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ORIGINAL ARTICLE

Marijke van der Veen · Glynis Jones

A re-analysis of agricultural production and consumption: implications for understanding the British Iron Age

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Abstract Patterning in the carbonized seed assemblages from Iron Age sites in Britain has led to the development of several explanatory models. The most influential of these, by Martin Jones, proposed that grain-rich assemblages represent producer sites and weed-/chaff-rich assemblages consumer sites. The assumptions underlying this model and the method of constructing the diagrams are discussed and a new approach is put forward, stressing the need for appropriate levels of analysis and interpretation. It is concluded that a predominance of grain-rich samples is far more likely to be an indicator of the scale of production and consumption, than a means of distinguishing between the two. A review of the evidence from Iron Age Britain indicates that grain-rich site assemblages primarily occur in the south of the country, and frequently co-occur with pits, used for the storage of surplus grain. Moreover, such pits are concentrated in hillforts. It is proposed that the grain stored in such pits may have been used in large communal feasts and that the hillforts functioned as locations for feasting.

Keywords Agricultural production · Consumption · Iron Age Britain · Scale of production · Storage pits · Feasting

Introduction

The interpretation of patterning in the charred site assemblages from Iron Age and later settlements in Europe has long troubled archaeobotanists. Iron Age Europe was a society based on farming, farmsteads were the most common form of settlement, and most people were farmers. However, a variety of archaeological evidence points to growing socio-economic change, regionalisation, and the development of elites. In terms of agriculture, this may be reflected in changes in the scale of agricultural production (e.g. ability to produce a surplus, intensive/extensive cultivation regimes) and the level of specialisation (e.g. crops versus animals, farming versus non-farming settlements). The reliable assessment of such changes through archaeobotanical data hinges on choosing the right methodology and the right scale of analysis and interpretation.

To date, much discussion of Iron Age intra- and interregional variation in crop production has focussed on the level of specialisation, namely the identification of producer and consumer sites. A model developed by Jones (1985) and applied to sites in the upper Thames Valley, central-southern England, was the first apparently successful attempt to identify settlements which produced their own crops (arable or producer sites) and those which received crops that had been grown elsewhere (pastoral or consumer sites). This pioneering work has brought archaeobotanical data into the forefront of mainstream archaeological debate and has stimulated much of the more recent research in this area. The model aimed to facilitate easy comparison between sites and to monitor the movement of arable produce across the landscape. While the main assumptions underlying the model and the method of constructing the triangular diagrams were criticised early on (Jones 1987; Van der Veen 1987, 1991, 1992, Chapter 8), the model, and the conclusions drawn from it, are still widely used.

In this paper, we argue that the problems associated with M. Jones' model are such that it cannot be used to distinguish between producer and consumer sites, and that other, more recent explanations of differences between archaeobotanical assemblages at sites in the upper Thames Valley (Campbell 2000; Stevens 2003) are also flawed. Here, we briefly summarise M. Jones' model, and the criticisms it has received, and review the more recent interpretations of the observed site differences. We then approach the problem from a different angle, proposing levels of analysis and

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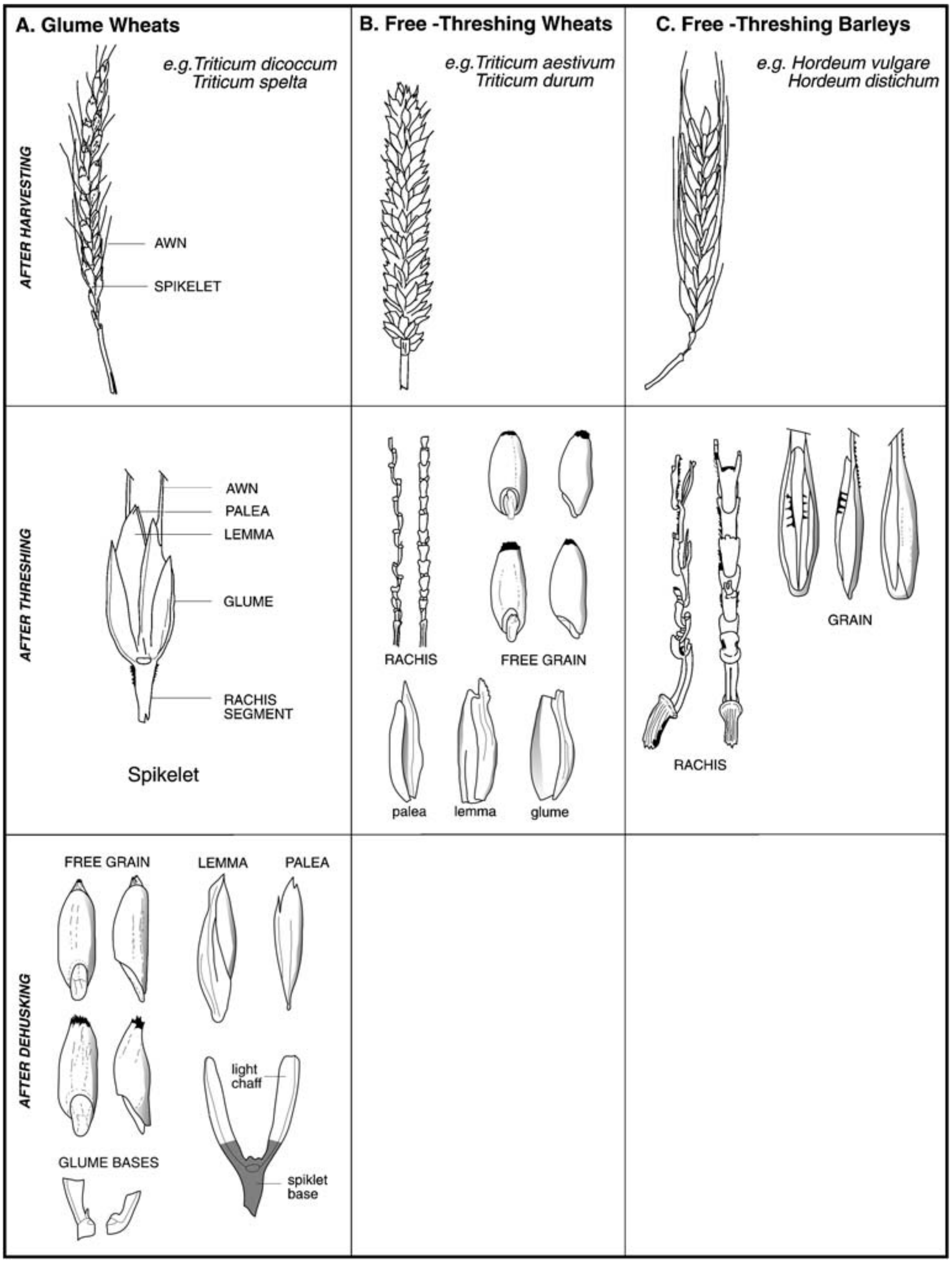
M. van der Veen (✉)
School of Archaeology & Ancient History,
University of Leicester,
University Road, Leicester LE1 7RH, UK
e-mail: mvdv1@leicester.ac.uk
Tel.: +44-116-252-2611
Fax: +44-116-252-5005

