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Food, economy and society: Multi-faceted lessons to learn from ancient plant remains

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Abstract

Plant remains and animal bones from archaeological excavations form the basis for interpretation in ancient food studies. This paper presents the methods and theory of archaeobotany, followed by a discussion of the Danish archaeobotanical record. The often very well-preserved archaeobotanical assemblages, of which some examples are presented below, hold great potential for providing new insights on ancient agriculture and food practices.

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Ancient food studies have become an increasingly popular aspect of archaeology, with a growing number of specialist disciplines providing us with a variety of information on the subject. The amount of systematically sampled bioarchaeological material retrieved from excavations within the last 70 years enable us to move from the spectacular single finds of charred seeds or bones to a much more representative dataset of food remains reflecting both large-scale feasting events (Dietler and Hayden 2001) as well as the everyday, mundane activities of having a meal.

These studies also provide us with information on the organization of food production – the tilling of fields, processing of crops, hunting of animals, and the cooking of meals. Apart from the purely economic and nutritional aspect, food has also long been recognized as an important factor in constructing society and culture (Douglas 1972, Gosden and Hather 1999). Food reflects both social strategy and cultural practice, enabling and upholding the division of gender and social classes, and it is used as a tool in the accumulation of power and wealth. We share meals with family, friends and allies, and by sharing meals with others, we not only invite them into this inner circle of social relations but also leave them in our debt (Halstead 2004). As such, food is extremely powerful. Finally, food, as the very fabric of our existence, brings us as close to the individual human being and the most mundane activities of the past as it is possible to come when studying the archaeological record. The last meal of Iron Age Grauballe Man (Harild *et al.* 2007) or the accidentally charred, dried apples (*Malus sylvestris*) found at Late Neolithic Nørre Sandegård (Helbæk 1952), pose fascinating glimpses into ancient subsistence strategies: the actual meal still sitting in the stomach of a human being, and the wild apples, carefully halved and dried, ready for winter storage sometime during the latter half of the third millennium B.C. (Fig. 1.).

In this paper, we focus on the potential of plant remains including pollen to inform us on food practices in Denmark in the past; on their own and in connection with other archaeological finds. In the case of one particular find, discussed below, the spectacularly non-culinary context adds information on other uses of plants in the past and reminds us of the importance of the social value adhered to food products. An introduction to archaeobotany is followed by some archaeological examples in order to show the variety and potential of the Danish archaeological record

Fig. 1. Wild apples (*Malus sylvestris*) from the Neolithic site of Nørre Sandegård, Bornholm. The apples had been carefully halved and dried in order to preserve them before they were accidentally charred. This find throws light on the ancient practice of preserving food other than grain crops. Photo: Peter Steen Henriksen 2016.

with regards to subsistence practices. We conclude with an outline of an interdisciplinary research project now underway at the National Museum of Denmark to take us even further by combining a range of finds, analyses and methodological approaches.

Archaeobotany and plant economy

Plant remains (grains, seeds, pollen etc.) are potentially very useful in the reconstruction of ancient subsistence practices. Given the right conditions, charred or waterlogged plant remains provide insights into the production and management of crops, including (1) methods of field cultivation and post-harvest processing of crops; (2) the storage, distribution and consumption of plants as food and fodder, and other economic uses such as roof thatching and textiles; and (3) the distribution of crops and other economic plants over shorter or longer distances as part of larger exchange networks (Hald 2008).

Plant remains are easy to extract from excavated soil and store for analysis, making their use a cost-efficient strategy for bioarchaeological problem solving. Charred plant remains are extracted from soil samples by means of flotation, a simple process in which soil is mixed with water, leaving the charred plant remains to float to the surface and thus be separated from the soil. Waterlogged plant remains are wet sieved by hosing down soil samples through a series of sieves. The identification of plant remains is done by assessing their morphology (size, shape, surface cell pattern, etc.) with a microscope and with the help of a modern reference collection for comparative analysis.

