAEOBOTANICAL MORPHOMETRIC ANALYSIS ON *VICIA FABA* L.**

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During the last decades, the archaeobotanical research carried out in Apulia region (SE Italy) highlights the complexity of agricultural practices in the II millennium BC, a crucial moment in



the history of the relationship between man and nature.

Recent investigation reveal the role of *V. faba* (variety *minor*), among the earliest cultivated plant in the ancient world.

In this study, we present the results of biometric and morphometric analyses carried out on ancient seed of *V. faba* L., dated to different chronological periods.

One group of archaeological samples of *V. faba* var. *minor*, collected from the protohistoric sites of Coppa Nevigata, Apani and Roca, was compared with a group found in historical sites of the same region and with a modern reference collection of *V. faba* var. *minor* and *equina*.

The analysis of transformation in seed morphology provides accurate criteria to discriminate between different *cultivar* and to identify possible improvements occurred during the protracted cultivation of the specie.

The study offered a base to compare well-preserved archaeological remains to modern varieties, and to assess the potential of biometric analysis for the characterization of legumes.

The comparison between the biometric and morphometric results obtained for the modern carbonized samples and for the archaeological samples allowed to highlight the differences between the different groups. Insights into local in agricultural practices that include the use of *V. faba* L. can be inferred from our results.

*Key-words: Vicia faba, Apulia, Bronze Age, biometry, morphometry*

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## **ARCHAEOBOTANICAL RESEARCH IN A 15TH-16TH CENTURY REFUSE PIT IN PIAZZA G. DI VAGNO, CORATO (APULIA, SE ITALY)**

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Archaeological excavation carried out in Piazza G. Di Vagno, in historical hearth of Corato, allowed to identify four different phases of occupation which reflect the transformation the city underwent between the 14th and the 18th century AD.

The earliest phase includes seven burials, dated to the 14th century, which were obliterated by a monastic complex dated to the 15th century. During the 16th century (3rd phase) a small church was built on the ruins of the monastery, and later, in the 17th-18th century, three buildings were added next to the church (4th phase).

The building and the pits dated to the 2nd phase provide interesting clue about the monks' diet between the 15th and the 16th century. The particular chemical-physical conditions in the pit favoured the preservation of several seeds both in late Medieval and in modern age urban contexts. Grape (*Vitis vinifera*), cucurbits (*Cucumis melo/sativum*) and Pomoideae (*Pyrus/Malus*), associated with citrus fruit (*Citrus* sp.) seeds are the most frequent ones, and point to a specific diet. Moreover, the latter are used also in the pharmacopoeia.

This archaeobotanical assemblage is one of the rare examples in Apulia during these centuries and provides useful information on the monks' food-habits and the natural remedies they might have used between the 14th and the 18th century.

*Key-words: South of Italy, Modern Age, Urban Archaeology, Plant macroremains*

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## **AGRICULTURAL PRODUCTION AND ENVIRONMENTAL CHANGES DURING THE BRONZE AGE IN SHAHR-I SOKHTA (SE IRAN)**

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This study presents the results of the archaeobotanical analysis carried out at the UNESCO site of Shahr-i Sokhta, located in the Sistan area of Iran. The Sistan plateau is a key area to investigate different aspects of human resilience and vulnerability in the face of climatic and environmental changes that occurred during the Bronze Age. The abrupt changes in rainfall regimes led to a reduction in the water resources available to the community that inhabited Shahr-i Sokhta.

Our research aims to understand the correlation between climate/environmental conditions and the types of cereals cultivated, harvested, processed, stored and consumed. Archaeobotanical analysis has been carried out on plant remains (charcoals, seeds, fruits) found in one of the rooms of the Building 33, dated to the third phase of the site (2500-2300 a.C.). Preliminary data show the presence of wheat and barley (attested by grains and chaff remains), as well as other species typical of arid environments. The study of chaff remains and weeds allows us to interpret this space as connected to the processing activities of the major cereal cultivated; while the analysis of charcoals shed new light on the use of wood as fuel and the different catchment areas.

*Key-words: Iran Sistan, Bronze Age, Agriculture, Climatic changes*

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## **AGRICULTURAL “REGIMES” AND PALEO-ENVIRONMENT AT CASALE SAN PIETRO (PA - SICILY) DURING THE MEDIEVAL PERIOD**

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The work is part of the Archaeobotanical investigations undertaken by the Laboratory of Archaeobotany and Palaeoecology of University of Salento in the SICTRANSIT project - *The archaeology of Regime Change: Sicily in Transition* (ERC AdG 2016 n. 693600), which aims to investigate medieval Sicily between the V and the XII centuries through a multidisciplinary approach.

