

# TERRA NOSTRA

*Schriften der GeoUnion Alfred-Wegener-Stiftung – 2010/2*



**15<sup>th</sup> Conference**  
of the  
**International Work Group  
for Palaeoethnobotany**

**May 31 - June 5, 2010**  
**Wilhelmshaven**  
**Germany**

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## 15<sup>th</sup> Conference of the International Work Group for Palaeoethnobotany

**Wilhelmshaven, Germany**

**May 31 - June 5, 2010**

### **Local organising committee**

Felix Bittmann, Friederike Bungenstock, Dirk Enters,  
Johannes Ey, Hauke Jöns, Erwin Strahl, Steffen Wolters

### **Advisory group**

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Gerd-Möller-Stiftung, Wilhelmshaven



## PROGRAMME and ABSTRACTS

Niedersächsisches Institut für historische Küstenforschung



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for Palaeoethnobotany**

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## Address of Lutz Stratmann, Minister of Science and Culture of Niedersachsen

For the second time – after an interval of 33 years – the conference of the International Workgroup for Palaeoethnobotany is taking place in Wilhelmshaven, as decided at the last meeting in Kraków 3 years ago. It is a pleasure for me to welcome all of you to our Federal State of Niedersachsen and here in Wilhelmshaven.

I regard the decision to organise this important conference here as a tribute to the scientific activities of the Lower Saxony Institute for Historical Coastal Research (NIhK).

As I was told, the series of these meetings started in 1968, on a small scale only, close to Prague where 30 leading archaeobotanists from Europe had been invited, and Professor Dr. Karl-Ernst Behre, the later head of the NIhK, was among the founders of this group. The idea for such a work group was launched on the occasion of the 7<sup>th</sup> International Archaeological Congress 1966 in Prague with the aim of promoting palaeoethnobotany as scientific discipline on its own. At that time nobody expected the enormous development palaeoethnobotany – or as we now say *archaeobotany* – has undergone since then, presently indicated by a new peak of around 250 pre-registered participants from 33 countries at this 15<sup>th</sup> conference.



Both the terms palaeoethnobotany and archaeobotany clearly impart their interdisciplinary character. Only by means of cooperation among various disciplines is it possible to reveal the relations between humans and environment in the past.

In particular, the understanding of early agrarian economies and their impact on landscapes and natural environments has become a major goal of many large-scale projects, some of them also conducted by the Lower Saxony Institute in Wilhelmshaven. The shaping of cultural landscapes by the spread of agriculture, animal husbandry and the building of settlements has been the most influential development since the beginning of agriculture more than 10.000 years ago.

Coastal areas like this on the southern shore of the North Sea have suffered from large natural environmental changes in the past, causing severe implications for the people living here. Animal husbandry, of course, but also plant cultivation – your particular subject – was necessary to survive. Today, we are interested in how our ancestors lived, what they ate and how they survived in this area which was regularly flooded, at least before they built dykes to defend their farms and fields from the sea.

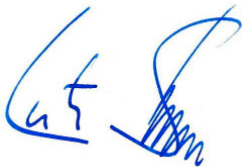
Further research questions are related to the history of the coast itself, in particular the changes in sea-level. In this regard, archaeobotanical studies allow detailed reconstructions of past environments and the degree of salt water influence, hence of the historical sea-level and its rise. Data about the increase and the oscillations of the former sea-level is extremely important for the estimation of their future development. The topics of sea-level rise, climate change and the preceding processes continue to receive a great deal of public attention in science, politics and media. We need to learn much more about the natural variability of these changes in order to distinguish and separate the anthropogenic influence of the last 200 years. Palaeoecology, including palaeoethnobotany, can provide critical data on environment and climate reaching far back in time, much more than the short period of direct measurements, helping us to develop more reliable and serious forecasts for the future. This is one of the reasons why Niedersachsen supports this special and successful research institute.

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From the beginning, natural and cultural sciences have worked close together in the Lower Saxony Institute for Historical Coastal Research in order to reach joint goals. For decades this pioneering approach has been unique in Germany and the institute has achieved outstanding results, admittedly in a region providing excellent preservation conditions for organic material. Further verifying its scientific success, other institutions subsequently chose the NIhK as a model for their operations.

In the meantime, interdisciplinary cooperation has become the central working method at many institutes, employing as many facets as possible to reconstruct former environments and conditions of life. This can also be seen from the wide variety of contributions representing the state of the art as well as new trends in special fields or particular areas of interest. To me, the scientific programme of this meeting gives a clear impression of the importance of archaeobotanical investigations for various issues, such as environmental change, nutrition and even climate reconstruction.

I wish you an interesting conference, many new results, and an enjoyable stay in Wilhelmshaven and the surrounding landscape during the excursions.



Lutz Stratmann, Minister of Science and Culture of Niedersachsen

Hannover, April 2010

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Schedule	2
Abstracts Lectures	12
Abstracts Posters	101
Names and Addresses of Participants	197



**SUNDAY, 30th May**

**16.00 – 20.00 Registration** (Gorch-Fock-Haus, Viktoriastr. 15)

**MONDAY, 31st May**

**8.00 – 9.00 Registration**

**9.00 – 9.30 Introductory Session and Addresses:**  
 Welcome by **Dr. Felix Bittmann**  
**Eberhard Menzel, Mayor of Wilhelmshaven**  
**Prof. Dr. Hauke Jöns, chairman of the “Marschenrat”**  
 Announcements

**Gathering, Cultivation and Domestication**

**Chair: K.-E. Behre**

- |                      |                         |   |
|----------------------|-------------------------|---|
| <b>9.30 – 9.45</b>   | Kreuz, A./Schäfer, E.   | Weed finds as indicators for the cultivation regime of the Early Neolithic Bandkeramik culture?             |
| <b>9.45 – 10.00</b>  | Marinova, E./Popova, T. | Free threshing wheat from the Bulgarian prehistory  |
| <b>10.00 – 10.15</b> | Kirleis, W./Kroll, H.   | The orchard in the Neolithic: <i>Malus</i> in central Europe  |
| <b>10.15 – 10.30</b> | Kloß, S.                | Wood use and management of the Final Mesolithic fishermen-hunter-gatherers on the southern Baltic Sea coast |

**10.30 – 11.00 Coffee break**

**Chair: C.C. Bakels**

- |                            |   |   |
|----------------------------|---|---|
| <b>11.00 – 11.15</b>       | Viklund, K.   | The introduction of sustainable cereal cultivation into northernmost Europe – a survey and discussion of the archaeobotanical record from Sweden  |
| <b>11.15 – 11.30</b>       | Kloß, S./Kirleis, W./<br>Feeser, I./Dörfler, W.   | Neolithic farming and environmental change during the Funnel Beaker culture in northern central Europe  |
| <b>11.30 – 11.45</b>       | McClatchie, M./Whitehouse, N./<br>McLaughlin, R./Schulting, R./<br>Colledge, S./Barratt, P./<br>Bogaard, A. | Cultivating societies: New evidence for arable agriculture from Neolithic Ireland   |
| <b>11.45 – 12.00</b>       | Hovsepyan, R.   | Preliminary data on the prehistoric agriculture of the southern Caucasus (the main phases of development)   |
| <b>12.00 – 12.15</b>       | Kihno, K./Jääts, L.   | Observations of landraces of winter rye in slash-and-burn experiments in Estonia  |
| <b>12.15 – 12.30</b>       | Hovsepyan, R./Smith, A./<br>Bagoyan, T.   | Preliminary data on the archaeobotany of Areni-1 cave (Armenia)   |
| <b>12.30 – 14.00 Lunch</b> |   |   |
| <b>Chair: R. Cappers</b>   |   |   |
| <b>14.00 – 14.15</b>       | Melamed, Y.   | Food-plant remains from the Mousterian Nahal Mahanayeem outlet, Israel  |
| <b>14.15 – 14.30</b>       | Morales, J./Barker, G./Hunt, C./<br>Reynolds, T.  | Mesolithic plant gathering and early agriculture in northeast Libya: The plant remains from Haua Fteah and Hagfet al-Gama   |
| <b>14.30 – 14.45</b>       | Oliveira, H./Lister, D./Jones, M.   | Phylogeography of <i>Triticum turgidum</i> landraces in Iberia and North Africa: Genetic structure and cultivation history  |
| <b>14.45 – 15.00</b>       | Vrydaghs, L./Chevalier, A./<br>Horrocks, M./van der Kaars, S./<br>Denham, T.                                | Multi-proxy palaeoecological investigations (pollen, starch, microcharcoal, phytolith and macrobotanical) of human occupation and plant exploitation in the highlands of Papua New Guinea |

**15.00 – 15.30 Coffee break****Ethnobotanical approaches****Chair: M. Kohler-Schneider****15.30 – 15.45** Pető, Á./Pópty, D.

Complex microarchaeobotanical analysis of food remains from a Neolithic settlement; a case study from Tiszasziget archaeological site, Hungary

**15.45 – 16.00** Festi, D./Oeggli, K.

Archaeobotanical investigation on the Copper Age settlement of Latsch (eastern Italian Alps)

**16.00 – 16.15** Schwarz, A.S./Schmidl, A./  
Goldenberg, G./Oeggli, K.

Subsistence strategies at Bronze Age smelting sites in the eastern Alps

**16.15 – 16.30** Kvavadze, E./Bitadze, L./  
Narimanishvili, G./Kakhiani, K./  
Jalabadze, M./Koridze, I./  
Rukhadze, L./Chichinadze, M./  
Martkoplshvili, I./Pataridze, N./  
Laliashvili, S.

The Bronze Age first-aid kit, according to palaeobotanical data from archaeological sites in Georgia

**16.30 – 16.45** Pető, Á./Herendi, O.

Phytolith studies at a late Avar Period settlement near Hódmezővásárhely (southeast Hungary)

**16.45 – 17.00 Break****17.00 – 18.00 Public lecture:**

Dickson, J./Oeggli, K.

The Neolithic glacier mummy “Ötzi”: His life circumstances and environment

**18.00 – 18.30 “Transfer”****18.30 – 21.00 Welcome Reception****Neues Küstenmuseum, Weserstr. 58****TUESDAY, 1st June****8.30 – 9.00 Late Registration****Methods and Analytical Archaeobotany****Chair: R. Buxó****9.00 – 9.15** Fraser, R./Styring, A./  
Bogaard, A./Ditchfield, P.

Archaeobotanical remains for carbon and nitrogen stable isotope analysis: Pre-treatment, pitfalls and potentials

**9.15 – 9.30** Bogaard, A./Fraser, R./  
Charles, M./Heaton, T./  
Jones, G.

Stable nitrogen isotope analysis of archaeobotanical remains: Implications for the reconstruction of crop husbandry and palaeodietary practices

**9.30 – 9.45** Fiorentino, G./Caracuta, V.

Isotopic and biometrical analyses of charred caryopses from a Middle Bronze Age storage pit at Ebla (northwest Syria): A tool for identifying ancient crop provenance?

**9.45 – 10.00** Burger, P./Ruas, M.-P./  
Terral, J.-F.Assessing agrobiodiversity of *Prunus avium* L. and *P. cerasus* L. (cherries) during Antiquity and the Middle Ages: A morphometric approach**10.00 – 10.15** Wollstonecroft, M./Hroudova, Z./  
Hillman, G./Fuller, D.*Bolboschoenus glaucus*: A new species in the flora of the ancient Near East**10.15 – 11.00 Coffee break****Chair: S. Jacomet****11.00 – 11.15** Schlumbaum, A./  
Vandorpe, P.Considering the origin of Roman *Lagenaria siceraria* (bottle gourd) north of the Alps: A morphological and archaeogenetic approach**11.15 – 11.30** Brinkkemper, O./  
van der Maaten, L./Boon, P.Seeds of *Myosotis* (forget-me-not) no longer forgotten**11.30 – 11.45** Van der Veen, M./Morales, J./  
Cox, A.

Identifying foodways – new methodological approaches

**11.45 – 12.00** Berzsényi, B./Stika, H.P./  
Jones, M.K.

Agriculture, crop processing and social relations in Middle Bronze Age Hungary



<b>12.00 – 12.15</b>	Maier, U.	Detecting intra-site patterns with systematic sampling strategies – archaeobotanical grid sampling in lakeshore settlements
<b>12.15 – 12.30</b>	Schepers, M.	The identification of past plant communities using modern relevées: A case study from Swifterbant
<b>12.30 – 14.00 Lunch</b>		
<b>Chair: F. Bittmann</b>		
<b>14.00 – 14.15</b>	Hartmann-Shenkman, A./ Auman-Hazan, C./Faust, A./ Weiss, E.	The “pantry” of Tel ‘Eton, Israel – vessels and their content
<b>14.15 – 14.30</b>	Karg, S./Henriksen, S.P./ Henriksen, M.B./Mannering, U./ Allaby, R.	Cross-disciplinary studies on the evolution and cultural history of flax and linen in southern Scandinavia
<b>14.30 – 14.45</b>	Kreuz, A./Schäfer, E./Thiébaud, S./ Ruas, M.-P./Dreslerová, D./ Pokorná, A./Křivánková, D.	The archaeobotanical database programme <i>ArboDat</i> ®, a time economizing tool for data archiving and evaluation (German, French and English version)
<b>14.45 – 15.00</b>	Rovner, I./Gyulai, F.	Beyond typology: A new quantitative method for differentiating wild versus domesticated seed populations
<b>15.00 – 18.00 Break and Laboratory/Poster session</b>		

### WEDNESDAY, 2nd June

#### 8.30 – 9.00 Late Registration

#### Regional and Historical Archaeobotany

##### Chair: A. Kreuz

<b>9.00 – 9.15</b>	Boenke, N.	Do cannibals act differently? Archaeobotanical results from the Neolithic site of Herxheim, Rheinland-Pfalz, Germany
<b>9.15 – 9.30</b>	Borojevic, K.	Plant remains from a Late Neolithic building at the Vinča site
<b>9.30 – 9.45</b>	Antolín Tutusaus, F./ Buxó, R./	Durum wheat in the Early Neolithic of the Iberian Peninsula: Evaluating the evidences from La Draga (Banyoles, Girona Province, Spain)
<b>9.45 – 10.00</b>	Kubiak-Martens, L.	Late Neolithic settlement in a tidal environment of Noord-Holland, the Netherlands
<b>10.00 – 10.15</b>	Peña-Chocarro, L./Morales, J./ Pérez-Jordà, G.	The first farmers in southern Iberia
<b>10.15 – 10.30</b>	Rösch, M./Kleinmann, A./ Lechterbeck, J./Sillmann, M./ Wick, L.	A Bell Beaker site with wet preservation from Hegau/ south-west Germany: Macrofossil and pollen evidence for land use
<b>10.30 – 11.00 Coffee break</b>		
<b>Chair: S. Karg</b>		
<b>11.00 – 11.15</b>	Rottoli, M.	Middle Neolithic agriculture in northern Italy: Archaeobotanical results from sites of Square-mouthed Pottery culture
<b>11.15 – 11.30</b>	Salavert, A.	Plant economy of the first farmers in central Belgium (Linearbandkeramik, 5200-5000 BC)
<b>11.30 – 11.45</b>	Fahmy, A. G.	Food ingredients and cooking procedures in Predynastic Egypt: Archaeobotanical evidence from Hierakonpolis
<b>11.45 – 12.00</b>	Figueiral, I./Séjalon, P.	Deep down the wells in southern France: Plant remains (Neolithic – Roman) from Mas de Vignoles IX and their implication for the study of settlement, environment and economy

- 12.00 – 12.15** Lityńska-Zajac, M./Nalepka, D. Macroremains and pollen pattern of *Pinus sylvestris* – connected or disconnected? – based on findings in Poland since the Neolithic
- 12.15 – 12.30** Akashi, C./Tanno, K. Agriculture in the marginal zone: Tell Ghanem al-Ali, an Early Bronze Age site on the Euphrates, Syria
- 12.30 – 14.00 Lunch**
- Chair: M. Rösch**
- 14.00 – 14.15** Perego, R./Badino, F./Baioni, M./Jacomet, S./Ravazzi, C. The record of *Staphylea pinnata* L. from Bronze Age sites in Italy: Early imported artefacts or native stands?
- 14.15 – 14.30** Pollmann, B./Jacomet, S. Archaeobotany of the first discovered late Bronze Age/ Iron Age lakeside dwelling in Lithuania
- 14.30 – 14.45** Schmidl, A./Schwarz, A.S./Oegg, K. Cultivated plants in the eastern Alps during Bronze and Iron Ages
- 14.45 – 15.00** Tereso, J./Ramil-Rego, P./Gómez-Orellana, L./Almeida-da-Silva, R. An archaeobotanical approach to agricultural development in northwest Iberia during prehistoric and early protohistoric times
- 15.00 – 15.15** Toulemonde, F. Plant remains in northern France during the Late Bronze Age and Early Iron Age: New data from Ile-de-France and Champagne-Ardenne regions
- 15.15 – 15.30** Stika, H.-P./Jahns, S./Kennecke, H./Knipping, M./Boust, H./Christiansen, J. Botanical macroremains from Slav settlements on the river Elbe floodplains in comparison to on-site and off-site pollen data
- 15.30 – 16.00 Coffee break**
- Chair: K. Oegg**
- 16.00 – 16.15** Alonso, N./Rovira, N. Consumption and processing of plant products between 475 and 350 BC in Lattara (Lattes, France)
- 16.15 – 16.30** Bellini, C./Mariotti Lippi, M./Giachi, G./Gonnelli, T. Archaeobotanical investigations in the Iron Age site of Salut (Sultanate of Oman)
- 16.30 – 16.45** Bokeria, M./Ammann, B./Masserey, C./Lomitashvili, D./Kacharava, D./Akhvlediani, D. New archaeobotanical data from the land of Golden Fleece – ancient Colchis (western Georgia, Caucasus)
- 16.45 – 17.00** Caneppele, A./Heiss, A.G./Kohler-Schneider, M. Mistletoe from sacred groves...? – A Late Iron Age temple district in Lower Austria from an archaeobotanical perspective
- 17.00 – 17.15** Grabowski, R. Changes in cereal cultivation in southern Scandinavia during the Iron Age: A survey and interpretation of the archaeobotanical record
- 17.15 – 17.30** Lentjes, D. Seeds in context: The archaeobotanical macroremains from Muro Tenente, southwest Italy
- 18.30/19.00** Vegetation History and Archaeobotany, Editorial board meeting

## THURSDAY, 3rd June

### Origins of agriculture in the Near East

**Chair: G. Willcox**

- 9.00 – 9.15** Abbo, S./Lev-Yadun, S./Gopher, A. The agronomic and ecological basis of Near Eastern plant domestication in the light of archaeological evidence
- 9.15 – 9.30** Deckers, K./Riehl, S. Environmental settings at Natufian and PPNA sites in the Damascus region of Syria, based on plant remains from the archaeological sites Baaz and Kaus Kozah
- 9.30 – 9.45** Filipovic, D./Bogaard, A./Charles, M./Ergun, M./Jones, G./Livarda, A./Asouti, E. Recent archaeobotanical results from Çatalhöyük, central Anatolia
- 9.45 – 10.00** Fuller, D.Q. Cultivation as slow evolutionary entanglement: Comparative data on the rate and sequence of domestication

<b>10.00 – 10.15</b>	Kislev, M./Simchoni, O./ Hartmann-Shenkman, A.	Was the Neolithic revolution in the Near East really an agricultural revolution?
<b>10.15 – 10.30</b>	Nasu, H./Tanno, K./Hongo, H./ Fujii, S.	Archaeobotanical study of PPNB outpost, Wadi Abu Tulayha, southern Jordan with special reference to the beginning of nomadism at the southern edge of the Fertile Crescent
<b>10.30 – 11.00</b>	<b>Coffee break</b>	
	<b>Chair: M. Kislev</b>	
<b>11.00 – 11.15</b>	Riehl, S./Zeidi, M./ Conard, N.J.	Contribution to the beginnings of plant production in the eastern Fertile Crescent – archaeobotany at the PPN sites of Chogah Golan and Chia Sabz (Iran)
<b>11.15 – 11.30</b>	Tanno, K./Willcox, G.	Identifying domestication using charred spikelet bases from early agriculture sites in the Near East
<b>11.30 – 11.45</b>	Weiss, E./Zohary, D.	The spread of southwest Asian founder crops to Europe and beyond
<b>11.45 – 12.00</b>	White, C./Borojevic, K.	Early cultivation practices at the Pre-Pottery Neolithic site of el-Hemmeh, Jordan
<b>12.00 – 12.15</b>	Willcox, G.	Arable weeds and the origins of agriculture in the Near East
<b>12.15 – 12.30</b>	Jones, G./Charles, M./ Jones, H./ Jones, M./ Colledge, S./Brown, T.	Crop DNA evidence for the spread of agriculture in Europe
<b>12.30 – 14.00</b>	<b>Lunch</b>	
	<b>Regional and Historical Archaeobotany, continued</b>	
	<b>Chair: M. van der Veen</b>	
<b>14.00 – 14.15</b>	Zanon, M./Deaddis, M./ de Marinis, R./Perego, R./ Quirino, T./Ravazzi, C.	Etruscan settlements near Mantua in northern Italy: Plant goods trade and early woodland history since the Iron Age
<b>14.15 – 14.30</b>	Bouchaud, C./Tengberg, M./ Moulhérat, C./Dal Pra, P.	The cultivation of <i>Gossypium</i> (cotton) in Arabia during Achaemenid and Nabatean times
<b>14.30 – 14.45</b>	Kajale, M.D./Cherian, P.J.	Implications of spice-plant remains from early historical coastal site at Pattanam, Thrissur district, Kerala, India
<b>14.45 – 15.00</b>	Prøsch-Danielsen, L./ Soltvedt, E.-C.	The change from saddle querns to rotary hand querns in southwestern Norway with corresponding crop plant assemblages
<b>15.00 – 15.15</b>	Akeret, Ö.	Plant remains from two neonatal burials in the Roman legionary camp of Vindonissa, Switzerland
<b>15.15 – 15.30</b>	Chevalier, A./ Derreumaux, M.	<i>Daucus carota</i> L. and <i>Pastinaca sativa</i> L. ssp. <i>sativa</i> : Condiments for local fish sauce in Northern Europe or early pot-au-feu ingredients? A study using seeds, starches and phytoliths from the Roman site of Arlon (Belgium)
<b>15.30 – 18.30</b>	<b>Coffee break and Laboratory/Poster session</b>	
<b>17.30 – 18.30</b>	<b>IWGP Committee meeting</b>	
<b>19.00</b>	<b>Conference Dinner</b>	<b>Pumpwerk, Banter Deich 1</b>

## FRIDAY, June 4

### Regional and Historical Archaeobotany, continued

**Chair: W. Kirleis**

<b>9.00 – 9.15</b>	Lohmann, W.	Archaeobotanical investigations at the Roman Iron Age and Medieval site of Elsfleth-Hogenkamp (Niedersachsen, Germany)
<b>9.15 – 9.30</b>	Sadori L./Giardini M./ Pepe C.	Plant macro- and microremains from Portus, the harbour of Imperial Rome

<b>9.30 – 9.45</b>	Schaal, C.	A waste management of plants, human and animal faeces in urban areas: The Roman agglomeration case Horbourg-Wihr (Alsace, France)
<b>9.45 – 10.00</b>	Smith, W./Biddulph, E./ Smith, D.	Super-abundant spelt processing waste at Roman Northfleet Villa, Kent (UK): The implications for the introduction of malt, granary pests and market economy into Britain
<b>10.00 – 10.15</b>	Pińska, K.	Plant remains from the Early Medieval Pagan offering site in Żółte (northwest Poland)
<b>10.15 – 10.30</b>	Pokorná, A./Starec, P.	The oldest Medieval pond? Archaeobotanical investigations in historical Prague, Czech Republic
<b>10.30 – 11.00</b>	<b>Coffee break</b>	
	<b>Chair: G. Jones</b>	
<b>11.00 – 11.15</b>	Ruas, M.-P./Tengberg, M.	Archaeobotanical research at the Medieval fortified site of Îgîlîz-des-Hargha (Anti-Atlas, southwest Morocco) with special attention to the use of the argan tree
<b>11.15 – 11.30</b>	Hellmund, M.	Plant remains of the Bronze Age, Iron Age and the Roman Period from the Tell of Niederröblingen, Sachsen-Anhalt, Germany
<b>11.30 – 11.45</b>	Vrydaghs, L./Doutrelepont, H./ Court-Picon, M./Devos, Y.	The Early Medieval landscape of Brussels: The archaeological contribution to the study of Dark Earth
<b>11.45 – 12.00</b>	Wiethold, J./Bonnaire, E.	Medieval agriculture in eastern France: The comparison of the rural Medieval sites of Marnay/Pont-sur-Seine (Aube, Champagne-Ardenne) and Vitry-sur-Orne (Moselle, Lorraine)
<b>Concluding Session</b>		
<b>12.00</b>	Corrie C. Bakels	Summing up
	<b>Lunch thereafter</b>	Announcements: Publication, the 16 <sup>th</sup> symposium 2013?

**SATURDAY, June 5****Excursions****06.15 / 8.30     Departure from Wilhelmshaven****19.00             Arrival to Wilhelmshaven****Excursion 1     Wadden Sea, Spiekeroog island****Excursion 2     Around the Jade Bay****SUNDAY, June 6****Departure**

**POSTER SESSION A (Tuesday, June 1):  
Regional and Historical Archaeobotany**

- 1 Bárta, M./Beneš, J./Novák, J./Pokorná, A. Archaeobotanical research of the lake of Abusir at the edge of the Old Kingdom pyramid field of Abusir, Egypt
- 2 Beneš, J./Košňovská, J./Frolík, J./Matiášek, J. Archaeobotanical analysis of the Early Modern vault infill from Vladislav Hall, Old Royal Palace, Prague Castle, Czech Republic
- 3 Berihuete, M./Buxó, R. The archaeobotanical record of the Iberian site of Puig de Sant Andreu (Ullastret, Girona province, Catalonia): Preliminary results
- 4 Bernardová, A./Kalábek, M. Macroremain analysis of the High Medieval sediments from the former Minorite monastery in Olomouc, Czech Republic
- 5 Bernardová, A./Novak, J./Houfková, P./Meduna, P. The reconstruction of the Early Medieval vegetation in the Mělník vineyard region, Czech Republic
- 6 Bokeria, M./Mamuladze, S./Kakhidze, A. The archaeobotanical remains of Roman Age from the eastern Black Sea littoral (Gonio-Apsaros, southwestern Georgia)
- 7 Bosi, G./Rinaldi, R./Labate, D./Santini, C./Bandini Mazzanti, M. Archaeobotany and the history of local flora: The case of 12<sup>th</sup> century AD archaeobotanical records from the Bishop's Palace of Modena (Emilia Romagna, Italy)
- 8 Bouby, L./Bouchette, A./Figueria, I. An exotic plant in the western Mediterranean: *Sebesten (Cordia sp.)* fruits in Roman Narbonnaise (southern France)
- 9 Brombacher, C. Stans Kehrsiten: Macroremains from a Neolithic lake shore site in central Switzerland
- 10 Carra, M. Investigations on *Gereonium* (Molise, Italy): Seed remains from the castle's kitchen (14<sup>th</sup> century AD)
- 11 Castiglioni, E./Rottoli, M. Plant offerings from Roman cremations in northern Italy: A review
- 12 Ceriņa, A./Apsīte, L./Bērziņš, V./Kalniņa, L./Ozola, I. Vegetation change and human impact, as reflected in Littorina Sea lagoonal deposits near the Priedaine archaeological site at the head of the Gulf of Riga (plant macroremains, pollen and wooden artefacts)
- 13 Cooremans, B. Archaeobotanical investigations at the Roman town of Tongeren (Belgium)
- 14 Charles, M./Filipović, D./Bogaard, A. Identification criteria for barley rachis: Distinguishing two- from six-row and naked from hulled barley
- 15 Dreslerová, D./Kočár, P. Archaeobotanical finds of cultivated plants in the prehistory of the Czech Republic
- 16 Gianassi, E./Bosi, G./Massamba N'siala, I./Mercuri, A.M. Fewet (Libya, central Sahara) and the archaeobotanical research on Garamantian Times
- 17 Grasso, A.M./Fiorentino, G. Waterlogged grape remains (*Vitis vinifera* ssp. *vinifera* L.) from a Byzantine well at Supersano (southeast Italy): Remains of wine making?
- 18 Heiss, A.G./Kohler-Schneider, M. Farming and foraging on limestone and loess - archaeobotanical records from the Late Iron Age settlement of Michelstetten (Lower Austria)
- 19 Herbig, C. Fruits and ears - another well from the Linear Pottery culture: Schkeuditz-Altscherbitz, Sachsen, Germany
- 20 Hiie, S. Finds of charred grains from Estonian hillforts
- 21 Andreasen, M.H./Jensen, P.M./Mikkelsen, P.H. Macrofossils in „Grubenhäuser“ from Viking Age in Denmark
- 22 Kenéz, A./Gyulai, F. A hundred years of archaeobotanical investigation on a Roman fortress in Pannonia
- 23 Kodýdková, K./Frolík, J./Musil, J./Beneš, J. Archaeobotanical macroremain analysis of the Medieval cesspit 938 from Chrudim, Czech Republic
- 24 Kramer, A./Nösler, D./Wolters, S. The Funnel beaker culture in northwestern Germany - reconstructions from pollen investigations

- 25 Kropp, R./Röpke, A./Schamuhn, S./Schmidt-Wygasch, C./Zerl, T. Insight into the environment of an Early Modern oxbow lake (Rheinland, Germany), using a multi-proxy approach
- 26 Kvavadze, E./Chichinadze, M./Bokeria, M./Rusishvili, N./Kacharava, D./Akhvlediani, D. Environment and agriculture of ancient Vani (western Georgia) according to archaeobotanical and palynological data
- 27 Lempiäinen, M./Lindroos, T./Lempiäinen, T./Niukkanen, M./Hakanpää, P. Macrofossil finds of Porvoo/Borga – a Medieval town in southern Finland
- 28 Lempiäinen, T. The oldest documentary records and macrofossil finds of some medicinal plants in Finland
- 29 Lucas, L. Exploring archaeobotanical contributions in Cypriot prehistory
- 30 Mercuri, A.M./Bosi, G./Florenzano, A./Rinaldi, R./Torri, P./Pederzoli, A./Bandini Mazzanti, M. The city of Parma (Emilia Romagna, Italy) in the Roman and Medieval Periods: Seeds and fruits, pollen and parasite remains
- 31 Mueller-Bieniek, A./Walanus, A./Wasylikowa, K./Woch, M. Plants in Medieval Kraków – statistical analysis
- 32 Novák, J./Lisá, L./Kuna, M. Anthracological and geoarchaeological analysis of Early Medieval houses in Roztoky u Prahy (Czech Republic)
- 33 Novák, J./Svitavská, H./Sádlo, J. New adventures in the “Land of Fire” and their relevance to archaeobotanical and environmental reconstructions of the Doksy region, Czech Republic
- 34 Olmi, L./Mercuri, A.M./di Lernia, S. Pollen, macroremains and aDNA from fruits, from the Takarkori rockshelter: An integrated archaeobotanical research in central Sahara
- 35 Ozola, I./Cerina, A./Kalnina, L./Apsite, L./Berzins, V. Archaeobotanical studies in the Lake Burtnieks area, northeastern Latvia
- 36 Pomazi, P./Schäfer, E./Kreuz, A. Archaeobotanical results from the Neolithic and Bronze Age site Fajsz (southern Hungary)
- 37 Reed, K. Prehistoric Croatia: New archaeobotanical findings
- 38 Rinaldi, R./Bosi, G./Rovina, D./Biccone, L./Bandini Mazzanti, M. First archaeobotanical analysis from a Medieval well (14<sup>th</sup> century AD) in Sassari (Sardinia, Italy)
- 39 Šálková, T./Chvojka, O. Macro-remain analysis of the Late Bronze Age ditches in Březnice u Bechyně, Czech Republic (preliminary results)
- 40 Šoštarić, R./Krajačić, M.A./Gluščević, S./Mareković, S./Jelaska, S.D. Plant remains from the Roman harbour at Zaton near Zadar (Croatia)
- 41 Ucchesu, M./Peña-Chocarro, L. Agriculture in the Bronze Age in Sardinia: The case of Grotta Monte Meana (Santadi)
- 42 Uzquiano, P./D’Oronzo, C./Fiorentino, G./Ruiz-Zapata, B./Gil-Garcia, M.J./Martens, G./Contreras, M./Ruiz-Zapatero, G./Baquedano, E. Cereals for the Carpetanians: Archaeobotanical research in El Llano de La Horca, a late Iron Age oppidum (Santorcaz, Madrid, Spain)
- 43 Vaněček, Z./Beneš, J./Frolík, J./Mácalová, M. Archaeobotanical investigation at an Early Iron Age (7<sup>th</sup> – 6<sup>th</sup> century BC) Bylany culture settlement, Prague – Černý most, central Bohemia
- 44 Woch, M.W./Mueller-Bieniek, A. Anthropophytes of Medieval Kraców
- 45 Wojas, L./Badura, M./Misiuk, Z. Plant material from early Medieval (12<sup>th</sup>/13<sup>th</sup> century) economic structures on the site of Tartaczna in Gdańsk (N Poland) – preliminary results
- 46 Žáčková, P./Pokorný, P./Kunes, P./Šida, P./Chvojka, O. Plant macrofossils from the deposits of Lake Schwarzenberg (southern Bohemia, Czech Republic) and from associated Mesolithic archaeological sites



**Poster Session B (Thursday, June 4):****Regional and Historical Archaeobotany; Methods and Analytical Archaeobotany; Gathering, Cultivation and Domestication; Ethnobotanical approaches**

- 1 Antolín Tutusaus, F. Experimental archaeology as a resource for approaching formation processes of seed assemblages: First results
- 2 Arranz, A./Ibáñez, J./Zapata, L. Early agriculture and woodland use in the Near East: The case of PPNB Qarassa (Jordan Valley, Syria)
- 3 Bešta, T./Novák, J./Dreslerová, D. The influence of human activity on the changes of ecological conditions in Komořanské Jezero (Czech Republic)
- 4 Bittmann, F./Grimm, J./Sander, A. Plant and zoological remains from a hole in the kitchen wall of the castle in Jever near Wilhelmshaven
- 5 Bittmann, F./Wolters, S./Lohmann, W. Cultivated plants in the Clay district of Niedersachsen, Northwest Germany
- 6 Brun, C./Zech-Matterne, V./Derreumaux, M. Evolution of arable weed flora during protohistoric and early historic periods in northern Gaul: A statistical approach taking account of archaeobotanical results and pollen study surveys in present-day non-mechanised agriculture
- 7 Coubray S./Fiorentino, G./Zech-Matterne, V./Bui-Thi, M./Pagnoux C. New perspectives about the history of *Citrus* in the western Mediterranean: A multidisciplinary investigation in the Campania region (Italy)
- 8 D'Alpoim Guedes, J./Warinner, C. Establishing open-access online reference collections for archaeobotanical research
- 9 D'Oronzo, C./Aruta, G./Fiorentino, G. Bread for the Gods: Macro and microscopical analyses of bread fragments from a religious context in southeastern Italy
- 10 D'Oronzo, C./Stellati, A./Fiorentino, G. Archaeobotanical analysis of the Middle Bronze Age village of Filo Braccio at Filicudi (Aeolian Islands, Italy): Spatial analysis and the identification of different activity areas
- 11 Ulas, B./Fiorentino, G. A recent identification of a new glume wheat type: A biometrical and morphological study of spikelet forks from the Neolithic levels in Mersin-Yumuktepe (Turkey)
- 12 Flohr, P./Müldner, G./Jenkins, E. Environmental reconstruction through carbon stable isotope analysis of cereal remains
- 13 Herchenbach, M. Flora Antica – a database of trees of ancient Italy
- 14 Hillbrand, M./Hadorn, P./Hasenfratz, A./Haas, J.N. Neolithic and Bronze Age human impact and landscape development in the Seebachtal, Thurgau, Switzerland
- 15 Kajale, M. Food preparation and religious aspects of maize (*Zea mays* L.) in Lachung Valley, northern Sikkim, India
- 16 Kingwell-Banham, E./Harvey, E./Weisskopf, A./Fuller, D.Q. New analyses on the development of early rice cultivation systems in India
- 17 Kisielienė, D./Stančikaitė, M./Masiulienė, I. Landscape history of Klaipėda, Lithuania, in the 16<sup>th</sup>-17<sup>th</sup> centuries AD: Archaeobotanical and archaeological data
- 18 Longford, C./Charles, M./Crowther, A./Ertug, F./Herbig, C./Jones, G./Kutterer, J./Madella, M./Maier, U./Out, W./Pessin, H./Zurro, D. Integrated archaeobotanical research – online tutorial
- 19 López López-Dóriga, I./Arias, P. Charred seeds and fruits from the Mesolithic-Neolithic transition in northern Spain: Los Gitanos and Arangas caves
- 20 Margaritis, E. The domestication of the vine and olive in the Aegean and Cyprus
- 21 Masi A./Baneschi I./Sadori L./Zanchetta, G. Past climate reconstruction at Arslantepe (Malatya, Turkey): The contribution of the stable carbon isotope
- 22 Moolhuizen, C./Bos, H./Bouman, M./Zuidhoff, F. The N57 archaeological investigation (Zeeland, The Netherlands) – reconstruction of a buried landscape using a multi-disciplinary approach

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| 23 | Motuzaite Matuzeviciute, G./<br>Hunt H.V./Jones, M.K.                                       | Experimental approaches to understanding variation in grain size in <i>Panicum miliaceum</i> and its relevance for interpreting archaeobotanical assemblages   |
| 24 | Oeggel, K.  | The plant remains from the "Ice-Maiden", the Inca mummy from Nevado Ampato, Peru   |
| 25 | Parks, K.   | Changing Iron Age and Roman arable practice in the east of England   |
| 26 | Pérez Jordà, G.   | Spatial analysis of the La Mata building (Campanario Badajoz, Spain)   |
| 27 | Pető, Á./Kreiter, A./Berzsenyi, B./<br>Horváth, Z./Gulyás-Kis, C./<br>Tugya, B./Csippán, P. | Introducing the paleoecological work of the field service for cultural heritage in Hungary   |
| 28 | Preiss, S.  | Aspects of agriculture and diet of the Medieval Period (10 <sup>th</sup> -14 <sup>th</sup> century AD) in Northern France  |
| 29 | Primavera, M./Fiorentino/G.   | Acorn gatherers: Fruit storage and processing in southeastern Italy during the Bronze Age  |
| 30 | Röpke, A./Herbig, C./<br>Nowacki, D./Marinova, E./<br>Wunderlich, J.                        | A multi-proxy approach to reconstruct mid- to late Holocene environmental changes in the lower Danube floodplain near the Copper Age settlement of Pietrele, southern Romania                            |
| 31 | Ros, J./Ruas, M.-P.   | Production and storage of food plants of eastern Languedoc during the 10 <sup>th</sup> -11 <sup>th</sup> century AD: The sites of Dassargues and Lunel Viel, Hérault, France                             |
| 32 | Rousselet, O./Bouby, L.   | Agriculture in the south of France during late Neolithic: The cereal stores at the site of Capoulière (Mauguio, Hérault)   |
| 33 | Rusishvili, N./Jinikhadze, T./<br>Maisaia, I.   | The expansion of <i>Triticum timopheevi</i> Zhuk. in Georgia according to palaeoethnobotanical data  |
| 34 | Sabato, D./Sadori L.  | Crop storage, processing and timber exploitation during Early Bronze Age III at Arslantepe (Malatya, Turkey)   |
| 35 | Sadovnik, M./Nelle, O./<br>Bork, H.-R.  | Can the period of dolmen construction be seen in the pollen record? Pollen analytical investigations on the Holocene settlement and forest history in the area of Westensee, Schleswig-Holstein, Germany |
| 36 | Save, S./Gubellini, L./Kovacik, J./<br>Vaughan-Williams, A.                                 | Harvest, processing and storage: Plant macrofossil analysis of a "classical" villa from Belgic Gaul  |
| 37 | Sillmann, M./Rösch, M./<br>Märkle, T.   | The archaeobotanical garden in Hemmenhofen   |
| 38 | Solinas, F./Fiorentino, G.  | Morpho- and biometrical analysis of grape pips from the Middle Minoan site of Monastiraki (Crete, Greece)  |
| 39 | Sopelana Salcedo, I./<br>Moreno-Larrazabal, A.  | Traditional farming of millets ( <i>Panicum miliaceum</i> and <i>Setaria italica</i> ) in northern Iberia: An ethnographic approach  |
| 40 | Valamoti, S.M./Capparelli, A./<br>Wollstonecroft, M.  | Plant processing around the globe: Archaeobotanical, experimental and ethnobotanical approaches  |
| 41 | Valamoti, S.M./Gatzogia, E.   | Plant remains from an Iron Age pit at Karabournaki, northern Greece  |
| 42 | Valamoti, S.M./Moniaki, K./<br>Karathanou, A.   | Processing and consumption of pulses in prehistoric Greece: Archaeobotanical, experimental and ethnographic evidence   |
| 43 | van der Valk, J.M.A./<br>Marinova, E./Valamoti, S.-M.                                       | Inferring the taphonomy of charred olive stones by comparing the anatomy of fracture surfaces under different burning regimes  |
| 44 | Wallace, M./Charles, M./<br>Jones G./Fraser, R./Heaton, T./<br>Bogaard, A.                  | A direct assessment of archaeological crop water status  |
| 45 | Weisskopf, A./Qin, L./Fuller D.Q.   | Reconstructing changes in rice water management through archaeological weeds in Neolithic China  |
| 46 | Zerl, T.  | Recent archaeobotanical investigations into the range and abundance of crop plants in Bronze and Iron Age settlements in the Rhineland area, Nordrhein-Westfalen, western Germany                        |



## LECTURES



## THE AGRONOMIC AND ECOLOGICAL BASIS OF NEAR EASTERN PLANT DOMESTICATION IN THE LIGHT OF ARCHAEOLOGICAL EVIDENCE

Shahal ABBO<sup>1</sup>, Simcha LEV-YADUN<sup>2</sup>, Avi GOPHER<sup>3</sup>

*Key words: Founder crops, Domestication centres, Monophyletic versus multiple origin*

Phylogenetic analyses of a number of crop plants and their wild progenitors suggest that the geographical location of the founder stocks of the Near Eastern crops is in a specific region in southeastern Turkey and northern Syria. This view has recently been challenged by a number of scholars who view Near Eastern plant domestication as geographically diffuse, with multiple domestication centres and multiple origins for several different crop plants. This paper examines the distribution of the wild progenitors and their ecological preferences, and provides field data to show the sympatric occurrence of the majority of the founder crop package in several locations across southeastern Turkey. The agronomic features of the founder crops are highlighted with special emphasis on their yield buffering capacity and nutritional complementarities. The phytogeographic, agronomic and genetic data are considered in the light of dated archaeological and archaeobotanical finds and their bearing on the possible location of the homeland of Near Eastern agriculture.

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## **AGRICULTURE IN THE MARGINAL ZONE: TELL GHANEM AL-ALI, AN EARLY BRONZE AGE SITE ON THE EUPHRATES, SYRIA**

**Chie AKASHI<sup>1</sup>, Ken-ichi TANNO<sup>2</sup>**

*Key words: Tell Ghanem al-Ali, Syria, Early Bronze Age*

Tell Ghanem al-Ali is an Early Bronze Age (EB) site situated in the Euphrates valley 50 km east of al-Raqqa. The area between al-Raqqa and Deir ez-Zor has produced little archaeobotanical data to date. A Syrio-Japanese team has been excavating the site since 2007 and revealed an occupation from the late Chalcolithic / earliest EB to EB4A.

Archaeobotanical remains from Tell Ghanem al-Ali show a predominance of barley, along with some other crops such as legumes and grape. More than 40 taxa of wild or weed plants, particularly species within the Chenopodiaceae, were recovered. Some taxa suggest that they originated as field weeds and dung fuels. The average annual precipitation of Tell Ghanem al-Ali (approx. 180 mm) today is much lower than the nearest contemporary sites, such as Swehyat (300 mm) or Selenkahiye (200 mm). The transition of subsistence strategy through the 3<sup>rd</sup> millennium BC in one of the most marginal farming areas in Syria is discussed.

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## **PLANT REMAINS FROM TWO NEONATAL BURIALS IN THE ROMAN LEGIONARY CAMP OF VINDONISSA, SWITZERLAND**

**Örni AKERET<sup>1</sup>**

*Key words: Roman period, Switzerland, Neonatal burial, Mineralised plant remains*

During excavation at the Roman legionary camp of Vindonissa (Windisch, Switzerland) in 2003, bones of five neonates were discovered. Sediments from two of the burials, one of which contained two individuals, were analysed for macroscopic plant remains. Both burials were situated inside a building and contained no archaeological finds that could be interpreted as offerings. They contained a total of 74 plant remains, of which 68 were mineralised. The hypothesis that the building had served as a latrine was rejected, because there were very few food plant remains among the finds. The majority of the species were grassland plants or weeds. Therefore, it is assumed that the source of calcium phosphate was animal dung rather than human faecal material. The building could, therefore, have served as a stable.

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## CONSUMPTION AND PROCESSING OF PLANT PRODUCTS BETWEEN 475 AND 350 BC IN LATTARA (LATTES, FRANCE)

Natàlia ALONSO<sup>1</sup>, Núria ROVIRA<sup>2</sup>

*Key words: Fruit and seed remains, Landscape, Economy, Protohistory, Lattara, Languedoc*

Research on the archaeological site of Lattara (Lattes, Hérault, France), a protohistoric port, has revealed that the city sat between two branches of a river and on the edge of a lagoon. A recent study of archaeobotanical macroremains of fruit and seeds found in various archaeological contexts, dated between 475 and 350 BC, and from two zones of the city, supports this hypothesis thanks to the discovery of plant remains related to brackish waters, specially those of coastal lagoons.

We present in this work the results of the archaeobotanical study of these archaeological contexts, especially from an economic point of view. Concerning methodology, we want to stress the fact that most of the seed and fruit remains found in these zones come from deposits related to human activities, especially of consumption and/or production. At the same time, we will discuss various taphonomic questions, especially the modes of preservation of the fruit and seed remains, which are of major importance when interpreting the archaeobotanical assemblages.

