AEA 2008 Annual Conference

THE CONSEQUENCES OF FIRE

12.-14. September 2008, Århus, Denmark

The Conference is hosted by

Department of Environmental Archaeology and Conservation
Moesgård Museum
DK-8270 Hojbjerg
Denmark
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Programme:

Friday 12/9

1400 - 2000  Arrivals

1800 - 1930  Dinner

2000  Welcome (Peter H. Mikkelsen Head of Dept. of Environmental Archaeology and Conservation, Moesgård Museum)

2000 - 2130  The Consequences of Fire: Recent Danish Research

Mogens Bo Henriksen, Odense City Museums: Prehistoric Cremation technique - archaeological evidence and experimental experience

Jacob Kveiborg, Moesgård Museum: Animal husbandry in Early Iron Age Denmark based on evidence from burnt down houses

Peter Mose Jensen, Moesgård Museum, Denmark: Carbonized Late Neolithic and Early Bronze Age grain finds from Central Jutland and the storage of grain during the period

2130 – 2200 Grauballe Man – scientific investigations. (David E. Robinson, English Heritage)

2200 -  Socialising

Saturday 13/9

0730 - 0830  Breakfast

0830  Welcome (Jan Skamby Madsen, Director of Moesgård Museum)

0845 -1000  Session

Ferran Antolin, Universitat Autònoma de Barcelona: An interdisciplinary approach to the study of a partly burned Early Neolithic burial deposit in Can Sadurní Cave (Catalonia, Spain)
Fay Worley, English Heritage, UK: Faunal Pyre Goods in Late Iron Age and Roman Cremation Burials in Britain

1000 - 1030 **Coffee/Tea**

1045 - 1145 **Session**

Peter Steen Henriksen, The National Museum, Denmark: Carbonised macro remains from Iron Age and Viking Age in Denmark. Results from recent investigations

Martin Bell, University of Reading: Mesolithic fire history in lowland Britain

1200 - 1300 **Lunch**

1300 - 1500 **Session**

Alex Brown, University of Reading: Fire and wetland exploitation in the Neolithic to Iron Age of the Severn Estuary, southwest Britain

Sabine Karg, The National Museum, Denmark: Burning down the heath – Plant remains from the Bronze Age gravemound of Skelhøj in Western Denmark

Pamela I. Chester, New Zealand: Fire and Pteridium cultivation by Polynesians in prehistoric New Zealand

1500 - 1530 **Coffee/Tea**

1530 - 1700 **Session**

Harry Kenward & Allan Hall, University of York: Carbonised insects: rare, overlooked or destroyed by sample processing?

Poul Nissen, Moesgård Museum, Denmark: Burnt house remains with well preserved finds as a basis for intra-site analysis – some theoretical considerations based on a study of six burnt house sites from the Danish Iron Age

Jess Tipper, Suffolk County Council Archaeological Service: Fire and Ashes: the detailed investigation of a burnt building at West Stow Anglo-Saxon Village

1700 - 1745 **Posters**

1800 - **Dinner and socialising**
Sunday 14/9

730 – 830  Breakfast

830 – 1000  AEA AGM & Closing of conference

1000 – 1145  Excursion to Moesgård (Grauballe Man and Illerup Ådal)

1200 – 1330  Lunch

1330 -  Departure
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Prehistoric Cremation technique
- archaeological evidence and experimental experience

Mogens Bo Henriksen; Odense City Museums, Denmark
E-mail: MBHE@odense.dk

If we want to understand the structure of and the material from prehistoric cremation graves, it is important to know what happens at the funeral pyre. An understanding of the cremation process can help us to get an insight into:

- funeral rituals (e.g. pars pro toto).
- formation processes, particularly if we want to compare the contents of inhumation graves and cremation graves.
- the interpretation of archaeological structures (e.g. cremation pyres vs. cremation pits)
- the interpretation of the osteological material
- forensic medicine (identification/damage to body/bones)

In the archaeological litterature we can read that:

- The cremation process produces smoke and a bad smell.
- Much wood is needed to burn a human corpse.
- It is necessary to add oil or fat to the funeral pyre.
- The process takes many hours.
- Picking up the cremated bones is a repulsive and time-consuming job.
- Afterwards the bones must be cleaned or even washed - and crushed!

Which sources and relics can help us to understand the prehistoric cremation process?

- Written sources (e.g. Homer c. 700 BC, Tacitus 98 AD, Bjowulf c. 700 AD, Ibn Fadlan 9th cent.)
- Pictures (Greek vase paintings, Roman coins)
- Ethnographic parallels (present India, Cambodia, Asia etc.)

- Archaeological relics
- Experiments
The archaeological relics from Denmark (especially Funen/Fyn) consist of:

**Structures:**
- Cremation graves (*from Fyn c. 6000 Bronze Age and Iron Age cremations*)
- Cremation pyres (*very rare*).

**Objects from structures:**
- Bones, artefacts, charred material etc.

What is important to observe in cremation graves?

- Sorting/stratification of the contents
- Traces of direct fire or not
- Post or stone constructions?
- Grave goods: Character, position inside the grave, handling
- Cremated bones: Character and quantity, handling

The contents of the cremation graves can give much information:

**Osteological material:**
- Temperature during cremation
- Placement of the body during cremation.
- Traces of quartering of the body before cremation.
- Bones of animals (*food/ornament/additiv*).
- Handling of bones after cremation (*crushing/sorting?*).
- Systematic sorting of the cremation pyre (*pars pro toto*).

**Objects**
- Artefacts, burnt or not (*pyre goods vs. grave goods*)
- Charred organic material (*fuel and pyre goods, food or additives?*)
- Intentional / non intentional “grave goods” (*fire cracked flint/stones, macro fossils etc.*)

To understand the dynamics of prehistoric cremation graves it is necessary to combine:

- Archaeological data
- Osteological data
- Ethnographic studies

- the observations can be used to prepare:
- Controlled experiments
Mogens Bo Henriksen (DK), experiments I-IV (1989-92):

- I: Pig, 65 kg. – above pyre.
- II: Pig, 52 kg. – under pyre, built over shallow pit, post construction.
- III: Pig 63 kg. - above pyre, built over pit (20 cm), post construction.
- IV: Pig 50 kg. – above pyre, built over pit (60 cm). Post construction (tripod).

Summary of “technical” results from four cremation experiments:

- Consumption of wood: C. 1 cubic metre.
- Duration of cremation: C. 5 hours.
- - if the body is above or inside the pyre.
- - if there is a post construction to support the pyre in the beginning of the cremation process.
- - if there is a pit under the pyre (to stimulate the circulation of oxygen).
- - if the fire is taken care of in the beginning of the process.

“Archaeological observations” from four cremation experiments:

- Relics of the pyre on the ground: c. 3x2 m – or less – and superficial.
- Bones: Less than 1 kg. left, size less than 7 cm – crushed by the collapsing pyre.
- It is easy to pick up the grave goods and the cremated bones if the ashes are removed by wind or

We can contradict the statements from the archaeological litterature:

- The cremation process doesn’t produce much smell and smoke.
- The cremation of an average body demands c. 1 cubic metre of wood – and no additives.
- The cremation is not a complicated or a long-drawn-out process.
- Sorting of the pyre isn’t complicated.
- It isn’t necessary to clean and crush the bones.
From experiments to archaeological data:

- Cremation pits are graves (i.e. secondary depositions) – not pyres (primary depositions) as suggested by several archaeologists.
- Triangular or four-sided post constructions from late BA and IA-cemeteries can represent remains of a pyre construction.
- The material from the prehistoric graves is primarily a result of cultural processes after the cremation (objects are destroyed, sorted and placed intentionally).

**Conclusion:**
The decisive element for the character of the prehistoric cremation graves is the sorting of the cremation pyre!

