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Rye in Viking Age Denmark: New Information from Øster Aalum, North Jutland

by PETER ROWLEY-CONWY

INTRODUCTION

The discipline of archaeobotany was first put onto a scientific basis in Denmark through the work of pioneers such as Hans Helbæk and Knud Jessen, and much work has been done within Danish archaeology to elucidate the history of crop plants. Nevertheless, samples of charred grain from the Viking Period are very rare, and the crops and agricultural practices of the period remain little known. The author was therefore very fortunate to be able to study the sample from Øster Aalum in order to contribute to an understanding of the agriculture of the period.

THE ARCHAEOLOGICAL CONTEXT by David Liversage

The site lies on the present west coast of Denmark where there is severe erosion just north of the Limfjord (fig. 1). In Viking times the North Sea undoubtedly lay some kilometers away, and the nearest water was the lake of Fladesø, deposits from the floor of which outcrop on the beach close south of the site. At the time of settlement there was only a very thin layer of blown sand, but now the site is sealed under several meters of dunes. The name "Øster Aalum" is an artificial one, being taken from the Nørre Aalum shown about a kilometer westwards on the eighteenth century Videnskabernes Selskab map.

The sample was recovered from a flat-bottomed pit about 3 m across and 25 cm deep. A photograph of a section through it is shown in fig. 2. It may originally have been a pit house or sunken shed of a kind common in later Iron Age contexts, but owing to the limited nature of the excavation its character is not known with certainty. There was, however, an agricultural settlement as several postholes, a hearth, an old ploughsoil, a field embankment and drainage ditches were observed. The pit fill was wind-deposited and must have formed after the supposed shed had been pulled down. It appeared in section as close irregular lenses of black-olive-brown, and reddish sand. Mixed throughout was a considerable quantity of charcoal, largely in the form of stems of heath plants, but also containing many charred cereal grains and other seeds. Examination showed about three quarters of the charcoal to consist of these stems. Somewhat over 10% was other wood charcoal, and rather under 10% consisted of charred cereal grains and other seeds. It should be emphasised that the charcoal was not from a primary deposit, where it would have formed a compact layer, but was a secondary deposit spread evenly through the whole 25 cm or so of streaky fill.

A few buckets of fill were water-sieved during the excavation, using a sieve with mesh size of about 1.5 mm, until it was thought that a sufficient sample had been collected. This mesh was coarser than ideal, and some small weed seeds were probably lost. If an exact record

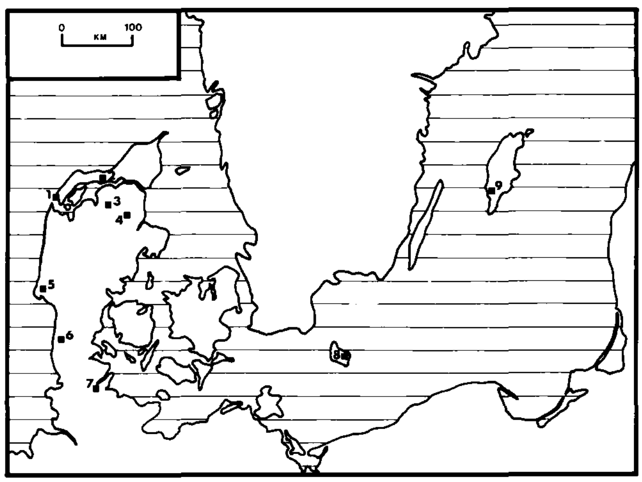

Fig. 1. Map showing locations of sites mentioned in the text. 1: Øster Aalum; 2: Aggersborg; 3: Østerbølle; 4: Fyrkat; 5: Oxbøl; 6: Drengsted; 7: Haithabu; 8: Sorte Muld; 9: Vallhagar.

had been kept of the amount of sand put through the sieve it would have been possible to calculate both the average number of grains in a liter sand and the expected total grain content of the pit. Even as it is it is possible to estimate that the average number of grains in a liter of fill was approximately 150–200, and that the pit held altogether a total of 4–10 liters of grain.

The excavator's opinion is that the grain is present in such quantity that it can only derive from a carbonized store (of which only a small part of course ended up blown into the pit). A hypothesis that seems to fit the observations is that a sod-built structure burned down and collapsed in such a way that the grain stored in it and the heather and other plants in the sods of which it was built were enclosed in the collapse and carbonized rather than totally burned away. It may be supposed that the ruin was later eroded by the wind, and some of its sand and charcoal ended up in a nearby depression. Such erosion is easily envisaged in an area of dune sand!