Plant remains are very good indicators on the state of agriculture, starting with the presence of wild and domesticated taxa – i.e. defining whether agriculture was at all undertaken at a given site. Whereas cereal crops like wheat, barley and rye are relatively tolerant to agricultural strategies such as varying intensity of manuring, watering and weeding, the weeds in the crop field are often comparatively more specific in their habitat requirements. These requirements include levels of humidity and nitrogen in the soil, and levels of disturbance from, for instance, trampling, hoe-

ing or weeding. As a consequence, whereas the crops can tell us primarily which types of plant food were present at a given site, the accompanying crop weeds may be able to give us an indication of the conditions in the field, reflecting the character and intensity of crop management practices – as such, they potentially reflect the nature of agriculture at a given site. Recent developments in isotope studies have also made it possible to detect manuring and watering practices from the values of $\delta 14N$ and $\delta 13C$ isotopes, respectively, in the cereal grains (Bogaard and Outram 2013; Bogaard *et al.* 2013).

We have come a long way from simply assuming that every plant found at an archaeological site must reflect its use as a food resource. It has been recognized that plants, both crops and wild taxa, could have had multiple uses and entered the site along a variety of routes; for instance, crops may have been used for both food and fodder and it is quite obviously to our advantage to be able to distinguish between meals and manure. Hemp (*Cannabis sativa*) may have been used for both rope making and as a hallucinogenic or medicinal plant, while flax (*Linum usitatissimum*) may have been used for its edible seeds, for oil production, and for its fibres in textile production. The distinction is not always quite fixed, either. Ethnographic studies in Greece have shown how cereal crops are used for both food for humans and fodder for animals, depending on, for instance, the success of one season's harvest; what is regarded as an inferior crop used only for fodder in times of plenty may be "upgraded" to a perfectly acceptable food crop during lean years (Jones and Halstead 1995). What is necessary, therefore, before making any culinary assumptions based on the plant material in front of us, is to ascertain that this is indeed *food*. This can be undertaken by an identification of the plant composition of each sample coupled with an assessment of the associated context and finds. Wild taxa with a growing cycle different to that of wheat or barley, for instance, are unlikely to have produced seeds by the time a cereal crop was harvested; therefore, if seeds from these particular wild taxa are found within a sample of cereal grains, we must assume that those cereal grains have been mixed with other plant material along its post-harvest "lifetime" – i.e., we are not looking at a pure food sample, and should be careful with an interpretation in terms of food practices.

As with all other archaeological artefacts, plant remains are silent without a definite and thoroughly recorded finds context. Associated tools and ceramics as well as the presence of features such as grindstones, hearths or ovens may assist in the interpretation of a particular assemblage of plant remains. Given the right conditions, it will be possible to interpret the archaeobotanical assemblage with respect to practices such as the processing and consumption of crops, cooking and serving traditions, and strategies concerning the preservation and storage of food.

It should also go without saying that questions on ancient food practices are best solved when excavating archaeologists and specialists work towards a strategy of problem solving and sampling from the time of the very definition and design of the archaeological project. Defining what we are looking for not only defines the number and types of samples needed to be taken during excavation, but also limits time and funding being spent on types of analysis that may end up being irrelevant. In the words of one specialist our research "will need to be driven by archaeological questions, not analytical opportunism" (O'Connor 2014).

Making the most of the Danish archaeological record

Denmark holds a rich, varied, and often very well-preserved archaeological heritage. Archaeological finds have been collected and registered in Denmark systematically for the past 150 years, providing us with a very large collection of not only traditional archaeological finds, but also of bioarchaeological material. In some cases, such as the wealth of bog bodies and oak coffin burials, the archaeological assemblages provide collections unique in their size, state of preservation and long-term sampling strategy.