**References**


**Bibliography on cremation**
http://www.srgw.demon.co.uk/CremSoc/LegalEtc/Bibliography.html
During the last decade there has been an increase in the number of excavations of burnt longhouses from Early Iron Age Denmark containing well preserved animal remains.

The material in question is the result of accidental fires and provides a unique snapshot of daily life in the Early Iron Age. Due to huge piles of collapsed building material, the sites became sealed immediately after the catastrophic event and the number of taphonomic factors that can have altered the material up to the present day is minimal. The material is therefore readily interpreted, compared to animal bone remains found elsewhere in refuse dumps, pits etc.

Figure 1: The distribution of burnt Early Iron Age houses containing preserved animal remains

The sites in question are restricted to the Limfjord area (fig. 1) and should roughly be dated to the centuries around the birth of Christ. Due to its limited distribution in time and space, the material comprises a well defined and homogeneous unit well suited for detailed analysis of animal husbandry. Preliminary results confirm that the function of byres was not restricted to the stalling of cattle and horses and that the absence of stall partitions is not equivalent with the absence of a byre and stalling of...
animals. It is therefore necessary to rethink our methods on how to approach the overall size and shape of the animal herds kept. Furthermore, the material indicates that there could be differences in stalling practices regarding large and medium-sized animals. Some finds also show a remarkably similar distribution of species in different areas of the byre which could indicate that the stalling of animals followed a fixed pattern.

Although the material provides a solid basis for an attempt to understand the use of stables and byres in the Early Iron Age, there are however some problems which blur the picture concerning the formation processes for the finds, the time of year of the fire and whether the animals found constitute the total number of stalled animals or whether some animals were rescued in time.
Carbonized Late Neolithic and Early Bronze Age grain finds from Central Jutland and the storage of grain during the period

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During the last four years Moesgaard Museum has received several very large Late Neolithic and Early Bronze Age grain finds for analysis from Central Jutland, especially from the area around the town of Herning - until now an archaeobotanically virtually blank area for this period.

The site of Enkehøj was excavated by Herning Museum in 2004. During the excavation many soil samples were taken. These contained an estimated 16 plus litres of processed, carbonized grain dated to the Danish Late Neolithic (2400-1800 B.C.). The grain was found in six pits and the two easternmost roof-bearing postholes in two two-aisled houses. One of the houses is presumed to have had a centrally placed sunken floor, the other had not. The grain consisted of a mixture of Hordeum vulgare var. nudum and Triticum dicoccum, generally with Hordeum as the dominant species. The grain was obviously cleaned for storage, with very few weed seeds. As is normal for presumed storage finds from this period Hordeum vulgare var. nudum consisted of naked grains, whereas the Triticum dicoccum grains were found with remains of their spikelets. All pits were without traces of burning, so carbonization must have taken place elsewhere, and deposition in the pits was therefore secondary. At least three of the pits were from outside, and one pit was clearly from inside a house.

The site of Gilmosevej is situated a few kilometres southeast of Enkehøj, and was excavated by Herning Museum in 2006. During the excavation, a two-aisled longhouse of a type without a sunken floor was uncovered. Just north of this house, a large pit was found, presumably connected with the house. Recent $^{14}$C analyses date both pit and house to about 1.700 BC or very early Bronze Age. When examined, one half of the pit was found to contain an estimated 20 litres of carbonized acorns, charred in their shells, together with about 5000 grains of processed Hordeum vulgare var. nudum and about 1400 grains of Triticum spelta. While the Hordeum vulgare var. nudum was practically without any chaff fragments present, a large presence of Triticum spelta glume bases indicates that part of the spelt find consisted of waste from the processing of Triticum spelta spikelets/ears. Just like at Enkehøj, there were no traces of fire in the pit itself, so deposition was secondary. The fact that the acorns and the Triticum spelta were concentrated in the bottom layers of the pit and Hordeum vulgare var. nudum in the top layers, indicates that several portions of secondary material in the pit were deposited shortly after each other.

Carbonization may have occurred by accidental burning of a food deposit. An alternative explanation for the carbonized acorns could be that heat treatment to remove the tannins in the acorns had taken place but went wrong. The third find to be mentioned here is the site of Petersborg Vest, situated about 40 km east of the other two finds. The site was excavated by Horsens Museum in 2004.
So far only preliminary archaeobotanical investigations have taken place, so the find cannot be explained in detail here. The material appeared during the excavation of a two-aisled burnt house $^{14}$C dated to about 1.800 B.C. The house was of the type with a sunken floor in one part. Under the sunken floor, three carbonized wooden containers were uncovered. These were dug down in the sunken part of the hut. The three containers proved to contain an estimated 50 litres of carbonized grain. The grain had been processed and separated into different crops, apparently with Triticum dicoccum in one container, Triticum spelta in another and Hordeum vulgare var. nudum in the last.

There are several previous examples from the Late Neolithic and Early Bronze Age in Denmark where carbonized grain has been found in outdoor pits, apparently without any signs of containers. As in the cases presented here, it does not appear that these pits were used for storage. More definite finds of deposited grain have been located inside two-aisled longhouses of both the type with and without a sunken floor. The largest and most numerous of these grain finds, however, are from the two-aisled houses with sunken floors, where the grain typically is found spread out in the fill of the sunken parts.

Relative to the large grain finds from the Late Neolithic and Early Bronze Age, it is striking that there are so few grain finds from the preceding Single Grave culture and earlier Neolithic periods. One very plausible reason for this is, of course, that grain was less important during these periods. Another reason for the large finds towards the end of the Neolithic could perhaps be the way people stored their grain.

You can choose to store your grain inside or outside your house, for instance in pits or separate constructions. If you store your grain outside, you save a lot of space inside your house. On the other hand you have less control over your grain, and it will be more exposed, for instance, to attacks by animals, theft by others etc. By keeping the grain with you in your house you also keep a better control over it. On the other hand you will need more storage space, and if your house burns down – which happened sometimes in the period - the grain is lost. The two-aisled longhouse of the type with a partially sunken floor is known in Denmark in the period from the Single Grave culture until the Early Bronze Age. By lowering the floor you increase the standing height in that part of the house. This increases storage space in the house. An increased standing height could, for instance, be exploited to build a loft. It could also be possible to build a floor over the sunken part of the house. Several changes in house construction took place during this period. Towards the end of the Stone Age some houses became longer, and in the early Bronze Age the three-aisled long house was introduced. The three-aisled construction has often been interpreted as an indicator of the beginning of winter stalling of animals, but the three-aisled construction would also be suitable for building lofts for winter fodder and grain.

As there is a need for both seed corn and grain for eating, storage probably would have taken up quite a lot of space in prehistoric houses. Perhaps different types of grain were stored in different ways. Is it, for instance, possible that constant temperature changes and smoke concentrations under the roofs of these houses with open hearths would be harmful to viability of grain stored here. Accordingly, seed corn was generally stored closer to the ground, for example in pits? Future studies will hopefully help to show if there are specific patterns regarding grain storage in these houses.
An interdisciplinary approach to the study of a partly burned Early Neolithic burial deposit in Can Sadurní Cave (Catalonia, Spain)

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Can Sadurní Cave is located on the slope of a low hill that oversees one of the very few fertile planes in the Garraf Mountains, a calcareous formation located on the central coast of Catalonia, NE Spain. The cave is 420 metres above sea level. The inner surface of the cave is around 200 m\textsuperscript{2} but we present here the first results from a trial trench of 1x4 m. 21 different occupational levels have been identified between the Mesolithic and Late Roman times in the cave. Layer n. 18 is a burial deposit dated to between 5475 – 5305 cal. BC (Blasco \textit{et alii}, 2003), which means that it represents some of the first evidence for Neolithic groups on the Iberian Peninsula. The archaeological record is quite exceptional, as it is very rich both qualitatively and quantitatively. Interdisciplinary studies are currently ongoing, but one taphonomic process has been detected which affects part of the record: fire. In this presentation we describe the main finds from the layer and the evidence of thermo-alteration present in each type of artefact, in order to propose some possible explanations for the activity or activities that created the deposit.