During the medieval period, the island experienced a sequence of radical changes due to the succession of different politic powers, such as the Byzantines, Saracens, Normans, and Swabians. Each regime introduced new rules that affected the political establishment, the local economy and culture, which in turn, influenced the agricultural sector. Each new ruler introduced new crops and technological improvements to improve the Sicilian agro-economy.

Information about these changes comes from the major urban sites, but little is known from rural settlements of the period, especially in regards to their farming economy. At this regards the medieval site of Casale San Pietro, is therefore of particular interest: located on the river Platani, Casale is strategically close to the ancient Roman route that connected Palermo to Agrigento.

Archaeobotanical analysis has been carried out on charcoals and seed/fruits remains collected in different archaeological context of Casale San Pietro (from V to XII cent.). The data collected allowed a first reconstruction of ancient environment, in terms of vegetation cover, as well as on agricultural practices, in particular in regards to tree fruits cultivation.

*Key-words: Medieval Sicily, agricultural practices, Castronovo di Sicilia, Regime changes*

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## **READING THE RITUAL PRACTICES OF THE IV CENTURY BC WORSHIP PLACE AT CASTRO-LOCALITÀ CAPANNE (LE): THE CONTRIBUTION OF ARCHAEOBOTANY**

Marianna Porta<sup>1</sup>, Milena Primavera<sup>1</sup>, Francesco D'Andria<sup>2</sup>, Girolamo Fiorentino<sup>1</sup>

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2. *Emeritus Professor, University of Salento, Lecce, Italy.*

In this work, we try to integrate the archaeobotanical analysis with the archaeological data in order to reconstruct the ritual practices of an ancient cult place located in Castro. The site of *Castrum Minervae*, inhabited since the II millennium BC, is located on a slight hill along the Adriatic coast of the Salento Peninsula, 47 km south from Lecce (Italy). In Località Capanne, the investigations were concentrated in the Hellenistic sanctuary dedicated to the goddess Minerva, where votive offerings and traces of consumption of ritual meals are clearly documented. In particular, the archaeobotanical analysis focused on plant macro-remains (charred seeds/fruits and charcoals) collected in soil samples from the sacred offerings buried underneath the altar. The archaeobotanical record provide crucial information about the role the plants and crops played in the ritual, but also about the environment surrounding the site of *Castrum* in the II millennium BC. Moreover, the discovery of a remarkable number of A.C.O. (Amorphous Charred Objects), analyzed via SEM, allowed to add information about the use of processed-food in rituals.

*Key-words: Salento, Italy, Hellenistic period, plant offerings, doughs, SEM analysis*

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## **MEDIEVAL GRANARIES AND STOREHOUSES IN MIRANDUOLO (SIENA, ITALY): INVESTIGATING SOCIO-ECONOMICAL ASPECTS THROUGH PLANT REMAINS AND STABLE ISOTOPES SIGNATURES**

Milena Primavera<sup>1</sup>, Paula Calò<sup>1</sup>, Miriana Concetta Colella<sup>1</sup>, Ignazio Minervini<sup>1</sup>, Marco Valenti<sup>2</sup>, Girolamo Fiorentino<sup>1</sup>

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2. *Dipartimento di Scienze Storiche e dei Beni Culturali, Università di Siena, Italy.*

The first evidences related to Miranduolo archaeological site (Chiusdino, SI) date back to the 7th century AD, when a village was found to exploit the rich mineral resources available in the area. Between the end of the 7th and the beginning of the 8th century AD, some important changes in the agricultural production system took place. These transformations, clearly detectable in the archaeological record, point out at the key role played by new the storage systems in Mirandulo. In particular, the frequency and location, together with the typology and structural traits of storage facilities suggests a social differentiation in crops collecting and foodstuffs distribution, according to a certain hierarchy.

The aim of our work is to investigate plants remains and their isotopes values ( $\delta^{13}C$  and  $\delta^{15}N$ ) from different kind of storage systems (storehouse, silos) and belonging to various social groups (peasant, blacksmith, landowner) in order to reconstruct farming production changes as well as their socio-economic implications at Miranduolo during this crucial period. In particular, specific attention will be paid to those aspects related to the growth condition of the stored crops as possible markers of field's provenience and/or harvest selection.