Plant remains and pollen have been sampled systematically from archaeological excavations in Den-

Fig. 2. Barley (*Hordeum vulgare*) grains from the storage cellar at Overbygård, Northern Jutland. Analysis showed how individual deposits of crops were stored in different stages of crop cleaning. The crop cleaning waste was also stored, indicating that this had some economic purpose, and the weed flora from the samples was useful in reconstructing the conditions of the crop fields at Overbygård. Photo: Peter Steen Henriksen 2015.

mark for more than 70 years. Most of these samples are housed at the National Museum in Copenhagen, with the collection of plant remains comprising more than 60.000 samples, reflecting the plant economy through prehistory to the Renaissance. Along with these, some 75.000 pollen samples, covering primarily the prehistoric periods, present us with a reflection of the surrounding landscape and its use. The archaeobotanical assemblages derive from a mixture of long-term research projects and shorter-term rescue archaeology. Accompanying these major datasets from both collections are the extensively detailed archives containing excavation data, early reports and related correspondence with staff at the National Museum – an invaluable mine of information regarding contexts and general background knowledge of the samples.

Stories from a burnt-down granary

Concentrations of charred or waterlogged plant remains are found in excavations across the country. The apples from Neolithic Nørre Sandegård are a particularly fine example of preserved food remains, but the Danish archaeobotanical material spans everything from a few grains in a posthole to very large concentrations of grains in definite storage contexts. One such example is the find of 100+ litres of grains in various stages of crop processing from a burned-down storage room at Early Iron Age Overbygård in Northern Jutland (Henriksen and Robinson 1996). At Overbygård, analysis of the charred plant remains showed that barley (*Hordeum vulgare*) and bread/club wheat (*Triticum aestivum*/var. *compactum*) were the most common crops, with smaller concentrations of oat (*Avena sativa*) and flax (*Linum usitatissimum*), which may have been present as crop weeds. The arable weed flora accompanying the crops showed that they were most likely spring sown and derived from fields with variable soil conditions in terms of moisture and nutrient levels. It was noted by the archaeologists dig-

ging the assemblage that the charred plant remains had been stored in clearly definable individual deposits, and samples were taken from each of these deposits. This enabled the archaeobotanists to identify crop samples in several different stages of processing and cleaning. This particular assemblage of plant remains, therefore, has provided us with detailed information not only on the crops grown around Overbygård, but also the means of storing and processing the crops, as well as the growing conditions of these crops (Fig. 2).

The last meals of our ancestors – the Iron Age bog bodies and the Bronze Age Egtved Girl

In many cases, the archaeological record provides us with insights into the subsistence practices of the past. The bog bodies provide us with a close-up view of last meals, from the preserved stomach contents of some of them, including Tollund Man (Helbæk 1950), Huldremose Woman (Holden 1997), and Grauballe Man (Harild *et al.* 2007). Studies of the stomach contents of Grauballe Man, for example, have shown that his last meal consisted primarily of seeds from a large range of wild taxa as well as cereal glume bases with a minor component of cereal grains – a relative composition of plant remains usually seen in by-products of cereal crop cleaning, and, in fact, almost identical to some of the deposits of crop processing waste analysed from Overbygård, mentioned above. It appears, therefore, that Grauballe Man was served a gruel or porridge made primarily from waste from crop cleaning. Included in this meal there may have been a small proportion of meat, judging from the tiny bone remains found in the stomach.

Overall, the content and composition of the meals reconstructed from Tollund Man and Huldremose Woman is similar to that of Grauballe Man. There are a number of caveats and questions to keep in mind regarding the bog bodies, including how to interpret these meals (typical everyday meals, floor sweepings as a final insult to the condemned, or the only type of food left during a time of famine?). Nevertheless, the stomach contents of the bog bodies give us a unique glimpse of what was eaten by a specific person on the last day of his or her life. The meals, although relatively nutritious, do not strike us today as very tasty, and the high proportion of weed seeds thrown in with the cereal grains in the meal does suggest that we are looking at a poor man's diet, or perhaps even famine food. From what we have seen at Overbygård, above, crop processing methods were advanced enough to provide a fully clean crop ready for consumption. What we have also learned from Overbygård, however, is that crop cleaning waste clearly had some economic value, as it was stored along with the cleaned crop. Perhaps what we see, in the stomachs of the bog bodies, is this crop cleaning waste coming to use to bulk up an otherwise meagre cereal gruel at a time of scarcity. And this, in turn, may aid in the interpretation of the practice of human sacrifice: If we consider the high proportion of weed seeds as an indicator of scarcity or even famine (also bear in mind the Greek ethnographic example, above), it is tempting to view the bog bodies as sacrifices made during times of scarcity in the hope of improving the next harvest. The archaeobotanical analysis can, in this way, throw some new perspective on the bog bodies, and, not least, why these people were sacrificed in the past.