200 human remains belonging to a minimum of five individuals have been found. It is not clear whether they are \textit{in situ}, as there is a possibility that all the recorded finds were moved from the entrance of the cave (a few metres higher) at some point in the past. Only some cranial fragments were burned. This cremation does not seem to have been caused by a direct exposure to fire. They could have been intentionally burned, though we are not able to determine how or why at the moment.

854 animal bones and fragments were recovered. Two different assemblages were identified: one was composed of intentionally fragmented bones, between 0.5 and 2 cm in size (80% of the whole assemblage); and another one consisted of several left extremities of sheep mostly found in anatomical connection. 30% of the fragmented bones were clearly and intensely burnt, while the rest were not burnt at all. This seems to indicate different processes were applied to the faunal remains.

More than 20% of the 120 lithic pieces found are termoaltered but it is difficult to say whether this was intentional or not. The layer was full of stones, some of which were completely burned sandstone. Some bracelets and little ornaments
made of shell were also found. They seem to be profoundly decalcified and a few of them are clearly burned.

Over 60,000 seeds have been recovered by flotation. These seeds were associated with several jars, profusely decorated with the Cardium technique, although most of them were found spread throughout the sediment. We believe the seeds were burned inside the vessels, which must have been broken at some point after their deposition as funerary apparel.

All this evidence seems to contradict the results of soil micromorphological analysis, which revealed no traces of ash. This could be due to the location of the sample taken for these analysis (at one edge of the trial trench) and the fact that some of the charcoal was found to be burned green wood; this is known to reach lower temperatures and produce less ash. We are wondering at the moment whether this could represent some kind of funerary ritual, which could have involved the burning of wood and part of the apparel.

Some of these results remind us to those obtained in Cova de l’Or, the source of some of the earliest Neolithic evidence on the Iberian Peninsula. This could indicate some kind of burial pattern that was common to the first farmers who populated the eastern coast of the peninsula.

References
Faunal pyre goods from Late Iron Age and Roman Britain

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Key Words: Zooarchaeology, Archaeozoology, Pyre Good, Cremation, Iron Age, Roman

Cremation was reintroduced into Britain in the Late Iron Age (approximately 100BC), during a period of social change, often linked to contact with the Roman Empire on the continent. The distribution of cremation as a funerary tradition spread across much of England with the Roman Conquest, and continued up to and beyond the end of the Roman presence in Britain.

The crematory funerary rite sometimes included burning animals as faunal pyre goods and depositing a portion of their remains in the cremation burial. This presentation is based on my doctoral research examining faunal pyre goods from first millennium AD Britain, but also includes the results of subsequent additional cemetery analyses. It will examine the evidence for the use of animals in Late Iron Age and Romano-British cremation traditions in Britain, highlighting differences and similarities between the periods, and suggesting evidence for regional variation in the rite. The paper aims to highlight the importance of specialist analysis of faunal pyre goods to elucidate aspects of funerary practice in the archaeological record which are not accessible by any other means.
Carbonised plant macro remains from the Iron Age and Viking Age in Denmark. Results from recent investigations

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In the 80s, the remains of a large village were excavated at Vorbasse in Central Jutland, Denmark. A single house in three phases dated to the beginning of the Germanic Iron Age (400-500 AD) was sampled for archaeobotanical analysis. In its second phase, the house burned down, resulting in a lot of carbonised material in the postholes. Recently, the analysis of these samples has been completed. Most of the plant remains were grains of barley and rye and seeds of arable weeds. The distribution of the carbonised grains and seeds revealed functional divisions of the longhouse and also indicated that the house burned down in summer. Many of the samples also contained scorified ash. The distribution of this showed how the fire developed in the house.

In Thy, north western Jutland, an area with many pit houses dated to the Viking Age and the beginning of the Medieval period (800-1100 AD) was excavated and samples for archaeobotanical analysis were systematically taken from all houses. Samples from 16 pit houses were analysed. The pit houses were filled with household refuse, showing that barley, rye, oat, wheat and peas were grown. The analyses also revealed that brewing of beer took place on a large scale as charred malt and seeds from sweet gale (*Myrica gale*) were found in most of the pit houses.

Large amounts of scorified ash indicated that peat coal made from heather peat had been used for smithing.
Mesolithic fire history in lowland Britain

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Evidence for charcoal and associated vegetation change is well attested in the first half of the Holocene in the moorlands of the British uplands. Many associate this with deliberate burning by Mesolithic communities (Simmons 1996; Zvelebil 1994). Others argue that some charcoal may derive from domestic hearths or wildfire as a result for instance of lightning strikes (Tipping 1996). There is also debate between advocates of deliberate burning, as regards its principle causes, whether to increase browse at the woodland edge particularly for red deer; or to create suitable conditions for favoured plants of the woodland edge, or to facilitate easier passage through wooded landscapes; or simply to mark territorial possession. Each of these factors is attested in the rich ethnohistorical record of hunter-gatherer burning (Mellars 1976; Boyd 1999). Our contention is that these issues can only be resolved by detailed investigation of linked archaeological and palaeoenvironmental sequences, precise dating and investigation of fire in the context of the full spectrum of environmental disturbance factors, natural as well as anthropogenic. Previously the practice has been mainly identified in the later Mesolithic with the implication that it may represent one of several pieces of evidence for evolutionary development towards more complex societies within the Mesolithic. These issues will be critically examined using recent evidence from lowland sites in Britain, a lakeside situation at Star Carr, a river valley at Thatcham on the Kennett and from many coastal, now intertidal, sites in Wales and western Britain.

The Mesolithic burning episodes which have been documented in the greatest detail are those at the early Mesolithic site of Star Carr, Yorkshire (Mellars and Dark 1998) which is among the earliest evidence of Mesolithic burning, dated by high precision wiggle-match radiocarbon dating to 8970-8790 cal BC (Dark 2000). Here episodes of burning included reeds around the Mesolithic lake burnt in early spring, thus contributing to the continuing debates about the nature and seasonality of activity at Star Carr.

Also of early date is evidence of burning from the Holocene sediment sequence in the Kennet river valley (Chisham 2004, forthcoming). This is particularly associated with the site of Thatcham where the burning episodes occur between c 9100 to c 8000 Cal BC thus contemporary with archaeological dates from excavated Mesolithic sites at Thatcham. Also in the Kennet Valley charcoal occurs at a comparable date at Woolhampton although no Mesolithic artefacts are known from this site. We have, however, excavated an early Mesolithic site at Ufton Green where there is little evidence of charcoal (Allen and Allen 1997; Bell et al 2006).

In our western British study area which centres on Wales, and includes adjoining areas of Merseyside, north Devon and Somerset, 40 sites have been identified with evidence of vegetation disturbance, mainly burning, in the Mesolithic. At 33% of these burning is directly associated with artefact horizons. Of these the most extensively investigated are sites around the edge of a former island in the
Severn Estuary at Goldcliff (Bell et al. 2007), a site particularly significant for the discovery of human and animal footprints in annually banded silts associated with the Mesolithic activity areas in use c 5800 cal BC to 4800 cal BC. Some charcoal here was associated with cooking activities and there was much evidence of heat fractured stone and calcined bones of mammals and fish. However charcoal was also associated with trees of the lower submerged forest which ended at about the time when Goldcliff became an island at high tide and occupation began c 5700 Cal BC. Two Goldcliff submerged forests are dated by wiggle-match radiocarbon dating. During a subsequent phase of reedswamp development c 5600 Cal BC when Mesolithic activity was also present there was evidence of charred reeds. Burning is thought to have been responsible for the development of hazel woodland on the island; hazel nuts were abundant and many charred examples in some Mesolithic activity areas attest to their use as a resource. The occurrence of charcoal in annually laminated sediments showed that in 4 out of 5 years burning occurred in summer (Dark and Allen 2005). After the main phase of Mesolithic activity evidence of burning continued through the initial stages of fen woodland development round the island and a number of trees in the upper submerged forest which ended about 4200 Cal BC have charcoal associated with them (Timpany 2005).