The adoption of an open area excavation procedure for excavating the site, the carrying out of systematic sampling and the use of adequate sieving methods have allowed the collection of a great number of seed and fruit remains not only from cultivated plants, but also from wild plants. These remains show for this period a landscape strongly influenced by human action, most of it in relation to agricultural and/or husbandry practices. Our results are associated with data resulting from other archaeobotanical, archaeozoological and geomorphological analyses in order to understand not only the characteristics of the surrounding landscape, but also its exploitation by the city inhabitants.

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## **DURUM WHEAT IN THE EARLY NEOLITHIC OF THE IBERIAN PENINSULA: EVALUATING THE EVIDENCE FROM LA DRAGA (BANYOLES, GIRONA PROVINCE, SPAIN)**

**Ferran ANTOLÍN TUTUSAUS<sup>1</sup>, Ramon BUXÓ<sup>2</sup>**

*Key words: Durum wheat, Early Neolithic, Iberian Peninsula*

La Draga is by far the most important settlement of the early Neolithic period in the Iberian Peninsula, partly due to its exceptional conditions of preservation in an anaerobic environment, thanks to the close location of the site to Lago de Banyoles. The site was occupied for a relatively short period at some point between 5300-5150 cal BC. Wooden artefacts and all types of organic materials have been extraordinarily preserved. Among them, seeds are one of the most important, and hundreds of thousands of remains have been preserved even in areas that were further away from Lago de Banyoles, thanks to their exposure to heat and eventual carbonization. So both carbonization and waterlogging have been tremendously important for the preservation of seeds at the site. This is a unique case in the prehistory of the Iberian Peninsula since no other lakeshore settlements have so far been identified there.

The seed analysis from La Draga is still in progress, so we will not be presenting it as a whole. It has yielded some tens of taxa, but *Triticum durum* (durum wheat) is always absolutely predominant at the site. In this presentation, we aim to assess its economic significance at La Draga by analyzing its production process with special attention to the burned stores, and we will eventually consider its importance at a wider scale in the early Neolithic of the Iberian Peninsula.

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## ARCHAEOBOTANICAL INVESTIGATIONS ON THE IRON AGE SITE OF SALUT, SULTANATE OF OMAN

Cristina BELLINI<sup>1</sup>, Marta MARIOTTI LIPPI<sup>1</sup>, Gianna GIACHI<sup>2</sup>, Tiziana GONNELLI<sup>1</sup>

*Key words: Arabian Peninsula, Pollen, Seed/fruits, Charcoal*

The preliminary results of the archaeobotanical investigations on the Iron Age site of Salut, Sultanate of Oman, are presented here. The site is located on a small hill rising from a wide plain near an oasis north of the town of Bisiyah, about 40 km from Nizwa, northern Oman.

The archaeobotanical record refers to the Iron Age phase (1300-800 BC), but the site was later inhabited during the Islamic period. In order to reconstruct the ancient landscape and investigate plant use and economy, samples were collected for pollen, wood, charcoal and seed/fruit analyses.

The pollen analysis showed that the site was in a dry environment characterized by a mainly shrubby vegetation. The best represented shrubs/trees were Capparaceae, *Acacia*, Leguminosae Caesalpinioideae and Faboideae, Chenopodiaceae and Compositae Cichorioideae. Gramineae pollen grains mainly belong to seasonal herbs, even if cereals were also recorded and hint at farming practices near the site, and also indicated by weeds and other cultivated plants. The farming in this dry context must have been connected to some form of water management: indeed, the contemporary expansion of plants of wet environments could suggest the local presence of water bodies in the natural oasis, or man-made canals or pools.

Wood and charcoal testify that trees such as *Ziziphus*, *Acacia* and *Tamarix* were cut for timber and firewood. Seed/fruit analysis shows the extensive use of palm dates in cult practices.

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## AGRICULTURE, CROP PROCESSING AND SOCIAL RELATIONS IN MIDDLE BRONZE AGE HUNGARY

Brigitta BERZSÉNYI<sup>1,2</sup>, Hans-Peter STIKA<sup>2</sup>, Martin K. JONES<sup>3</sup>

*Key words: Százhalombatta, Bronze Age, Crop processing, Spatial variability*

The Százhalombatta Project is part of three case studies building the “Emergence of European Communities”. The main goal of the Százhalombatta Project, running since 1998, is the complete re-evaluation of the middle Bronze Age tell settlement at Százhalombatta-Földvár (2000-1400 BC). In more detail, the primary objective is to study how the inner space of domestic structures was used and organised at the site. With the aid of systematic sampling, spatial variability of cereal processing and food processing could be detected. Flotation samples were taken from contexts representing the general accumulation of domestic waste from outside the houses (31 samples), as well as from the houses’ insides (33 samples). The macroremains revealed differences in how space was organised indoors and outdoors, both vertically and horizontally. Similarities in plant processing were also demonstrated between the phases of the houses. The outside areas contained waste remains from cereal processing. Inside the houses, the stages of cereal processing were carried out in different areas: the find assemblages show that the main cereal cleaning surface was located in the central and southern areas of the houses – which is also the place where the “final” cereal cleaning was carried out. However, only the primary products (the cleaned grains) were taken to the areas with hearths or baking ovens for further food processing.

In the spectrum of cultivated crops from the 100 sampled pits at Százhalombatta-Földvár, *Triticum monococcum* (einkorn) and *Hordeum vulgare* (hulled barley) were the dominant crops, while *Triticum dicoccum* (emmer), *T. spelta* (spelt), *T. aestivum/durum* (bread/hard wheat) and *Panicum miliaceum* (broomcorn millet) were subdominant. *Hordeum vulgare* var. *nudum* (naked barley) and *Secale cereale* (rye) are represented by single finds. Some of the chaff finds clearly indicate the presence of “new type” hulled wheat. The pulses *Lens culinaris* (lentil), *Pisum sativum* (pea) and *Vicia ervilia* (bitter vetch) seem to have been of great importance, while finds of *V. faba* (faba bean) are rare. Some seed remains of *Camelina sativa* (gold-of-pleasure) were found, and few/single finds show the presence of *Linum usitatissimum* (linseed, flax), *Papaver somniferum* (opium poppy) and *Carthamus tinctorius* (safflower). The latter is the earliest find from Hungary so far.

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## DO CANNIBALS ACT DIFFERENTLY? ARCHAEOBOTANICAL RESULTS FROM THE NEOLITHIC SITE OF HERXHEIM, RHEINLAND-PFALZ, GERMANY

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*Key words: Bandkeramik, Cannibalism, Ritual practices, Subsistence, Interregional relationships*

From the archaeological and the anthropological point of view the findings from Herxheim, Rheinland-Pfalz, Germany, offer a unique insight into ritual aspects of life at the end of the Bandkeramik Culture (LBK) period. The site, which was initially supposed to be a kind of ditch system, turned out to constitute two parallel circles of separate, deep pits. The backfills of these pits have produced hundreds of human bone fragments with distinct traces of cannibalism as well as LBK pottery from several regions throughout Europe. While the material from the pit circles indicates that the site was ritual in character, the remains of a normal type of LBK settlement have been found inside the structure. This combination of very different deposits is equally interesting for the comparison of features within the place as well as their comparison with other LBK settlements. Did cannibals act differently? What was the basis of their subsistence? How did the ritual practices fit together with a society of farmers? In a period when the harvest of crops played an important role for subsistence of the individual, archaeobotanical analysis should offer some answers to these questions.

As far as the analysis of the archaeobotanical material shows, the people at Herxheim participated completely in the agricultural ways of their time. The main cereals were *Triticum dicoccum* (emmer) and *Triticum monococcum* (einkorn). *Pisum sativum* (pea), *Lens culinaris* (lentil), *Linum usitatissimum* (flax) and *Papaver somniferum* (opium poppy) were also cultivated. Most of the features show more signs of consumption than of production, as chaff was quite rare. Also, while the number of weed seeds was not high, there is an interesting range of taxa. Beside the cultivated plants, some gathered plants have also been found.

The following presentation will use the good data set to have a look at the distribution patterns of distinct botanical remains in ritual and/or ordinary features. Furthermore, the results will be compared with the spread of typical, regional ceramic styles at the site as well as with archaeobotanical researches from these regions, with the aim of questioning the impact of interregional relationships.

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## STABLE NITROGEN ISOTOPE ANALYSIS OF ARCHAEOBOTANICAL REMAINS: IMPLICATIONS FOR THE RECONSTRUCTION OF CROP HUSBANDRY AND PALAEODIETARY PRACTICES

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*Key words: Manuring, Nitrogen isotopes, Modern studies*

In this paper we present results of a broad investigation into the impact of animal manure application on  $\delta^{15}\text{N}$  values in modern crops, with a view to refining the reconstruction of crop husbandry and palaeodietary practices. We summarize the effect of manuring on  $\delta^{15}\text{N}$  values in a range of Old World seed crops (cereals and pulses), under variable manuring levels / regimes and at a series of locations extending from northwest Europe to the eastern Mediterranean. The results of the modern studies, which include both agricultural experiments and “traditional” farming regimes, demonstrate that intensive manuring can raise cereal  $\delta^{15}\text{N}$  values by the equivalent of a trophic level (ca. 3‰) or more, the degree of impact depending on level and frequency of manure application; conversely, the impact on  $\delta^{15}\text{N}$  values in pulses, which fix atmospheric nitrogen, is generally slight. The expected geographical trend towards greater  $\delta^{15}\text{N}$  with increasing climatic aridity is not apparent, probably because crop growing conditions are heavily “buffered” through management. We use these modern observations to interpret archaeobotanical  $\delta^{15}\text{N}$  values and consider implications for the inference of land use and, together with stable nitrogen and carbon isotope analyses of associated faunal and human remains, palaeodietary practices.

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## NEW ARCHAEOBOTANICAL DATA FROM THE LAND OF GOLDEN FLEECE - ANCIENT COLCHIS (WESTERN GEORGIA, CAUCASUS)

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*Key words: Archaeobotany, Linum bienne, Nokalakevi, Vani, South Caucasus*

Here we present the first archaeobotanical analyses which have been done as part of a multidisciplinary international Swiss – Georgian joint project, “Nokalakevi and Vani in the 1<sup>st</sup> millennium and earlier, cultural and environmental context”, in 2005-2008. Macrofossil analyses deal with reconstruction of the local palaeoenvironment and the agricultural activities of the most important settlements of ancient Colchis. Colchis is well known in Greek mythology as the place of the Golden Fleece. Archaeological finds strongly support the authenticity of the mythical Colchis. From the Nokalakevi area, 95 samples totalling ca. 200 litres of sediment have been studied. Archaeobotanical material has been obtained from cultural layers of the early Antique (8<sup>th</sup> – 6<sup>th</sup> centuries BC) and Hellenistic periods (4<sup>th</sup> – 2<sup>nd</sup> centuries BC). About 24 taxa represent the wild and weedy plant spectrum. From the Hellenistic cultural layers of the Antique period city of Vani, 19 samples with a total volume of 650 litres were studied, dated to the 4<sup>th</sup> – 3<sup>rd</sup> centuries BC. About 21 species of wild plants were recorded. There is evidence of *Corylus*, *Juglans* and *Vitis sylvestris*, as well as carbonised fruit remains of *Ilex* and *Humulus*. These plants are native and still widespread nowadays in Colchic woodlands. The spectra of useful and wild plants recovered from Nokalakevi and Vani are quite similar. The carbonized remains of several kinds of *Triticum*, *Setaria italica*, *Panicum miliaceum*, *Pisum* and *Lens* show the possible composition of the ancient inhabitants' diet. The significant occurrence of naked wheat in the investigated samples suggests that these crops were preferred in this area. Millets were probably cultivated as summer crops. Evidence of synanthropic plant remains, such as crops, annual weeds that are common in waste places and ruderal plants, reflect close connection with human agricultural activity. Remains of carbonised *Vitis vinifera* pips from Vani and the large number of fragmented grape pips from the Nokalakevi settlements could indicate winemaking traditions in ancient Colchis. Seeds of *Linum bienne* (pale flax) with small seeds and flax weeds such as *Camelina* and *Alyssum linifolium* also suggest that flax could be sown as a summer crop in the Nokalakevi area. According to historical sources, export of high quality linen cloth, as well as flax, pitch, wax, agricultural produce and shipbuilding materials such as timber were of especial importance for the economy of ancient Colchis. Earthen and stone tools for textile processing were discovered in the Vani and Nokalakevi settlements from the cultural layers, dating to the 8<sup>th</sup> – 6<sup>th</sup> centuries BC.

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## PLANT REMAINS FROM A LATE NEOLITHIC BUILDING AT THE VINČA SITE

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*Key words: Food, Storage, Processing, Vinča Culture, Neolithic*

Large-scale sampling and flotation have been carried out at the renewed excavations of the tell site of Vinča, the type site of the Neolithic Vinča Culture in southeast Europe. Well preserved charred plant remains and mineralized cereal chaff were recovered under the destruction layer of a structure (House 01/06). Three radiocarbon dates obtained from seeds and fruits from the structure date it to ca. 4500 BC, securely placing the use of the building in the late Neolithic period of the region. The structure was built of wattle and daub material, a typical construction method of the Vinča Culture. Plant remains, including phytoliths, together with associated grinding stones, ovens and ceramics, have provided an exceptional opportunity to study the processing and storage of plant foods, and to examine a possible function of the structure. The ca. 7x5 m<sup>2</sup> large building was divided into three rooms. No plant macroremains were found in the northern, smallest, room. In the central room, charred grains of *Triticum dicoccum* (emmer), including fragmented bulgur type were identified. Next to a domed oven, an ashy layer packed with well preserved mineralized emmer wheat chaff, but no grains, was recovered. In the southern room, a “pantry”, the largest quantity of charred plant macroremains was found. Adjacent to a grinding bin there was a concentration of charred clean emmer grains, *Vicia ervilia* (bitter vetch) and *Linum usitatissimum* (flax) seeds. This is the first find of bitter vetch on a Vinča site, an otherwise common legume at contemporary Greek and Bulgarian Neolithic sites. Only small quantities of spikelet forks of emmer and possibly of the new tetraploid wheat were found, and just a few weed seeds, indicating that the cereals and legumes were stored already cleaned and intended to be consumed fairly quickly. Several whole fruits of *Prunus spinosa* (sloe) were mixed with the grain. Under a broken conical bowl, charred emmer grains were still aligned in spike forms. Several charred fruits of *Pyrus* sp. (pear) were found near a large broken pot. Since no animal bones were found to indicate meat processing, we may conclude that the ground floor of this building represents a type of specialized area where storage and preparation of plant food for humans took place.

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## THE CULTIVATION OF *GOSSYPIMUM* (COTTON) IN ARABIA DURING ACHAEMENID AND NABATEAN TIMES

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*Key words:* Cotton, Arabia, Madâ'in Sâlih, Qal'at al-Bahrain, Achaemenid, Nabatean

The term “cotton” (from the Arabic *al qutn*) refers to four different species of the genus *Gossypium*, Malvaceae family, which have been cultivated for their fibres. While two of these (*G. barbadense* and *G. hirsutum*) were domesticated in the New World, the other two (*G. arboreum* and *G. herbaceum*) originate from the Old World. The long history of cotton use in the Middle East, beginning at the Neolithic site of Mehrgarh (Pakistan) in the 6<sup>th</sup> millennium BC, is still fragmentary and known essentially from fortuitous finds of fibres or textile impressions from a limited number of sites, mostly located on the Indian subcontinent. Recent discoveries of cotton seeds and textiles at two archaeological sites in Arabia allow us to complete our knowledge of the history of cotton cultivation in this part of the world during the centuries before and after the beginning of the Christian Era. The identification of *Gossypium* remains in the Achaemenid levels (6<sup>th</sup> – 4<sup>th</sup> centuries BC) of Qal'at al-Bahrain, Bahrain, corroborates the writings of the Greek naturalist Theophrastus, who described the presence of “wool-bearing trees” on the island that was then called Tylos by the Greeks. Similar discoveries at the Saudi Arabian site of Madâ'in Sâlih (ancient Hegra) shows that cotton was also a crop in the western part of the Arabian peninsula during Nabatean times (1<sup>st</sup> century BC – 5<sup>th</sup> century AD). At both sites, cotton seeds were identified together with the remains of other crop plants, notably *Phoenix* (dates), indicating that cultivation was carried out in irrigated date palm gardens. During these periods of long-distance trade throughout Asia, Arabia and the eastern Mediterranean, these sites in the dry Arabian peninsula appear, perhaps surprisingly, as centres of textile production.

Besides discussing cotton cultivation at Qal'at al-Bahrain and Madâ'in Sâlih, the present paper will present the morphological criteria used for the identification of cotton seeds and fibres as well as the problematic distinction between the two Old World *Gossypium* species.

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**SEEDS OF *MYOSOTIS* (FORGET-ME-NOT) NO LONGER FORGOTTEN****Otto BRINKKEMPER<sup>1</sup>, Laurens VAN DER MAATEN<sup>2</sup>, Paul BOON<sup>3</sup>***Key words: Myosotis, Seed identification methodology*

Despite their name, the identification of seeds of *Myosotis* species (forget-me-not) has received little attention from archaeobotanists up to now. In an attempt to assemble a set of reliable identification criteria, digital image analysis was applied by means of Fovea Pro 4.0. This programme provides 23 variables related to size and shape from photographs, with calibration of scale for each photo. Statistical analyses of a data set of 1333 individual seeds was done with Discriminant Analysis, Correspondence Analysis and t-Distributed Stochastic Neighbour Embedding (t-SNE), a technique for digital image analysis newly developed by Laurens van der Maaten. The combination of analyses provided clues to distinguish most of the seven Dutch species of *Myosotis*. An identification key could be established for the identification of waterlogged *Myosotis* seeds. We aimed to use easily obtainable measurement criteria as much as possible. Where more detailed identifications are possible using variables obtained from performing digital image analysis of seed photographs, we have included these variables as well. The number of available seeds of *Myosotis stricta* was limited. We would still welcome material of this species for temporary loan. The seeds will not be destroyed, only photographed. Please contact the first author if you can help!

The identification key will be available as a hand-out at the IWGP meeting.

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## ASSESSING AGROBIODIVERSITY OF *PRUNUS AVIUM* L. AND *PRUNUS CERASUS* L. (CHERRIES) DURING ANTIQUITY AND THE MIDDLE AGES: A MORPHOMETRIC APPROACH

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*Key words: Prunus avium/cerasus, Morphometrics, Archaeobiology, Agrobiodiversity*

Abundant and diverse *Prunus* stones (cherries, plums, sloes, peaches, etc.) are frequently recovered from archaeological waterlogged contexts such as wells, latrines, lake dwellings, etc. in Europe, and particularly in France. The distinction between *Prunus* species based on traditional morphological characters of the fruitstones is usually not problematic; however the discrimination between *Prunus avium* L., *P. cerasus* L., etc. (cherry tree species), based on these classical criteria alone, often turns out to be ambiguous and almost impossible.

The cherry tree is part of the subgenus *Cerasus* (Mill.) Focke within the family Rosaceae. This project aims to study its cultivation history and varietal diversity in France, based on archaeobiological analyses. Techniques developed in this project combine traditional and geometric morphometric methods (Elliptic Fourier Transforms -EFT- and a superimposition method) in order to examine variations in size and shape of stones in a biosystematic perspective.

Morphometric features of archaeological stones from French and Swiss excavations dating from the 1<sup>st</sup> to the 16<sup>th</sup> century AD are compared to modern stone characters in order to access their taxonomic status and to gain information about historical agrobiodiversity of the cherry tree. The first results of this study will be presented and discussed here.

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## MISTLETOE FROM SACRED GROVES...? A LATE IRON AGE TEMPLE DISTRICT IN LOWER AUSTRIA FROM AN ARCHAEOBOTANICAL PERSPECTIVE

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*Key words: Archaeobotany, Late Iron Age, Celts, Austria, Offerings, Ritual, Plant macroremains*

Roman writers have created a frequently cited but distorted image of their neighbours in central and western Europe, describing the Celts as tree-loving and fierce savages, celebrating religious events in oaken groves. Archaeology has however long complemented this biased account with ample evidence for built structures such as temples and sacred districts. In addition to sites known from France and Germany (*enclos cultuels*, *Viereckschanzen*), a large temple district has been unearthed at the La Tène settlement of Sandberg near Roseldorf, Niederösterreich. Up to now, three temples and a sacrificial pit have been excavated. The spectrum of cultivated plants from the Roseldorf temple district shows only slight deviations from finds made in other parts of the settlement, especially those from a burnt granary. As in the granary, einkorn, spelt and barley were the most important cereals. Besides substantial amounts of rye, fair numbers of broomcorn millet and naked wheat were recorded. Single finds of emmer, lentil, pea, gold of pleasure, poppy and flax further contributed to the overall higher diversity in the sacred enclosures. A striking difference is the presence of possible Mediterranean imports, like seeds of dill and a single pip of cultivated grape. The crop plant spectrum fits well into the general picture of La Tène sites in eastern central Europe, where naked wheat and einkorn are of greater importance compared to western sites, while barley and millet are common everywhere. The importance of rye in the Roseldorf sanctuary is however remarkable: it would point to a very early date of intentional cultivation in central Europe. The rich spectrum of wild plants involves segetal and ruderal species from dry calcareous soils (*Nigella arvensis*, *Adonis aestivalis*, *Bupleurum rotundifolium*, *Hyoscyamus niger*), representatives of steppe grassland on loess soils (*Stipa pennata* agg., *Salvia nemorosa*), as well as species from dry heathland on acidic bedrock (*Trifolium arvense*, *Scleranthus perennis*) and plants from thermophilous (oak)woods (*Thalictrum minus*, *Buglossoides purpureocaerulea*, *Clematis recta*). It reflects the warm and dry climate of the region and points to the importance of livestock grazing, corroborated by archaeozoological finds, as well as to the large activity radius of the settlers.

The archaeological context of the finds made it necessary, however, to thoroughly discuss the taphonomy of the find assemblage. Bones from the largest sanctuary indicate the public display of cattle skulls and human femora, possibly from dead warriors. The bone assemblage shows no traces of exposure to fire as would be expected if these were burnt offerings. Cut marks and fractures in the animal bones rather imply food residues, possibly the remains of ritual feasting. The fact that the sanctuary's food plant spectrum basically represents everyday nutrition is comparable to results of Iron Age ritual sites in France, the Alpine area and northern Italy. In addition, a few remarkable finds might indicate intentional use of plants in the rituals as ornamentals, as fragrant herbs or for their possible symbolic value.

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**DAUCUS CAROTA L. AND PASTINACA SATIVA L. SSP. SATIVA: CONDIMENTS FOR LOCAL FISH SAUCE IN NORTHERN EUROPE OR EARLY POT-AU-FEU INGREDIENTS? A STUDY USING SEEDS, STARCHES AND PHYTOLITHS FROM THE ROMAN SITE OF ARLON (BELGIUM)**

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*Key words: Botanical macroremains, Starch, Phytolith, Fish sauce, Roman*

An excavation in Arlon (Belgium), conducted by the Service Archéologique de la province du Luxembourg, uncovered five Roman enclosures which were included in the vicus, along the road from Metz to Tongres. Each of them included a habitat what could be a garden or a courtyard.

An archaeozoological study conducted on a cesspit located in the back of one of these enclosures revealed fish bones that have been related to the use of a local fish sauce, *allec*.

The macrobotanical study revealed the presence of plants that could potentially have been part of the same fish sauce. Three seed taxa were particularly numerous: *Agrimonia eupatoria* L., *Daucus carota* L. and *Pastinaca sativa* L. ssp. *sativa*. Since *Agrimonia eupatoria* is not a condiment plant, it is usually scarce in archaeological contexts. However it is cited by Gargilius Martialis in his fish sauce recipe and it can be therefore assumed that this plant was among the ingredients of the *allec* sauce, for its antibacterial properties.

The presence of the *Daucus carota* and *Pastinaca sativa* seeds is unclear since it could also reflect the consumption of their roots.

In order to identify the use of these two taxa, we conducted starch grain as well as phytolith analyses on the same latrine sediments. If present, starches and phytoliths from their roots would indicate their use at least as vegetables, and their seeds would reflect their use as seed stock for horticultural purposes, and not as ingredients for the *allec* production.

We will present the results, and bring our best interpretations to explain the presence of the seeds from these three taxa in Arlon.

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## ENVIRONMENTAL SETTINGS AT NATUFIAN AND PPNA SITES IN THE DAMASCUS REGION OF SYRIA, BASED ON PLANT REMAINS FROM THE ARCHAEOLOGICAL SITES OF BAAZ AND KAUS KOZAH

Katleen DECKERS<sup>1</sup>, Simone RIEHL<sup>1</sup>

*Key words: Vegetation reconstruction, Natufian, PPNA, Charcoals, Seeds*

The rock shelter site of Baaz of in the Damascus province of Syria contains a major occupation horizon attributed to the Natufian Period, while the site of Kaus Kozah, located only 3 km away from Baaz, has a major occupation phase in the prepottery Neolithic A Period, but also contains some evidence for earlier Natufian activities. Macrobotanical remains from both sites were investigated in order to gain an understanding of the vegetation at the end of the Pleistocene and start of the Holocene, and of the possible implications for human occupation and subsistence in the region

Although *Amygdalus* steppe occurred during the Younger Dryas in this region, the PPNA samples from Kaus Kozah indicate that shortly after the Younger Dryas, climatic conditions were moister, resulting in a lush vegetation cover within this region. Although at first sight the vegetation changes seem to be rather minimal, they could have important implications for places where remains of early agriculture sites should be sought. More precisely, while in the Younger Dryas this region seems to have been somewhat further away from the zone of dense stands of wild cereals, shortly after in the early PPNA, this region was probably located within this zone. The sites within the scope of this study nonetheless do not seem to contain evidence of increased reliance on cereals, but this may be due to the fact that both sites were probably places used for hunting.

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## FOOD INGREDIENTS AND COOKING PROCEDURES IN PREDYNASTIC EGYPT: ARCHAEOBOTANICAL EVIDENCE FROM HIERAKONPOLIS

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*Key words: Food preparation, Egypt*

The discovery of food preparation installations at Hierakonpolis provides robust archaeobotanical evidence of raw resources (ingredients) and processing procedures for food during the Predynastic Period in Upper Egypt (3700-3500 BC). The installations appear in two basic configurations, Type 1 & 2. These vats were arranged within rectilinear structures in two rows containing 2-5 vats each. Three examples of Type 1 installation (vats with rounded bases) have been found in HK24A and HK24B, while Type 2 (vats with tapering bases) were discovered at HK11C sq A6. A systematic sampling strategy was designed to collect 46 ash/soil samples from 11 loci around/inside the cooking vats. The sample volumes ranged between 1 and 3 litres of ashy deposits containing charcoal fragments. Well preserved charred plant assemblages were retrieved from all samples of HK24B by use of flotation. These botanical assemblages contained concentrations of charred cereal grains and husk fragments of emmer wheat, free threshing wheat (?), hulled and naked barley. In addition, sprouted grains of emmer wheat, hulled and naked barley were discovered in almost all samples. However, no grains or fruits were found in the samples of HK11C sq A6.

This study provides ample evidence that processing procedures of food began with malted grains and coarsely ground grains culminating in a cooked grain mixture. This grain-based food could have been consumed immediately as a kind of porridge, or it may have been decanted and strained into wort. The strained liquid was then transported to the second installation at HK11C sq A6, where fermentation took place using a more gentle heating system to produce a drink, which could have been beer!

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## ARCHAEOBOTANICAL INVESTIGATION ON THE COPPER AGE SETTLEMENT OF LATSCH (EASTERN ITALIAN ALPS)

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*Key words: Copper Age, Subsistence strategies, Macroremains, Charcoal, Iceman*

The Copper Age site of Latsch represents, so far, the first and only settlement traces contemporary with the Neolithic Alpine Iceman, located within walking distance of his discovery site on the Similaun-gletscher. The site is located in the Vinschgau, Südtirol, Italy, which is assumed to have been the territory of the Iceman. A multi-proxy study aims to deliver an insight into life in this valley in the Neolithic. Archaeological finds provide details of the activities carried out in the settlement; faunal remains give a picture of the composition of livestock and the importance of husbandry, while archaeobotanical investigations supply information about the agricultural system and enable the reconstruction of the former vegetation and its use. This paper presents in particular the results of the macroremains and macrocharcoals analyses. During the excavation, sediment samples were taken from cultural layers (3895-3010 cal BC) and analyzed, delivering significant first results on diet during the Copper Age in the Vinschgau. The macroremain assemblages are dominated by cereals and pulses. The cereals recovered are mainly *Hordeum vulgare* (hulled barley), *Triticum dicoccum* (emmer) and *T. monococcum* (einkorn), in agreement with other cereal finds in northern Italy and those with the Iceman. However, pulses are surprisingly represented by finds of *Pisum sativum* and *P. sativum* ssp. *medullare* (garden pea), which were not recovered with the Iceman, nor in contemporary northern Italian sites. Furthermore, the charcoal analysis reveals a first insight into the woodland vegetation of the lower Vinschgau. There is evidence of an ongoing climate change in the development of the vegetation.

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## DEEP DOWN THE WELLS IN SOUTHERN FRANCE: PLANT REMAINS (NEOLITHIC - ROMAN) FROM MAS DE VIGNOLLES IX AND THEIR IMPLICATION FOR THE STUDY OF SETTLEMENT, ENVIRONMENT AND ECONOMY

Isabel FIGUEIRAL<sup>1</sup>, Pierre SÉJALON<sup>1</sup>

*Key words: Wells, Plant remains, Settlement, Economy, Environment*

Recent rescue excavation work carried out in the outskirts of Nîmes, southern France, led to the discovery of a large density of archaeological remains, which provide new insights on the history of human settlement in this area, from the early Neolithic to the Roman period. At Mas de Vignolles IX five unlined wells provided the conditions required for an archaeobotanical study, constant anoxic conditions and presence of plant remains.

Plant material studied comprised waterlogged and charred seeds/fruits, charcoal and waterlogged wood. The amount of material available varied considerably among the different wells, most probably as a result of factors such as spatial organization of human habitat, length of nearby human presence, distinct uses of wells and different approaches to refuse disposal. On the whole, however, the wells yielded relatively high levels of plant remains which offer evidence of diverse habitats.

Low frequencies of charcoal and seed remains recorded in the Neolithic well may be the result of short-term use of this structure.

The absence of charcoal from the Bronze Age well, coupled with the abundance of seed remains of ruderal plants and crop weeds may testify to the proximity of cultivated fields while the habitat could have been located further away. High concentrations of *Polygonum aviculare* and *Plantago major* suggest the proximity of well trodden areas.

Only the Iron Age well appears to record the presence of a long-lasting human habitat in its close vicinity. High frequencies of riparian elements such as *Fraxinus*, *Ulmus* and *Salix* in the charcoal record suggest that the areas in the immediate proximity of the river were an important source of firewood for local populations.

The presence of cereal rachis elements and the abundance of typical segetal weeds are considered to be a reliable indication of local cereal cultivation. Also, during this period the abundance of *Chenopodium album* and most especially of *Portulaca oleracea* is particularly striking, raising the question of the possible collection and consumption of these plants.

The abundance of reeds in the Roman well is particularly conspicuous. Current research in the Languedoc area appears to associate Gallo-Roman agrarian sites, wells, significant frequencies of *Arundo* and/or *Phragmites* and presence of cultivated fruit, especially grapevine. This may imply that these plants played an important role in the farming system.

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## **ISOTOPIC AND BIOMETRICAL ANALYSES OF CHARRED CARYOPSES FROM A MIDDLE BRONZE AGE STORAGE PIT AT EBLA (NORTHWEST SYRIA): A TOOL FOR IDENTIFYING ANCIENT CROP PROVENANCE?**

**Girolamo FIORENTINO<sup>1</sup>, Valentina CARACUTA<sup>1</sup>**

*Key words: Nitrogen isotopes, Carbon isotopes, Syria*

Nitrogen and carbon stable isotopes have been widely used in archaeology as tools to investigate dietary habits of ancient populations, past environmental conditions and agricultural practices. As far as this last aspect is concerned, most of the analyses have been focused on the identification of irrigational practices, the use of fertilisers and the state of soils.

Given that the simultaneous use of these two isotopes has rarely been done in previous analyses, we intend to discriminate remains originating from different fields, found mixed in a store room at the proto-historic site of Ebla, Syria, by combining elemental carbon and nitrogen isotope analyses with multivariate statistics.

Since the remains are found charred, the first attempt was aimed at evaluating the effect of carbonisation on the isotope signature and the shape, so charring experiments have been carried out on modern samples of Syrian land races.

Once we had ascertained that fresh grains, when reduced to charred remains, retained more or less their characteristic shapes and isotope signatures, we plotted these parameters together to identify cereals harvested at different sites.

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## ARCHAEOBOTANICAL REMAINS FOR CARBON AND NITROGEN STABLE ISOTOPE ANALYSIS: PRE-TREATMENT, PITFALLS AND POTENTIALS

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*Key words: Stable isotopes,  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ , Chemical pre-treatment*

The application of bio-geochemical techniques, in particular carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) stable isotope analyses, to charred archaeobotanical remains is attracting increasing interest. The  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values of plant remains can provide additional information relating to past environment and growing conditions. Isotope values from crop remains, such as cereals and pulses, can be compared with the isotope values of contemporary animal and human remains and also those of surrounding sediments and soils. Used in this way, crop isotope values form part of the isotopic base for unravelling the palaeodietary food webs of local faunal assemblages and societies, and also for contributing information about the wider (regional) palaeoecology, all of which can inform research on the development and changes in past land use and agriculture.

Although the bio-geochemical techniques are well established, their application to archaeobotanical remains is still quite new. Submitting rare and valuable archaeobotanical remains for isotope analysis is a decision not to be taken without due consideration of the requirements and limitations of analysis. As charred plant remains survive in many different burial and depositional contexts, two very important questions arise before the chemistry begins: firstly, do charred archaeobotanical remains retain their original organic molecules and  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  signatures, and secondly, how should these fragile remains be pre-treated to remove potential contaminants before stable isotope analysis?

This presentation explains the approaches we have taken to investigate the preservation and chemical pre-treatment of archaeological grains. We report on the effects of the acid-base-acid (ABA) chemical pre-treatment method, which is often applied to charcoal and charred seeds submitted for radiocarbon dating, and assess its relevance to stable isotope analysis of modern charred and archaeobotanical crop remains. Our results so far indicate that many original organic molecules remain in modern charred and archaeological grains and meaningful isotopic data can be obtained from these often small and unique remains. Therefore, the  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values from charred crop remains found in archaeological contexts have the potential to help reconstruct past ecologies and can also be used to make inferences about past land use and crop husbandry.

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## **CULTIVATION AS SLOW EVOLUTIONARY ENTANGLEMENT: COMPARATIVE DATA ON THE RATE AND SEQUENCE OF DOMESTICATION**

**Dorian Q FULLER<sup>1</sup>**

*Key words: Domestication traits, Early cultivation, Evolutionary rates, Selection coefficients*

Collation of the growing body of quantitative archaeobotanical data on probable domestication traits across a number of crops allows us to assess directly the rate of evolution under cultivation and to infer with greater strength processes of causation. Archaeobotanical data from the Levant remains the most extensive, with evidence on non-shattering from einkorn and barley, and grain size change data for wheats, barley, lentil, pea and chickpea; for comparison a small number of crops from other regions will be considered (Indian mungbeans, African pearl millet, Chinese rice, American sunflower and *Iva annua*). These data leave no doubt that contrary to older assumptions, domestication traits evolved to fixation in early cultivated populations slowly. In order to objectively put slow domestication in perspective, evolutionary rates have been calculated for 10 crops in terms of Darwin and Haldane units (often used in palaeontology). These data demonstrate the rates of morphological change during domestication fall within the modal range of natural evolution, and the slower side of that range. These values further allow estimates of selection coefficients which are typical of natural selection, comparable to estimates from genetic selective sweep data, and orders of magnitude lower than the assumptions of earlier models (e.g. Hillman and Davies). An exploration of the factors that account for slow domestication will be considered including human practices of harvesting and field preparation, and the effects population genetics.

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## CHANGES IN CEREAL CULTIVATION IN SOUTHERN SCANDINAVIA DURING THE IRON AGE: A SURVEY AND INTERPRETATION OF THE ARCHAEOBOTANICAL RECORD

Radosław GRABOWSKI<sup>1</sup>

*Key words: South Sweden, Iron Age, Archaeobotany, Cereal cultivation, Long term change*

This paper is part of a doctoral research project entitled “*The organisation of cereal cultivation in Iron Age south Scandinavia – tradition, innovation and ecological adaptation in a changing society*”, conducted at the Environmental Archaeology Laboratory, Umeå University, Sweden. The main aim of the project is to study causes, processes and influences behind long term change in the organisation of cereal cultivation. A secondary objective is to discuss the application of archaeobotanical and other environmental studies in the establishment of social theoretical models of Iron Age societies.

The research project uses material from a number of southern Scandinavian sites as case studies. These sites are analysed in detail with the methods of archaeobotany, geochemistry, geophysics and palynology using a multi-proxy approach.

In order to interpret the results of the analyses within a regional context, existing archaeobotanical data are used in this paper to present the general development of cereal cultivation in the southern Swedish provinces of Skåne, Blekinge, Halland and Småland. This area has been subject to unprecedented archaeological activity in the last three decades, primarily due to major infrastructure development projects. A significant number of archaeobotanical analyses has been undertaken in connection with these projects but the results are currently presented and published in a fragmented and disorganised manner, hampering insight into major developmental trends in cereal cultivation. By collecting and synchronising data from quantitatively and qualitatively relevant and chronologically well defined assemblages, the distribution and composition of the archaeobotanical material is presented in a comprehensive manner.

The results are used for an interpretation and discussion regarding the introduction of new cultivars, with specific focus on the introduction of *Avena sativa* L. (oats), *Secale cereale* L. (rye) and *Triticum aestivum* L. (bread wheat) as well as the shift from cultivation of *Hordeum vulgare* L. var. *nudum* (naked barley) to *Hordeum vulgare* L. var. *vulgare* (hulled barley). Changing cultivation strategies – such as autumn as opposed to spring sowing – and regional variations in cereal cultivation in southern Sweden between 500 BC and AD 1100 are also addressed.

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## THE “PANTRY” OF TEL ‘ETON, ISRAEL – VESSELS AND THEIR CONTENT

Anat HARTMANN-SHENKMAN<sup>1</sup>, Chen AUMAN-HAZAN<sup>1</sup>, Avraham FAUST<sup>1</sup>, Ehud WEISS<sup>1,2</sup>

*Key words: Pantry, Storage jars, Four-room house, Spatial analysis*

The Iron Age II site Tel ‘Eton is located ca. 18 km west of Hebron. The city was conquered and violently destroyed by the Assyrian army in the late 8<sup>th</sup> century BCE, possibly under King Sennacherib. A massive four-room house, some 180 m<sup>2</sup> (ground floor), was erected in the highest point of the city, with four roofed rooms around an open courtyard in the centre. The building was sealed under a massive wall-fall. One room of this building – the “pantry” – burned to the ground and contained 20 broken vessels. Of these, 12 storage jars contained various plant remains. In an attempt to reconstruct the use of this room, it was excavated in a “prehistoric” manner, with the floor divided into 20x20 cm squares.

In this lecture, we will discuss the content of the different jars, as well as the spatial distribution of plant assemblages on the floor. An additional topic is whether there is a relationship between the typology and the content of the jars.

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## PLANT REMAINS OF THE BRONZE AGE, IRON AGE AND THE ROMAN PERIOD FROM THE TELL OF NIEDERRÖBLINGEN, SACHSEN-ANHALT, GERMANY

Monika HELLMUND<sup>1</sup>

*Key words: Macroremains, Cultivated plants, Metal Age, Flood plain, Tell*

To the south of the Harz mountains, in the area of Niederröblingen and Sangerhausen, Sachsen-Anhalt, a prehistoric settlement was discovered due to the building project for a new Autobahn (BAB A71). The settlement existed close to the flood plain of the river Helme over a time span from the Neolithic to the Roman period, and since the middle/late Bronze Age nearly continuously. The interdisciplinary investigations and analyses are still in progress.

On the flood plain, another historic river bed of the Helme was revealed, which was much later than the adjacent settlement features. Pollen analyses and radiocarbon datings were carried out. They proved that the river sediments were deposited during the late Middle Ages and the sediments of the flood plains in the upper region are still later.

The local settlement persisted at the same location, accumulating a kind of tell of 250 m by 130 m to an actual height of 1.80 m without the plough horizon, especially during the late Bronze Age, the Iron Age and finally the Roman period. Probably due to the excellent preservation conditions, 17 features with mass finds of carbonized cereals were excavated. Eleven records have already been dated by radiocarbon. They mostly belong to the late Bronze Age, but also to the Iron Age and to the Roman period. *Hordeum vulgare*, *Triticum dicoccum*, *T. spelta* and *Panicum miliaceum* were the prevalent cultivated plant species. Chaff was recorded in many of the finds. Legumes were not found here, but seeds of *Lens culinaris* are reported in some samples from the tell layers. *Camelina sativa* and *Papaver somniferum* are represented in samples of the Iron Age. The finds of the macroremains of Niederröblingen reveal an insight into the history of cultivated plants over a time span of around 1500 years.

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## PRELIMINARY DATA ON THE PREHISTORIC AGRICULTURE OF THE SOUTHERN CAUCASUS (THE MAIN PHASES OF DEVELOPMENT)

Roman HOVSEPYAN<sup>1</sup>

*Key words: Caucasus, Prehistoric agriculture, Cereals, Pulses, Oil plants, History of agriculture*

Some similarities in the palaeoethnobotanical situations of several dozen prehistoric agricultural sites are shown, and the main phases of Neolithic to Iron Age (6<sup>th</sup> – 1<sup>st</sup> millennia BC) agricultural development in the southern Caucasus are tentatively reconstructed. Agriculture has been recorded in the southern Caucasus since the late Neolithic period (after the end of 7<sup>th</sup> – beginning of 6<sup>th</sup> millennia cal BC; settlements of Shulaveri-Somu Culture), when a comparably formed agricultural economy existed, where most of the cultivated plants were already domesticated. The prehistoric agriculture of the southern Caucasus can be preliminarily divided into four general phases, which somewhat correspond chronologically with archaeological periods. The first phase includes the late Neolithic and possibly early Chalcolithic periods (6<sup>th</sup> – 5<sup>th</sup> millennia cal BC), and it is characterised by highly developed agriculture, where cultivation of naked cereals (wheats and barley) was primary, but the production of pulses and oil plants was also important. Cultivation in the first phase consisted mainly of naked wheats, naked and some hulled barleys, emmer, lentil, bitter vetch and grape. In addition, there is evidence of the use and possible domestication and cultivation of two oil-producing crucifers, *Alyssum* and *Camelina* (Ararat valley). The second phase includes the late Chalcolithic period (end of 5<sup>th</sup> – first half of 4<sup>th</sup> millennia cal BC). This phase can be considered as a transitional period when the cultivation of naked cereals (bread wheat and naked barley) continued to predominate, hulled barley cultivation started to rise, the cultivation of pulses (lentil and pea) started to fall, and cereal cultivation became the main direction of agriculture. Viticulture and horticulture developed considerably and were finally established in the life of the local population. No oil crops were recorded for the second phase. The third phase, the roots of which come from the previous one (late Chalcolithic), includes the entire Bronze Age and the early Iron Age (after the second half of 4<sup>th</sup> to the beginning of the 1<sup>st</sup> millennium cal BC). It seems that agriculture moved to the secondary plan in this phase, and animal economy was most important for food production. The main and possibly the only direction of agriculture from the early Bronze Age to the early Iron Age period was cereal cultivation, when the main crops were naked bread wheats (common bread, club and round-grained wheats), hulled barleys (mostly 2-rowed and some 6-rowed subspecies) and viticulture. There is no strong evidence of naked barley, and extremely few records of pulses and oil-producing plants in the third phase. The fourth phase began with the Van Kingdom (9<sup>th</sup> – 6<sup>th</sup> centuries BC), when the cultivation of a series of pulses restarted. Also in this phase, several crops which had been previously unknown or poorly known in this region, such as millets, sesame, rye, several fruits, etc., were introduced into local agriculture. Viticulture and horticulture were highly developed in the fourth phase. These data suggest that agriculture and, in general, the plant economy were strongly related to the agricultural and general economic traditions of the dominant population.

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## PRELIMINARY DATA ON THE ARCHAEOBOTANY OF ARENI-1 CAVE (ARMENIA)

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*Key words:* Cave site, Desiccated plant remains, Agriculture, Horticulture, Viticulture

Areni-1 (Birds' Cave) is a karstic cave site situated in the canyon of the river Arpa in southern Armenia (a left tributary of the river Arax, ca. 1000 m asl) that overlooks one of the best passes through the Lesser Caucasus. Excavations directed by Boris Gasparyan, Gregory Areshyan and Ron Pinhasi have revealed well preserved occupation layers dating to the Late Chalcolithic (late 5<sup>th</sup>/early 4<sup>th</sup> millennia cal BC), and the medieval periods (7<sup>th</sup> – 10<sup>th</sup>, 13<sup>th</sup> – 14<sup>th</sup> and 17<sup>th</sup> – 18<sup>th</sup> centuries cal AD), as well as earlier Palaeolithic strata. The Areni region is very dry, with annual rainfall rarely exceeding 300 mm. Modern day vegetation includes dry steppes and rare xerophile forests with an extremely diverse flora, including many edible plants. The cave itself has experienced continually arid conditions, resulting in excellent preservation of anthropogenic organic material, including a wide range of plant remains such as seeds, fruits, and even leaves, rope, textiles, leather and wooden artefacts. The study of well-preserved desiccated plant remains, where selective preservation pressures are greatly reduced, will provide valuable information on a fuller range of wild and cultivated plants exploited in the past and will allow ancient vegetation, agriculture, horticulture, viticulture and the general environment and climate to be considered rigorously. To date, several dozen plant taxa have been identified from Chalcolithic and Medieval deposits, where desiccated fruits and fruitstones of arboreal taxa (*Celtis* sp., *Prunus* spp., *P. armeniaca*, *Persica vulgaris*, *Cerasus* sp., *C. incana*, *C. cf. mahaleb*, *Amygdalus* spp., *Crataegus* sp., *Rosa* spp., *Rubus* sp., *Pyrus* sp., *Elaeagnus angustifolia*, *Juglans regia*, *Juniperus* sp. (seeds), *Capparis spinosa*, *Vitis vinifera* and *V. sylvestris*) are commonly found. A wide range of field-crops and weedy plants also occur, including *Triticum aestivum*, *T. dicoccum*, *Hordeum vulgare* (both naked and hulled varieties), *Lens culinaris*, *Lathyrus* sp.; species of *Buglossoides*, *Lithospermum*, *Vaccaria*, *Ranunculus*, *Galium*, *Polygonum*, *Camelina*, *Alyssum*, *Thlaspi*, *Scrophularia*, *Althaea* and *Allium*. The field crops and weeds occur in lower frequencies relative to the arboreal taxa, suggesting a heavy emphasis on fruit cultivation and collection at the site. This emphasis continues today and the Areni region is often associated with highly developed viticulture and horticulture of apricots, peaches, plums, cherries, apples and pears. The majority of the woody and shrubby plants identified from the cave are common elements of rare xerophile forests of the Daralagez floristic region, where the cave is situated. The only exceptions could be walnut, peach and grape cultivars, which have become naturalized in the wild in this region.