The Bronze Age coffin burials are also informative with respect to ancient food practices. Probably the most famous of the burials, the Egtved oak coffin, dated to 1370 B.C., contained the remains of a young girl, 16–18 years of age along with some of her possessions. A flower of yarrow (*Achillea* sp.) found in the coffin with her shows that her funeral must have taken place in July or August. While her skeleton has dissolved, organic remains such as her hair, teeth and nails are still intact, along with her well-preserved woollen top and skirt. The burned bones of an infant were found in the coffin with her. A birch (*Betula*) bark box by her head contained tools, more burned bones, a tuft of wool and a hair net made of ox- or horse tail hair (Nielsen 2013: 97-99). From a food perspective, the most interesting find was a bucket made of birch bark, found at the girl's feet, containing a fermented drink made by using ingredients such as malted wheat, bog myrtle/sweet gale (*Myrica gale*), cow- or

Fig. 3. Birch bark bucket found in the oak coffin of the Egtved Girl. Analysis of the bucket showed that it had once contained a fermented drink made from malted wheat, sweet gale, cow- or cranberries, and honey. These ingredients were used to craft the "prehistoric" beer next to the bucket, now for sale in the shops. Photo: Morten Fischer Mortensen 2015.

cranberries (*Vaccinium oxycoccus*), and honey. The analysis of the contents of the bucket, represented by pollen grain deposited in the bottom of the container, has subsequently led to the commercial production of a light "prehistoric" beer, crafted by Peter Steen Henriksen in cooperation with a Danish brewery (Fig. 3).

The Nørre Sandegård Vest onion – lucky charm, identity marker or moth ball?

Finally, a find from the National Museum collections, made recently when revisiting the archival material on the Nørre Sandegård excavations, and with anything but a culinary context, was that of a clove of wild onion (*Allium scorodoprasum/oleraceum/vineale*) deposited in a woman's grave (Hald *et al.* 2015). The woman, buried at Nørre Sandegård Vest and dating to the Iron Age (ca. 700 A.D.), wore several brooches on her chest, from one of which a small copper-alloy box was suspended (Jørgensen and Jørgensen 1997). The box, made of thin sheet-metal and decorated on the outside with zoomorphic figures, contained a rolled-up ball of woollen string and a single clove of wild onion (Fig. 4). This is the earliest appearance of onion in the Danish archaeological record, and possibly the earliest archaeobotanical find of onion in Europe; onions have little chance of survival in the earth due to their high moisture content and very thin outer skins, and, if burned, will quickly burn to ashes. Consequently, they are usually only found preserved by desiccation in arid climates such as that in Egypt (van der Veen *et al.* 2009). In the case of the Nørre Sandegård Vest onion, preservation was aided by its placement in a copper alloy container, which has prevented it from decaying.