*Key-words: storage system, crops, isotopic analysis, Miranduolo*

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## LANDSCAPE EXPLOITATION AT ANCIENT *AKRAI* (SE SICILY) FROM LATE HELLENISTIC TO LATE ANTIQUE PERIODS: NEW DATA FROM BIOARCHAEOLOGICAL INVESTIGATIONS

Matilde Stella<sup>1</sup>, Roksana Chowanec<sup>2</sup>, Anna Gręzak<sup>2</sup>, Girolamo Fiorentino<sup>1</sup>

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2. *Institute of Archaeology, University of Warsaw, Poland.*

Ancient *Akrai*, near the modern town of Palazzolo Acreide, is located at the top of the Acremonte plateau, one of the hills forming the Hyblaean Mountains in south-eastern Sicily. The archaeological site is characterized by karst and steep slopes and presents a Mediterranean climate.

*Akrai*, as a sub-colony was founded by Syracuse in 664/663 BC and developed under its influence until 212 BC, when became a part of the first Roman province. From that moment, the town was inhabited until the Late Antiquity.

The aim of this work is to reconstruct - through the archaeobotanical analysis of plant remains - the natural and cultural landscapes, dietary preferences, food production and storage systems in the area around *Akrai* from the Late Hellenistic until the Late Antique period.

Our study provides a diachronic view of the site's life and economy and the environmental changes that occurred around the site during its life span. Preliminary results show that the investigated area was almost continuously occupied and suggest that the landscape, the strategic location (at the top of a hill) and the environmental resources (springs, rivers and forests) were very important in the growth and the development of the town.

*Key-words: bioarchaeology, landscape, environment, ancient Akrai, south eastern Sicily*

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## SU ZEYTI: THE TRADITIONAL TECHNIQUE OF OLIVE OIL PRODUCTION IN ANATOLIA

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2. *İstanbul Koç Universty, Turkey.*

3. *Middle East Technical University, Ankara, Turkey.*

Antakya, the ancient name being Antiochia, is one of the oldest cities around the Mediterranean Sea. Located at the very southern part of Turkey, next to Aleppo - Syria, the region has a reputation for local agricultural products.

Olive oil is one of those special products with a peculiar taste. The town named Altınözü, in the Antiochian Region, has millions of olive trees, including very old ones more than 500 years old. The wide variety of local olive trees, some of them being endemic, with different peculiar tastes and textures naturally have paved the way for developing an "olive and olive oil culture" through the centuries in the region. Various techniques still have been used in olive and olive oil production for years. The "water washed olive oil" production technique is one of them. This technique is based on the careful collection of the oil accumulated on warm water in special pools after the ripe olives are crushed by means of the grinding stone in the form of cylinders. The study of these traditional techniques shed new light on possible ancient ones.

*Key-words: Olive oil, traditional, water washed olive oil, Antiochia*

## WORKSHOPS & LABORATORIES

### Workshop

#### **ERC PROJECT AND ARCHAEOBOTANY**

*Thursday 06 June 2019 - h. 16.45 - Building 6, Room 2*

Archaeology, and specifically Archaeobotany, has been very successful over the years and secured several ERC grants at different level. The objective of this workshop is to sum up the last few years of accrued experience of archaeobotanists as PIs or panel members. The workshop will bring together a group of colleagues that were or are PIs in a starting, consolidator or advanced grant to discuss:

- 1) Their experience in preparing the grants and building the necessary network;
- 2) Selection procedures;
- 3) Administrative and management issues;
- 4) Suggestions for future applicants.

At the same time the workshop will showcase a few projects that are currently ongoing or that recently finished.

The workshop will be co-managed by Amy Bogaard, Dorian Fuller, Leonor Pena Chocarro, Sultana MariaValamoti, Carla Lancellotti.

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## Workshop

### **NATIONAL AND INTERNATIONAL ARCHAEOBOTANICAL NETWORKS: NOT ONLY DATABASES**

*Tools and keys for an interdisciplinary science and versatile applications*

*Thursday 06 June 2019 - h. 16.45 - Building 6, Room 7*

The great accumulation of botanical data coming from past deposits is at the base of the current need to create flexible platforms to collect information, improve knowledge on existing analyses and share data for common projects and publications. The existence of large datasets on plant micro/macroremains from archaeological sites, as well as from other sedimentary contexts, can give more and more accurate floristic lists and quantification of the environments and human-environment interactions. Despite the urgency of creating specialized networks and databases, there are few opportunities for scientific projects to support the needs of continuous updating and the maintenance of networks. Moreover, low cooperation among the different networks seems the only possible option as, currently, the net-systems have a low chance to talk to each other.

