7. Discussion and interpretation

7.1. Discussing culinary sub-themes.

The primary part of this chapter (section 7.1) amalgamates the results from each of the sites studied in order to discuss the three sub-questions (7.1.1. to 7.1.3) that contribute to an understanding of the relative importance of traditions of food values through time and across the study region. Included in these collections of primary data, are a small number of previously published lipid residue and single compound isotope analyses from Ringkloster (EBK, N=8), Roskilde Fjord (TRB, N=1), Store Åmose (TRB, N=5), Norsminde (TRB, N=2), Bjørnsholm (TRB, N=9) to extend the context for discussion. These discussions are aimed at exploring the significance of the results within the framework of existing debates about what changed at the transition to agriculture, how it changed, and how fast.

The second part of this chapter (section 7.2) seeks to tackle the overall research question: how is cuisine implicated in the transition to agriculture in southern Scandinavia? Part of the aim in this section is to use the results to stimulate more diverse debates about what food values, or cuisine motivated the shift to domesticated foods. The discussion is intended as a collection of 'social models', for further evaluation and verification, the outline for which will be detailed in the conclusion. This discussion works from the premise that food as cuisine is a complex of potent and diverse values that extend from both the ritual to the mundane spheres. Food is not of singular value, thus it inherently operates socially as embedded in multiple processes of change. This brings discussion to the second aim of this interpretive questioning; as well as stimulating consideration of other reasons *why* domesticated foods came to positively penetrate the evaluation processes of hunter-gatherer-fishers, the intention is to represent the *multiplicity* of the processes and ways these farmed and gardened cuisines came to be valued. Since food is a complex of values operating to fulfil social concerns in the past not all of these values necessarily motivate the outcome of domestication and the agricultural cuisine in a directly linear way.

7.1.1. Are there regional cuisines, and do they change through time?

There are marked differences in regional cuisines between inland and coastal sites, related to the procurement of local fresh foods. The bulk isotope values in figure 7.1 are a collation of the carbon-13 and nitrogen-15 isotope contributions of all of the foodcrusts studied. Inland sites including Åkonge, Stenø and the bog pot sites show a trend for more depleted $\delta^{13}C$ values with the exception of one outlier which is relatively enriched in carbon-13 at c.-24‰, in more marine ranges. By contrast coastal locations including Neustadt, Wangels and Tybrind Vig plot in the relatively enriched region of the $\delta^{13}C$ range across the centuries from c.4500-3800 BC. However, a slightly larger proportion of 14% of these coastally derived vessels fall across the more isotopically depleted carbon -13 range occupied primarily by inland samples, suggesting a greater contribution of woodland/inland resources to the overall bulk isotope signature. Despite this overlap, inland and coastal sites differ significantly in the $\delta^{13}C$ values for the foodcrusts studied ($p=1.44^{-16}$ (<0.05), $t=1.99$, (inland) $N=42$, (coastal) $N=64$). By implication these preliminary identifications of vessel contents show a reliance on foods local to the respective sites, although not exclusively.

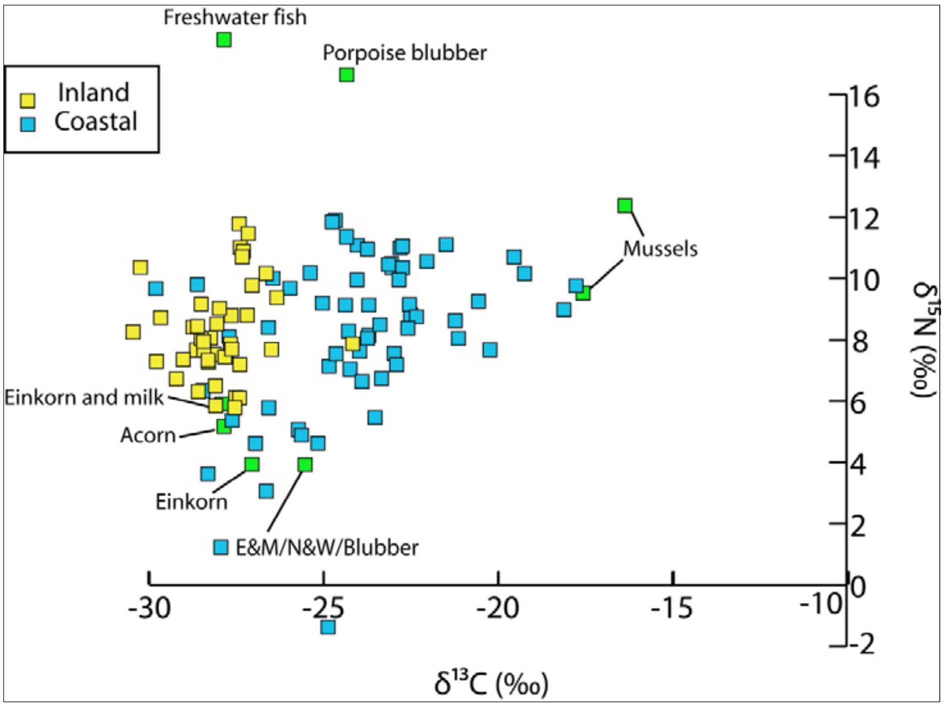

Figure 7.1. A plot of the collated bulk carbon and nitrogen isotope values for all the sites, indicating samples from inland and coastal locations.

A more targeted isotopic characterisation of the medium chain length C_{16} and C_{18} *n*-alkanoic acids from coastal and inland absorbed residues reveals more subtle differences in regional cuisines (figure 7.2 a & b). There is an almost exclusive importance of locally procurable resources associated with the respective regions; only two examples clearly deviate from this trend. One Ertebølle sherd from the inland site of Ringkloster yielded a marine signature from the relatively depleted region of the marine animal range (figure 7.2 a), although testing negative for aquatic biomarkers. Inversely, one Ertebølle sherd from coastal Neustadt is an outlier to ruminant adipose ranges, and possesses the most depleted $\delta^{13}C_{16:0}$ value of any of the coastal sites studied, plotting it in the terrestrial freshwater fish region of the graph (figure 7.2 a). This is further supported by a suite of aquatic biomarkers including C_{18} and C_{20} ω-(o-alkylphenyl)alkanoic acids, phytanic acid and TMTDs. Thus, at least in the case of aquatic foods only minor transportation of culinary contributors occurred between coastal and inland regions; 1% of the total coastal assemblage, and 2% of the total inland ceramic dataset. Interestingly, no clear examples of TRB inter-regional food transportation are documented by the data although there is overlap in the available foods between inland and coastal locations that are not discernable from these data, with woodland hunting grounds backing on to the coastlines, for example.

Instead, a region specific use of aquatic foods is in evidence. At coastal sites there is extensive evidence of marine animal consumption in both EBK and TRB-style vessels based on carbon-13 enrichment on $C_{16:0}$ and $C_{18:0}$ fatty acids for c.24% of the overall coastal assemblage (figure 7.2 a). Around 3 of these samples plot closely to a theoretically unadulterated marine mammal signature, whilst the remaining samples are relatively depleted in carbon-13 suggesting either a mixture with more terrestrial foods or a greater contribution of C_{16} and C_{18} from isotopically depleted marine sources such as fish. In contrast, a cursory appraisal of inland *n*-alkanoic isotope values would suggest a potential lack of aquatic foods. However, supporting evidence from lipid molecule characterisations indicates that c.43% (N=15/30) of the inland assemblage exhibit at least one aquatic biomarker. The disproportionate graphical representation in favour of ruminant-based foods may in part result from the relative prevalence of the C_{18} fatty acid in ruminant animals to weight isotope values towards their ranges. A freshwater origin for these aquatic foods is supported by the maintenance of depleted terrestrial/freshwater carbon-13 signatures from bulk isotope values (figure 7.1). Thus aquatic foods strike a distinctive regional character to cuisine between inland and coastal locations.

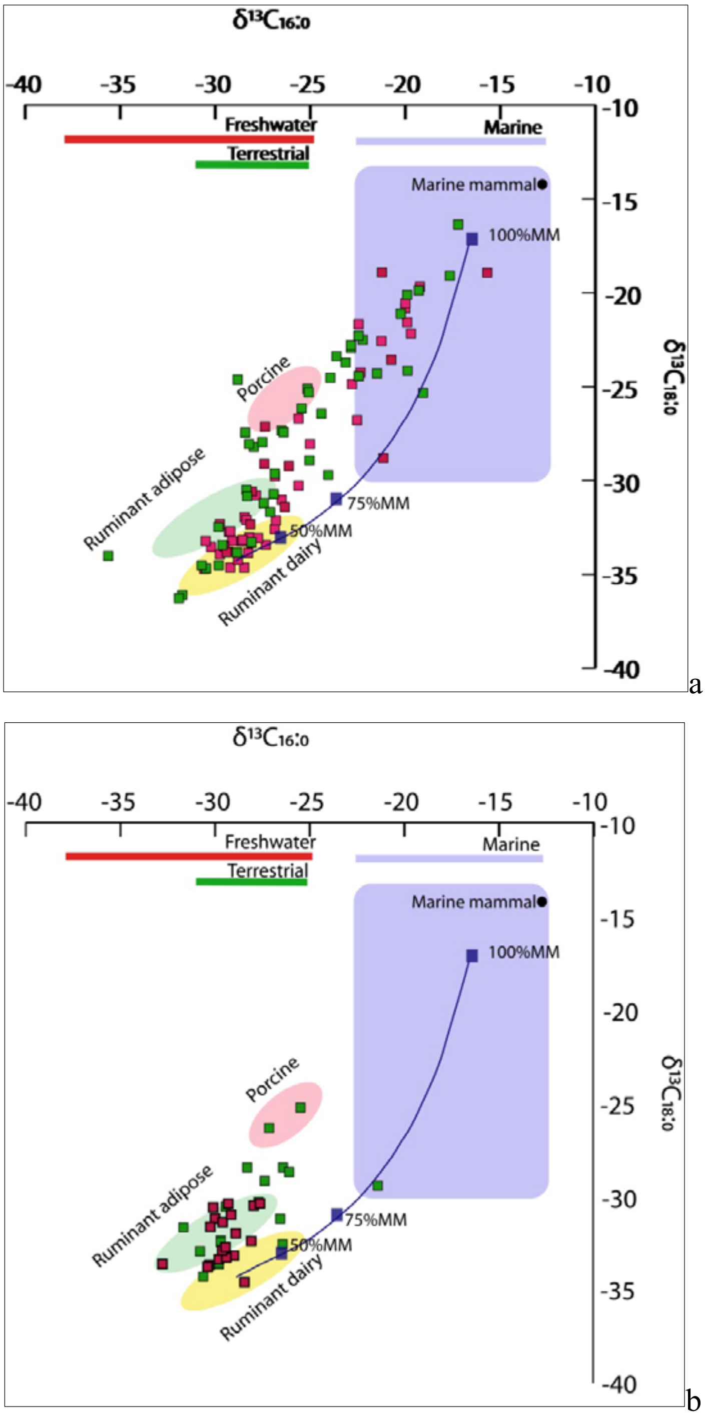

Figure 7.2. Single compound isotope values for a) coastal, and b) inland sites. Including values for Roskilde Fjord, Bjørnsholm, Norsminde, Store Åmose and Ringkloster. Red datum points indicate TRB samples, green datum points indicate EBK samples. The line indicates a theoretical mixing curve calculated by weight, so a 75% marine mammal to 25% dairy mixture will be weighted outside the modern range for marine foods, for example.

Although EBK vessels from both coastal and inland regions display *n*-alkanoic carbon-13 isotope characterisations across a wide range of food classes (figure 7.2 a & b), TRB vessels from *inland* locations exhibit greater restriction in the variety of food classes represented. During the early Neolithic, inland sites demonstrate an importance placed on ruminant foods. The same cannot be stated of coastal funnel beakers where porcine contributions to cuisine remain in evidence, and samples that are outliers to modern authentic reference ranges testify strongly to more complex mixtures of foods (figure 7.2 a). Inland funnel beaker sites seem to suggest restriction and intensification in the use of ruminant related cuisine.

Interestingly the ratio of ruminant adipose to dairy dominated vessels differs between inland and coastal regions, especially in funnel beaker-style pots. Inland, there is a 12:7 ratio of ruminant adipose to ruminant dairy during the early Neolithic (figure 7.2 b). In coastal regions the ratio is inversed at 4:9 (N=8:18). So, whilst both foods are present, the results suggest that dairy foods perhaps substitute for ruminant flesh at coastal locations to a certain extent, whereas inland the opposite is true. The reasons for this are unclear, but it is possible that (semi)-nomadic pastoral scheduling brought cattle to coastal locations during the spring when migrations of fish such as salmon (*Salmo salar*) and eel (*Anguilla anguilla*) were occurring. Spring is also the birthing season of primitive cattle, inducing lactation of the cows and resulting in the higher occurrence of milk at the coast. By implication, hunting, gathering and pastoralism were not exclusive strategies for subsistence, with farming outstripping the viability or value of hunting and gathering.

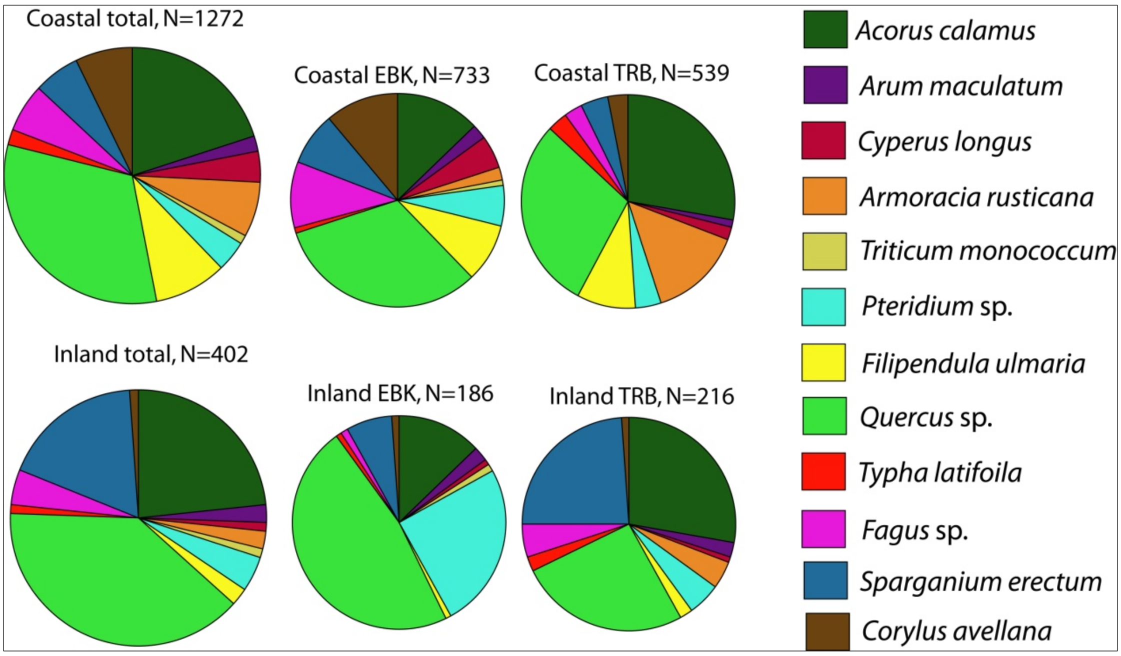

Figure 7.3. A series of pie charts collating the results of automated starch classification for inland and coastal sites, incorporating a breakdown of these regional plant traditions into EBK and TRB periods.