The result would be the deposition of exactly the mixture of black and red sand, carbonized heather stems, and cereal grains that was found. It is therefore important to remember that it is a secondary deposit, and it cannot be assumed that all the charcoal had a single source, and indeed it seems likely that there were secondary sources as well as the main one. This might apply particularly to the many *Chenopodium album* seeds, and it would be unwise to regard the full weed spectrum as necessarily belonging to the crop: but owing to the large number and high concentration of grains it may fairly safely be assumed that a burned store came somewhere into the picture as the main source.

A sample of the carbonized grain has given a radiocarbon date of 750 ad ± 70, or A.D. 780–855 calibrated (K-4642).

THE SAMPLE

Approximately 0.75 litres of charred material was sent to the author. This consisted mainly of charcoal fragments and pieces of plant material such as small twigs etc. The sample was coned, and one quarter selected for further analysis. This was sorted, yielding 669 cereal grains or fragments of grains, and 259 weed seeds. These are listed by species in table 1.

Preservation of the material was generally poor. Individual cereal grains were sometimes well preserved, but many had been much distorted during charring and heavily eroded subsequently. Identification was limited to grains which were more or less complete. This accounts for the fact that only 328 (49%) of the 669 cereal grains were identified.

Rye, *Secale cereale*		203
Barley, *Hordeum vulgare*,	hulled	24
	indeterminate	82
Oats, *Avena* sp.		16
Wheat, ?*Triticum* sp. (uncertain identification)		3
Total identified cereals		328
Unidentified cereals		341
Total cereals		669
Chenopodium album		177
Polygonum persicaria		17
Rumex sp.		1
Empetrum sp.		10
Silene noctiflora		2
Bromus sp.		8
Gramineae indet.		2
Galeopsis tetrahit		2
Carex eg *curta*		14
Carex sp. (smaller seeded)		15
Carex sp. (larger seeded)		11
Total weeds		259

Table 1. Charred plant remains from Øster Aalum.

A. Rye, *Secale cereale* (N = 50)
length 4.7 mm, standard deviation ±0.6 mm (range 3.7 – 6.2 mm)
breadth 2.35 mm, standard deviation ±0.3 mm (range 1.7 – 3.1 mm)
thickness 2.1 mm, standard deviation ±0.3 mm (range 1.5 – 2.8 mm)

B. Hulled Barley, *Hordeum vulgare* (N = 21)
length 6.1 mm, standard deviation ±0.7 mm (range 4.9 – 7.5 mm)
breadth 3.3 mm, standard deviation ±0.4 mm (range 2.2 – 4.3 mm)
thickness 2.6 mm, standard deviation ±0.4 mm (range 1.8 – 3.3 mm)

Table 2. Dimensions of the Øster Aalum seeds.

Of the 106 barley grains, 24 were definitely hulled. The remaining 82 were undiagnostic in this respect, and so could have been hulled or naked. No definitely naked grains were seen, however, and traces of the hulls may very easily disappear from the grains especially when preservation is poor. It is therefore quite possible that the entire sample may originally have been hulled. The presence of numerous twisted, assymetrical grains indicates the six row variety. Measurements are given in table 2 and fig. 3.

Grains of rye were approximately twice as common as barley in the sample, and showed the typical dimorphic morphology of the species. Some grains were long, narrow and slightly curved, others shorter, more squat and straight. Measurements are given in table 2 and fig. 3.

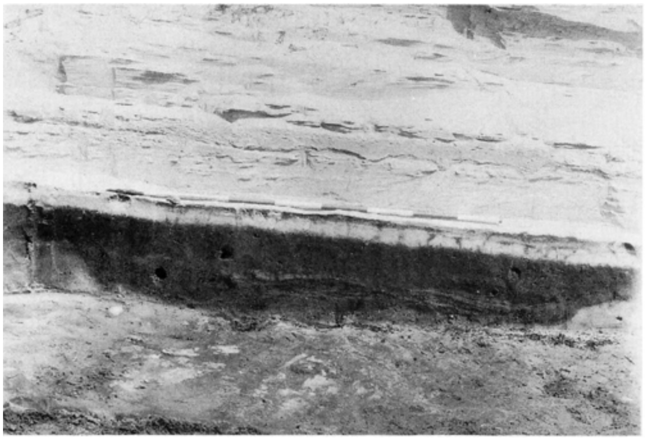

Fig. 2. Øster Aalum. Section through the pit with the grain. The grain came from the streaky lower half of the black layer. The upper half is the homoneneous old ploughsoil sealing the pit. Photo D. Liversage.