This workshop encourages the dialogue among networks and the different subfields of archaeobotany. The BRAIN-Botanical Record of Archaeobotany Italian Network, ArboDat-Multi, ArchbotLit, etc. ([brainplants.successoterra.net](http://brainplants.successoterra.net); <https://www.wikis.uni-kiel.de/archbotlit/>; <https://lape.prf.jcu.cz/en/arbodat-databasis/>) wants to be examples as they are databases of archaeobotanical research and analyses which was developed starting from the results on plant records from archaeological sites; then, also some different type of sites close to archaeological sites in Italy (off-sites, or near-sites), and located in the Mediterranean basin were added. Web site hosts the inventory of the researches, mainly archaeological, including pollen, palynomorphs, seeds/fruits, wood, charcoals and other plant remains analyses. The website also makes the archaeobotanical data available for archaeological researches and studies on conservation and biodiversity on a long-term perspective.

Following the idea that archaeobotany is a key tool 'for the understanding of the biological-cultural diversity', the general network on archaeobotany can include several different and specialty networks, becoming fruitfully used to deepen the history of past vegetation, land cover, land-uses and palaeoethnobotany, and the modern assessment of biodiversity conservation and ecological strategy for sustainability. Maintaining biodiversity and ecosystem services in a changing environment requires a competent knowledge of the past. The joint action of sciences and humanities, that is intrinsically rooted in archaeobotany, is based on digital platforms in the networks. The collected data are able to give the temporal perspective that informs correct reconstructions of past contexts, and realistic restoration and management targets.

The workshops wishes to explore the experiences of several databases, and proposes a more cooperative interaction between the different networks.

The workshop will be managed by Anna Maria Mercuri, Assunta Florenzano, Felix Bittmann, Wiebke Kirleis, Angela Kreuz, Alexandra Livarda, Lisa Lodwick, Adela Pokorna, Simone Riehl.

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## Workshop

### **ARCHAEOBOTANY AND PUBLIC**

#### **From Petri dish to spotlight: the opportunities for archaeobotany in the public eye**

*Thursday 06 June 2019 - h. 16.45 - Building 6, Room 3*

Much like archaeology in a broader sense, archaeobotany needs and deserves support of the public. Given the fact that everybody needs to eat and everybody has an environment, both now and in the past, botany offers countless possibilities to strike the audience's interest. Despite this, archaeobotany often seems neglected in museums and elsewhere. Existing initiatives tend to be largely historically inspired, as opposed to archaeobotanically. Can archaeobotanical results add to existing outreach?

Yes, they can!

To attain this, the archaeobotanical discipline needs to reach out and present botany to a wider audience in a way that is attractive and stimulating. Therefore, for the first time, IWGP organises this workshop where we explore the possibilities of putting archaeobotany in the spotlight. In this workshop, we hope to reach several goals:

- to share with fellow practitioners the efforts already made within public outreach;
- to learn how these presentations of archaeobotanical material by colleagues were set up and received;
- to compare ideas for different target audiences, ages etc.;
- to raise awareness of the occurring distance between the research field and the public;
- to discuss what we as a discipline are doing right and what requires improvement;
- to bring to mind why it is so important to share archaeobotanical results in an accessible way;
- last but not least: to let the participants of the workshop actively engage in designing new ideas for future presentations, exhibitions, museum quests and every other brainchild they can come up with.

We hope that by the end of the workshop, all participants can agree on the importance of public outreach and will have many fresh ideas!

The workshop will be managed by Cornelia Moolhuizen, Dragana Filipovic, David Stone, Eva Degli Innocenti.

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Laboratory**NAKED WHEAT*****Tuesday 04 June 2019 - h. 16.45 - Building 6, Room 4***

The lab session is structured to train participants on how to differentiate between tetraploid and hexaploid wheat to ensure that this important distinction does not go unremarked in the archaeobotanical assemblage. The presence of tetraploid naked wheat was first reported by Hillmann (1986), who defined the rachis criteria for the identification of naked wheats, and Jacomet and colleagues who recognized tetraploid wheat in the Late Neolithic Swiss Lake dwellings (Jacomet and Schlichtherle 1984; Jacomet *et al.* 1989).

Later studies proved the co-existence of tetraploid and hexaploid naked wheat in Neolithic dwelling of Central Europe (Schlumbaum *et al.* 1999). In recent years, Kirleis and Fischer prove that the tetraploid naked wheat was among the staples used by the Funnel Beaker North group in Denmark and Germany (2014). In addition the interrelation of the origin of tetraploid naked wheat and the beginning of agriculture in the Alpine foreland, as well as northern Germany have been discussed in Kreuz *et al.* 2014.