Other sites where evidence of burning is associated with Mesolithic activity (Brown 2005) include the Severn Estuary sites of Llandevenny and Oldbury and the Bristol Channel site of Westward Ho! Elsewhere there are cases with extensive evidence of charcoal but no direct association with Mesolithic lithic spreads or other artefacts. An example is the submerged forest at Redwick where there are extensive charcoal spreads and burnt oak trees but no known Mesolithic site. Charcoal horizons also occur at Woolaston where there are only a few unstratified flints of indeterminate date. In our western British study area half of the identified Mesolithic vegetation disturbance episodes occur below 10m OD.

These studies emphasise the temporal and spatial extent of charcoal occurrence in Mesolithic Britain. Some of the most detailed records occur at Star Carr and Thatcham within 500-1000 years of the start of the Holocene and before the full development of what might be described as climax forest at both sites. It is also now clear that evidence for fire is not mainly associated with the woodland edge on upland Moorland sites but is, at least in our western British study area, equally frequent at the woodland edge and in reedswamps at the coast. Some of the charcoal episodes must relate to domestic hearths and wildfire but on a number of them at Star Carr, Thatcham, Goldcliff, Westward Ho!, Llandevenny and Oldbury the association with human activity is very clear, in some cases involving more than one episode of burning and the burning of both woodland and reedswamp. In a number of the most well documented cases it is difficult to escape the conclusion that burning is a result of human agency. In the coastal situations this seems more likely to relate to the encouragement of particular plant resources of the woodland edge and reedswamp than the provision of browse for deer because the highly dynamic coastal environment of the later Mesolithic would have naturally created extensive sub-climax plant communities which attracted red deer and aurochs, as footprint-tracks in the laminated sediments show.

Although the intertidal sites are all later Mesolithic, those before c 6000 cal BC will mostly have been submerged. The early Mesolithic evidence from Star Carr and Thatcham does not support the model of burning and plant use relating to evolutionary developments within the Mesolithic, however, intuitively attractive that model may be given the loss of lowland and insularity as a result of Holocene sea
level rise and the likely population rises through the Mesolithic. A major paradox remains: the disparity between increasingly abundant evidence for fire throughout Mesolithic Britain and the comparative paucity of such evidence on the mainland of continental Europe, with which Britain was connected during the early Mesolithic prior to the inundation of Doggerland and the formation of the English Channel c 8300 Cal BC.

References


Evidence for fire is well-documented from prehistoric contexts in the Severn Estuary and surrounding landscapes. Recent focus has been on the evidence for fire and associated vegetation change during the Mesolithic, synthesised in Bell (2007), but burning is apparent also from subsequent periods in prehistory. Charcoal occurs in sedimentary profiles associated with burning of the woodland edge, reedswamp and raised bog, and in occupation contexts. Charcoal in the latter context may derive from domestic camp-fires, whilst the former could relate either to intentional manipulation of the landscape or naturally occurring fires. This paper considers what the evidence for fire from Neolithic, Bronze and Iron Age sites contributes to our understanding of the exploitation of both wetland and adjoining dry ground environments in later prehistory. Key sites mentioned in the text are shown on Figure 1. Consideration of the evidence requires a balanced approach to interpretation that places the data in an environmental and archaeological context, and considers the role of both natural and anthropogenic agencies.

Few coastal sites show evidence for continued wetland exploitation into the Neolithic. Instead, the archaeological evidence for human activity in the centuries around 4000 cal BC appear to reflect a shift in activity away from the coastal zone in the late Mesolithic to the wetland interior and dry ground during the Neolithic. At Llandevenny, located at the northern margins of the Gwent Levels, evidence for burning is apparent in occupation horizons of both late Mesolithic and early Neolithic date (Brown 2007). Here there is compelling evidence that during both the late Mesolithic and early Neolithic, humans burnt the vegetation along the woodland edge, either to create clearings or perhaps to expand and/or maintain existing clearings created through natural agencies (e.g., wind throw, lightning strikes, animal agencies). This promoted the growth of a number of herbaceous taxa already growing along the woodland edge. It is argued that this reflects a specific strategy designed to increase the productivity of locally growing, seasonally available, edible wild plants. This hypothesis is supported by the simultaneous decline in arboreal pollen and increases in the seeds of herbaceous taxa, some charred, associated with substantial peaks in both microscopic and macroscopic charcoal, and, significantly, lithic débitage. Several charcoal horizons are also apparent from a long pollen and plant macrofossil sequence located 220m from the wetland edge, located within a raised bog environment. An anthropogenic origin for these fires is uncertain in the absence of associated archaeological evidence.

Burning is also apparent on Neolithic sites within the middle Severn Estuary at Oldbury Flats and Hills Flats (Brown 2005, 2007a and b). At Oldbury Flats, charcoal is often found associated with small scatters of lithics recorded from buried soils sealed by peat, but is also present in reed peat associated with animal bones, lithics and footprints of domesticated cattle. Three kilometres to the north, at
Hills Flats, charcoal was recorded from a late Mesolithic reed peat, but may have continued into the early Neolithic at a lower intensity.

Widespread exploitation of coastal wetlands occurs from the middle Bronze Age. Several settlements have been identified and investigated on the coast and at the margins of the wetlands (e.g., Hume 1992; Allen 1995; Nayling and Caseldine 1997; Bell et al 2000; Bell and Brown 2005, 2007b). Charcoal is often found in association with occupation debris at these sites, perhaps reflecting domestic camp-fires. However, at Redwick, there are several episodes of burning in the peat sequence below the rectangular buildings, both in fenwood and raised bog (Bell, pers comm.). At Goldcliff West, charcoal horizons of early Bronze Age date (2330-2040 cal BC) are attributed to burning of wet heath (Bell et al 2000). Charcoal has also been recorded from peat sealing palaeochannels at Peterstone Great Wharf containing substantial quantities of wooden structures and artefacts.

Widespread clearance of the adjoining dry ground is reported widely from pollen profiles throughout the Severn Estuary from the early-middle Bronze Age (e.g., Beckett and Hibbert 1979; Caseldine 1984; Nayling and Caseldine 1997; Walker et al 1998; Bell et al 2000; Brown 2005; Jordan 2007). More often than not, no comment was made on the presence or absence of charcoal from these sequences, but at Llandevenny, there is an increase in charcoal from 2140-1950 cal BC, associated with clearance on the nearby dry ground.

Activity decreases within the wetlands during the early Iron Age contemporary with a period of climatic deterioration and rising sea-levels, but is followed by renewed activity from the middle Iron Age. Several settlements of Iron Age date have been investigated (Locock 2000; Bell et al 2000; Gardiner et al 2002). No charcoal was recorded from the Iron Age buildings at Goldcliff West (Bell et al 2000), but charcoal was recorded from features associated with settlements on the Avon Levels at Hallen (Gardiner et al 2002). By comparison to the Neolithic and Bronze Age, there is very little palaeoenvironmental evidence for surrounding environmental conditions.