Oats were relatively rare. In the absence of the rachilla and lemma base, it could not be determined whether the grains were of cultivated or wild type.

Three grains are tentatively referred to wheat in table 1. These are very doubtful identifications, all the grains being distorted and eroded. They are included to make the point that the presence of the species cannot be excluded – particularly in view of the large proportion of unidentified grains.

These identifications present a similar picture to that from impressions in pottery from various sites examined by Sarauw in the last century (listed in Hatt 1937), and added to by Helbæk (listed in Jessen 1954).

The presence of numerous weed seeds is typical of many samples of charred plant remains from the Late Bronze Age and later periods in Denmark. The seeds of *Chenopodium album* were definitely charred, and were therefore not recent intrusions into the deposits. They were identified to species by comparison with the drawings of the sculpturing of the testa of various species given by Clapham, Tutin and Warburg (1962, fig. 36). Nutlets of *Carex* are often difficult to identify to species. Those listed as *Carex* eg *curta* could very well be of that species. The small seeded *Carex* sp. examples are similar to such species as *C. distans, C. hostiana* and *C. lepidocarpa*, and might be from these or another similar species. The other nutlets listed as *Carex* sp. are morphologically similar but larger, and could likewise be from a variety of species.

COMPARISON WITH OTHER SITES

Few samples of crop plants are available from southern Scandinavia from the 1st millennium AD. Many of these are discussed by Helbæk (1970, 1974). The earliest find of rye in Denmark is from Østerbølle, dating from the 1st century AD; rye amounted to about 0.1% of the total cereals, and Helbæk concluded that rye was not grown as a separate crop, but appeared only as a weed in barley. The seeds were very small (fig. 4). From the 6th century AD, two samples are available from Denmark: at Oxbøl, rye amounted to 0.5% of the cereals (Helbæk 1958a, 1970), while at Sorte Muld on the island of Bornholm it formed 3% (see fig. 1 for the locations of sites discussed in the text). Rye was apparently still only a weed of cultivation. The grains from Oxbøl and Sorte Muld are, however, rather larger than those from Østerbølle, indicating that the plant "had adapted to the climate and soil« (Helbæk 1970, 284, my translation).

The first evidence for the separate cultivation of rye in Denmark comes from Drengsted, dating to the 3rd century AD. Mixed samples of straw, roots, leaf blades, internodes and grains indicated that »rye plants were pulled up by the handful« (Helbæk 1974, 14), apparently for use in connection with the iron smelters on the site. The sample is small, but the seeds correspond in size to those from Østerbølle; Helbæk concludes that »although it was grown separately, it was not an established and respected crop at Drengsted. Possibly it was grown as an experiment with a foreign bread corn recently introduced from the south" (Helbæk 1974, 15).

In Denmark, rye first becomes important in the Viking period. Apart from Øster Aalum, two samples are known. One comes from the village underlying the Viking fortress at Aggersborg. This was recovered from a series of pits, and consisted of a mixture of barley and rye, with a trace of oats, rye amounting to 31%; many weeds were also present (Jessen 1954). From the Viking fortress of Fyrkat came a very different sample. This consisted of some 70,000 grains of rye recovered from a burnt building. There was a very slight admixture of hulled barley (0.15%), and a small number of weed seeds (Helbæk 1970, 1974).

This is a very small number of samples upon which to base conclusions. Under modern sampling strategies, each settlement may be expected to produce tens or hundreds of samples of plant remains, and yet only seven samples (including that from Øster Aalum) are available from Denmark from the whole of the 1st millennium AD. This may be compared with the nine major samples of rye from the single site of Haithabu in northern Germany dating from the Viking period, where rye was second in importance to barley (Behre 1983).