Since the 6th IWGP in Groningen, 1983, the meeting has become a platform to evaluate the role of tetraploid naked wheat among the early farmers and an opportunity to advance the identification criteria. The 16th IWGP in Thessaloniki, 2013, with its theoretical and practical lab sessions, highlighted the importance of training new generations of archaeobotanists on the identification of tetraploid wheat.

Here at the 18th IWGP, we pursue the same education goal and we invite the attendees to bring specimens of naked wheat chaff or grains to the lab-session for training in the analysis of their samples.

The laboratory session will be held by Angela Kreuz, Ferran Antolin and Marlu Kühn.

**References:**

Hillman, G.C., Mason, S.R.L., de Moulins, M.D., Nesbitt, R.M. (1996) *Identification of archaeological remains of wheat: the 1992 London Workshop*. *Circaea*, The Journal of the Association for Environmental Archaeology 12, 195-209.

Jacomet, S., & Schlichtherle, H. (1984). *Der kleine Pfahlbauweizen Oswald Heer's: neue Untersuchungen zur Morphologie neolithischer Nacktweizen-Ähren*. Sixth Symposium of International Workshop for Palaeoethnobotany, Plants and Ancient Man: Studies in Palaeoethnobotany. Gronigen, 30 May - 3 June 1983, pp. 153-176.

Jacomet, S., Brombacher, C., & Dick, M. (1989). *Archäobotanik am Zürichsee: Ackerbau, Sammelwirtschaft und Umwelt von neolithischen und bronzezeitlichen Seeufersiedlungen im Raum Zürich: Ergebnisse von Untersuchungen pflanzlicher Makroreste der Jahre 1979-1988* (Vol. 7). Komm. Orell Füssli.

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Kreuz A., Märkle T., Marinova E., Rösch M., Schäfer E., Schamuhn S., Zerl T. (2014). *The Younger Neolithic Michelberg culture—just ramparts and ditches? A supra-regional comparison of agricultural and environmental data*. *Prähistorische Zeitschrift* 89 (1), 72-115.

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Laboratory**LEGUMES**

***Tuesday 04 June 2019 - h- 16.45 - Building 6, Room 5***

The scope of the laboratory is to extend the knowledge about identification of legumes, with theoretical and practical approaches for the study of their anatomical features.

Morphological characteristics used by archaeobotanists to identify legumes are rarely illustrated or described. The earliest attempt to provide criteria for the identification of legumes from archaeological sites was that of Butler, in the early 2000's, who studies pods and, later, seeds testa (Butler 2002, 2014).

Among the most detailed study is that carried out by Fuller and Harvey who listed the criteria for the identification of archaeological seeds of Indian native legumes (Fuller & Harvey 2006). Around the same time, Tanno and Willcox analyzed in detail the anatomy of chickpea and faba bean seeds from a Pre-Pottery Neolithic site in northern Levant (Tanno & Willcox 2006). More recently, Caracuta and colleagues developed criteria for the identification of wild and domesticated legumes coming from Natufian and Pre-Pottery Neolithic sites in Southern Levant (Caracuta et al. 2016, 2017).

The laboratory session at the 18th IWGP conference is meant to provide archaeobotanists criteria for the identification of legumes coming from different ecological regions. Modern reference material will be compared to the archaeological samples to assess the effect of degradation on the anatomy of ancient specimens.

Valentina Caracuta and Yohel Melamed will lead this laboratory session.

## References:

Butler, A. (2002). *Investigations of pod characters in the Viciae*. Vegetation History and Archaeobotany, 11 (1-2), 127-132.

Butler, A. (2014). *24 Cryptic anatomical characters as evidence of early cultivation in the grain legumes (pulses)*. Foraging and Farming: The Evolution of Plant Exploitation, 390.

Fuller, D. Q., & Harvey, E. L. (2006). *The archaeobotany of Indian pulses: identification, processing and evidence for cultivation*. Environmental Archaeology, 11 (2), 219-246.

Tanno, K. I., & Willcox, G. (2006). *The origins of cultivation of Cicer arietinum L. and Vicia faba L.: early finds from Tell el-Kerkh, north-west Syria, late 10th millennium BP*. Vegetation History and Archaeobotany, 15 (3), 197-204.

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## Laboratory

### NEW GLUME WHEAT

***Friday 07 June 2019 - h. 16.45 - Building 6, Room 4***

The Laboratory session at the 18th IWGP emphasizes a hands-on approach to identify the ‘New’ Glume Wheat based on the morphology of the grains’ spikelet.