G. Jones
Department of Archaeology, University of Sheffield,
Northgate House, West Street, Sheffield S1 4ET, UK

Fig. 1 Effects of crop-processing on glume wheats and free-threshing cereals (after Charles 1984). [Note that hulled barley is a free-threshing cereal; it behaves in the same way as bread wheat during threshing (the 'hulls' refer to the lemma and palea, which are fused with the grain, not to the glumes; Hillman 1981)]



interpretation appropriate to the data available and the questions posed. Finally, we put forward our own interpretation of the patterning observed.

As the model is based on the interpretation of charred plant remains, our arguments inevitably concern detailed considerations of the formation processes of such remains. Some basic features of cereals and the terminology used in this paper are, therefore, briefly explained below.

Cereal types and terminology

The cereals grown in Britain during the Iron Age include both glume wheats (emmer and spelt) and free-threshing cereals (bread wheat and barley), which has implications for the way in which archaeological remains of these two groups of cereals should be interpreted. Because the glume wheats break up into individual spikelets when threshed, while the ears of the free-threshing cereals disintegrate into free grain and glumes (Fig. 1), the glume wheats require further dehusking to release the grain from the glumes, which is not necessary for the free-threshing cereals. Another factor to be taken into consideration is that the chaff elements most likely to survive archaeologically (because of their robustness) are the glume bases for the glume wheats, and the rachis segments for free-threshing cereals.

When we use the term 'producer site', we follow Jones' (1985) original definition of a site growing and harvesting its own crops. This is effectively the same as his later

Table 1 Alternative interpretations of grain and chaff-/weed-rich assemblages

Model	Samples rich in grain	Samples rich in chaff/weeds
Jones (1985)		
Interpretation	Producer site	Consumer site
Reason	Grain wasted at harvest time	Grain carefully conserved
Campbell (2000)		
Interpretation	Fodder scarce	Fodder plentiful
Reason	Chaff used as fodder	Chaff used as fuel
Stevens (2003)		
Interpretation	Communal storage	Household storage
Reason	Storage as 'semi-clean spikelets'	Storage as 'partially threshed ears'
Van der Veen and Jones		
Interpretation	Large scale	Small scale
Reason	Accidental charring of products	By-products of day-to-day processing

definition of 'biological' production (the production of grain by the plant itself), rather than his definition of 'economic' production, which includes all crop-processing activities including the later grain cleaning stages (Jones 1996, p. 34), and which tends to blur his earlier distinction between consumer and producer sites. By consumption we mean the use of these crops, mostly their consumption as food, as opposed to 'everything that humans do' (Jones 1996, p. 34). For the purposes of this paper, therefore, the inhabitants of producer sites are cultivators (as well as consumers of crops), who may or may not export part of their produce, whereas consumer sites import their crops from elsewhere, though they may process them further to obtain clean grain (especially in the case of the glume wheats).

Throughout the paper we will use the terms grain-rich, chaff-rich and weed-rich to refer to the *relative* quantities of grain, chaff and weed seeds. Where large *absolute* quantities are indicated, we have described these as 'large'. Furthermore, the term 'assemblage' will be used to indicate a *site* assemblage of archaeobotanical remains, while the term 'sample' will be used to refer to the plant remains recovered from a *single* archaeobotanical sample.

M. Jones' archaeobotanical model of production and consumption

The model

The model relies on the interpretation of triangular diagrams, which display the broad compositional characteristics of charred plant assemblages from individual sites (Jones 1985). M. Jones made the convincing case that the occurrence of grain-rich samples required an explanation, as grain is that part of the harvest least likely to be wasted, and he argued that the "most likely place for this unlikely event to occur is at its place of production" (Jones 1985, p. 120). By plotting the relative proportions of cereal grain, chaff and weed seeds onto triangular diagrams, on a sample-by-sample basis, and giving a measure of seed density, the overall assemblage from each site could be characterised. Grain-rich sites (i.e. Ashville and Mount Farm) were interpreted as producer sites, and sites poor in grain (but rich in weeds and/or chaff) as consumer sites (i.e. Smith's Field and Claydon Pike) (Table 1). Danebury is different from both of these categories in terms of both composition and density, and was interpreted as being engaged in a "broad range of agricultural activities" (Jones 1985, p. 121). Finally, sites where the samples are concentrated in the centre of the diagram (with approximately equal proportions of grains, chaff and weeds; e.g. some Iron Age sites in north-east England) were seen as "self-contained units" (Jones 1996, p. 35).