Collating the results of automated starch classification reduces any issues of small starch counts and allows the positing of some more generalised comments on regional plant foods (figure 7.3). Overall the programme generated four main classifications that were consistently reproduced in proportions of c.25% or more, in both inland and coastal contexts through time. Bracken fiddleheads (*Pteridium* sp.), acorn (*Quercus* sp.), bur-reed (*Sparganium erectum*), and sweet flag (*Acorus calamus*) make up the most consistently classified starch forms. At coastal locations hazelnut (*Corylus avellana*) type starch occurs in higher proportions than inland, supporting the notion proposed by pollen profiles (Regnell and Sjögren, 2006) that the margins of dense woodland canopy which are found at the coast were utilised for the management of hazel stands. In tentative contrast, there are higher proportions of bracken (*Pteridium* sp.) type starch forms inland, a plant associated with the under-canopy of the woodland core. Overall however, where animal foods mark some regional distinctions in cuisine, plant foods seem to lend a culinary continuity to it. Acorn (*Quercus* sp.) type starch is persistently classified in all regions and periods (figure 7.3). Plant food management does not seem to have been as regionally conditioned as animal foods, in essence for the simple fact that extensive woodland cross-cuts these regions. A change from high *Pteridium* sp., to high *Sparganium erectum* between inland EBK and TRB vessels is likely an exaggerated change brought about by the ritually deposited bog pots during the TRB, which represent a specific- perhaps atypical- role in cuisine.

7.1.2. What is the relative importance of wild versus domesticated foods in the context of pottery?

Wild foods continue to play a major role in cuisine with the advent of the earliest domesticated food evidence in pottery. In particular the evidence from pottery supports a continuation in the use of aquatic foods like fish as pottery styles change and other domesticates are introduced. The bulk carbon and nitrogen isotope analysis of surface deposits (N=91) from EBK and TRB techno-stylistic ceramics show that both Ertebølle and Funnel Beaker samples are distributed across the same carbon-13 and nitrogen-15 ranges (figure 7.4). As an indicator of how much marine foods have contributed towards the bulk isotope signature, the $\delta^{13}C$ values between EBK and TRB groups do not change substantially (t-test, p=0.44 (>0.05), t=2.00, (EBK) N=58, (TRB) N=33). Therefore these preliminary indications suggest that there was not a *dramatic* shift away from the sea during the early Neolithic as has been suggested on the basis of bone isotope measurements (Richards *et al*. 2003a; Richards *et al*. 2003b; Tauber, 1981).

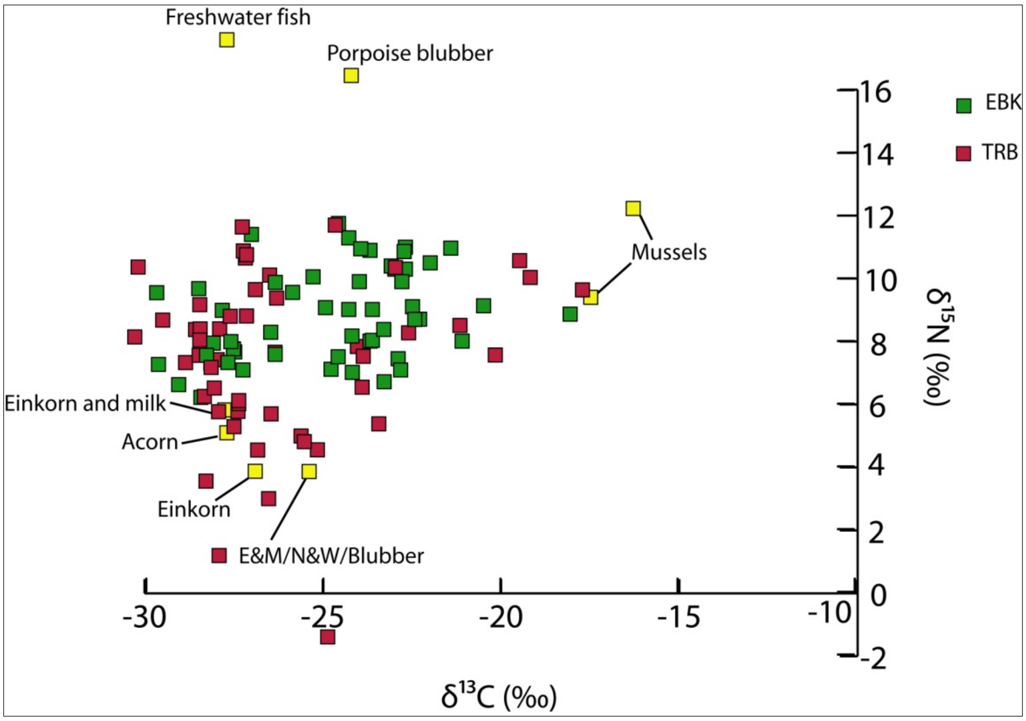

Figure 7.4. Bulk carbon and nitrogen isotope values for all the sites studied showing distributions of EBK and TRB samples. Modern reference foods are included.

Further, c.23% of all the single compound isotope signatures originating from Ertebølle-style vessels fall in the modern ranges for marine animals, but this decreases by only 4% to 19% in the Funnel Beaker period (figure 7.5). Although the majority of these samples register relatively more depleted $\delta^{13}C$ values on the $C_{18:0}$ fatty acid, indicative of marine foods with a higher $C_{18:0}$ content such as fish, a minority from both EBK (N=2) and TRB sherds (N=1) plot closely to a 100% marine mammal value. By implication, it was not only marine fishing that continued in the early Neolithic period, but also large marine mammal hunting may also have sustained a similar importance despite the addition of new domesticates to cuisine.

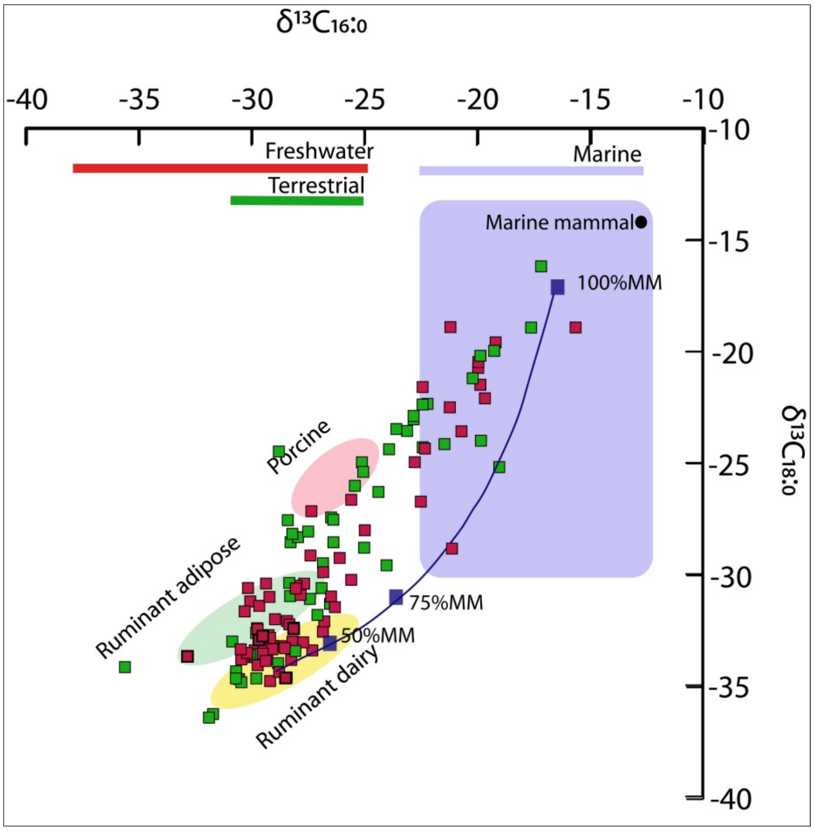

Figure 7.5. The single compound isotope values for all the sites collated. Extra samples from Roskilde Fjord, Bjørnsholm, Ringkloster, Store Åmose and Norsminde are included. Red datum points indicate TRB samples, green datum points indicate EBK samples. The line indicates a theoretical mixing curve calculated by weight, so a 75% marine mammal to 25% dairy mixture will be weighted outside the modern range for marine foods, for example.

Direct evidence supporting the continued use of wild aquatic foods during the early Neolithic comes from the presence of a range of absorbed lipid biomarkers indicating the heating of aquatic foods in the vessels. Around 30% (7/24) of the those samples that register a marine signature also presented biomarkers including isoprenoid fatty acids and long chain (C18, C20) ω-(o-alkylphenyl)alkanoic acids, and of these 57% (N=4) are from TRB vessels. To include those vessels that plot single compound isotope values beyond the ranges of marine foods, c. 40% of all the absorbed lipids analysed from sherds (N=66/169) revealed a range of phytanic acid, TMTDs and long chain ω-(o-alkylphenyl)alkanoic acids. Of these, around 60% come from funnel beaker style vessels. The relative importance of wild aquatic foods certainly does not seem to diminish with the advent of foods of domestic animal origin. These findings resonate with the archaeological evidence; fish weirs along the Danish coast actually increase in size and robusticity in some cases during the early Neolithic, as well as the persistent use of shell middens across the transition (Andersen, 2008; Fischer, 2007; Milner *et al.* 2006).

Plant foods entrench this notion that wild foods persisted in importance into the early Neolithic Funnel Beaker period. At none of the sites is there substantial plant microfossil evidence for domesticated cereals in pottery through to c.3700 BC (figure 7.6), in terms of either bimodal starch or dendritic silica long cells. If this absence does not represent a truly late introduction of cereals in pottery cuisine, the lack of findings may either be the result of preservation biases relating to cereal starches, or that cereals were part of a more extended a-ceramic cuisine. In the former case more research is required to more precisely describe the cuisine-related conditions under which cereal starches do and do not preserve. The degree of heating, mixture with other food types, the percentage of resistant starch not to mention other processes such as fermentation, may all allow for different degrees of preservation of starch. From the experimental cooking already performed the characteristic 'bagel-shape' and extremely blackened, dehydrated cereal starches are more susceptible to enzyme attack in the burial environment which may explain their reduced representation in pottery residues.

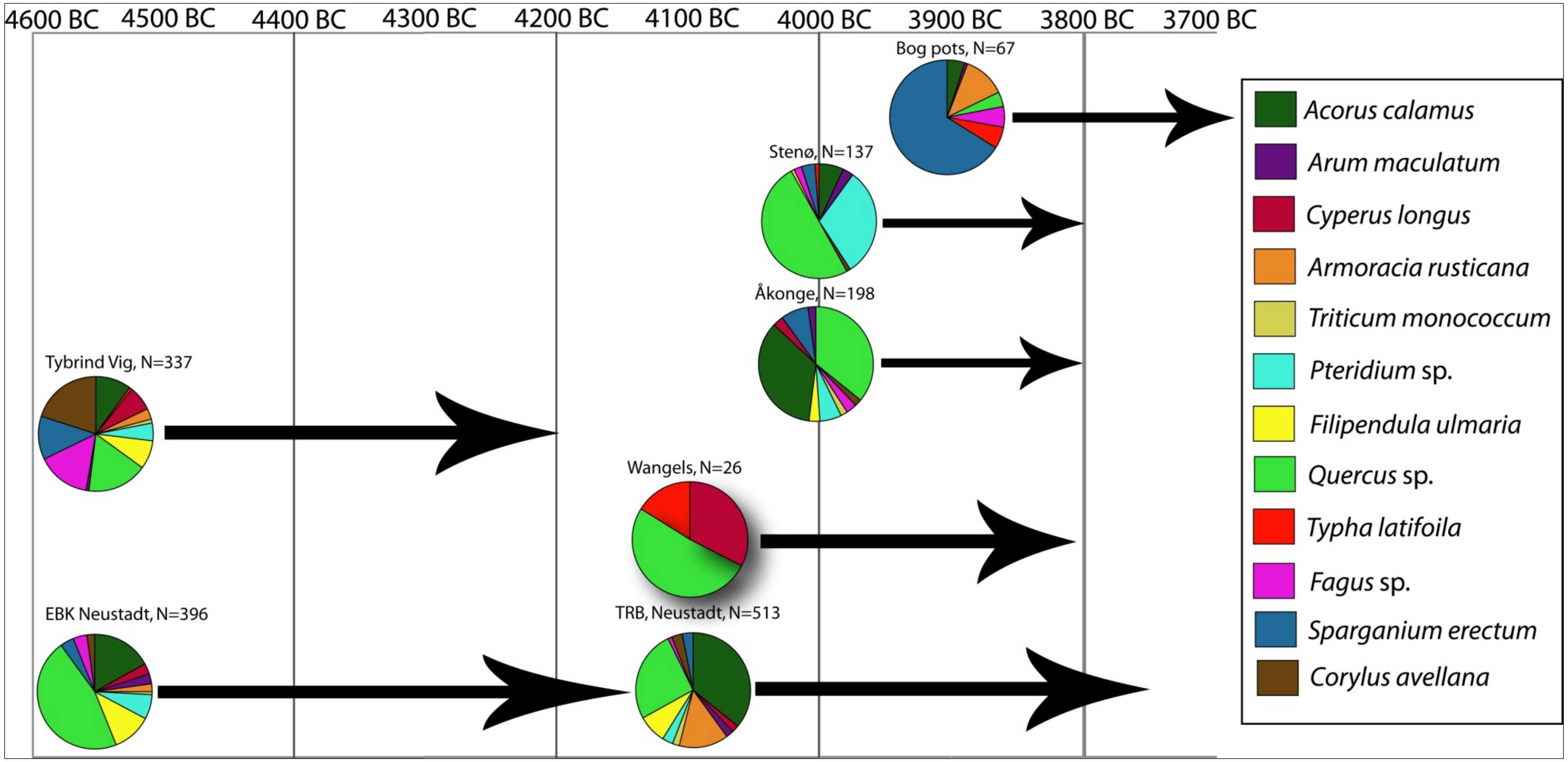

Figure 7.6. The results of automated starch classification on a site by site basis, with arrows indicating the time period over which each pie chart of plant use tradition spans.

The contextual evidence for cereal agriculture/gardening in the centuries around 4100-3900 BC is scant (figure 7.7), and there are only three examples where cereals have been found directly. Two of these, Mossby and Limensgård (Fischer and Gotfredsen, 2005-6) are from sites further east in southern Scandinavia as well as being small quantities. Such a limited presence would seem to suggest that exchanges were small-scale and therefore targeted on certain limited exchange networks. The presence of wheat (*Triticum* sp.) impressions in pottery from contexts after 4050 BC at Löddesborg (Fischer 2002), in advance of the earliest direct evidence in the eastern part of this region suggest that perhaps the exchange networks for the earliest cereals were linked to those of pottery exchange, without those pots necessarily having to contain cereal foods. In this case, pottery and cereals would be in a value relationship governed by the exchange networks they operated in, with the degree of pottery exchange conditioning access, knowledge and to a certain extent desire of cereals.