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## CROP DNA EVIDENCE FOR THE SPREAD OF AGRICULTURE IN EUROPE

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*Key words: Phylogeography, Barley, Multiple origin*

Recent research indicates that traditional local landraces of barley, that have not been subject to formal crop improvement, retain, at least partially, a genetic record of their prehistoric origins. The phylogeographic distributions of adaptive and non-adaptive genetic markers in European barley landraces are therefore used to provide information on the origin and spread of agriculture. In particular, there is evidence to indicate multiple origins of barley in western Asia, which may have been followed by independent routes of spread into Europe.

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**IMPLICATIONS OF SPICE PLANT REMAINS FROM THE EARLY HISTORICAL COASTAL SITE AT PATTANAM, THRISSUR DISTRICT, KERALA, INDIA****Mukund KAJALE<sup>1</sup>, P.J. CHERIAN<sup>2</sup>***Key words: Spices, Pattanam, Mantai, Indo-Roman, Trade*

The paper embodies recent results and implications of palaeoethnobotanical findings from the coastal archaeological site of Pattanam in south India and the inland site of Mantai, northern Sri Lanka, especially ranging in age from c. 500 BC to c. AD 1000 for assessing the roles of various economically important plants in transoceanic trade and socio-economic environment of contemporary western and central Europe and the Mediterranean regions.

From Pattanam, there is factual evidence for economically important plants like pepper (*Piper nigrum*), cardamom (*Elettaria cardamomum*), sandal wood (*Santalum album*), teak (*Tectona grandis*), frankincense (*Boswellia serata*), etc. recovered from waterlogged historical levels.

The paper also discusses the significance of plant remains (spice and non-spice) from Mantai for a wider understanding of inter-regional trade relations between south Asia, northern Africa and Europe during the Indo-Roman and later historical periods.

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## CROSS-DISCIPLINARY STUDIES ON THE EVOLUTION AND CULTURAL HISTORY OF FLAX AND LINEN IN SOUTHERN SCANDINAVIA

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*Key words: Linum usitatissimum, Cultural history, Late Bronze/Early Iron Age, aDNA*

According to current evidence, flax was introduced to Scandinavia during the first millennium BC. Several records of carbonised seeds, as well as uncarbonised seeds, capsule fragments and stems are dated to the late Bronze Age/early Iron Age. Offerings of flax stems in ritual deposits clearly show that the plant and its products were highly appreciated by the Iron Age population.

During recent years, the use of flax for textile production has been shown by the results of excavation of a number of structures in Denmark in which flax stems had been retted. The best preserved structures were excavated by archaeologists of the Odense City Museums on the island of Fyn. At three localities that can be dated between the late Bronze Age and the Migration Period, a number of wells were detected. Bundles of flax stalks without seeds were regularly found at the bottom of these wells. A similar large-scale flax production site has been revealed at a Viking Age excavation on Sjælland, where more than 50 retting pits were found in the vicinity of a settlement.

Textiles made of linen are rare finds in the Scandinavian archaeological context. The earliest Scandinavian woven textiles are all made of wool and date to the early Bronze Age. From the early Iron Age a few linen textiles have been preserved in grave finds, while in the late Iron Age linen was clearly an important part of the costume.

Besides the use of flax stem fibres for textile production, the seeds serve for food, and they are particularly useful since they contain high concentrations of short-chain omega-3 fatty acids. Today we know that different types of flax exist, fibre and oil flax. The questions as to when these different types separated during evolution of the flax plant, and which types were used in prehistoric times, are not yet solved. A new approach is currently being applied to archaeobotanical finds from Denmark, in which seeds, capsule fragments and stems from the Iron Age period are being examined using biomolecular methods. The results thus obtained will improve our understanding of the evolution, origin and spread of flax, and will lead to a better understanding of past interregional communication and trading systems.

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## OBSERVATIONS OF LANDRACES OF WINTER RYE IN SLASH-AND-BURN EXPERIMENTS IN ESTONIA

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*Key words: Slash and burn, Swidden fields, Burnt land, Winter rye, Yield*

According to historical sources there was a special landrace of winter rye grown on the burnt land that differed from the one grown on permanent fields. The burnt land rye was characterized by exceptionally numerous stems – one plant could produce up to 30-40 of them. At the time prior to agricultural modernisation the yields of a permanent manured field were 4-fold, so one sown seed produced approximately four crop seeds. The average productivity of the burnt swidden fields was reportedly 10-20 seeds, although this high yield was reached only during the first year of cultivation. The crops from the second and the third years were much lower, closer to the productivity of the permanent fields. Together with the ending of swidden cultivation this landrace has been lost in Estonia.

There has, however, been some hesitation about the correctness of the reported high yields of swidden fields among agrarian historians. The experiments done during recent years tend to confirm the historical and ethnographic data. A small-scale experiment was conducted in 2006 in southern Estonia near Tartu, where seeds of rye were planted one by one in a burnt-land bed of 1.5 x 3 m<sup>2</sup>, about 30 cm apart. The seeds were planted straight into ashes, to a depth of ca. 1 cm. This experiment produced 28 plants; 40 stems with ears per plant (max. 83) and approximately 40 grains per ear, thus amounting to an average productivity of 1600 seeds to 1 planted seed. The productivity of this small-scale planted bed experiment probably cannot be extrapolated to the conditions of larger-scale swidden fields.

Another experiment was started in 2007 in southeast Estonia, in the territory of Karula National Park. Two experimental sites have been burned over in 2007 and 2009. On both sites a 20 to 25-year-old, mainly deciduous scrub was cut down, dried and burned. On both plots a landrace of winter rye was sown, on the first field in two consecutive years; in the second field the first year of cultivation is going on presently. Preliminary results from these experimental fields display similar dynamics to those described in historical sources – the first yield of winter rye from a swidden plot gave at least 10 seeds to 1; the second yield from the same plot was considerably lower. The first year plants had approximately 6 stems with ears (max. 22 ears); in the second year at the same field most of the rye plants had only one stem. The nutrient quality of the first year crop has been analysed in comparison to present-day winter rye varieties. The burnt-land rye displays smaller grains but otherwise equal quality markers (protein content, falling number and bulk content) compared to the present day varieties.

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## THE ORCHARD IN THE NEOLITHIC: *MALUS* IN CENTRAL EUROPE

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*Key words: Neolithic, Orchard, Central Europe, Apple*

The landscape in the Neolithic is dominated by dense forests. Areas suitable for light demanding woody taxa such as the thorny shrub or small tree wild crab apple, *Malus sylvestris*, are extremely rare. Only special stands with more open vegetation like river banks and small scale natural forest openings offer appropriate ecological conditions for the growth of wild apple. Human activity opens the woodlands, creates hedges and gives new habitats to many fruits like sloe, raspberry and blackberry, hawthorn, elder and briar. All these fruit shrubs are neglected by cattle. In contrast, all wild and domestic animals browse on apple leaves, twigs and fruits. A young apple tree in the surroundings of a prehistoric village with free browsing of domestic stock has no chance to grow.

A collation of published records on *Malus* sp. from archaeobotanical databases has resulted in more than 100 entries for the Neolithic period. This large number of prehistoric records of *Malus* sp. was never again reached in the metal ages. It reflects that livestock husbandry has gained a higher importance and does not show an effect of a biased state of the art.

Findings of apple pips and halves of dried apples in a prehistoric settlement stem from either wild, domestic or feral forms. For feral forms, we can predict domestic ones as predecessors. The question of domestication is complicated and cannot be answered in a satisfying way by analysing the apple remains alone. Perhaps frequency of findings gives a hint. For example, in Okolište, a Neolithic settlement in Bosnia, we have three kinds of fruits and nuts, common and ubiquitous ones like hazel and cornelian cherry – we believe in *Corylus* and *Cornus* gardens – rare ones with 1-3% frequency like *Physalis*, *Fragaria*, *Sambucus ebulus*, *Prunus spinosa* and *Rubus fruticosus*, and very rare ones, *Rubus idaeus*, *Vitis*, and *Rosa* with less than 1%. *Malus* is in the second group with 1-2%. If we have charred apple pips or fruits in an excavated prehistoric settlement in a similar frequency to other less sensitive sturdy fruit pips like *Rubus* or *Rosa* or *Prunus spinosa*, then we can presume that apple was a common food source in this settlement. For Okolište, we think that these one to two percent of apple remains represent a common food that was grown in protected areas.

In general, we state that a woodland management strategy to protect apple trees is developed in Neolithic times. Man has to protect this common source of food against domestic stock and wild animals. Protection is the first step towards cultivation and the establishment of orchards.

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## **WAS THE NEOLITHIC REVOLUTION IN THE NEAR EAST REALLY AN AGRICULTURAL REVOLUTION?**

**Mordechai KISLEV<sup>1</sup>, Orit SIMCHONI<sup>1</sup>, Anat HARTMANN-SHENKMAN<sup>2</sup>**

*Key words: Agricultural Revolution, PPNA, Near East, Domestication*

We all believe that the agricultural revolution began in the Near East during the PPNA. Quantities of wild or domesticated barley, emmer wheat, oats, lentils, as well as hard wheat, chick pea and flax are reported from dozens of early Neolithic sites. However, a careful observation of the results of each site reveals that in many cases only one or two crops are present (monoculture). It is suggested that crop cultivation as well as domestication were independently invented in various sites scattered in the Fertile Crescent. In other words, the change from hunter-gatherers into farmers was a slow process – a quiet revolution, which lasted for thousands of years in the Near East. At the end of this period some farmers adopted the additional crops and were ready for exporting the products of this process, which made the agricultural revolution in Europe, North Africa and the rest of Asia.

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## WOOD USE AND MANAGEMENT OF THE FINAL MESOLITHIC FISHERMEN-HUNTER-GATHERERS ON THE SOUTHERN BALTIC SEA COAST

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*Key words: Wood use, Mesolithic, Hazel, Coppicing, Fishing gear*

In the last 12 years several excavations have been carried out in northern Germany on the southwestern Baltic coast in wetlands and under water, where many wooden artefacts were found. This research deals with remains from final Mesolithic coastal settlements of the Ertebølle Culture between 5500 and 4100 BC and the transition to early Neolithic. The importance of fishing and hunting is reflected in the artefact spectrum found at the shore line, mainly fishing gear.

In the context of these investigations, wood analyses were carried out on the artefacts and measurements and signs of working were recorded. In the case of hazel sticks, annual rings were generally counted. Overall the data comprises about 450 pointed sticks, 370 leister prongs for eel catching, 100 spear fragments and 400 other artefacts like paddles, dugout canoes, fish trap baskets, stone tool handles, bows, arrows etc. Remains of scattered fishing fences, burnt wood and wood waste material make up an additional 3000 pieces of wood.

The results of the wood analyses show that specific woods were chosen for different implements. Clear preference exists, for instance, for hunting bows made of elm (*Ulmus* sp.), paddles and spears of ash (*Fraxinus excelsior*) and log boats of lime (*Tilia* sp.). Moreover many of the wooden sticks found in the waste layers of the former shallow water zone belong to destroyed fishing fences. They were made of wickerwork from hazel rods (*Corylus avellana*). For the construction and maintenance of these structures huge amounts of long straight hazel rods were needed. Results from botanical investigations indicate that hazel rods were produced by coppicing the bushes. Presumably the same was done with dogwood (*Cornus sanguinea*) and guelder rose (*Viburnum opulus*), which were used intensively for the building of fish trap baskets.

Hazel and other open woodland species were preferentially selected and favoured by people, so that anthropogenic open habitats already developed at the end of Mesolithic period on the Baltic coast. Oak (*Quercus* sp.) and other deciduous taxa as well as fruit trees (Maloideae) were also used for wood working and burning.

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## NEOLITHIC FARMING AND ENVIRONMENTAL CHANGE DURING THE FUNNEL BEAKER CULTURE IN NORTHERN CENTRAL EUROPE

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*Key words: Neolithic, Plant macroremains, Pollen analysis, Funnel Beaker Culture*

Environmental change and farming as a basis for monumentality are an aspect of a research project on the Funnel Beaker Culture in northern central Europe (4100–2900 BC). So far the number of archaeobotanical investigations on this culture is low due to the fact that only very few settlements are known and have been excavated. Megalithic tombs usually contain few botanical remains - the same is true for earthworks. It is now a great opportunity to improve the state of archaeobotanical knowledge as this study is embedded as a central project in the priority programme of the German Research Foundation (DFG) on 'Early monumentality and social differentiation'. Within this, multidisciplinary cooperation allows regular and intensive sampling for archaeobotanical analyses.

Onsite macroremains from megalithic graves, earthworks and settlements give insight into subsistence economy and the variety and importance of used plants. Well-dated high-resolution pollen analyses aim at reconstructing environmental changes on different spatial scales so that micro-, meso- and macroregional patterns and their underlying factors can be identified. Tephrochronology and analyses of laminated sediments are applied to get estimates of the dating, speed and duration of settlement processes and landscape development.

The first results of the macroremain study are based on about 300 soil samples from nine Neolithic sites in northern and central Germany. They provide a sound basis for reconstructing agricultural activities and the importance of various crop plants during the Funnel Beaker Culture. Plant remains in these contexts are sparse and badly preserved, which is generally the case for Neolithic sites in Europe. We will discuss whether the low density of plant finds hints at special husbandry practices or food processing. Around 37% of the samples contain identifiable plant remains. Both cultivated and gathered plants are found regularly. Emmer (*Triticum dicoccum*), einkorn (*Triticum monococcum*) and naked barley (*Hordeum vulgare* ssp. *nudum*) were cultivated. No oil plants are recorded up to now, but one remain of pulse was found. Evidence of weeds shed more light on husbandry practices. While our understanding of the economy of the Funnel Beaker Culture so far was decisively based on plant imprints in ceramics and just few soil sample finds, the new project offers an extended material basis for the reconstruction of early agriculture.

For further information see also the website: <http://www.monument.ufg.uni-kiel.de/projekte/differenzierung-von-landwirtschaft-und-umwelt>.

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## WEED FINDS AS INDICATORS FOR THE CULTIVATION REGIME OF THE EARLY NEOLITHIC BANDKERAMIK CULTURE?

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*Key words: Weeds, Garden cultivation, Early Neolithic, Central Europe*

Archaeobotanical investigations have been carried out in the context of two research projects on the beginning of the Neolithic in western central Europe. Results from 51 sites have been archived with our database programme *ArboDat*®.

During the second half of the 6<sup>th</sup> millennium BC in Hungary and beyond, a new agricultural system began. In contrast to the cultural groups of the Starčevo-Körös-Criș complex of southwest and eastern Hungary, Romania and Bulgaria, agricultural communities of the Bandkeramik Culture started cultivating a crop spectrum which was reduced.

The archaeobotanical results can be interpreted as hints of a simple agricultural system with an emphasis on summer crop growing. According to the archaeobiological results and the archaeological state of research, the management of the fields was practised by handwork without ploughs. The type of reproduction, ecological strategy types as well as life and growth forms of the Bandkeramik weed species are discussed as indicators of the intensity of field cultivation.

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## THE ARCHAEOBOTANICAL DATABASE PROGRAMME *ARBODAT*®, A TIME ECONOMIZING TOOL FOR DATA ARCHIVING AND EVALUATION (GERMAN, FRENCH AND ENGLISH VERSION)

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Dagmar DRESLEROVÁ<sup>3</sup>, Adéla POKORNÁ<sup>3</sup>, Dana KŘIVÁNKOVÁ<sup>3</sup>

*Key words: Database, Archaeobotanical macroremains, Supraregional data exchange*

In 1999 the database programme *ArboDat*® was designed by the working group at Wiesbaden to handle large numbers of archaeobotanical results as well as the whole range of archaeological, ecological and other related data. The programme has been considerably improved and updated since then and is now used in 23 laboratories in central Europe.

Based on Microsoft Access, *ArboDat*® is a valuable working tool not only for archiving data but also as a research database suited for data evaluation. Data input or standard evaluations can be conducted without special knowledge of Access. Some forms, reports and queries for data analysis are part of the software provided to colleagues together with a detailed manual. Very useful tools economizing much working time are the new automatic taxa list functions “at the push of a button”.

The underlying concept of *ArboDat*® is to facilitate a supraregional archaeobotanical data comparison and exchange. *ArboDat*® is provided free of charge to archaeobotanical work groups or scientists, in order to support such a supraregional data evaluation in future.

In 2006 a French version of *ArboDat*® was produced in collaboration with the national project of a French bio-archaeological database represented by Stéphanie Thiébault and Marie-Pierre Ruas, Muséum National d'Histoire Naturelle, Paris.

At the moment, an English version of *ArboDat*® is being prepared together with Dagmar Dreslerová, Adéla Pokorná and Dana Křivánková from the Archaeological Institute of the Academy of Sciences, Prague, in the context of a national Czech project.

Essential features of the programme versions and examples of data evaluation possibilities will be briefly presented.

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## LATE NEOLITHIC SETTLEMENT IN A TIDAL ENVIRONMENT OF NOORD-HOLLAND, THE NETHERLANDS

Lucy KUBIAK-MARTENS<sup>1</sup>

*Key words: Plant remains, Parenchyma, Organic residues, Late Neolithic subsistence, North Holland*

In the 1980s and 1990s a series of late Neolithic settlements associated with the Single Grave Culture (ca. 2900-2500 cal BC) was excavated in the province of Noord-Holland. The exceptional quality of the sites, especially regarding the preservation of organic material and settlement features was overwhelming. Until now, however, the excavation data from the sites have never been analysed integrally. In spring 2009, The Netherlands Organisation for Scientific Research (NWO) has granted a subsidy to a group of specialists to carry out a multi-disciplinary project called "Unlocking North Holland's Late Neolithic Treasure Chest". The project is now well underway and concerns three settlement sites: Kolhorn, Mienakker and Keinsmerbrug.

Archaeobotanical studies focus on seed and fruit assemblages as well as parenchymatous vegetative plant remains including roots and tubers, and organic residues preserved on pottery. This rather unusual (in archaeobotany) combination of data has allowed the accumulation of evidence that is of particular relevance in reconstructing the diet and subsistence of the late Neolithic population living in a tidal environment in Noord-Holland. The project – as soon as completed – should also allow significant advances in our understanding of economic processes and cultural dynamics in the northwest European late Neolithic in general.

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## THE BRONZE AGE FIRST-AID KIT, ACCORDING TO PALAEOBOTANICAL DATA FROM ARCHAEOLOGICAL SITES IN GEORGIA

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*Key words: Medicinal plants, Seeds, Pollen, Non-pollen palynomorphs*

An investigation of pollen, non-pollen palynomorphs, fruits and seeds preserved in baskets, pots and other objects from Bronze Age graves provides some insight into the medicinal remedies that accompanied burials of that period. Further evidence of Bronze Age medicines comes from organic substances in mortars and grinders preserved in settlement layers. The results suggest that humans in southern Georgia were probably aware of the curative properties of *Tilia* flowers by the 3<sup>rd</sup> millennium BC. Large quantities of lime pollen were found in a basket in burial mound No. 2 on the Bedeni Plateau. Bundles of blossoming lime branches may have been collected in this basket and bound together with flax ribbon. The same basket contained macroremains of millet (*Panicum*) and pollen of many medicinal herbs. The occurrence of all these medicinal taxa leads us to believe that the basket was a domestic medicine chest. Large amounts of lime pollen were also found on the internal wall of a small wooden casket in the rich No.10 burial mound at Bedeni. The lower section of the casket contained charred leaves and burnt plant stalks. Pollen analysis showed that these remains were dominated by pollen from various medicinal herbs, although the composition varied in different sections of the casket. For example, *Artemisia* pollen is predominant in one section, while *Chenopodiaceae* prevails in the second, *Cichorioideae* in the third and *Solidago* in the fourth. Well-known medicinal herbs such as *Achillea*, *Trifolium*, *Polygonum* and *Plantago* are all represented palynologically. Samples taken from the padded walls of the casket contain pollen of melliferous plants and microremains of bee hair. This may indicate that pieces of propolis or bee wax were kept in the casket or used as sealant. Charcoal may have also been a part of this medicine in the chest, judging by the large quantity of charcoal macroremains. The small, woven box found in Bedeni burial No. 5 containing figs, millet and wheat could have been for medicinal purposes. By the second half of the Bronze Age, medicines were also placed in small pots. The richest material from the Safar-Kharaba and Imera burials suggests that mead, vine leaves and extracts of *Juniperus* and *Ephedra* were used as medicine. *Vitis* pollen was encountered in large amounts in women's graves, occurring in organic material found on their teeth and in their stomachs.

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## SEEDS IN CONTEXT – THE ARCHAEOBOTANICAL MACROREMAINS FROM MURO TENENTE, SOUTHEAST ITALY

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*Key words: Early Hellenistic period, Agricultural intensification*

From an archaeobotanical point of view, pre-Roman southeast Italy is a scarcely explored area. We know very little about agricultural production, land use and the organization of rural towns and farms in the first millennium BC. The few pioneering studies on this matter have remained isolated: synthesizing papers on, for instance, long-term developments in land use are rare. A general framework for the interpretation of archaeobotanical remains is much needed.

A case in point is the settlement of Muro Tenente in Puglia. Systematic soil sampling has revealed large quantities of carbonized archaeobotanical macroremains on this site, mostly dated to the early Hellenistic period (late 4<sup>th</sup> - early 2<sup>nd</sup> century BC). The purpose of this talk is to present the archaeobotanical material from Muro Tenente and interpret it in a larger, regional perspective.

Muro Tenente forms a case study in a long term project carried out by the author on charred macroremains from several key sites in southeast Italy, dating from the first millennium BC. In this period, major changes in landscape organization, settlement dynamics and agricultural practices can be witnessed. Possible evidence for these changes can be found in the archaeobotanical record from several sites. Particular attention is paid to issues such as agricultural intensification, centralization and increasing human impact on the landscape. The purpose of this study is to create a regional and diachronic perspective on the mutual relationship between human societies and the physical landscape in pre-Roman southeast Italy.

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## MACROREMAINS AND POLLEN PATTERN OF *PINUS SYLVESTRIS* – CONNECTED OR DISCONNECTED? – BASED ON FINDINGS IN POLAND SINCE THE NEOLITHIC

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*Key words: Pinus sylvestris, Macro- and microremains, Archaeological sites, Poland*

The macroscopic remains of *Pinus sylvestris* (Scots pine) preserved in archaeological sites are charcoal, bark, cones, leaves (“needles”), husks and seeds. The most common macroremains of pine from Polish archaeological sites are fragments of charcoal. The remains of Scots pine have been found so far on 276 sites of different ages.

Pine, a wind pollinated tree, produces huge amounts of pollen grains. Each pine pollen grain is equipped with air sacs, which help to disperse them over vast distances, which means hundreds or even thousands of kilometres. Pollen grains (microscopic remains) of pine are identified as *Pinus sylvestris* type. As pine does not have any strong requirements for environment conditions, it is a pioneer plant. Pine pollen grains are present in practically all pollen spectra, even coming from completely treeless landscape sites. Nevertheless *Pinus sylvestris* t. pollen could be a sensitive indicator of human activity in the past. Decreases and increases pine percentage curves in pollen diagrams, together with the presence of anthropogenic indicators like charcoal or *Cerealia* undiff. pollen in the same pollen spectra, provide some information of unconscious or more conscious burning of forest or cutting of pine trees for various economic purposes. The analysis of pine curve changes in the offsite pollen diagrams from near the archaeological sites being studied, together with the presence of macroscopic pine remains directly from these sites, give more probable evidence of human pressure on the woodland and more widely on the environment. The comparison between isopollen maps of *Pinus sylvestris* t. showing the distribution of its pollen and the presence of Scots pine macroscopic remains on the archaeological sites in Poland since Neolithic is under interpretation.

Both types of material, palynological and from macroremains, confirm the widespread presence of Scots pine in different forest communities. The cultural nature of the preserved remains in archaeological sites indicates the gathering of pine wood and its uses such as for fuel in hearths and kilns in the farms. At several sites, such as those from the Roman period, it can be demonstrated how this pine was used in funeral rituals. Simultaneously, the pine pollen curve showing a decrease could be interpreted as a proof of the active cutting of pine wood by the people. Conversely, the increase of the pine pollen curve, following the sharp decrease of other tree percentages, is interpreted as evidence of immigration of new pine trees into the previously cleared areas.

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## ARCHAEOBOTANICAL INVESTIGATIONS AT THE ROMAN IRON AGE AND MEDIEVAL SITE OF ELSFLETH-HOGENKAMP (NIEDERSACHSEN, GERMANY)

Wolf LOHMANN<sup>1</sup>

*Key words: Cultivated plants, Weeds, Iron Age, Northwestern Germany*

Exceptional metal findings at the Roman Iron Age and Medieval site of Elsflëth-Hogenkamp led to a test excavation. The site is situated in the riverine clay district in northwestern Germany, next to the river Hunte, near its confluence with the river Weser. Due to this position and the archaeological finds, the site is thought to have been a landing and market place. Most finds were made during several surveys. In a small-scale trench dug next to the mound, parts of a former channel of the river Hunte or a ditch were excavated, containing well preserved waterlogged plant remains. Most samples are from the organic sediments filling the channel or ditch. Two further samples were from a pit and a sherd pavement. Two samples of the fill were radiocarbon dated, one near the base (AD 155 ± 85), and one near the top (AD 430 ± 110) (2σ).

About 200 taxa were identified, mostly by their seeds and fruits. Among these, ten species of cultivated plants were found. The most abundant were *Linum usitatissimum*, *Triticum dicoccum* and *Hordeum vulgare*. Smaller numbers were found of *Camelina sativa*, *Isatis tinctoria*, *Triticum monococcum*, *T. cf. spelta* and *Panicum miliaceum*. Probably the plants were cultivated near the site and further processed at the site. *Triticum cf. spelta* is rarely found in the Roman Iron Age in northern Germany. *Isatis tinctoria* is rare too, and it was also found at the contemporary site of Feddersen-Wierde.

*Cannabis* and *Avena sativa* could be identified only in the sample from the pit dated to the first century AD by potsherds. So far it is the earliest find of hemp seeds in northern Germany. Its regular cultivation began here about AD 1100.

Fruits and nuts of *Corylus avellana*, *Sambucus nigra*, *Prunus spinosa*, *Rubus idaeus*, *Malus sylvestris*, *domestica* and *Rosa* sp. were collected. Identified wood fragments were from *Alnus* sp., *Quercus* sp., *Salix* sp., *Fraxinus* sp., *Ulmus* sp. and *Acer* sp., most probably brought to the settlement to be used for various purposes.

From the natural and synanthropic vegetation, taxa of freshwater reed beds, typical of the modern plant communities of the *Phragmites*, *Magnocaricion* and *Bidentetalia tripartiti*, were most common. Also present were taxa of wet meadows, pastures and rural habitats. Some of the weed species are typical of *Linum* fields. Finds of *Agrostemma githago* and *Raphanus raphanistrum* may indicate the presence of winter corn, but might be imported. Halophytes indicating salty conditions were quite rare.

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## DETECTING INTRA-SITE PATTERNS WITH SYSTEMATIC SAMPLING STRATEGIES – ARCHAEOBOTANICAL GRID SAMPLING IN LAKESHORE SETTLEMENTS

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*Key words: Sampling strategies, Intra-site patterns, Neolithic, Wetland sites, Southwest Germany*

The moorland settlement „Torwiesen II“ is located in the Federsee, southwest Germany. The archaeological layer was about 1 metre below the modern surface embedded in peat. The whole site covered an area of about 2000 m<sup>2</sup>. The 15 houses, arranged in two rows along a central boardwalk, have dendro dates between 3283 and 3278 cal BC representing one settlement phase of the Horgen Culture. In 1997-2005 the entire settlement was excavated by the Landesamt für Denkmalpflege Baden-Württemberg and in 2005-2007 a multidisciplinary project was carried out, financed by the DFG (German Research Fund).

From the beginning a systematic sampling programme has been conducted, providing samples not only for the archaeobotanical investigations, but also for the other involved disciplines (wood and charcoal analysis, pollen and phosphate analysis, animal bones, insects and intestinal parasites). As in the site Hornstaad Hörnle IA („Röhrchenprogramm“) in every square metre a plastic tube, 10 cm in diameter and 20-30 cm long has been brought in from the surface of the cultural layer. Every second tube was analysed archaeobotanically and more than one million plant remains of more than 150 taxa (crops and wild plants) were identified. For every species and every tube the concentration (remains per litre of sediment) was calculated and plotted with *AutoCAD*. Every plot shows the quantitative distribution of a species on the site and indicates a special pattern that may reflect economic conditions or even social differences in the settlement. With the plots we were able to detect areas of special activity inside and outside the houses: a zone for dehusking emmer, another zone for threshing naked wheat, an area for threshing flax capsules and others. Cereal chaff has been used for making fire and charred edible plant parts around the hearths indicate that they had been used in cooking meals. Rubbish heaps with large amounts of burnt animal bones, charcoal, human coprolites and other organic waste were clearly separated from the areas of crop processing. The content of crops and edible wild plants inside the houses show the socio-economic structure of the settlement with full-range farmers, crop-specialists and gatherers. Altogether it seems that this was not a consistent community of equal families, but much more a structured society.

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## FREE THRESHING WHEAT FROM BULGARIAN PREHISTORY

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*Key words: Neolithic, Chalcolithic, Early crop cultivation, South Eastern Europe*

During the Neolithic up to the Iron Age, the main staple cereal crops in southeast Europe were the hulled wheats (einkorn and emmer). The free threshing wheats, which are much more widespread today, occurred only sporadically during the prehistoric period in the area under consideration. The palaeoeconomic significance of these wheats increases during the Bulgarian Late Neolithic/ Early Chalcolithic, when the first storage finds are known. The period between 4800-4500 cal BC is the time when their storage finds increase in the archaeobotanical record, especially for the Black Sea coastal area and eastern Thracian plain, at sites like Durankulak, Sava, Bikovo, Azmak, Simeonovgrad etc. Together with the already well known finds from Bulgaria, some recent storage finds mainly from the Bulgarian Early Chalcolithic period (ca. 4800-4500 cal BC) raise the question whether these wheats were actually cultivated in the area under consideration. A similar tendency is also well illustrated at several sites in the Chalcolithic period (4800-4200 cal BC) of western and eastern Romania. During the Bronze Age and the Iron Age of Bulgaria, these wheats could be found in several sites, but until now they are rarely found as storage finds.

Based on the data from the archaeological sites in Bulgaria, the way of use and the importance of the free threshing wheats during the prehistoric period is evaluated in the paper.

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## CULTIVATING SOCIETIES: NEW EVIDENCE FOR ARABLE AGRICULTURE FROM NEOLITHIC IRELAND

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*Key words: Ireland, Neolithic, Agriculture, Cereals, Database*

Investigations into the origins and development of agriculture, and associated societal impacts, continue to be a major focus of research in European archaeology. Ireland is, however, often conspicuously absent from such discussions, despite its rich evidence for Neolithic settlement. Although the 'first farmers' are often referred to in accounts of Neolithic Ireland (4000–2500 BC), there is little discussion of how farming was practised, and the situations in which crops were consumed and deposited. Even less attention is paid to understanding how the production and consumption of these crops may have changed over the course of the Neolithic.

Closer examination of early agriculture in Ireland is timely, particularly because of a recent increase in the detection of Neolithic sites, many of which were found during archaeological investigations associated with large-scale infrastructural projects. A research project, funded by the Heritage Council (INSTAR awards 2008 and 2009), has been established to collate all unpublished and published evidence for charred plant macro-remains from Neolithic Ireland. This paper will detail the results of initial analyses of the newly established dataset, which contains archaeobotanical evidence from more than 50 Neolithic excavations.

Cereal remains were present at approximately three-quarters of Neolithic sites where plant macro-remains were recorded. Emmer wheat appears to have been the dominant crop grown during this period, and there is also evidence for naked wheat, hulled barley and naked barley. The recovery of flax and possible pea remains extends the range of crops being cultivated at this time in Ireland. Cereals were recorded at a wide range of site types, suggesting that many different communities used cereals in a variety of circumstances. In order to place the Irish evidence in context, this paper will also provide the results of preliminary comparison analyses between the Irish and European Neolithic datasets.

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## FOOD-PLANT REMAINS FROM THE MOUSTERIAN NAHAL MAHANAYEEM OUTLET, ISRAEL

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*Key words: Edible plants, Hula valley, Mousterian, Nahal Mahanayem Outlet, Wet-habitat plants*

Thousands of remains of seeds and fruits have been identified from the new Middle Palaeolithic Mousterian site of Nahal Mahanayem Outlet (NMO). This site at the outlet of river Nahal Mahanayem to the river Jordan was discovered as the result of a drainage operation north of Gesher Benot Ya'aqov in the southern Hula valley, Israel. Survey and surface collection brought to light the presence of a rich lithic assemblage ascribed primarily to the Mousterian tradition. Significant pre-excavation finds include a fragment of human skull, and a skull and femur of a lion. The first two excavation seasons revealed thousands of seed and fruit remains. OSL dating suggests 70 kyr for the layer that contained these botanical remains.

The remains were found waterlogged and most of them in their original shape. The species which were identified to date belong in a variety of wet habitats as well as some dry habitats. The most common remains are those of *Scirpus lacustris* which is an emergent plant of fresh or brackish shallow water, a frequent habitat in the river Jordan banks. Generally, the botanical assemblage suggests a vegetation which is similar to that prevailing in the Hula valley today.

Remnants of some edible plants were found, most of which are from wet habitats, such as *Butomus umbellatus*, *Ceratophyllum demersum*, *Myriophyllum spicatum*, *Nuphar lutea*, *Typha sp.* and *Vitis sylvestris*. Edible plants of dryer habitats, such as *Beta vulgaris* and *Sylibum marianum* were also found. These plants supply several types of vegetable foods from their berries, leaves and seeds as well as from underground storage organs (USO). However, it seems that the flora is somewhat smaller than that of the Gesher Benot Ya'aqov site (780 kyr), since none of the exotic water plants that were found in this nearby Acheulian site have been identified in NMO yet.

The rich palaeobotanical assemblage of NMO provides us an opportunity to expose a new segment of the palaeo-vegetation sequence in the Hula valley. The results of this palaeobotanical research together with those of the Lower Palaeolithic site of Gesher Benot Ya'aqov will lead us to a better understanding of the changes that took place in the vegetation and the environment near hominid activity sites in the Hula valley during the Middle and Upper Pleistocene.

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## MESOLITHIC PLANT GATHERING AND EARLY AGRICULTURE IN NORTHEAST LIBYA: THE PLANT REMAINS FROM HAUA FTEAH AND HAGFET AL-GAMA

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*Key words: Northeast Libya, Mesolithic, Neolithic, Archaeobotany*

This paper reports on the preliminary data from the analysis of macro-botanical remains collected in the archaeological sites of Haua Fteah and Hagfet al-Gama (Cyrenaica, Libya). These studies are included in a major project, “*The Cyrenaican Prehistory Project*”, focussing on the investigation of the relationships between cultural and environmental change over the past c. 200,000 years in northeast Libya. The project combines archaeological excavation with a suite of geomorphological, palaeoecological and archaeological methodologies to address the topic of the colonization of North Africa by Modern Humans (*Homo sapiens*) and the beginning of farming in this area.

In order to obtain new data about the beginning of agriculture, samples from Mesolithic and Neolithic levels have been analyzed, showing the presence of ancient charred seeds at both sites. In Mesolithic layers remains of nuts such as *Pinus halepensis* and *Pistacia lentiscus* are frequent, as well as the seeds of wild pulses (*Vicia/Lathyrus/Lens*). These plant remains are abundant and they could have played an important role in the diet of the last hunter-gatherers of North Africa. In addition, data from Neolithic layers indicate the presence of cereal crops, hulled barley (*Hordeum vulgare*) and durum wheat (*Triticum durum*), and two pulses (*Vicia/Pisum*), and provides early dates for the arrival of domesticated plants in Libya.

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## ARCHAEOBOTANICAL STUDY OF PPNB OUTPOST, WADI ABU TULAYHA, SOUTHERN JORDAN WITH SPECIAL REFERENCE TO THE BEGINNING OF NOMADISM AT THE SOUTHERN EDGE OF THE FERTILE CRESCENT

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*Key words: PPNB, Jordan, Desert, Outpost, Nomadism*

This study presents the results of archaeobotanical analyses from Wadi Abu Tulayha in the Jafr Basin, southern Jordan, to reconstruct the past plant use and the environment surrounding of the site during middle to late PPNB (ca. 8200-9100 uncal BP). The present vegetation of the site belongs to the Saharo-Arabian desert type. The annual precipitation of the region today is less than 50 mm. The settlements were used as outposts for seasonal gazelle hunting, probably occupied by people from contemporary farming communities to the west. Faunal assemblages also included a small number of domestic sheep/goat suggesting some transhumance along with the hunting. The main archaeobotanical finds were domesticated cereals including emmer wheat (*Triticum dicoccum*) and barley (*Hordeum vulgare*), and some species of legumes (*Pisum/Lathyrus* sp.). Many fragments of edible wild nutlets of *Pistacia* sp. and one wild almond were also found. The wild plants were dominated by Gramineae spp. accompanied by *Malva* sp. and *Arnebia* spp. These results from both floral and faunal assemblages indicate that the vegetation was probably steppe to semi-desert. The possibility of the farming of cereals at that site, and the relationship between environmental deterioration and the beginning of pastoral nomadism in this area will be discussed.

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## PHYLOGEOGRAPHY OF *TRITICUM TURGIDUM* LANDRACES IN IBERIA AND NORTH AFRICA: GENETIC STRUCTURE AND CULTIVATION HISTORY

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*Key words: Phylogeography, Genetics, Wheat, Neolithic, Western Mediterranean*

The tetraploid wheat species *Triticum turgidum* (van Slageren 1994) includes cultivated forms such as durum (*T. turgidum* ssp. *durum*), rivet (*T. turgidum* ssp. *turgidum*) and emmer wheat (*T. turgidum* ssp. *dicoccum*). Hulled emmer wheat was domesticated from wild emmer in the Fertile Crescent region around the 8<sup>th</sup> millennium BCE. Durum and rivet, the naked forms, appear shortly afterwards in the same region, evolving from either the already domesticated hulled emmer or *de novo* from wild emmer. Both forms were part of the initial crop package introduced into Europe and North Africa during the early Neolithic. Naked forms, most likely durum and/or rivet, were preferred in Iberia since the initial introduction of farming in the 5<sup>th</sup> millennium BCE. Contrastingly, emmer was the staple crop in ancient Egypt until the introduction of durum in the Hellenistic period. In the Maghreb the archaeobotanical record is scarce, but recent excavations in Morocco have yielded wheat grains in a Cardial Culture context. Cardial pottery is associated with early farmers in Italy, southern France, Iberia and the Maghreb. The degree of contact between both shores of the western Mediterranean during the early Neolithic, and the origin and mode of cereal introduction in the Maghreb remain largely unknown.

The geographical distribution of the present genetic diversity within a species can be informative about its history. This phylogeographical approach has been applied to crop species. Landrace varieties are particularly useful as they are genetically diverse, adapted to a particular location and associated with traditional farming systems. Some emmer landraces have been suggested to have been established in their associated localities since the Neolithic.

The objective of this work was to elucidate patterns of crop movement between the Iberian Peninsula and North Africa by examining the phylogeography of wheat landraces. 216 landraces of emmer, durum and rivet from the Mediterranean basin (with more samples from Iberia and Maghreb) were genotyped for a panel of 29 nuclear and 5 chloroplast SSRs markers. The data generated were statistically analysed for population structure and genetic diversity. These analyses revealed three distinct population groups. Group I includes only emmer wheat accessions. Group II clusters all rivets and most durums. Group III includes a discrete group of durum accessions distributed only along the western Mediterranean.

These results suggest that rivet and durum are genetically similar and were probably introduced jointly throughout the Mediterranean region. A second introduction of durum is likely to have occurred at a different time from Iberia/Italy into the Maghreb (or from the latter to the former). Emmer forms a clearly distinct population from both rivet and durum.

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## THE FIRST FARMERS IN SOUTHERN IBERIA

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*Key words: Neolithic, Southern Iberia, Early agriculture*

This contribution constitutes the first preliminary results of the archaeobotanical analyses carried out within the framework of the ERC Advanced Grant project “Origins and spread of agriculture in the western Mediterranean region”. Despite many years of archaeobotanical research, knowledge of early farming in the southern part of the Iberian Peninsula is still scant. Samples included in this paper include two types: those coming from sites where systematic sampling and recovery techniques have been applied, and those from storage areas, mainly pits (silos), both from new and old excavations. The assemblages studied come from various sites located in the provinces of Córdoba and Málaga from where AMS dates are available dating the first domesticated plants to ca. 5500 cal B.C. Plant remains include a wide variety of species: *Triticum dicoccum*, *Triticum aestivum-durum* (wheats), *Hordeum vulgare* (barley) and several legumes (*Pisum sativum*, *Vicia faba*, *Lathyrus* spp, *Vicia* spp). Seeds of *Papaver somniferum/setigerum* (poppy) are also an important component in at least one of the sites. Wild taxa are rather scarce, being represented by acorns and wild olives. Results will be presented within the more general framework of the Iberian Neolithic.

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## THE RECORD OF *STAPHYLEA PINNATA* L. FROM BRONZE AGE SITES IN ITALY: EARLY IMPORTED ARTEFACTS OR NATIVE STANDS?

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*Key words:* *Staphylea pinnata*, Archaeobotany, Bronze Age, Italy

A necklace made of *Staphylea pinnata* L. (bladder-nut) seeds and marble stones has been recently found in a pile-dwelling layer of the early Bronze Age (2030-1980 B.C.) at Lucone, Garda amphitheatre, northern Italy. The prehistoric lake village lies 5 km from a place where *Staphylea* grows now, forming the understorey of *Ostrya-Carpinus betulus* woodlands on limestone scree slopes facing north, close to the Garda lakeshore. The archaeobotanical investigation at the Lucone pile-dwelling is still in progress, but, up till now, no other macroremains of *Staphylea pinnata* have been found. This new record stimulates the debate about the prehistory of this plant, the definition of its original area of occurrence in the Mediterranean and the influence of humans on its spread, a topic so far discussed in the inland European continent for later time periods (Roman to Middle Ages).

As far as we know, this is the earliest record of *Staphylea* in cultural layers. A few additional finds related to prehistoric settlements, dating back to the middle and late Bronze Age, all originate from northern and southern Italy. Meusel and Jäger (1992) pointed out that the present-day distribution boundary of this species in Italy is not well defined. We present here an updated modern range distribution that will be discussed in relation to the Holocene records in the same area from pollen and macroremains.

The pollen-vegetation relationships and species representation in pollen rain have been evaluated by pollen analysis of modern surface samples compared with vegetation cover. We also measured pollen productivity. The sediment embedding the necklace was analysed for pollen and compared with the modern pollen spectra. Although the modern pollen-vegetation relationships do not represent good analogues for the Bronze Age vegetation, the comparison of fossil and modern data allows us to confirm the supposed native status of this species in northern Italy; nevertheless, a contemporary import of artefacts along the trade path from the east, through the foothills of the Slovenian Alps, is not to be excluded. A precise understanding of the timing and extent of human alterations that modified the original middle Holocene native status of the species needs further study of both the fossil pollen record and the species representation in modern pollen rain.

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## PHYTOLITH STUDIES AT A LATE AVAR PERIOD SETTLEMENT NEAR HÓDMEZŐVÁSÁRHELY (SOUTHEAST HUNGARY)

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*Key words: Phytolith analysis, Late Avar Period, Southeast Hungary, House typology*

For a long while very little was known about the plant-human interactions of the Avar Period in the Carpathian basin. Due to the rapid extension of motorway building, large cemeteries as well as settlements from this period have been brought to light, so a more extensive amount of archaeobotanical work could be done.

Besides the analysis of macrobotanical remains, the role of microscopic remains such as plant opal particles (phytoliths) plays an important role in the examination of human-plant interactions.

Floors and profiles of various features at a late Avar settlement near Hódmezővásárhely, southeast Hungary, were studied to gain information on how the inhabitants used their living and working space, and to detect seasonal patterns in human-plant interactions.

The aim of the study was to integrate archaeological knowledge, based on finds and previous typological work, with the results of phytolith analysis in order to contribute to our knowledge of the everyday life of this highly diverse confederacy which inhabited the Carpathian Basin for centuries.