Nevertheless, Helbæk pointed to a number of peculiar features of the sample from Fyrkat: (a) mean grain size is considerably larger than in any of the other Danish samples (fig. 4); (b) the find is remarkably pure, containing very few other items (111 barley and 280 weed seeds in about 70,000 rye grains); (c) among the weeds are a number of species not recorded from Denmark before (Helbæk 1970, 1974). Helbæk argued that the immediate environment of the sites could not explain this: if anything, the area round Fyrkat is less suitable for rye cultivation than that round Aggersborg, and yet the Fyrkat rye is much superior. The status of Fyrkat as a fortress is important in this connection. Aggersborg, a village, would see consumption of a locally produced crop, while the inhabitants of Fyrkat (argued Helbæk) would not be cultivating but *importing* crops, not necessarily grown locally. Concerning the peculiarities of the Fyrkat sample, Helbæk concludes:

"Two conditions must apparently be met before such a result can be achieved: a) a high agronomic level, with each cereal cultivated separately, carefully weeded, and carefully kept separate after threshing; b) a systematically organised trade, where the purchaser made high demands on the producers of a wide area, so that the purchaser could as a result buy a standard pure product of the quality he was prepared to pay for.

None of these conditions are likely to have been met in Denmark during the Viking period or for a long period into the Middle Ages" (Helbæk 1970, 289, my translation).

"Only one thing can be taken as given without further consideration: *[the Fyrkat rye] was not cultivated on Danish soil*" (ibid., 290, my translation, added emphasis).

Helbæk concluded that the sample represented a crop carried home from a Viking foray into eastern Europe, perhaps the Dvina or Dniepr region, because rye of the right size is known in these regions at this time (Helbæk 1970, 1974).

ØSTER AALUM AND FYRKAT: THE IMPORT HYPOTHESIS RECONSIDERED

It is clear from the foregoing comparisons that the Øster Aalum sample resembles that from Aggersborg in (a) mean size of the rye grains (fig. 4), (b) the admixture of barley, and (c) the presence of a relatively large number of weed seeds. Fyrkat is clearly distinct from both sites in these respects.

It is open to question whether these are sufficient grounds to assume a long-distance import of the Fyrkat sample, however. Recent work suggests a simpler explanation, which will be examined here.

This recent work has taken place in the field of ethnographic study of crop husbandry and processing. Recent studies make clear the fact that each crop goes through a series of threshing, winnowing and cleaning processes between harvest and consumption. At various points in this sequence, the composition of the crop is significantly altered. Residues and products from various stages in the sequence may be recognized in the archaeological record (Hillman 1981, 1984; Jones 1984).

The stages of the process relevant to this discussion occur quite late in the sequence. Stages 12 and 13 in Hillman's model involve fine sieving the crop; this occurs after threshing, winnowing and coarse sieving (Hillman 1981 figs. 5–7, 1984 figs. 2–4). During fine sieving, prime (i.e. larger) cereal grains stay in the sieve, together with any larger weed seeds. Tail (i.e. small) cereal grains and most weed seeds pass through the sieve. These are sometimes stored for animal fodder or human famine food; ethnographic observations reveal another possible fate, however:

"But when – as in wet climates – cleaning with sieves is undertaken in small batches, especially in winter when fires are burning in the hearths, it is usual for the waste from the later sievings... to be tossed straight into the fire. Here, many of the denser items will trickle down into the ashes and char. It is not surprising, therefore, that the type of charred remains most commonly recovered from sites where wide-ranging sampling strategies have been applied consists – in the case of Iron Age and Roman sites at least – of smaller weed seeds, tail grains, glume bases and the occasional straw node, i.e. precisely those components generally separated from the prime grain in step 12..."

(Hillman 1981, 155–156)

The two products can thus be distinguished in the archaeological record. Thorough fine sieving would theoretically remove all grains below a certain size, while leaving only grains larger than this. In normal practice, however, sieving is rarely so thorough, and many of the smaller grains will remain in the sieve, although these will be fewer than the larger grains that