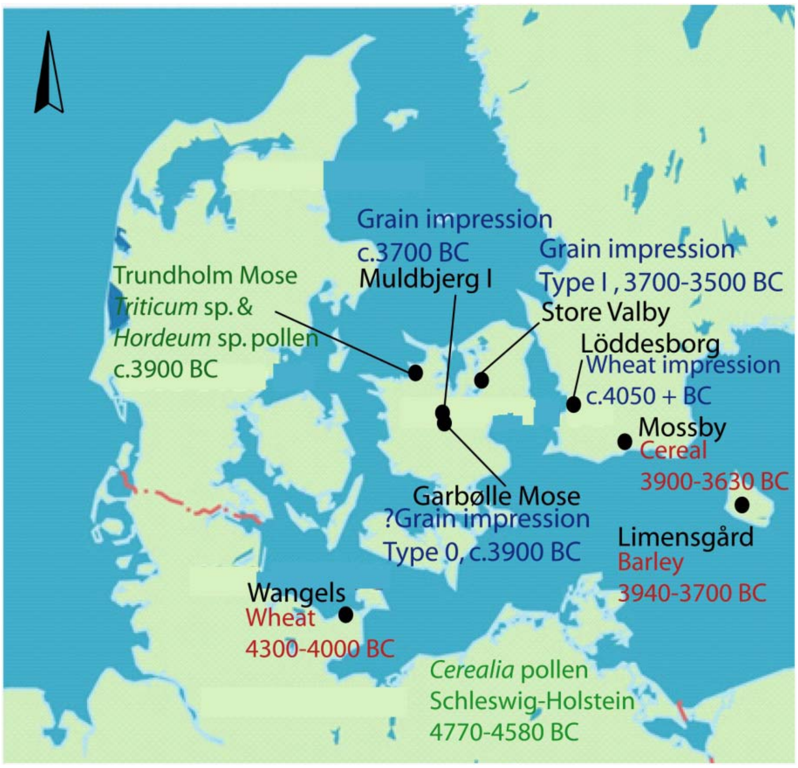

Figure 7.7. A summary map showing the wider evidence for early cereal introductions in each region of the study area. Red indicates direct evidence of grains, green indicates pollen evidence of cereals, blue indicates grain impressions in pottery.

The only other direct, early evidence of cereals comes from Wangels (Hartz, 1997-8) in contexts several centuries earlier than are found in the south-east of the

Scandinavian region (figure 7.7). Although extremely limited evidence this does point to a northerly trajectory for cereal exchanges, with an easterly weighting on the basis of direct findings. However, the early findings of wheat grains at Wangels are not supported by plant microfossil evidence in pottery residues. As the evidence currently stands then, the *use* of cereals was limited to a-ceramic cuisine, but it is possible that networks for exchanges of pottery and other pottery-cuisine foods may have been involved in establishing the *access to* and *value* of cereals. Ruling out cereals in pottery residues is pending more targeted investigations of precise conditions of starch preservation though. What is more certain is that wild plant foods retained a strong representation in pottery throughout the period of study, c.4600-c.3700 BC. Considering the suggestion in section 7.1.1 that plant foods cross-cut regional cuisines and provide an almost culinary 'backbone' to cuisine, their role as reliable and well-managed staples could have contributed to their retention and persistent relative importance in the face of other domesticated food introductions.

Dairy foods are the earliest vanguard evidence of domesticated contributions to cuisine from pottery residues. Around 16% of the 169 sherds analysed returned an offset on the $C_{18:0}$ fatty acid indicative of a dairy food content (figure 7.5). Around 6% of the total sherds analysed (N=10) came from vessels with Ertebølle techno-stylistic features. The five examples from Åkonge and nearby Stenø in the Zealand Åmosen must be considered from a later phase of the ceramic Ertebølle however, as both sites have a short occupation that spans the first faunal evidence of cattle c.3950 BC. At Neustadt though, the Ertebølle pottery sampled has a *terminus post quem* of c.4600 BC, which potentially extends the earlier evidence of stock husbandry seen at Wangels c.4200 BC (figure 7.8) to other areas of northern Germany, reinforcing the geographical range of an earlier introduction of domesticates than the 4100 BC which the region is conventionally credited with (Hartz *et al.* 2002).

Earlier introductions of dairy foods in the south of the region continue to support the model of influence from farming communities in south-central Germany (figure 7.8). The abundance of dairy present in EBK-style pottery across a wide geographical range (figure 7.5) would seem to suggest that animal husbandry regimes were adopted relatively rapidly, perhaps within a few centuries or less between northern Denmark and northern Germany. Confirmed domesticated cattle from Rosenhof are heifers (Scheu *et al.* 2008). Female cattle are the prized portion of a dairy herd, and will only be put to slaughter if there are sufficient animals to replace them and also retain the reproductive viability of the herd, so this tentatively suggests that sufficient beasts were available for such a husbandry practice. In the north of the study region at Åkonge (figure 7.8) the cattle remains also included a female, as well as a calf (c.3950 BC) (Fischer and Gotfredsen, 2005-6). The presence of a young animal also supports the relatively rapid adoption of intensive animal husbandry with substantial herd sizes. Culling of young males occurs if there are available studs to replace them. It is more beneficial to retain males for beef stock if the herd size is small enough to accommodate the extra foddering, so the potential culling of this individual implies a larger herd structure.

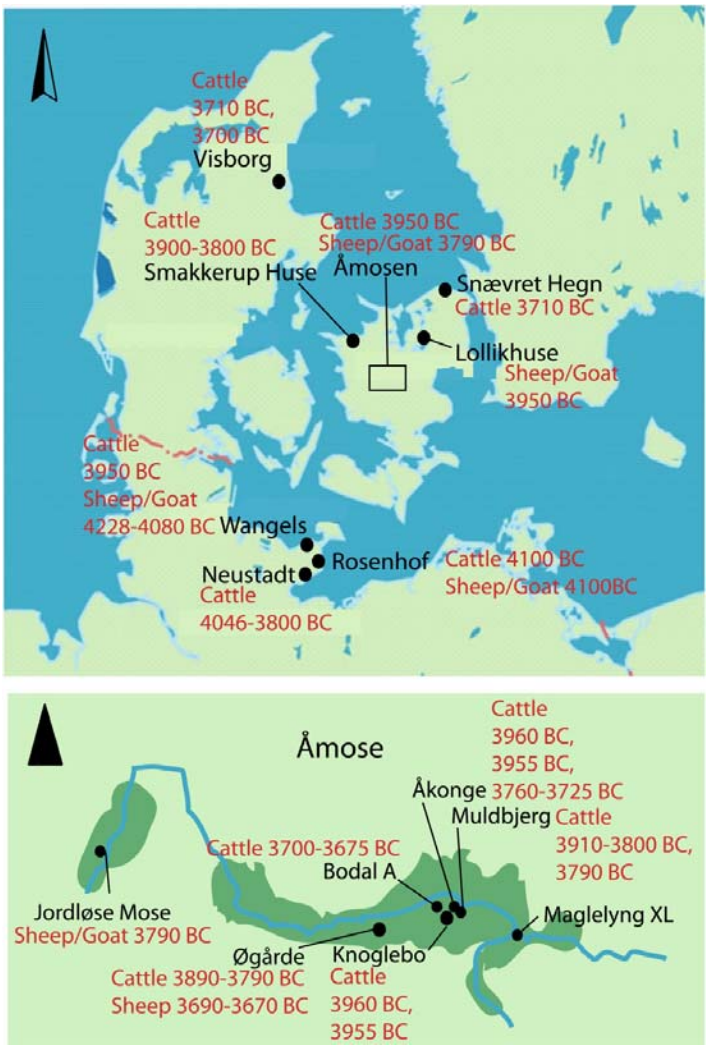

Figure 7.8. A summary map of the wider evidence of early domesticated animals. The map at the bottom is a close up of the Åmosen where a particularly high concentration of sites have been discovered with early domesticates.

However, despite abundant dairy evidence from pottery residues only 24 domesticated cattle (Glykou, 2010) bones have been recovered from Neustadt (c.4046-3800 BC), an insubstantial number to suggest a large herd investment. Cattle at Rosenhof are represented by a single individual (Scheu *et al.* 2008). Such small numbers of stock distributed across the sites point to a (semi-)mobile herding strategy, where culling practices for one herd are dispersed across several sites in a region.

So, although wild foods like fish and plants persist in importance for many centuries after the introduction of animal domesticates, the latter appear to have been rapidly and intensively adopted across a wide region. The evidence from pottery residues compellingly argues that dairy foods were the primary domesticated addition to cuisine, and are present as an abundant proportion of the total pottery assemblage. Contextual faunal assemblages are arguably consistent with a large-scale management strategy that allowed for the culling of members of the herd structure that present otherwise valuable resources in a small herd.

7.1.3. What is the relative importance of plant versus animal foods in the context of pottery?

Debate surrounds the importance of plant contributions to past consumption practices, relative to animal foods. Faunal assemblages are more durable to decomposition in the burial environment than many floral remains, and it is argued that this had led to an over-representation of animal importance in diet. Arguably, this has had a knock-on effect for social explanations of why the transition to agriculture occurred, with cattle considered the exotic forerunners of other domesticates in prestige exchange networks (Fischer, 2002). Bone isotope analyses have compounded this problem by emphasising the marine-terrestrial polarity in diet across the transition, responsibility for which was accorded to a taboo on fish in the early UK Neolithic (Thomas, 2003). Explanations for why plant, whether wild or domesticated, were important to the social concerns of past communities have been less forthcoming.

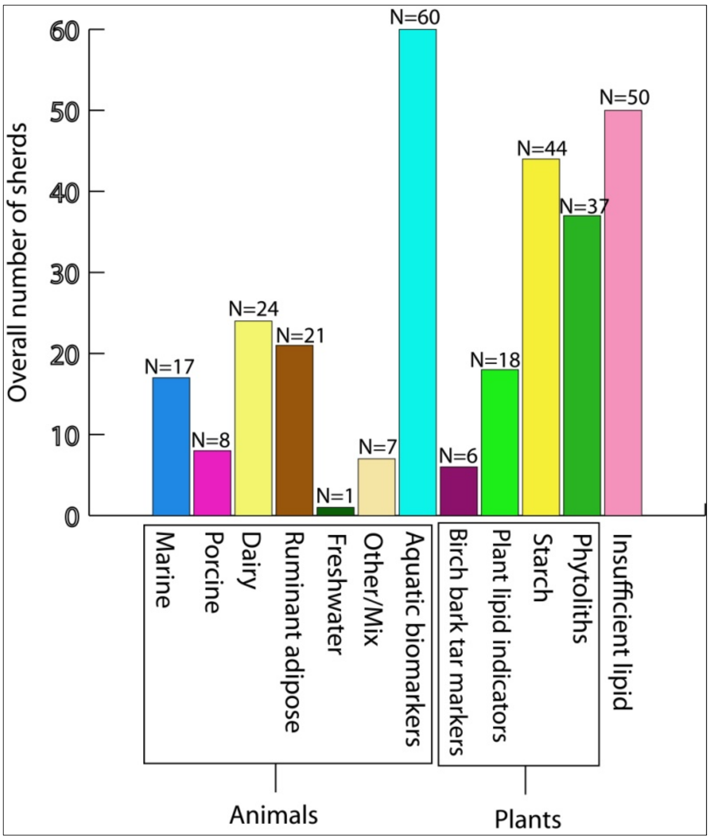

Figure 7.9. A graph showing the total number of sherds with evidence of each class of food from single compound analyses, lipid characterisation and plant microfossils. Extra samples from Roskilde Fjord, Store Åmose, Ringkloster, Bjørnsholm and Norsminde are not included because there are no plant microfossil data from these sites.

Figure 7.9 depicts a collation of the number of sherds from which each class of food evidence was retrieved. Apart from aquatic biomarkers the animal food classes were defined on the basis of single compound isotope analyses. Fifty of the total number of sherds analysed did not produce a single compound isotope result because of insufficient lipid. Although these extra samples could theoretically add to the animal class counts, it is considered that surface deposits are equally as susceptible to organic decomposition and thus counts of plant food peaks are also negatively affected by degradation, though not measurably as in the case of animal foods. The prevalence of plant foods in pots on the basis of microfossils (N=44, N=37) is only outmatched by aquatic animals, indicated by the presence of one or more aquatic biomarkers (ω-(o-alkylphenyl)alkanoic acid, TMTD, phytanic acid) (figure 7.9). Although *ranking* of these foods is not achievable or a tenable indication of value, because the number of incidences cannot account for the number of re-uses of the vessel, what the data in figure 7.9 does imply is a rebalancing in the importance of plant foods in cuisine.

Food	Calorific value per medium-sized vessel
Pork	3140 kJ
Milk	8792 kJ
Cheese	7410 kJ
Butter	3508 kJ
Ruminant	14,653 kJ
Fish	14,967 kJ
Whale blubber	48,675 kJ
Acorn (*Quercus* sp.)	50,241 kJ

Figure 7.10. A table showing the relative calorific values of different food classes for a medium-sized vessel.

In purely calorie terms this possible importance is also borne out. Estimations in figure 7.10 are calculated using an average, medium sized vessel with a volume of approximately 3.5 litres (Koch, 1998), and the data published on calorie content by Rowley-Conwy, 1984), the National Institute for Health and Welfare (www.fineli.fi/food) and the USDA National Nutrient Database for Standard Reference. Pork is c.1256 kJ/kg meat, and c.2.5 kg (5lb) of meat will occupy the volume of the vessel. Thus a vessel used to cook pork will release c.3140 kJ of food energy.

Dairy foods are described for different products, speculating a vessel use for just milk, cheese or butter respectively. So, there is c.2930 kJ in 1kg milk (1kg=c.1litre) (www.weightlossresources.co.uk), which is 8972 kJ per medium-sized vessel. A litre of milk will produce approximately 120ml of curd, weighting c.150g for one vessel. There are 247 kJ per 100g of curd cheese (National Institute for Health and Welfare, www.fineli.fi/food), so the three litre vessel of milk will generate c. 7410 kJ. One medium-sized vessel of milk will also produce 3253 kJ of butter fats. In 100g (c.100ml) milk there are 3.9g of butter fats, which means 117g of butter can be produced from one medium-sized vessel of milk. There is 2999 kJ in every 100g of butter, resulting in c.3508 kJ for an average vessel.

Rowley-Conwy (1984) quotes ruminant foods such as deer to contain c.5861 kJ/kg. Working from the same quantity of 2.5kg (5lb) meat capacity for a 3 litre vessel, the same as for pork, venison generates 14,653 kJ per medium-sized vessel. Although fish biomarkers were found in by far the most number of vessels (N=60), a breakdown of their calorific content reveals that their purely calorific value was more limited than their prevalence would imply. An average fish is c.5987 kJ/kg, which is 14,967 kJ for the estimated 2.5kg of meat that a single medium vessel could hold. Large marine mammal blubber is another possible cause for the presence of aquatic biomarkers in vessels. For 2.5kg (5lb) of blubber, whales generate 48,675 kJ per medium-sized vessel.

In particular, the relative importance of plants is potentially elevated from traditional notions where an incidental recovery played down their role. Using *only* acorns- which were classified in 73% of the vessels studied- and discounting other plants for which there is no published calorific data, a conservative estimation of plant calorific value suggests a rebalanced role for them in cuisine. Around 80g of acorns occupy 100ml of volume, so one medium sized vessel can hold 2400g of the edible portion of acorns. Rowley-Conwy (1984) quotes 5000 kcal/kg (20,934 kJ) of acorn-meat which is 12,000 kcal (50,241 kJ) per vessel.

Of course, calorie content is only one process for evaluating foods, but in experiential terms calories play a lead role in sating appetite. From this evidence it seems part of the role of some plants was to provide carbohydrate 'bulk' to cuisine. Considering that plants were the food class that created overlap in regional cuisines, this role seems to find support. Animal foods generated a diversity of umami-themed regional tastes to which plant foods provided inter-regional culinary continuity.