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## COMPLEX MICROARCHAEOBOTANICAL ANALYSIS OF FOOD REMAINS FROM A NEOLITHIC SETTLEMENT; A CASE STUDY FROM TISZASZIGET ARCHAEOLOGICAL SITE, HUNGARY

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*Key words: Neolithic Period, Phytolith analysis, Starch analysis, Pollen analysis, Building sacrifice*

A well-preserved assemblage of pottery and various stone artefacts was excavated in the southern part of Tiszasziget, near the town of Szeged, Hungary. The settlement had been inhabited by the late Neolithic Gorzsa Group, who lived in the New Stone Age. The most significant find is the fragment of a long stilt house. The careful analysis of the intact pottery defined as a building sacrifice may help us to reveal human-plant interactions in the period in question.

A piece of organic residue has been analysed in the laboratory. After precise sampling of the residue, 2.5 g was processed with the standard method to recover inorganic plant remains, phytoliths. The so called sinox method was applied to recover organic remains, starch and pollen.

The recovered silicified tissues and articulated phytoliths were subjected to morphometric measurements which revealed that the food remains which had been placed in the building sacrifice were made out of *Triticum* and *Avena*. Starch granules of cereals were also detected, whilst the pollen analysis resulted in pollen types most likely to be related to the accompanying weed flora.

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## PLANT REMAINS FROM THE EARLY MEDIEVAL PAGAN OFFERING SITE IN ŻÓŁTE (NORTHWEST POLAND)

Katarzyna PIŃSKA<sup>1</sup>

*Key words: Early Middle Ages, Pagan offering site, N-W Poland*

Archaeobotanical research was done on one of the few sites included in the project on archaeological sites connected with lakes and related to religion in early medieval times in northwest Poland, which was carried out by the Archaeological Institute, Nicolaus Copernicus University, Toruń. The site of Żółte is located in Zarańsko Jezero, on a small island in the lake, close to the peninsula on which early medieval settlement remains have been recorded. The abundance and variety of archaeological finds from the island as well as from the underwater shoreline distinguish this site from other similar ones. It is most likely that the island played an important role in society life in the past, as a place of assemblies, barter and for religious purposes.

The aim of the archaeobotanical research is:

- to provide data for reconstructing local vegetation in early medieval times,
- to characterize ecological conditions around the island,
- to gather information on plants cultivated in the vicinity of the island,
- to record specific plants which could have been used during religious rites in the past.

51 sediment samples were collected from the land and underwater parts of the site in order to conduct archaeobotanical analyses. Samples from the land part of the site contained charred cereal finds, with *Secale cereale* (rye), *Panicum miliaceum* (broomcorn millet) and *Triticum* sp. (wheat) as the dominant taxa. Most of the charred material was much fragmented, preventing further identification.

The richness and variety of waterlogged botanical material obtained from the underwater excavations allows the characterization of palaeoenvironmental conditions and description of the natural and anthropogenic vegetation in the area. Exceptional botanical material was collected from inside a fully preserved pot deposited close to the piles - wooden construction remains surrounding the island. The very rich plant material shows remarkable taxonomical diversity with more than 160 taxa and a unique botanical species combination with *Saxifraga* cf. *granulata*, *Valeriana officinalis*, *Primula veris*, *Dianthus deltoides*, *Chrysanthemum segetum* and *Malva alcea*, which may indicate local ritual practice.

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## THE OLDEST MEDIEVAL POND? ARCHAEOBOTANICAL INVESTIGATIONS IN HISTORICAL PRAGUE, CZECH REPUBLIC

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*Key words: Medieval city, Archaeobotany, Wetland deposits, 3D-reconstruction, Hydrology, Fishpond*

It is known from several sources that there were many streams, springs and even small swamps in the suburbs of the medieval Staré Město (Old Town) of Prague, Czech Republic. Various farming and craft villages arose in the vicinity of these water sources during the Medieval Period. However, hydrological conditions of the area have been substantially changed as a result of strong urbanization, earth moving and increased water level of the river Vltava. The aim of this project is to reconstruct the likely directions and the characters of watercourses in the area of today's Nové Město (New Town) of Prague.

The medieval Nové Město (New Town) of Prague was founded in AD 1348 by Karel IV just outside the city walls to the east and south of Staré Město (Old Town), situated on the right bank of the river Vltava. The new gothic town replaced several rural settlements in this area. One of them, mentioned in a document from the end of the 10<sup>th</sup> century, was called *Rybník* (fishpond). One of the oldest Bohemian ponds was probably situated in this settlement.

Data from geological boring as well as geological reports from rescue archaeological excavations have been used for 3D reconstruction of the earth surface in the Medieval Period. Hydrological assessments, street directions, local names and historical sources were used too. In order to reconstruct the natural environment, archaeobotanical analyses have been carried out on material from the 13<sup>th</sup> century from two different excavations, 800 m apart. The waste material from a dump deposit behind the walls of the Staré Město came from the first excavation. Clayey sediment from the pond bottom came from the other excavation.

The results show that the Staré Město Prague suburbs were still enclosed by fields and meadows in the 13<sup>th</sup> century. 177 plant species have been identified in total, 154 in the waste deposit, 103 in the pond. A surprisingly high proportion (45%) of plant species were the same in both excavations, even though the pond sediment contained neither crop plant seeds nor rubbish. Plant species of banks and of wet meadows along with weeds were very common in both sites. Pollen analyses carried out in the area give similar results as well.

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## ARCHAEOBOTANY OF THE FIRST DISCOVERED LATE BRONZE AGE/ IRON AGE LAKESIDE DWELLING IN LITHUANIA

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*Keywords: Waterlogged, Plant macroremains, Bronze Age/Iron Age, Lake-dwelling, Lithuania*

The archaeobotanical investigation of the late Bronze Age/Iron Age lakeside dwellings at (lake) Luokesa ež. (ca. 800-400 BC) presented here, is part of an ongoing doctoral research programme funded by the Swiss National Science Foundation, and carried out at the Institute for Prehistory and Archaeological Science, Basel University, Switzerland, under the supervision of Stefanie Jacomet. The archaeobotanical samples were taken in collaboration with a local archaeologist, Elena Pranckėnaitė, and her team during the underwater excavations in 2008 and 2009.

The aim of the study includes different questions regarding local environmental change, conditions at the site at the time the lake dwellings were built, the reconstruction of human diet, the processing of different plants and finally agriculture and husbandry. The results of the archaeobotanical investigations will be compared with other archaeobotanical studies of lakeside settlements in the circum-Alpine region. Of special interest are the comparison of the evidence of taxa, the preservation of the plant remains, the economy and the palaeoenvironment.

The first results indicate that the botanical material is very rich and particularly well preserved. Remains of cultivated plants, weeds and herbs, water plants, trees and shrubs could be identified. Beside the plant macroremains, remains of insects, coprolites, molluscs, fish scales, small bones and teeth can also be found. The analysis of the first profiles showed a change from grey natural lake marl with varied remains of natural underwater vegetation, to brownish very organic cultural layers. These layers often contained more than 1000 seeds/litre. The high concentration and the good preservation of the plant remains have already allowed the identification of more than 130 different taxa. Among the cultivated plants, the remains of *Panicum miliaceum* (millet) and *Camelina sativa* (gold of pleasure) are very frequent. In addition, large grained cereals such as *Triticum spelta* (spelt), *T. dicoccum* (emmer), *T. monococcum* (einkorn), *T. type nudum* (naked wheat) and *Hordeum vulgare* (barley), as well as pulses such as *Pisum sativum* (pea), could be identified. Many edible wild fruits were found, including *Corylus avellana* (hazelnut), *Fragaria* (wild strawberry), *Vaccinium* (cranberry), *Rubus idaeus* (raspberry), *Rubus fruticosus/saxatilis* (blackberry or stone bramble) and *Trapa natans* (water chestnut). Various cornfield weeds such as *Centaurea cyanus* (cornflower) were also present. Beside plants of anthropogenic habitats, a wide range of wild plants indicates the presence of water, wetlands and woodland in the surroundings of the settlement.

This doctoral research is a pioneer work on Bronze Age and Iron Age waterlogged plant remains in Lithuania. Even at this early stage the interpretation of the results promises exciting results which provide a better understanding of prehistoric lakeside life on Luokesa. A comparison of Luokesa data with that from other lakeside settlements in central Europe could help shed light on the phenomenon why lake dwellings in Europe disappeared in later prehistory.

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## THE CHANGE FROM SADDLE QUERNS TO ROTARY HAND QUERNS IN SOUTHWESTERN NORWAY WITH CORRESPONDING CROP PLANT ASSEMBLAGES

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*Key words: Crop processing, Querns, Mills, Iron Age, Norway*

This paper is part of an ongoing project “The Norwegian Millstone Landscape” run by the Geological Survey of Norway (NGU) and financed by the Research Council of Norway (NFR). The Norwegian millstone quarries are among our largest industrial landscapes from the past and represent one of our longest-lasting extractive industries. By interpreting these landscapes, important insights into the use of and trade in natural resources have been recorded. At present, ‘industrial-scale’ millstone production dates back to at least the 8<sup>th</sup> century from Hyllestad in Norway with hand driven querns and ended up by the early 20<sup>th</sup> century with water driven mills. In this paper, emphasis will be put on the querns that pre-date these ‘industrially-produced’ ones, the dating of saddle and rotary hand querns from archaeological settlement contexts in Rogaland in southwestern Norway. These querns were probably produced from small quarries locally or from local boulders. As querns represent the tool for grinding grains and milling them into flour for bread making, we will focus on the changes in farming economy and especially the progression in crop plants and cereal cultivation throughout parts of the Iron Age (500 BC – AD 600). This knowledge is gained through palynological and archaeobotanical studies that have for the last 40 years progressed parallel to the archaeological excavations of the Iron Age settlement complexes in Rogaland. Finally, we want to establish whether there is a corresponding change in crop plant assemblages that matches the change from saddle to rotary querns. If not, are there any other plausible explanations?

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## CONTRIBUTION TO THE BEGINNINGS OF PLANT PRODUCTION IN THE EASTERN FERTILE CRESCENT – ARCHAEOBOTANY AT THE PPN SITES OF CHOGAH GOLAN AND CHIA SABZ (IRAN)

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*Key words: PPN, Near East, Iran, Cultivation, Domestication*

Recent archaeological research in Iran leads to a revision of the hypothesis of discontinuity of cultural development on the central Iranian plateau between the Epipalaeolithic and the Neolithic, and also questions earlier assumptions on the adoption of agriculture via diffusion from the West. There is, however, still insufficient data to clearly conceive the transition to agriculture.

Differences in the Post-glacial environmental development between the Levant and the eastern part of the Fertile Crescent with a marked difference of impact of the Younger Dryas on the composition of the vegetation complicate the consideration of available resources in the different regions of the Fertile Crescent.

According to recent investigations, the dynamics of  $\delta^{18}\text{O}$  in the sediments of Lakes Zeribar and Van and the Holocene dispersion of the Poaceae, which increase roughly after 13000 cal BP, are similar, and indicate a considerable environmental potential for the cultivation of wild cereals.

Archaeobotanical samples from the PPN sites of Chia Sabz near Kuh Dasht (Lorestan Province) and Chogah Golan on the Mehran plain (Ilam Province) are investigated to contribute to the question of the time and modalities of the beginnings of plant cultivation and domestication in southwestern Iran.

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## A BELL BEAKER SITE WITH WET PRESERVATION FROM HEGAU, SOUTH-WEST GERMANY: MACROFOSSIL AND POLLEN EVIDENCE FOR LAND USE

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*Key words: Bell Beaker site, Wet preservation, Crops, Land use extension, South-western Germany*

Our knowledge about settlement and land use in the Final Neolithic, especially the Bell Beaker Culture is very restricted, because throughout Europe only very few sites have been excavated, most of them graves and none at all with wet preservation. In 2007, in Engen in the Hegau mountains a Bell Beaker site was excavated. A large and deep ditch contained cultural layers with wet preserved organic material from the Bell Beaker Culture (Final Neolithic) and the early Bronze Age. The examination of the plant macrofossils of the Bell Beaker layers revealed a high concentration of charred cereal chaff, mostly of *Triticum monococcum*, but also of *Hordeum vulgare* (naked barley), *T. dicoccon* and *T. spelta*. *Corylus avellana*, *Rubus fruticosus*, *Sambucus nigra* and *S. ebulus*, and *Viburnum lantana* were present in an uncharred state, as well as several crop and ruderal weeds, and plants of damp places. The pollen composition is strongly locally influenced: Cereal pollen grains are dominant, including both *Triticum* type and *Hordeum* type. *Apium graveolens* pollen was identified, too. Pollen grains of crops and ruderal weeds, but also of plants from meadows or pastures, and of wet places indicate a more or less open cultural landscape. The tree pollen spectra are dominated by *Corylus avellana* and *Alnus glutinosa*. Also common are *Quercus robur* type and *Fagus sylvatica*. However, the extent of Bell Beaker land use cannot be deduced from on-site data. Therefore, new palynological investigations on mires in the Hegau are in progress, in order to obtain new off-site data. Our data about Bell Beaker land use in the Hegau will be related to a series of high-resolution pollen records from the adjacent western Lake Constance (Bodensee) area. There, the Bell Beaker Culture, dated at about 2300-2100 cal BC, corresponds with the second *Fagus* maximum, lasting from about 2500 to 1900 cal BC. This *Fagus* maximum has two peaks with *Fagus* values exceeding 40%, separated by a decline to about 30% at 2300-2100 cal BC. At the same time, *Corylus*, *Quercus*, non-arboreal pollen and charred particles increase, cereals and other anthropogenic indicators occur, and the curve of *Plantago lanceolata* is sub-continuous for the first time. The Bell Beaker human impact phase is separated from the preceding Corded Ware and the following early Bronze Age human impact phases by periods of about 1-2 centuries showing only minor indicators of human impact. A comparison of the Bell Beaker phase with earlier phases reveals an extent of human impact similar to the Corded Ware, Horgen and Pfyn Cultures, but differences in the land-use practices. Slash-and-burn seems still to have been practised, but to a lesser extent. Permanent arable land with short fallow phases as well as livestock grazing seems to have been of growing importance, a development which was continued in the Bronze Age. The seven pollen profiles evaluated, Hornstaad, Durcheinbergried, Steisslinger See, Mainau-Obere Güll, Mindelsee, Buchensee, and Böhringer See represent an area of about 200 km<sup>2</sup>.

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## MIDDLE NEOLITHIC AGRICULTURE IN NORTHERN ITALY: ARCHAEOBOTANICAL RESULTS FROM SITES OF THE SQUARE-MOUTHED POTTERY CULTURE

Mauro ROTTOLI<sup>1</sup>

*Key words: Neolithic, Crops, Agriculture specialisation, Subsistence system*

During the 6<sup>th</sup> millennium cal BC the culture named “Vasi a Bocca Quadrata” (Square Mouthed Pottery) spreads in northern Italy. On the basis of pottery shape and decoration, this culture is actually divided into three phases, whose chronological and geographical limits are not always well defined.

Three sites of SMP 2<sup>nd</sup> phase have been studied, two located in the Adige valley at Riva del Garda, via Brione and at Vela di Trento, and one in the Po plain at Parma, via Guidorossi. The range of cultivated crop species is similar in the three sites, with *Triticum dicoccum* dominant and *T. monococcum* well represented. “New glume wheat” and *Hordeum vulgare/distichum* are less well represented; pulses are rare.

These new results are compared with archaeobotanical data from other 27 SMP sites in northern Italy, and early Neolithic records (6<sup>th</sup> millennium cal BC). With respect to the early Neolithic sites, in SMP sites *Papaver somniferum* appears, *Linum usitatissimum* and “new glume wheat” have a greater diffusion, but naked wheat and pulses are instead less represented.

Some hypothesis can be suggested in order to explain this new economic system: a different geographical distribution of settlements, an agriculture specialisation, a modification in soil and climate or/and a change in subsistence system.

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## BEYOND TYPOLOGY: A NEW QUANTITATIVE METHOD FOR DIFFERENTIATING WILD VERSUS DOMESTICATED SEED POPULATIONS

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*Key words: Seeds, Domestication, Morphometry, Variation, Typology*

Conventional methods for differentiating wild and domestic seed populations rely predominantly on comparisons of morphological characteristics and/or a few measured parameters such as length, width and thickness. Domestication is often identified by a significant increase in the mean size of a seed population in comparison to an established reference standard. However, computer-assisted measurement of several size (and shape) parameters of more than 1400 seed populations representing more than 1100 taxa has exposed substantial weaknesses and inaccuracies in conventional typological methods widely accepted in palaeoethnobotanical studies. In 400 cases of replicate seed populations, comparing wild-to-wild and domestic-to-domestic taxa, mean size values (using unpaired t-test) were not similar, so that a mean value was significantly larger than its replicate in 98% of cases. Significant difference in mean size alone is not a reliable indicator of wild versus domestic taxa.

The inherent weakness in typology, that is, morphotypes and mean values, is not so much its reliance on subjective perceptions and arbitrary selection of morphological characteristics by the observer, but in its goal of reducing or eliminating morphological variation to a single arbitrary and/or idealized construct, for example the “type,” the “type standard,” the mean value, a primary mode, etc. Typology is especially inapplicable in botanical analysis because it suppresses consideration of fundamental Darwinian variation. On the other hand, computer-generated morphometric data is quickly, easily and accurately transferred into histogram displays of distribution patterns of Darwinian variation for comparison and analysis.

Contrary to our expectations, Nature is not “normal”. Histograms of measured seed area of many wild taxa consistently showed a pattern of multimodal, non-Gaussian distributions. On the other hand, histograms of domestic seed populations appeared normal (Gaussian) or hypernormal, obviously due to the effects of human, not natural, selection. These patterns appeared consistently and were independent of variation in mean size values. Wild versus domestic distribution patterns were often visually obvious, but were subjective and unreliable in some instances. Therefore, an objective method for quantifying, that is, measuring, the shapes of distribution histograms was devised which consistently differentiated wild versus domestic seed populations. This quantitative method is easily applied to archaeological seed populations. Conceivably, it could also be applied to a sequence of appropriately collected archaeological seed populations to document the transition from wild to fully domestic taxa as human selection reconfigures patterns of natural (wild) morphological variation through time.

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## ARCHAEOBOTANICAL RESEARCH AT THE MEDIEVAL FORTIFIED SITE OF ÎGÎLÎZ-DES-HARGHA (ANTI-ATLAS, SOUTHWEST MOROCCO) WITH SPECIAL ATTENTION TO THE USE OF THE ARGAN TREE

Marie-Pierre RUAS<sup>1</sup>, Margareta TENGBERG<sup>1</sup>

*Key words: Argania spinosa, Almohad, Middle Ages, Morocco, Fruit, Wood*

The present paper deals with the archaeobotanical study at the medieval fortified site of Îgîlîz-des-Hargha, located at 1350 m asl in the Anti-Atlas mountain chain in southwestern Morocco, around 60 km to the south-southeast of the modern city of Taroudant. The first excavation season at the site which was undertaken in spring 2009 as a joint French-Moroccan cooperation, directed by A. Ettahiri (INSAP, Rabat), A. Fili (Univ. El Jadida) and J.-P. van Staëvel (Univ. Paris 4), allowed the recovery of numerous and well-preserved botanical macroremains (carbonised seeds and fruits, charcoal). Five AMS dates obtained from charcoal and seed remains indicate an occupational period from the 10<sup>th</sup> to the 12<sup>th</sup> centuries AD. Written contemporary sources indicate that the inhabitants of the fortress during the early 12<sup>th</sup> century (AD1120-1130) belonged to a Berber Mohammedan religious community led by the illustrious Ibn Tûmart, founder of the Almohad Dynasty which was later to dominate large parts of North Africa as well as Moorish Spain.

Preliminary results of the archaeobotanical study show the presence of 55 cultivated and wild taxa including cereals (barley, wheat, sorghum), pulses (grass pea) and fruits (date palm, fig, almond and grape). However, the most frequently found remains of wood and fruits belong to *Argania spinosa* (L.) Skeels in the Sapotaceae family, the argan tree. This tree, here identified for the first time in an archaeological site, is endemic to southwestern Morocco where it forms characteristic woods or shrublands depending on local conditions and grazing intensity.

After a description of the macroremains and their context of discovery, the paper will present various hypotheses on the use during the Medieval period of the argan tree, which is today of major economic importance in the region. The possibility of its use for edible oil, fuel, construction wood and fodder will be discussed.

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## PLANT MACRO- AND MICROREMAINS FROM PORTUS, THE HARBOUR OF IMPERIAL ROME

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*Key words: Plant landscape, Pollen, Seeds, Fruits, Rome Imperial harbour*

The investigation focused on the area of the ancient harbour built by the Roman Emperor Claudius in the 1<sup>st</sup> century AD, inaugurated by Emperor Nero in AD 64, and enlarged by Emperor Trajan in the 2<sup>nd</sup> century AD. It was Rome's principal maritime port from the middle of the 1<sup>st</sup> century onward and an important gateway between Rome and the Mediterranean. The harbour was the world's largest artificial feature of its kind in antiquity. The harbour town named *Portus* developed together with the port itself and expanded in the following centuries. The remains of the port are in the Tiber delta, in an area covered by post-Roman marsh and alluvial deposits and by beach ridges of pre-Roman age, and are 3.5 km away from the present coastline. Relict sparse marshy areas were reclaimed in the 1930s.

The "Soprintendenza per i Beni Archeologici di Ostia" carried out a series of deep corings in the area of the ancient port, at present an archaeological park, to reconstruct the shape and the environment of the Tiber delta dating back to the Roman period. The current multidisciplinary research on the area of the ancient port has involved several disciplines such as archaeology, geomorphology, palynology, archaeobotany, ostracodology and geochemistry.

The present study is based on integrated analyses of plant macroremains, pollen and microcharcoals carried out in two cores. The selected cores are PTS5 from Canale trasverso (a channel excavated during the early Flavian period) and PTS13 from the darsena (dock area), down to depths of 11.22 m and 6.76 m respectively.

The chronologies of the records are based on stratigraphical criteria, radiocarbon dates, historical data and pottery fragments.

Plant macroremains and pollen indicate that the two cores record different periods of time. One core shows the first phases of the harbour activities, with a rather preserved plant landscape typical of a coastal environment. The other core records a stronger human impact related to the presence of the port town.

Plant macroremain analyses show the presence of seeds and fruits of many cultivated and synanthropic taxa, besides riverine, marshy, freshwater, as well as aquatic plants. Pollen assemblages reveal the presence of a mosaic of natural vegetation types, consisting of deciduous coastal plain woods, a Mediterranean evergreen vegetation formation (probably a *maquis*), and riparian trees. Cultivated and synanthropic taxa were also found.

In conclusion, the landscape changes which resulted are only partly linked to natural changes, but mainly to the human management of the harbour and to the development of *Portus*, the harbour town.

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## **PLANT ECONOMY OF THE FIRST FARMERS IN CENTRAL BELGIUM (LINEARBANDKERAMIK, 5200-5000 BC)**

**Aurélie SALAVERT<sup>1</sup>**

*Key words: LBK, Belgium, Archaeobotany, Cultivated cereals, Poppy*

Archaeobotanical results obtained from the LBK sites of central Belgium were first synthesized during the middle of the 1980s by Bakels and Rousselle. Since then, other studies have been carried out e.g. by Heim, Bakels, Dietsch-Sellami, Jadin. An extended synthesis is thus needed to understand the plant economy of the first farmers who settled here at the end of the 6<sup>th</sup> millennium BC in the northwestern part of the LBK territory.

Carbonized seeds and fruits from 13 LBK sites in central Belgium are studied. The main cultivated plants come from the Near East, hulled wheats (emmer and einkorn), pulses (pea, lentil) and flax. Opium poppy is well established in northwestern Europe at the end of the 6<sup>th</sup> millennium BC. It has generally been considered that the plant comes from the Mediterranean area. However, finds of poppy earlier than or contemporary with the LBK are scarce in the western Mediterranean zone, suggesting that this hypothesis should be revised. Analysis of seeds and fruits point to a homogenous farming economy from the Rhineland to the Parisian basin during the LBK period as well as revealing extra-cultural contacts and regional differences involving the main cultivated cereals.

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## **A WASTE MANAGEMENT OF PLANTS – HUMAN AND ANIMAL FAECES IN URBAN AREAS: THE ROMAN AGGLOMERATION CASE HORBOURG-WIHR (ALSACE, FRANCE)**

**Caroline SCHAAL<sup>1</sup>**

*Key words: Alsace, Roman period, Archaeobotany, Waterlogged plant material, Latrines, Excrement*

During archaeological rescue excavation of the Horbourg-Wihr « Kreuzfeld » site (Haut-Rhin, Alsace, France), concentrations of fruitstones and shell have been uncovered in rectangular pits arranged with a wooden lining and dated to the end of the 1st century to the beginning of the 3rd century AD. These discoveries, always original in an archaeological site, offer the opportunity to begin archaeobotanical research on these structures, whose functions remain to be defined.

The exceptional character of the site has to be underlined. The presence of groundwater which is 1 to 3 metres under the ground has waterlogged a large part of the organic material of vegetable origin such as architectural wood (dendrochronological study, W. Tegel), wooden objects (xylological study, W. Tegel), pollen (palynological study, D. Aoustin), seeds (carpological study, C. Schaal) and a part of the material of animal origin such as insects or parasites (parasitological study, M. Lebailly).

The archaeobotanical study is not only meant to identify the plants which were produced and eaten by the population, but above all to supply functional hypotheses on the converted pits. In total 13868 seeds were seen for 158 taxa identified.

The carpological assembly of converted pits is characteristic of latrines.

We will see how interdisciplinary studies allow us to understand the integrated waste management involving excrement during the Roman period.

Just as in our modern compost or manure heaps, during the 2nd century the biodegradable waste might have been stored in order to speed up its decomposition into elements which could be used as organic fertilizer for farming and gardening.

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## THE IDENTIFICATION OF PAST PLANT COMMUNITIES USING MODERN RELEVÉES: A CASE STUDY FROM SWIFTERBANT

Mans SCHEPERS<sup>1</sup>

*Key words: Vegetation reconstruction, Syntaxonomy, Mixed deposits*

Vegetation reconstruction is one of the major goals in archaeobotanical research. A major challenge in this reconstruction is the translation of the raw data to the past vegetation. In this paper, an overview of the different approaches will be presented. At the Neolithic site of Swifterbant S4, situated on the shore of a buried creek system, in situ preserved driftlines were identified. The plant macroremains in samples from these driftlines were used to reconstruct syntaxonomical associations by comparing the records with modern vegetation relevés. The validity of using recently classified plant communities as a mirror to past vegetations as well as the taphonomical and methodological constraints of samples taken from driftlines will be discussed.

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## CONSIDERING THE ORIGIN OF ROMAN *LAGENARIA SICERARIA* (BOTTLE GOURD) NORTH OF THE ALPS: A MORPHOLOGICAL AND ARCHAEOGENETIC APPROACH

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*Key words : Bottle gourd, Lagenaria, Ancient DNA, Roman, Chloroplast DNA, Morphometry*

The domestication history of *Lagenaria siceraria*, Cucurbitaceae (bottle gourd ) is complex and the subsequent diffusion of the species in particular into Europe is unclear. Although only one modern wild population of bottle gourd has so far been detected in Zimbabwe, a genetic and archaeological perspective suggests that it was first domesticated in Asia and reached the Americas as early as 10000 BP.

North of the Alps, bottle gourd was introduced by the Romans. Archaeological evidence is rare and consists mainly of a few waterlogged seeds. Based on the morphology of seeds, Kobyakowa distinguished between an Asian and an African type of bottle gourd. Yet recent studies revealed large morphological variation between seed sizes and shapes of modern bottle gourd accessions from various geographical areas. Genetically, bottle gourds of Asian and African origin differ at three chloroplast markers among other genetic markers.

In our study we used a morphological and archaeogenetic approach to investigate the “domestication” origin of bottle gourds from the Alpine foreland. We focused on the Roman settlement of Oedenburg/Biesheim-Kunheim (Alsace, France), where exceptionally well-preserved remains of bottle gourds were recovered. Measurements of pericarp fragments and seeds revealed only small differences in shape and size. They are similar to the Asian type described by Kobyakowa. The genetic analysis of the three geographical chloroplast markers from the pericarp of an almost complete fruit from the 1<sup>st</sup> century AD confirmed an Asian origin of this bottle gourd.

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## CULTIVATED PLANTS IN THE EASTERN ALPS DURING THE BRONZE AND IRON AGES

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*Key words: Eastern Alps, Bronze and Iron Age, Cereals, Legumes, Gathered plants*

The first metallurgical activities shown by evidence of copper slag were recovered from an early Neolithic settlement located on a hill-top located in the Inntal, Austria. Consequently, ore deposits imply an increase of settlement activities in the Alpine area from the Bronze Age onwards. In this paper, several excavation sites are related to copper mining and show the importance of metal production throughout both cultural periods.

Archaeobotanical evidence indicated that *Hordeum vulgare* (hulled barley), *Triticum dicoccon* (emmer) and *Panicum miliaceum* (broomcorn millet) were the main cereals during the Bronze and Iron Ages in the eastern Alps. The most abundant crop, barley, is one of the hardiest cereals, widely tolerant of soil conditions, and therefore it also grows at high altitudes, more than 1800 m asl. Beside cereals, legumes such as *Vicia faba* (horse bean) and *Pisum sativum* (pea) were also frequently found from cultural layers and supplemented the diet of prehistoric settlers. Furthermore, a wide range of wild plants such as *Corylus avellana* (hazelnut), *Prunus spinosa* (sloe), *Rosa* sp. (rose), *Rubus fruticosus* agg. (blackberry), *R. idaeus* (raspberry) and *Sambucus nigra* and *S. racemosa* (edible elder species) were still gathered and contributed considerably to the daily diet. All of the wild plants from the samples yielding the larger grain assemblages were common weeds of cereal fields and were almost certainly harvested accidentally together with the crop; an assertion strongly supported by their range and, in general, this suggested that crops were sown in spring and autumn and it indicated crop rotation.

To sum up, current archaeobotanical data has revealed a complex pattern of plant resource utilisation in the Alpine area during the Bronze and Iron Ages. Additionally, ongoing archaeobotanical investigations within the interdisciplinary Special Research Project HiMAT (Historical Mining Activities in the Tyrol and Adjacent Areas) will give further insights related to subsistence strategies of prehistoric settlers in the eastern Alps.

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## SUBSISTENCE STRATEGIES AT BRONZE AGE SMELTING SITES IN THE EASTERN ALPS

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*Key words: Alps, Mining, Crops, Charcoal, Natural environment*

Prehistoric settlement activities in the eastern Alps are supposed to be related to early copper metallurgy. The impact of such early copper processing on the environment in connection with settlement development in the area is being studied in the course of the interdisciplinary specific research program “HiMAT – The History of Mining Activities in the Tirol and Adjacent Areas”. The latest archaeological excavations in the Inntal, Tirol, Austria, have unearthed a Copper and early Bronze Age hilltop settlement at Kiechlberg and a final middle to late Bronze Age smelting site at Mauken in the nearer and wider vicinities of the copper ore deposits of the Inntal. Unique for this region, the waste dump of the Kiechlberg settlement revealed numerous artefacts indicating local copper ore smelting and processing which is allocated economically to the initial phase of a mining district. The recovered charred plant remains provide a first insight into the subsistence of these early settlers. Crops, primarily *Hordeum vulgare* (barley), *Triticum dicoccum* (emmer) and *Pisum sativum* (peas) with a few admixed weeds were brought to the camp. Gathered plants like *Sorbus* (rowan), *Sambucus nigra* (elder), *Corylus avellana* (hazelnut), *Physalis alkekengi* (japanese-lantern) and also *Quercus* (oak) were collected in the vicinity of the site. The charcoal spectra reveal the composition of the local woods: The taxa *Picea* (spruce), *Abies* (fir) and *Fagus sylvatica* (beech) reflect a coniferous dominated mountain mixed woodland in the surroundings, while *Acer* (maple), *Ulmus* (elm) and *Quercus* (oak) are trees of a nearby ravine wood. Light demanding pioneer trees and shrubs such as *Pinus sylvestris* (pine), *Betula* (birch), *Corylus avellana* and *Sorbus* indicate small glades near the dwelling site. The smelting site of Mauken provides the first results on wood use and the timber supply connected with copper processing in a prehistoric consolidated mining district in the Alps. Plant macroremains from a copper ore dressing site provide information about fuel demand and about the composition of the local natural woodland. The huge amount of uncarbonised and charred timber and needles of *Picea abies* and *Abies alba* indicates the use of wood from the immediate surroundings. Furthermore, diaspores from *Sambucus nigra*, *Rubus idaeus* (raspberry), *R. fruticosus* (blackberry), *Urtica dioica* (nettle) and *Stellaria media* (chickweed) indicate open and nutrient rich areas in the vicinity of the site. The macroremain results suggest that the smelting site at Mauken was supplied with foodstuff from settlements down in the valley bottom, which is corroborated by archaeozoological studies. This implies a societal structure with a division of metallurgical and agricultural activities during times of advanced copper extraction in the final middle and late Bronze Age.

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## UNIQUE PLANTS IN PATTERNED LANDSCAPES

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*Key words: Paintings of plants, Symbolism,*

The representation of landscapes in late medieval religious paintings, as in every pictorial art up to the beginning of modern times, is oriented towards a magic-symbolic and narrative-illusionistic function, which determines both qualitatively and quantitatively the principles of illustration. Only the narrative function of the picture has to be taken into consideration, and categorises perception of people and the phenomenology of objects, and has the prerequisite to develop into real landscape art and related illusionism. Depictions of plants in late medieval religious paintings have both symbolic and realistic value, in that they participate in the phenomenon of cultural and natural character, specific to the time period. Plant images occur in late medieval religious paintings in three main groups of contexts: plants in landscapes, plants in various uses, and plants as attributes. The latter category is the traditional object of art historical studies. Plants that are depicted in use, in vases, potted, in arrangements or scattered, are interpreted as attributes, but there is evidence of these ways of using plants in written sources. Plants in the context of landscapes differ from the above-mentioned contexts in that they are shown growing in natural, seminatural or cultural landscapes. Repetition can be observed in their depiction, which in some cases refers to their symbolism, in other cases to their frequency of occurrence in natural environments. Many plant images are unique representations of (supposedly) local natural vegetation.

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## **SUPER-ABUNDANT SPELT PROCESSING WASTE AT ROMAN NORTHFLEET VILLA, KENT (UK): THE IMPLICATIONS FOR THE INTRODUCTION OF MALT, GRANARY PESTS AND MARKET ECONOMY INTO BRITAIN**

**Wendy SMITH<sup>1</sup>, Edward BIDDULPH<sup>1</sup>, David SMITH<sup>2</sup>**

*Key words: Malt, Spelt, Grain pests, Roman, Market economy*

Excavation at Northfleet Roman Villa in Kent, England was carried out in advance of the Channel Tunnel Rail Link development. A remarkably well-preserved and exceptionally rich archaeobotanical assemblage was recovered as a result of this commercial excavation. Out of a total of 176 Roman period samples, 108 were assessed as RICH (>250 quantifiable items) to SUPERABUNDANT (>1000 quantifiable items). In total, 100 out of the 108 RICH - SUPERABUNDANT samples were strongly dominated by spelt (*Triticum spelta* L.) glume bases and spikelet forks. Detached sprouts were frequently noted, sometimes in large quantities. Notably cereal grain (in this case spelt) was not as abundant, but germinated spelt grain was noted in several of the fully analyzed samples. Charred grain pests also were encountered in a few samples.

This paper presents the results of our analysis of the archaeological, archaeobotanical and archaeoentomological remains from Northfleet Villa. The ubiquity of spelt chaff and detached embryos has previously been argued to constitute good evidence for malting and we present our reasoning for arriving at a similar view. The recovery of this charred debris scattered over the site and beyond suggests the regular and large-scale use of malt processing waste for fuel. Aside from being a nice example of Roman recycling, this may have been a conscious decision in terms of the desired flavour of the malt products. Infested cereal grain is to be expected and is well-recorded in Roman England, but could have implications for the malt products. Finally, the methodological decisions taken to quantify these remains are discussed in terms of future recognition of malting by-products.

Our data are startling - suggesting dedicated, large-scale production of spelt malt was taking place at Northfleet Villa throughout the entirety of the Roman period.

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## BOTANICAL MACROREMAINS FROM SLAV SETTLEMENTS ON THE RIVER ELBE FLOODPLAINS IN COMPARISON TO ON-SITE AND OFF-SITE POLLEN DATA

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*Key words: Slav settlements, Medieval, Macroremains, Pollen, Elbe*

Sediment samples from several excavations covering early to High Medieval (7<sup>th</sup>– 12<sup>th</sup> century AD) contexts were analysed for botanical macroremains within the DFG Paketantrag “Die slawische Besiedlung an der unteren Mittel Elbe” (the Slavonic settlement of the lower middle Elbe). The investigated Slavonic rural settlements and forts are situated in the floodplains of the river Elbe and its hinterland at Lenzen-Burg, Lenzen 32 and Lenzen-Neuehaus in Brandenburg; at Meetschow Vorburg, Vietze, Brünkendorf and Wustrow in Niedersachsen and at Friedrichsruhe in Mecklenburg-Vorpommern. Sediments from pits, hearths/ovens and cultural layers inside and outside houses as well as from dumping areas, burnt layers, rampart layers, ditches, wells, etc. were sampled, containing charred, waterlogged and mineralised plant remains. Mixed storage samples of *Panicum miliaceum*, *Secale cereale*, *Avena sativa* and *Linum usitatissimum* were commonly found. *Hordeum vulgare* (hulled barley) was another important crop, *Triticum* cf. *aestivum* (free-threshing wheat) was less common. *T. dicoccum* and *T. monococcum* (hulled wheats) and the pulses *Vicia faba*, *Lens culinaris*, and *Pisum sativum* (broad bean, lentil and pea) as well as *Setaria italica* (foxtail millet) and *Camelina sativa* (gold-of-pleasure) were rarely represented. The identified weeds aided in the reconstruction of past environmental conditions in the crop fields, while grassland taxa displayed the ancient use of wetlands as well as of dry and sandy areas by the Slavs.

From the Slavonic fort of Lenzen-Burg, profiles of cultural layers with a total depth of 7 m were analyzed both for pollen and botanical macroremains to directly compare the two different botanical records. The resulting pollen diagram shows that prior to the construction of the fort in 950 AD, and also in the earlier period of the fort settlement until the first part of the 11<sup>th</sup> century AD, the surroundings of Lenzen were still largely wooded with *Quercus*, *Fagus*, *Carpinus* and *Pinus*. In the wetter lowlands, *Alnus* grew frequently. Starting in the mid 11<sup>th</sup> century AD, extended clearing of woodland, increasing agriculture and the spread of heaths and dry grassland are indicated. There are several remarkably early finds of *Fagopyrum* (buckwheat) pollen grains in layers from the first part of the 12<sup>th</sup> century, while macroremains of this crop are still absent. Information on a regional scale is added by an off-site pollen profile from the nearby lake, Rudower See, which displays similar woodland dynamics and land use in the Slavonic period.

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## IDENTIFYING DOMESTICATION USING CHARRED SPIKELET BASES FROM EARLY AGRICULTURE SITES IN THE NEAR EAST

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*Key words: Origins, Near East, Domestication, Wheat, Barley*

We will present new results taken from our ongoing project on identifying wild and domestic cereals from early agriculture sites in the Near East. Charred spikelet bases provide the best evidence for distinguishing wild from domestic varieties of wheat and barley. In wild populations, spikelets separate at the abscission layer as they dry during ripening. If they are harvested before becoming fully ripe they still break in the same way. In domestic varieties of einkorn and emmer, spikelets also break at the abscission layer leaving a jagged surface, while barley and naked wheats break at various points on the fused rachis. However, the majority of charred spikelets of einkorn and emmer are incomplete, perhaps due to damage during de-husking. Because of this we defined four categories: definitely wild, definitely domestic, possibly domestic and unidentifiable. Using these categories we examined new material from sites such as Dederiyeh (Natufian, northwest Syria), Aswad (D. Stordeur's excavations, early PPNB, southern Syria), Seker al-Aheimar (late PPNB) and Salat Cami (southeast Turkey). Combining this new data with previous analyses from Tell Qaramel (Khiamian/PPNA, northwest Syria), Jerf el Ahmar (PPNA, north Syria), D'jade (PPNB, north Syria), Nevali Cori (early PPNB southeast Turkey) and Tell el-Kerkh (Pottery Neolithic, northwest Syria), Kosak Shamali (northern Syria, Chalcolithic) a large data set was obtained which reinforces previous conclusions that domestic varieties took millennia to replace wild varieties.

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## AN ARCHAEOBOTANICAL APPROACH TO AGRICULTURAL DEVELOPMENT IN NORTHWEST IBERIA DURING PREHISTORIC AND EARLY PROTOHISTORIC TIMES

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*Key words: Northwest Iberia, Agriculture, Prehistory, Protohistory*

Some approaches have been made to the coupled development of societies and environment in north-west Iberia. However, they fail to explain trends in both realities because they do not fully incorporate archaeobotanical data. The investigation of archaeological seeds and fruits allows us to define three major phases in pre-Roman agriculture in northwest Iberia: assimilation in the early Neolithic, development in the late Neolithic/Chalcolithic and consolidation in the Bronze and Iron Ages. The purpose of this study is to understand the conditions leading to the consolidation phase by correlating archaeobotanical, palaeoenvironmental and archaeological data.

While early Neolithic production practices had little impact on the landscape, sedimentary studies show an increase in anthropogenic soil erosion possibly due to slash and burn practices, by the end of the Neolithic and during the Chalcolithic, thus suggesting significant changes in subsistence strategies. In fact, it is clear that a great diversification of crops happened in the Chalcolithic and that no other economically significant crop was then added until historic times. The main crops were naked and hulled wheat, naked and hulled barley, horse bean and Brassicaceae. However, it is possible that Chalcolithic diversification did not involve great expansion of cultivated areas since most pollen sequences in the area show significant loss of woodland, mostly since the Bronze Age.

Concerning the crops, in the consolidation phase there was an increase in the importance of *Panicum miliaceum* (millet). Although the first millet grains appear already in the Chalcolithic levels of Crasto de Palheiros, only by the late Bronze Age and early Iron Age does the production of millet gain any economic relevance in the region. This, combined with archaeological evidence of further settling of communities, suggests a shift in agricultural strategies in the Bronze Age towards the use of both winter and spring cereals and the use of catch-crops. This scenario fits well with the archaeological models of regional settlement reorganization taking place at the time, which resulted in an increase of productivity and improvement of territorial control and communication, thus assuring the communities' resilience.

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## **PLANT REMAINS IN NORTHERN FRANCE DURING THE LATE BRONZE AGE AND EARLY IRON AGE: NEW DATA FROM ILE-DE-FRANCE AND CHAMPAGNE-ARDENNE REGIONS**

**Francoise TOULEMONDE<sup>1</sup>**

*Key words: Northern France, Early Iron Age, Late Bronze Age, Archaeobotany*

Little is known about the Bronze Age and early Iron Age plant economy in northern France. Some archaeobotanical results have been published by C. Bakels and V. Matterne but there are few syntheses really focusing on these periods. A notable exception is the large amount of research done by Anne de Hingh on sites located in the Moselle region. In the regions Ile-de-France and Champagne-Ardenne, only a few archaeobotanical studies on these periods have been carried out in the past, and no synthesis is available. However, a large amount of archaeobotanical research has been undertaken lately and a dozen sites are currently under study, in Seine-et-Marne, Aube and Marne départements. The chronology of the occupation of these sites ranges from late Bronze Age to late Iron Age, while some of them cover the entire period. Preliminary results already available are presented. They show different patterns in the choice of the main cereal crops (barley-emmer versus barley-spelt), importance of pulses on many sites, early and frequent records of gold of pleasure, and presence of the “new” glume wheat. The reasons for local differences are discussed.

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## IDENTIFYING FOODWAYS – NEW METHODOLOGICAL APPROACHES

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*Key words: Methodology, Foodways, Food consumption, Food preparation*

The term 'foodways' in the title refers to the complex, culturally specific practices relating to food, that is what is eaten, how it is eaten, how it is acquired, how it is prepared, and who participates in the meal. Over the last 30 years we have made tremendous progress in identifying and analysing which foods were eaten in the past. More recently great progress has been made in understanding and analysing the cultural role of food, by studying social differentiation in access to food and the role of food in feasting and ritual. But what about actual food consumption, can we get at that? Sherratt already pointed out some time ago that people do not eat species, they eat meals. So how do we move from our list of identified species to a reconstruction of food consumption practices? Can we use our data to reconstruct how particular foods were prepared and/or in what way they were eaten? In this paper various new methods are presented by which we can begin to approach these questions. Methods include the analysis of waste materials produced during food preparation and consumption (debitage analysis), a method more commonly used in lithic studies. Another method concerns multivariate analysis of spatial patterning in food remains. The rich archaeobotanical assemblage from Roman and Medieval Quseir, Egypt, will be used to demonstrate how these new ways of looking at our data can help us to get closer to food preparation and consumption practices.

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## THE INTRODUCTION OF SUSTAINABLE CEREAL CULTIVATION INTO NORTHERNMOST EUROPE – A SURVEY AND DISCUSSION OF THE ARCHAEOBOTANICAL RECORD FROM SWEDEN

Karin VIKLUND<sup>1</sup>

*Key words: History of crop cultivation, Sweden, Sustainability, Environmental change*

The introduction of farming to southern Scandinavia and further north did not follow a straight line of development, but instead it was characterized by shorter or longer periods of interruptions as well as trials with new crops and farming practices. These various courses of events during different times may be indications of attempts to adjust to new challenges such as new environmental conditions and climate change.

Cultivation started around 4000 BC in Denmark and southern Sweden. The reasons for the nearly 1000 years, during which the spread of farming from the continent and further north halted, is still a major issue in Nordic archaeology. A couple of millennia later, by the end of the middle Neolithic, crop cultivation was also pursued in northern Sweden – but only for a short period of time before it was given up. The next attempt was made at the end of the Bronze Age. However, crop cultivation did not continued this time, either. Not until the end of the Roman Iron Age was sustainable farming established in northern Sweden.

These various events in the history of cereal cultivation in prehistoric Sweden are discussed from the point of view of economic sustainability and environmental change. The study is based on the archaeobotanical record from different regions in Sweden, accompanied by archaeological and environmental data.