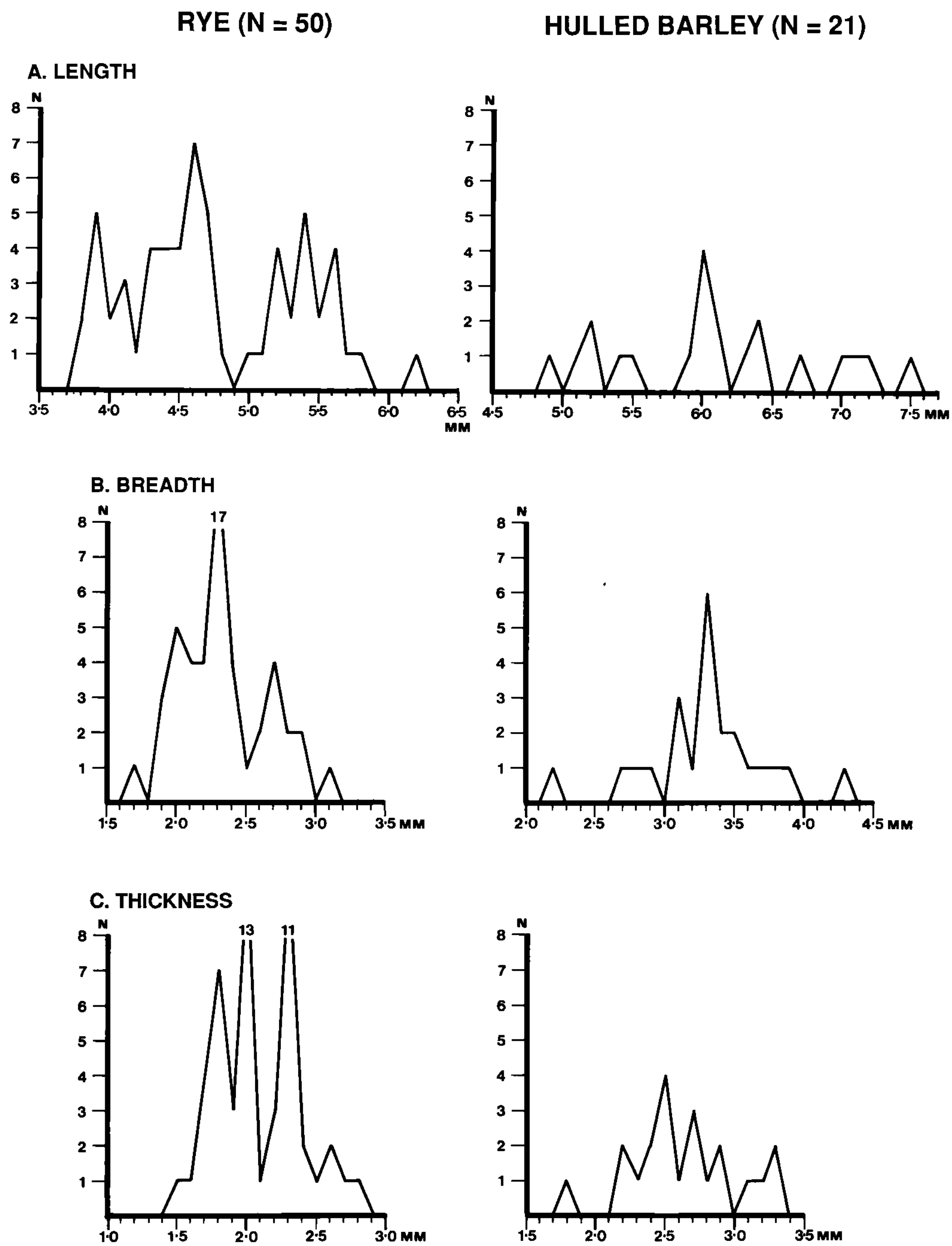

Fig. 3. Dimensions of the rye and hulled barley grains from Øster Aalum.

cannot pass through. The result is that the grain remaining in the sieve will contain the full size range of grains in the crop, but that smaller grains will be relatively less frequent. Only small grains will pass through the sieve, so the waste fraction will consist only of the lower part of the size range (Hillman 1984, graph C on p. 23).

Fig. 4 shows that the size differences between Øster Aalum and Aggersborg on the one hand, and Fyrkat on the other, conform to those expected from fine sieving.