7.2. Interpretation: how is cuisine implicated in the transition to agriculture?

7.2.1. Introduction.

Having tackled the broad-stroke implications of the results in the framework of existing debates (section 7.1), this section extends interpretation to explore some of the social implications for these cuisine choices. One of the over-arching aims is to extend and alter traditional debates about food in light of the project's findings, speculating that other culinary evaluation processes may have existed to bring about changes. Here, we discover that foods have complex uses and values along a continuum from the mundane to the ritual, and the practical to the symbolic. These values are mediated and enhanced by pottery; a context charged with metaphor and symbolism for the preparation, storage and appreciation of foods. Subsection 7.2.2 explores the genesis of values associated with pottery, by engaging with the process of evaluation; the way choices about how to create pottery were made and changed through time, and how the practice of creating pottery engaged past peoples in structuring what was important, in both a practical and metaphorical realm. Subsection 7.2.3 takes that most symbolically potent food, meat, and explores its representation in ceramics compared to other animal remains on transitional sites, to suggest that control was exerted over what could be cooked in pots. Not only was content managed, but the timing of consumption may have come under the control of tradition during the Early Neolithic, with many large vessels employed for the group consumption of fish.

In subsection 7.2.4 the idea is introduced that milk played a fundamental role in cuisine in the context of pottery. The implications of its inception as one of the *earliest* domesticated products are explored. Here, some of the many possible reasons why milk was valued are discussed, its inherent properties as a colloid, its association with breastfeeding and weaning, as well as mention of possibly toxic milk values in a lactose intolerant population. Finally subsection 7.2.5 seeks to redress the bias against plant foods. The complex potential of values associated with plants is proposed for biotopes inhabited across the transition to agriculture. Out of their many faceted natures, certain plants arise as important in the context of pottery cuisine. The reasons why acorn (*Quercus* sp.) type starches feature so prominently in pottery are proposed, compared to hazelnut (*Corylus* sp.) forms which are relatively uncommon. Contradictions generated by the use of wild plants with new domesticated foods may have contributed to the later intensification of domesticated cuisine relative to wild foods. This section proceeds to consider the implications of spice use in the Ertebølle, and its indirect potential significance to the adoption of agriculture over a longer time frame.

Throughout these interpretations it becomes clear that a valuable asset of pottery in cuisine was its potential to *transform* foods; whether through infusion, counteracting toxins, or altering the chemical structure of foods in almost proto-alchemical explorations. Despite such an overarching theme to the value of pottery cuisine, the importance of foods from the late 5th-early 3rd millennia BC is plural although often interrelated. In some instances it is possible to measure the relative importance of one food against another to suggest reasons why certain trajectories of change emerged. Other evaluation processes for food seem indirectly related to an ultimate outcome of domestication, and were motivated by considerations other than directly changing the relationship between humans-animals-plants.

7.2.2. An ethnography of pottery values.

7.2.2.1 The introduction of ceramics.

In order to grasp the values of pottery to Late Mesolithic hunter-gatherers and the way they changed across the transition to the Early Neolithic (c.4100-3950 BC), our starting point must be the temporal context of the tradition, the adoption of ceramics. At stratified sites such as Ringkloster this has been dated to c.4700 BC (Andersen, 2000), at Bjørnsholm c. 4600 BC (Andersen, 1991). Although an eastern pointed-base influence has been postulated from the Elshan tradition in Samara, south-east Russia (Dolukhanov *et al.* 2005) which filtered to the regions of the Narva and Niemen cultures in Latvia and Lithuania (Gronenborn, 2003, 2007), the incorporation of a pointed ceramic tradition seems to have been achieved with some aspects peculiar to the western Baltic.

One of the main peculiarities may be in the relationship between pottery and shell midden sites. The most intense phase of shell midden accumulation in Denmark centred around 4500 BC (Andersen, 2000), framing a period which is coarsely synchronous with the introduction of ceramics. I propose that there is a specific reason for this correspondence, that shell middens became *a* locale for the small-scale production of pottery. During the excavation of Ertebølle (Andersen and Johansen, 1986), Bjørnsholm (Andersen, 1991) and Norseminde (Andersen, 1989) ash layers made up the most frequent type of 'hearth' at the sites. At Ertebølle and Bjørnsholm these light grey ash accumulations begin coincidentally with the occurrence of pottery in profiles (figure 7.11) (Andersen and Johansen, 1986).

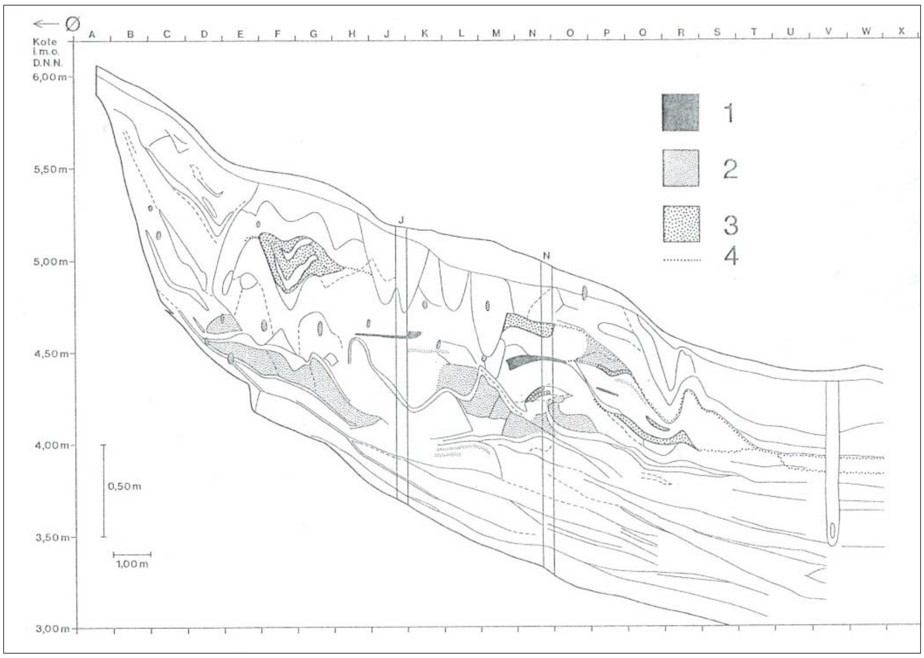

Figure 7. 11. Section through the midden at Ertebølle, showing the layers of shell-ash that begin in the a-ceramic period (Andersen and Johansen 1986).

Three to five of these ashy layers occur at Bjørnsholm interspersed with layers of shell fragments and burnt shells (Andersen, 1991). Analyses of the ash show it to be calcium carbonate from the burning of the shells (Andersen, 1991). Pottery was most abundant in these ash layers (Andersen, 1991). Examples of pottery were analysed from Ringkloster to elucidate the source of clay. Whilst a number of the samples corresponded to locally acquired river clay, not all clay sources could be identified and a minority were higher in calcium carbonate (Andersen, 1998). It is quite possible that ash was added to the clay matrix as an aggregate, with the practical effect of purifying the clay and reducing shrinkage and cracking during drying. The association of these ashy hearths with the manufacture of pottery is further reinforced at Bjørnsholm where fire-cracked 'cooking stones' of quartzite and granite are found beside them. Granite and quartzite are almost exclusively used as the temper of pottery from the earliest Ertebølle vessels and into Funnel Beakers.

The stones found in ceramic period ashy layers are noted as much smaller and more cracked than examples from lower down in the strata (Andersen, 1991). By implication it seems unlikely that very fragmentary stones would be suitable as pot boilers, or to roast foods in oven pits as the likelihood of stony inclusions in food would be increased. For the purposes of *making pottery* however, these fragments are the desirable element. Fire-cracking is a necessary requisite of preparing granite and quartzite for temper because they are too hard to pulverize without micro-fracturing with thermal shock. From practical experience this is achieved by heating the stones in a fire to high temperature and then placing immediately in a body of cold water, such as a coastal location would afford. Smaller stones fragment more easily because it is possible to create a catastrophic temperature differential. That is, neither extremes of heat or cold conduct as efficiently through larger fragments of the stone, buffering them against micro-fracture.

7.2.2.2. A chaîne-opèratoire of pottery production.

It is possible to understand the making of ceramics as enmeshed in the wider symbolic context of shell-middens then. The process of producing the final vessel entailed some practical constraints that bounded and conditioned values that came about from working with the materials. As the technology changed with the production of Funnel Beakers, so too did the process of evaluating which elements in the chaîne-opèratoire were key, and why. It has already been suggested that a high degree of selection was exerted over the *ingredients* of the fabric paste. This idea of what it is appropriate to combine, and in what quantities to successfully generate a pot is but one value of construction that is also played out in wider culinary choices. To a degree the changing values implicated in the construction process parody changes in cuisine values.

Figure 7.12 shows the chaîne-opèratoire of pottery construction for Ertebølle vessels based on evidence from the vessels, annotated with values (green) generated by the symbolism of the materials and the practice of working with them. It also describes the necessary prerequisites to successfully achieve the vessels found in the archaeological record. The use of quartzite and granite as primary tempers follows a practical rationale as these were formerly used to create an even temperature of cooking in roasting pits as at Åle, Jutland, where they were in close proximity to charcoal-rich hearths (Andersen, 2000). The value here is symmetry, and evenness to create balance in the transformation that is occurring within the vessel. The use of quartzite diverges from Elshan tradition of pointed-based vessel manufacture which was often tempered with coarse sand and organic matter (Kul'Kova *et al.* 2001). These latter selections certainly offer less time-consuming tempering methods, which suggest that quartzite and granite were not arbitrary choices.

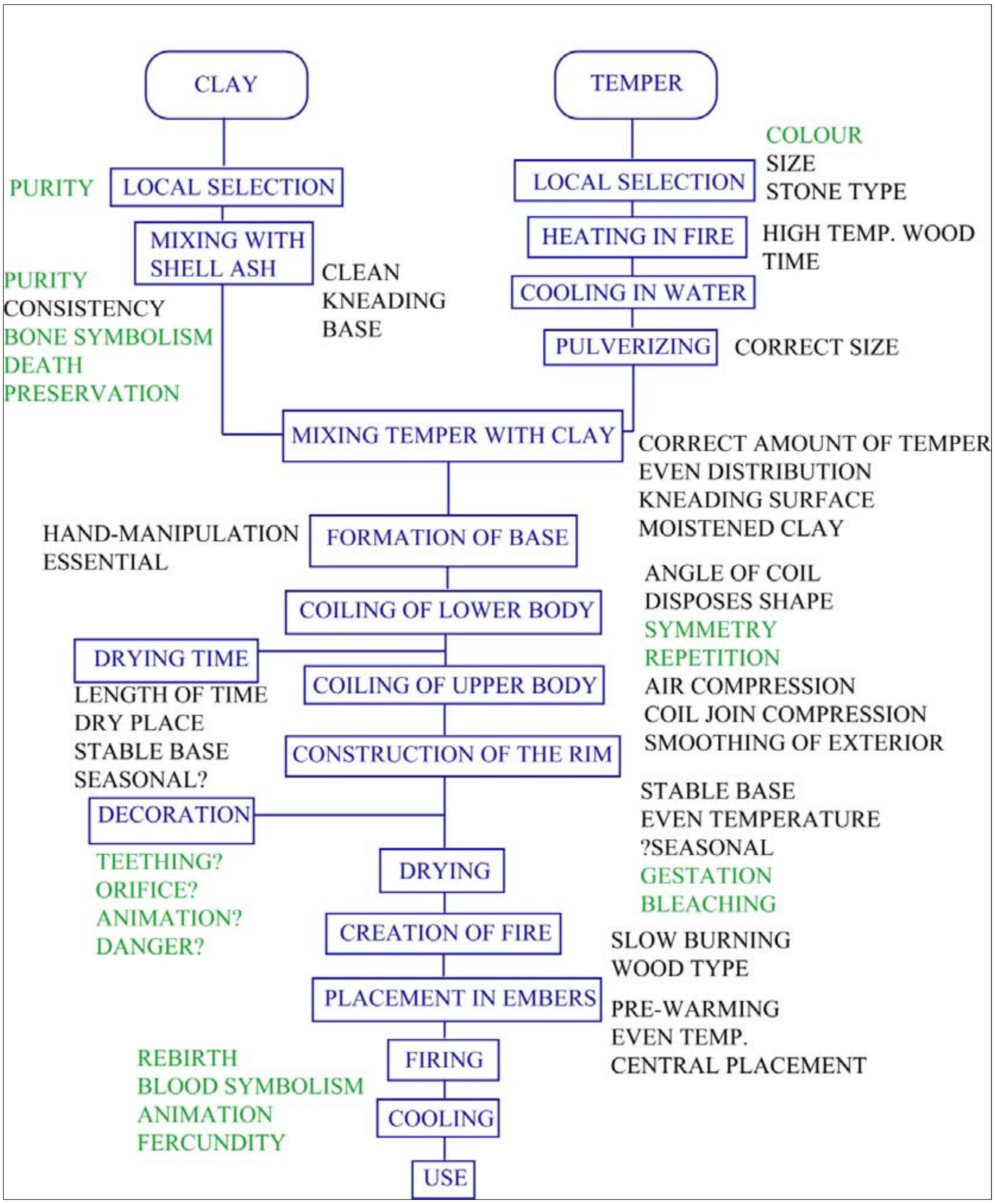

Figure 7. 12. A chaîne-opèratoire of pottery manufacture for Ertebolle-style vessels, which is similar in many ways to the Funnel Beaker chaîne-opèratoire.

In the construction of Ertebølle pottery the angle of coiling on the base disposes the overall form of the vessel, be that the conical or more cylindrical variety. The pointed-base necessitates manipulation of the vessel by hand rather than on a pedestal. In the construction of larger vessels small-group authorship may have been necessary. Formation of the body occurred with the downward motion of the clay into H- or U-construction (Koch, 1987). Symmetry and repetition are valued in the practice of construction, and these are tested to a greater extent in cylindrical styles, such as the example on the left in figure 7.13a from Tybrind Vig compared to a form with fewer curves from the same site (Figure 7.13b). Forming the curves requires more diversity in the coil angle necessitating more formalised measurements of coil thickness and the number of coils applied. It may be that vessels with a more marked S-shaped profile were the product of greater experience at attaining these values of symmetry through repetition. It is interesting to note that figure 7.13a is an example of a very large sized vessel (>30cm diam.) which would have required an additional potter to support the vessel whilst construction proceeded, making apprenticeship and observational learning a possibility at times when large ceramics were important.

a  b 

Figure 7. 13. Greater challenges to construction are posed by vessels with curved contours (a), than more straight-sided conical pots (b). Both examples are from Tybrind Vig.

These larger vessels may have required drying time between the constructions of different vessel portions. Malleable clay will fold under its own weight. Judging the correct length of time to allow drying to occur also requires a high level of experience; too little and the integrity of the symmetry will be compromised with the continued application of coils, too much drying and the hardened upper coil surface will not securely bond to fresh paste leaving a weakened joint. Larger vessels may have been important representatives of accumulated knowledge and experience in potting. This experience was primarily displayed through size, with shape variation a secondary value.

Most vessels were without decoration in the Ertebølle, but a minority possessed bands of incisions in the area of the rim, and an even greater minority show more extensive surface decoration. In the latter case, one sherd fragment is known from Norsminde with a ‘checkerboard’ pattern created using squares of incised dots (Andersen, 1989). Similar examples are known from a few sherds from Löddesborg and Ringkloster (Andersen, 1998). More commonly, if an Ertebølle vessel was to be decorated this was done by a line of stab marks on the exterior of the rim or incising the rim edge with the fingernail in a 'toothed' effect (figure 7.14). In both cases the region of the pot emphasised is the orifice, and it is perhaps significant that the mode of emphasis often resembles teeth. Larsson (1990) reports on early twentieth century findings in Scania for the post-mortem use of crania as containers during the Late Mesolithic. Use wear suggested that skulls had been scalped and perhaps filled with consumables. Similar cranial cutmarks are observed on the adult female cremation from Vedbæk (5480-5390 BC) posing a possibly antiquity to this practice.