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## **MULTI-PROXY PALAEOECOLOGICAL INVESTIGATIONS (POLLEN, STARCH, MICROCHARCOAL, PHYTOLITH AND MACROBOTANICAL) OF HUMAN OCCUPATION AND PLANT EXPLOITATION IN THE HIGHLANDS OF PAPUA NEW GUINEA**

**Luc VRYDAGHS<sup>1</sup>, Alexandre CHEVALIER, Mark HORROCKS, Sander van der KAARS, Tim DENHAM**

*Key words: Terminal Pleistocene-early Holocene, Human-environment relations, Plant exploitation*

Three key archaeological sites in the highlands of Papua New Guinea, originally excavated between the late 1950s and early 1970s, have been subject to multiproxy palaeoecological re-analysis. The occupation sites are Wañelek (open site, dating from the Terminal Pleistocene), Kiowa (rockshelter, dating from the Terminal Pleistocene) and Manim (rockshelter, dating from the early Holocene). The results of multi-proxy palaeoecological analyses at each site, using pollen and microcharcoal, phytolith and starch grains and macrobotany, will be presented. Besides documenting the palaeobotanical record of plant exploitation in the highlands at the turn of the Pleistocene/Holocene, the results illustrate changing human-environment relations in the vicinity of each site.

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## THE EARLY MEDIEVAL LANDSCAPE OF BRUSSELS: THE ARCHAEOBOTANICAL CONTRIBUTION TO THE STUDY OF DARK EARTH

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*Key words: Dark earth, Phytoliths, Early medieval agriculture, Brussels*

The early development of Brussels, a city of the second generation, is historically poorly documented. However, the study of the urban soil in Brussels and more particularly of the Dark Earth, consisting of dark, humus-rich, non-peaty, strongly melanised and apparently homogeneous layers, has given some new insights on the environment in Brussels during the 10<sup>th</sup> - 13<sup>th</sup> centuries AD. In order to understand the soil formation processes, to enable the identification of ancient activity zones, and to evaluate the role and the interaction of natural and human factors within the landscape, a research programme involving archaeopedology, micro-archaeology and archaeobotany has been developed. The present contribution focuses on the archaeobotanical part of the programme, which integrates charcoal, phytolith, seed and pollen analyses.

The systematic application of the protocol to study these Dark Earth units allows the identification of evidence of pasturing and agriculture, amongst other activities. By providing direct evidence for cultivated crops, the contribution of the archaeobotanical analyses is of major significance to this latter identification.

The identification of new arable fields dating from the 11<sup>th</sup> - 13<sup>th</sup> centuries suggests an intensification of agricultural activities. Such intensification has historically been identified for the neighbouring villages, but so far no data have been available from the historical centre of Brussels. Moreover, this evidence fits within a broader historical paradigm of intensification of agriculture in northwestern temperate Europe.

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## THE SPREAD OF SOUTHWEST ASIAN FOUNDER CROPS TO EUROPE AND BEYOND

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*Key words: Founder crops, Domesticants, Neolithisation, Southwest Asia, Europe*

Eight founder grain crops started Mediterranean-type agriculture in southwest Asia by shifting people from a hunting and gathering way of life to one of planting and farming. At least three progenitors of these crops are strict endemics to small areas in the Fertile Crescent (wild emmer wheat, wild einkorn wheat and wild chickpea). All successful domesticants keep close genetic and morphological relationships with their wild relatives. In this paper, we would like to present some new data and insights gained in the course of preparation of the 4<sup>th</sup> edition of *Domestication of plants in the Old World*. Topics we intend to discuss include: (i) The convincing signs for detecting first-wave domesticants in archaeobotanical assemblages. (ii) The earliest domesticants in southwest Asian archaeology. (iii) The Neolithisation of Europe from the archaeobotanical perspective.

We were fortunate to receive significant information from our distinguished IWGP colleagues, and would like to use this opportunity to express our appreciation for their help.

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## EARLY CULTIVATION PRACTICES AT THE PRE-POTTERY NEOLITHIC SITE OF EL-HEMMEH, JORDAN

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*Key words: Pre-Pottery Neolithic, Southern Levant, Pre-domestication, Barley, Agriculture*

Archaeobotanical samples were retrieved and analyzed from recent excavations at the Pre-Pottery Neolithic site of el-Hemmeh in Jordan. The site provides a unique setting for examining the emergence and the intensification of agricultural practices in the southern Levant, with deposits dating to both the Pre-Pottery Neolithic A (PPNA) (ca. 11500-10500 cal BP) and the Late Pre-Pottery Neolithic B (Late PPNB) (ca. 9250-8400 cal BP) periods. Samples were collected from a variety of contexts, including sealed floor deposits, hearths, burials and storage areas, and were processed in the field using standard flotation procedures. Samples were then transported to the Paleoethnobotany Laboratory at Boston University, USA, for analysis and identification.

The well-preserved carbonized plant remains from three circular PPNA structures at el-Hemmeh contained mainly *Hordeum spontaneum* (wild/cultivated barley), *Pistacia* sp. (pistachio), *Lens orientalis* (lentil), and cf. *Vicia* (large legumes). In 42 analyzed PPNA samples, significant numbers of both morphologically wild and pre-domesticated barley grains have been identified. While most rachis fragments appear wild with a clean abscission scar, approximately 30% display a downward “rip” from the scar to the broken rachis body, which may suggest that barley stands were harvested while in a near-ripe stage. Another 50 analyzed samples recovered from extensive Late PPNB deposits at el-Hemmeh indicate that barley continued to be an important food source, along with *Triticum dicoccum* (emmer wheat) and legumes such as *Vicia ervilia* (bitter vetch) and *Lens culinaris* (lentil). High percentages of field weeds including species of *Astragalus*, *Trifolium*, *Trigonella* and *Medicago* signify intensive cereal cultivation, although less than 50% of the barley rachis fragments contain a domesticated-type scar. While this may indicate inter-mixing with local wild barley stands or its presence as a crop weed, it is likely that a sizeable proportion of the barley present at el-Hemmeh remained in a predomesticated stage well into the Late PPNB.

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## **MEDIEVAL AGRICULTURE IN EASTERN FRANCE: THE COMPARISON OF THE RURAL MEDIEVAL SITES OF MARNAY/PONT-SUR-SEINE (AUBE, CHAMPAGNE-ARDENNE) AND VITRY-SUR-ORNE (MOSELLE, LORRAINE)**

**Julian WIETHOLD<sup>1</sup>, Emmanuelle BONNAIRE<sup>2</sup>**

*Key words: France, Early Middle Ages, Carolingian, Agriculture, Food*

Rescue excavations of two early medieval rural sites in eastern France have revealed rich spectra of carbonised plant remains. The site of Marnay/Pont-sur-Seine “La Gravière” is situated in the Seine valley in the southern part of the region Champagne-Ardenne. The excavation of 2007 has uncovered evidence of groups of silo pits, houses and pit houses, and a craft area. The plant assemblages can be attributed to two major chronological phases of occupation, Carolingian (8th-10th century AD) and high medieval (10<sup>th</sup> - 12<sup>th</sup> century AD).

The site of Vitry-sur-Orne “ZAC de la Plaine” is situated on an upper terrace of the river Orne, a tributary of the Moselle, about 15 km north of Metz. It was excavated from 2002-2004 and again in 2007. The medieval rural occupation starts with a Merovingian settlement with a craft area, followed by a Carolingian occupation (8<sup>th</sup> - 10<sup>th</sup> century AD), a high medieval phase (10<sup>th</sup> - 12<sup>th</sup> century AD) and six farmsteads of a late medieval village (12<sup>th</sup> - 15<sup>th</sup> century AD). The site allows the study of agricultural development and plant foodstuffs over about 900 years of permanent occupation. The ecological conditions of the two sites are quite different. While Pont-sur-Seine has sandy and less fertile soils, Vitry-sur-Orne is characterised by heavy loamy and fertile soils.

Archaeobotanical data obtained from these two rural medieval sites gave evidence of varied spectra of remains from cultivated plants, comprising cereals, pulses, oil and textile plants, and fruit trees. In the regions of Champagne-Ardenne and Lorraine, naked wheat, probably bread wheat, was the most important cereal during early, high and late medieval times. In contrast to the southern part of the Champagne with mainly sandy and less fertile soils, rye played only a minor role in Lorraine where soils were more loamy and fertile. Hulled barley, oat and spelt were cultivated. At Vitry-sur-Orne some finds suggest that spelt and einkorn were also cultivated locally. Einkorn was probably grown for the use of the straw as binding material in viticulture. The range of cultivated pulses at both studied sites is rich and diversified. The associated remains of weeds and ruderal plants recorded at the two sites indicate soil fertility and other ecological parameters of the fields. The cultivation of fruit trees also seems to have been well developed during early medieval times. The gathering and use of wild plants has contributed considerably to human food. The different preservation states of the recorded plant remains - carbonised, mineralised and waterlogged – enabled us to gain an important insight into early, high and late medieval agriculture and how people were fed. The remains of wild plants allowed reconstruction of the weed flora and also local vegetation and environmental conditions at these two excavated sites, covering a chronological range from the end of the 6<sup>th</sup> century to the 15<sup>th</sup> century AD.

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## ARABLE WEEDS AND THE ORIGINS OF AGRICULTURE IN THE NEAR EAST

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*Key words: Weeds, Origins, Near East, Cultivation, Agriculture*

Tilling encourages the proliferation of weedy plants. Many of today's arable weeds evolved within agro-systems and spread with agriculture around the world. Some weeds originated in the Near East and may have become incorporated into field systems soon after cultivation started approximately 11500 (cal) years ago. Weed taxa have been recognized in charred seed assemblages from late Pleistocene/early Holocene sites in the Near East. Several researchers have suggested that the presence of these taxa is evidence for pre-domestication cultivation. However, our understanding of the origins of arable weeds in the Near East is still very limited. In this presentation we will compare the presence of taxa which are known to have been common arable weeds on later sites, where they occur alongside domestic crops during the Neolithic and the Bronze Age in the Near East, with their presence on earlier sites prior to domestication. The seeds of the taxa chosen have no known use. Many correspond to obligatory weeds as defined by Michael Zohary, being found today exclusively in segetal habitats which suggests that they had a long history of evolution under cultivation. In conclusion, the comparison between eight sites with wild cereals and six sites with domesticated cereals implies that this group of arable weed taxa arose under cultivation prior to morphological domestication.

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**BOLBOSCHOENUS GLAUCUS, A NEW SPECIES IN THE FLORA OF THE ANCIENT NEAR EAST****Michèle WOLLSTONECROFT<sup>1</sup>, Zdenka HROUDOVÁ<sup>2</sup>, Gordon HILLMAN<sup>1</sup>, Dorian FULLER<sup>1</sup>***Key words: Bolboschoenus, Epipalaeolithic, Near East, Neolithic, taxonomy*

Taxonomic advancements for the genus *Bolboschoenus* (Cyperaceae, formerly included in the genus *Scirpus*) have resulted in the reclassification of the plant previously known as *Bolboschoenus maritimus* (synonym, *Scirpus maritimus*) into several similar but separate species. These improved taxonomies are of importance for archaeobotanical investigations of ancient sites within the temperate zones where this genus frequently occurs, because they detail the distinct ecological requirements and overall morphological characteristics of each species as well as their different fruit (nutlet) anatomies. We examined charred nutlets recovered from four Near Eastern Late Pleistocene and early Holocene early village sites in Anatolia and the Levant: Hallan Cemi, Çatalhöyük, Abu Hureyra and Aswad. Using the new classification, all archaeobotanical specimens, which had previously been identified as *B. maritimus* (or *S. maritimus*), were re-identified as *Bolboschoenus glaucus*. In this paper we explain the anatomical distinctions between *B. maritimus* and *B. glaucus* and discuss the ecological implications.

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## ETRUSCAN SETTLEMENTS NEAR MANTUA IN NORTHERN ITALY: PLANT GOODS TRADE AND EARLY WOODLAND HISTORY SINCE THE IRON AGE

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*Key words: Pollen record, Archaeobotany, Northern Italy, Etruscans, Iron Age*

Forcello, one of the most important Etruscan settlements in northern Italy (16 m asl, 6<sup>th</sup> to 4<sup>th</sup> centuries BC), was built along the valley floor of the river Mincio, and acted as a harbour for trade along the river, connecting the eastern Mediterranean basin with continental Europe (De Marinis and Rapi 2005).

This settlement flourished on the shore of a large perfluvial lake, Lago di Bagnolo, constrained within the terraced valley. The lacustrine sedimentation started at the beginning of the Iron Age. Independent archaeological evidence suggests that the lake was dammed by the river Po, after diversions related to the alluvial events of the „Iron Age cold phase” in the 8<sup>th</sup> century BC. It can be supposed that the diversion of the main river modified the fluvial network of the lower alluvial plain, and promoted upstream shipping from the northern Adriatic to the perfluvial Lago di Bagnolo, where a main harbour was thus established. Lago di Bagnolo remained until the Middle Ages, when reclaimed for land, so lake sediments record woodland history and human activities since the time of the Etruscan settlement up to the 14<sup>th</sup> century AD.

We present here the archaeobotanical investigation of pollen and plant macroremains from the archaeological layers at Forcello (phase F, 510-500 BC). Many useful plants, above all pulses, and weeds were identified, together with a smaller amount of wild plants of wet environments. Altogether they provide information on the diet of the Etruscans and on some possibly imported plants.

Also, an offsite pollen investigation from the lake succession has been carried out. According to four radiocarbon dates, the records extend from the late Bronze Age to the late Middle Ages. The pollen record shows Roman woodland clearances and provides unprecedented evidence of an early Middle Ages phase of abandonment. Finally, an overall change in land use is dated to the 10<sup>th</sup> century AD. The first occurrences of some taxa important for the palaeoenvironmental history of northern Italy, such as *Juglans* (walnut) and *Castanea* (chestnut), were also found here. In particular, walnut pollen increases around the 8<sup>th</sup> century BC, well before its appearance at the southern border of the Alps, demonstrating its earlier introduction in the lower Po plain by the Etruscans.

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POSTER



**MACROFOSSILS IN "GRUBENHÄUSER" FROM VIKING AGE IN DENMARK****Marianne Høyem ANDREASEN<sup>1</sup>, Peter Mose JENSEN<sup>1</sup>, Peter Hambro MIKKELSEN<sup>1</sup>***Key words: Functional analysis, Floor cover, Weaving, Storage*

Two recent finds of carbonized macrofossils from Viking Age Grubenhäuser (sunken buildings) have given an insight in different aspects of the construction and function of these types of houses.

A Grubenhaus from a rural site on the west coast of Jutland contained a floor layer, partly preserved by fire. The layer consisted mainly of straw, but the archaeobotanical analysis also revealed large numbers of awns and grains of *Secale cereale*, rye. The proportion of grains and awns in combination with the presence of straw reveals that the floor presumably had been covered with threshed rye straw. Another sample from the house which contained many weed seeds indicates that underneath the layer of straw there presumably was a layer of turf. According to weaving experiments, straw on the floor of a Grubenhaus gives a better light in the house and provides constant humidity, which are beneficial for weaving. The archaeological investigations uncovered several loom weights and small pieces of cloth in the house which supports its interpretation as a building used for weaving.

A recently excavated Grubenhaus in the town centre of Viking Age Aarhus contained large amounts of grain. The house had been used for occupation and a preliminary analysis of the macrofossils indicates that the grains were part of a store of rye and oats.

The archaeobotanical analyses of Grubenhäuser thus revealed different uses of these kinds of features, which can only be determined by careful excavation and investigation.

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## EXPERIMENTAL ARCHAEOLOGY AS A RESOURCE FOR APPROACHING FORMATION PROCESSES OF SEED ASSEMBLAGES: FIRST RESULTS

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*Key words: Experimental archaeology, Formation processes, Heat treatment, Recovery techniques*

The properties of the seed register are our only tools for making inferences of seed analysis results. These properties are affected in different ways by a large number of processes, ever since the seeds were first deposited on the soil. The existence of these formation processes is well known, but their effects on the properties of the seed assemblages are at the moment difficult to evaluate. This is because of the lack of a systematic project of experimentation that can find direct causes for the characteristics of each property.

For this first of our series of experiments, we have worked with two species: *Triticum aestivum* (5130 remains) and *Lens culinaris* (1478 remains). We have characterized the assemblage before its exposure to heat and after it, so that we can evaluate the differential effects of it when a whole assemblage is under study (most experiments work with single elements). After that, the assemblage has been divided in five equal groups. Four of them have been buried for one month in open air (from mid December of 2009 to mid January of 2010) and the remaining one has been left exposed without any covering during the same period.

After that, two of the samples have been excavated with a screwdriver and two of them with a trowel, aiming to compare the distinct effects of excavation techniques on seed fragmentation. Finally, one of each has been processed by flotation and the other one by water sieving, with the same purpose.

With this work we do not only expect to draw some preliminary conclusions on formation processes, but we also want to propose a more precise description of the properties of seeds in our everyday analyses. These more complete descriptions are the only way to be able to understand formation processes and, eventually, to evaluate the representativity of the assemblages under study.

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## **EARLY AGRICULTURE AND WOODLAND USE IN THE NEAR EAST: THE CASE OF PPNB QARASSA (JORDAN VALLEY, SYRIA)**

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*Key words: Plant use, Fuel, Agriculture technology*

The aim of the poster is to present the first results obtained from the analysis of plant macroremains, both wood and seeds, from the PPNB site of Qarassa, Jordan Valley (Syria). This work is part of a more complex research project that focuses on the analysis of different Syrian sites from Natufian, PPNB and Neolithic periods (<http://www.imf.csic.es/esp/dptos/proyectos/siria/index.htm>). The sites are located in the upper Orontes valley for the sites of Tell Marj and Jeftelik, and on the other hand, in the Jordan valley for the site of Qarassa. In this case, the objective is to present recent data on plant use in the PPNB period of Qarassa, the agricultural technology that was employed, the types of wood that were selected as fuel and the social context where this work was carried out. This work is being carried out along with other disciplines such as anthropology, geology and palynology.

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## ARCHAEOBOTANICAL RESEARCH ON THE LAKE OF ABUSIR AT THE EDGE OF THE OLD KINGDOM PYRAMID FIELD OF ABUSIR, EGYPT

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*Key words: Pyramid field, Macro-remains, Xylotomy, Environmental changes, Citrullus lanatus*

The former Lake of Abusir is situated on the western edge between the Nile alluvium and the pyramid fields of 5<sup>th</sup> – 6<sup>th</sup> Dynasties of the Old Kingdom of Abusir and Saqqara. Since 2005, an interdisciplinary project focusing on the environmental history of the lake has been in progress in connection with long-term archaeological activity in Abusir necropolis. In 2007, four trenches were excavated in the area dividing the Western Desert slopes from the area of the former lake.

The trenches uncovered badly preserved remains of cemetery structures. An important series of valuable environmental data has been gathered. These archaeobotanical data are crucial for the interpretation of the sedimentary layers and archaeological features. Rather poor macroremain assemblages confirm the prevailing wetland characteristics of the local environment after abandonment of the Old Kingdom cemeteries. Important stratigraphy was recorded in trench SA. At groundwater level, remains of what may have been a landing quay were uncovered. Above this level, a simple stratigraphy was recorded which consisted of layers which filled up the periodically waterfilled basin and can be dated to the medieval and modern periods.

The archeobotanical material from the mudbricks is rather poor, but some valuable finds have been recorded, for example *Citrullus lanatus* which probably represents one of its oldest finds known so far from Egypt. The research in the former alluvial zone is combined with archaeobotanical study of desert environment in the necropolis. Another interesting aspect can be seen in data from xylotomical (wood) and anthracological (charcoal) analyses, reflecting the use of fuel and wood at a local level during the Old Kingdom period.

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## ARCHAEOBOTANICAL ANALYSIS OF THE EARLY MODERN VAULT INFILL FROM VLADISLAV HALL, OLD ROYAL PALACE, PRAGUE CASTLE, CZECH REPUBLIC

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*Key words: Macro-remains, Xylotomy, Vault infill, Early Modern Period, Arachis hypogaea*

Pražský hrad (Prague castle) was one of the most important medieval and early modern royal courts in Europe. Within it, Vladislavský sál (Vladislav Hall) was the main ceremonial space used at the end of the Gothic period and beginning of the Renaissance. In 2008, restoration of the hall floor was carried out in connection with archaeological research focused on detailed understanding of material, sociological and environmental knowledge of the historical building. The most valuable results are connected with the vault infill, which was subjected to archaeobotanical analyses. A combination of dry sieving and flotation methods have been used and allowed to specify the different amounts and quality of the archaeobotanical assemblages. Based on the macroremains and xylotomy (wood) analysis of the waste-vault infill from the Early Modern period floor in Vladislavský sál, the character of the Prague Castle environmental and the dietary traditions from the 16<sup>th</sup> to the early 20<sup>th</sup> century are reconstructed. The waste-vault infill is unique material consisting of specially selected components of dry waste, targeted to isolation function. Beside the many unique artefacts such as the wooden spoon, the playing cards, knives, alchemists' weights, handwriting and so on, the main archaeobotanical collection of the basic elements of waste materials such as hay, fuel charcoal and constructional wood were analysed. The assemblage of useful plants consisted of many common and valued taxa such as *Amygdalus communis*, *Juglans regia*, *Persica vulgaris* and others. Very important is *Arachis hypogaea* (peanut) identification, probably the first find in the Post-Medieval period in central Europe.

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## THE ARCHAEOBOTANICAL RECORD OF THE IBERIAN SITE OF PUIG DE SANT ANDREU (ULLASTRET, GIRONA PROVINCE, CATALONIA): PRELIMINARY RESULTS

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*Key words: Hulled barley, Sampling methodology, Iberian site*

Since the appearance of hulled barley (*Hordeum vulgare*) in deposits is relatively frequent in Iberian sites of different chronological periods, and several examples are well known, some questions remain without a satisfying answer.

There are questions such as whether the mixture of species, very often millet (*Panicum miliaceum*) and Italian millet (*Setaria italica*), is because of factors connected with storage, or connected with cultivation techniques, or if the mixtures are for human or animal consumption. We are trying to solve them, through the study of a new deposit found in the Puig de Sant Andreu (Ullastret, Girona province), dated to the end of the 6<sup>th</sup> century BC or the beginnings of the 5<sup>th</sup>.

Moreover, we will try to check our sampling methodology, based on previous works, in order to improve our technique.

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## MACROREMAIN ANALYSIS OF THE HIGH MEDIEVAL SEDIMENTS FROM THE FORMER MINORITE MONASTERY IN OLOMOUC, CZECH REPUBLIC

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*Key words: Minorite monastery garden, Macrofossils, High Medieval*

During the reconstruction of a depository in the city of Olomouc, medieval layers which contained wood fragments, leather and bone fragments were excavated. According to the pottery chronology, the sediments dated back to the High Medieval period. The excavated area was probably part of a Minorite monastery.

Approximately 150 litres of sediment were processed by flotation for macroremain analysis. A rich assortment was found there of over 80 plant species. Because of the presence of bone, leather and wood fragments, we suppose that this area was part of the monastery garden where rubbish or litter was deposited. As well as common useful species, such as *Fragaria*, *Rubus* and *Vitis vinifera*, some relatively rare plants were found: *Anthemis tinctoria*, plant used for dying fabric, *Cichorium intybus* which could be used as a coffee substitute, and *Juniperus cf. sabina*, a tree which is a medicinal plant used for healing cystitis or for causing abortions. An interesting find is of seeds of *Nepeta racemosa*, a plant which is not native to Europe, but comes from the Caucasus, which is planted for medicinal and ornamental use.

Among the weeds, some species which were found are very threatened now, mainly due to modern agromonomical technology, including *Agrostemma githago*, *Bupleurum rotundifolium* and *Stachys cf. annua*. Ruderals were represented in typical composition such as *Chenopodium*, *Atriplex*, *Hyoscyamus niger* and *Solanum nigrum*. However, some currently rare or endangered species were found: thermophilous *Onopordum acanthinum* and *Urtica urens*. Also, *Ranunculus sceleratus* and *Stellaria palustris* form part of the Isoëto-Nanojuncetea association of vegetation in bare pond bottoms or periodic pools. Another endangered species of periodically wet habitats is *Ranunculus sardous*. It is also necessary to mention some nitrophilous species which grow along large rivers or in alluvium, because of the vicinity of the river Morava. Into this group belong *Cucubalus baccifer*, *Solanum dulcamara*, *Humulus lupulus* and *Urtica dioica*. Rich species composition indicates various stand conditions and intensive use of neighbouring vegetation.

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## THE RECONSTRUCTION OF THE EARLY MEDIEVAL VEGETATION IN THE MĚLNÍK VINEYARD REGION, CZECH REPUBLIC

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*Key words: Malacology, Macrofossils, Early Medieval, Vine growing*

The fertile lowland of central Bohemia is an important area for historical events in its development. The town of Mělník, at the junction of the rivers Vltava and Labe, is connected with the wife of the first Czech Christian monarch Bořivoj I, the duchess Ludmila who was grandmother of St. Václav (Wenceslas), the patron of the Czech state. According to the legend, St. Ludmila with St. Wenceslas founded the first vineyards in Bohemia. From the practical point of view, St. Ludmila would not be able to do without wine, if she would perform a Christian ritual.

The reconstruction of the historic centre of Mělník revealed the fortification of the castle from the 9<sup>th</sup> century and consequent development of the settlement into the medieval town, with a small settlement site near the river Pšovka with the production area. Archaeological research also had the specific goal to find out about *Vitis vinifera* cultivation in the Mělník region.

Palaeoecological analyses reconstructed the area in the near vicinity. The results of anthracological (charcoal) and molluscan analyses indicate a mosaic landscape with a pattern of intensively used open vegetation and thermophilous dry stands. A mosaic of oak and pine woods, sparse coppice and scrub are reconstructed in the vicinity of the settlement. All molluscs found are species which avoid woodland, the most frequent of which were *Vallonia costata* and *V. pulchella*, indicators of dry or moderately humid environments. Species of dry stony stands were also frequent (*Truncatellina cylindrica*) or humid areas (*Succinella oblonga*, *Vertigo pygmaea*).

Analysis of macrofossils revealed the most important useful plants, *Triticum aestivum*, *Hordeum vulgare* and *Panicum miliaceum*. There were also some weeds that were quite frequent finds, but in recent times they have become extinct or very rare in our landscape, such as *Bupleurum rotundifolium*, *Stachys annua*, *Polycnemum majus*, etc. Among the macroremains, a charred *Vitis vinifera* pip has also been found, and it is a question whether it is either an isolated import or the confirmation of local viticulture. Supporting arguments for local viticulture, that have also been found, are weed species typical of vineyards.

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## THE INFLUENCE OF HUMAN ACTIVITY ON THE CHANGES OF ECOLOGICAL CONDITIONS IN KOMOŘANSKÉ JEZERO (CZECH REPUBLIC)

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*Key words: Diatoms, Lake trophic status, Lake sediment, Micro-charcoal, Human impact*

The Komořanské jezero is a lake forming the largest natural water body in the Czech Republic (max 25 km<sup>2</sup>). The extensive sediments were completely destroyed due to opencast coalmining in the last century. The only saved lacustrine materials are four rediscovered sediment profiles gathered during field work in the 1980s, and representing a continuous record of the Pre-boreal to Sub-atlantic periods. The lake drainage basin and the lake shores were intensively occupied from Palaeolithic times with the most remarkable settlement peak in the Neolithic represented by the Linearbandkeramik Culture. The lake was at a very stable meso-eutrophic level during its whole existence. The aim of the study presented here was to compare changes in the lake aquatic conditions with intensity of settlement, against the background of coincident climatic changes. Diatom based indices of the lake trophic status slightly increased during the period rich in archeological material. However, the shift was also connected with warming after the 8.2 kyr BP cold event.

This implies that no direct evidence for human influence on the aquatic environment during the period of intensive settlement was found. Such a result may support the idea that large meso-eutrophic lakes could have been hardly affected by the even relatively numerous human population.

Micro-charcoal evidence from the lake sediment seems to be the best indicator of human activity.

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## PLANT AND ZOOLOGICAL REMAINS FROM A HOLE IN THE KITCHEN WALL OF THE CASTLE IN JEVER NEAR WILHELMSHAVEN

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*Key words: Kitchen waste, Modern times, Nutrition, Plant use*

'Schloss Jever' was built in AD 1428 and the castle was further enlarged and fortified during the following centuries. It was used and inhabited by several noble lineages, first by the Frisian Wiemken family of chieftains. When the last autonomous regent of 'Jeverland', *Fräulein Maria*, died in 1575, the counts of Oldenburg inherited the castle but used it only occasionally and as a subordinate residence. In 1667 Count Anton Günther of Oldenburg died and it passed to the Princes (Fürsten) of Anhalt-Zerbst. When in 1793 the last of them, Friedrich August von Anhalt-Zerbst, died, his sister Katharina II, Tsarina of Russia, became owner of 'Jeverland', leaving the administration to her sister-in-law Friederike Auguste Sophie until 1807. From 1813 the Duchy of Oldenburg ruled 'Jeverland' again and established the castle as a residence, making substantial modifications from 1821-1842.

The kitchen area had originally been built in the 15<sup>th</sup> century as a hall-like room with a high ceiling but it was used after the 16<sup>th</sup> century only when a larger court was held in Jever.

In the southern outer wall of the former kitchen area several holes or niches were found during restoration in 2003, and in one of these organic remains preserved by drying, molluscs (snails and mussels) and ceramic fragments were found. Two <sup>14</sup>C dates (230 ± 25 BP, AD cal 1642–1672 and 1778-1799; 315 ± 25/-20 BP, AD cal 1492–1601, 1613-1643 and 1943-1955) gave an age of about AD cal 1640-1645 because the content should have been deposited within a short time period and both dates should therefore represent the same age.

At least 4 mammal species (cattle, pig, sheep/goat, house mouse), 14 bird species (12 wild, some from the coast) and 6 fish species (fresh and sea water) were identified. The bones found, mainly from domestic animals, are interpreted as butchery and kitchen waste.

The botanical material consisted of cultivated plants: *Secale*, *Hordeum*, *Cannabis* and *Linum*, together with typical weeds of rye fields, *Agrostemma githago*, *Centaurea cyanus*, *Rumex acetosella* and *Arnoseris minima*.

Astonishing finds are aquatic plants and taxa from wet places like *Hippuris vulgaris*, *Oenanthe aquatica*, *Ranunculus aquatilis* agg., *R. sceleratus*, *Sphagnum magellanicum*, *Juncus* spp., and also *Calluna vulgaris* and *Erica tetralix*. Maybe these were part of the peat sods used for fuel in the kitchen. More difficult to interpret are taxa from grasslands and many ruderals (*Anthriscus sylvestris*, *Holcus lanatus*, *Taraxacum* sp., *Arctium minus* s.l., *Lapsana communis*, *Urtica dioica*, *U. urens*). From the garden are *Buxus* leaves, *Prunus domestica/insititia*, perhaps *Crataegus* sp. and *Prunus spinosa*.

Exotic and not growing in the area are *Olea europaea* (an import from the Mediterranean) and *Carex brizoides* known as a filling stuff of mattresses, probably indicating this use. Why all these taxa were deposited in the niche or how they got there is unclear – most probably as waste. Nevertheless the intention is unknown and additional interpretations are welcome.

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## CULTIVATED PLANTS IN THE CLAY DISTRICT OF NIEDERSACHSEN, NORTHWEST GERMANY

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*Key words: Crops, Waterlogged sediments*

The *Marsch* or clay district is one of the main natural landscape units of northwestern Germany, which was deposited along the coast and the rivers during the Holocene. The occupation of the clay district has had a long history, dating back to the Neolithic period with several sites known in the Netherlands, and was substantially affected by sea level changes all the time. Because of the waterlogged conditions in the clay district, preservation of organic material is excellent, allowing detailed reconstructions of the former environments, and especially the marine influence and its impact on vegetation and occupation. The Lower Saxony Institute of Historical Coastal Research has been conducting archaeobotanical investigations in the clay district of the southern North Sea coast for several decades. Most influential for the development of archaeobotany at the institute were the investigations at the famous Roman period dwelling mound of Feddersen Wierde at the end of the 1950s. In the meantime, more than 20 sites have been investigated, among them the late Bronze Age site at Rodenkirchen Hahnenknooper Mühle, the oldest settlement in the German part of the clay district, and other sites which cover all cultural periods up to the Middle Ages. Neolithic sites as investigated in the Netherlands are unknown in the German part. These are surely present, but are covered by sediments too thick to be detected by presently available prospection methods.

The most important cultivated plants of the clay district are taxa which are at least moderately tolerant of soil salinity. *Triticum dicoccum* (emmer) and *T. monococcum* (einkorn) together with *Hordeum vulgare* (barley) were the most important cereals during the whole period, supplemented by *Avena sativa* (oats) since the Iron Age. *Secale cereale* (rye), which is present in small quantities since the Iron Age in the Pleistocene hinterland of the *Geest*, could not be cultivated in the clay district and was also not brought there by trade, as far as we know. Hence the percentage cereal composition in the clay district is very different from that of the neighbouring Pleistocene land, from which einkorn and emmer virtually vanished after the Roman period and the main cereal changed there from barley to rye. Investigations have also shown that there is no significant difference in the spectra of cultivated plants between sites in salt marshes and in riverine brackish marshes.

Plant proteins and oils were provided by *Vicia faba* (horse bean), *Linum usitatissimum* (flax) and *Camelina sativa* (gold-of-pleasure), which could also grow under oligohaline conditions and were cultivated in the whole clay district since the late Bronze Age. *Cannabis sativa* was not used before medieval times, but from then it is regularly present. From two sites of Roman age, Feddersen Wierde and Elsfléth-Hogenkamp, we know of *Isatis tinctoria*, which is used for dyeing. However, because of its suitability to dry soils it could hardly be cultivated directly in the clay district and was probably imported to dye the textiles for which the Frisians were famous.

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## THE ARCHAEOBOTANICAL REMAINS OF ROMAN AGE FROM THE EASTERN BLACK SEA LITTORAL (GONIO-APSAROS, SOUTHWESTERN GEORGIA)

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*Key words: Archaeobotany, Agriculture, Apsaros, South Caucasus, Roman age*

Apsarosis is a Roman fortification on the southwestern Black Sea, 15 km south of Batumi (western Georgia). The Caucasus region was conquered by the Roman commander Pompeius as early as 65 BC, later Nero increased concentration of Roman military forces in the east and a special force, the so called "Pontic Limes" was formed. Apsaros was a functioning force already from AD 70, according to archaeological evidence from red-glazed bowls, amphorae, Sinopean louteria, glass vessels etc., as well as Pliny as a written source. In 2005 outside the western fort wall of the Gonio-Apsaros fortress, to the left of the central entrance, the remains of a building were unearthed from a trial trench, which was dug through in front of the tower N4 into a cultural layer of the Roman period. In the inner space of the building, between the floor and the crumbled remains of the tiled roof, a rather thick 40-50 cm deep charred layer was found over the whole area. In its southwest corner, a charred pile of cereals was disclosed. Next to it, fragments of a solene type of amphora, pottery with red varnish and glassware were revealed. In the charred layer of cereals was a silver coin of Trajan (AD 98-117). This cereal layer was studied archaeobotanically in 2008. The layers are dated to the second half of the 1st and the first half of the second century AD, according to the finds of pottery, glassware and the silver coin. The total volume sediment studied was 400 litres. In the carpological (seed) sample, among the crops appeared: naked wheat, *Triticum aestivum* s l., *T. dicoccum*, a few remains of *Hordeum sativum* ssp. *vulgare* as well as *Avena sativa*, *Lens culinaris* and *Lathyrus sativus*. About 30 wild plant species were present. Among them are cereal weeds: *Setaria glauca*, *Galium aparine*, *Agrostemma githago*, *Asperula arvensis*, *Bifora radians*, *Vicia tetrasperma* and *Sinapis alba*. Ruderals or weeds are: *Cirsium arvense*, *Lathyrus tuberosus*, *Stellaria media* and *Vaccaria segetalis*. Common ruderals are: *Falcaria vulgaris*, *Leucanthemum vulgare*, *Galium verum* and *Vicia sepium*. Weeds of arable fields and gardens or ruderals are: *Aethusa cynapium*, *Androsace maxima*, *Thymelaea passerina* and *Fumaria officinalis*. Spices and condiments are: *Apium graveolens*, *Carum carvi* and *Coriandrum sativum*. Naked wheat seems to be the most important crop, represented only by grain, therefore it was not possible to determine its ploidy level, and it could have been used and cleaned before storing. The role of lentils was very minor. The few remains of barley as well as those of rye could have grown as crops, but the quantity of remains is very small and they could have grown as ruderal weeds. Common condiments, that are well known for culinary uses seem to have been a luxury import for the soldiers, or could possibly have been cultivated as well. This paper presents the first archaeobotanical results from this site on the use of food by its inhabitants, their living conditions and the natural environment.

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## ARCHAEOBOTANY AND THE HISTORY OF THE LOCAL FLORA: THE CASE OF 12<sup>TH</sup> CENTURY AD ARCHAEOBOTANICAL RECORDS FROM THE BISHOP'S PALACE OF MODENA (EMILIA ROMAGNA, ITALY)

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*Key words: Seeds and fruits, Middle Ages, Modena, Flora, Biodiversity*

In 2009 archaeological excavations in the bishop's palace of Modena brought to light a canal of the 12<sup>th</sup> century AD filled with plant material. Seeds and fruits, above all waterlogged except a few charred ones, showed a good state of preservation. The concentration of remains is 52174 seeds or fruits in 60 litres, and the floristic list includes 146 taxa. Archaeobotanical analyses show that the canal was partly naturally, and partly anthropogenically filled up, but it was rarely used for depositing garbage and latrine waste. The canal, rich in wetland plants, was probably close to a kitchen garden and a little orchard, with fruits, vegetables, aromatics/medicinal plants and weeds, as well as ornamental plants, such as for example *Aquilegia vulgaris/atrata* and *Prunella vulgaris*, probably also plants with a religious meaning, according to the archaeological context.

The revision of the *Flora of the Province of Modena* (in press) allows us to compare past and present floras. Among weeds, more than a fifth of taxa found in the archaeobotanical record are today rare or absent, such as *Agrostemma githago*, *Amaranthus graecizans/lividus*, *Ammi majus*, *Anthemis cotula*, *Chenopodium ficifolium*, *Medicago arabica*, *Neslia paniculata*, *Thymelaea passerina* and *Veronica hederifolia*. Of wetland plants, more than a third of taxa are in the same situation: we may mention *Cicuta virosa*, perhaps also grown as a medicinal plant in this context, *Cladium mariscus*, *Eleocharis multicaulis*, *Epilobium tetragonum*, *Hydrocotyle vulgaris*, *Oenanthe fistulosa*, *Pedicularis* cf. *palustris*, *Polygonum amphibium*, *P. minus*, *Ranunculus flammula*, *Rhynchospora alba*, *Salix viminalis* and *Scutellaria galericulata*. Several plants which today are missing from the plain, grow in the hills of the Emilia Romagna region. For example, in the medieval settlement of S. Agata Bolognese (BO, 17 m a.s.l., 10<sup>th</sup> – 11<sup>th</sup> century AD) we find many carpological records of *Drosera intermedia*, a protected species today, absent from the plain, but still present in the hills. So, archaeobotany is able to supervise the vegetal biodiversity in time, giving evidence of plants which have now disappeared.

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## AN EXOTIC PLANT IN THE WESTERN MEDITERRANEAN: SEBESTEN (*CORDIA* SP.) FRUITS IN ROMAN NARBONNAISE (SOUTHERN FRANCE)

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*Key words: Cordia, Roman period, Southern France, Imported goods*

Genus *Cordia* (Boraginaceae) includes hundreds of tree and shrub species from the tropical and sub-tropical zones of America, Africa, Asia and Oceania. Mentioned by Pliny the Elder, the Sebesten (*Cordia mixa*) was well known in the Roman world, both as edible fruit and for the medicinal properties of the drupe for lungs and nasopharyngeal disorders. Due to these properties, the fruits could be dried and subject to long distance trade as testified by numerous archaeobotanical findings. Its cultivation is clearly recorded in Egypt, a country included in the area of origin of this plant.

Recent archaeological rescue work carried out in two Roman sites in southern France, Marseilles and Nîmes, allowed the exceptional recovery of *Cordia* stones. The status of this plant and the exact meaning of its discovery in the Narbonnaise will be discussed, based on the archaeological contexts (filling of the ancient port, high social status habitat, funerary offerings) and on the associated plants recorded.

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## STANS KEHRSITEN: MACROREMAINS FROM A NEOLITHIC LAKE SHORE SITE IN CENTRAL SWITZERLAND

Christoph BROMBACHER<sup>1</sup>

*Key words: Lake dwellings, Cultivated plants, Gathered plants, Waterlogged preservation*

The site of Stansstad-Kehrsiten, located in the canton of Nidwalden (Switzerland), represents the first Neolithic lakeside settlement on the border of the pre-Alpine region. Following trial sondages in 2003 and 2004, a large underwater excavation was conducted in the winter of 2007/2008. In total 12 m<sup>2</sup> were excavated.

As usually found in lake shore settlements, several occupation phases are identified in Stansstad-Kehrsiten. The earliest phase dated to the Cortaillod (ca. 4000 BC) and the latest phase dated to the Horgen Culture (ca. 3200 BC); the latter did not yield a cultural layer.

The archaeobotanical analysis is confined to the settlement phases of the Cortaillod (ca. 4000 BC) and the Pfyn (3450 BC), from which sediments were available. 60 sediment samples were analysed, yielding approximately 255,000 plant remains belonging to more than 100 different taxa. In both the Cortaillod and Pfyn phases, waterlogged plant remains dominate, while the proportion of charred finds comprising mainly cereals is only about 7 or 6%.

The spectrum of cultivated plants is dominated by naked wheats and barley in both settlement phases, as is known from contemporary settlements in the northern Alpine foothills. Hulled wheats, on the other hand, are rare. In the Cortaillod there is evidence of einkorn; however it could not be detected in the layers belonging to the Pfyn culture. Notable is the almost complete absence of emmer.

In both settlement phases remains of opium poppy are abundant. Remains of flax are very frequently recorded in the Pfyn layer and almost absent in the Cortaillod layer. Peas are present in small numbers, and their evidence is limited to the Pfyn layer.

The spectrum of wild plants shows a remarkable number of forest plants, including large quantities of silver fir, hazel and wild apple. Remains of spruce, beech, lime-tree, maple, oak and alder are equally frequent. Noteworthy also are the large numbers of yew seeds, found mainly within the Cortaillod layer. In addition leaves and stems of mistletoe are found in large numbers.

In contrast to the forest plants, indicators of open land are scarce. Weeds of winter cereals and grassland plants are rarely represented. Nonetheless, in the Pfyn layer, the presence of *Silene cretica* represents a typical weed of flax cultivation. The small amount of aquatic plants indicates a low lacustrine influence on the cultural layers.

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## EVOLUTION OF ARABLE WEED FLORA DURING THE PROTOHISTORIC AND EARLY HISTORIC PERIODS IN NORTHERN GAUL: A STATISTICAL APPROACH TAKING ACCOUNT OF ARCHAEOBOTANICAL RESULTS AND POLLEN STUDY SURVEYS IN PRESENT-DAY NON-MECHANISED AGRICULTURE

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*Key words: Arable weed flora, Northern France, Gallo-Roman period, Archaeobotany, Palynology*

Archaeobotanical studies carried out on 89 farm settlements and 30 storage contexts revealed important changes in the composition of the arable weed flora in northern France, especially between the Iron Age and the beginning of the Gallo-Roman period (1<sup>st</sup> century BC – 1<sup>st</sup> century AD). New species, such as *Myagrum perfoliatum* and *Centaurea cyanus*, are encountered and the importance of other ones, such as *Agrostemma githago*, *Lithospermum arvense*, *Orlaya grandiflora* and *Torilis japonica*, increases considerably.

Considering the continuous diversification of the weed flora in northern France, and the multiplicity of the factors involved in those changes, it is not easy to determine their cause, but the introduction of a spring sown crop in agricultural systems, the importance of naked wheat cultivation, and the development of cereals in long distance trade are probably part of the answer.

It is a fact anyway that the reconstruction of ancient plant communities remains quite problematic, so that the necessity of comparison models taking account of the archaeobotanical data has been underlined. Approaches such as the FIBS developed by Bogaard, Jones, Charles and collaborators, on the basis of dry farmed and irrigated fields in northern Spain, have already greatly improved the interpretation of archaeological plant assemblages.

The possibility of extending botanical surveys to regions of similar weather conditions to the ones investigated here is examined. Regional surveys of the arable weed floras in places with present day non-mechanised agriculture appear as an emergency, since these floristic areas are often unprotected and clearly endangered in many parts of Europe. From this point of view, Romania represents a particularly favourable study area in the European context because of its geographical and historically original situations. So, to get a better understanding of the agricultural systems of northern Gaul, an ecological reference has been elaborated in this area. In this poster, we will discuss the potential and the limits of this crossed approach.

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## INVESTIGATIONS ON *GEREONIUM* (MOLISE, ITALY): SEED REMAINS FROM THE CASTLE'S KITCHEN (14<sup>TH</sup> CENTURY AD)

Marialetizia CARRA<sup>1</sup>

*Key words: Medieval, Crops, Weeds, Farming calendar, Palaeoenvironmental reconstruction*

The site of Gerione has a very long history. The original name, *Gereonium*, comes from a village mentioned in the works of Hannibal's war historians. A castle was built at Gerione at the beginning of the Middle Ages which was then destroyed by the earthquake of 1349. The archaeological excavations, by a team from Bologna University since 2003, are discovering various phases of occupation of the site.

The archaeobotanical analyses began in 2006. The aims of the carpological (seed) research are the study and identification of the various remains, wild or cultivated and the most frequent parts found (caryopses, rachis fragments, seeds, cotyledons, fruits, etc.), observation of the annual crop weeds to reconstruct the farming calendar, study of possible evidence of pests of stored products to find out about how foodstuffs were stored, observation of the autochthonous plants (which grew on the spot) and the remains from other vegetation associations, analysis of the wild component to study the palaeoenvironment, and planimetric analysis to investigate potential areas with a particular use.