On early Neolithic sites where charcoal is recorded, it occurs within similar environmental contexts to the late Mesolithic, perhaps suggesting some continuity in land use practices. There is evidence for continued burning of the woodland edge at some sites, associated with the exploitation of wild plant resources. At other sites of both Neolithic and Bronze Age date, burning of reed beds and raised bog is apparent. In addition, when charcoal has been quantified, pollen sequences show increasing charcoal frequencies during the Bronze Age at a time of widespread woodland clearance on the dry ground. Wetland occupation appears to have been seasonal rather than permanent in nature. Charcoal from settlements is very likely to derive from camp-fires and associated domestic activities. But where burning is apparent from contemporary sediments closely associated with these settlements, it may reflect purposive manipulation of the surrounding vegetation related to seasonal activity within the wetland, for example in improving areas of graze for cattle. Fire could also have been used to open up or maintain the openness of particular areas, for example, around settlements. There is also significant evidence that highlights the symbolic importance of ‘wet places’, particularly during the Bronze and Iron Ages. Was fire socially important in a landscape likely to have been charged with symbolism?
References


Burning down the heath – plant remains from the Bronze Age grave mound of Skelhøj in Western Denmark

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Land-use management systems in prehistoric times can be elucidated with the aid of systematic studies of plant remains from defined archaeological contexts. In this lecture I would like to present the results of studies of plant remains from building material in the Bronze Age grave mound Skelhøj in Western Jutland (Denmark).

As the Danish grave mounds are constructed using grass- or heath-sods derived from the surrounding areas, it is possible to reconstruct the shape and management of the former landscape with the aid of these “in situ vegetation samples” which are contemporary with the archaeological monument.

The bio-archaeological studies of several sods from Skelhøj clearly show that the landscape surrounding the grave mound around 1400 BC was a newly re-established heathland. An older heath had previously been burnt, probably in order to fertilize the soil for agriculture and to get rid of shrubs that become established on heathland when grazing is infrequent or has been abandoned. Before the heath sods were used as building material to construct Skelhøj, a new vegetation layer had already been re-established on top of the burnt heather.

The plant evidence for the burning activity will be discussed and a brief summary of the practice of fire management of Scandinavian heathland during the past, up until the 19th century AD, will be given.
The arrival date of the first New Zealanders has been a subject of longstanding controversy (Sutton et al. 2008). Current temporal hypotheses may be classified into three categories: short, traditional and long. The short chronology suggests that first human settlement occurred no earlier than 600 years ago, the traditional suggests it was about 1000 years ago, and the long that it happened up to 2000 years ago. Palynological investigations, which include analyses of microscopic charcoal particles have played a role in these debates (Chester 1988, 1991; Chester & Prior 2004; Wilmshurst 1997).

In Europe, palynological evidence of anthropogenic environmental change has focused on two aspects – clearance of indigenous plants and cultivation of domesticated plants (Behre 1981, 1986). In the pollen record these activities are signalled by the decline of indigenous plants (usually woodland), coincident rises in pioneer plants and microscopic charcoal, and the presence of cultigens and weeds. Only the presence of introduced cultigens is unequivocal evidence of human presence. In New Zealand, poor production and short dispersal distances of the pollen of introduced cultigens make difficult the recognition of the palynological signal of human impact (Chester 2003). Evidence of human impact has therefore depended on indirect evidence of human presence: a decline in forest species; an increase in pioneer species; and abundant charcoal.

A sudden dramatic rise in the abundance of microscopic charcoal particles in the New Zealand pollen record at about 600-800 years ago has often been considered indicative of initial arrival/settlement of New Zealand, when land was cleared by fire to make space for settlements and for cultivation of crops brought to New Zealand by Polynesians from their tropical Pacific homeland. There is a coincident and equally dramatic rise in Pteridium esculentum (Austral bracken) spores, and decline in woodland taxa (Fig. 1). After the initial increase the great abundance of microscopic charcoal particles and P. esculentum spores is sustained until European colonization in the mid 19th century, when it increases.

Pteridium esculentum is non-endemic, but is native to New Zealand. It is also native to most temperate areas in the southern hemisphere and is closely related to other bracken species throughout the world. It is a pioneer and growth is encouraged by burning. P. esculentum was not a cultivar in the Polynesian homeland (Leach 2003), but by the time of European contact it was a major cultivar of Polynesians in New Zealand; the bracken rhizome was a major source of carbohydrate (Best 1976; Salmon 1991).

Could the sudden increase of charcoal particles and P. esculentum spores, of such great magnitude, result from land clearance associated with initial settlement? Or was it the result of human activities that occurred subsequent to initial occupation? Flenley & Todd (2001) have argued that the dramatic rise in charcoal abundance and P. esculentum spores may represent the establishment of the use of the rhizome as a staple food, which allowed people to settle areas previously
uninhabitable because of lack of a suitable crop. They proposed that small and sometimes intermittent occurrences of *P. esculentum* before the rapid increases might reflect early slash and burn agriculture, that is, small temporary clearings in the forest used to grow crops for a few years and then abandoned. In this situation, the bracken is a weed in the abandoned gardens, and may disappear as forest regenerates. The production of an edible product from bracken rhizome is complex (Flenley & Todd 2001). It would have taken a considerable amount of experimentation before the technology required to produce an edible product from the *P. esculentum* rhizome was developed. Part of that technology may have been the intentional firing of larger areas to encourage its growth.

![Pollen diagram](image)

**Figure 1:** Pollen diagram.

Three well-dated tephras and two dates from AMS dating of pollen and spore concentrates were used to construct the chronology shown to the right of the stratigraphic column.

Charcoal abundance is shown in two size classes to give an indication of distance from the source fire; large particles = close to the source fire, small particles = more distant.

**References**


Carbonised insects: rare, overlooked or destroyed by sample processing?

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Carbonised insects are sometimes recorded from archaeological occupation deposits from various parts of the world. They are generally found in small numbers (e.g. Dal Monte 1956; Frison 1971; Hall et al. 2000; Hevley and Johnson 1974; Johnstone et al. 2000; Robinson 2003). Occasionally they have been recovered in much larger quantities, though such occurrences seem usually to have been restricted to groups of grain pests, and those from Europe seem all to be from Roman deposits (Buckland 1982; Osborne 1977; Yvinec 1997.), though there are records of material of various dates on a wider geographical scale (e.g. from Israel: Kislev and Melamed 2000). Assemblages of carbonised grain pests and associated scavengers are clearly of interpretative value, although exactly what their significance may be requires careful thought in each case: excavation evidence, and preferably also analysis of associated grain, is needed before we can hope to distinguish (for example) deliberate destruction of ‘weevilled’ grains from accidental fires. The significance of small numbers of carbonised individuals of other occupation site fauna is generally much less clear, although many may have been charred when fires were lit on top of the deposits containing them, and others may have originated from peat or turves.

We are very much aware that the recovery of carbonised insects is rather a matter of chance. Specimens may contain sufficient voids to be buoyant and thus be recovered by standard paraffin flotation (or even by ‘flotation’ using the various forms of bulk-sieving tank). If they do not float, they may be found in residues by archaeobotanists who examine this fraction, although they are not necessarily easy to recognise. We have also, from our earliest encounters with carbonised insects, wondered whether these extremely fragile objects are usually broken into minute fragments during sample collection and processing and are thus small enough to pass fine sieves or too fragmentary to be recognisable. While there have been investigations of the formation and recovery of charred plant remains (e.g. Van der Veen 2007; Wright 2003), there seems to have been no systematic research into carbonised insects. In view of this lack of information we have initiated a series of simple experiments. Firstly, we have developed a protocol for carbonising or charring (‘toasting’) modern specimens. These insects have then been subjected to physical assaults resembling those occurring when organic-rich deposits are compressed (e.g. by heavy plant), during trowelling, as a result of the jarring experienced as sample bags are handled, and through the mechanical attrition consequent upon disaggregation and sieving.