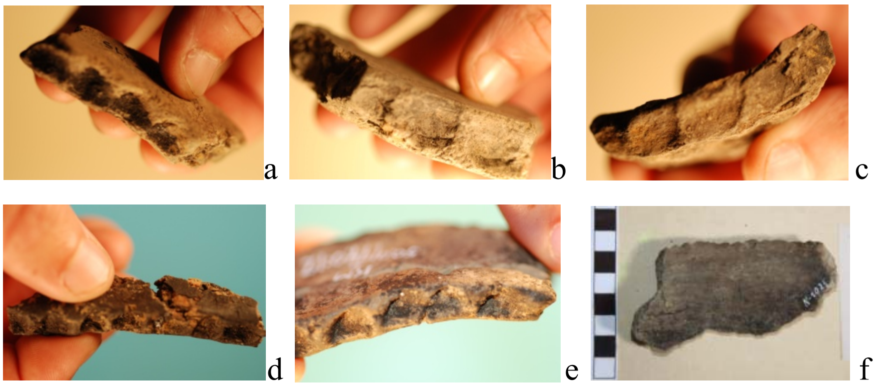

Figure 7. 14. Examples of 'teethed' orifices on Ertebølle pottery vessels from (a-c) Bodal K, Åmosen, d-e) examples from Åkonge, Åmosen, f) an example from Neustadt, Schleswig-Holstein.

At the site of Bodal K in the Åmose 'teething' is the most common decoration type in Ertebølle style rim sherds (Appendix IX) (Saul and Fischer, *in prep*). It is also one of the decorative motifs at Åkonge (Saul and Fischer, *in prep*) and examples are recorded across southern Scandinavia including Norseminde (Andersen, 1989) and Neustadt in Schleswig-Holstein (Glykou *pers. comm.*).This further stresses bodily metaphors, especially relating to the skull in this instance.

After the selective application of decoration, the vessels were left to dry. This can take a number of weeks, especially considering the relatively thicker walls of Late Mesolithic vessels. A stable foundation, with even temperature is important for this gestation period and may have entailed a *degree* of seasonal manufacture. Freezing of moist vessels could result in fracture. In addition, going from an excessively low temperature into the firing embers is much more likely to cause catastrophic fracture. Thus it may have been necessary to warm the pots before firing them, or conduct activities in the summer. The need to keep the unfired pots evenly warm and dry in a temperate climate would almost certainly involve them being undercover. There is a persistently high level of care involved during the whole process of manufacture, which may have necessitated the inclusion of unfired vessels as household members, with an allocation of the social space that that entails.

The firing is a crux in the process of manufacture, and a number of weeks' worth of activity can hinge on fire-management knowledge. There is a much greater risk of catastrophic fracture from thermal shock if the fire is in flame rather than as embers, meaning the addition of fuel half-way through is inadvisable. Slow burning woods will produce more even temperatures and complete firing, for example apple (*Malus* sp.) and hazel (*Corylus* sp.) produce few flames but generate a lot of heat for relatively longer periods. Oak (*Quercus* sp.) tends to generate acrid smoke, but if it is cured over a season it makes a good firing environment (Mears, 2004). The firing process climaxes the physical and symbolic transformations in Ertebølle pottery manufacture. The parched, bone-white of the unfired pot is reanimated to a rich red, through its oxidation (figure 7.15). The process of construction therefore is also a process of evaluation. One of the main values is the control of material transformation that construction embodies; from soft to hard clay, managed by the possible addition of an aggregate and firing temperature, as well as grey to oxidised red which marked the successful achievement of even drying and firing.

Figure 7. 15. Pre-fired clay is grey but transforms to an oxidised red with firing. The process of construction embodies a management of material transformation.

Pottery production therefore introduces and embodies values associated with fixed transformation; that is, change from one state of being to another. Indeed, the fact that ceramics become the most abundant artefact type on numerous sites (Andersen, 1989, 1991) suggests that a fascination with exploring the modes of transformation they presented was significantly invested in.

This preoccupation persists in some of the *uses* to which pottery were put. Pottery cuisine necessitates the desecration of animalistic and plant identification features in order to deposit them in the vessel; they must be jointed and chopped. Correspondingly, flint blade manufacture retains a refinement seen in the aceramic Ertebølle, supporting this culinary divergence, whilst other artefact types alter much more or disappear. There is a sense of a removal from part of the identity of the animal and plant in pottery cuisine. Instead, pottery opens up the possibility of *infusion* of multiple culinary sources, which the evidence of residue analysis suggests is a key feature. Rather than a focus on the corporeal identity of plants and animals, the use of pottery engenders a refocusing on their more abstracted properties. The introduction of Ertebølle pottery can be suggested as a key turning-point in the value of what plants and animals *were* as food, their manipulation becoming something more akin to 'proto-alchemy', where the intactness of animal-plant identities is broken down and new identities are formed through culinary transformations.

Though pottery styles diversified into the Funnel Beaker forms the technology to construct them is not considered to have radically altered (Koch, 1987; Koch, 1998). There are more subtle differences in the possible *values* attached to pottery through their construction which contrasts Ertebølle vessels, and these are recognisable by a comparison of the chaîne-opèratoires. According to radiocarbon determinations made by Koch (1998) and stratigraphic observations vessels of Type 0, I, II and III are broadly sequential, but with overlapping calibrated ranges which suggests their innovation was relatively rapid within a few centuries, and their use-life probably made them broadly contemporaneous at many sites.

Few radiocarbon dates exist for Type 0 vessels. The example from Bjørnsholm was dated by associated oyster shell and is probably slightly early because of a reservoir effect. The most confident date is from 'Peter's pot' at Åkonge which can be dated to 3300+/-70 b.c. (calibrated 3950 BC +/-1 standard deviation 3980-3800 BC). Type I vessels benefit from a number of closed context dates, such as the male Dragsholm grave dated to 2890+/-100 b.c. (calibrated 3640 BC +/-1 standard deviation 3710-

3520 BC). Find 150 from Bodal in the Åmose dates to 3900-3800 BC (3160+/-75 b.c., calibrated 3950 BC +/-1 standard deviation). It is reasonable to date the funnel beakers of Type II to the period around 5050 -4750 B.P., or around 3900-3700 B.C. in calendar years (Koch *pers. comm.*.). Apart from dates made on foodcrusts, there are closed finds from the Præstelyngen Boat II, Store Åmose, in which a fireplace was found with sherds of a vessel of this type. These dates are from the period 5010 ±100 B.P. - 4790 ± B.P. (calibrated 3790 B.C., ±1 standard deviation 3950-3700 B.C. - calibrated 3630-3540 B.C. ±1 standard deviation 3660-3380 B.C. (Koch, 1998). Finally, dates for funnel beakers and slender lugged beakers of Type III orbit the period around 5050-4750 B.P. (uncal.) or around 3800-3600 B.C. in calendar years, also in the early part of EN I (Koch, 1998).

These dates also suggest that the fairly rapid innovation of different styles was incremental, that vessel forms were added to the repertoire rather than replacing earlier creations. Up until the actual *formation* of the vessels the chaîne-opèratoire (figure 7.12) is unaltered. Examples of the very early Type 0 vessels have a rounded base, an intermediate between pointed and flat varieties. This form still necessitates manual rotation or rotation by a potting assistant as the coils are applied. Scope for imparting knowledge through apprenticeship to the assistant is maintained, but a reciprocal *reliance* between apprentice and potter may have become less important with the advent of flat-based Type I forms. Stylistically, Type 0 vessels are affirmed as Funnel Beakers with southern influence, but the local intra-community traditions of knowledge transfer are maintained.

Figure 7.16. An example of a very thin-walled pot from Bodal K, Åmosen. The N-construction is very oblique suggesting the paddle-and-anvil technique was used.

Quite rapidly then, the predominance of flat-based vessels suggests a greater restriction in the way potting experience is shared, perhaps a specialisation. Certainly the inclusion of flask types as well as squatter beakers points to a more formalised placement of the coils, which suggests that the challenges of forming more complex *shape* were the emphasised value, above size which were categories maintained since the Ertebølle (Andersen, 1989; Koch, 1998). Large vessels could now be formed without the assistance of an apprentice, and perhaps lost their role as markers of the experienced potter. Instrumental to this value of more elaborate shapes were the correlates of symmetry and repetition. Koch (1998) has suggested that a paddle-and-anvil technique may have developed in many very thin walled pots, based on the very oblique N-construction they often display, such as an example from Bodal K (figure 7.16). In these instances to control the shape and symmetry requires a projection of the desired outcome, as the shape during coiling is only a rough-out for the finished product.

Once again, the formalised application of coils, their angle, thickness and number, was necessary based on the ability to distinguish them statistically in archaeology (Koch, 1998). The consequence of a paddle-and-anvil technique is the firmer bonding of coils and expulsion of trapped air in the fabric, making firing much lower risk and less of a crux in the process. It also means that drying times are reduced, which limits the time spent socialising with the drying vessel in the household. In all, the trend in values during the Funnel Beaker seems to be the specialisation of vessels into different shapes, which the evidence from funnel bowls and lugged flasks at Neustadt with a low $\delta^{15}N$ value suggests is also a function of specialisation. Concomitantly there is a reduction in bodily metaphors for pottery, and the place for pots as socialising agents whilst they dry in settlement space is reduced. In addition, of the many funnel beaker offerings to bogs, the vast majority were found *away* from settlements, removed from the social realm of humans. There are only seven examples that contravene this trend (Koch, 1998). So overall, the notion that pottery affords controlled alterations of food corporeal *identity* into a series of food *properties* is entrenched. This is reflected in a construction operation for the ceramics that became increasingly directed towards the exploitation of specific food properties.

7.2.3. Meeting the meat makers.

7.2.3.1. Not for the cooking pot: animals as meat, animals as metaphor.

There is no doubt that animal flesh was an important contributor to diet and cuisine across the transition to agriculture. In the context of pottery, however, it seems that the bodies of certain animals were favoured more greatly than others, compared to percentages of animal remains on settlements. This comparative bone assemblage data is only available for two sites in the study set: Neustadt (Glykou, 2010) and

Wangels (Heinrich, 1998). However, their location at the 'frontier zone' of contact and their overlapping occupation time-frame means they usefully document long-term attitudes to animal consumption of those group(s) with agro-pastoral contact only c.200km away. Figures 7.17 and 7.18 illustrate the relative percentages of animal foods in pottery (based on GC-C-IRMS values) and on settlements for Neustadt and Wangels respectively. Bone assemblages can be considered more representative of the total animal contribution to cuisine, whilst pottery residues account for the selective incorporation of flesh, with bone discarded or reused. At Neustadt a 34% (n=816) majority of terrestrial mammal bones are from red deer (*Cervus elaphus*) followed closely by 22% (n=528) wild boar (*Sus scrofa*) (Glykou, 2010) (figure 7.17). Comparable percentages of pots show porcine contents, but the proportion of ruminant animals pot cooked at Neustadt is markedly low. It is likely that this represents an expression of appreciable value towards *deer* species rather than beef animals, as there are only 24 bones from domesticated cattle, and only 6% of the mammal assemblage is from auroch (*Bos primigenius*) (*ibid.*). In the breakdown of vessels by period, the EBK pottery assemblage marks this phenomenon distinctly. There seems to be a social reluctance to render deer- especially red deer- into pottery cuisine. Red deer have been associated with a tradition of significance or reverence with antler often representing the material of choice for high status artefacts such as antler mattocks and T-antler axes. It may have been important to manage the integrity of their bodies as part of the process of creating cuisine.

There is little evidence of domesticated ruminants at Neustadt, but the Wangels bone assemblage is heavily composed of domesticated cattle. They make up 68.3% of the domesticated animals, and 69% of the total animal assemblage, suggesting that they heavily contribute to the 50% proportion of ruminant products in the pottery assemblage (figure 7.18). Wangels is early Neolithic in date, broadly contiguous with the later phases of Neustadt, but here there is evidence that domesticated ruminants were indeed selected for incorporation into cuisine.

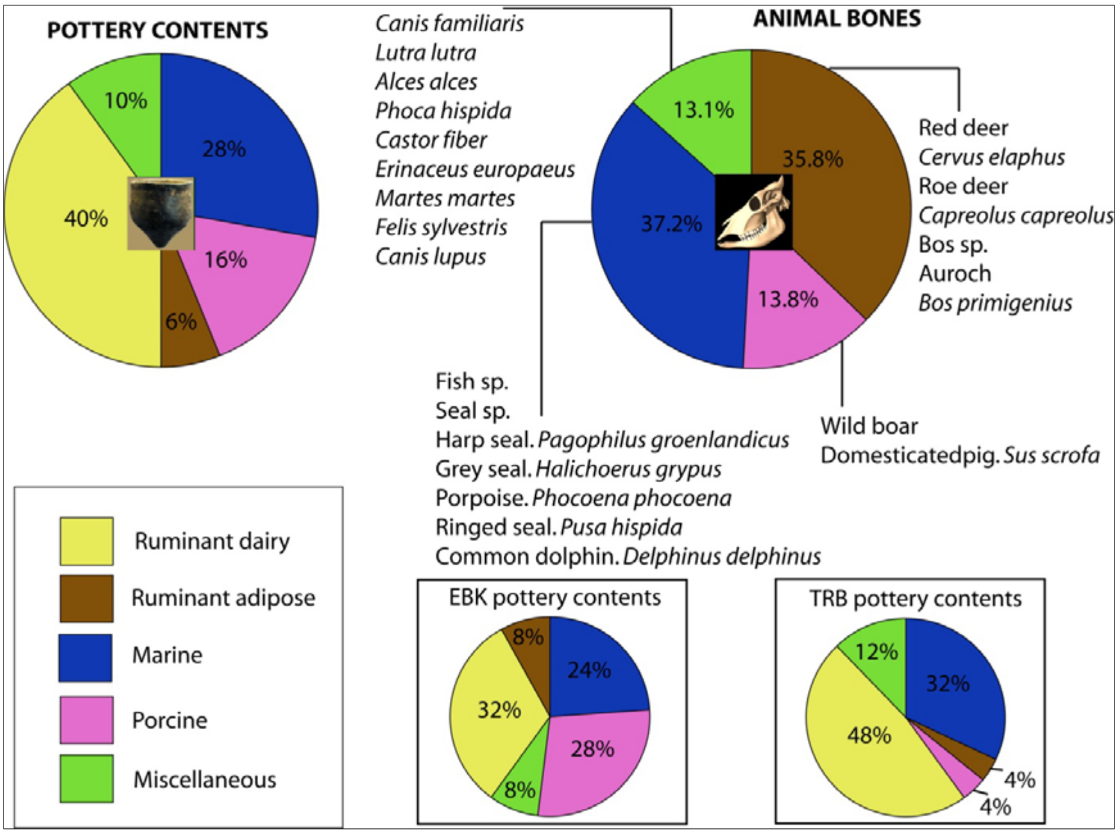

Figure 7.17. The relative proportions of classes of foods in pottery, compared to proportions of those classes in bone assemblages at Neustadt.