The seed analysis at Gerione mainly concerns the castle's kitchen where the archaeologists found the situation in situ after the earthquake. The remains in the kitchen are pulses (horse bean, pea, chick pea and vetch), cereals (wheat and barley even if fragmented) and many flax seeds, probably used for food and oil. Various edible fruits have also been found, but there is a chronological difference: olive and grape remains are more frequent in the older samples (11<sup>th</sup> - 12<sup>th</sup> century AD) while there are more walnut and fig fragments in the later samples (14<sup>th</sup> century AD).

Lastly, there are a few remains from herbaceous vegetation, mainly crop weeds such as *Lolium* sp. L., *Bromus* sp. L., *Plantago lanceolata* L., *Silene alba* (Miller) Krause, *Fumaria officinalis* L. and *Galium* sp. L., and some medicinal plants such as *Malva alcea* L. and *Physalis alkekengi* L.

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## **PLANT OFFERINGS FROM ROMAN CREMATIONS IN NORTHERN ITALY: A REVIEW**

**Elisabetta CASTIGLIONI<sup>1</sup>, Mauro ROTTOLI**

*Key words: Iron Age, Roman, Plant offerings*

This study presents a review of plant products (cereals, pulses, fruits and bread) used as offerings in Roman graves in northern Italian cemeteries.

During the Iron Age, funerary offerings in inhumations and cremations were already common in Italy but only the cremation ritual allows a greater preservation of remains by carbonisation. Iron Age data seems to be more various in quantity and quality, due perhaps to different rituals.

With Romanisation, plant offerings become abundant and more standardised, largely dominated by fruits; different types of bread are also frequent. In each necropolis, this general outline presents variations, probably due to individual, social, ritual and economic aspects. In order to understand the relative importance of each factor, it is necessary to compare archaeobotanical results with anthropological and archaeological data and with ancient written sources.

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## VEGETATION CHANGE AND HUMAN IMPACT, AS REFLECTED IN LITTORINA SEA LAGOONAL DEPOSITS NEAR THE PRIEDAINĒ ARCHAEOLOGICAL SITE AT THE HEAD OF THE GULF OF RĪGA (PLANT MACROREMAINS, POLLEN AND WOODEN ARTEFACTS)

Aija CERĪNA<sup>1</sup>, Liene APSĪTE, Valdis BĒRZIŅŠ, Laimdota KALNIŅA, Ilze OZOLA

*Key words: Plant macroremains, Pollen, Wooden artefacts, Littorina lagoon*

The material for this study comes from an archaeological excavation at the edge of the Priedainē Neolithic settlement site, on the shore of a Littorina sea lagoon/lagoon lake, and from a core about 20 m out from the former shoreline. Pollen and macroremain analysis of Core 20, taken near the settlement site, reflects the development of the Priedainē lagoon from the middle to the end of the Atlantic (AT2, AT3). The lagoon became a lake during the Sub-boreal, and infilling continued. A mire developed in the area of this former water body during the Sub-atlantic.

Ruderal and cultivated land herb pollen indicates human presence and activities in the area since the time when organic sediment began to accumulate. Accumulation was especially intensive during AT2 and AT3, subsequently decreasing. Macroremain complexes have been divided as follows: Ia – dominance of terrestrial plants (AT2 pollen zone); Ib – *Ruppia maritima* presence among aquatic plants (beginning and middle of AT3); Ic – aquatic plants *Nymphaea alba*, *Zannichellia palustris*, *Najas marina*, *N. flexilis* and increase of mire plant remains (end of AT3, SB); II – dominance of terrestrial plant remains (end of SB, SA). The finds from the excavation area, at the foot of a linear dune, relate to the uppermost peat layer and an underlying layer of fine sand, rich in plant matter. The archaeological material, dated to the middle/late Neolithic, includes large numbers of pine laths, in two cases bound with birch bark (probably waste from the making of fishing structures), as well as some unusual wooden implements. Among the plant macroremains are remains of food plants: *Corylus avellana* nuts, *Trapa natans* fruits, as well as seeds of *Rubus idaeus* and *Fragaria vesca*. The diversity and quantity of remains of other dryland plants (*Pinus*, *Picea*, *Arctostaphylos uva-ursi*), including ruderals (*Chenopodium album*, *Urtica dioica*, *Polygonum lapathifolium*), is much greater than in the core samples. Seeds of the aquatic plants *Najas flexilis*, *N. marina* and *Nymphaea alba* indicate a subaqueous depositional environment.

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## IDENTIFICATION CRITERIA FOR BARLEY RACHIS: DISTINGUISHING TWO- FROM SIX-ROW AND NAKED FROM HULLED BARLEY

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*Key words: Barley, Rachis, identification, Çatalhöyük, Neolithic, Chalcolithic*

In this poster, to be accompanied by 'demonstration' and discussion in the laboratory session, we summarize criteria for distinguishing the rachis of two- and six-row barley (*Hordeum vulgare* L. ssp. *distichum* and ssp. *vulgare*) deriving from both hulled and naked varieties based on morphological observations in modern accessions. Previous work on the differentiation of rachis from hulled and naked barley varieties in the archaeobotanical literature has focused on central European remains of six-row barley. Furthermore, existing criteria for distinguishing two- and six-row barley refer primarily to hulled barley. It remains to determine whether the rachis of two-row naked barley can be distinguished from two-row hulled barley, on the one hand, and how both types differ from six-row hulled and naked varieties, on the other. This poster assesses previously suggested criteria for distinguishing two- versus six-row and naked versus hulled varieties of six-row barley together with new observations in order to develop a system for distinguishing all four major types of domesticated barley (two-row hulled, two-row naked, six-row hulled and six-row naked). We also present application of these criteria to material from Neolithic-Chalcolithic Çatalhöyük, central Anatolia, Turkey.

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## ARCHAEOBOTANICAL INVESTIGATIONS AT THE ROMAN TOWN OF TONGEREN (BELGIUM)

Brigitte COOREMANS<sup>1</sup>

*Key words: Roman period, Belgium, Agriculture, Diet, Urban organisation*

Macrobotanical research at various sites in Roman Tongeren has provided information about agriculture, diet and urban organisation. The majority of these sites are from the 1<sup>st</sup> and the first half of the 2<sup>nd</sup> century AD.

The first period of the Roman occupation started at about 10 BC and lasted only for a few years. During this phase, characterised by the presence of the Roman army, barley seems to have been an important crop but it loses its prominent position in favour of spelt.

On the whole the role of millets, regarded as having been important for the indigenous community during the Iron Age, becomes insignificant during Roman times and bread wheat and in particular rye are hardly met with. The decreasing importance of oats seems to coincide with the increasing degree of urbanisation of the town.

The influence of the Romans on the diet of the native inhabitants is clearly reflected by the presence of exotic products, newly introduced species and a growing variety of herbs, spices, fruit and vegetables. As for the urban organisation, evidence has been found for the presence of orchards and gardens in the close vicinity of the town. And even as late as in the 2<sup>nd</sup> century, in a less developed part of town, there may still have been space available for cattle-breeding.

Finally, a comparison with the nearby indigenous rural settlements of Veldwezelt and Kesselt will be made.

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## NEW PERSPECTIVES ABOUT THE HISTORY OF *CITRUS* IN THE WESTERN MEDITERRANEAN: A MULTIDISCIPLINARY INVESTIGATION IN THE CAMPANIA REGION (ITALY)

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*Key words: Citrus, Western Mediterranean, Archaic period, Roman period, Hesperids*

Recent discoveries of archaeobotanical macro-remains (seeds and fruits) and the pollen record can be used to shed new light on the history of hesperids spread in western Mediterranean regions. Fresh evidence comes from the island of Ischia (6<sup>th</sup> century BC) and from the cities of Cumae (6<sup>th</sup> century BC) and Pompeii (1<sup>st</sup> century BC-AD). In this context, while few doubts exist about its belonging to the *Citrinae* subtribe, the specific identification of a carbonized fruit from Ischia remains problematic. Besides classical morphology, we used micro-CT and MEB to characterize its subtle outer and inner structural morphology.

By relying on complete inter-fertility and apomixis (offspring being genetically identical to the parent plant), the classification of this specimen within the genus *Citrus* (or its close relatives) appears quite complicated. In fact, the “classical” classifications based on anatomical and morphological criteria have proved inadequate in appropriately assessing past “species”. Recent phylogenetic work based on SSRs molecular and AFLP markers supports the original suggestions that only *Citrus medica*, *C. maxima* and *C. reticulata* should be considered to be true species, while *C. limon*, *C. aurantium* and *C. aurantiifolia* are more likely represent hybrids occurring from cross-breeding or natural events.

While some consensus exists about the role of southwest China and northeastern India in the origin and diversification of the genus *Citrus*, the material reported so far is still too sparse to trace a reliable history of the date and mode of spread of hesperids towards other areas, notably the Mediterranean. Commercial routes which could have facilitated this trade have been extensively examined and classical sources carefully searched. However, the scarcity of the archaeobotanical remains, as well as some methodological limits in assessing taxa unequivocally, leaves this problem unsolved. Nonetheless, our investigations on the specimen from Ischia have also taken into account the iconographic evidence and classical sources.

Together with the evidence from Pompeii, the original material presented here is part of the extremely rare archaeobotanical record directly available on *Citrus* and may significantly contribute towards our understanding of its history and human use in antiquity.

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## **ESTABLISHING OPEN-ACCESS ONLINE REFERENCE COLLECTIONS FOR ARCHAEOBOTANICAL RESEARCH**

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*Key words: Reference collection, Website, Database, Open-access*

Limited access to high quality reference material has been a limiting factor in the advancement of archaeobotanical research. However, advancements in web-based database technology and faster downloading times make online curation of archaeobotanical reference images feasible for the first time. We describe the establishment of an open-access online reference collection database for macrobotanical, starch, phytolith and isotopic data to help to standardize and improve the identification of archaeobotanical remains.

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## **BREAD FOR THE GODS: MACRO- AND MICROSCOPICAL ANALYSES OF BREAD FRAGMENTS FROM A RELIGIOUS CONTEXT IN SOUTHEASTERN ITALY**

**Cosimo D'ORONZO<sup>1</sup>, Giovanna ARUTA<sup>1</sup>, Girolamo FIORENTINO<sup>1</sup>**

*Key words: Starch, Doughnut, Cereal, Sanctuary, Experimental archaeobotany*

Archaeological and archaeobotanical analyses have allowed understanding the use of plant resources in a complex cultural context, a sanctuary at Oria, Lecce, Italy, during the 6<sup>th</sup> century BC.

The archaeobotanical analysis has been done on charred remains of wood tissue of some Mediterranean taxa such as olive and oak which were used as fuel, and palaeoethnobotanical analysis of cereals, pulses, grape pips and various kinds of dough used in cultural rituals.

The main shape of the dough is like a doughnut, but it is possible distinguish flat bread too. In order to identify the grain used to make them, we tried to check various kinds of marker such as starch grains.

Therefore a particular experiment was designed to extract starch grains from cereals and other seeds such as pulses and tree fruit. The dough and leavened dough were experimentally reproduced and after cooking, they were charred at different temperatures.

Our results confirm that the heating process caused morphological changes often resulting in the total destruction of starches. The experimental results and the ESEM (environmental scanning electron microscope) analysis suggest choosing another marker such as the internal morphology of dough: the density and dimensions of voids are connected to gluten quantity. On the basis of our analysis, we propose that the taxon used to make the doughnut was a cereal with a high percentage of gluten, such as naked wheat.

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## **ARCHAEOBOTANICAL ANALYSIS OF THE MIDDLE BRONZE AGE VILLAGE OF FILO BRACCIO AT FILICUDI (AEOLIAN ISLANDS, ITALY): SPATIAL ANALYSIS AND THE IDENTIFICATION OF DIFFERENT ACTIVITY AREAS**

**Cosimo D'ORONZO<sup>1</sup>, Angela STELLATI<sup>1</sup>, Girolamo FIORENTINO<sup>1</sup>**

*Key words: Functional approach, Spatial sampling, Archaeobotany, Aeolian islands*

During 2009 the new archaeological investigations at the middle Bronze Age settlement of Filo Braccio (16<sup>th</sup> – 14<sup>th</sup> century BC) revealed a series of new huts and a multifunctional open area. All the archaeological contexts have been investigated through two different kind of spatial sampling: the first one based on a one metre square grid, and the other one using irregular features connected to the presence of hearth structures and pottery remains. Collected plant macroremains, such as cereals, pulses and grape pips, have been counted and plotted on the settlement plan.

In order to interpret the management of these areas, a functional approach has been carried out. The spatial distribution of seeds shows as the multifunctional open area which was assigned to the processing of cereals (threshing and roasting), while in the huts it is possible to distinguish indirect cooking from storage and refuse areas.

This preliminary study allows us for the first time to shed new light on the uses of the various areas in the Aeolian Bronze Age settlements.

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## ARCHAEOBOTANICAL FINDS OF CULTIVATED PLANTS IN THE PREHISTORY OF THE CZECH REPUBLIC

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*Key words: Botanical macroremains, Cultivated crops, Prehistoric agriculture, Czech Republic*

The results of almost eighty years of archaeobotanical determination of plant macroremains from pre-historic archaeological contexts in the Czech Republic are summarised in the poster presentation. The early, more or less accidental finds are supplemented by and reviewed with the modern results from the last decade. Chronological development of cultivation of cereals, legumes and technical plants is compared with the knowledge from surrounding countries. The results show generally identical correspondence with the trends observed in other parts of central and northwest Europe.

The development of arable agriculture can be divided into five periods, according to changes in the range of cultivated plants:

- “archaic” agriculture with a typical Neolithic range of crops – emmer, einkorn and legumes.
- agriculture of the Eneolithic (late Neolithic) and the early Bronze age; significant domination of emmer, a rising proportion of barley.
- agriculture of the late and final Bronze Age and early Iron Age characterised by a wide range of cultivated species (the total sum rises to thirteen). An introduction of naked wheat cultivation.
- progressive agriculture of the late Iron Age, with a range of innovative changes, headed by the rapid onset of naked wheat cultivation and the start of rye and oat cultivation. First evidence of meadow cover (hay) and the cultivation of fodder plants on arable land.
- agriculture of the Roman and Migration periods with signs of mutually opposing evidence: progressive spread of oat cultivation against archaic or a regressive drop in the importance of naked wheat and spelt.

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## RECENT ARCHAEOBOTANICAL RESULTS FROM ÇATALHÖYÜK, CENTRAL ANATOLIA

Dragana FILIPOVIC<sup>1</sup>, Amy BOGAARD<sup>1</sup>, Michael CHARLES<sup>2</sup>, Müge ERGUN<sup>3</sup>, Glynis JONES<sup>2</sup>, Alex LIVARDA<sup>4</sup>, Eleni ASOUTI<sup>5</sup>

*Key words: Çatalhöyük, Neolithic, Chalcolithic, Storage, Consumption*

In this poster we summarize recent archaeobotanical work at Neolithic-Chalcolithic Çatalhöyük, central Anatolia, Turkey, with particular attention to on-site activities surrounding plant storage and consumption. *In situ* concentrations of plant material recovered from several burnt houses offer insights into choices made in the placement, scale and diversity of plant stores. Archaeobotanical remains from hearths/ovens, small-scale burning events in external areas ('fire spots') and middens provide complementary evidence of plant processing and consumption activities. The small scale, repetition and widespread spatial distribution of plant-related activities suggest that they reinforced the modular household-based social structure of the community. Extensive excavation and sampling provide the opportunity to consider the extent to which these activities varied across neighbourhoods and through time. Consideration of other bioarchaeological datasets (especially faunal remains) suggests that plant- and animal-derived foods played interdependent roles in broader social as well as dietary terms. Analysis of wood charcoal alongside seed, chaff and fruit/nut remains enables us to consider plant 'consumption' in its broadest sense, including use of firewood and architectural timber.

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## ENVIRONMENTAL RECONSTRUCTION THROUGH CARBON STABLE ISOTOPE ANALYSIS OF CEREAL REMAINS

Pascal FLOHR<sup>1</sup>, Gundula MÚLDNER, Emma JENKINS

*Key words: Carbon isotope, Cereals, Environmental reconstruction, Irrigation*

Climate change is often linked to socio-economic changes as seen in archaeological evidence. To make a case for a causal link, a first step is to correlate changes in the environment with changes in the archaeological material. A potentially valuable method in this respect is carbon stable isotope analysis of ancient plant remains. This method is based on the relation between plant carbon stable isotope ratios and environmental factors, especially water availability, as attested in modern examples. Indeed, there have already been interesting applications to archaeological samples of Mediterranean and Near Eastern sites. The application of the carbon isotope analysis of plant remains to archaeology is relatively new, however, and therefore some questions still need answering. The first aim of this research is to look into these and refine the method. Thereafter, it will be applied to archaeological samples from the southern Levant.

This poster will focus on results of the methodological part of the research. For this, samples of experimentally grown cereals are being used. Wheat and barley were grown for three years at three sites in northern Jordan, and sorghum is currently being grown for the second year. The crops were and are grown under five different irrigation regimes, ranging from 0% (rainfall only) to 120% of the crops' optimum water requirements. Environmental factors were and are closely monitored. The carbon isotope ratios of the crops thus give information about the relative effects of different environmental variables and natural variation, as well as giving baseline values of cereal carbon isotope ratios for the region.

In addition, the applicability of the method to archaeological samples is looked into by assessing the effects of charring and burial on the stable isotopic composition of the cereals. The first is done by experimentally charring, both under laboratory conditions and in open fires. The latter is being achieved by experimental burial of samples of wheat and barley at sites in the United Kingdom and Jordan.

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## FEWET (LIBYA, CENTRAL SAHARA) AND THE ARCHAEOBOTANICAL RESEARCH ON GARAMANTIAN TIMES

Elisa GIANASSI<sup>1</sup>, Giovanna BOSI, Isabella MASSAMBA N'SIALA, Anna Maria MERCURI

*Key words: Fewet, Garamantes, Mature phase, Agricultural strategies*

The site of Fewet, located in the southwestern part of the Fezzan region of Libya, was inhabited by a clan or tribe of ancient peoples of the Sahara who, using oases and controlling the Saharan caravan routes, flourished in this region in the period ca. 500 BC – AD 500. In the ancient Greek and Roman sources they are known by the name Garamantes. The site includes a little agricultural compound (200 BC – 0) and an adjacent necropolis (650 BC – AD 350).

The research on plant macroremains and charcoal has allowed to know the “mature phase” of the Garamanian culture and economy in a territory at the edge of their former kingdom, where it is more possible to follow the transition from the Late Pastoral period to this culture. *Phoenix dactylifera*, in the form of stones, fruits and charcoal, is the best represented plant in the archaeobotanical record. The biometrical and morphological data of date palm stones are important markers of domestication and cultural cares. Cereals, above all *Hordeum vulgare*, are always in association with pulses suggesting a complementary use of these crops in the central Sahara. The landscape of the oases was thus already like a garden in Garamanian times, with trees for fruit, fuel and timber, and herbaceous plants cultivated in the shade of the trees. Many of these plants together with plants from natural desert vegetation were used by the Garamantes in several ways, like weaving mats and baskets.

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## **WATERLOGGED GRAPE REMAINS (*VITIS VINIFERA* SSP. *VINIFERA* L.) FROM A BYZANTINE WELL AT SUPERSANO, SOUTHEAST ITALY: REMAINS OF WINE MAKING?**

**Anna Maria GRASSO<sup>1</sup>, Girolamo FIORENTINO<sup>1</sup>**

*Key words: Byzantine Italy, Well context, Wine making, Vitis vinifera, aDNA, Grape pip morphometry*

Wine making is amply attested by written sources in Italy for the entire Middle Ages, but the archaeological and archaeobotanical evidence turns out to be sporadic because of its difficult interpretation and little research on it.

Recent archaeological investigations carried out in the Byzantine (7<sup>th</sup> – 8<sup>th</sup> century AD) settlement of Supersano, southeast Italy, have identified a well with waterlogged and charred plant materials. The composition of the collected samples includes large numbers of *Vitis vinifera* remains such as pips (often fragmented), grape skins and pedicels that strongly suggest grape processing for making wine. In order to identify the varieties employed, we have also undertaken outline shape analysis of pips in association with ancient DNA studies.

The results show indirect evidence of ancient winemaking in the Byzantine settlement and the analysis of varieties has demonstrated cultural and/or commercial contacts with eastern Mediterranean areas.

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## FARMING AND FORAGING ON LIMESTONE AND LOESS – ARCHAEOBOTANICAL RECORDS FROM THE LATE IRON AGE SETTLEMENT OF MICHELSTETTEN (LOWER AUSTRIA)

Andreas G. HEISS<sup>1</sup>, Marianne KOHLER-SCHNEIDER<sup>1</sup>

*Key words: Iron Age, La Tène, Forest-steppe, Plant collection*

Macrofossil analyses of the samples from six pit houses from the La Tène settlement of Michelstetten yielded a total of 1526 charred plant remains and 74 identified taxa (17 cultivated and 57 wild plant taxa). Cereals were mainly represented by broomcorn millet (*Panicum miliaceum*) and barley (*Hordeum vulgare*), while einkorn (*Triticum monococcum*), spelt (*T. spelta*), emmer (*T. dicoccum*) and naked wheat (*T. aestivum/durum/turgidum*) were found in relatively low numbers. Foxtail millet (*Setaria italica*) was rare, and records of rye (*Secale cereale*) and “new type” glume wheat were restricted to single specimens. Pulses were represented by pea (*Pisum sativum*) and lentil (*Lens culinaris*), while oil seeds were – most probably due to taphonomical reasons – completely absent. Charred remains of food residues were recorded in the pit houses with the richest plant material, consisting mostly of amorphous crusts with cereal bran remains. The entire spectrum of cultivated plants fits well with plant assemblages from other Iron Age sites in eastern Austria (Oberleiserberg, Roseldorf, Gars-Thunau) and matches the general pattern of eastern central Europe during the Iron Age.

Among the wild plants, ruderal plants and arable weeds were clearly dominant, followed by species of steppe- and forest-steppe-like habitats. Forest species however were much rarer, and wetland species played an insignificant role. Some of the recorded weeds (e.g. *Buglossoides arvensis*, *Asperula arvensis*) indicate that the Iron Age settlers had to make use of stony, marginal soils in addition to the rich loess sites in the settlement's vicinity – a possible hint of a relatively dense human population. Of particular interest is the find of *Xanthium strumarium*, as it comes from a purely ruderal context: so far, most prehistoric records of this species had been associated with natural riverine habitats. It seems that the ruderal career of *Xanthium* has begun at quite an early date. Judging from the abundance of dry land species in Michelstetten, open habitats must have played an important role in the Iron Age landscape. Recorded species range from typical steppe representatives like *Stipa pennata* to forest steppe- and shrubland-species, like *Nepeta nuda* and *Veronica teucrium*, which points to a rich and varied mosaic of open and semi-open habitats. This matches the archaeozoological record of ample livestock keeping in the settlement.

Woodland species are mostly represented by taxa growing on forest edges and in open woodland tracts, e.g. hazel (*Corylus avellana*), cornelian cherry (*Cornus mas*), bladder cherry (*Physalis alkekengi*), elder (*Sambucus nigra*) or apple/pear (*Malus/Pyrus*). These fruit-bearing, edible taxa might rather reflect wild plant collecting activities than vegetation patterns. Aside from the fruits, other wild plants recorded in Michelstetten might have been collected, either for consumption or medicinal purposes. When compared with other Iron Age sites of the region, the wild plant spectrum of Michelstetten mirrors subtle differences in local climate, which can still be observed today.

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## FRUITS AND EARS – ANOTHER WELL FROM THE LINEAR POTTERY CULTURE: SCHKEUDITZ-ALTSCHERBITZ, SACHSEN, GERMANY

Christoph HERBIG<sup>1, 2</sup>

*Key words: Neolithic, Waterlogged, Wooden construction, Cultivation of Physalis and Hyoscyamus*

During large scale archaeological excavations in advance of the expansion of the airport for Leipzig/Halle, the Archaeological Heritage Service in Saxony uncovered a settlement from the early Neolithic Linear Pottery Culture (LBK), including a well. It is now the sixth early Neolithic well found in Sachsen. Three of these, found near Eythra and Plaußig, were presented by U. Maier at the 14<sup>th</sup> Symposium in Kraków 2007.

The lower 3 m of the well with its wooden shaft were preserved in waterlogged conditions by the ground-water table. The feature was block-lifted and transported to the premises of the Archaeological Heritage Service where further excavations directed by Rengert Elburg, and almost under laboratory conditions, started in March 2008 and will finish this year.

The wooden shaft of the well was built in log-cabin style from oak and dates dendrochronologically shortly before 5100 cal BC. After its abandonment, the lower part of the well was filled, in several episodes, with sediments and organic material which is remarkably well preserved.

Archaeobotanical investigations accompany the excavation. By February 2010 about 300,000 plant macroremains from 120 species were identified, mainly cultivated plants (*Triticum dicoccon*, *T. monococcum*, *Hordeum vulgare*, *Lens culinaris*, *Pisum sativum*, *Linum usitatissimum*, *Papaver somniferum*) and ruderals which reflect the human impact within the settlement and its immediate surroundings.

Some plants like *Physalis alkekengi* (5400 seeds) and *Hyoscyamus niger* (1200 seeds) are so regularly found that their cultivation can be presumed. The well contains not only fruits and seeds but also complete inflorescences. Sensational and most impressive are complete uncarbonised cereal ears, which will be presented on the poster.

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## FLORA ANTICA – A DATABASE OF TREES OF ANCIENT ITALY

Michael HERCHENBACH<sup>1</sup>

*Key words: Roman Italy, 1<sup>st</sup> – 3<sup>rd</sup> century AD, Archaeobotany, Ancient literature, Ancient art*

The “Flora Antica” database was developed within a doctoral research project and tries to collect information on trees and their remains to be found in Italy during the first centuries of the Roman Empire (1<sup>st</sup> – 3<sup>rd</sup> centuries AD). The focus of the research is Pompeii with its extensive possibilities to combine archaeobotanical and iconographical sources; further evidence comes from Rome and research throughout the Italian peninsula. Very important references for plants in the Empire are also ancient literary sources such as Pliny the Elder, Dioscorides and Columella, to name only a few. These three types of testimonials – archaeobotany, literary sources and iconography – are the basis of the “Flora Antica” database.

The data is presented online at [www.flora-antica.de](http://www.flora-antica.de). The website allows viewing of the information according to modern botanical nomenclatural systematics. As much information as possible is presented for each species: introductions on the archaeobotanical finds (seeds and fruits, wood and on-site pollen), knowledge about the referred plant in ancient times according to Latin and Greek sources, as well as its representation in ancient frescoes. All archaeobotanical entries cite the responsible scientists; bibliographical hints are also often given for identifications in art. If possible, the archaeobotanical data is presented in plant use categories like food, medicine etc.; these categories are comparable to those found within literary sources. As a database like “Flora Antica” can only be a “work in progress”, further input on literature or representation in art is welcome.

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## FINDS OF CHARRED GRAINS FROM ESTONIAN HILLFORTS

Sirje HIIE<sup>1</sup>

*Key words: Cereals, Hillfort*

There are no systematically collected archaeobotanical samples from Estonian hillforts, but some of these have still provided very impressive finds of burnt cereals discovered during archaeological excavations.

In 1936 – 1938 archaeological excavations took place on Iru hillfort. Under the wall ruins dated to the 9<sup>th</sup> century AD, numerous charred *Hordeum vulgare* (barley) grains were found with a small amount of *Triticum aestivum* (bread wheat) and *Secale cereale* (rye). *Pisum sativum* (pea) together with barley were also found. The same composition of grains was observed in the material from the excavations in 1952 and 1955.

From the 11<sup>th</sup> century AD hillfort Kuusalu Pajulinn, a 10 – 20 cm thick layer of carbonized cereals was discovered near the wall during the excavations in 1938. This layer consisted mostly of grains of *Hordeum vulgare* and *Pisum sativum*, as well as small amounts of *Triticum aestivum* and *Secale cereale*.

From the Rõuge hillfort site, charred grains of *Hordeum vulgare* were found on a house floor dated to the 9<sup>th</sup> – 10<sup>th</sup> centuries AD.

The most impressive archaeological find of cereals was discovered in the 11<sup>th</sup> century AD Soontagana hillfort, a charred layer of grains consisting of 95% *Secale cereale* (rye) and the rest *Hordeum vulgare* and *Triticum aestivum*. Some grains of *T. turgidum* were also determined. Finds of *Bromus secalinus* indicate the cultivation of winter rye.

The dominant cereal in Otepää hillfort from the 11<sup>th</sup> – 12<sup>th</sup> centuries was *Triticum aestivum*, accompanied by small quantities of *Secale cereale*, *Hordeum vulgare* and *Avena sativa*. In the 12<sup>th</sup> – 13<sup>th</sup> centuries *Secale cereale* dominated with a few grains of *Triticum aestivum* and *Avena sativa*.

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## NEOLITHIC AND BRONZE AGE HUMAN IMPACT AND LANDSCAPE DEVELOPMENT IN THE SEEBACHTAL, THURGAU, SWITZERLAND

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*Key words: Neolithisation, Eutrophication, Lake-level fluctuations, Climatic change, Macrofossils*

The Seebachtal is located southwest of Bodensee (Lake Constance) which is bordered by Switzerland, Germany and Austria, in a region settled by prehistoric people since the Neolithic period. Archaeological research has revealed three major lake-shore and pile-dwelling villages in the Nussbaumersee (Neolithic 3840–3700 BC: approx. 30 buildings, early Bronze Age 1580 – 1538 BC: approx. 30 buildings, and late Bronze Age 850 – 800 BC: at least 100 buildings). In order to reconstruct general landscape and vegetational changes, a lake sediment core was taken from the deepest point of the Nussbaumersee and analysed for pollen, non-pollen palynomorphs and macrofossils. Each of the known larger settlements is also represented in the pollen and macrofossil data by indicators for human impact (especially charcoal and Cerealia), even if there is no direct correlation between village sizes and these biological markers. Population density, social and sustainability aspects, and/or different economic systems of prehistoric societies may have contributed to this picture. In addition, it was revealed that eutrophication of the lake ecosystem took place during the settlement periods, shown for example by higher quantities of *Nymphaea alba* finds, as well as by various animal and fungal remains. The macrofossil data also show repeated lake level changes which partly correlate with the known climate changes during the Holocene, and which show that the archaeologically preserved settlements were mainly built during times of generally low lake levels. In contrast to the archaeological evidence, however, palaeoecological data show that human influence in the area started at least 4900 BC and continued with only a few interruptions until the present. The virtual lack of archaeological finds during the periods of higher lake levels can best be explained as the result of unlikely chances of preservation of archaeological remains on dry upland settlement locations.

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## **FOOD PREPARATION AND RELIGIOUS ASPECTS OF MAIZE (*ZEA MAYS* L.) IN LACHUNG VALLEY, NORTHERN SIKKIM, INDIA**

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*Key words : Sikkim, Maize, Lachung, Monasteries*

During the first half of the 20<sup>th</sup> century, there was a hypothesis that small seeded maize (*Zea mays* L.) originated independently in parts of Sikkim, Nagaland and Bhutan. However, subsequent cyto-taxonomical and genetical studies have shown that this was, in fact, one of the varieties of maize which primarily originated in Mexico.

Pending detailed archaeological excavations and systematic palaeoethnobotanical studies in Bhutan, Nagaland and Sikkim, it is still unclear as to when and how this important item of present day food reached the innermost parts of northeast India, especially southern and northern portions of Sikkim and adjoining countries. This, in all probabilities, seems to have happened during Late Historical and sub-modern times.

The paper incorporates results of field observations of traditional communities around Lachung valley, which is, in fact, the northernmost limit for human habitation as well as for maize cultivation in northern Sikkim. The Lachungpas, the original inhabitants of Lachung valley, also offer maize along with barley, juniper leaves and berries, etc. to the local Buddhist monasteries in religious rituals. This is an excellent example of secondary diversification, adoption and amalgamation of foreign food elements in culinary practices of hill dwellers facing an acute shortage of cultivable land.

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## A HUNDRED YEARS OF ARCHAEOBOTANICAL INVESTIGATION ON A ROMAN FORTRESS IN PANNONIA

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*Key words: Hungary, Roman Age, Pannonia, Castrum, Archaeobotany, Macroremains*

One of the biggest Pannonian fortresses in Hungary is located on the west bay shore of Lake Balaton. The 14 ha fortress in Keszthely-Fenékpusztá was destroyed in the middle of the 5<sup>th</sup> century AD, probably by the Goths. Archaeological research started here in the second part of the 19<sup>th</sup> century. Plant macroremains were found in four excavation periods. The first botanical finds came to light in the year 1904 from a rubbish layer of a Roman villa built at the end of the 4<sup>th</sup> century AD. About 15000 diaspores of 19 species were found, mostly einkorn and emmer. The second archaeobotanical assemblage is known from the 1970-72 excavation campaign, in which the charred remains were systematically collected. The large number of seeds, the carbonized, metre thick layer of cereals found in front of the southern fortification gate, in a well and ovens imply that at least 1000 tons of cereals must have been stored within the walls, mainly in the horreum, before the attack and fire. More than half a million seeds and fruits of 53 taxa (cultivated plants, weeds and wild plants) were identified during the long-term archaeobotanical investigation. The third archaeobotanical collection is known from the excavation of the year 1993. Despite the systematic sampling, only a hundred carbonized remains of 13 plant species could be found in front of the west gate, mostly barley, emmer, common wheat, lentil and weeds of ruderal habitats and cereal fields. The fourth archaeobotanical research programme was done in 2009 within the framework of a joint German-Hungarian co-operation. The samples were taken systematically from a villa heating system of the early/mid 4<sup>th</sup> century AD. This time, 300 charred seeds of 42 taxa and hundreds of fragments of food remains were found. Keszthely-Fenékpusztá is outstanding among Roman age archaeobotanical sites. This is the only site in Hungary where a hundred years of archaeobotanical remains are available. At the same time, changes in methodology can be tested. With the help of plant remains we could reconstruct not only the cereal cultivation but also fodder production, horticulture and viticulture during the Roman occupation. During the hundred years research, 600,000 seeds and fruits of about 60 plant species have been found. They are mostly cereals, weeds and species of the contemporary natural vegetation. Some of the grains presumably came from other provinces. The most important cereals were barley, common wheat and rye. Einkorn, emmer, spelt and millet were also present. Among the poppy, pea, bitter vetch and horse-bean seeds there also occurred large-seeded lentil. Some evidence of local fruit growing and viticulture are available, from finds of peach, walnut and grape. Carbonised cereal gruel and leavened bread fragments indicate that the inhabitants had various and nutritional foods supplemented by imported figs and olives.

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## **NEW ANALYSES ON THE DEVELOPMENT OF EARLY RICE CULTIVATION SYSTEMS IN INDIA**

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*Key words: Weeds, Phytoliths, Irrigation*

There is a small, but growing, dataset of weed seeds and phytolith assemblages to complement the records of Neolithic, Chalcolithic and Iron Age rice in India. Here we compile evidence for morphological diversity in phytoliths and changes in grain size with an increase that starts after the Neolithic. Weed assemblage data suggests that the earliest cultivation was based on natural flood or rainfall regimes, with increasing evidence for wetland weeds and therefore irrigated rice fields by the Iron Age (from ca. 1000 BC) after which wetfield rice cultivation spread more widely in India, including to the south and Sri Lanka.

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## LANDSCAPE HISTORY OF KLAIPĖDA, LITHUANIA, IN THE 16<sup>TH</sup> – 17<sup>TH</sup> CENTURIES AD: ARCHAEOBOTANICAL AND ARCHAEOLOGICAL DATA

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*Key words: Archaeobotany, Plant macroremains, Pollen, Landscape development*

In 1252 the Teutonic Knights established a fort called Memelburg at the mouth of the river Dane, close to the eastern shore of the Baltic Sea. In the early of 16<sup>th</sup> century during the fort reconstruction, the town was moved to a newly formed island that gave birth to the town of Klaipėda, Lithuania. Archaeological excavations carried out there have uncovered layers enriched by numerous artefacts such as ceramics, glass, iron, remains of clothes and shoes dating back to the middle of the 16<sup>th</sup> to the end of the 17<sup>th</sup> century AD. As shown by archaeobotanical data, there was little husbandry in this area before the town started to develop, or traces of this activity were destroyed later. Townspeople initially settled on the hill, on the uppermost part of the island. The wet lower part of the island was occupied in the middle to second half of the 16<sup>th</sup> century AD. The oldest discovered remains of wooden buildings date back to this time, when a rapid spread of ruderal plants instead of wetland ones was noted. The shore line of a pond that existed until the 17<sup>th</sup> century was detected here. Archaeobotanical investigations also provide data on the use of plant material, functions of houses and trade connections as well as on the social and economic conditions in the town. Quite a large number of pollen grains of cultivated plants (*Secale cereale*, *Cannabis sativa* and *Fagopyrum*) and macroremains of weeds (*Agrostemma githago*, *Galeopsis tetrahit*, *Chenopodium album*, *Fallopia convolvulus*, *Spergula arvensis*, *Persicaria lapathifolia* et al.) accompanied by various ruderal taxa have been discovered in the cultural layers deposited within the dwellings and yards. Although the existence of small cultivated fields close by cannot be excluded, the major part of the identified pollen grains and some plant macroremains were evidently brought into the area together with crops. However, plant macrofossil material suggests that gardens existed close to the investigation point where various plants such as *Cucurbita* were cultivated and weeds flourished. The presence of *Vaccinium myrtillus*, *Rubus idaeus*, *Fragaria vesca* and *Corylus avellana* remains indicates contemporary use of woodland resources. Being a seaport, Klaipėda had dealings with other European countries, and exotic plants such as *Ficus carica* and *Juglans regia* were imported and used by the local population in the 16<sup>th</sup> and 17<sup>th</sup> centuries AD.

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## ARCHAEOBOTANICAL MACROREMAIN ANALYSIS OF THE MIEVEAL CESSPIT 938 FROM CHRUDIM, CZECH REPUBLIC

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*Key words: Bohemia, Macroremains, Cesspit, Royal town, Useful plants*

The medieval town of Chrudim, a prominent royal town in eastern Bohemia, was situated on an important trade route from Prague to Moravia. The areas of three ground-plots belonging to three houses were investigated in archaeological salvage research in 2006. Several features were discovered including cesspits, waste pits and a cellar with a barrel vault. Results of archaeobotanical analysis carried out on cesspit nr. 938 are presented. This is one of three circular cesspits with stone walls, chosen for its very fine stratigraphy. The cesspit was in use from the 14<sup>th</sup> to the 17<sup>th</sup> century, and it was partially emptied several times during this period. Based on the macroremain analysis, the former vegetation of urban ground-plots and the dietary habits of the medieval townsfolk are reconstructed. Approximately 13000 plant remains belonging to 71 species were identified. Useful plants such as *Fragaria vesca/viridis*, *Vitis vinifera*, *Rubus idaeus* and *R. fruticosus* are abundant. *Brassica nigra* seems to have been frequently used as a spice. *Ficus carica* was identified as an ordinary imported fruit. A difference in structure of weed and ruderal vegetation between the High Medieval and the Early Modern period sediments was confirmed. This is connected with a change of lifestyle and agricultural methods in the Early Modern period compared with the older period. The high concentration of useful plants suggests the possibility of the partial preservation of the original fillings of vessels found in the cesspit.

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## THE FUNNEL BEAKER CULTURE IN NORTHWESTERN GERMANY - RECONSTRUCTIONS FROM POLLEN INVESTIGATIONS

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*Key words: Neolithic, Funnel Beaker, Pollen*

Northwestern Germany was settled by the Funnel Beaker (Trichterbecher) people (western group) and the succeeding Single Grave culture. Several megalithic tombs, grave mounds, earthworks and signs of former settlements show the presence of these cultures in the area between ~6000 and 4000 cal yr BP. Despite these prominent monuments, only little is known about the structural context between graves and settlements, temporal and spatial patterns of the Neolithic occupation period, and the level of influence these cultures had on the surrounding landscapes. In the present study, archaeological excavations and pollen as well as macroremain investigations shall shed light upon these issues. The selected study sites are located in the federal state of Niedersachsen (Lower Saxony) in the Weser/Ems and Elbe/Weser area and represent sandy *geest* islands that were formed due to the fragmentation of Pleistocene sands by enhanced bog growth during the Atlantic period. These bogs provide valuable information for the palynological investigation, but industrial and rural peat-cutting as well as intense agriculture limit the availability of adequate archives particularly in the Weser/Ems area. Detailed information from the Neolithic in the Elbe/Weser area was obtained by Behre and Kučan from the Siedlungskammer Flögelin. The investigation showed an early Neolithic phase of leaf fodder collection after ~5900 cal yr BP that was followed by a rapid transition to wood pasture and farming after ~5100 cal yr BP. Whether these findings could be related to the whole sphere of the Funnel Beaker Culture (Trichterbecherkultur) (western group) needs to be further investigated. For the present study, 15 sites were sampled, and two promising profiles were recovered close to archaeological finds. These samples will be analysed soon and shall help us to understand the Neolithic occupation period in Niedersachsen. Macroremain studies are planned for settlement excavations.

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## INSIGHT INTO THE ENVIRONMENT OF AN EARLY MODERN OXBOW LAKE (RHEINLAND, GERMANY), USING A MULTI-PROXY APPROACH

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*Key words: Interdisciplinary investigations, Land use change, Early modern time*

In a multi-proxy approach, an oxbow lake on the lower reaches of the river Inde in the Rheinland was analysed. The investigation area is situated in one of the most fertile landscapes in western Germany, in the vicinity of the cities of Aachen, Köln and Jülich. Using archaeological and natural scientific methods, such as pollen analyses, macro remains, micromorphology and element analyses, the environment and land use of early modern time were studied.

The pollen analyses from the oxbow lake showed an intense cultivation in this area producing plenty of cultivated plants (crops, cannabis, flax, horse bean). The floodplain grassland was used as meadow and/or pasture, whereas the arable land was situated on the elevated loess areas. Seeing the diversity of species and the amount of pollen grains from grassland and cultivated plants, it seems likely that the food for cities such as Köln was produced in this area.

The micromorphological results show a distinct horizontal lamination of differing thickness. The silt- and clay-dominated layers are broken up by several thin layers of clay or light organic layers. Parts of the sediments contain a high proportion of charcoal. The deposits indicate a slow and steady sedimentation in the oxbow lake.

Furthermore, grain size analyses and other geochemical analyses like CNS were carried out. To measure element concentrations, the sediment samples were investigated by a mobile X-ray analyser. The first results show that different sedimentation phases have special distributions of the content as well as composition of heavy metals. The increase of contamination caused by human activities, attributed to mining within the catchment area, is plainly visible within the sediments.

The different human land use activities become apparent when combining these diverse analyses. The environmental history is stored both in archaeobotanical and sedimentological archives.

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## ENVIRONMENT AND AGRICULTURE OF ANCIENT VANI (WESTERN GEORGIA) ACCORDING TO ARCHAEOBOTANICAL AND PALYNOLOGICAL DATA

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*Key words: Palaeoecology, Human impact, Seeds, Pollen, Non-pollen palynomorphs*

Vani is a unique archaeological site in western Georgia which was inhabited from the 8<sup>th</sup> to the 1<sup>st</sup> centuries BC. Decades of research here have unearthed defence walls with gates and towers, secret tunnels, various workshops, temples, sanctuaries, altars and burials. Rich and varied archaeological material has been collected, including ceramic vessels, bronze, silver and gold ornaments, and vessels of precious metals. An exhibition of the most beautiful and unusual gold objects from Vani toured the leading museums of Europe and America from 2007 to 2010.

We studied organic material preserved in burials and cultural layers dated to the second half of the 4<sup>th</sup> century to the 3<sup>rd</sup> century BC, as well as burial objects (candelabra, icon-lamps, incense burners, statuettes, arrow-heads, etc.) from the first half of the 1<sup>st</sup> century BC. 29 samples from cultural layers were analyzed for botanical macroremains. Economic plants were represented by carbonised remains of three species of wheat, millet, pea and lentil. Naked wheat and common millet were most abundant. Native taxa from Colchic woods were also represented, such as hazel, wild vine, holly and the common hop. Pips of *Vitis vinifera* indicate the viticultural traditions of ancient Vani. The presence of macrobotanical remains from around 14 weed species, characteristic of wheat fields and ruderal habitats, reflects a close connection with human agricultural activity. In the layers dated to the 1<sup>st</sup> century BC, the representation of cereal macroremains reduces sharply and no pips of *Vitis vinifera* were found at all.

More than 20 samples were studied palynologically. The richest were organic remains from amphorae, icon-lamps and censers. Samples of fossilised wax were also unusually rich in palynomorphs. These palynological data indicate that climatic conditions around Vani during the second half of the 4<sup>th</sup> century were warmer than nowadays and that broadleaved woods of oak, *Zelkova* (Caucasian elm) and chestnut were widespread. Pollen indicators of agriculture and viticulture are also well represented, in agreement with the results of macrobotanical investigation. However, by the beginning of the 1<sup>st</sup> century BC, a substantial change in climatic conditions is indicated. Mean annual and especially summer temperatures were lower than today. Rainfall was higher, causing waterlogging in the Vani area. Agriculture declined in importance relative to the 4<sup>th</sup> century BC, but livestock herding assumed a greater economic role. Woodland composition also changed, and alder-dominated gallery and swamp woods expanded alongside hornbeam, elm and pine woods.

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## MACROFOSSIL FINDS FROM PORVOO / BORGÅ — A MEDIEVAL TOWN IN SOUTHERN FINLAND

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*Key words: Macrofossils, Medieval towns, Porvoo, Finland*

This paper presents some results of macrofossil finds in archaeologically dated soil samples from the medieval town of Porvoo, dating to the 14<sup>th</sup> – 16<sup>th</sup> centuries AD. Porvoo (in Swedish, Borgå / Borgå; borg=castle, å=river) is the second oldest city in Finland, which obtained town rights after Turku (Åbo) in the mid-14<sup>th</sup> century. In written sources, the name Borgå is mentioned for the first time in 1327.