The first identification, in 2000, of a new type of hulled wheat in Greece by Jones and colleagues paved the way for the study of this ‘new’ species that shares anatomical features of both the emmer and einkorn type (Jones *et al.* 2000).

Over the last two decades, findings of this “new” glume wheat multiplied all over Europe and the Near East. In 2013, a special session about New Glume Wheat was organized at the 16th IWGP conference, during which more records were presented. New findings quickly emerged in large parts of Eurasia, leading to more accurate morphometrical descriptions of spikelet bases and caryopses of the wheat, and to time its diffusion across continents (Kenez *et al.* 2014; Toulemonde *et al.* 2015).

This lab session intends to provide scholars with the most updated criteria for the identification of the spikelet of NGW. Participants are invited to bring chaff remains of hulled wheat to the lab-session for training in the analysis of their samples.

Dragana Filipovic, Liz Stroud, Amy Bogaard, Françoise Toulemonde, Sultana Valamoti and Burhan Ulas will host the session.

#### References:

Jones, G., Valamoti, S., & Charles, M. (2000). *Early crop diversity: a “new” glume wheat from northern Greece*. *Vegetation History and Archaeobotany*, 9 (3), 133-146.

Kenéz, Á., Pető, Á., & Gyulai, F. (2014). *Evidence of ‘new glume wheat’ from the Late Neolithic (Copper Age) of south-eastern Hungary (4th millennium cal. BC)*. *Vegetation history and archaeobotany*, 23 (5), 551-566.

Toulemonde, F., Durand, F., Berrio, L., Bonnaire, E., Daoulas, G., & Wiethold, J. (2015). *Records of “new” glume wheat in France: a review*. *Vegetation history and archaeobotany*, 24 (1), 197-206.

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## Laboratory

### MILLETS

***Friday 07 June 2019 - h. 16.45 - Building 6, Room 5***

A major problem for the identification of millets is the large number of small-seeds species that belong to this group which present similar morphological characteristics. The lab session at the 18th IWGP aims to define the criteria used for the identification of millets that are found in archaeological sites and provide general guidelines for archaeobotanists working in tropical areas.

The earliest attempts to develop criteria for the identification of archaeological come from the framework of African archaeobotany, and are based on the researches carried out in the 70's by Bruken and Hilu and colleagues who worked on finger millet and pearl millet (Brunken *et al.* 1977, Hilu *et al.* 1979).

Jacomet's work later implemented the criteria for the identification of other species, such as broomcorn and foxtail millets (Jacomet 1987). In the early 2000's, a comprehensive study was published by Fuller who provided guidance for the identification of the most common millets found in archaeological sites (Fuller 2006).

The lab session is open to archaeobotanists who are interested in learning the fundamentals of the identification of millets. Modern reference material, representative of the most common species, will be described and will serve as base for the identification of archaeological specimens.

Dorian Fuller and Marco Madella will lead this laboratory session.

#### References:

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Jacomet, S. (1987). *Prähistorische Getreidefunde: eine Anleitung zur Bestimmung prähistorischer Gersten-und Weizen-Funde*. Selbstverlag.

Fuller, D. Q. (2006). *A millet atlas: some identification guidance*. London: University College London.

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## Laboratory

### IMAGE ANALYSIS

**Friday 07 June 2019 - h. 16.45 - Building 6, Room 6**

The Lab session on image analysis at the 18th IWGP intends to provide participants with an overview of the major techniques used to analyze seed shape. These involve fitting some type of curve to the seed's outline, with the resulting coefficients then being used as variables for statistical analysis.

There are several approaches that can be used to analyze seed shape. Since the early 2000s the elliptical Fourier analysis (EFA) method has been extensively used in archaeobotany to discriminate between wild, feral and domesticated forms of Mediterranean plants (Terral *et al.* 2009) and discriminate between different varieties of the same species (Terral *et al.* 2012).

An alternative method to Fourier analysis is Procrustes analysis, which is based on landmark configurations, was also used to study the spread of olive domestication in the Mediterranean basin in antiquity (Terral *et al.* 2004).

At the 18th IWGP scholars will have a hand-to-hand experience of fitting a polynomial curve to plant remains using the most common programs for shape analyses.

The Laboratory session will be led by Laurent Bouby and Clémence Pagnoux .

#### Reference:

Terral, Alonso, Buxò, Chatti, Fabre, Fiorentino, Marinval, Perez Jorda, Pradat, Rovira, Alibert 2004. *Historical biogeography of olive domestication (Olea europaea L.) as revealed by geometrical morphometry applied to biological and archaeological material*. Journal of Biogeography, 31, 63–77.

