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Carbonized Grain from Mortens Sande 2

– A Single Grave Site in Northwest Jutland

by DAVID ROBINSON and DORTHE KEMPFNER

INTRODUCTION

A great deal of our knowledge of prehistoric crops, and the agricultural practices associated with them, comes from the study of crop plants and crop weeds preserved by waterlogging, dessiccation, carbonization and mineralisation or as impressions in pottery. To date only carbonized remains and impressions are known from the Danish Neolithic and these records are almost exclusively from the Funnel Beaker Culture or from sites dated to the Late Neolithic/Early Bronze Age (Jørgensen 1976, 1979, 1981; Rowley-Conwy 1978). Records from the Single Grave Culture are rare. Hans Rostholm, in his recent review (Rostholm 1986), lists a total of 26 impressions and four carbonized grains for the whole Single Grave period.

Reviewing the Neolithic period as a whole, Jørgensen (1981) has shown that during the Early Neolithic it was wheat, in the form of einkorn and in particular emmer, that was the dominant crop. Other wheat species and barley were present but rare. In contrast, in sites of the Late Neolithic and Early Bronze Age it is barley, mostly of the naked form, which is most abundant. Spelt and bread wheat also achieve more prominance, being present in addition to emmer and einkorn. This changeover from wheat to barley cultivation, which was not a sudden phenomenon, apparently took place over the transition between the Funnel Beaker and Single Grave Cultures in the late Middle Neolithic (Davidsen 1978; Jørgensen 1981; Rostholm 1986). Naked barley is proportionately better represented in the later Funnel Beaker sites (Jørgensen 1981) and accounts for 20 of the 30 records from the Single Grave Culture (Rostholm 1986). Rather more convincing evidence for the important role of naked barley during the Single Grave Culture can now be seen in the find of carbonized grain from Mortens Sande 2, a settlement site in northwest Jutland, which was occupied several times in the centuries around 2000 bc.

METHODS

The site, which is described in detail by Liversage in this volume, lies in blown sand and was revealed by coastal erosion, which has subsequently continued and removed all traces of the site (Liversage, this volume, fig. 2). The samples came from stratum 0, at which level structural remains were located and which contained charcoal giving a radiocarbon date of 2110±85 bc. Samples were taken from the culture layer inside and outside the house and from a pit associated with the structure (Liversage, this volume).

The layers were excavated in plan and large samples were processed by the excavator who describes the sampling and processing methods as follows: 'During the excavation samples were taken for seed analysis. Sand was taken, normally a bucketful at a time, from a recorded layer and grid square, and was processed on site either by flotation or by sieving. Flotated samples were placed carefully, a handful at a time, into a specially constructed flotation bucket with weir (broad flat spout), containing sea water. The floating fraction drifted out over the spout and was caught in a piece of muslin with a mesh-size so small that it is very unlikely that any seeds were lost. The flotated material was later washed out of the muslin in the laboratory, dried, and then stored for laboratory analysis in glass bottles. Sieved samples were placed, a handful at a time, into a sieve with 0.8 mm apertures and agitated gently in water. This let through all the sand and left behind all charcoal big enough to be caught in the mesh, and this included cereal grains. Sieving was a good deal faster, and after about 60 litres had been flotated it was thought that the weed seeds would be adequately sampled and we continued sieving only for cereal grains. The sieved samples were also dried before being stored for laboratory analysis.'

In the laboratory the carbonized plant macrofossils were sorted, identified and, as far as was possible,

measured. The results are presented in tables 1 and 2. All macrofossils have been retained for future reference.

Carbonized grain

It is clear from the archaeological evidence that the carbonized grain and other macrofossils in these layers do not represent a store or hoard and as such can not be taken as representative of a harvested and processed crop. They did, however, become charred and then incorporated into the layer as a result of normal day-to-day activities at the site which naturally would include crop processing and food preparation and the utilisation or disposal of the by-products which resulted. They must therefore relate, in some way, to the crops which were cultivated.

The overwhelming majority of the carbonized grains recovered were of naked barley (*Hordeum vulgare* var. *nudum*). They had the distinctive rounded outline and cross-section and on many, the transverse wrinkling across the surface of the grain was also apparent. A much smaller proportion of the grains had the angular outline and cross-section characteristic of hulled barley. This particular morphology is a consequence of the grain having being held fast between the lemma and palea or 'hulled'; hence the name. In addition there was a significant number of the carbonized grains which could be identified as barley, but damage to the surface of the grains prevented their being assigned to the hulled or naked categories. Some of the grains were obviously twisted, identifying them as being from six-rowed barley. However the proportion fell far short of the 66% which would be expected if all the grain was of the six-rowed type. It may therefore be possible that two-rowed barley is also present but it is not possible to prove this with the evidence to hand.