Experiments are not, at the time of writing, complete, but we can report that simple methods, placing insects in sand and firing them in a laboratory furnace, can be used to produce carbonisation or toasting just as is the case with cereal grains and chaff. Very delicate insects can be carbonised; this is best illustrated by cereal moths (Ephestia), which may emerge from the furnace entire, with hairs and scales still visible. Thus the survival of beetles, which are more robust, is not surprising. Carbonised insects are
certainly extremely fragile, well exemplified by the forceps damage to *Aglenus brunneus* visible in the illustration given by Kenward (1978).

Overall, loss of carbonised fossils seems inevitable without exceptionally careful extraction techniques, except where insects are located within seeds, when larvae, pupae and adults of even fragile insects may survive (e.g. in cereal grains: Kislev and Melamed 2000; beans: Caseldine 1987; and dates: Costantini and Audisio 2000), or in wood (Robinson 2003). Cereal grains are often found which show ‘holing’ which may easily be assumed to have been formed by grain weevils. However, the blistering which occurs during carbonisation under some circumstances may generate round holes, so caution is required. Further experiments include charring grains which have been completely hollowed out by grain weevils; how robust are the emptied grain sacs which they leave and is there any reason to suppose they would survive in the ground? We shall also examine ‘carbonised’ and ‘toasted’ insects to see whether biomolecules survive and whether they retain their stable isotope composition, with possible implications for determining the source of cereals and levels of exchange between settlements (King et al. submitted; King accepted).

Concerns over the formation and recovery of carbonised insects are not just academic. The grain pests seem likely to have had very substantial economic importance in some societies in the past, if records of losses under low-grade storage regimes in the 20th century are any guide (McFarlane 1989; Tyler and Boxall 1984; Payne 2002). In addition, the grain pests are strongly synanthropic in temperate countries, that is they rely on the artificial conditions created by humans, and they seem to require large grain stores and intensive trade to survive, in Britain at least. They are thus important as potential socio-economic indicators (e.g. in late 4th C Lincoln, Dobney et al. 1998).

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A house is the social arena and the man-made environment for the smallest social institution of a society: a household. In the light of this fact, it is obvious that the investigation and analysis of burnt house remains with an associated well-preserved household inventory and food stores must be one of the key sources for a study of the household in archaeological research.

Through an investigation of the distribution of ceramic material at six burnt house sites from the Early Iron Age in Denmark, an initial step has been taken in obtaining a more detailed view of how space was organised in the dwelling areas of longhouses. As the household inventory is the main source of data in this study, some theoretical considerations of factors creating variation in this material, with special focus on burnt houses, will be presented. This aspect is considered vital to the interpretation of the find material. An attempt is made to identify patterns of use through the comparative analysis of the distribution of the different vessel types in the six houses.
Fire and Ashes: the detailed investigation of a burnt building at West Stow Anglo-Saxon Village

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The Grubenhaus or Sunken-Featured Building is a distinctive building type that occurred in England and across North-west Europe from the fifth to the late seventh centuries AD. SFBs are one of the defining features of early Anglo-Saxon settlements and their interpretation has been one of the central issues in settlement studies during the last 30 years. Key evidence in their interpretation as suspended-floored buildings was the excavation of the remains of two buildings at West Stow that appeared to have burnt down, preserving the evidence of both planked floor and walls. However, this has not been unanimously accepted and opinions have been, and still are, divided between this and their traditional interpretation as rudimentary sunken hut-dwellings.

This paper concerns the detailed investigation of an experimental reconstruction of a Sunken-Featured Building destroyed by fire in 2005, as a result of suspected arson. It’s destruction represented a unique opportunity to assess the data preserved following a fire within a Grubenhaus or SFB and, in particular, this is the first reconstruction of its type, i.e. with a raised floor, to have been burnt. We know exactly how it was constructed, what the building contained and where furniture and fittings were located.

The paper will present the preliminary results of the detailed archaeological investigation of the burnt remains, which were recorded in a manner comparable to a conventional excavation using a suite of scientific techniques and methods. The evidence will be compared with the archaeological remains of this building-type and used to inform the debate about the nature of fires relating to buildings in the archaeological record, specifically relating to the (re-) construction of SFBs. Finally, using techniques of investigation generally applied in contemporary forensic fire scenes, an attempt to understand the nature and dynamics of the fire and try to identify the seat of, and possibly the cause, of the fire.
The bone material from two Iron Age graves was analysed. The first is a 10th-13th century stone grave from Maidla in Western Estonia and the second is from the 6th-10th century Rõsna-Saare I sand-barrow cemetery in South-eastern Estonia (the area of the Long Barrow culture).

Objectives
The research had two main objectives.

The first objective was to find out if there are any temporal changes or/and geographical differences in Iron Age burial customs. The cremated bones were scattered in the Western Estonian stone grave; in the South eastern sand barrow, compact conglomerations of burnt bones were distinguishable. The Western Estonian stone grave contained cremations as well non-cremated human remains - inhumation burials were also in use. The South eastern sand-barrow cemetery contained only cremated bones, thus inhumation was not practised in the Long Barrow culture. The Western Estonian material indicated temporal differences in burial customs which were reflected in the size and colour of cremated bone fragments. In earlier, 10th century, cremations the bone fragments were longer and soot-blackened bones were present rarely in comparison with the 13th century cremations. The analysis of bone fragment size and colour in Long Barrow culture cemetery is not finished, but first impressions are that the maximum bone fragment length in the bone finds is greater on the average compared with the Western stone grave.

The second objective was to determine the number of burials in graves and to estimate the age and sex of the people buried. The total number of burials in the stone grave was 74, of which 42 were cremations and 32 inhumations. The percentage of children’s burials in the stone grave was relatively high - 29.7% (22 burials) of the total number. Moreover, seven children (9.5%) were below 1 year of age and five of them (6.7%) had died before they were two months old. It is noteworthy that only two of children’s burials were cremations and no infant cremations were identified.

The total number of burials in the barrow cemetery was also 74, all of which were cremations. There were 28 children (37.8%) who died before their 15th birthday, the number of children who died before their sixth birthday was 16 (21.6%) and six of children (8.1%) died as babies.

Conclusions
The proportion of children’s burials is surprisingly representative in both graves. In the Western Estonian stone grave, inhumation was a widespread burial custom for children, only few cremations were identified. There could be three reasons: the remains of children were not cremated as a rule, the remains of children were not buried in the family grave in most cases or we are not just able to find the cremains in graves because of poor preservation.

The percentage of children’s cremations in the barrow cemetery is quite high. It may depend on the local culture and burial customs as well natural conditions -
sandy soils. In sand barrows the conditions for the preservation of cremains are much better than in stone graves, so an osteologist has relatively well-preserved material for identification. On the other hand, the high percentage of children’s cremains in the grave of the Long Barrow culture may refer to the peculiarity of local burial customs and/or socio-cultural behaviour. In the areas of this culture, children were, as a rule, buried in family cemeteries in the same way as adults, because they were full and equal members of the family. Cremation, as a burial ritual, was common in the case of an adult’s as well as a child’s death.

Further research
Henceforth, the cremated bone material from different cultural areas of Estonia and from different time periods must be investigated to evaluate temporal changes and cultural differences in the use of fire in Iron Age burial customs. It became evident that cremation itself, handling of the burnt bones afterwards and construction of the burial place have a remarkable effect on bone preservation, especially of children’s cremains. Likewise, further research into Iron Age burial customs of children is important. How were the bodies of children handled after their death? Were their bodies always cremated or did our ancestors avoid cremation of deceased children in some cases? All these questions need further investigation.