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## WORKSHOPS AND LABORATORIES

### ABSTRACTS

#### **SEIGNEURIAL LAND MANAGEMENT AND CONTROL: AGRIFOOD PRODUCTION AND TRADE IN MEDIEVAL TUSCANY FROM THE 10TH CENTURY AD**

Mauro Paolo Buonincontri<sup>1-2</sup>, Marta Rossi<sup>1</sup>, Giovanna Bianchi<sup>1</sup>, Richard Hodges<sup>1-3</sup>, Gaetano Di Pasquale<sup>2</sup>

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2. *Department of Agricultural Sciences, University of Naples "Federico II", Portici, Italy.*

3. *Sustainable Cultural Heritage Faculty, American University of Rome, Italy.*

The ERC-2014-ADG nEU-Med is investigating the causes and modes of the great economic growth in southern Tuscany and subsequently the central Mediterranean from the 10th c. AD bringing into question past historical frameworks. Sedimentological analysis identified significant river regulating measures and land reclamations supported by fire clearance from the mid-9th c. AD. Such activities were promoted by public authorities, manifested through an increase in crop and orchard surfaces, detectable as agrarian landscapes from the mid-10th c. AD. The agri-food production was controlled and stored in new granaries built in fortified sites.

Radiocarbon datings and new and revised taxonomic analyses of seeds and fruits from granaries of three rural archaeological sites (Vetricella, Rocca degli Alberti, and Montarrenti) and an urban site (Florence) clarified the relationship from the coast to the inland between producer sites and town consumer markets. *Triticum* sp., *Hordeum vulgare* and pulses were the main taxa cultivated, selected and stored in the seigneurial rural estates from the 10th c. AD, with interesting local peculiarities. The morphometric and shape analysis of caryopses defined the sizes and allowed to evaluate the agronomic skills of the Medieval Tuscan peasants. This trend continued later on when the towns encompassed rural areas in their juridical and fiscal systems. The expanding and changing agri-food system in the Early Middle Ages represented a revolutionary phase that gave way to the social and economic growth of Late Medieval Tuscany.

*Key-words: ERC-ADG, central Mediterranean, granaries, crop surplus control, socio-economic growth*

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## **ARCHBOTLIT – CONVERSION OF THE ONLINE DATABASE ON LITERATURE ON ARCHAEOLOGICAL REMAINS OF CULTIVATED PLANTS INTO A WIKI PLATFORM**

Wiebke Kirleis, Helmut Kroll

*Institute of Pre- and Protohistoric Archaeology, CAU Kiel, Germany*

The database on literature on archaeological remains of cultivated plants, established by Schultze-Motel in the 1980ies, continued from 1992 onwards in "Vegetation History and Archaeobotany" and as online database "archaeobotany.de" by Kroll, is an important tool to get targeted access to archaeobotanical publications. It offers the opportunity for archaeobotanists, archaeologists, students and an interested public to be informed, increases the visibility of archaeobotanical studies beyond the inner circle and supports teaching in environmental archaeology. To sustain the database in the long run, it is converted into the wiki-platform ArchbotLit hosted at Kiel University. ArchbotLit offers the known search options for multiple variables, such as species, site location, dating. Newly, links or DOI for the pdf can be included. The main change and challenge is, that the responsibility for data upload is now handed over to the authors of the respective archaeobotanical publications! This in order to cope with the by far increasing number of publications that no longer allow for upload by a single person. While search options are open access, data upload is restricted to archaeobotanists who register with us. We would like to encourage you archaeobotanists world-wide to make use of the updated online platform! Data search- and data upload-options are presented here. During the lab-session, we will offer guidance to try data entry and data retrieval on a laptop.

*Key-words: Literature database on archaeobotanical remains, Wiki-platform*

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## **REPRODUCIBILITY IN ARCHAEOBOTANY: DATA PUBLICATION AND CITATION PRACTICES**

Lisa Lodwick

*University of Oxford, U.K.*

Across a wide-range of academic disciplines a reproducibility crisis has been identified. As each data point is unique in archaeology, the reproducibility of research relies on the sharing of primary data and the methods used to analyse it. Archaeobotany is a sub-discipline built on the labour-intensive and skilled production of such data-sets. Previous studies have highlighted problems of data-availability from commercial archaeology, but there has been no assessment of data sharing and citation practices within research archaeobotany. This paper presents a review of data sharing and data citation practices in 8 specialist and general archaeology journals over the last 10 years. The analysis of 189 articles shows that publishing data as in-text tables is still the most common way of sharing data, followed by supplementary tables. Around half of all journal articles reporting on new assemblages have no primary data. An assessment of data citation practices shows that

many meta-analysis studies do not provide citations of the data used, meaning the results cannot be verified or built upon. The data sharing practices highlighted here result in data sets being lost, make meta-analysis difficult and time-consuming and limit the use of archaeobotany in wider disciplines. Recommendations are made for how data-sharing and citation practices can improve, including the implementation of journal research data policies and incorporating open science practices into training.