The critique

While the aspiration of the model was widely welcomed, three aspects were criticised from the start. Firstly, in the construction of the diagrams the content of each sample is summarised without regard for context or species composition. With regard to the latter, any variation in the abundance of glume wheats (emmer or spelt wheat) versus free-threshing cereals (bread wheat or barley) affects the location of samples in the diagram (Jones 1987; Van der Veen 1991, 1992, p. 98), because of differences in the likelihood of chaff from these two types of cereal being found archaeologically. The chaff of free-threshing cereals is largely represented by rachis remains, which are removed early in the processing sequence, often off-site. These are, consequently, relatively rarely represented in archaeobotanical assemblages. The chaff of glume wheats, on the other hand, is largely composed of glume bases, which are removed at a later stage of processing, often on a day-to-day basis in a household context (Hillman 1981). Thus, variations in the proportion of chaff as indicated in a triangular diagram may reflect variations in the relative importance of emmer and spelt wheat versus bread wheat and barley, rather than variations in subsistence strategy. Secondly, the assertion that grain is wasted more frequently on producer sites than on consumer sites is questionable (Jones 1987; Van der Veen 1991, 1992, p. 98). It has been argued that, on the contrary, producer sites are characterised by the 'waste' from early stages of crop-processing (straw and rachis) and consumption by grain-rich samples (Hillman 1981, 1984a). The burning of grain usually represents an accident, and accidents can occur on all types of site (Jones 2000). Finally, the diagrams make no reference to context or crop-processing stage; this is problematic because variations between sites in the contexts or stages sampled (e.g. storage areas versus ditch fills and/or products versus by-products) may affect the position of samples in the diagram (for example, storage areas house the cleaned products of crop-processing and so are likely to be richer in grain than ditch fills receiving waste mainly from the by-products of crop cleaning) (Van der Veen 1992, p. 98).

Problems with the application of the model

Attempts to apply the model have been problematic, with authors struggling to interpret the patterns found. The classification provided by the model frequently failed to match the expectation based on other information. M. Jones encountered such a situation himself at Maiden Castle, where the assemblage was dominated by chaff (especially glumes) and to a lesser extent weeds, even though grain-rich samples might reasonably have been expected, given the type of the site: a hillfort, like Danebury, with ample storage facilities (Palmer and Jones 1991). This discrepancy was explained by (1) a sampling factor (the area excavated was small and grain-rich deposits may have lain outside this area), (2) a taphonomic factor (locally poor preservation of grain), and (3) a cultural factor (scale of storage smaller than at Danebury) (Palmer and Jones 1991, p. 136). In fact, in the original study, the evidence that Danebury was a site supplied with crops from various parts of its territory was based primarily on the presence of weed species representing a mixture of ecological types (Jones 1985), rather than on the relative proportions of grain, chaff and weeds. The suggestion that this grain would then leave Danebury in a clean state introduces a methodological problem. The sites receiving this grain would be characterised by clean grain only, similar to the grain-rich assemblages considered by M. Jones to be typical of producer sites, making the two types of site difficult to distinguish.

Similarly, the application of the model to Iron Age sites in north-east England led to all sites south of the river Tyne being classified as consumer sites, which would have meant a complete absence of producer sites in that region (Van der Veen 1992, Chapter 8). Conversely, the assemblage from a Roman fort at South Shields was classified as a producer site, even though the assemblage was derived from a granary destroyed by fire at a classic consumer site (Van der Veen 1992, Chapter 8).

Alternative interpretations of variation in archaeobotanical site assemblages

Recently, two researchers have offered interesting alternative interpretations of the patterns observed by M. Jones, which provide new insights into the possible nature and organisation of Iron Age settlement and stimulate further debate. We review both of these interpretations here (see also Table 1).

Use of chaff as fodder

Campbell (2000) applied the model to several Iron Age sites in the Danebury Environs Project and reviewed the evidence from the upper Thames Valley, England. She suggests that M. Jones' producer and consumer sites may, in fact, have all been growing their own crops, and relates some of the observed differences to variations in the need for fodder (Table 1). The inhabitants of sites on the second gravel terrace, where pasture was thought to have been scarce, may have used chaff as fodder rather than as fuel, and hence created charred assemblages low in chaff. Moreover, high status sites with more animals to feed over the winter (examples she mentions are Danebury and Suddern Farm) may also have used all the available chaff as fodder, rather than fuel.

This interpretation is attractive in that it offers a possible explanation for the lack of chaff at some sites, in particular at M. Jones' producer sites which, if they were producing (and presumably partly consuming) their own crops, would be expected to generate considerable quantities of chaff. It does not, however, explain why some samples are dominated by large quantities of grain, a commodity which should not, in the normal course of events, be deliberately burnt. If grain cleaning by-products were used as fodder, any grain that was inadvertently removed in this way would have been consumed by the animals along with the chaff. This explanation is therefore partial, at best, and some other explanation must be sought for the presence of grain-rich assemblages.