References
Divergent prehistoric fire histories on the uplands of south west England

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Microscopic charcoal records from peat sequences may be used as proxy records of localised burning of vegetation in prehistory. Within the UK it can be demonstrated that deliberate use of fire began at the onset of the Holocene: the earliest Mesolithic communities had the expertise to use fire to manipulate their local environment to enhance resource exploitation (Mellars and Day, 1988). Burning of local vegetation may have been carried out in the past to enhance productivity of the wetland plants which had value as a human resource, for both food and other subsistence based activities. This paper explores how fire was used in the development and creation of the open moorland environments that characterise the British uplands, by reviewing microscopic charcoal and pollen records from Dartmoor and Exmoor, the two largest uplands in southwest England.

The existing palaeoecological data from Dartmoor and Exmoor suggests divergent uses of fire through time. On Dartmoor the major period of use of fire was the later Mesolithic, between 5750 and 4150 cal BC, most probably to manage the exploitation of red deer and other ungulates (Caseldine and Hatton, 1993). There is little evidence at present for the widespread use of fire within the Neolithic period to control or manage grazing areas (Fyfe et al., 2008), despite abundant field archaeology to suggest continued use of the upland throughout the period. On Exmoor there is little evidence for the use of fire during the Mesolithic period, although the lowlands immediately to the south of the upland do show localised use of fire to manage river valley wetlands around 6500 cal BC (Fyfe et al. 2003a). The start of the Neolithic period, though, is marked by a clear increase in microscopic charcoal in several records (Fyfe et al., 2003b). This is interpreted as deliberate burning over parts of the moorland to create, manage and maintain the upland for grazing herds controlled by Neolithic groups.

The contrasting fire histories from Dartmoor and Exmoor, two moorlands within the same region of the UK, demonstrates significant complexity in both time and space in the development of the upland landscape of Britain. The palaeoecological records show that Mesolithic and Neolithic communities both had the skills and knowledge to manipulate their local environments using fire ecology; however, these communities chose to manage different environments in different ways. It is unclear at this stage why this should be so, but the overall character of the uplands, the legacy of the landscapes they inherited from preceding communities, and the roles that these geographic spaces placed in seasonal movements of people in prehistory, may all have been important factors.

References


Charcoal and charred plant remains from a Roman bath-house and hypocaust at Groundwell Ridge, Swindon, Wiltshire, UK

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Introduction
This poster presents the results of analyses of charred plant remains – charcoal and plant macrofossils – recovered from the flues and furnaces associated with a bath-house and hypocaust built into a rural Roman villa from the 2nd – 4th centuries AD. The plant material is interpreted primarily as the remains of fuel used in firing the furnaces responsible for heating the hypocaust under the rooms.

Charcoal, cereal remains, weed seeds and fruits and other plant remains were present in moderate to large quantities within the hypocaust system and in rake-out from the furnaces.

Charcoal
The charcoal analyses revealed the presence of ten woody taxa – all hardwoods: *Acer* (maple), *Corylus* (hazel), *Fraxinus* (ash), Pomoideae (pomaceaeous fruits), *Populus/Salix* (poplar/willow), *Prunus* spp. (cherries s.l.), *Quercus* (oak), *Sambucus* (elder), *Tilia* (lime) and *Ulmus* (elm). All samples contain a mix of at least six wood types, but *Quercus* dominates, usually making up c. 40-50 % and reaching c. 80-90 % in some samples. *Quercus* was probably dominant because a) it was abundant and b) it is a particularly good, heat-producing fuel. Other favoured fuel types appear to be *Fraxinus*, Pomoideae, *Populus/Salix*, *Prunus* spp. and *Corylus*.

Comparison with other similar sites is problematic as there are few previous analyses of the wood used to fuel Roman hypocausts. Levy (1971) did however analyse the main fill of a bath-house hypocaust in a Roman villa, finding *Fraxinus*, *Crataegus* sp. (hawthorn) and *Pyrus*-type (pear) - the latter both Pomoideae-type. An ash layer from the furnace stoke-hole at the same site contained *Quercus/Castanea*.

The samples analysed also commonly contained vitrified charcoal fragments; whilst it is not understood which processes or conditions are responsible for vitrification, it is thought that it does not relate to the re-burning of wood (i.e. charcoal) (McParland *et al.*, in prep.).

Charred plant macrofossils
A range of cereals is represented by charred chaff and/or grains. Spelt (*Triticum spelta*) is generally commonest, followed by hulled barley (*Hordeum vulgare var. vulgare*) and free-threshing bread wheat (*Triticum aestivum s.l.*). There are also remains of emmer (*Triticum dicoccum*), oat (probably *Avena sativa* – cultivated oat) and possible einkorn (*Triticum cf. monococcum*). Other crop plants present comprise pea (*Pisum sativum*) and flax/linseed (*Linum usitatissimum*). Possible wild food plants are few in number but there is a wide range of herb species represented in the samples. Some of these are clearly arable weeds which have grown in the fields alongside the cereals – others also occur as ruderals.
The other clear component in the material is that of various types of (probably calcareous) grassland – dry, damp, open and shady. Evidence for possible wetland in the vicinity is provided by *Iris pseudacorus* and various species of *Carex, Scirpus/Eleocharis* and *Juncus*.

The overall picture obtained is of a mosaic of habitats occupying the slopes around the villa complex: various types of grassland - damp, dry, shady, open - arable fields and – but also paths, roadsides and ruderal areas.

Comparison with previous analyses from Roman sites in south central England reveals a common pattern - i.e. spelt dominant with smaller quantities of emmer, bread (free-threshing) wheat, hulled barley and oat, and the presence of peas and flax. Arable weeds, ruderal plants and grassland species are also well represented.

**Hypocaust fuel**
The fuel seems to have comprised twigs and branches of hardwood species (primarily oak) together with cereal waste (chaff) and hay-like material. The latter two would ignite quickly, and rapidly produce a high temperature, whereas the former would burn somewhat slower but for longer. It seems likely that a (possibly complex) combination of the two was used to produce and control the heat *via* the hypocaust as required during the day.

**References:**
In the fire of the pyre. The relationship between burial ritual and plant remains discovered in cremation graves.

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The submission of samples for archaeobotanical analysis, collected from archaeological objects by the archaeologists themselves, was a disadvantageous and, unfortunately until recently, a quite frequently employed research procedure. In such situations information concerning the context of the discovery of macroscopic plant remains (the place where the samples were collected) reached the archaeobotanist secondhand. As a result of this situation archaeobotanists could often show little interest in the context of the find – this information was accepted without dispute – while researchers’ efforts were focused on the species identification of macroscopic plant remains as well as the ecological and economic interpretation of sources (Lityńska – Zając 1997). In recent years the problem of the relationship between the way in which anthropogenic layers were formed (the process of stratification) and the degree to which the macroscopic plant remains discovered in them are representative, has been more and more often observed in publications. This especially concerns archaeobotanical material from settlements (Lityńska – Zając, Wasylikowa 2005, p. 47-51; Lityńska – Zając 2005, p. 32-35). The requirement that the archaeobotanist takes part in excavation research has also become a significant postulate. By participating in the research process, archaeobotanists can familiarize themselves with the characteristics of the site and the employed research methods. They can also, on a current basis, plan and modify the strategy for collecting samples for the analyses carried out by them and, independently or in cooperation with archaeologists, gather information concerning their context (Lityńska – Zając, Wasylikowa 2005, p.167).

The growing awareness of the need to take into account the archaeological context in the interpretation of macroscopic plant remains from excavation research does not always lead to its correct interpretation. This is especially visible in the case of archaeobotanical sources from graves. The claim that: “materials found in graves which were not subjected to secondary disturbance had been placed in them concurrently with the burial and were all of the same age...” (Lityńska – Zając, Wasylikowa 2005, p. 50) is, in the case of cremation graves, debatable. What we are dealing with here is an interpretation from an archaeobotanical perspective of observations concerning the chronology of objects comprising the burial furniture, treated as a coherent complex.