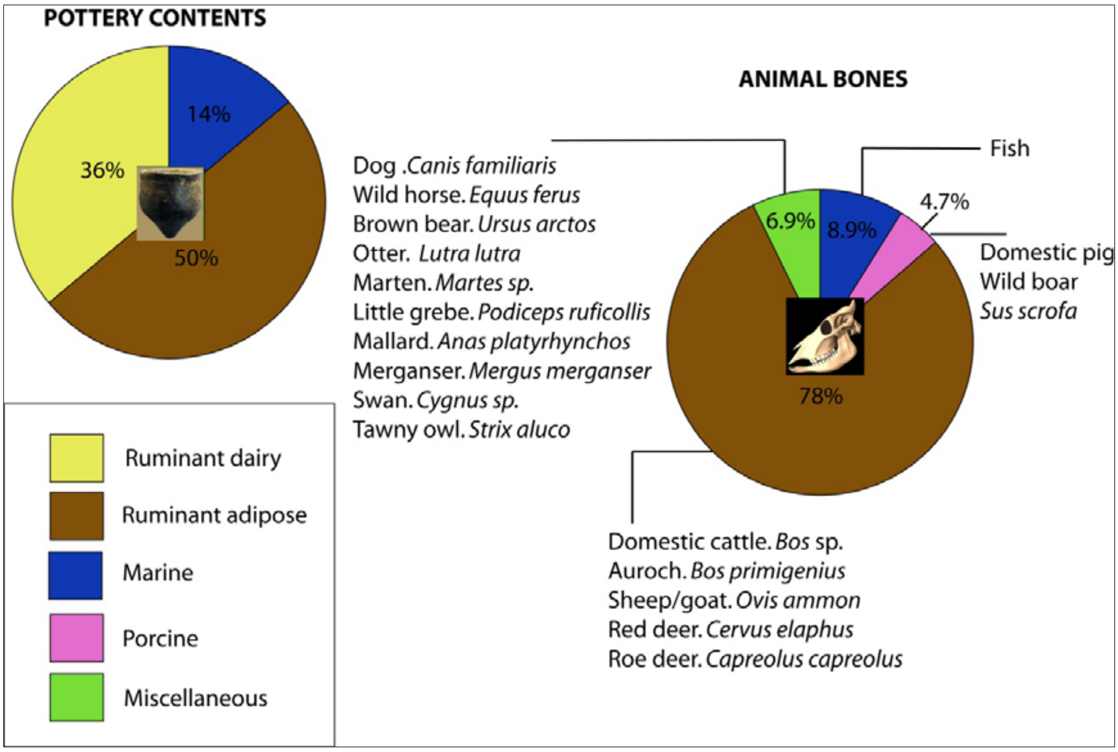

Figure 7. 18. The relative proportions of classes of foods in pottery, compared to proportions of those classes in bone assemblages at Wangels.

7.2.3.2. Fish for feasting? Responding to debates about fish in the Neolithic.

The debate about whether fish continued to be eaten during the early Neolithic is longstanding (Milner *et al.* 2004; Richards *et al.* 2003a; Richards *et al.* 2003b; Tauber, 1981). The main reason for this is a contradiction in the evidence; stable isotopes analyses on human bone point to a shift to a dominantly terrestrial diet (Richards *et al.* 2003a; Richards *et al.* 2003b; Tauber, 1981), whereas assemblages from early Neolithic layers at shell middens continue to be rich in marine species (Milner *et al.* 2004). Although fish are reduced in number, at Bjørnsholm they are still noted (Andersen, 1991; Milner *et al.* 2004), and as far south as Wangels and Neustadt fish species are still present in Neolithic strata (figure 7.17 & 7.18) (Glykou, 2010; Heinrich, 1998). Pedersen (1995) describes five coastal sites with fishing paraphernalia such as fish traps which date to the early Neolithic, many of which actually become larger and more robust constructions (Fischer *pers. comm.*.). Large marine mammal hunting also continued to be practised (See Milner *et al.* 2004, for details).

Evidence from the residue analysis of pottery supports the notion that fish and marine foods continued to make up part of Neolithic cuisine. Around 19% of all the early Neolithic residues sampled produced single compound isotope ratios consistent with marine foods. At Neustadt, for example, all of the funnel beakers that registered marine values came from large vessels. This trend extends to Wangels where two of the limited number of three vessels with marine isotope signatures of aquatic biomarkers are associated with extra large vessels (>38cm rim diameter), that could have held an estimated 56 litres (Koch, 1998), feeding around 50-60 people. At Neustadt, sample N_3233 is from a vessel with an orifice of 28cm estimated to have held a volume of 14-15 litres (Koch, 1998). Surface residue was present on the interior of the vessel right up to the rim, evincing its use to capacity. Given a rough value of 0.5 litres of broth per individual, the vessel could have provided food for a substantial group of 28-30 people. Based on the extensive covering of soot on the exterior of the pot, it would seem the contents were cooked as opposed to fermented as has been suggested for other meals such as the blood, egg white, hazelnuts and seed concoction from Löddesborg (Jennbert, 1984). The co-occurrence of high proportions of acorn (*Quercus* sp.) suggests a possible mixing, and infusion of flavours. The community consumption of fish at Neustadt may have coincided with migrations of fish. Figure 7.19 (Glykou, 2010) shows the percentages of each type of fish in the Neustadt assemblage, the majority of which is made up of the migratory cod family. This may explain the increased size and robustness of fish weirs during the earlier Neolithic, if large quantities were being caught in a single episode, as opposed to exploiting a large number of fish in the Ertebølle but not focusing solely on migrations of fish. The more temporally localised use of fish at specific community gatherings may contribute to their poor representation on bone isotope signatures.

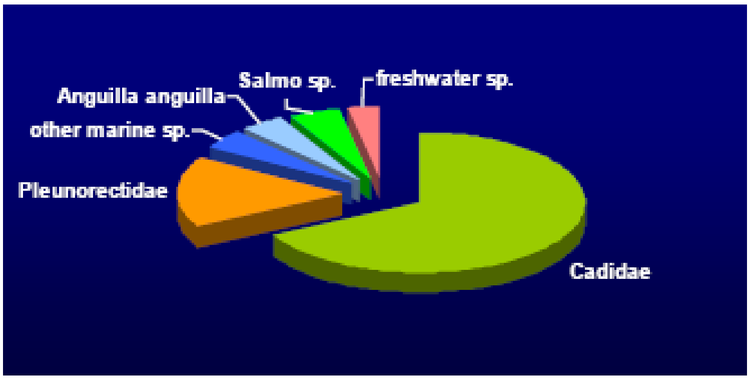

Figure 7.19. A pie chart showing the relative proportions of the fish bones from Neustadt (Glykou 2010).

7.2.4. Weaning age and social structure: colloidal fascinations.

The evidence for dairy products is extensive in the pottery residues analysed. The evidence pushes back the use of milk foods into the late Mesolithic vessels. As a result of this extended time depth for dairy foods in the sampled pottery, what the results may be representing is a palimpsest of different processes that played out with contiguous or sequential aspects that it is challenging to disaggregate. In the following, the results of dairy findings from pottery analyses are set into contextual frameworks that explicate some of the possible processes in which they were instrumentally valuable.

7.2.4.1. Medicinal milk: a new weaning food?

From as early as the a-ceramic Mesolithic child burials feature strongly in ideological rationalisations of death manifest in burials. At the cemetery of Bøgebakken for example, infants occupied graves 8 and 15 (Strassburg, 2000). New-born babies were found in two stone-edged pits at Gøngehusvej, Zealand (Petersen, 1990), as well as infants carefully placed on wooden trays (Petersen, 1990). At Nivågård in northeast Zealand a five-year-old was arranged with its head resting on a stone ‘pillow’ (figure 7.20) (Jensen and Hansen, 1999). This implies that managing infant mortality was of both practical and cosmological issue.

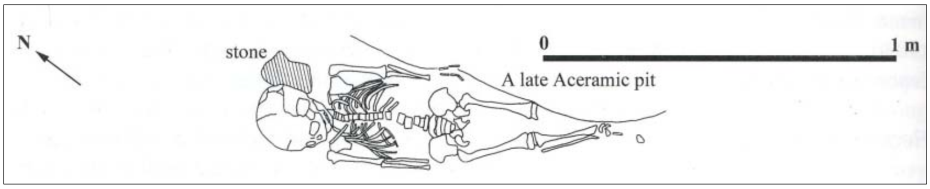

Figure 7.20. A five-year-old at Nivågård on Zealand was buried with its head resting on a stone pillow (Jensen and Hansen, 1999, 15).

In many instances, including some of the above examples, a nurturing attitude may be suggested of the deposition of the child even in death. This is nowhere more clearly expressed than in the joint burials of infant and adult. At Gøngehusvej the body of the child had been arranged so that its leg wrapped around the lower torso of the adult female, in a position strongly resembling a breastfeeding infant (Petersen *et al.* 1993). At Strøby Egede the collective burial is dominated by child burials; five of the eight bodies were of children seven years or under, three of them were new-borns (figure 7.21a) (Strassburg, 2000). Two of the children were protectively positioned around the chest area of the two exterior adults. This theme of an ideology of child nurturing persists into the ceramic Late Mesolithic with the corpse of a sub-adult woman arranged to be holding a new-born infant from Tybrind Vig (figure 7.21b) (Andersen, 1987).

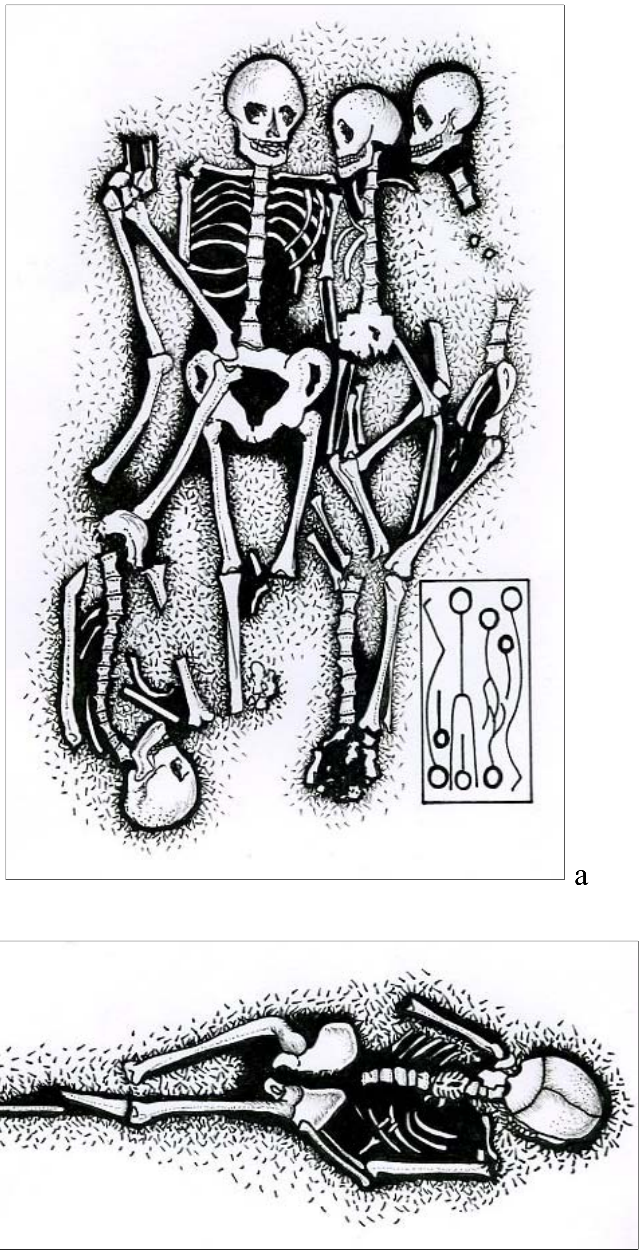

Figure 7.21. a) The collective burial at Strøby Egede comprised eight individuals, five of which are child burials, b) the burial of an adult and child at Tybrind Vig.

Nurturing imagery in graves is combined with persistent references to fertility. These are made in a variety of ways; by positioning bodies to mimic birth, pointing to possible birthing blood on the skull with ochre, and emphasising menstrual or birth blood around the pelvis. At Strøby Egede a 50 year-old woman in an extended position had been laid out with a newborn infant placed between her legs, head down in the form of a crowning baby, as if referencing the mode with which the child had departed into death (figure 7.21a) (Strassburg, 2000). At a-ceramic Bøgebakken the region of the uterus and pelvis were emphasised with ochre in graves 3, 4, 8 and 19c

(Strassburg, 2000). At Skateholm III the latest aceramic corpse of a woman was enclosed in ochre, and the persistence of this fertility imagery is clear from its continued use into the ceramic Ertebølle period at Skateholm I where graves 24, 25, 26, 36, 37, and 43 all show ochre deposits centred on the pelvis region (Strassburg, 2000).

Far from suggesting that the Late Mesolithic was a period of population *increase* that eventually tipped a threshold which forced the adoption of a more economically efficient domesticated food source (e.g. Grøn, 1998), this evidence suggests that community integrity was a matter of cosmological concern, to be practically dealt with. Possible attentions in death to birth and breast-feeding may contribute to an explanation of why *milk* was the earliest domesticated component of cuisine though, based on pottery residue findings. It may be that animal milk was introduced to supplement breast milk, with the intention of alleviating a social problem to do with the perceived successful production/nourishment of breast milk. In many traditional knowledge systems breast-milk is acclaimed for its medicinal properties. For the Siddis of Uttara Kannada in India breast milk infused with the root of *Sita cordata* (long-stalk sida) is used to treat diarrhoeal complaints (Bhandary *et al.* 1995). In traditional western folklore, squirting breast milk into the baby's nose is said to relieve nasal congestion (Walter, 1975), whilst into the ear cures earache (Black, 1935). The adult female and child in the Gøngehusvej joint burial may not have been a mother and her infant, but the scene could be staged to emphasise the importance of nurture. The child is positioned across the chest of the adult in a manner resembling a breastfeeding infant. In this sense, the idea of milk holding cosmic as well as practical potential to sustain life is affirmed, as is its potential in death to *positively alter* the social imbalance of infant death, giving milk medicinal connotations.

Evidence from skeletal remains supports the introduction of milk for a stepwise process of weaning during the ceramic late Mesolithic, across an extensive region of southern Scandinavia. The age of dietary disturbance, related to weaning behaviour is documented on the teeth of skeletons from Skateholm II and I which document a period of infant dietary health from the a-ceramic to the ceramic Mesolithic respectively, only a few miles across the sound from Åkonge where milk in Ertebølle-style pots was also found. At Skateholm II all the documented stress-related linear accentuations- termed perikymata- on teeth are a product of weaning at 5 years (figure 7.22) (Alexandersen, 1988). At Skateholm I, however, there is a greater range in the periods of weaning-induced perikymata. A trend towards the much earlier introduction of weaning food coincident with the introduction of domesticated milk products in pottery is in evidence (figure 7.22). In grave 36 this begins as early as 2 years, but there is a tendency for the first indicators of stress to occur around 3 years old and again around 4 or 5, earlier overall than in the Skateholm II population. This trend is enforced by the ceramic late Mesolithic skeleton B at Dragsholm for which there is also documentation of an earlier weaning age based on enamel hypoplasia, beginning at 3 years (Price *et al.* 2007).

The *earlier* and *dual* periods of infant dietary stress are significant because they suggest that milk may have been supplementing the child's diet at a young and therefore less immunologically developed stage, and that milk was valued as a liquid forerunner to solid weaning foods, perhaps conceived as literally an identical substitute for human breast milk. The former issue is very important; introducing cow's or sheep/goat milk into infant cuisine would appear in the short-term to be having a beneficial effect. Cow's milk has a higher fat and protein content than breast milk (Park, 2009) which would result in more rapid body mass increase in the short-term. However, the selection of *animal* milk as a supplement would decrease the tolerance of the infant to alien gut bacteria, whilst simultaneously potentially *introducing* harmful bacteria into cuisine. In addition, the decision to begin weaning can affect both the quantity and quality of subsequent breast milk production, creating a certain element of forced investment in a weaning programme (Dettwyler, 1995).