The presence of a single onion clove in a woman's

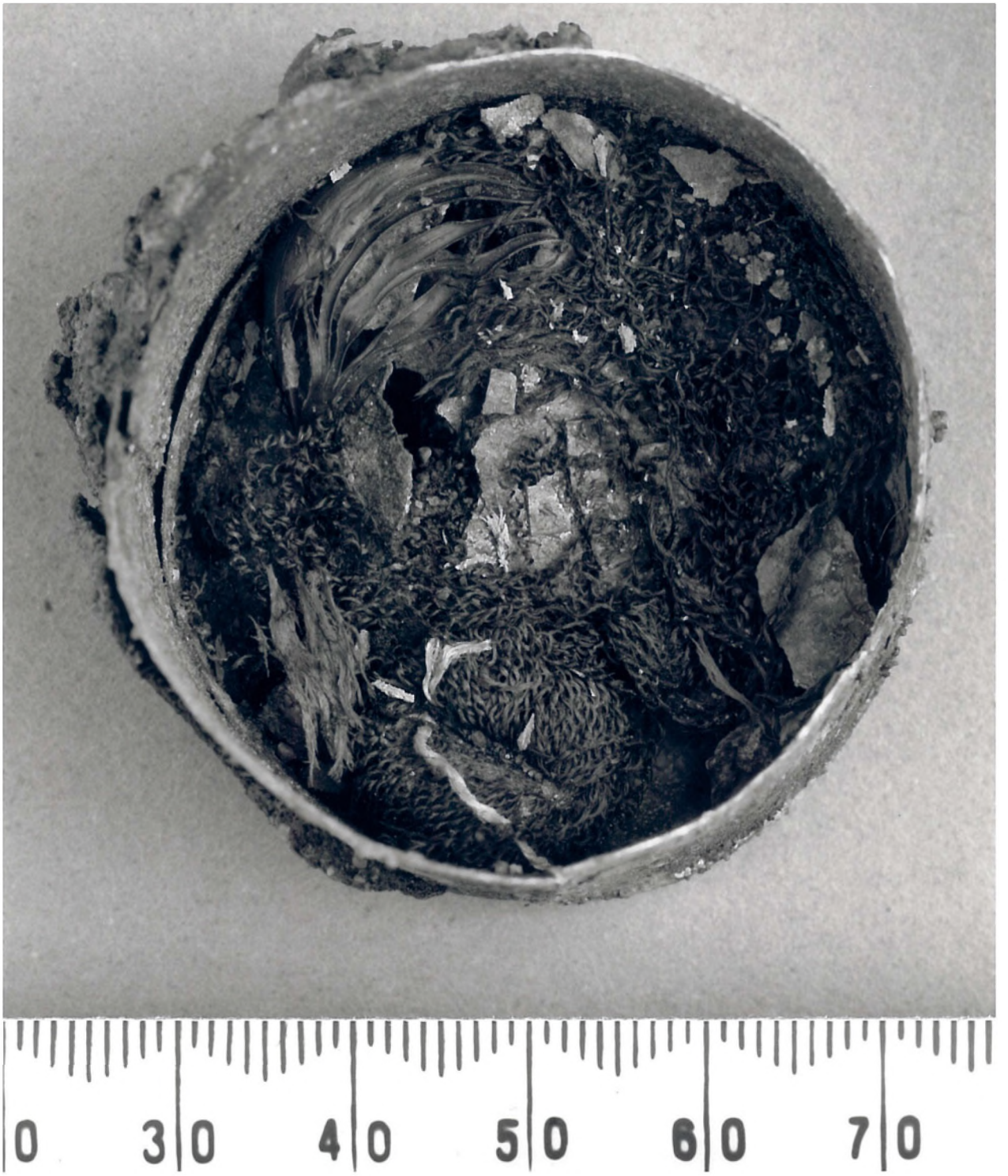

Fig. 4. The Nørre Sandegård onion, as it was found in the copper alloy box along with the ball of yarn. Food in a non-culinary context such as this indicates the social value often adhered to food products. Photo courtesy of Lars Jørgensen, from Jørgensen and Jørgensen 1997.

grave, worn as part of her jewellery set, strongly suggests that here we are not looking at food. The unusual finds conditions suggest that high value was attributed to onions, whether symbolic, medicinal or practical. The strong taste of onion, enhancing the flavour of a meal, is coupled with its equally strong smell, which may have given the onion a reputation as a powerful object. Onion is mentioned in several of the Norse sagas, probably most famously in the saga of Regnar Lodbrog, described below. It was also known for its abilities to neutralise poisoned mead (Alm and Furnes 1998). As a medical tool, onion is said to have been used to detect lesions in the stomach and bowel regions from its smell; a wounded warrior would be given an onion-based gruel to eat, and if his wounds smelled of onion, it would indicate that the stomach or bowels had been penetrated (*ibid.*).