Discoveries of places where funeral pyres were burnt are extremely rare in cremation cemeteries. This problem may be illustrated through the example of the Bogaczewo culture from the period of Roman influence associated with the Baltic Galindai tribe mentioned by Claudius Ptolemeus in the middle of the 2nd century AD (Nowakowski 2007). From among around 100 cemeteries of this culture, more or less systematically covered by excavation work, remnants of funeral pyres have been found in only seven. Equally rare are discoveries of remnants of funeral pyres in the cemeteries of the Przeworsk culture associated with the Germanic Vandals (Czarnecka 2004, p. 100).
Remnants of funeral pyres in the area of the Bogaczewo culture have been discovered in cemeteries in: Bartlikowo (Bartlickshof) (Kemke 1900, p. 109), Bogaczewo – Kula (Kullabrücke) (Okulicz 1958, p. 60-61, 70, 110-111, plan), Miętkie (Mingfen), Wólka Prusinowska (Preussenort) and Zdory (Sdorren) (Hollack E. 1908, p. 151) as well as in Turwagi (Thurwangen) (quoted after Nowakowski 2007) and Paprotki Kolonia (Goldensee) (Karczewska, Karczewski 2007, p. 203, fig.2). Apart from the cemetery in Paprotki Kolonia, the remaining cemeteries were investigated through excavation before World War II. The macroscopic plant remains found in grave-pit fills did not arouse the interest of archaeologists of the time.

From the beginning of the research in the cemetery in Paprotki Kolonia, that is from 1991, charcoal samples from the fills of grave pits have been collected for species analyses (Tomczyńska 2007). Analyses of macroscopic plant remains other than charcoal found in grave pits have also been carried out here since the year 2000.1 The abundant list of species so far identified includes the remains of both charred and uncharred plants. Among the identified charred plant remains were the grains of: wheat (*Triticum sp.*), common barley (*Hordeum vulgare*) and broomcorn millet (*Panicum miliaceum*).

The relics of funeral pyres in the cemetery in Paprotki Kolonia were located on the southern edge of the western part of the cemetery, away from the area occupied by burials. Their stratigraphy and the material discovered in them indicate that cremations were performed repeatedly in the same area of the cemetery. The ritual activities and post-depositional processes resulted in the partial mixing of the remains of pyres. This fact is of fundamental significance in the interpretation of the contents of the grave-pit fills. In respect of the burial – the remains of the deceased and the accompanying grave goods – they are undisputedly coherent complexes. There is no such certainty, however, in the case of the charcoals and other macroscopic plant remains discovered in the fills of grave pits. The contents of the remnants of funeral pyres indicate that not all remains of the deceased, goods burned with him and charcoals from the pyre were carried from the place of cremation into the grave pit. It is most likely that after removing most fragments of burnt human bones and grave goods from the pyre the grave pit was filled with charcoal gathered from the place of cremation. That way charcoals mixed with macroscopic plant remains from several cremations could have got into the fill of one pit.

Among the charred plant remains deposited in the graves were fragments of plants used in the funeral ritual as well as plants overgrowing the sites of funeral pyres. During the burial, charred and uncharred plant remains from older burials damaged during the digging and filling of a newer grave pit, uncharred plants used in the funeral ritual as well as uncharred plants (especially their seeds) overgrowing the cemetery and its vicinity at the time of the burial could have been also put into the grave pit. As a result of post-depositional processes, whose effects are often imperceptible in the stratigraphy of grave pits, macroscopic plant remains from older burials (charred and uncharred) as well as uncharred parts of plants overgrowing the area of the cemetery and its vicinity could have been moved into their fills.

From the observations above it is possible to conclude that it is difficult to recognize the macroscopic plant remains from a crematory grave as a coherent complex. Their interpretation must take into account the whole intricate complex of

1 The author of the analysis of macroscopic plant remains is Dr. Aldona Bieniek from the W. Szafer Institute of Botany, Polish Academy of Sciences in Cracow.
phenomena connected with the formation of the grave-pit fill and its modification as a result of post-depositional processes. One of the fundamental problems which must be resolved at this point is connected with disregarding uncharred macroscopic plant remains, which are treated arbitrarily as a secondary contamination of the sample, in the interpretation. Such a research procedure considerably impoverishes the already incomplete source base (Fig 1).

**Figure 1:** The origin of palaeobotanical sources discovered in the fills of grave pits and their elimination in the process of interpretation based on the feature: charred / uncharred - palaeobotanical sources not taken into consideration in the analysis of macroscopic plant remains, treated as a secondary contamination of the sample.

The deposition of macroscopic plant remains connected with older cremations in grave pits with cremation burials, as well as those moved there as a result of post-depositional processes must be taken into account in their interpretation. This is especially significant in the case of cemeteries where places of multiple cremations have been discovered.

**References**


An experimental use of slash-and-burn cultivation in Karula National Park, Estonia

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Slash-and-burn, also known as swidden cultivation, has played an important role in land use in Estonia for about 4000 years and has been practised in all Estonian regions. However, it survived the longest, up to early 20th century, in Eastern and South-Eastern Estonia (EA 22). According to historical data, two kinds of swidden cultivation have been practised in Estonia – so-called high-forest swidden agriculture and coppice-forest swidden agriculture (Manninen 1933). During this project we reconstruct the latter.

Karula National Park (Põlva-Valga-Võru region of State Nature Conservation Centre) has been chosen as the slash-and-burn experiment site because, in this region of extensive forests and the traditional settlement pattern of single farms, swidden cultivation has historically been an important land-use strategy (Tomson 2007). The experimental areas were chosen from among state-owned previous arable land covered with 15-20 year old coppice (mostly birch, alder and spruce). Three experimental sites, with an area approximately 0.04 ha, will serve as base for long-term research. Some developments relevant from the point of view of historic land-use, as well as that of environmental effects, occur on the site 10-20 years after the end of cultivation.

The project objective is to study:
- the impact of burning practices and slash-and-burn cultivation methods on soil and vegetation;
- the dynamics of crop yields during the years;
- vegetation regeneration after cultivation, which enables conclusions to be drawn about the impact of slash-and-burn cultivation on the formation of plant communities;
- how slash-and-burn cultivation and subsequent changes in vegetation appear in pollen spectra;
- atmospheric transportation capacity of microscopic charcoal particles used in palaeoecological reconstructions;
- the specific structure of soil and burning remain which will serve as comparative material for the archaeological interpretation of ancient swidden fields;
- the technology, tools and size of workforce in traditional swidden cultivation.
Activities and analyses in the experimental fields:

Field I: In one of the three planned experimental fields (Karjasoo) we have completed the preparatory phase and the first year of cultivation. In summer 2006 all the trees and bushes in the Karjasoo experimental field were cut and left to dry for one year. In August 2007 dried wooden material was burnt; the plot was ploughed and harrowed following historical techniques as closely as possible and the burnt-land variety of rye was sown. The crop was harvested in July 2008 and a second year of rye cultivation will follow.

Field II: In the second plot (Sora) all the trees and bushes have been cut and left to dry for one year.

Field III: The site of the third field (Ansi) has recently been selected and the preliminary vegetation mapping is in progress.

Archaeological inspection has been carried out at the chosen sites. Soil analyses and vegetation mapping have been completed in fields I and II prior burning to obtain background material for the forthcoming studies. The effect of burning in field I was analysed according to two sets of soil samples: the first taken immediately after burning and the second two months later. Glycerol jelly-covered glass plates were used to study atmospheric transportation of microscopic charcoal particles during burning and ploughing.

We obtained data on the pollen composition from a two-year period of trapping near fields I and II. Pollen material from traps will provide an idea of the variation in pollen spectra across the different phases of the slash-and-burn cycle. The results of pollen trapping are expected to provide an objective basis for the recognition of the historical slash and burn practice in pollen records from peat and lake sediments.

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