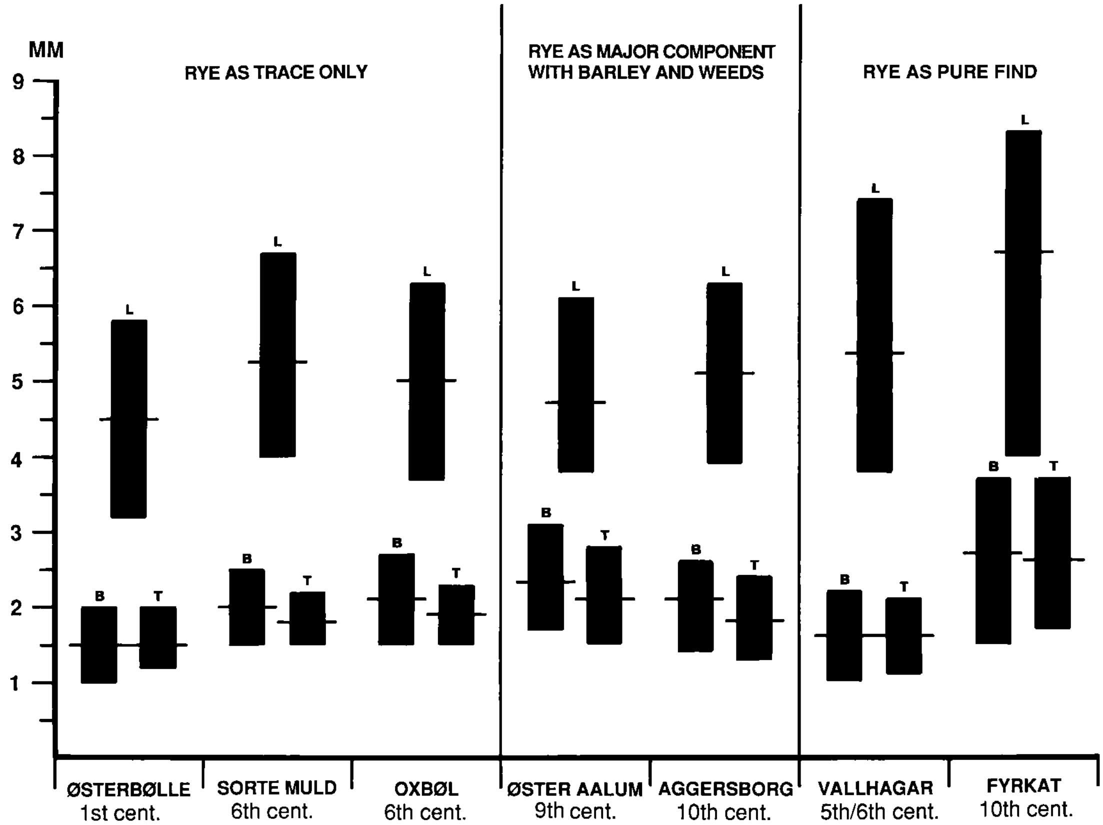

Fig. 4. The Øster Aalum rye grains compared with other finds, showing length (L), breadth (B) and thickness (T). The horizontal lines mark the means. Details of other sites from Helbæk (1970, fig. 3; 1974, fig. 10), except Vallhagar, from Helbæk (1955).

The smallest Fyrkat grains are closely similar to the smallest from the other two sites, but at the top end the Fyrkat range extends much higher. The Fyrkat grains *could* thus be larger on average because the sample represents the grains retained in the fine sieve, while Øster Aalum and Aggersborg represent those that have passed through it.

Although the size ranges are correct, however, there are difficulties with this argument. It takes no account of either: (a) changes through time or space in the size of rye grains, or: (b) variations in conditions of carbonisation. Regarding (a), it would be preferable to argue from a series of crop samples from a single site, grown in the same region over a limited time period. However, Helbæk's import argument was put forward on the basis of a few samples from the whole of Denmark, and any further argument must of necessity be similarly based. It must be *assumed* that 9th and 10th century rye crops at Øster Aalum, Aggersborg and Fyrkat all had similar sized grains – an assumption that future work may prove false. On the other hand, studies of present day populations of primitive races of rye in areas such as Turkey reveal remarkable uniformity in the size of rye grains compared to those of wheat and barley. Indeed, even the weed races produce grain of precisely the same size range as the cultivars (Hillman 1978). Regarding point (b), in view of the small changes that occurred in the sizes of the rye grains carbonised by Renfrew (1973 fig. 4) (less than in any other cereal except hulled barley) it is probable that the major differences between Fyrkat and the other two sites were *not* caused by the carbonisation processes alone.

Other factors must thus be called upon to contribute to the argument of import against different processing stage. The first of these is the *context of the samples*. Ethnographic studies have shown that, particulary in wetter areas where sieving is undetaken indoors, the waste from fine sieving is often thrown on the fire (see the quote from Hillman, above). If Øster Aalum and Aggersborg are to represent waste, and Fyrkat storage, then this would be supported if the find contexts corresponded to this.

The excavator's description of the find (see above) states that the Øster Aalum sample was recovered from a large, shallow pit. He stresses that the material was not in a primary context, and suggests that it was redeposited by wind action from a burnt building nearby, although other sources are not excluded. In the absence of direct evidence of the original primary context, is is suggested that one other possibility is that the material is waste from a nearby hearth or hearths, either blown or deliberately dumped into the pit, probably over a period of time. This would not conflict with the secondary context of the material, and could also account for the lenses in which it was deposited. The stems of heather and the wood charcoal would in this view represent the fuel burnt in the hearth. The Øster Aalum sample *could* therefore represent waste material.