Communal versus household storage

Stevens (2003) reinterpreted the assemblages used in M. Jones' original model, alongside some newly studied sites from the upper Thames Valley, and related the differences to the stage at which crops were put into storage which, in turn, may reflect storage at a communal or household level (Table 1). He argued that cleaning waste from wheat stored as 'clean or semi-clean spikelets' led to samples rich in grain compared with weed seeds (as at M. Jones's producer sites), and were characteristic of communal storage, while cleaning waste from wheat stored as 'unsieved spikelets'[1] led to samples poor in grain compared with weeds (as at M. Jones' consumer sites), and were characteristic of household storage. While the concept of storing sieved

[1] In fact, Stevens uses the term "partially threshed ears" here but, as glume wheat ears inevitably break up into individual spikelets when threshed (Hillman 1981, 1984a,b), it is not clear how 'partially threshed ears' would ever be generated. As Stevens himself implies that both types of storage product are still in a state where the glumes (chaff) tightly invest the grain (i.e. they have not undergone the dehusking process), the term 'unsieved spikelets' is used in place of 'partially threshed ears'.

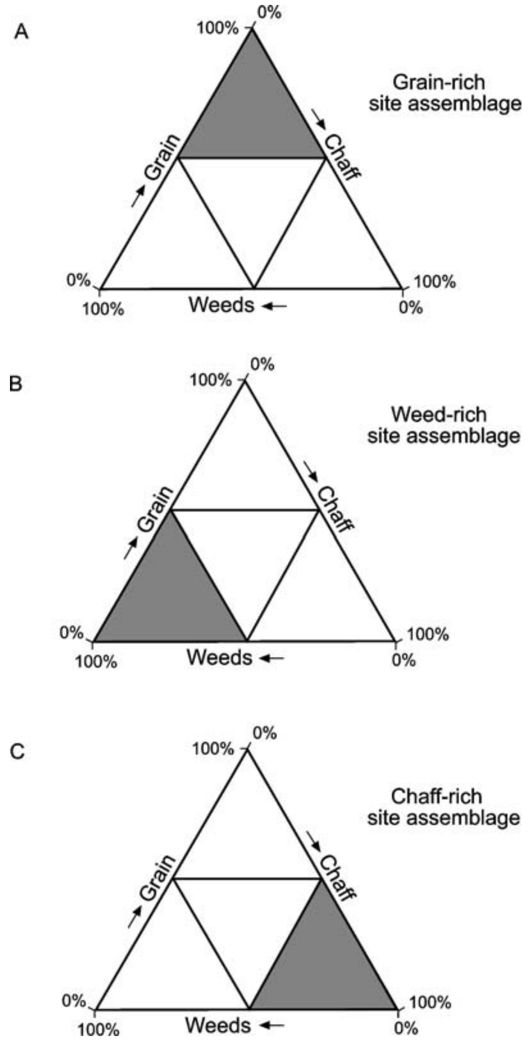


Fig. 2 Different types of charred plant assemblages. *Shaded areas* indicate the position (in the plot) of the majority of samples in each type of assemblage

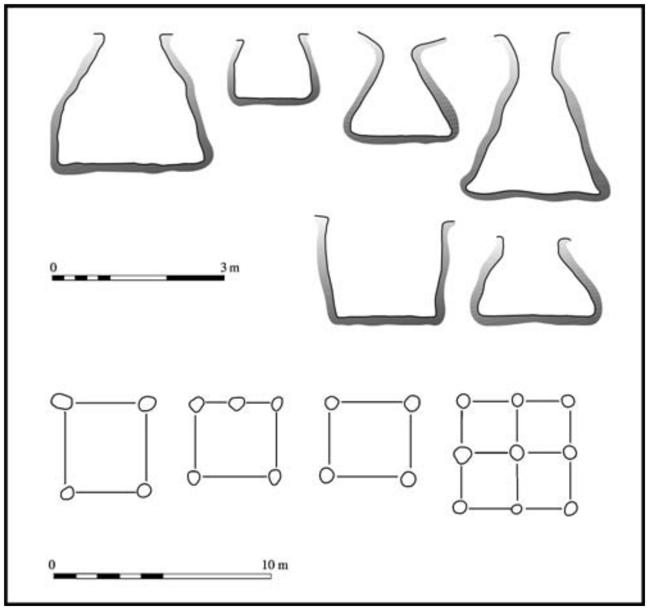


Fig. 3 Storage pit profiles and four-post granary plans from Iron Age Britain (after Cunliffe 1991; Fig. 15.2)

versus unsieved spikelets is an interesting one to explore (and could indeed have some connection with household or communal storage practices), it does not explain the pattern observed. Both forms of storage involve whole spikelets, and the quantity of grain relative to chaff (glumes) would therefore be the same in both cases.

Stevens maintains that the samples from his sites consist primarily of the processing waste associated with the routine, day-to-day dehusking and cleaning of glume wheat spikelets, after these had been taken out of storage (and that samples rich in grain result from a bias against the preservation of chaff in this type of processing waste—cf. Boardman and Jones 1990). However, contrary to what he says, this would generate samples rich in weed seeds relative to chaff at sites where unsieved spikelets were stored (i.e. samples in the bottom left corner of a triangular diagram—see Fig. 2b), and samples rich in chaff relative to weed seeds where sieved spikelets were stored (i.e. samples in the bottom right corner of a triangular diagram—see Fig. 2c). If there were a bias against chaff, because it is preferentially destroyed compared with grain, some of the chaff-rich samples would appear higher in the triangle. In fact, however, neither of the sites (Ashville and Mount Farm) that he classifies as storing cleaned spikelets (indicating communal storage, the equivalent of M. Jones' 'producer' sites) have samples rich in chaff compared with weed seeds, whereas some of the samples from sites (e.g. Gravelly Guy and Yarnton) classified as storing unsieved spikelets do (indicating 'household' storage, the equivalent of M. Jones' 'consumer' sites; Stevens 2003; Fig. 3). This is the opposite of expectations based on his model.