Porvoo has been an important centre of trade since the 13<sup>th</sup> century. It was established at the junction of the sea and the river, at a place where people used to come to trade their merchandise. Goods from the rest of Europe travelled via Porvoo, and people brought furs and other commodities to Porvoo to be transported via Tallinn to central Europe. The wealthiest and most influential townsmen were merchants of German origin, burghers who were responsible for town planning. They also built a centre for local administration and trade activities, with a town hall and a market place. The key landmark was the church which was founded on the hill to dominate the town.

Archaeological excavations have been carried out at several sites in Porvoo. These have revealed medieval log buildings, stone structures and streets. At a churchyard, over 50 graves have been excavated. Altogether over 20000 macrofossil finds have been identified and they represent 130 different taxa. The most interesting macrofossil finds from the sites are weed seeds of *Agrostemma githago*, *Anthemis cotula* and *Anthemis ruthenica*, *Centaurea cyanus*, *Chrysanthemum segetum*, *Hyoscyamus niger* and *Urtica urens*, which do not grow any more or are extremely rare in Finland today. Finds of cultivated or collected plants were grains of *Hordeum vulgare* and *Secale cereale*, as well as seeds of *Arctostaphylos uva-ursi*, *Fragaria vesca*, *Vaccinium myrtillus*, *Rubus chamaemorus* and *R. idaeus*. Leaves of mosses, Bryophyta, were found in the grave of a newborn baby. The leaves were attached to the skull of the baby and came from a pillow made of mosses.

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## THE OLDEST DOCUMENTARY RECORDS AND MACROFOSSIL FINDS OF SOME MEDICINAL PLANTS IN FINLAND

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*Key words: Finland, Medicinal plants, Oldest documents, Macrofossils*

The paper presents the oldest documentary records of some medicinal plants and their earliest macrofossil finds in Finland. The oldest document comes from the Naantali/Nådendal monastery and is dated to the 15<sup>th</sup> century. The plants used for medicinal purposes were presented there as popular names. The second document, dated to the 16<sup>th</sup> century and written by the reformer of Finland and the Bishop of Turku/Åbo, Mikael Agricola, presents 22 'useful' plants or 'herbs' in the calendar of his '*Prayer Book*' (*Rucousciria Bibliasta*, in Finnish), and the names were also given as their popular forms. The third document, *Catalogus Plantarum* by Elias Tillandz, the professor of the Academy of Turku, presents plants with Latin and some of them also with Finnish names, for the first time. This small book, the first Finnish Flora, was published in 1673 and the second edition in 1683, with a short Latin description of the plants and their medicinal use.

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## INTEGRATED ARCHAEOBOTANICAL RESEARCH – ONLINE TUTORIAL

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Christoph HERBIG, Glynis JONES, Johannes KUTTERER, Marco MADELLA, Ursula MAIER,  
Welmoed OUT, Hugues PESSIN, Debora ZURRO**

*Key words: Integrated archaeobotany, Training, Online tutorial*

The Integrated Archaeobotanical Research project (IAR) was funded by the EU Marie Curie Framework 6 Transfer of Knowledge programme at the University of Sheffield 2007–09.

Traditionally, charred or waterlogged seeds and fruits, recovered from archaeological sites, have been the primary source of evidence for the reconstruction of past diet, subsistence strategies and plant economy, but other types of plant material can also shed light on these research areas. The purpose of the IAR project was to bring together specialists in a wide range of archaeobotanical materials: charred plant remains (including underground storage organs such as roots and tubers), wood charcoal, waterlogged plant remains (including fragile leaf and stem fragments), silica phytoliths and starch, to develop complementary research and training strategies for investigating the ancient economy, building on each discipline's strengths.

The training output of the IAR project is encapsulated in the 'Online Archaeobotany Tutorial' available from the University of Sheffield website. The 'Online Archaeobotany Tutorial' is not designed to be used in isolation as a self-taught archaeobotany course. Rather, the tutorial is intended to be used in tandem with a taught course or under archaeobotanical supervision.

The tutorial contains teaching packages on wood charcoal, charred seeds and fruits, charred roots and tubers, waterlogged plant tissues, pollen, phytoliths and starch. Each archaeobotanical specialism is explained in terms of the history, sampling, recovery, identification, quantification, data analysis, interpretation and storage of the botanical material concerned. The individual components of the package can be accessed individually, or followed through in sequence for each type of material. In addition, there is a section on modern interpretive tools, currently comprising ethnobotany, but soon to include a plant ecological database.

Web address: [http://archaeobotany.dept.shef.ac.uk/wiki/index.php/Main\\_Page](http://archaeobotany.dept.shef.ac.uk/wiki/index.php/Main_Page)

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## **CHARRED SEEDS AND FRUITS FROM THE MESOLITHIC-NEOLITHIC TRANSITION IN NORTHERN SPAIN: LOS GITANOS AND ARANGAS CAVES**

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*Key words: Seeds, Neolithic, Mesolithic, Atlantic Europe*

In this paper, the results of a carpological (seed) analysis of two Mesolithic and Neolithic assemblages from northern Spain are presented, Los Gitanos in Cantabria and Arangas in Asturias. Although seeds and fruits are scarce in both contexts, these sites allow us to get a preliminary view of the human use of plant resources in this region. Whereas pulses have not been found, a great variety of cereals seems to have been cultivated. However, specimens of wild plants outnumber those of cultivated plants. However, the samples might be biased by their origin in cave contexts, which were probably not the main settlement places for the communities we are studying. Thus, the necessity of developing survey programmes oriented towards the search for late Mesolithic and Neolithic open air sites is stressed.

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## EXPLORING ARCHAEOBOTANICAL CONTRIBUTIONS IN CYPRIOT PREHISTORY

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*Key words: Archaeobotany, Cyprus, Neolithic, Chalcolithic, Bronze Age*

Recent archaeobotanical results from early Aceramic Neolithic sites on Cyprus have put the island in the forefront of debates on the spread of Near Eastern agriculture, with domestic cereal crops appearing at nearly the same time as on the mainland. Since Cyprus was thought to be the first region to be colonized after the emergence of agriculture in the Levant and demonstrates the earliest definite evidence of a targeted migration by farmers, it is an important region for better understanding aspects of the Neolithic revolution and its transmission, particularly with regard to timing. However, what happened after the introduction of agriculture to Cyprus has been relatively poorly researched. Further consideration is needed of the role of new introductions, local agricultural developments and intensification in subsequent cultural phases of Cyprus that correspond with evidence for trade and increasing social complexity. To address these issues, a review of the prehistoric Cypriot archaeobotanical record will be presented along with preliminary results from three recently excavated sites: Krittou Marattou 'Ais Yiorkis, Kissonerga Skalia, and Souskiou Laona. The preliminary results are compared with previous archaeobotanical data from Aceramic Neolithic, Ceramic Neolithic, Chalcolithic, and Bronze Age occupations in Cyprus and it will be shown how these data contribute to our understanding of the island's prehistoric economic development.

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## THE DOMESTICATION OF THE VINE AND OLIVE IN THE AEGEAN AND CYPRUS

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*Key words: Bronze Age, Olea, Vitis, cultivation, oil and wine production*

In 1972, Colin Renfrew presented for the first time in the *Emergence of Civilisation* the so-called Mediterranean polyculture (olive, vine and wheat) hypothesis, arguing that during the early Bronze Age (3<sup>rd</sup> millennium BCE) the systematic exploitation of olive and grapevine transformed traditional Neolithic subsistence, until then based on cereals, pulses and livestock.

The timeframe of the initial intensive cultivation of both grapes and olives in Greece is a cornerstone of the debate. While Renfrew suggested the early Bronze Age, others have proposed the late Bronze Age or even later periods. These scholars have emphasised the absence of archaeological and especially archaeobotanical evidence for the intensive production of olive oil and wine during the Aegean Bronze Age.

This project will for the first time directly address the insufficient study of archaeobotanical evidence. Previous and ongoing fieldwork by this applicant is leading to the formation of a comprehensive programme of sample collection covering a wide region and timespan in a collection strategy specifically designed to address the question of the introduction of intensive olive and grapevine cultivation. The present proposal is to approach these issues through the direct analysis of archaeobotanical remains of olive and vine found charred in securely dated archaeological contexts. Such remains, retrieved mainly from sites in the Aegean and Cyprus, will be analysed in order both to create a) reliable models and techniques for the distinction of wild and domesticated olive and vine and b) to detect direct archaeobotanical evidence for wine and olive oil production, such as pressed grape pips and crushed olive stones respectively. These analyses will lead to clear-cut, direct and statistically valid evidence for the domestication and intensive cultivation of vine and olive in the Aegean and thereby offer a solid evidential basis for the roles played by olive and grapevine cultivation in the formation of the earliest complex societies in Europe.

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## PAST CLIMATE RECONSTRUCTION AT ARSLANTEPE (MALATYA, TURKEY): THE CONTRIBUTION OF THE STABLE CARBON ISOTOPE

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*Key words: Plant macroremains, Carbon isotope, Palaeoclimate reconstruction, Arslantepe, Turkey*

The site of Arslantepe (*Arslan* = Lion; *Tepe* = mound) is located on the Malatya plain in eastern Turkey. Today it is a 30 m high hill, formed by a series of settlements built and destroyed over 5000 years of almost uninterrupted occupation. Arslantepe has been bringing to light extraordinary remains of past prehistoric and protohistoric cultures of eastern Anatolia. The excavation is still ongoing, the oldest archaeological level dates back to the 7<sup>th</sup> millennium BP, the most recent is of Byzantine times.

Excavations by a team from "La Sapienza" University of Rome at the site have been carried out uninterruptedly since 1961, bringing to light a large amount of archaeobotanical material from the entire sequence of occupation of the site.

The archaeobotanical studies have highlighted the presence of various botanical taxa preserved by charring, belonging to arboreal and crop species. Great variety was found, and the diversity in cultivated taxa and the selective use of wood could be either due to a choice or even to environmental availability. Many studies have correlated cultural changes with environmental factors. At Arslantepe, a number of important changes is found. It is not clear, however, if the important variations found in plants used by the successive settlers are due to cultural choices or to environmental changes.

A contribution comes from the study of the stable carbon isotope carried out both on ancient and present-day plants. The relationship between the fractionation of carbon isotope and climate is well known. The  $^{13}\text{C}/^{12}\text{C}$  ratio depends mainly on moisture and the isotopic ratio of atmospheric  $\text{CO}_2$ . Such independent information on environmental variations permits discrimination between cultural and environmental changes.

More than one hundred charred samples of deciduous *Quercus* and *Juniperus* were analyzed. They come from five archaeological periods at Arslantepe, ranging from late Chalcolithic V (5350-5000 BP) to early Bronze Age III (4500-4000 BP). The variability of data is high, however a  $\delta^{13}\text{C}$  variation is present and some trends recognisable. The data from fossil assemblages are compared with those from living plants of the same genus in order to reconstruct past environment and climatic trends through more than one millennium.

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## THE CITY OF PARMA (EMILIA ROMAGNA, ITALY) IN THE ROMAN AND MEDIEVAL PERIODS: SEEDS AND FRUITS, POLLEN AND PARASITE REMAINS

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*Key words: Plant remains, Parasite remains, Emilia Romagna, Roman, Medieval*

Archaeobotanical analyses have been carried out on material from the site of Piazza Garibaldi at Parma, a city located in the plain of Emilia Romagna, a region of northern Italy. The studied layers were dated to the 4<sup>th</sup> – 2<sup>nd</sup> centuries BC, around the time of the foundation of the Roman state, and to the 9<sup>th</sup> – 12<sup>th</sup> centuries AD. In Roman times the site was probably a sacred area, while in the medieval period it was a market square. Data from pollen and seeds/fruits were useful for both palaeo-environmental and palaeoethnobotanical reconstructions.

Oak woods and hygrophilous woods grew far from the site, while human activities highly influenced the environment in early times. Cereals, legumes and hemp were probably cultivated together with chestnut trees, figs, grapevines and members of the Pomoideae. Moreover, a number of medicinal/ vegetables/ spice plants were present. *Papaver somniferum* and *Coriandrum sativum*, together with *Fragaria vesca*, were characteristic in the seed record. Altogether, archaeobotanical data correspond well to votive offerings to several gods, and particularly some of them including opium poppy and cereals would have been offered to Demeter/Ceres, the goddess of crops and soil fertility.

Concerning the Middle Ages, the archaeological structures which were studied included four pits and one latrine. Analyses of plant and parasite remains have suggested that the infillings consisted of waste, human and animal excrements, deteriorated vegetable food and marc (winemaking waste). In particular, human parasite remains belonging to the genera *Ascaris* and *Trichuris* were found in the latrine, while parasites of animals such as species of *Capillaria*, *Dicrocoelium dendriticum* and *Diphyllbothrium* were also present in pits. Pollen from entomophilous plants (such as *Digitalis purpurea* which lives wild today only in Sardinia) were common in the latrine, possibly also due to human consumption of honey. Cultivated fields of *Triticum aestivum/durum/turgidum*, *T. monococcum*, *T. dicoccum* and other cereals, together with legumes, grapevines and fruit trees were grown in the area. Some olive trees were probably cultivated in the hills. Many wild plants were found in the deposits, including *Agrostemma githago* and *Thymelaea passerina*. The archaeobotanical record from the Medieval period revealed two main 'agro-ethno-botanical' features this city: a) a particular consideration for *Prunus spinosa* whose fruits are still today collected and prepared as an alcoholic drink ("*Bagnolino*"); b) a low consideration and importance of *Cucumis melo* in the economy of this area compared with other areas of Emilia Romagna such as the provinces of Ferrara and Ravenna.

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## THE N57 ARCHAEOLOGICAL INVESTIGATION (ZEELAND, THE NETHERLANDS) — RECONSTRUCTION OF A BURIED LANDSCAPE USING A MULTI-DISCIPLINARY APPROACH

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*Key words: Crops, Late Iron Age, Medieval period, Coastal environment, Diet*

An archaeological investigation was carried out in Zeeland, the coastal area in the southwest of the Netherlands. In this area, a series of sites ranging from the late Iron Age to the late Medieval period were excavated. A multidisciplinary approach was used to reconstruct the local and regional changes in landscape, vegetation and crop cultivation and consumption.

The combination of physical geography, micromorphology, botanical analyses (microfossil and macro-remains), <sup>14</sup>C and OSL dating, presented evidence for a dynamic coastal environment. A peatland area, high salt marshes and a large tidal environment alternated between the 1<sup>st</sup> century BC and the 12<sup>th</sup> century AD.

The macrobotanical remains showed that the use of crops changed through time. The cultivation of emmer wheat (*Triticum dicoccum*) declined after the Roman period, followed by the emergence of bread wheat (*T. aestivum*) and pea (*Pisum sativum*) from the medieval period onwards. Crops such as barley (*Hordeum vulgare*) and horse bean (*Vicia faba*), however, formed a continuous part of the local diet through the centuries.

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## EXPERIMENTAL APPROACHES TO UNDERSTANDING VARIATION IN GRAIN SIZE IN *PANICUM MILIACEUM* AND ITS RELEVANCE FOR INTERPRETING ARCHAEOBOTANICAL ASSEMBLAGES

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*Key words: Panicum miliaceum, Grain size variation, Grain immaturity*

Analysis of common millet (*Panicum miliaceum*) grains from the 1<sup>st</sup> millennium BC archaeological site of Zanolvskoe in eastern Ukraine found a large variation in the grain sizes. The grain dimensions ranged from 1.0 - 1.8 mm in breadth and 1.2 - 2.18 mm in length. This set of observations gave rise to experimental work on common millet plants and grains, aiming at a comprehensive understanding of factors that may contribute to variation in grain size among common millet in archaeobotanical assemblages. We carried out experimental work to analyze how grain size variation depended on environmental conditions during growth, seed maturity and taphonomic factors in the formation of the archaeological record. Our results demonstrate that immaturity is more likely than environmental stress to account for small grain size in common millet plants. The preservation of millet grains is demonstrated to be dependent on its stage of maturity and carbonization temperature. These results are potentially important for accurate identification of millet assemblages. Our results show that immature charred *Panicum miliaceum* grains can be similar morphologically to grains of wild millet species of *Setaria* spp. and *Echinochloa* spp., leading to the possibility of confusion among these three genera. We present key characteristics of immature *Panicum miliaceum* grains collected at different stages after anthesis and charred at two temperature regimes, which allow differentiation of immature common millet grains from wild *Setaria* and *Echinochloa* species.

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## PLANTS IN MEDIEVAL KRAKÓW – STATISTICAL ANALYSIS

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*Key words: Medieval Kraków, Plant macroremains, Correspondence analysis*

The medieval layers of Kraków have been archaeobotanically studied for many years, and this poster focuses on materials identified by a number of researchers in the W. Szafer Institute of Botany, Polish Academy of Science. The analysis covers 277 samples (excluding barren ones and those consisting of fruit-stones only) from 28 sites. Most of the samples come from Rynek Główny (the main market square) from 13 sites, and from Wawel Hill (5 sites). The samples are divided into 3 chronological units: 1 - Tribal period (until 10<sup>th</sup> century), 2 - early Medieval (11<sup>th</sup> – mid 13<sup>th</sup> century) and 3 - late Medieval (mid 13<sup>th</sup> – 15<sup>th</sup> century). 483 taxa were identified (376 species or groups of species, 18 at genus level and 89 at family level). Most of the remains are waterlogged, but charred and mineralized ones are also present. All the samples were processed in similar ways, but some differences are noticed in identification based on the approaches of different authors. In order to detect wider patterns in the data, statistical correspondence analysis was done in two ways:

- 1) for all the taxa found in more than 30 samples, with some species treated as one (for example all *Carex* species as *Carex* sp.; *Fragaria vesca*, *F. viridis* and *F. sp.* as *Fragaria* sp. etc.)
- 2) with all the taxa grouped in 9 broad ecological groups (cultivars, crop weeds, garden weeds, ruderals, ruderal/segetal plants, grasslands, wet shores/wet places, forests, undiff.)

In some analyses the number of specimens is recalculated by the square root transformation, in order to diminish the influence of extremely abundant samples/taxa. In some cases the type of preservation is also taken into account. In the interpretation, sample chronology and site details are also taken into account.

We notice a strong separation of samples because of the presence of cultivated plants in every type of analysis, ruderal plants and those growing in grasslands and wet shores/wet places, also separate groups of samples. Ruderal plants (mainly *Urtica dioica*, *U. urens*, *Chenopodium hybridum*, *Sambucus nigra* and *Hyoscyamus niger*) are particularly dominant in the early Medieval period. Because of the large number of taxa, as many as 5 dimensions were found to be significant in the correspondence analysis. Taking into account all 5 dimensions, some interesting taxa clusters are visible.

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## ANTHRACOLOGICAL AND GEOARCHAEOLOGICAL ANALYSIS OF EARLY MEDIEVAL HOUSES IN ROZTOKY U PRAHY (CZECH REPUBLIC)

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*Key words: Medieval, Slavic settlement, Anthracology, Geoarchaeology*

A large agglomeration of settlement features from the 6<sup>th</sup> and 7<sup>th</sup> centuries AD has been discovered in Roztoky u Prahy. These finds belong to the so-called Prague Culture which is believed to represent the earliest Slavic populations in central Europe. The unusually large number of early Medieval houses (more than 600) and their location on the floor of a deep canyon-like valley is to a great extent enigmatic. Hypothetically, this concentration of people may be explained by the site being located not only on the major long-distance route, but also at a ford across the river.

The anthracological (charcoal) analysis of selected features from the early Slavic settlement of Roztoky u Prahy tries to reconstruct the local character of species composition. The analysis of 18119 charcoal fragments led to the identification of 18 plant taxa. The settlement is situated in an area with intensive long-term habitation; the determined taxa composition indicates strong human influence on the nearby vegetation. A mosaic of oak-hornbeam woodland, sparse coppice and scrub used for pasture was probably to be found in the vicinity of the settlement.

Among the studied archaeological layers, the charcoals from the ovens were markedly different. We can distinguish the ovens with dominance of oak, beech, shrubs or conifer charcoals. Anthracological analysis clearly demonstrates a different anthracomass in archaeological layers of the houses.

The geoarchaeological study applied to this site is concerned with the infillings of the sunken houses. A similar pattern is visible in many of these infillings. The site is located in so-called dusty to sandy over-bank deposits. The former houses were probably 1 m deep, but now 40-70 cm thick sedimentary infilling composing of three to four layers is preserved. A typical floor layer is usually missing, and just a trampled background is preserved, richer in clay minerals and with less voids. This could be interpreted as evidence of cleaning activities in the house. Above this layer is sometimes preserved a 1 cm thick layer richer in decomposed organic matter, remains of bones and charcoal together with strong bioturbation. This layer is interpreted as the remains of the last human activities in the house before destruction or part of the destroyed roof. A 20-40 cm thick layer above, poor in charcoal and other remains from human activities, typically features light orange spots, which are interpreted as concentrations of clay minerals. Those concentrations are a post-sedimentary development, during the change of pH which forced clay minerals to move down the profile. The change of pH was inhibited by the presence of an ashy layer in the final destruction layer. This layer composes the last preserved layer and usually contains a huge amount of charcoal, stones from destroyed ovens and decomposed organic matter.

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## NEW ADVENTURES IN THE “LAND OF FIRE” AND THEIR RELEVANCE TO ARCHAEOBOTANICAL AND ENVIRONMENTAL RECONSTRUCTIONS OF THE DOKSY REGION, CZECH REPUBLIC

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*Key words: Pedoanthracology, Pollen, Human impact*

The Doksy study region of more than 150 km<sup>2</sup> is characterised by the presence of a large area of sandstone pseudokarst, a shallow basin with peat bogs, and isolated volcanic elevations. Recently the landscape has been predominantly a timbered land. *Pinus sylvestris* is characteristically dominant on the sandstone pseudokarst, and on basalt elevations *Fagus sylvatica* shows highest abundance.

The study area has always been sparsely populated and agriculture has not been the main human activity. Mesolithic, Neolithic, Eneolithic, Bronze Age, Hallstatt and La Tène settlement sites have been found in the region, but with regard to the natural conditions, archaeological research has usually been restricted to rock shelter sites. The development of human impact in the region was connected with the activity of King Karel IV in the 14<sup>th</sup> century. Other important settlement activity was during the 16<sup>th</sup> century with glass-blowing and charcoal making.

Pollen analysis has not registered any human activity from the presence of primary and secondary human indicators up to the 17<sup>th</sup> century.

The pedoanthracological (soil charcoal) research was carried out in 2008 and 2009 and twelve pedological profiles were studied. Within all profiles a large amount of charcoal was found. The charcoal from the profile base is dated to the Mesolithic, Bronze Age, Hallstatt, Early Medieval, High Medieval and Modern period. In all layers of the studied profiles, a dominance of *Pinus sylvestris* and a sparse abundance of *Quercus* sp., *Corylus avellana*, *Betula* sp. and *Sorbus* sp. were recorded.

While we have a reliable conception of Holocene development of the vegetation in the landscape scale in general, the Holocene history of vegetation at the local scale is still indistinct. The main problem is connected with options for pollen analyses. These kinds of analyses often show mainly local pollen assemblages with a mixture of regional pollen rain. In addition, the pollen analysis profiles come from places with wetland vegetation with a different vegetation history from that of terrestrial habitats. We consider pedoanthracological analysis to be a significant indicator of human activity and vegetation history at a local scale in the sandstone pseudokarst here.

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## THE PLANT REMAINS FROM THE “ICE-MAIDEN”, THE INCA MUMMY FROM NEVADO AMPATO, PERU

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*Key words: Inca, Mummy, Capacocha, Peru*

In 1995 the frozen body of an Inca girl, known as the “Ice-Maiden” or “Frozen Lady” in analogy with the Neolithic Tyrolean Iceman, was discovered by the anthropologist Johan Reinhard on Nevado Ampato, a stratovolcano in southern Peru. Between AD 1440 and 1450 the girl, at the age of 12 – 14 years, was offered as a sacrifice on the Ampato summit at about 6300 m altitude and was buried on the summit platform. Due to melting, the platform collapsed and the mummy had fallen inside the crater ca. 65 m below the summit together with female figurines, food and pottery. This combination of material offerings and human sacrifice in the Inca ritual is termed a “*capacocha* complex”. Here we present the analysis of the plant remains recovered with the body.

All of the plant remains found are edible and most of them are crops. Predominant are carbohydrate containing plants such as *Zea mays*, *Chenopodium quinoa*, *Solanum tuberosum*, *Ipomoea batatas*, and also legumes including *Phaseolus lanatus* and *P. vulgaris*. Single fruits of *Psidium guajava* (guava) and *Pouteria lucuma* were also represented in the find assemblage. Furthermore, a bundle of leaves from *Erythroxylum coca* (*coca tree*) indicates its consumption. The implications of the plant finds and the Inca offering rite are discussed.

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## POLLEN, MACROREMAINS AND aDNA FROM FRUITS, FROM THE TAKARKORI ROCKSHELTER: AN INTEGRATED ARCHAEOBOTANICAL RESEARCH IN THE CENTRAL SAHARA

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*Key words: Multidisciplinary research, Rockshelter, Central Sahara, Libya*

The archaeobotanical samples from the Takarkori rockshelter (Fezzan, south-western Libya) were systematically collected in the 2003-2006 excavations\*. About 120 m<sup>2</sup> were excavated, revealing occupation layers which were radiocarbon dated to between ca. 4500 and 8900 uncal BP. The rockshelter had a 1.6 m thick archaeological deposit including structures, fireplaces and burials of women and children interred near the shelter wall. An impressive amount of mainly desiccated and well preserved plant macroremains was brought to light from Late Acacus and Pastoral layers. Known amounts of sediment (3 or 6 l) were dry sieved. Charcoals and seed/fruit concentrations visible to the naked eye were also collected. Material for pollen analysis was sampled from trenches including different amounts of organic matter. The main pollen zones were in agreement with the main cultural changes in the archaeological record. Moreover, the exceptionally well-preserved fruits of Poaceae encouraged analyses on aDNA at the Centre for Ancient DNA Research, University of Copenhagen. The extraction of aDNA was carried out on three samples of Poaceae fruit accumulations (spot n° 8136, 1423 and A2908). Two of the spot samples are dated to ca. 8000 uncal BP; one is dated to ca. 6000-5500 uncal BP. Notwithstanding the common doubts about the possibility of DNA preservation in arid and hot environments, the laboratory study was quite successful, with 5 out of 6 samples extracted and with 3 out of 5 correctly identified. DNA sequences (blind analyses) from *Echinochloa*, *Panicum* and *Sorghum* agree with the identifications made on the basis of morphological analysis. Further elaborations of the sequences obtained allowed a more detailed identification of the genus *Panicum* to be reached, which, when compared with the sequences currently available in the online database, seems to be *P. laetum*.

The integrated archaeobotanical studies on macroremains and pollen, carried out within a multidisciplinary research framework, provide information on the past human-environment relationships and on the Holocene landscape evolution of the area.

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## ARCHAEOBOTANICAL STUDIES IN THE LAKE BURTNIEKS AREA, NORTHEASTERN LATVIA

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*Key words: Human impact, Environment reconstruction, Vegetation composition*

Sediment cores taken from ancient Burtnieks lake and mire deposits were used to reconstruct the vegetation development, changes and traces of human presence and impact on nature over the very end of the Pleistocene and most of the Holocene. Studies including plant macroremain data, pollen records, sediment composition analyses, archaeological investigations and <sup>14</sup>C radiocarbon dates were used to determine character of the vegetation and human-plant interrelationships. Identification, analysis and interpretation of the plants recovered from sediment sequences from the ancient Burtnieks northern lake area give insights into past subsistence and environment. The aim of the investigations was to reconstruct environmental conditions and the development of palaeovegetation during the first half of the Holocene in the northern area of the Burtnieks palaeobasin. Another aim was to find the earliest detectable human impact in the pollen and macroremain data from the archaeological sites of Brauksas I and Brauksas II.

Pollen data show the vegetation dynamics in the Lake Burtnieks region since the Younger Dryas (DR3) until today with significant fluctuations in vegetation composition caused not only by climatic changes, but also due to human activities. Data from plant macroremains and pollen analyses demonstrate the gradual overgrowing of the palaeolake Burtnieks and the presence of ancient people in the area since the Pre-boreal period. Pollen of anthropogenic indicators such as *Plantago major/media*, *Rumex acetosa/acetosella*, *Chenopodium album* and *Urtica dioica* has been found at several sites investigated in the northern part of the ancient Burtnieks area, which point to the presence of Stone Age people in the area.

At the Pantene site, where archaeologists found the Stone Age artefacts, a 7.6 m long sediment sequence of clay, silt with ostracods and shell fragments, gyttja, and fen peat has been investigated. At the Ceriņi-2007 site, a 4.72 m long sediment sequence of sand, gyttja and fen peat has been investigated and at Seda a 6.5 m deep mire sequence of sand, gyttja and fen and wood peat layers.

Both wild gathered and cultivated plant remains have been found in the sediments of cultural deposits including the charred nuts of *Corylus avellana* L. and *Trapa natans* L., and charred *Triticum* grains, which point to the possibility that they were used as food. The finds of Cerealia pollen indicate the start of crop growing in the middle Atlantic period (AT2). The composition of plant macroremains and pollen indicate the start of agriculture as well as gathering.

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## CHANGING IRON AGE AND ROMAN ARABLE PRACTICE IN THE EAST OF ENGLAND

Kate PARKS<sup>1</sup>

*Key words: Iron Age, Roman, Arable practice, Scale of production, Population increase*

The contribution is based on ongoing doctoral research into arable practice in the East of England in the Iron Age and Roman period, based on secondary data (published and unpublished), collected by the author, on carbonised archaeobotanical assemblages. The objectives of the wider project are to identify

- Which crops were cultivated
- How the crops were processed and stored
- How they were cultivated (e.g. intensive or extensive, manured and weeded or not)

The poster focuses on the first two of these objectives. The middle Iron Age and early Roman period are identified as times of shifting arable practice, centring on evidence for increased scale of arable production. The middle Roman period saw further changes, probably indicative of continuing large scale crop processing and suggesting the use of spelt wheat fine-sieving by-products as fuel. The timing of these changes in arable practice is consistent with the identification in the wider archaeological literature of the middle Iron Age and Early Roman period as times of population increase in this region.

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**SPATIAL ANALYSIS AT LA MATA BUILDING (CAMPANARIO BADAJOZ, SPAIN)****Guillem PÉREZ JORDÀ<sup>1</sup>**

*Key words: Spatial analysis, Southern Iberia, Iron Age*

La Mata is an aristocratic rural residential complex, located in the Guadiana valley, Extremadura, Spain. The site has been dated to the period between the turning of the 6<sup>th</sup> to the 5<sup>th</sup> century BC and the end of the 5<sup>th</sup> century BC, the post-orientalizing period.

The archaeological excavations carried out at La Mata between 1999 and 2002 uncovered a monumental complex of approximately 50x50 m<sup>2</sup> that included a two-storey building with an estimated height of 6.5 to 7 m, a surrounding mud-brick wall, a terrace and a ditch. The building was oriented to the east, its façade had two towers and it was probably covered with a flat roof forming a wide terrace.

The territory of La Mata, subjected to intense land exploitation, would have encompassed two clearly defined sectors:

- a) the siliceous “*monte*” zone to the south of the building that would have been covered with Mediterranean woodland and would have provided firewood, game, acorns and pastures and
- b) the “*labor*” zone to the north where cereals, legumes and fruit trees would have been cultivated on the soils irrigated by El Molar stream. Archaeological survey in this “*labor*” sector has identified various rural hamlets that would probably have been dependent on the main La Mata complex.

The building was destroyed by a fire that has ultimately favoured the preservation of archaeobotanical remains. This unique situation provided the possibility to study the spatial distribution of these remains aiming, in conjunction with other archaeological evidence, to assess the function of the various compartments (rooms) of the building. A 1 m<sup>2</sup> grid was used for the excavation of each compartment (room) to guarantee the recovery of all types of archaeological materials (pottery, metal objects, etc.) and the systematic sampling (10 l per m<sup>2</sup>) for archaeobotanical remains.

The study of the archaeobotanical samples has allowed us to discover the activities that had taken place in each compartment. We have identified two differentiated areas, one of them designated for cooking and consumption and the other for storage and cereal processing.

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## INTRODUCING THE PALEOECOLOGICAL WORK OF THE FIELD SERVICE FOR CULTURAL HERITAGE IN HUNGARY

Ákos PETŐ<sup>1</sup>, Attila KREITER, Brigitta BERZSENYI, Zoltán HORVÁTH, Csaba GULYÁS-KIS, Beáta TUGYA, Péter CSIPPÁN

*Key words: FSCH, Multi- and interdisciplinary research*

The Field Service for Cultural Heritage (FSCH) was established in the spring of 2007 as a state-run organization responsible for the protection of national cultural heritage. Within the frames of the FSCH a Laboratory of Conservation and Applied Research has been set up to serve the scientific purposes of archaeological interpretation.

With the involvement of several branches of natural and environmental sciences – geology, archaeozoology, archaeobotany, malacology, palynology and ceramic petrography – the nature and scope of archaeometric tasks cover the needs of archaeological work in the fields of palaeoecology and human-nature interactions. The institute has the infrastructure to meet the increasing requirements of modern material analysis. Environmental analytical examinations are primarily based on the sedimentological, palaeopedological and malacological examination of on-site profiles as well as shallow drillings, whilst palaeovegetational reconstruction is accomplished through combined pollen, phytolith and macroremain analysis.

The aim of the poster is to give a short overview of the methodological work done routinely at the FSCH laboratory and to briefly demonstrate complex multidisciplinary studies done by the FSCH.

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## **ARCHAEOBOTANICAL RESULTS FROM THE NEOLITHIC AND BRONZE AGE SITE OF FAJSZ (SOUTHERN HUNGARY)**

**Peter POMAZI<sup>1</sup>, Eva SCHÄFER<sup>1</sup>, Angela KREUZ<sup>1</sup>**

*Key words: Hungary, Neolithic, Late Bronze Age*

In the years 2007 and 2008 excavations were carried out by the Archaeological Institute of the Hungarian Academy of Sciences and the Institut für Vor- und Frühgeschichte, Eberhard-Karls-Universität Tübingen, in southern Hungary, funded by the DFG (German research funding organisation). The site is situated in Bács-Kiskun county about 4 km from the present course of the river Danube upon an elevation, roughly 2 m above the surrounding seasonally flooded area. The excavations yielded features from various cultures ranging from the early Neolithic to the time of the Avars.

Neolithic and Bronze Age archaeobotanical results will be presented and compared.

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## ASPECTS OF AGRICULTURE AND DIET OF THE MEDIEVAL PERIOD (10<sup>TH</sup> – 14<sup>TH</sup> CENTURY AD) IN NORTHERN FRANCE

Sidonie PREISS<sup>1</sup>

*Key words: Seeds/fruits, Medieval period, Agriculture and diet, Social context, Northern France*

Archaeobotanical investigations of several Medieval sites in northern France (Picardy and the northern Ile-de France region) have provided charred and mineralised plant remains (seeds and fruits). Despite some taphonomical constraints of the different preservation of these plant assemblages, archaeobotanical analysis has revealed valuable information on the diet, the agriculture and the horticultural production of the Medieval population in northern France between the 10<sup>th</sup> and 14<sup>th</sup> century AD. The archaeobotanical results were influenced by the different types of features from which macro-remains were retrieved and by the reliability of the samples.

The main crop plants were naked wheat (*Triticum aestivum/durum/turgidum*) and rye (*Secale cereale*). According to the site investigated, they were accompanied by relatively significant amounts of oats (*Avena sativa* or *Avena* sp.) and hulled barley (*Hordeum vulgare*). *Setaria italica* and *Panicum miliaceum* occurred sporadically in the assemblages. The pulses *Pisum sativum*, *Vicia sativa* and *V. faba* ssp. *minor* were common crops of the medieval period. The presence of *Lens culinaris*, *Vicia ervilia* and *Lathyrus* sp. varied from site to site. Fruits like *Vitis vinifera*, *Pyrus* sp./*Malus* sp., *Prunus* sp., *Fragaria vesca*, *Rubus fruticosus/idaeus*, *Sambucus* sp. and *Corylus avellana* were abundant in the archaeobotanical material. They were followed by smaller amounts of *Cornus mas*, *Ficus carica* and *Mespilus germanica*. The numbers of recorded remains from the “wild forest fruits” (*Fragaria vesca*, *Rubus fruticosus/idaeus*, *Prunus avium*, *Corylus avellana*...) raise the question of their probable cultivation. Oil and fibre plants like hemp and cultivated flax and vegetables or spices like *Coriandrum sativum*, *Foeniculum sativum*, *Juniperus communis* and *Humulus lupulus* occur rarely.

The social context of the investigated sites is known to be quite heterogeneous. The potential of archaeological data in helping to identify social differences by defining archaeobotanical indicators of social level is to be discussed.

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## ACORN GATHERERS: FRUIT STORAGE AND PROCESSING IN SOUTHEASTERN ITALY DURING THE BRONZE AGE

Milena PRIMAVERA<sup>1</sup>, Girolamo FIORENTINO<sup>1</sup>

*Key words: Acorn, Southeastern Italy, Bronze Age, Gatherers*

The analysis of archaeobotanical assemblages recovered in recent and past archaeological excavations carried out on several sites located in southeastern Italy (Apani, Torre Guaceto (BR); Rocavecchia, Melendugno (LE); Piazza Palmieri, Monopoli (BA); Scoglio del Tonno (TA)), have revealed the importance of acorn gathering and use among Bronze Age societies.

A number of documentary sources (ancient literature, ethnographical observation, etc...) describe the use of acorns as food, both in human and animal diet, even if their occurrence does not necessarily mean evidence of use as food; in fact different purposes have also been reported (tanning agent, medical function and so on). On the other hand, charred acorns recovered in Bronze Age sites and examined in this study were strongly related to domestic fireplaces (accumulated adjacent to griddles and mixed with other edible plants such as cereal grains and legumes), suggesting an important role in protohistoric economies.

In order to address the role of oak fruit gathering and to investigate the processing methods, we present our first results carried out using biometric analysis and experimental procedures.

Data collected through morphometric studies, aimed at identifying the specific taxonomy of the cotyledons, are compared with modern analogues, on the basis of the areal distribution of the species; while experimental protocol reproduces the main cooking methods on the basis of ethnographical data: 1. Boiling – “*Sardinia Method*”; 2. Roasting; 3. Pounded into flour “*Californian Indians’ method*”.

Preliminary results are discussed and addressed to decode the archaeological, archaeobotanical and taphonomical evidence connected to the method of gathering and processing acorns in Bronze Age agrarian societies.

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## PREHISTORIC CROATIA: NEW ARCHAEOBOTANICAL FINDINGS

Kelly REED<sup>1</sup>

*Key words: Neolithic, Bronze, Crops*

From the late Neolithic through to the late Bronze Age we see the occurrence of many socio-cultural and economic changes in European societies, such as the introduction of metallurgy, the growth of trade and evidence for increasing centralisation of power. Agriculture is central to everyday life in this time period, and must have both underpinned these developments and been changed by them. This poster will present the preliminary results of studying archaeobotanical remains collected from a number of archaeological sites within Croatia spanning this period. The results show that emmer (*Triticum monococcum*) and einkorn (*T. dicoccum*) persist as the main crops of choice, supplemented by wild resources. As with the rest of southeast Europe, the increased presence of spelt (*T. spelta*), free-threshing wheat (*T. aestivum/durum*) and rye (*Secale cereale*) through this period is also seen in Croatia. The archaeobotanical data recovered from these sites will contribute greatly to our understanding of agricultural development within the region.

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## FIRST ARCHAEOBOTANICAL ANALYSIS FROM A MEDIEVAL WELL (14<sup>TH</sup> CENTURY AD) IN SASSARI (SARDINIA, ITALY)

Rossella RINALDI<sup>1</sup>, Giovanna BOSI<sup>1</sup>, Daniela ROVINA<sup>2</sup>, Laura BICCONE<sup>2</sup>,  
Marta BANDINI MAZZANTI<sup>1</sup>

*Key words: Well, Middle Ages, Seeds and fruit, Ethnobotany, Sassari*

An excavation took place in the old town of Sassari covering an area (via Satta) which had been occupied in the 14<sup>th</sup> century AD by houses and courtyards, built with stones of limestone and clay. In one of these courtyards there was a well, the oldest one found in the town, a very narrow one, about 90 cm diameter and 14 m deep. By AD 1330-1350, the well was no longer used and was filled with household waste, mostly leftovers from meals and dishes. In the well there were even organic objects preserved, found in very large quantities; the lack of oxygen and the presence of water allowed the preservation of various wooden items, in addition to many botanical and zoological remains (the latter being studied by Barbara Wilkens, University of Sassari). Among the remaining items, a hazelnut (*Corylus avellana*) with a small circular hole, which contained a drop of mercury, is really particular: this is an amulet against the eye of evil of the Catalan tradition, a tradition which never had a popular following on the island.

Archaeobotanical research, still in its early stages, shows the presence of cereals, such as wheat and barley, herbs, vegetables and wild plants. The most significant fact, for the moment, is the large presence of remains known as "fruit": *Citrullus lanatus*, *Cucumis melo*, *Ficus carica*, *Juglans regia*, *Malus/Pyrus/Sorbus*, *Morus nigra*, *Prunus cerasus*, *P. domestica* ssp. *domestica* and ssp. *insititia*, *P. dulcis*, *P. spinosa*, *Punica granatum*, *Rubus fruticosus* s.l. and *Vitis vinifera* ssp. *vinifera*. In several cases, concentrations of these remains are very high, for example *Cucumis melo* has over 1500 seeds in 8 litres. The large quantity of remains associated with this category can develop more ethnobotanical considerations, linking traditions of the past with ones of the present. For example, in Sardinia, melon is now used in a typical preserve: melon peel oil. Peels are boiled in water and vinegar, then drained; then peels are put in jars with spices and oil. In Italy the practice of eating the peel of this fruit (it is considered excellent in soups) has been attested at least since the Renaissance, as well as the practice of preserving whole melons in honey.

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## **A MULTI-PROXY APPROACH TO RECONSTRUCT MID- TO LATE HOLOCENE ENVIRONMENTAL CHANGES IN THE LOWER DANUBE FLOODPLAIN NEAR THE COPPER AGE SETTLEMENT OF PIETRELE, SOUTHERN ROMANIA**

**Astrid RÖPKE<sup>1</sup>, Christoph HERBIG<sup>1</sup>, Dirk NOWACKI<sup>2</sup>, Elena MARINOVA<sup>3</sup>, Jürgen WUNDERLICH<sup>2</sup>**

*Key words: Multi-proxy approach, Palaeoenvironment, Floodplain, Romania*

East of Giurgiu (Romania) the floodplain of the lower river Danube widens to about 8 km. Since the Neolithic period this area has been settled and thereafter it must have been of importance for the traffic between the Black Sea area and central Europe. Most prominent is the Copper Age settlement mound Măgura Gorgana (4400–4250 cal BC) in the vicinity of the modern village of Pietrele, which has been excavated by the German Archaeological Institute, Berlin (DAI).

Due to drainage since the 1960s the former landscape of meadows with lakes, oxbow lakes and small water courses of a branching river system have almost disappeared. However, the floodplain still offers a variety of sedimentological archives whose investigations are promising for studying Holocene palaeoenvironmental history. The archaeological field work in Pietrele has been accompanied by geoarchaeological investigations. Palaeoecological and fluvio-morphological research has been conducted to reconstruct the Holocene floodplain development and the evolution of the fluvial system. Based on the evaluation of historical maps and satellite images, corings up to 17 m and geoelectric profiling have been carried out. For a better understanding of the dynamic wetland system, sediment cores have been examined in detail by an interdisciplinary team. The multi-proxy investigations of the presented core include analysis of pollen, plant macroremains, insects, charcoal and sediment, which allow the reconstruction of the local and extralocal landscape development in the centuries after the abandonment of the settlement mound. The results of the pollen analysis describe the changing vegetation of the surrounding area. To trace the local deposition environment and hydrological changes, plant macrofossils and insect records are applied. Our results so far show the close connections between changes of sediment and the local/extralocal palaeoenvironment.

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## **PRODUCTION AND STORAGE OF FOOD PLANTS IN EASTERN LANGUEDOC DURING THE 10<sup>TH</sup> – 11<sup>TH</sup> CENTURY AD: THE SITES OF DASSARGUES AND LUNEL VIEL, HÉRAULT, FRANCE**

**Jérôme ROS<sup>1</sup>, Marie-Pierre RUAS<sup>2</sup>**

*Key words: Crops, Middle Ages, Mediterranean France, Storage*

The study of different fills in several storage pits from the medieval rural sites of Dassargues and Lunel-Viel in Languedoc (Hérault, France) offers the opportunity to re-examine the question of the agrarian areas and the crops cultivated during the 10<sup>th</sup> – 11<sup>th</sup> centuries AD in this region.

These primary or secondary burnt deposits provided the principal components of the farming practices in the Mediterranean low plains of Languedoc during the high medieval period: the major economic role of cereals (hulled barley and free-threshing wheat), the secondary place of the grapevine, and the importance of pulses (horse bean, pea and chickpea). The data from seed and fruit remains found in these sites complete the information from medieval written sources.

Despite the fact that large areas of storage pits were excavated (more than 200 silos at Dassargues), only a few provided concentrations of archaeobotanical remains. Most of the pits were filled with secondary deposits.

At Lunel-Viel, the small capacity of the pits has suggested that they were used for family consumption and/or to store seeds for sowing. But the fact that this storage area composed of several tens of pits was located outside the village would however indicate that the peasant population managed its storage communally. At Dassargues, the results indicate that the concentration of wheat and barley came from a burnt store other than a pit, probably a habitat. The poster will present the crop spectrum diversity attested for the two sites and discuss the possibility on the one hand of mixed crop storage (cereals and/or pulses), and on the other hand the existence of two simultaneous methods of storage: in pits and in buildings.