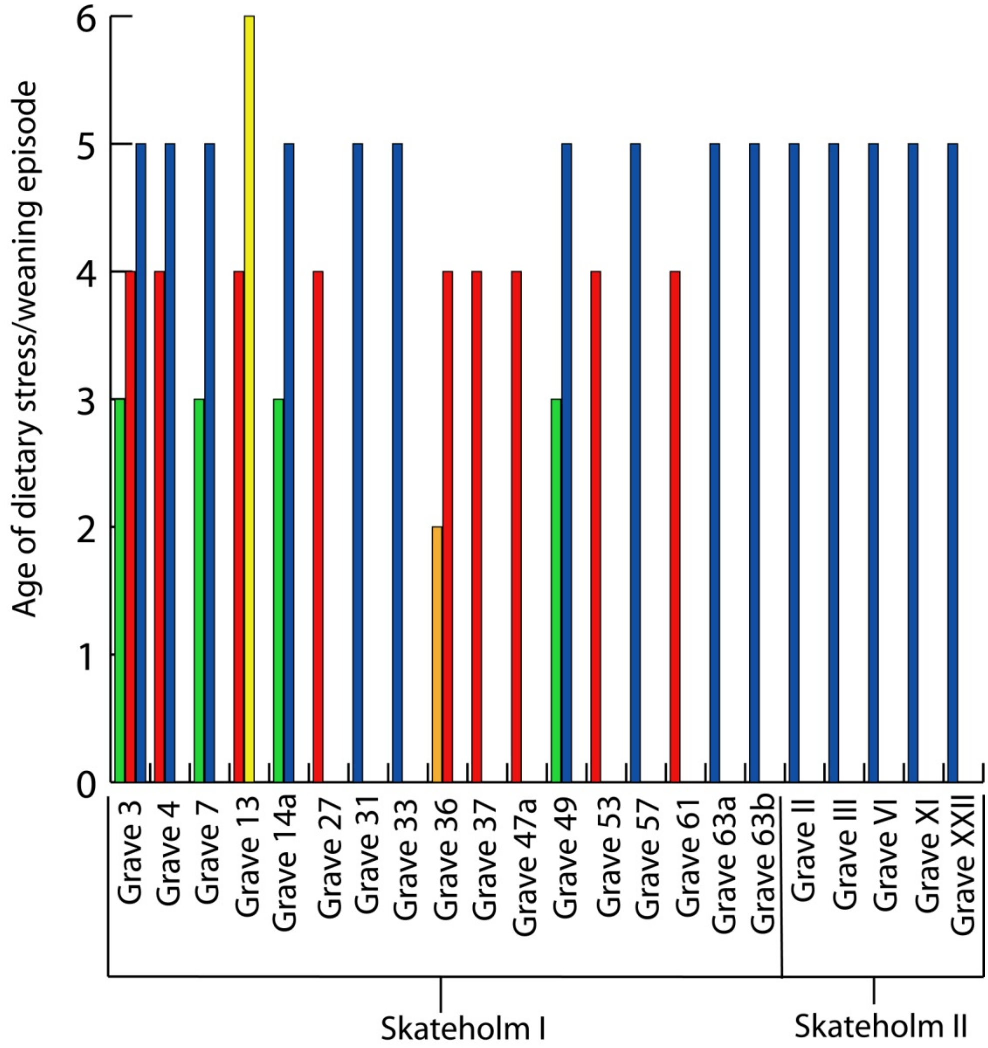

Figure 7. 22. A chart showing the ages of dietary stress shown on tooth enamel at the Skateholm cemeteries. At Skateholm II the weaning period is singular c.5years old, but several periods of dietary stress possibly linked to multiple weaning stages are in evidence at Skateholm I.

Human breast milk contains the antibacterial agents and antibodies immunoglobin A (IgA), lactoferrin, peroxidases and lysozymes. The IgA coats the infant gut and inhibits the attachment of diarrhoea-causing bacteria such as *Streptococcus* sp., *Staphylococcus* sp., and *Haemophilus influenzae* (Andersson *et al.* 1986), whilst lactoferrin preferentially binds iron into the infant gut, depriving bacteria (Park, 2009). Cow and goat's milk shows lower inhibitory activity against bacterial infection in infants because they contain significantly less of these beneficial proteins (figure 7.23, Park 2009, 64). Human milk has ten times the amount of lactoferrin than the animal milks, as well as over ten times the amount of IgA. Decreasing the intake of disease preventative breast milk with a substitute that is less rich in antibodies increases the risk of diarrhoea, a common weaning affliction that could lead to dental hypoplasia.

Proteins	Goat's milk	Cow's milk	Human breast milk
Lactoferrin (µg/mL)	20-200	20-200	2000
Transferrin (µg/mL)	20-200	20-200	50
Prolactin (µg/mL)	44	50	40-160
IgA	30-80	140	1000

Figure 7. 23. A table showing the antibiotic constituents of different types of milk.

Weaning on to milk perhaps made diarrhoea bouts less life threatening than in the earlier a-ceramic Mesolithic because their emaciating effects are offset by a more robust body mass. Hence, although child mortality persists from Skateholm II-Skateholm I, it is in a reduced state. At Skateholm II 18% of the burials were focused on rectifying child mortality, compared to a reduced 11% in the Skateholm I population (Fahlander, 2008; Nilsson Stutz, 2003).

Finally, a possible consequence of an altered weaning age may be the values ascribed to the relationship between parent and child. Breastfeeding engenders socially negotiated attitudes to childhood: what it is, and its relationship to adulthood, community investment in childhood, individual autonomy, not to mention acceptable childhood practices for things like work and eating. By beginning weaning earlier the relationship between mother and child may have changed, with nurturing values to childhood being supplemented by a greater autonomy of the child. Although joint burial between (symbolic) parent and child is a practice that persists up to the early Neolithic, children may also be accorded additional value in society. Returning to the Skateholm skeletal evidence, a-ceramic evidence of wear facets is slim in individuals up to 8 years-old, whereas in the later ceramic Mesolithic children as young as 4 years-old show evidence of wear (Alexanderssen, 1988). If these wear facets are activity related, as the adult versions suggest, this would seem to point to the much earlier inclusion of 'children' in productive community activities involving mechanical manipulation of materials with the teeth, such as basketry or leather-working.

7.2.4.2. Lactose as toxin: attitudes to milk processing.

In section 7.2.2 it was argued that the introduction of pottery into Mesolithic cuisine brought about an alteration to an ideology founded on the value of animal-human-plant permeability. Instead, it was shown that the *manufacture* of pottery engendered a focus on the values of more permanent transformation between states, from soft to solid, death to rebirth, white to red. It is this point that I would like to take up once again now, and explore evidence for the way the *use* of pottery for dairy foods ignited and reinforced values about transforming states of being. Part of the significance of dairy products as the *earliest* example of domesticated cuisine components derives from a late Mesolithic pursuit and fascination with physico-chemically dynamic foods, such as colloids, that have the capacity to enter into multiple states-of-being.

At Neustadt, the evidence for dairy foods in pointed-based pottery could be as old as 4700-4600 BC because this is when evidence suggests ceramics first came in to use on the site (Glykou *pers. comm.*). The location of the site less than 200km north of agro-pastoral communities further south would suggest that knowledge of dairy foods was at least physically accessible right from the beginning of the introduction of pottery. A clearer idea of exactly *how* early these dairy foods in Mesolithic vessels are, must await direct AMS dating. The site of Åkonge however, exhibits a predominantly 'transitional' ceramic inventory and seems to have been occupied for a relatively short duration (Koch, 1998) which suggests that the late Mesolithic style vessels with dairy evidence in northern Denmark come from a later period of the Mesolithic. Certainly this is supported by the presence of an isotopically dairy signature in the complete vessel 'Peter's Pot', which was deposited at the fringe of the settlement area proper and is a Type 0 hybrid (Fischer, 1984).

Figure 7. 24. A wooden spoon from the Danish National Museum collection. The spoon is from Maglelyng in the Åmosen.

In the results from Neustadt there was a diversification in the forms of vessels associated with dairy activities during the Funnel Beaker period. This diversity is not in evidence in late Mesolithic ceramics which all follow a similar chaîne-opèratoire, which would seem to suggest that the earliest use of milk had not been invested with specialised technology, and perhaps the process of expanding this technology went in tandem with a local exploration of the properties and values of milk rather than being immediately transferred from farming groups. The making of butter in pointed-based vessels, for example would be difficult because the process requires the separation of cream from milk. This is a challenging activity in the more closed-vessel forms, especially using flat ladels such as are known from Maglelyng in the Åmosen (4500-4000 BC) (figure 7.24).

The transformation of milk into different products may have held more values than just an alteration to taste, form and flavour. Natural milk is much higher in lactose than processed forms, with reductions in lactose following sequentially from yoghurt to cheese to butter (figure 7.25) (Ryan, 2004, 60). There is some evidence that

Food	**Serving size, oz**[3]	**Lactose content, g**
Milk	8	9-14
Yoghurt	8	10-15
Hard cheese (cheddar)	1	0.4-0.6
Soft cheese (camembert)	1	0.1
Cottage cheese	8	5-8
Sour cream	0.5	0.6
Butter	0.5	0.1

Figure 7. 25. A table showing the lactose content of different milk derivatives.

suggests lactase-persistence in prehistoric populations in Europe may be associated with the introduction of cattle husbandry (Gerbault *et al.* 2009; Malmström *et al.* 2010). Frequencies of the lactase-persistence allele LCT*P in modern northern European populations are too high to be caused solely by genetic drift, meaning a selective pressure *for* the lactase-persistence allele may be being exhibited (Gerbault *et al.* 2009). However, tying this phenomenon to a Mesolithic-Neolithic population difference has proved more challenging due to a lack of skeletal material, combined with unsuccessful extractions reducing sample numbers even further. Using nuclear DNA Burger *et al.* (2007) obtained high-confidence absence of the lactase persistence allele- associated genotypes from eight Neolithic humans and one Mesolithic sample from northern Europe, out of fifty-one.

Regardless of the *timing* for the introduction of the lactase persistence allele in northern Europe however, it is clear that lactose intolerance prevailed in a higher percentage of the population around the late 5th- early 4th millennia BC. It would seem that milk may have had acknowledged toxic values in some cases- at least to certain adult group members, as well as clearly being desirable since it makes up a strong contribution to pottery cuisine. To those who may have been lactose intolerant, experiments suggest that up to 12g of lactose does not have painful side-effects, but beyond that stomach cramps and flatulence prevail (Hertzler *et al.* 1996). This may have meant that dairy foods were a delicacy to some. The element of danger involved in processing milk, the responsibility to those for whom foods are being made, may have situated milk at the fringe of what food *was* to Mesolithic groups. In this sense the processing of dairy foods within the impermeable control of the pottery cavity is fitting; the milk is separated from the community realm of the settlement for the period of its transformation, by a rigid, impermeable barrier.

During the Mesolithic evidence for the forms this dairy transformation took are difficult to ascertain. Butter, cheeses and yoghurt are all possibilities. These processes are subject to considerable variation in the outcome of the product in terms of flavour, texture and colour, depending on minor alterations to the dairy components and methods used to process them (This, 2006). To make cheese, the warm milk must be acidified through the addition of a starter culture or by leaving the latent *Lacto bacilli* to begin to sour. In the latter case, too much souring without a coagulating enzyme creates a fragile curd that easily collapses. Using this method, timing is imperative and a batch can transform to become 'bad' within a short space. Traditionally, rennet is added before the production of this soured curd in order to bind casein proteins into a substantial curd. Even a drop of rennet to a litre of milk will cause a rapid transformation in the texture and liquidity of the milk. Superficially, the gel that is created looks firm. However, cutting into the curd releases the liquid whey that is trapped in the matrix; from liquid comes solid comes liquid. The whey goes rancid much quicker that the curd and so must be removed to make a durable cheese.

The curds are coaxed out of the suspension at low temperature, but small variations in this temperature can significantly alter the final flavour of the cheese, as can the acidity of the original suspension (This, 2006). In addition, the type of milk used plays a role in texture and flavour, with high protein milks creating dryer curds (This, 2006). So, there are many factors involved in the production of cheese that affect the visible transformations to texture as well as the end flavour. Using late Mesolithic fire technology and ceramic vessels, would almost certainly have led to a range of flavour outcomes, but ultimately the creamy-sour experience would probably have been a novel flavour sensation. As Funnel Beaker forms were introduced, evidence in the form of specialised vessels suggests that the *management* of the transformation of milk was intensified, and consequently flavour variation was invested in.

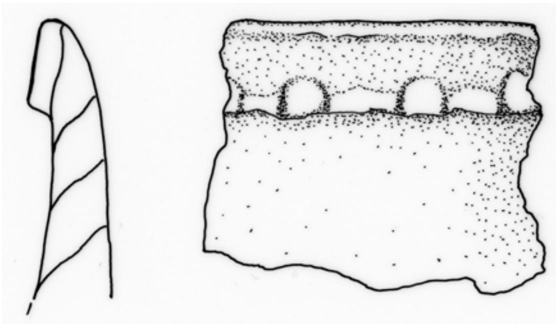

Figure 7. 26. Vessel N_22, a funnel bowl that would have had an open orifice suitable for separating cream, or whey from milk solids. Picture by K. Glykou. Scale 3:4.

At Neustadt, for example, the results of residue analysis show that there is a significant cluster of funnel beaker vessels with low $\delta^{15}N$ values, composed of a variety of vessel forms. N_22 is a funnel bowl (figure 7.26) with an open orifice suitable for the skimming of cream and the separation of whey from milk solids (Koch *pers.comm*). At Wangels vessels that plot isotopically for ruminant dairy include KE_1, a flask. This vessel has a narrow neck suggesting it was valuable at a liquid phase of the process. This feature also allows for the restriction of oxygen to fermentation bacteria, giving better control over the souring.

In addition to these local ceramic developments for the control and enhancement of flavour, vessels at Neustadt also evidence a possible non-local contribution to the process of colloidal transformations. Two of the vessels with low $\delta^{15}N$ values have rims with applied lists of clay- termed 'arcade rims'- characteristic of Michelsberg groups further south in Germany. Neustadt is not alone in this non-local exchange; a radiocarbon dated pit at nearby Flintbek (4233-3969 BC) contained numerous Michelsberg-style vessel sherds (Hartz *et al.* 2002). It may be that dairy foods were valuable exchange items because their successful consumption was a product of their correct preparation; they embodied the value of trust necessary for strong inter-group communications. In addition though, the transportation of dairy products would have introduced new strains of bacterial cultures, which could be used to create innovative alterations to the dairy transformation processes. Thus both the development of specialised vessels and the introduction of non-local bacterial cultures suggest that during the early Neolithic Funnel Beaker period, pottery innovations were strongly related to exploring the transformative values of milk colloids, as expressed through flavour and texture.

7.2.5. Plants.

We have seen that evidence for the presence of domesticated plants such as einkorn (*Triticum monococcum*) are sparse in pottery, and that wild plant foods continue to be used when other domesticated foods get introduced. The values ascribed to wild plants, which motivated their retention, are important to understand therefore. Contextual evidence for the use of plants is sparse compared to animal remains. This is certainly a preservation issue in part, but it is also a product of there being less systematically published material, or where material *is* published it is done so to varying resolutions. Some research, for example, records quantities of different plant remains on site, whilst at other sites plants are listed on a presence or absence basis. This makes it challenging to interpret the relative importance of plants in pots, to plants processed in other ways. Nonetheless, the absence of certain plants from pottery residues where they are found on site would seem to be significant, especially in the case of hazelnut (*Corylus avellana*) which will be discussed here.