Formation of the archaeobotanical record and the scale of agricultural production and consumption

It will be clear from the discussion earlier that we cannot expect a simple relationship between the observed patterning in the charred plant assemblages and the status of the sites in terms of production or consumption, nor do the alternative interpretations put forward by Campbell (2000) and Stevens (2003) explain the observed differences between sites. Nevertheless, patterning in the crop, chaff and weed components exists in the archaeological record and the desire to interpret their meaning remains. We contend that an appreciation of the formation processes underlying the charred archaeobotanical record will help understand the patterning.

With the exception of deliberate offerings or destruction due to conflict, charring events usually occur in one of three circumstances: (1) when the by-products of grain dehusking and cleaning are deliberately burnt as either fuel or waste, (2) when an accident occurs during some process involving fire, e.g. during parching, drying or cooking, and (3) when a building containing stored produce catches fire.

The first circumstance mostly arises from day-to-day processing immediately prior to consumption and is likely to yield samples rich in chaff and/or weed seeds rather than grain. Cooking will often involve 'processed' grain (e.g. cracked wheat or flour) or cooking with water, neither of which is likely to generate whole, charred grains. Drying/parching and destruction in store therefore remain the most likely events leading to samples rich in charred grain, and more likely (at least for large grain-rich samples) than either the 'wastage' of grain proposed by M. Jones or the preservation bias against chaff in processing waste proposed by Stevens (earlier). Thus, though most archaeobotanical material was probably generated during the day-to-day processing of cereals, some was generated during infrequent accidents.

The day-to-day processing of cereals took place at all sites (producers and consumers), and the presence of samples consisting primarily of chaff and/or weed seeds is, therefore, to be expected at all sites. In contrast, the occurrence of large grain-rich deposits, as Jones (1985) says, needs explanation. The answer to the question, "where are accidents involving parching, drying and storage most likely to occur?" is that they will tend to occur in places where these activities are regularly carried out, i.e. where grain is handled in bulk. Hillman (1984a) suggested that quantities of charred grain most commonly occur on large sites, whether large producers (e.g. for a later period, manorial farms) or large consumers, since there is more opportunity at these sites for accidents such as the destruction of a store by fire (or for large-scale parching/drying accidents).

A possible exception to this association of grain-rich deposits with accidental charring is the cleaning of storage pits through the deliberate burning of pit linings. This activity could generate grain-rich deposits that were not created by accident, though the *absolute* number of grains might be smaller in this case. Furthermore, as these pits tend to be associated with the large-scale handling of cereal produce (see later), they also point to sites engaged in the bulk handling of grain.

In other words, a predominance of grain-rich samples (interpreted as accidental charring of cleaned products or the deliberate cleaning of storage pits by fire) is far more likely to be an indicator of the *scale* of production and consumption than a means of distinguishing between the two (see also Van der Veen 1987, 1991, 1992, Chapter 8). The upper Thames Valley 'producer' sites may therefore represent large-scale production and/or consumption and the 'consumer' sites may represent settlements engaged in small-scale activity in relation to cereals.[2] Whether the sites are producers or merely consumers of cereal grain may not be reflected in the chaff:grain ratios because sites that import grain in bulk, and then store and dry it, might well produce plant assemblages very much like large-scale producers, and small producers may be indistinguishable from small consumers (Van der Veen 1991).

[2] We agree with Stevens (2003) that it is unlikely that M. Jones' 'consumer' sites in the upper Thames Valley were purely 'pastoralist' sites, as this would imply a level of agricultural specialisation (in crops or animals) not known in Britain until the mid 1900s. Non-farming pastoralists are rare, and are typically found only in extreme environments such as deserts. Instead, we interpret these sites as having little emphasis on arable production, or as occupied for a short period of time only. Indeed, the concept of consumer sites of cereals is one we would see as having little relevance for rural settlements in Iron Age Britain, with the possible exception of 'special' sites such as the port-of-trade at Hengistbury Head.

Levels of archaeobotanical analysis and interpretation

The fact that some archaeobotanical samples are generated during routine activities while others occur primarily by accident also has implications for the level at which archaeobotanical remains should be analysed and interpreted (cf. Jones 1991).

Level of analysis

A critical drawback of M. Jones' model is that it interprets a site assemblage 'mechanically' on the basis of broad botanical composition. We have indicated above that the complexity of the archaeobotanical record is such that only an analysis that takes account of this complexity can hope to succeed. This means that we need to understand the taphonomic pathways of individual samples (primarily from botanical composition but also taking into account archaeological context—Dennell 1974, 1976; Hillman 1981, 1984a; Jones 1984a,b, 1987). Only through this type of analysis can a distinction be made between regular, routine activities, of a particular type, and rare accidents, with their likely cause. While at the level of the sample this may be seen as rather mundane in itself, the bringing together of samples which have first been interpreted individually ultimately provides a more reliable interpretation at the site level and above, than does the broad botanical site composition.

We suggest therefore that, rather than using a triangular diagram to summarise the botanical composition of a whole site, methods are first applied to determine the origin of individual samples. This can be achieved through a combined consideration of the ratios of major plant components (grain, chaff, straw and weeds), the *types* of weed accompanying crops, and the circumstances of deposition (see Table 2). Another advantage of this approach is that it allows the calculation of separate chaff:grain ratios for free-threshing cereals (rachis internodes:grains) and glume wheats (glume bases:grains), while still allowing the calculation of weed:grain ratios, as it is not possible to determine the association of particular weeds with a particular crop type in a mixed sample (Hillman 1981, 1984a; Jones 1984a,b; for applications see Jones 1987; Van der Veen 1992; Campbell 2000; Hodgson et al. 2001). As different types of weed are removed at each stage of processing, this provides a complementary way of assessing processing stage and is applicable to both glume wheats and free-threshing cereals. This can be achieved through multivariate statistical methods (Jones 1984a,b; for applications see Jones 1987; Van der Veen 1992; Charles and Bogaard 2001) or, more simply but less conclusively, by