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## AGRICULTURE IN THE SOUTH OF FRANCE DURING THE LATE NEOLITHIC: THE CEREAL STORES AT THE SITE OF CAPOULIÈRE (MAUGUIO, HÉRAULT)

Oriane ROUSSELET<sup>1</sup>, Laurent BOUBY<sup>1</sup>

*Key words: Fontbouisie Culture, Crops, Cultivation methods*

Located on the littoral plain of Languedoc, the site of Capoulière (Mauguio, Hérault) is dated from the late Neolithic and is associated with the Fontbouisie Culture. This site is characterized mainly by raw clay architecture, a complex network of ditches and apsidal habitat structures typical of Fontbouisie buildings. The site destruction by fire allowed the exceptional preservation of elements of cob walls and adobe bricks, and safeguarded several important concentrations of botanical remains. Indeed, during the excavation, various carbonized seed pockets were taken between layers of collapse. These collections are largely dominated by naked barley and naked wheat (*Hordeum vulgare* var. *nudum* and *Triticum aestivum/durum/turgidum*), with a notable presence of einkorn (*T. monococcum*).

The study of these carbonized remains aims to specify the nature of the concentrations and to determine their connection to the identified architectural elements. The ultimate aim is to better understand the agricultural activities at the site and the methods of storage, by interpreting in particular the taphonomy of the glumes. Moreover, an examination of the fruits and seeds from Capoulière and their associated adventitious plants will provide a first glimpse into the cultivation methods employed and food plants used during the late Neolithic, along the southernmost plains of Languedoc.

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## THE EXPANSION OF *TRITICUM TIMOPHEEVI* ZHUK. IN GEORGIA ACCORDING TO PALAEOETHNOBOTANICAL DATA

Nana RUSISHVILI<sup>1</sup>, Tamar JINIKHADZE, I. MAISAIA

*Key words: Bronze Age, Triticum timopheevi, Cultivation*

This paper aims to gain a better understanding of the geographical expansion and morphological description of modern *Triticum timopheevi* ears and grains and identification of the fossilized grains and ear remains.

The Georgian name of *T. timopheevi* is “*Chelta Zanduri*.” The last data about recent growing of this wheat were in west Georgia (Racha-Lechkhumi) in the 1960s. “*Chelta Zanduri*” is very rarely grown by itself. *T. timopheevi* is mainly present with *T. monococcum* and *T. zhukovskyi* Men. et Eriz. (Zhukovskyi wheat). The unity of these species of wheat is known in Georgia as the *Zanduri* population. The three species in the *Zanduri* population belong to glume wheat and are harvested by the primitive tool “*Shnakvi*”.

During the excavation of the early Bronze Age (Natsargora) and late Bronze Age (Dighomi) settlements, also antique period (Tsikheagora) temple, with *T. monococcum* carbonized grains there were grains of unusual emmer wheat which we can assume belong to *T. timopheevi*.

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## CROP STORAGE, PROCESSING AND TIMBER EXPLOITATION DURING EARLY BRONZE AGE III AT ARSLANTEPE (MALATYA, TURKEY)

Diego SABATO<sup>1</sup>, Laura SADORI<sup>1</sup>

*Key words: Seeds, Fruits, Charcoal, Early Bronze Age, Central Turkey*

Arslantepe (Malatya), located in southeastern Anatolia near the river Euphrates, was inhabited continuously from the early 4<sup>th</sup> millennium BC until the Byzantine period. The superimposed archaeological layers built up an artificial hill about 30 m high. The Italian Archaeological Mission in eastern Anatolia financed by “La Sapienza” university of Rome started excavations in 1961. The plant finds discussed here were excavated during several archaeological campaigns, from 1987 onwards. The extensively excavated areas of each period provide us with a rare opportunity to study the evolution both of farming and environment along time, shedding light on crop distribution, food processing and plants in the landscape.

The current work concerns the plant remains analysis from the VI-D phase of Arslantepe (early Bronze Age III, 2500-2000 BC), characterized by a small village arranged on several levels and protected by walls.

The study led to the identification of 17 taxa from seeds/fruits and 13 taxa from charcoal analyses. A total number of ca. 11000 seeds/fruits, mainly cereals and legumes, and ca. 10 kg of wood charcoals, was identified. Among cereals, *Triticum* cf. *aestivum*, *T. dicoccon* and *Hordeum vulgare* are the main taxa. Legumes are represented principally by *Vicia/Lathyrus* and *Pisum*. Woody taxa are represented mainly by charred remains of *Populus*, deciduous *Quercus*, *Fraxinus* and *Juniperus*. The analyses allowed us to assess differences in indoor and outdoor activities, with the potential for identifying patterns of spatial organisation in the processing and storing of crops, and the preparation of food. The contemporary presence of charred *Vitis* pips, stems and grapes suggests wine making. Shiny agglomerates of free threshing cereal caryopses, probably wet before charring, induce us to think of crop processing.

The preponderance of *Populus* sp. among the trees and of free-threshing wheat (*Triticum* cf. *aestivum*) among the grains reflects a relatively moist environment. This fact is in apparent contrast with the Anatolian climatic data available for the same half millennium. This difference could be attributed to the hydrography of the territory surrounding the hill, characterised by several natural springs, but it has to be confirmed by analyses of other environmental proxies still in progress.

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## **CAN THE PERIOD OF DOLMEN CONSTRUCTION BE SEEN IN THE POLLEN RECORD? POLLEN ANALYTICAL INVESTIGATIONS ON THE HOLOCENE SETTLEMENT AND FOREST HISTORY IN THE AREA OF WESTENSEE, SCHLESWIG-HOLSTEIN, GERMANY**

**Mykola SADOVNIK<sup>1</sup>, Oliver NELLE<sup>1</sup>, Hans-Rudolf BORK<sup>1</sup>**

*Key words: Megalithic graves, Palynology, Archaeology, Human impact, Neolithic period*

In this multidisciplinary project we investigate the long-term vegetation dynamics from the Neolithic period to the present in the Westensee area of Schleswig-Holstein, Germany. In the study area are five megalithic graves arranged in a straight line, which are located ca. 100 m from the Krähenberger Moor. By combining the pollen record with AMS radiocarbon dating and archaeological data, we are attempting to date local woodland clearance as a result of the first human impact and the construction of the megalithic graves.

The morphology of the area adjacent to the graves was investigated using airborne laser altimetry data. Digital relief simulation revealed unknown patterns that are interpreted as the boundaries of cultivated land similar to the Celtic fields in the Late Bronze Age field system. A geomagnetic survey at this site was done, and in the magnetogram unknown anomalies surrounding the grave are visible.

A 5.60 m sediment core was obtained from the centre of the Krähenberger Moor. The uppermost 2 m was sampled at 2 cm intervals and analysed for pollen. Vegetational changes as a result of human impact, including the erection of megalithic graves, are reflected in the pollen record by the occurrence of pollen grains of anthropogenic indicators and charcoal. The pollen record of the Krähenberger Moor has been divided into 9 pollen assemblage zones. The lowermost zone KRM-1 is characterised by a decrease in *Ulmus* pollen (at 3953-3767 cal BC), an increase in pollen of anthropogenic indicators and increased frequencies of charred particles. This change in the pollen spectra corresponds to the transition from the Atlantic period to the Sub-boreal and the beginning of human impact on the landscape. Just at this time, the change from the Mesolithic culture of hunters and gatherers to Neolithic economic systems with agriculture and permanent settlements occurred. At a depth from 1.90 to 1.94 m (3801-3732 cal BC) the pollen diagram shows a succession of the occurrence of grasses, Ericales and a significant peak of *Corylus*. A decrease of *Quercus* and *Tilia* in the pollen diagram and an increase of wetland and aquatic plants can be interpreted as a short but significant opening of the landscape. The increase of *Pinus* pollen in the peat deposits in this period, from long-distance pollen influx, supports this finding. The archaeological material from the study site indicates that human activity in the area took place in the Neolithic, Bronze Age and Iron Age, which is corroborated by the pollen record, suggesting that human impact occurred periodically from the end of the Atlantic period.

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## MACRO-REMAIN ANALYSIS OF THE LATE BRONZE AGE DITCHES IN BŘEZNICE U BECHYNĚ, CZECH REPUBLIC (PRELIMINARY RESULTS)

Tereza ŠÁLKOVÁ<sup>1</sup>, Ondřej CHVOJKA<sup>2</sup>

*Key words: Earth ditches, Late Bronze Age, Macro-remains analysis, South Bohemia, Crop structure*

The late Bronze Age settlement in Březnice near Bechyně (South Bohemia) was investigated during 2005-2009. As well as commonly found features, many ditches were also found (about 1/3). In settlement areas of the late Bronze Age several such ditches have been excavated in south and west Bohemia in the Czech Republic, in southwest Germany and Austria. These ditches are linear pits oriented in a north-south direction and the length (usually 4-7m) is four times the width. The ditches are usually filled with burned pottery, ceramic weights and stone artifacts. The results of macro-remains analysis of the late Bronze Age settlement in Březnice represent extraordinarily rich collections of archaeobotanical finds. Until now, five ditches out of ten have been analyzed. Extracted macro-remains from these objects bear attributes of waste origin where *Chenopodium album*, *Polygonum aviculare*, *Fallopia convolvulus* are the most frequent. In the analyzed samples the main cereals were barley (*Hordeum vulgare*) and millet (*Panicum miliaceum*). Less frequent were species of wheat: bread wheat (*Triticum aestivum*), spelt (*T. spelta*), emmer (*T. dicoccum*) and einkorn (*T. monococcum*). Other macroremains found were legumes: lentil (*Lens esculenta*), pea (*Pisum sativum*) and broad bean (*Vicia faba*). Poppy seeds (*Papaver somniferum*) were rare. Particular ditches display specific characters of species composition ranging from a rather low background composition to a high concentration of charred macro-remains. Preliminary interpretations of such archaeological features should reflect their subterranean settlement character, whereas their function as offering places is not excluded.

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## HARVEST, PROCESSING AND STORAGE: PLANT MACROFOSSIL ANALYSIS OF A “CLASSICAL” VILLA FROM BELGIC GAUL

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*Key words: Belgic Gaul, Roman, Villa, Crop processing, Plant macrofossils*

Discovered in 2007 during developer-funded excavations in Bailleul (located in the territory of the Menapiens, a province of Belgic Gaul in what is now northern France), the “Villa des Collines” is a huge rural Roman settlement organised on a ‘classic’ axial plan. Plant macrofossil studies were undertaken on remains collected from the site, the aim being to investigate the agricultural organisation of the villa. The study revealed a very diverse agricultural economy, characteristic of Roman production in Belgic Gaul. The analysis determined that the complete *chaîne opératoire* in terms of crop processing was undertaken on-site, specifically within the *pars rustica* of the villa, allowing a clear scheme of the spatial organization of the villa to be established. Winnowing, coarse and fine sieving, pounding and storage areas have been identified. In addition, analysis has demonstrated that fodder crops were also present and used at the site. In summary, this detailed plant macrofossil analysis of remains from the “Villa des Collines” shows us an ideal and complete rural Roman settlement of Belgic Gaul and the full range of economic agricultural activities of its inhabitants.

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## THE ARCHAEOBOTANICAL GARDEN IN HEMMENHOFEN

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*Key words: Archaeobotanical garden, Cultivated plants, Weeds, Reference collection, Gardening*

Every research unit working with botanical macroremains needs to deal with the effort of building up a comprehensive reference collection as part of its laboratory infrastructure. This was one of the reasons for establishing an archaeobotanical garden in front of the botanical laboratory of the Landesamt für Denkmalpflege at the Regierungspräsidium Stuttgart. An area of 30 m<sup>2</sup> was divided into squares of 1 m<sup>2</sup> each, where 30 taxa of old economic plants like cereals, legumes and spices are grown. Not only species which are still found in gardens and fields of the 21<sup>st</sup> century grow there, but forgotten taxa like *Camelina sativa*, *Vicia ervilia* and *Atriplex hortensis* are cultivated, too. Also, some weed species, which are almost extinct today due to modern agriculture, like *Agrostemma githago* and *Orlaya grandiflora* are deliberately sown in between the cereals. In this way we not only get supplies for our reference collection of seeds, but also for the herbarium. The garden can also be used to identify exotic and unknown fruits and seeds by letting them germinate and grow. Another reason for setting up this garden was the request to create adequate surroundings for some remarkable *Prunus* trees which had been donated by U. Körber-Grohne about 20 years ago, and to communicate archaeobotanical research to the public. Therefore each taxon is labelled and two information plates show the history of cultivated plants in southwest Germany. Since our laboratory is located in a touristic area, we offer guided tours each year that are well attended, and directions to the garden are given in a tourism authority booklet. So an archaeobotanical garden is a lively possibility for arousing interest in the public for our science.

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## MORPHO- AND BIOMETRICAL ANALYSIS OF GRAPE PIPS FROM THE MIDDLE MINOAN SITE OF MONASTIRAKI (CRETE, GREECE)

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*Key words: Vitis vinifera, Middle Minoan, Morpho and biometrical analysis*

This project, the topic of a doctoral thesis, aims to develop a new methodological approach to the diversification of domestic grape pips through the application to and comparison between the traditional biometric and geometric morphometry methods. It is based on the use of systems software for acquisition analysis and image elaboration, and aims to define a new concept in analytical morphometry.

The archaeobotanical material used in the experiment consists of a sample of thousand seeds, from the warehouses of the east of the middle Minoan palace of Monastiraki, Crete.

This new model of analysis means to furnish a new methodology to approach the well known traditional biometric methods of Stummer, Schiemann, Perret and Mangafa-Kotsakis, which can only be used for the taxonomic definition of the two subspecies, *ssp. sylvestris* and *ssp. vinifera*. The model proposes the possibility of identifying the probable differentiations in the grapevine, especially for the phases such as the Bronze where only the archaeobotanical and archaeological data allow a palaeo-economic and palaeo-environmental reconstruction.

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## TRADITIONAL FARMING OF MILLETS (*PANICUM MILIACEUM* AND *SETARIA ITALICA*) IN NORTHERN IBERIA: AN ETHNOGRAPHIC APPROACH

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*Key words: Millet cultivation, Iron Age, Medieval times, Traditional farming*

Millets, both *Setaria italica* and *Panicum miliaceum*, are a very important component of the archaeobotanical samples we are studying in northern Iberia from the Iron Age and early Medieval period. Although it was thought that the traditional cultivation of these crops had completely disappeared from northern Spain, a survey of the Atlantic northern coast has allowed us to find what we think are the last farmers who include millets in their crop system. *Setaria italica* and *Panicum miliaceum* are still grown as mixed crops in the Concejo de Cangas de Narcea in the area of Asturias. This poster summarises the interviews and field work we have carried out with these farmers in order to explore the farming practices, uses and beliefs related to Panicaceae in this region.

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## PLANT REMAINS FROM THE ROMAN HARBOUR AT ZATON NEAR ZADAR (CROATIA)

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*Key words: Plant macrofossils, Mediterranean cultivated plants, Roman harbour, Croatia*

71 archaeobotanical samples from an undersea archaeological site – a Roman harbour at Zaton near Zadar (Croatia) were analysed. Cultural layers excavated in Zaton provide material evidence for the activity of this harbour during the time between 1<sup>st</sup> to the 3<sup>rd</sup> (eventually 4<sup>th</sup>) century AD. Out of the collected samples, a total of 3611 seeds, fruits and other mostly non-carbonized plant remains have been separated, out of which 3409 have been identified, mostly up to species level.

An analysis of the results showed that the most important agricultural products were the grape vine (*Vitis vinifera*), olives (*Olea europaea*) and figs (*Ficus carica*). The stone pine (*Pinus pinea*), sweet/sour cherry (*Prunus avium/cerasus*), peach (*Prunus persica*) and almond (*Prunus amygdalus*), some cereals, vegetables and seasoning plants were cultivated or traded as well. Mediterranean evergreen vegetation, today described as alliance *Quercion ilicis*, already existed in the Roman period but under anthropogenic influence it became degraded into maquis, garigue and pasture. The most interesting finds, new and unexpected for the investigated area, are radish (*Raphanus sativus*), red horned-poppy (*Glaucium corniculatum*) and Assyrian plum (*Cordia myxa*).

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## AGRICULTURE IN THE BRONZE AGE IN SARDINIA: THE CASE OF GROTTA MONTE MEANA (SANTADI)

Mariano UCCHESU<sup>1</sup>, Leonor PEÑA-CHOCARRO<sup>2</sup>

*Key words: Plant remains, Wood charcoal, Bronze Age, Sardinia*

Research into archaeobotany in Sardinia, Italy, is still at its early stages with very few sites studied for plant macroremains. This poster focuses on the preliminary results from both seeds and charcoal from the recently excavated site Grotta Monte Meana. Flotation has been systematically applied and samples are currently under study. The aims of this study are to study of the formation processes of the archaeobotanical record and to explore the role of plant resources in the subsistence of the Bronze Age community that inhabited the cave. Comparison with other contemporary sites in the region will offer a more complete picture of an area which is little known from the archaeobotanical point of view.

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## **A RECENT IDENTIFICATION OF A NEW GLUME WHEAT TYPE: A BIOMETRICAL AND MORPHOLOGICAL STUDY OF SPIKELET FORKS FROM THE NEOLITHIC LEVELS IN MERSIN-YUMUKTEPE (TURKEY)**

**Burhan ULAS<sup>1</sup>, Girolamo FIORENTINO<sup>1</sup>**

*Key words: Neolithic, New glume wheat type, Biometrical analysis, Mersin-Yumuktepe, Turkey*

The questions of cultivated and/or wild glume wheat use in the Near East pre-ceramic era and during the Neolithic period are still being discussed. Particularly, if we talk about the so-called “new glume wheat type”, we know that it is one of the most hard to interpret as far as its origin, first use and taxonomic classification are concerned.

The archaeobotanical evidences of this cereal, particularly the spikelet forks, come from three Neolithic sites and one Bronze Age site in northern Greece, as well as from Neolithic and Bronze Age sites in Turkey, Hungary, Austria, Germany and probably northern Italy. Among the earliest evidence, we have now found the forks from Mersin-Yumuktepe too, from the early Neolithic levels (7200 B.C.) and the following middle and late Neolithic period levels.

In this presentation, we show a thorough morphological and biometrical analysis of “new glume wheat type” spikelet fork characters, comparing them with the most similar ones, of *Triticum dicoccum*.

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## CEREALS FOR THE CARPETANIANS: ARCHAEOBOTANICAL RESEARCH IN EL LLANO DE LA HORCA, A LATE IRON AGE OPPIDUM (SANTORCAZ, MADRID, SPAIN)

Paloma UZQUIANO<sup>1,2</sup>, Cosimo D'ORONZO<sup>2</sup>, Girolamo FIORENTINO<sup>2</sup>, Blanca RUIZ-ZAPATA<sup>3</sup>, M<sup>a</sup> José GIL-GARCÍA<sup>3</sup>, Gabriela MARTENS<sup>4</sup>, Miguel CONTRERAS<sup>4</sup>, Gonzalo RUIZ-ZAPATERO<sup>5</sup>, Enrique BAQUEDANO<sup>4</sup>

*Key words: Central Spain, Madrid, Second Iron Age, Llano de la Horca, Archaeobotany*

"El Llano de la Horca" (Santorcaz, Madrid) is an important *oppidum* (9.5 ha) of the Carpetanians in central Spain which was occupied between the end of the 3<sup>rd</sup> century BC and early decades of the 1<sup>st</sup> century BC. The urban planning is a complex one with rectilinear streets and blocks of rectangular houses. We have concentrated the research in a huge area in the centre of the *oppidum*, where several houses have been excavated. Houses are usually divided into an entrance, a central room with hearth and lateral departments with storage and other possible functions (sleeping and service areas). Excavation of two departments at the back of the houses has revealed abundant cereal grain remains, spread around their respective surface excavation areas. Naked wheats are dominant (*Triticum aestivum-durum* and *T. compactum*). *T. monococcum*, *T. dicoccum* and *Hordeum vulgare* are also present. The preservation state of the caryopses suggest good storage conditions, but the cereal mixture indicates that the archaeological contexts could correspond more to domestic areas, where cereals would have been processed for meals, with grinding surfaces close to hearths, instead of a storage place with cereals in pottery vessels or textile sacks.

Other archaeobotanical analyses of pollen and wood charcoal, indicate an open landscape dominated by herbaceous taxa (Asteraceae, Chenopodiaceae, Poaceae, *Glomus*) resulting from land cleared of woods. These studies have also revealed the presence of *Pinus* (*P. sylvestris-nigra*, *P. pinea-pinaster*), *Juniperus* (*J. phoenicea* type), *Quercus faginea*, *Q. ilex* and *Q. suber* as the main trees exploited. Occurrences of *Alnus*, *Corylus*, *Fraxinus* (*F. angustifolia*) and *Juglans* indicate the existence of several periods with an optimum in water resources availability.

The results draw a picture of a subsistence based on cereal agriculture and crop processing activities, with evidence of woodland clearance in order to gain space for crop fields for the necessities of a growing community, which was probably in the order of many hundreds inhabitants.

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## PLANT PROCESSING AROUND THE GLOBE: ARCHAEOBOTANICAL, EXPERIMENTAL AND ETHNOBOTANICAL APPROACHES

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*Key words: Plant processing techniques, Food, Dietary traditions*

Stemming from presentations and discussions between the authors during the 2007 IWGP in Kraków, a symposium was organized within the framework of the 5<sup>th</sup> International Conference of Ethnobotany, held in Bariloche, Patagonia, Argentina in September 2009. The title of the symposium was: 'Recent research in post-harvest traditions in human prehistory: Old and New World palaeoethnobotanical approaches to linking the archaeology and ethnobotany of plant processing'. The main theme of the symposium was plant processing techniques aiming towards the transformation of plants into foodstuffs, their shelf life and their nutritional properties as regards human food and health. The selection of techniques, the formation of dietary traditions, and the relationship of processing techniques with land use, permanence or mobility of habitations are trajectories of inquiry discussed by the participants. Archaeobotanists, ethnobotanists and archaeologists from Japan, Turkey, Greece, France, Canada and Argentina presented recent ethnographic research on plant processing and its potential for contributing towards the interpretation of archaeobotanical remains.

Wollstonecroft outlined the significance of post-harvest plant processing in the evolution of human societies and in expanding the potential of natural resource exploitation. Processing of *Algarrobo* (*Prosopis chilensis*, *Prosopis flexuosa*), carob trees of Latin America has been one of the research interests of Capparelli. Experimental and ethnographic work on the uses of this plant in Argentina, have helped clarify potential uses of the plant at archaeological sites where it has been found in abundance. López, Capparelli and Nielsen presented their ethnographic research as regards processing of quinoa (*Chenopodium quinoa*) in Bolivia. Lema's contribution combined ethnographic and archaeobotanical work towards the investigation of the garden as an early form of plant husbandry, leading to the formation of landraces, using the cultivation of *Cucurbita maxima* as her case study. Moving from the New World to the Old, Leo Aoi Hosoya discussed wild acorn processing by 4<sup>th</sup> millennium BC farming communities of China and Japan. From Japan to Turkey, F. Ertuğ investigated recent linseed (*Linum usitatissimum*) processing in Cappadocia for the production of oil in a region where olives do not grow. Valamoti presented her ethnographic work on traditional *trachanas* production in modern Greece and information on bulgur production in conjunction with experimental research, contributed towards the interpretation of archaeobotanical remains of stored, pre-processed cereals from Bronze Age northern Greece. Patricia Anderson discussed cereal processing in the region of Atlas in Tunisia.

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## PLANT REMAINS FROM AN IRON AGE PIT AT KARABOURNAKI, NORTHERN GREECE

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*Key words: Iron Age Greece, Grape pressings, Silica awns*

Plant remains retrieved from successive layers that filled an Iron Age pit at the coastal site of Karabournaki, nowadays within the modern city of Thessaloniki, are presented in detail. The pit, which contained destroyed clay cooking installations, pottery, bone and sea-shell, was rich in a variety of cereal and pulse species as well as fruit and seeds of weed species or of plants growing in the wild. Glume wheats, dominant in the Neolithic and the Bronze Age, are still represented by glume bases and spikelet forks, while free-threshing cereals like barley and bread/durum wheat are represented by both grain and rachis internodes. The presence of silica awns and lemma tips in the samples is impressive and in some samples constitutes the main archaeobotanical component of the pit samples. Among the fruit finds, grape pips are the most common and a few examples of pressed grapes are also present. Pressed grapes are widely distributed in various parts of the site of Karabournaki and despite their limited number, may point towards the production of a local wine. The mixed composition of the pit samples suggests refuse and fuel charred within the context of Iron Age cooking in a hearth or other cooking installations. Archaeobotanical evidence from the Greek Iron Age in the north of Greece (10<sup>th</sup> – 6<sup>th</sup> centuries BC) is rather sparse, consisting mainly of preliminary publications. The detailed presentation of this assemblage, from a secure context of the Iron Age of northern Greece, makes a significant contribution towards our knowledge of plant exploitation by Iron Age communities in the region.

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## PROCESSING AND CONSUMPTION OF PULSES IN PREHISTORIC GREECE: ARCHAEOBOTANICAL, EXPERIMENTAL AND ETHNOGRAPHIC EVIDENCE

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*Key words: Prehistoric Greece, Lathyrus sativus, Vicia ervilia*

The importance of pulses in the diets of Neolithic and Bronze Age communities of Greece has been emphasized by many authorities and supported by archaeobotanical evidence consisting of a significant contribution of pulse species found in rich, dense concentrations as stored crops. Their significance has led A. Sarpaki to talk of a Mediterranean 'tetrad', thus breaking the stereotypic 'triad' of cereals, wine and oil. Lentil, pea, grass pea and bitter vetch, with the addition in the Bronze Age of Celtic bean, Cyprus vetch and Spanish vetchling, provide the range of pulses used in prehistoric Greece. Pulses can be used as food, fodder or both and despite the toxicity of some, like grass pea and bitter vetch, ways for detoxifying them or for counteracting their toxicity are known from written sources, modern ethnographic accounts and food science research papers. This presentation brings together archaeobotanical evidence on pulses available from Greece, placing particular emphasis on recent finds of *Lathyrus sativus* and *Vicia ervilia* from Neolithic and Early Bronze Age sites. These finds provide the incentive for an in-depth investigation of their processing for food as well as their context of consumption in prehistoric Greece.

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## INFERRING THE TAPHONOMY OF CHARRED OLIVE STONES BY COMPARING THE ANATOMY OF FRACTURE SURFACES UNDER DIFFERENT BURNING REGIMES

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*Key words: Olea europaea, Taphonomy, SEM, Olive oil, Experimental charring*

Abundant charred and broken olive stones excavated from Bronze Age layers at Tell Tweini (ancient Gibala) raised the question whether the olives were processed for oil by methods which could imply breakage, or just broken during charring and/or post-depositionally. Laboratory charring experiments were conducted on recent fresh, dried and salted olives under several burning conditions with variations in temperature, duration and oxygenation, resembling domestic fires. Anatomical comparisons based on SEM pictures were made to evaluate the difference between fracture surfaces of the stones when these were generated prior and after charring. Pre- versus post-charring fractures appear to be reasonably distinctive when considering changes in surface patterns, including cell shape and cell size. We also compared the experimental material to the archaeological olive stones in order to interpret the fractures, so whether they were ancient or recent. In addition, indications on how to recognise carbonised olive seeds are observed and described. These data can be used in subsequent studies to categorize and interpret processed and charred *Olea* remains more precisely.

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## ARCHAEOBOTANICAL INVESTIGATION AT AN EARLY IRON AGE (7<sup>TH</sup> – 6<sup>TH</sup> CENTURY BC) BYLANY CULTURE SETTLEMENT, PRAGUE – ČERNÝ MOST, CENTRAL BOHEMIA

Zdeněk VANĚČEK<sup>1</sup>, Jaromír BENEŠ<sup>1</sup>, Jan FROLÍK<sup>2</sup>, Michaela MÁCALOVÁ<sup>3</sup>

*Key words: Hallstatt Period, Agricultural settlement site, Macro-remains, Crop structure, Anthracology*

Identification of Bylany Culture settlement sites is very exceptional in Czech prehistoric archaeology and their archaeobotanical content is almost unknown. The settlement site area of Černý Most is located at the eastern periphery of Prague in a small stream valley. It is a multiperiod site with features belonging to the early Iron Age, the Roman Iron Age and the high Medieval period, which was rescue excavated in 2008. Eight houses and two pits were dated archaeologically to the early Iron Age (Bylany Culture, 7<sup>th</sup> – 6<sup>th</sup> century BC). It is the largest still known settlement site of this culture in the Czech Republic. Plant macroremains came from infills of houses, pits and from fireplaces. The most common species were *Panicum miliaceum* and *Hordeum vulgare*. Other cereals (*Triticum spelta*, *T. dicoccum*, *T. monococcum* and naked wheat) were found exceptionally. Pulses were mainly *Lens culinaris*, with some *Pisum sativum*. The final crop was *Papaver somniferum*. This structure agrees with other macroremain spectra from the early Iron Age of Bohemia. Weeds were found (*Chenopodium album*, *C. ficifolium*...) and grassland or wetland plants that allow thinking of mowing. Anthracological taxa spectra reflect surrounding macrovegetation, the use of fuel and constructional woods. All archaeobotanical data are useful contributions for the study of the Hallstatt period in the Bohemian lowland. Material from Černý Most includes data about the prehistoric period that reflects some climatic deterioration, and reaction of the people and agricultural system.

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## A DIRECT ASSESSMENT OF ARCHAEOLOGICAL CROP WATER STATUS

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*Key words: Archaeobotany, Irrigation, Palaeoclimate, Carbon isotopes*

The water status under which crops were grown in the past is potentially a valuable interpretative tool for archaeologists. In particular, knowledge of crop water status can contribute to discussion of palaeoclimate conditions, arable land selection and the application of irrigation. There is a theoretical link between the water status of a plant and the ratio of stable carbon isotopes locked in its structures. If these ratios survive archaeological preservation then this link could allow the water status of ancient plants to be inferred directly from their remains. A series of experimental studies indicate that there is a correlation between water status and stable carbon isotope ratio, and that with due caution this ratio can be used to model a plant's water status during life. Preliminary archaeological application at several Bronze Age sites in western Asia indicates that the stable carbon isotopes can make a substantial contribution to economic interpretations.

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## RECONSTRUCTING CHANGES IN RICE WATER MANAGEMENT THROUGH ARCHAEOLOGICAL WEEDS IN NEOLITHIC CHINA

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*Key words: Rice cultivation regime, Weed flora, Crop processing*

How can ancient rice arable systems be seen using archaeobotanical data? One method is by building modern analogues using the crop weeds found within each type of cultivation regime. Phytoliths and weed seeds can be used to show rice crop processing residues, for example changing significance of input from threshing/winnowing as opposed to predominantly dehusking waste. While these factors may affect weed assemblages, ecological signals are still evident. Cultivation conditions can be determined by the associated weed flora, diatoms and sponge spicules. Our current research program based on analogue field studies and a database of rice weeds aims to refine methods for identifying the signature of different rice cultivation regimes through weed seed, phytolith and diatom assemblages. The results of a pilot study analysing weed seeds and phytoliths, diatoms and sponge spicules from Baligang, Henan, central China indicate wet rice cultivation but show distinct variation between periods (Yangshao, Qiujialing to Longshan). This chronological change points to contrasting water management regimes, with a more intensive control of water in the middle period.

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## ANTHROPOPHYTES OF MEDIEVAL KRAKÓW

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*Key words: Medieval Kraków, Macroremains, Alien plants, Habitat preferences, Plant communities*

During the course of archaeobotanical studies in Kraków, fruits and seeds of 93 species known as anthropophytes (plants introduced to local flora by people) were found in medieval layers dated to the 9<sup>th</sup> – 15<sup>th</sup> centuries AD.

Among them the most common were archaeophytes – 90 taxa, mostly of Mediterranean-Iranian-Turanian origin. They were mainly synanthropic plants: weeds, ruderals and cultivars or former cultivars. Plants of meadows, xerothermic (dry) grasslands and woodland clearings were present as well. The archaeophytes (plants which were introduced up to the end of the 15th century AD) were dominated by weeds of cultivated crops characteristic of cornfields (*Centauretalia cyani* order) and flax fields (*Lolion-Linion* alliance), and of root crops and gardens (*Polygono-Chenopodietalia* order). Seeds of *Camelina* cf. *alyssum* and *Cuscuta* cf. *epilinum*, plants now extinct in Poland, but connected with flax crops in the past, were found in four samples dated to the late Medieval period. A second type of assemblage dominated by archaeophytic plants included taxa characteristic of annual vegetation communities in ruderal habitats (*Sisymbrium officinalis* alliance), also thermophilic (*Onopordetalia acantii* order) and heavily nitrophilous ruderal communities (*Arction lappae* alliance). Large numbers of remains of weeds and ruderal plants were also found which were characteristic of assemblages associated with a Mediterranean and subcontinental climate and which typically grow on calcareous, warm and nutrient-rich soils. These assemblages included some ancient archaeophytic vegetation types of ruderal and arable land. Three of the species found – *Calamintha sylvatica* Bromf., *Ficus carica* L. and *Glaucium corniculatum* (L.) Rud. ssp. *corniculatum* are ephemeroxytes in Poland. *Calamintha sylvatica* is a species with a sub-Mediterranean and west European range. It was probably imported as a medicinal plant from these regions or from southeast Poland; it might also have been cultivated or become naturalised near Kraków. *Ficus carica* is a Mediterranean plant, which was found only in the main market square. It was probably imported, but cultivation in places with particularly warm habitats like vineyards might have been possible. The last species, *Glaucium corniculatum*, is a taxon of Mediterranean-Iranian-Turanian range, and was probably brought with food from these regions or southeast Poland, where it might have grown as a field weed. It might have persisted for some time in segetal assemblages around Kraków, as well as in ruderal assemblages in the city.

We will discuss the implications of these results for the history of synanthropization of plant cover and the history of anthropophyte migrations in Europe, in relation to past environments and cultural connections.

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## PLANT MATERIAL FROM EARLY MEDIEVAL (12<sup>TH</sup>/13<sup>TH</sup> CENTURY) ECONOMIC STRUCTURES ON THE SITE OF TARTACZNA IN GDAŃSK (N POLAND) – PRELIMINARY RESULTS

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*Key words: Medieval town, Animal husbandry, Meadows, Fodder*

The site of Tartaczna is situated in the Old Town area in Gdańsk. During the archeological investigations, houses, yards and structures for animals (pigsties) were found there. The latter are of the most interest as they had not been found on the other sites in Gdańsk up to this time. Most of them represent the 12<sup>th</sup> and 13<sup>th</sup> century. This kind of economic structure can provide us with archaeobotanical information first of all about animal husbandry in urban conditions.

Preliminary results showed that macrofossils from the pigsty represent a rich group of meadow plants (*Lychnis flos-cuculi*, *Eleocharis palustris/uniglumis*, *Carex* spp., *Juncus* sp.) probably used as a fodder. Ruderal plants and weeds (*Polygonum lapathifolium*, *Stellaria media*, *Urtica dioica*, *Chenopodium album*, *Agrostemma githago*, *Echinochloa crus-galli*, *Setaria pumila*, *Fallopia convolvulus* and *Neslia paniculata*) were found mostly in houses and yards. In these contexts remains of cultivated and collected plants (*Malus* sp., *Linum usitatissimum*, *Cannabis sativa*, *Secale cereale*, *Humulus*, *Fragaria vesca*, *Vaccinium myrtillus* and *Sambucus nigra*) were sparsely dispersed in cultural layers, except for numerous *Panicum miliaceum* glumes, which show that millet was commonly used.

Archaeobotanical, archaeological and historical investigations on the site are still in progress. It means that it is too early to summarize the results, but we expect that the Tartaczna site will be one of the most interesting places on the early Medieval map of Gdańsk

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## PLANT MACROFOSSILS FROM THE DEPOSITS OF LAKE SCHWARZENBERG (SOUTHERN BOHEMIA, CZECH REPUBLIC) AND FROM ASSOCIATED MESOLITHIC ARCHAEOLOGICAL SITES

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*Key words: Mesolithic, Wooden artifacts, Trapa natans, Plant introduction*

Buried sediments of the former Lake Schwarzenberg were discovered in the late 1970s in Třeboň Basin, southern Bohemia. In the 1990s extensive modern investigation of the site started. The lake originated by the end of the Last Glacial Maximum (around 16000 BP) and terrestrialized in the middle Holocene, about 4500 BP. Over the last few years, archaeological survey and excavations around the former lake has confirmed a number of Mesolithic sites. Some are well preserved in a waterlogged environment and date to the very start of the Holocene. Wooden artifacts discovered are all made from pine wood.

Detailed botanical analyses of plant macrofossils, pollen and algal remains, and geochemical analyses of lake sediments and peat provide a detailed insight into Late-glacial and early Holocene environmental history of the site and the region. This paper is based mainly on the results obtained from the analyses of plant macrofossils extracted from one central profile and from three littoral ones.

The first organic deposits began to form in the centre of the lake basin at about 16000 BP. For this time period, treeless vegetation of steppe-tundra character can be reconstructed from the pollen spectra. During the Late-glacial Interstadial, organic production increased and it is possible to detect this period by macroscopic remains of oligotrophic macrophytic vegetation (oospores of Charophyta, seeds of *Batrachium* sp., *Potamogeton* cf. *gramineus*). In the littoral zone of the lake, vegetation of reed and tall sedge beds was present at the same time (*Carex rostrata/vesicaria*, *Carex* cf. *diandra*, *Typha angustifolia/latifolia*, *Menyanthes trifoliata*). The Younger Dryas chronozone is recognized by a decline in the presence of plant macrofossils. Finds of *Potamogeton praelongus* and *P. perfoliatus* give evidence of climatic deterioration. The start of the Holocene is well detected by the rapid development of macrophytic vegetation (*Batrachium* sp., *Najas marina*, *N. minor*, *Nuphar pumila*, *Myriophyllum spicatum*, *Potamogeton filiformis*, *P. alpinus*).

Regardless of the results of archaeological excavations, a Mesolithic settlement is reflected in the investigated profiles by the presence of pollen grains of anthropogenic indicators, as well as by macrofossils of some palatable terrestrial plants (*Rubus saxatilis*, *R. idaeus* and *Corylus avellana*) within the lake sediments. Enhanced influx of charcoal particles into the lake is dated to the early Holocene. Early occurrence of two plants – water chestnut (*Trapa natans*) and hazel (*Corylus avellana*) can be related to their deliberate introduction. Their first finds are radiocarbon dated to around 9500 uncal BP.

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## **RECENT ARCHAEOBOTANICAL INVESTIGATIONS INTO THE RANGE AND ABUNDANCE OF CROP PLANTS IN BRONZE AND IRON AGE SETTLEMENTS IN THE RHINELAND AREA, NORDRHEIN-WESTFALEN, WESTERN GERMANY**

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*Key words: Bronze Age, Iron Age, Rhineland, Crop plants*

During recent decades, numerous sites dating back to the last two millennia BC have been studied archaeobotanically in the Rhineland by K.-H. Knörzer and at the Laboratory of Archaeobotany, University of Cologne. New investigations within the scope of a doctoral thesis topic enable the comparison of the plant spectra from more than 40 Bronze and Iron Age settlements.

On the one hand, obvious differences in the crop assemblages can be shown. While the earlier Bronze Age settlements do not have a wide range of cultivated plants, the settlements of the late Bronze Age offer a broad package with wheat, barley, millet, oil plants and legumes. Their husbandry continued to the early Iron Age, where in most settlements up to a dozen plants were cultivated. In the late Iron Age this wide spectrum decreases and barley especially gained in importance. This development can also be seen in the crop weed assemblages.

On the other hand, it is possible to compare the contemporary Iron Age settlement assemblages with the aim of detecting agricultural production and consumption sites.

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## Übersicht über die erschienenen Hefte 2004-2009

- 2004/1 TSK X. 10. Symposium Tektonik, Struktur- und Kristallingeologie.** Kurzfassungen der Vorträge und Poster. 31.03.-02.04.2004, Aachen. – 108 S. – *Verkaufspreis: € 11,50*
- 2004/2 18<sup>th</sup> International Senckenberg Conference. VI International Palaeontological Colloquium in Weimar.** Late Neogene and Quaternary Biodiversity and Evolution: Regional Developments and Interregional Correlations. Conference Volume. April 25-30, 2004, Weimar, Germany. – 289 S. – *Verkaufspreis: € 21,-*
- 2004/3 A.M.S.El. Workshop 2004. "Analytik als Werkzeug für die Klima- und Geoforschung".** Programme und Zusammenfassungen der Tagungsbeiträge. 7.-8. Juni 2004, Alfred-Wegener-Institut, Bremerhaven. – 42 S. – *Verkaufspreis: € 7,-*
- 2004/4 XXVIII SCAR & COMNAP XVI.** SCAR Open Science Conference. "Antarctica and the Southern Ocean in the Global System". XI SCARLOP Symposium. "Towards the International Polar Year and Beyond". Abstract Volume. July 25-31, 2004, Bremen, Germany. – 480 S. – *Verkaufspreis: € 26,-*
- 2004/5 Proceedings of the XI SCALOP Symposium. "Towards the International Polar Year and Beyond".** 28 July, 2004, Bremen, Germany. – 242 S. – *Verkaufspreis: € 21,-*
- 2005/1 19<sup>th</sup> Colloquium on Latin American Geosciences.** April 18-20, 2005, Potsdam. – 147 S. – *Verkaufspreis: € 14,-*
- 2005/2 2<sup>nd</sup> European Conference on Permafrost.** Programme and Abstracts. June 12-16, 2005, Potsdam, Germany. – 224 S. – *Verkaufspreis: € 20,-*
- 2005/3 22. Internationale Polartagung der Deutschen Gesellschaft für Polarforschung.** Programm und Zusammenfassung der Tagungsbeiträge. 18.-24. September 2005, Jena. – 151 S. – *Verkaufspreis: € 14,50*
- 2005/4 2<sup>nd</sup> International Alfred Wegener Symposium.** Programme and Abstract. October 30 - November 02, 2005, Bremerhaven, Germany. – 115 S. – *Verkaufspreis : € 13,-*
- 2005/5 DFG-SPP 1135. Dynamics of the Central European Basin System.** 4<sup>th</sup> Rundgespräch. November 30 - December 02, 2005, Eringerfeld, Germany. 136 S. – *Verkaufspreis : € 14,- vergriffen*
- 2006/1 ICDP-Workshop PASADO. Potrok Aike Lake Sediment Archive Drilling Project.** Scientific Programme – Abstract Volume – Excursion Guide – Participants. March 15-19, 2006, Rio Gallegos, Santa Cruz, Argentina. – 90 S. – *Verkaufspreis : € 11,50*
- 2006/2 150 Years of Neanderthal Discoveries. Early Europeans – Continuity & Discontinuity.** Congress, July 21<sup>st</sup>-26<sup>th</sup>, 2006 in Bonn, Germany. – 170 S. – *Verkaufspreis : € 17,-*
- 2006/3 Shaping the Earth's Surface: Dynamics and Changing Environments.** GV International Conference 2006 and 96<sup>th</sup> Annual Meeting of the Geologische Vereinigung e.V. September 25-29, 2006, Potsdam, Germany. – 118 S. – *Verkaufspreis : € 14,-*
- 2006/3a Geomagnetic Field Variations: Space-Time Structure, Processes, and Effects on System Earth. International Final Colloquium of the German Science Foundation Priority Programme 1097.** Jointly organized by the Deutsche Forschungsgemeinschaft and the Deutsche Akademie der Naturforscher Leopoldina. October 4-5, 2006. – 120 S. – *Verkaufspreis: € 14,-*

- 2007/1-2 The Oceans in the Earth System.** International Conference 2007 and 97<sup>th</sup> Annual Meeting of the Geologische Vereinigung e.V. (GV), Bremen, Germany, October 1-5, 2007. – 267 S. – *Verkaufspreis: € 21,-*
- 2008/1 23. Internationale Polartagung der Deutschen Gesellschaft für Polarforschung.** Münster, 10.-14. März 2008. Programm und Zusammenfassung der Tagungsbeiträge. – 107 S. – *Verkaufspreis: € 14,-*
- 2008/2 12th International Palynological Congress (IPC-XII), 8th International Organisation of Palaeobotany Conference (IOPC-VIII).** Abstract Volume. August 30 – September 5, 2008 in Bonn, Germany. – 337 S. – *Verkaufspreis: € 25,-*
- 2009/1 KALMAR – First Bilateral Workshop on Russian-German Cooperation on Kurile-Kamchatka and the Aleutian Marginal Sea-Island Arc Systems.** Program and Abstracts. *Petropavlovsk-Kamchatka, Russia, April 27 - May 1, 2009.* – 73 S. – *Verkaufspreis: € 10,-*
- 2009/2 System Erde – Mensch. Handlungsoptionen und Managementstrategien.** Dokumentation der Strategiekonferenz am 12. und 13. Juni 2008 in Berlin. Herausgegeben von Rolf Emmermann, Gerold Wefer und Volker Mosbrugger. – 118 S. – *Verkaufspreis: € 5,-*
- 2009/3 Paläontologie. Schlüssel zur Evolution. 79. Jahrestagung der Paläontologischen Gesellschaft, Bonn, 5.-7. Oktober 2009.** Kurzfassung der Tagungsbeiträge. – 126 S. – *Verkaufspreis: € 14,-*
- 2009/4 Annual Meeting of the German Association of Stable Isotope Research (GASIR). Abstract Volume. – Jahrestagung der Arbeitsgemeinschaft Stabile Isotope e.V. (ASI).** Tagungsband. – AWI Potsdam, 5.-7. Oktober 2009. – 86 S. – *Verkaufspreis: € 10,-*
- 2009/5 Klima im System Erde. Klimawandel – Antworten und Fragen aus den Geowissenschaften.** Zusammenfassung der Konferenzbeiträge, dbb-forum Berlin, 2. und 3. November 2009. – 89 + 36 S. – *Verkaufspreis: € 5,-*

Gesamtübersicht über die Hefte seit 1993:

[http://www.geo-union.de/TERRA\\_NOSTRA\\_1993-2009.pdf](http://www.geo-union.de/TERRA_NOSTRA_1993-2009.pdf)