There are numerous possible interpretations of this unusal find from Nørre Sandegård. The box itself has been interpreted as a sewing box (Mannering 1997) due to the presence of the ball of wool, but it is more likely to have served as an amulet or a marker of identity, either personal and/or with respect to profession. The combination of wool and onion can be interpreted as a symbol of the dyeing of textiles with plants, onion skins providing the wool with a rich golden colour. The wool is indeed of a particularly fine white colour, a result from selective breeding in sheep since the Bronze Age, as white wool is particularly well suited for plant dyeing. Another suggestion is that onions may have functioned as a moth repellant, which again ties in well with the presence of the ball of yarn, symbolizing not only the mundane chores of keeping your woolen garments moth-free, but also, perhaps, hints at thoughts of longevity or eternity in the company of the dead.

One association with the sagas is the aforementioned saga of Regnar Lodbrog, who set his future wife Kraka the challenge of arriving at his ship neither full nor hungry, neither naked nor dressed and neither alone nor in the company of people. Kraka solved the riddle by biting an onion, dressing in a fishing net and taking her dog along for company. It is tempting to see an association with the Kraka figure in this box from its content of the onion itself, the ball of yarn representing the fishing net and the zoomorphic figures on the outside of the box representing the dog. Kraka, a strong-willed and resourceful woman, could well have been a popular character to relate to.

Another saga association is that of the Völsa þáttr, featuring a dried horse's penis, named Völsa, used for ritual ceremonies and kept in a linen cloth with onions and herbs to keep it from rotting (Larsen 1943-6). The story has been rejected by some scholars as a real Norse saga describing ancient rituals; some argue that this story should be regarded as later Christian propaganda, highlighting the debauchery of the Norse savages subsequently saved and christened by Olaf the Holy, king of Norway, who plays a major role in the Völsa þáttr. The association with Völsa is very likely to have had a connection to fertility and the Nørre Sandegård Vest box, with its clove of onion and ball of yarn possibly representing the linen cloth, may thus have served as a lucky charm. If this is indeed the case, it would add authenticity to the Völsa þáttr, which may be describing a ritual that in fact did take place in the past.

Putting it all together

As part of the research strategy *People, Food and Society* currently underway at the National Museum of Denmark (Jørgensen *et al.* this issue), a major synthesis of the archaeobotanical data, on its own, and coupled with a range of other bioarchaeological and "traditional" archaeological finds, will be attempted in the coming years.

Integrating different strands of bioarchaeological data is, surprisingly, still novel. Research on, for instance, archaeobotanical and zooarchaeological data is often presented in separate appendices following the "main" site report, which is not always cross-referenced with the bioarchaeological information. Inevitably, this makes it very hard to come to a fuller understanding of the palaeoeconomic strategies undertaken at the particular site, or for that matter, an entire region.

The application of large-scale data sets to archaeo-

logical problem solving has been shown to have a number of advantages. The integration of smaller (often single-period and site-based) datasets into a larger supra-regional dataset has made it possible to detect large-scale patterns and trends otherwise unnoticed (Conolly *et al.* 2011, Coward *et al.* 2008). Comparison of site-based assemblages on a larger scale will also detect outliers and anomalies that may not otherwise have been noticed, leading to a re-examination of these particular datasets (Conolly *et al.* 2011). Compiling such a supra-regional database of plant bioarchaeological data is one of the methodological aims of *People, Food and Society*, with the purpose of creating a representative overview of current archaeobotanical knowledge through prehistory and onwards. Earlier syntheses of isolated Danish datasets (e.g. Henriksen 1992, Robinson *et al.* 2009) have shown that there is great potential for pattern searching not otherwise possible with single datasets.

Our aims are to establish when and where our common food crops appear in the archaeological record, and to investigate the nature of the economic strategies applied in the growing, harvesting, processing and preserving of food prior to consumption, and the meals subsequently constructed from these crops. Coupled with archaeozoological data we shall be able to get a good perspective on the Danish "food-scape" through time, challenging, among other things, traditional ideas on the relatively late arrival of "exotic" food and spices, and the ancestry of traditional Danish cuisine. New Nordic food has been around for a long time and we believe that the results of our research will be able to throw new perspective on the current national debate on nutrition and traditional Danish food.

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