The Aggersborg sample was amalgamated from a series of pits associated with the village, described as containing much charcoal, "food waste" (Jessen 1954, 125) and "kitchen waste" (Helbæk 1970, 287) (author's translations). Both Øster Aalum and Aggersborg *could* thus represent material from fires into which waste material from fine sieving could have been dumped. Fyrkat is very different. The grain covered a large area of the eastern end of house 4S (Helbæk 1974 fig. 2), and Helbæk was in no doubt that it represented the destruction of a "quartermaster's store" (ibid., 5).

The contexts of the three samples may thus support the argument that (a) Fyrkat could represent grains retained in a fine sieve and subsequently stored; and (b) Øster Aalum and Aggersborg could represent waste material from hearths, consisting in part of material which had passed through sieves as fine cleanings.

The *degree of purity* of the samples also supports this explanation. There is no reason to suppose (cf. the quote from Helbæk, above) that only mixed crops could have been grown in Viking age Denmark. This seems an unreasonably harsh judgement on farmers who were, after all, the heirs of some four millennia of agronomic experience within Denmark. There is clear evidence that bread wheat, emmer (or spelt), and barley were grown as three separate crops by the later 2nd millennium bc (Rowley-Conwy 1984), and that emmer (or spelt) and barley were grown as two separate crops as early as 1500 bc (Rowley-Conwy 1978). The degree of crop purity achieved as early as the Neolithic has been stressed by Dennell (1974). The admixtures of barley (60% at Aggersborg, 32% at Øster Aalum) might equally well derive from the repeated throwing of waste from two separate crops into the fire, and the subsequent sweeping out of the ash into the locations where the samples were found.

The *weed seed proportions* are also suggestive: there was 1 weed seed for every 1.3 identified cereal grains at Øster Aalum; 1 for every 0.6 identified cereal grains at Aggersborg (Jessen 1954); but only 1 for every 250 cereal grains at Fyrkat (Helbæk 1970, 1974). This relative scarcity of weeds at Fyrkat is most likely to result from their removal during fine sieving.

The *size of weed seeds* in the samples is also relevant. Among the relatively few weed seeds at Fyrkat, Helbæk identified about 39 species (1974, 26–7). Those represented by more than 10 seeds are listed in table 3, along with the sizes given by Helbæk (op. cit.). It can be seen that these include large seeded species, with at least one dimension comparable to the breadth and thickness of the Fyrkat rye grains (fig. 4). Such seeds would thus be expected to remain in the fine sieve along with the prime grain. Helbæk (1970, 1974) also stresses the rarity of seeds of *Chenopodium album* (6 seeds only) and the absence of *Spergula arvensis* at Fyrkat. These are very small seeds, of a size that would easily be removed during fine sieving. In contrast, *Chenopodium album* was the most common weed at both Øster Aalum (see table 1) and Aggersborg (Jessen 1954).

The *sample of rye from Vallhagar* is also relevant. This site is on the Swedish Baltic island of Gotland (fig. 1). The sample dates from the 5th or 6th centuries AD; it was published by Helbæk (1955), but not considered by him in his reviews of rye in Denmark (1970, 1974). The sample (find no. 16.5) corresponds to that from Fyrkat in a number of ways. It was recovered from the floor of a destroyed house, not a rubbish pit; it was remarkably pure, consisting of 326 cc rye, no other cereals, one seed of *Polygonum convolvulus* and three of *Galium* sp. (relatively large seeded weeds); and grain length (though not breadth or thickness) extends above all the other sites except Fyrkat itself (fig. 4). This sample could represent grains retained in the fine sieve and stored, just as at Fyrkat. It makes the point that the Fyrkat sample is not unique in Scandinavia: any argument applied to Fyrkat should also apply to Vallhagar.

Trade in Scandinavia for most of the 1st millennium AD involved luxury goods; only in Viking period VIII (AD 750/800 – 1000) did utilitarian items such as quernstones, soapstone bowls and whetstones spread widely from their points of origin (Näsman 1984). In northern Europe as a whole, more mundane objects like cooking pots were seldom traded before the 12th or 13th centuries AD. There is hardly any documentary evidence for the movement of basic foodstuffs, which are likely to be one of the latest commodities to be traded (Hodges 1982). Fyrkat thus falls in the period when trade in compact utilitarian objects (but not foodstuffs) was starting; Vallhagar dates well *before* this, to a time when only luxury goods are documented. In view of this, the likelihood that the few available 1st millennium samples include *two* imports is minimal.