*Key-words: Archaeobotany, Open science, Data sharing, Data citation*

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## **DATA HARVESTING: TOWARDS THE DIGITAL AUTOMATION OF CHARRED CROP ANALYSIS**

Mark McKerracher, Amy Bogaard, Michael Charles, Elizabeth Stroud, Helena Hamerow

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The past twenty years have witnessed two complementary trends in archaeobotanical research. First, the development of a suite of quantitative and semi-quantitative techniques for the analysis of charred cereal deposits, including crop processing and functional weed ecological analyses; alongside the application of more traditional approaches such as presence analysis and the calculation of the relative proportions of different species. Second, in the United Kingdom as elsewhere, the collection of charred archaeobotanical remains in development-led excavations has become increasingly routine and systematic, creating a growing body of ‘big data’ that has the potential to shed unprecedented light on past environments, diets, and farming practices.

It is advantageous to unite these two trends, by applying a package of tried-and-tested methodologies to the increasing mass of data, in a systematic and repeatable fashion, and to update results as new data emerge. Yet such an approach currently presents a significant practical challenge: how to achieve this level of systematic analysis repeatedly without investing prohibitive levels of time and labour? This paper, arising from the ‘Feeding Anglo-Saxon England’ project, presents recent progress towards the digitized automation of charred crop analyses using a bespoke computer database, in the context of archaeobotanical research into surplus crop production in early medieval English farming.

*Key-words: charred grain, crop processing, computer databases, big data, statistics*

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## **THE MANNA PROJECT, THE NEW ATLAS OF MEDITERRANEAN SEEDS AND FRUITS**

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The implementation of reference collections is often expensive and time-consuming that is why seed and fruit atlantes offer an important support to the identification process. Many of them have been published in the last sixty years, but they are concentrated mainly on a specific geographical

region and/or group of plants. These atlantes only partially include taxa native from the Mediterranean Basin, which can sometimes be disadvantageous for Southern European researchers.

Our research team started building its collection in the 90's. We are currently holding a collection of around 4000 taxa, mainly focused on cultivated and wild plants with emphases on Mediterranean species of economic importance. Driven by our desire to share the results achieved with scientists from all over the world, an idea was born of creating a new database with high quality images of seeds and fruits, especially intended for identification purposes.

We are now proud to present our monography, the Ma.N.N.A. project: *Maris Nostris Novus Atlas - seeds and fruits from the Mediterranean Basin*. More than 2600 taxa from 137 families and 880 genera have been selected. We have established a protocol designed to enhance and speed the identification process by primarily dividing taxa according to size in order to organize intuitive sheets showing the items in the same scale according to the size group. Our ultimate goal is to provide the scientific community with a new useful tool for the identification of plant diaspores.

*Key-words: Identification tool, Mediterranean, plant diaspores*

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### **STANDARDS, STORAGE AND DISSEMINATION: NEW APPROACHES TO ARCHIVING, CURATION AND DATA SHARING OF ENVIRONMENTAL ARCHAEOLOGICAL MATERIAL (FULBRIGHT CREATIVE IRELAND MUSEUM PROJECT)**

David Stone

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The creation of stable, consistent and accessible archives from archaeological fieldwork is a fundamental building block of archaeological activity and research. The study of why and how archaeological material is retained and ways it can be better utilised and integrated into the discipline is vital and a recognition of the study of this resource needs to become a major area of activity in collaboration with the generation of new information through fieldwork. Museums in Azerbaijan currently have no procedures in place to curate plant or other environmental remains, facilitate access to, or disseminate information arising from their study. The sharing and availability of information from archaeobotanical assemblages is vital, as difficulty in accessing high quality information constitutes a major limiting factor in the advancement of archaeobotanical research in the region. This problem can be exacerbated by political unrest which may threaten access and possible collaborations in the future. The aim of my Fulbright research project is to collaborate with the Smithsonian Institute National Museum of Natural History, to address several key issues in Azerbaijani archaeology and to help depository institutions in Azerbaijan develop, enact and enforce guidance in best practice and curation of archaeobotanical materials.

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