Table 2 Variables useful for the identification of crop-processing stage, and their likely meaning

Sample variable (ratio)	Sample origin	
	High value	Low value
Cereal straw nodes/grains	By-product from early processing stage	Grain product
Free-threshing rachis internodes/grains	By-product from early processing stage	Grain product
Glume wheat glume bases/grains	By-product from late processing stage	Grain product
Weed seeds/cereal grains	By-product from late processing stage	Grain product
Small/large weed seeds	By-product from sieving	Product from sieving or by-product of hand cleaning
Number of crop items per litre of deposit	Rapid/single deposition (usually result of accident)	Slow/repeated deposition (usually day-to-day activity)

Note. For the first three variables the terms 'high' and 'low' value refer to the degree to which they differ from the ratio in the cereal plant; for the last three variables they refer to the relative values within the site/region

calculating ratios of, for example, small weed seeds:large weed seeds. Circumstances of deposition can be assessed through the 'density' of crop remains (number of items per litre of deposit), which gives a broad indication of the rate of deposition, and archaeological context, which may provide a clear indication of the nature of the deposit (e.g. a granary) or simply indicate a secondary or tertiary context (e.g. a refuse pit). This method will also help to distinguish between finds of very mixed origin and those derived primarily from one type of activity.

Level of interpretation

If it is accepted that differences between sites in the amount of grain charred are largely due to chance accidents, then the implication is that one cannot expect all sites to provide evidence for such accidents. On a *probabilistic* level, site assemblages dominated by grain may be an indication of large-scale agricultural activity. The assumption that this would inevitably be the case, however, will result in the misinterpretation of some individual sites, such as a site with small-scale storage totally destroyed by fire or a site with large-scale storage which happened never to have suffered any fire damage or where the area excavated lay outside that where grain-rich deposits were dumped (e.g. as suggested for Maiden Castle). To overcome this chance element, it is necessary to interpret charred archaeobotanical site assemblages at a regional level where individual sites make only a limited contribution to the overall pattern. The most useful levels of analysis and interpretation may therefore be those of the individual sample and the broad geographic region, respectively.

Grain-rich assemblages in Iron Age Britain—A reinterpretation

An examination of the likely reasons for the presence or absence of large grain-rich samples, at a regional level, may tell us more about the nature of early agriculture than whether individual sites were importing grain or producing their own. Large quantities of grain in the Iron Age, for example, have been contrasted with the relative lack of charred grain from Neolithic deposits, and used to suggest that cereals were not an important source of food in the Neolithic period (e.g. Barrett 1994; Edmonds 1997; Moffett et al. 1989; Thomas 1991). This has been questioned by several authors (e.g. Cooney 1997; Jones 2000; Monk 2000; Rowley-Conwy 2000) who attribute the lack of charred grain in Neolithic Britain to taphonomic causes and contextual differences (and indeed recent evidence suggests that the quantity of cereal grain from Neolithic sites is not substantially less than that from the Iron Age; Jones and Rowley-Conwy 2006).

We interpret large, accidentally charred grain-rich samples as representing large-scale production and/or consumption, rather than simply reflecting the relative contribution of cereals to the diet. Thus, any evidence indicating greater quantities of grain in the Iron Age suggests that arable production in some parts of Britain had moved beyond subsistence and included a considerable degree of surplus production.

Storage pits

The most striking aspects of cereal production patterns in Iron Age Britain are: (a) the distribution of grain-rich site assemblages and (b) the distribution of large-scale grain storage facilities. Significantly, grain-rich site assemblages are rare, but have been found in central and southern Britain (Jones 1985; Stevens 2003). This distribution is not dissimilar to that of the storage pits and, to a lesser extent, four-post structures (Gent 1983; Figs. 3 and 4), both of which have been widely identified as storage facilities for cereal grain (Bersu 1940; Cunliffe 1992; Reynolds 1974). The geographical distribution of pits is largely conditioned by the underlying geology, for they are primarily found on calcareous bedrocks, but also on gravels and clays (Bradley 1978; Cunliffe 1992). The distribution of four-post structures is wider than that of the storage pits, but both have their greatest concentration in central-southern Britain.

Recent four-post granaries use ventilation and the act of raising the grain off the ground as mechanisms to prevent damage by heat, moisture or vermin, while pits

Fig. 4 Distribution of four-post granaries and storage pits in Iron Age Britain (after Gent 1983; Figs. 2 and 4)

hermetically sealed by a clay layer (or similar) prevent all three (any oxygen present is soon used up by an outer layer of germinating grain preventing biological activity and thus any real damage), plus fire and theft (Fenton 1983; Sigaut 1988). Archaeological examples of four-posters are usually interpreted as storage structures for grain or other foods to which access was needed on a regular basis, while storage pits, which only function as satisfactory storage features as long as the content of the pit remains hermetically sealed, are interpreted as silos for long-term storage, specifically of seed-corn (Bradley 1978; Cunliffe 1992, 2000, p. 130; Jones 1984a,b; Reynolds 1974). This is, in fact, *contra* Bersu (1940, p. 98), who first discussed the presence of the storage pits on Iron Age sites in detail. He argued that seed-corn was probably stored in above-ground granaries, not in pits, because he assumed, probably erroneously, that grain stored in pits ran the risk of sprouting, as pits were often "damp and musty".