In conclusion, therefore, various attributes of the samples support the hypothesis that crop processing, not local against foreign origin, created the differences between the Øster Aalum and Fyrkat samples. These are summarised here.

	Øster Aalum	Fyrkat
(a) grain size range	lower part of Fyrkat range only	wide range
(b) context	?rubbish from hearth (but see excavator's comments above)	storage
(c) purity	mixed with weeds and barley	very pure
(d) size of weed seeds	smaller predominate	larger predominate

This supports the alternative suggestion that the Fyrkat and Øster Aalum samples are two different products of a single crop processing system, using similar crops of rye. This is a much simpler explanation of the differences than the import theory, which is not necessary to explain the archaeologically visible facts.

Realisation that many archaeological plant samples in fact reflect various stages in crop processing activities, and not intentional end-products in their own right, may alter many previously held views. A good example relevant to Denmark concerns the bodies of the bog corpses from Tollund and Grauballe. Their gut contents (Helbæk 1950, 1958b) have often been regarded as "ritual" meals. However, their contents conform so closely to the by-products of the fine sieving stages that a more likely explanation is that these people were simply fed on the poorest food available, namely waste products (Hillman 1986, 102–3; also Hillman 1981, 156–8; 1984, 13).

Species	Number of seeds	Size (mm)
Rumex crispus	62	L: 1.06–1.25, B: 0.69–0.88
Centaurea scabiosa	38	L: 3.25–4.63, B: 1.25–1.75, T: 1.25–1.56
Rumex maritimus	30	L: 1.06–1.25, B: 0.69–0.88
Polygonum convolvulus	20	not stated (relatively large)
Polygonum lapathifolium	16	not stated (relatively large)
Aethusa cynapium	15	L: 1.19–2.06, B: 0.81–1.50, T: 0.56–0.81
Melandrium album	10	L: 1.30, B: 1.20, T: 0.95
Vicia cracca	10	spherical, diameter 2.00–2.50

Table 3. Weeds at Fyrkat represented by 10 seeds or more, with sizes (from Helbæk 1974).

CONCLUSIONS

Øster Aalum provides important information concerning crop husbandry in Viking Age Denmark, both because it provides data on the crops themselves, and also because it has given rise to a re-interpretation of other finds of rye in Denmark.

It also stresses one aspect of current Danish archaeological work, namely that it is at present purely up to excavators to notice and recover samples of plant remains. Had the excavator of Øster Aalum been less alert and interested, the sample might never have been recovered. It was mentioned above that Haithabu *by itself* has produced more samples of Viking rye than are known from the whole of the 1st millennium AD in Denmark. This is an example of the sort of data that can be recovered using modern sampling strategies and recovery methods. For the Haithabu remains, much information is presented concerning the various samples (Behre 1983, 19–20, and diags. 8–10), and it would be interesting to know whether contexts, sample compositions etc could be examined using the methods developed by Hillman (1981, 1984) and Jones (1984).

Archaeobotanical work could answer many interesting questions. If one hundred samples (rather than one) were available from Fyrkat, it might be possible to decide whether the site really was just a consumer (as Helbæk suggests), or whether it was also a centre for cultivation. There is no way this can be determined on the basis of the single sample available – if the above arguments are correct, then this sample represents just one stage in the crop processing sequence. We have no way of knowing whether or not the preceding stages were carried out at Fyrkat, as would be expected if it were a "primary producer" farming settlement.

Danish archaeology currently displays little interest in archaeobotanical studies. This is particularly unfortunate, since Denmark was where archaeobotany first emerged as a regular scientific discipline. Crop plants still tend to be viewed as typological attributes, not as a source of much useful archaeological information. This may be why Denmark currently lags behind much of the rest of Europe and does not always employ modern methods in archaeobotanical studies. From the typological point of view, it may not be important that detailed sampling of (say) a Viking Age site would produce more samples of rye, because we already know that the crop was present. From the perspective of settlement archaeology, however, the plant remains can provide a great deal of information concerning human behaviour on every site where they are preserved.

Each settlement excavation that takes no interest in plant remains is therefore indulging in the destruction of irreplaceable data highly important to the interpretation of the settlement. It is hoped that current developments signal a change of course.

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