This section begins by exploring the relationship between milk and plant foods across the transition. In early Neolithic funnel beaker pottery there is some evidence to suggest the deliberate exclusion of plant material, a contradiction of values that may have established a trajectory that led up to an eventual decline in the use of certain wild plant foods, in favour of domesticated varieties. This is followed by a discussion of which plants were important in the context of pottery compared to those that were not, including possible reasons for this. It is suggested that combinations of different plants used would entail this complex management in the forests and wetlands. The third subsection moves away from those species that are most *dominant* in the pots, to explore the minor element of spice revealed through phytolith analysis. The significance of these findings is addressed in relation to evidence of other spices across Europe and the Near East. It is suggested that these residues reveal the earliest evidence of spice in Nordic cuisine. The *practice* of spicing food highlights the importance of taste to hunter-gatherer cuisine, and opens up the possibility that domesticated plants were adopted as much for the weed species ‘spices’ that cultivation encouraged to invade.

7.2.5.1. The relationship between plants and milk.

In the Neustadt residues, starches consistent with acorn (*Quercus* sp.) are present in c. 89% of surface residues that contain significant plant microfossils, nearly half (44%) of the total residue assemblage. In cluster D of funnel beaker residues with low $\delta^{15}N$ values that has been shown to correspond to dairy single compound isotope signatures there is an absence of plant microfossils, especially of acorn (*Quercus* sp.) type starch. It would seem that plant material was deliberately excluded from this group of vessels. Apart from reinforcing the idea that dairy food processing became more strictly controlled in the early Neolithic vessel styles, the corollary implication is that the processing of plants in the same pots somehow held as dangerous, with undesirable repercussions.

The reason may be found in the purpose of such intensive acorn presence in pottery cuisine. Acorn is high in toxic tannins, in one study of 18 species of acorn tannin percentages ranged from 0.1-8.8% (Bainbridge, 1986). The astringent sensation of eating tannins combines with a bitter flavour and a tendency to induce nausea. For these reasons tannins must be removed from the nutmeat before consumption, and it seems likely that this is a process that was intensively being conducted in the vessels. Soaking the acorns in repeated changes of hot water is a method used by Californian Native Americans (Bainbridge, 1986). So, as with milk products the role of pottery seems to be this controlled transformation of foods that partly encompass dangerous values; milk contains lactose, acorns contain tannins. Significantly, an effect of toxic tannins is to make dairy foods even more high risk cuisine items, because tannic acid inhibits lactase in the intestine (Chauhan *et al.* 2007), and could simulate the symptoms of lactose intolerance. This may explain why there is a separation in these processing activities at Neustadt. This may also explain why there is a nominal increase in the classification of edible reed starches during the early Neolithic, coincident with a decrease in acorn starch forms. The investment in dairy foods during the early Neolithic could have precluded the maintenance of similarly intensive acorn processing, setting a trajectory for the decline of this nutmeat's importance, at least in a pottery context.

7.2.5.2. Plants in pots and plants on settlements: the influence of management strategies on values.

As well as acorns there are a number of other plants worthy of note which were classified in high overall proportions in the pottery vessels. These include fern (*Pteridium* sp.) type starch and the edible reed grain forms (*Acorus calamus, Sparganium erectum,* and *Cyperus longus).* The combined use of these vegetables would necessitate certain broad strategies for managing their biotopes, and consequently those encounters with the plants in a growing state engendered or reinforced certain value-attitudes to them in cuisine. It certainly suggests that the singular role of hazelnuts as the plant staple has been overestimated (Holst, 2010), and that at least duel-staple cuisine with acorns may have been practised, if not multi-staple cuisine.

In distinction to hazelnut (*Corylus avellana*), many of these possible staples also possess dangerous components that can be made safe by appropriate processing, strengthening the claim that a value of pottery in cuisine was a controlled environment for the transformation of dangerous elements. Uncooked bracken contains thiaminase which degrades thiamine (Evans, 1976) and can lead to digestive trouble. Sweet flag (*Acorus calamus*) root has been documented to contain asarone, a toxic compound in the raw root (Chiej, 1984), which can be destroyed by cooking. It would seem that the subtle ginger flavour of the ground root was worthy of the effort (Facciola, 1998).

Based on this evidence, the concept of a staple in the traditional sense is questionable. What we are seeing does not seem to be a case of a singular reliance on an unadulterated starch source as with grain cultivation nowadays. Instead, a range of plants are being managed and processed. It seems likely that starch sources were adulterated by mixing with each other, in a flexible and dynamic environmental-cuisine management regime. Clearly an extensive knowledge is being displayed about the harmful values of these plants, and specific methods for combating them. In addition to this, pottery-related processing can render many of the plant staples suitable for storage. In the case of acorns and bracken, for example, the boiling necessary to make them safe only partially degrades their structural integrity, so after processing they can be dried and used for flour. As a result, the possibility that dietary stress forced the adoption of cultivated cereals, or other domesticates is not supported.

It is possible to understand something of the values of woodland-sourced plant cuisine by exploring the dynamic way woodlands were managed across the transition. The processing of plants in pottery is only part of their biography, but growing, pruning and harvesting regimes make up a temporal investment that contributed to the value of these plants during the more acute biographic phase of cooking and consumption. Oak woodland requires some distinctive management techniques and plant lore knowledge that set it apart from hazel.

Oaks (*Quercus* sp.) are a masting species meaning they don't produce a large crop of acorns annually but every two-five years instead (Keeley, 2002), depending on factors such as the species, nutrition, light access, and early spring frosts. Oaks belong to a masting region, and trees within that region will tend to mast in the same year. Masting regions vary in size, which led similar acorn-consuming groups in Native American California to operate across several masting regions (Andersen and Moratto, 1996). This entailed an intensive knowledge of what features to look for in the plants and surroundings to suggest the annual masting region(s), such as the timing of spring frosts which could damage a crop's development, and a monitoring of nut size. With up to a five year cycle recording the patterns and details of large regions of oak stands the corpus of plant lore and remembered knowledge necessary is immense and suggests a specialised role for those in the group that possessed that knowledge.

So, even without cultural intervention to alter or manipulate the production of these nut crops the amount of retained knowledge to successfully use acorns as a staple is large. Oak trees do respond to certain management practices for the increase of nutmeat yield though, but considering that each masting region will be in a different stage of management only compounds the depth and extension of knowledge a group must manipulate to successfully interact with this crop species. Oaks grow rapidly for around 80-120 years after which their growth slows. At 250-350 years decline sets in. Acorns are not produced until an oak matures to 40 years, with maximum production occurring between 80-120 years (Sork *et al.* 1993). The key feature of oak management is actually *not* to interfere with the trees themselves as much as managing the surroundings. Masting cycles can be affected by excessive intervention such as pruning. Oaks also crop badly if there is a paucity of light, putting them in direct competition with hazel. Therefore, the successful management of oaks entails a strict control over interaction, with direct manipulation likely to be restricted only to specific times such as harvesting, or when an old unproductive tree is to be removed. In Mesolithic-Neolithic plant lore this may have contributed to their liminal status in cuisine, as a plant with dangerous, high-risk associated values, something to be carefully interacted with.

This restricted interaction is played out further in the woodland landscape in the competition between oak and other utilised species. Bracken (*Pteridium* sp.) provides a dense ground coverage that restricts the access of light to oak seedlings. In addition bracken is known to produce allelopathic chemicals (Gliessman, 1976) which allow it to dominate other species by damaging growth. With rootstock occupying an extensive underground region, bracken can quickly expand to cover a hazel/oak woodland understorey. Apart from the damage to saplings, bracken is a hindrance to collecting activities, and so *consumption* of bracken fronds is an effective way of clearing a space around oaks. In effect, the consumption of bracken may be linked to oak and hazel management, and as a possible staple this interaction could have reached pre-cultivation levels. Bracken clearance serves to emphasise a landscape of preserved areas beneath oaks. Clearance of these areas served practical purposes, but may also have entrenched a reverence for a community's dealings with the trees and acorns; they occupied liminal arenas, to be interacted with in prescribed ways and at designated times in order to control the risks of doing so.

In contrast, hazel (*Corylus avellana*) stands need frequent, annual attention and interaction to maintain high production of nuts. Hazel coppicing activity is clearly evident in the frequent use of straight hazel poles for fish traps at many coastal sites (Andersen, 1987; Regnell and Sjögren, 2006a). In contrast to oaks, a high level of human-plant interaction is beneficial to hazel which fruit plentifully from young branches (Regnell and Sjögren, 2006a). Hence an attitude may have prevailed that hazel was a plant with much less dangerous and liminal connotations than oak. Pollen diagrams for southern Scandinavia show that *both* hazel and oak maintain high percentages (15-25%) throughout the Late Mesolithic-Early Neolithic (Regnell and Sjögren, 2006b), a phenomenon that is as much a result of their both occupying upper storey canopy for the wind transportation of their pollen, as well as their co-presence in high numbers in the woodland landscape. If hazel were an under storey shrub, its pollen would be localised, and less likely to present in such high quantities. What this suggests is that hazel and oak were managed into a woodland patchwork, where both were promoted to the light sources of the canopy. As the smaller of the two species, it is likely that hazel would be located more at the woodland fringes, nearer settlements, and thus again in a more intimately interactive human-plant relationship. Compared to oak, hazel was valued as a species that endured and thrived in its relationship with communities, and helped them to do the same. Foundation offerings of a single hazelnut were found in all the post holes at Tågerup (Regnell and Sjögren, 2006a), perhaps to imbue the structure with this valued endurance and thriving fertility.

7.2.5.3. Spice in hunter-gatherer cuisine.

Globular sinuate phytoliths found in the seeds of garlic mustard measure most consistently with the silica examples found in both EBK and TRB samples from Neustadt, Åkonge, Stenø and an Åmosen bog pot. The presence of garlic mustard argues for the selective value of flavour as well as calories in *hunter-gatherer* cuisine. The use of plants which produce potent flavour, and that otherwise offer little nutritional value are a phenomenon conventionally associated with the expansion of cultivated species from the Near East, with Neolithic agriculturalists. Across Europe and the Near East there is widespread coincidence between the findings of cereal remains on Neolithic settlements and what are commonly termed ‘weed-species’. Many of these plants that are secondary colonisers are also spice candidates, and in a capacity ancillary to cultivars they are associated with the phenomenon of Neolithisation (Zohary and Hopf, 2004).

Some of the earliest evidence for spice cuisine comes from the pre-pottery Neolithic B levels at Nahal Hemar cave in Israel (23,000 BP) where desiccated coriander (*Coriander sativum*) mericarps were found (Kislev, 1988). Much of the published evidence for spice use employs uncalibrated dates (bc) without reported ranges. In the following these have been translated into years BP, by adding the 1950 years removed from the original mid-range date point. Caper (*Capparis spinosa*) has been recovered as early as 7800-7750 bc (c.9750-9700 BP) from the a-ceramic Syrian sites of Tell Aswad (Hillman, 1975) and Tell Abu Hureya (Van Zeist and Bakker-Heeres, 1985). By c. 6750 bc (c. 8700 BP) this spice had reached Turkey and is found at the settlement of Hacilar on the Konya Plain (Helbæk, 1970). In Europe opium poppy (*Papaver somniferum*) which is native to the regions surrounding the Western Mediterranean Basin (Bakels, 2009), reaches the area of the Linearbandkeramik culture west of the river Rhine between 5300-4900 BC (Bakels, 2009). Coagulations of poppy seeds have been retrieved from the Neolithic lake villages of Niederwil, Seeberg and Egolzwil (c. 3700 bc, c. 5650 BP) (Jacomet *et al.* 1991; Zohary and Hopf, 2004). It is not until the Middle Neolithic that these spices that originate from Mediterranean Europe and the Near East reach the Atlantic coastal margins. Poppy has been recovered from Eberdingen in German Hochdorf, and Menneville in France around 3000 bc (c. 4950 BP). The earliest recorded example from the true mustard family (*Cruciferae*) is from the Temple Oval at Khafajah in Iraq c. 3000 BC, almost a thousand years later than the examples found in Nordic pottery.

In southern Scandinavia the period over which cereals were introduced also sees an increase in 'weed species', or secondary colonisers. Many of the examples that appear in pollen profiles over this period have been documented to possess flavoursome properties (figure 7.27). For example, the seed of *Galium aparine* (goose grass) has a bitterness likened to coffee, and *Thlaspi arvense* (field penny-cress) has a seed with a mustard taste; both of which appear during the early Neolithic synchronously with the very earliest discoveries of cereal evidence (Regnell and Sjögren, 2006c).

Plant	**Mesolithic**	**Early Neolithic**	**Middle Neolithic**	**Flavour**
***Chenopodium* sp.**	XXO	XXO	XO	-
Anagallis arvensis		X		-
Galeopsis bifida		X		-
Galium aparine		XO	O	Seed has coffee flavour
Galium spurium		X	XO	-
Polygonum aviculare	XO	XO	O	-
Solanum nigrum		X	O	Fruit is musky
Stellaria media	XO	XO	XO	-

Persicaria lapathifolia		X		-
Persicaria maculosa	X	X	XO	-
Thlaspi arvense		X		Seed tastes like mustard with a onion hints
Atriplex patula	O			-
Capsella bursa-partoris		O	O	Seeds have a peppery flavour
Euphorbia helioscopia		O		-
Sonchus asper			O	-
Rumex acetosella		XO		-
Silene latifolia		X		-
Potentilla repens		X		-
Arenaria serpyllifolia		O	O	-
***Cerastium* sp.**		X		-
***Cirsium* sp.**		X		-
***Epilobium* sp.**		X	O	Dried root is sweet
Lythrum salicaria		X		-
***Potentilla* sp.**	XO	XO	O	The roots of some of these species taste like parsnip.
***Vicia* sp.**		O		Flowers and seeds/pods are sweet
Spergula arvensis		O	O	Seeds are bitter
***Trifolium* sp.**		O	O	The herb has vanilla tones
***Veronica* sp.**			O	-

Figure 7. 27. A table showing the 'weed-species' introduced with the earliest advent of cereals in southern Scandinavia, with documented instances where these plants exhibit spice-properties. O= a minor presence, X= a considerable presence, XX= a major presence. Adapted from Regnell and Sjogren (2006c, 150-151), with additions from Watts (2007), Facciola (1998), and Bown (1995).

Garlic mustard (*Alliaria petiolata*), as possibly the earliest spice in southern Scandinavian cuisine, was a desirable culinary feature in hunter-gatherer foods, and the Neolithic opened up access to a number of other species such as poppy seed (*Papaver somniferum*), which was present in the southern Baltic by 3000 bc (c.4950 BP). The adoption of agricultural staples is a high-risk enterprise (Zvelebil, 1994), especially in the early stages when cultivation techniques are developing and it has not been satisfactorily explained why domesticated cereals were added to the culinary repertoire of hunter-gatherers that had otherwise been successfully subsisting on wild foods for millennia. Explanations have tended to emphasise how social and environmental stresses *forced* adoption in order that calorific needs be met. These findings of very early spice use suggest that there was a tradition of spicing food extending back into hunter-gatherer cuisine that may have influenced the *degree* to which cereal agriculture was practised, with more intensive cultivation regimes entailing a corresponding rise in these possible spice plants. Perhaps it was not just cereals that were desirable commodities of exchange with farmers, but also secondary spice plants that in the longer term acted to help consolidate an agricultural way of life.