Yet, there are good reasons to question the interpretation of pits as storage facilities for seed corn as it is based on the assumption that seed-corn needed to be stored in sealed pits to safeguard the grain for the long period (over winter) between harvest and sowing. It is incorrect, however, to assume that wheat, at least, was sown in spring during the Iron Age. In the Neolithic, emmer wheat was the principal wheat crop in Britain (Jones and Rowley-Conwy 2006), but was replaced by spelt wheat in the Iron Age (Jones 1981). While the usual sowing time for emmer is debated (Percival 1921; Jones 1981; Hillman 1981), spelt wheat is universally regarded as best suited to an autumn sowing regime (Jones 1981). So, as at least one of the crops most commonly stored in Iron Age pits, spelt wheat, was almost certainly an autumn-sown crop, the time between harvest and sowing would, in this case, have been very short (no more than 2 months). This undermines the supposed association between long-term pit storage and seed-corn. Indeed, Campbell and Hamilton (2000) have suggested that spring sowing was first practised in Britain at the end of the Iron Age because *Avena* (oat), which is thought to have been a weed of spring sown crops, increases relative to *Bromus* sp. (brome grass) by this period.

There is also no ethnographic evidence for the storage of seed-corn in pits. Sigaut (1988, p. 22) refers to the storage of grain in such silos as the storage of bulk grain on a rather large scale, and Fenton (1983, p. 586) refers to pit storage as a way of securing surplus grain for long periods and keeping it safe from intruders. He goes on to say that "there is nowhere in the more recent literature a suggestion that seed-grain is stored in this way, but rather surplus grain. . ." (ibid, p. 586).

Indeed there are compelling arguments to suggest that pits were used for the storage of surplus grain. While storage pits are known from earlier contexts, they are

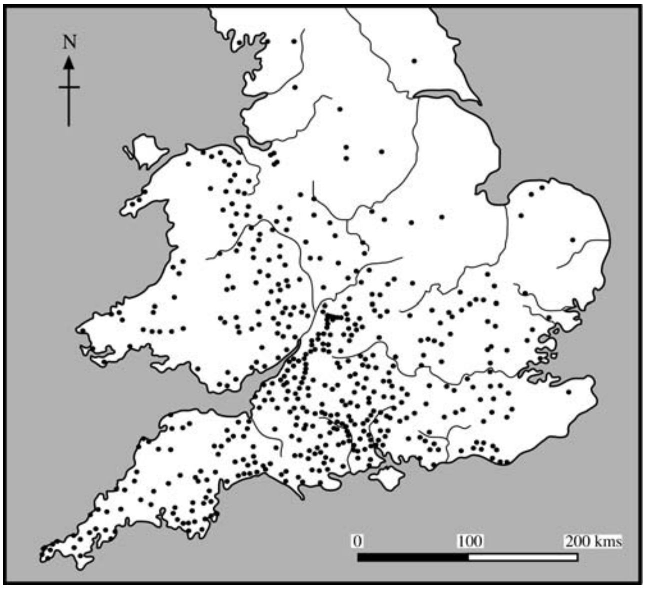


Fig. 5 Distribution of hillforts in Iron Age Britain (after Cunliffe 1991; Fig. 14.1)

uncommon and usually much smaller than Iron Age examples, and they disappear quite abruptly during the Late Iron Age. Their chronological spread is very specific: they occur between ca. 800 and - 100 B.C. in Britain (Cunliffe 1992) and, similarly, ca. 900 and - 20 B.C. in northern France (Gransar 2000). Thus, underlying geology alone cannot explain their presence. Rather, they predominate on a certain type of site, the so-called hillforts (Fig. 5; Cunliffe 1992; Gent 1983), where the amount of storage they provide often exceeds the needs of the individual site, especially during the Early Iron Age, suggesting some form of centralised storage of surplus grain (Cunliffe 1992; Sharples 1991).

Hillforts

This interpretation would fit comfortably within current models of social and economic change put forward for the Iron Age (e.g. Cunliffe 2000, Chapter 4; Haselgrove 1999; Sharples 1991). Such models have identified the demise of the position of the elites in the Late Bronze Age caused by the development of the new iron technology and the consequent reduced role of long-distance trade of precious metals. It is thought that this led to an increased reliance on the creation of—and control over—agrarian surpluses during the Iron Age.

In Britain, this period sees the development of hillforts. These are large sites, typically 300–600 m in diameter, and usually located on prominent hilltop locations. They are characterized by substantial bank and ditch ramparts. While such sites are known to have existed as early as the Bronze Age, most of them were built during the Iron Age and in a restricted part of the country only (Fig. 5), which broadly corresponds to the distribution of grain-rich site assemblages. The first Iron Age hillforts appear around 600 B.C., some 200 years after the start of the Iron Age. Initially they were simple in outline and of medium size, approximately 300 m in diameter. While they were originally seen as central places and residences of the elite (part of redistributive chiefdoms), it is now clear that these sites may not have been occupied permanently, since little evidence for occupation or indeed for their elite status has been found (Hill 1995b). Moreover, at Danebury, many of the storage pits appear to have been left open for longer periods than those at non-hillfort sites (Hill 1995a). More recent interpretations emphasize their communal role (Hill 1995a,c; Sharples 1991), which fits with the suggestion of centralised storage.

From about 300 B.C., we see a dramatic change. Several of the hillforts increase in size, and receive very substantial additions to the ramparts; moreover, there is evidence for increased occupation and increased storage facilities. These later hillforts are referred to as 'developed' hillforts. At the same time, we see that most other hillforts and smaller settlements in the vicinity of these 'developed' hillforts were abandoned, and there is clear evidence of settlement nucleation. The very appearance of the 'developed' hillforts is strongly suggestive of a need to emphasise power and dominance, with the earthworks being far in excess of what was needed in terms of defence. They may thus represent a symbol of the community's prestige (Haselgrove 1999).

By the Late Iron Age (ca. 100 B.C. onwards) the pattern changes: the hillforts were abandoned and settlement dispersed again, and storage pits disappear from the record. It is not clear exactly what caused these changes, but most authors refer to a combination of internal and external factors (Cunliffe 1994; Haselgrove 1999; Hill 1995c) including, towards the very end of the Iron Age, the re-emergence of long-distance trade. Throughout the period there is little evidence of social stratification except in south-east England.

Feasting

A possible explanation of the patterns discussed above is that, during the Early Iron Age, many communities in southern Britain worked to achieve grain surpluses, which were stored in pits and used for occasional feasts. Some of these feasts may have been small domestic feasts, others large communal ones, the latter taking place at the regional hillforts, which possibly acted as foci for rituals (Hill 1995b,c; Sharples 1991). By ca. 300 B.C., the leaders of certain communities appear to have succeeded in enhancing their status and prestige to such an extent that they could move into the (developed) hillforts and raise the required manpower to enhance the earthworks at these sites, involving further large-scale feasting and by using reciprocal 'corvée'[3] labour. This was accompanied by the concentration of shrines at such sites and increased evidence for ritual, including the structured deposition of animal and human remains—offerings to the deities—in disused storage pits (as at Danebury and Maiden Castle; Cunliffe 1992;

[3] Corvée, a day's work of unpaid labour due to a lord from a vassal; labour exacted in lieu of paying taxes (The Concise Oxford Dictionary).

Grant 1984, 1991; Sharples 1991). One of several explanations for the abandonment of hillforts by the Late Iron Age and the disappearance of storage pits is that, instead of storing surpluses for feasts, these now left the region in exchange for new consumer goods such as Roman ceramics, glass, and exotic foods such as wine and figs (Cunliffe 2000, pp. 191–192; Haselgrove 1999).

What we appear to observe is a classic change in the way food is used either to homogenise or "heterogenise" the participants in the meal (cf. Appadurai 1981; Dietler 1996; Van der Veen 2003, 2006). During the Early Iron Age grain surpluses may have been accumulated for celebratory feasts. In societies with little social inequality, such as those in Early Iron Age Britain, such feasts would have served to enhance social bonds. Over time certain communities or individuals managed to increase their standing and prestige by hosting more feasts and, by eating the food, the guests accepted the obligation to give something in return, either deference or labour. The shift towards the developed hillforts around 300 B.C. may point to these communities or individuals having achieved special status, and commensal[4] hospitality may now have been used to reiterate and legitimise growing differences in status and power. Leaders of these communities would have been expected to host lavish parties, while participants were expected to pay tribute and/or offer labour. Then, by the very end of the Iron Age, we see a move away from the use of food to maintain and enhance social bonds, towards the use of food to create distance. The emphasis is no longer on the consumption of the same foods (common staples), but on the consumption of different foods (Van der Veen 2006). Certain individuals started to consume wine and other exotic products (such as the figs found at Hengistbury Head—M. Robinson, pers. comm.); and use imported ceramics and glass to enhance the display component of the meal. Thus, we see a move from communal feasts to exclusive dining; in the latter there is no longer any element of reciprocity; the 'audience' no longer participates, as in Dietler's (1996) so-called 'diacritic' feasts.

Conclusion

In this paper, we have drawn attention to two aspects of archaeobotanical analysis and interpretation, one methodological and the other concerning the meaning of charred plant assemblages. First, the fact that grain-rich samples are generated primarily through accidents has two major methodological implications: (a) we need to understand the taphonomic pathway of individual samples, which means that the sample is the most useful level of analysis, and (b) we need to allow for the 'chance' element in archaeobotanical preservation, which means that the region is the most useful level of interpretation. This is in contrast to the more usual approach where the site constitutes the unit of both analysis and interpretation.

Secondly, we argue that, although the use of chaff as either fodder or fuel provides a partial explanation in some cases, the relative proportions of grain, chaff and weeds at archaeological sites tell us more about the scale of agricultural activity than about whether individual sites were consumers or producers, or whether storage was at the household or community level. These latter interpretations are based on the erroneous assumption that grain-rich samples are regularly generated through charring of the waste from routine activities rather than as a result of relatively rare accidents involving fire. We have argued that such accidents are most likely to have happened at sites where cereals are handled in bulk (be they producer or consumer sites), and that grain-rich samples thus point to large-scale production and/or consumption (adding an additional criterion to those discussed by Bakels (1996) for the detection of surplus production). We regard this ability to assess the scale of the agricultural system, with its implication for the presence of surplus production and its consumption, as an exciting new development—it will greatly facilitate the study of both regional variation and socio-economic change.

Finally, we have interpreted the evidence for the production and consumption of grain surpluses in southern Britain as surpluses that may have been produced for—and consumed during—feasts. These may initially have functioned to maintain the social bonds within and between communities, but may over time increasingly have been used by the leaders of certain communities to enhance their own prestige and status, resulting in certain hillforts becoming centres of power. By the end of the period we see a major change: grain surpluses are apparently no longer stored and consumed within the region, but possibly exported out of the region in return for items of elite display. Thus, during the Iron Age grain surpluses in southern Britain were used to mobilise prestige and status through local large-scale feasting; by the Late Iron Age we start to see the mobilisation of grain surpluses across the landscape, something that became more common during the Roman period. To conclude, during the Iron Age grain surplus (the economic capital) was used to acquire social power (prestige within the community); by the end of the period it started to be used to acquire cultural power (exclusivity or elitism, creating distance).

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[4] Commensal, from mensa = table, meaning 'eating together'; eating at the same table as another (The Concise Oxford Dictionary).

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