Within the naked and hulled forms of six-rowed barley there are also what are called dense-eared and lax-eared forms. The dense-eared forms have a short dense ear made up of short fat rachis internodes and which stands erect. Conversely the lax-eared forms have a longer less compacted ear made of longer slender rachis internodes which tends to bend over or 'nod'. Of the three complete rachis segments found at Mortens Sande 2, two measured 2.3 mm in the length and the third 2.4 mm. This is just at the lower size-limit for lax-eared barley and given their very slender nature and the overall small grain size, it seems almost certain that it is a lax-eared form which is present.

A few grains of oats were also recorded. They were very small and it seems likely that they are of wild oat (*Avena fatua*), although none of the distinctive 'sucker-mouth' floret bases were present to confirm this. One grain of emmer (*Triticum dicoccum*) was identified. The remaining grains were so badly damaged or deformed that identification to species was not possible. Many of the identified grains were, however, very well preserved in that the surface cell pattern was clearly visible even on very deformed examples. Surface damage and breakages which were apparent could well have occurred during sample processing rather than in antiquity and the grains show little sign of having been windblown. Many grains, although clearly identifiable as naked barley for the reasons given above, still had fragments of carbonized lemma attached to them. This is a most unusual feature, given the decidedly free-threshing nature of naked barley, as the grains tend to be lost from the spikelets as soon as they are ripe. There was also a large number of swollen and burst barley grains such as result from the charring of damp or unripe grain. This suggests that some if not all of the grains were still on the ear and possibly in an unripe or doughripe state when they were carbonized, firmly suggesting that this is food and not seed corn which we are dealing with. Contemporary ethnographical studies report a number of foods prepared from grain in such an immature state (Hillman 1985). The presence of several carbonized rachis internodes and an impression of the base of a lemma awn in a piece of fired clay also support, to some degree, the presence of unthreshed ears on the site.

Grain size

All grains not seriously deformed or broken were measured and the results are summarised in table 2. Within stratum 0 there is a clear difference in size between those grains found inside the structure and those found outside, the former being, on average, larger. Whether this is the result of some kind of selection process is not clear. The average grain size in the pit is identical to that for grains outside the structure in stratum 0. Seen in relation to more recent examples and even some contemporary finds, the grains are small. However they do correspond very well with the grain sizes from Sarup (Jørgensen 1976, 1981) and Nørre Sandegård (Helbæk

		inside	house	outside	house	pit	total
whether flotated or sieved		F	S	F	S	F&S	
approximate sample volume		40 l	34 l	18 l	33 l	20 l	145 l
FOOD PLANTS							
Avena sp. (? wild oats)	c		3		2	1	6
Hordeum vulgare var. *nudum* (naked barley)	c	8	49	45.5	39	139	280.5
Hordeum vulgare (hulled barley)	c		1	1.5		9	11.5
Hordeum vulgare undiff.	c	7.5	30.5	36.5	24	91	189.5
(badly preserved barley)	rachis					10	10
clay impression of	lemma awn		1				
Rubus idaeus/fructicosus (blackberry/raspberry)	s					5	5
Triticum dicoccum (emmer)	c			1			2
unidentified cereals		14	13	36.5	6	28	99.5
	straw		+	+	+		
total cereal		29.5	97.5	121	71	283	601
WEED SPECIES							
Anthemis sp. (mayweed)	a					1	1
Galium cf. *aparine* (goosegrass)	s					1	1
Polygonum sp. (persicarias)	fr					4	4
P. cf. *aviculare* (knotgrass)	fr					2.5	2.5
Rumex acetosella (sheep's sorrel)	fr					1	1
Solanaceae (nightshade family)	s					0.5	0.5
Urtica dioica (stinging nettle)	s	1		0.5			1.5
Vicia sp. (vetch)	s	1		0.5			1.5
OTHER							
Calluna vulgaris (heather)	twigs					+	+
Cirsium cf. *heterophyllum* (melancholy thistle)	a			2			2
Cyperaceae (sedge)	n					1	1
cf. *Ranunculus ficaria* (lesser celandine)	tuber				1		1
unident. charcoal	buds and twigs	+	+	+	+	+	+
Viola sp. (violet)	s					1	1
unidentified	plant macros		1			1	2
MISCELLANEOUS							
amber chips		+	+	+	+	+	
burnt bone	f		+			+	
burnt flint	f		+		+	+	
Cenococcum geophilum (fungus)	fruiting body	>4	+	many	48	6	
insect	f					+	
unidentified fungus	fruiting body					+	

Table 1. Mortens Sande 2. Plant macrofossil determinations. c = caryposis, s = seed, a = achene, fr = fruit, n = nutlet, f = fragment.

	inside structure	outside structure	pit
	Σ 44	Σ 60	Σ 88
L	5.4–3.3 (4.4)	4.8–3.2 (4.2)	5.3–2.7 (4.2)
B	3.8–1.7 (2.7)	3.2–1.6 (2.5)	3.7–1.2 (2.5)
T	2.5–1.4 (2.1)	2.4–1.2 (1.9)	2.7–1.0 (1.9)

Table 2. Mortens Sande 2. Grain measurements for *Hordeum vulgare* var. *nudum* (naked barley) in mm. L = length, B = breadth, T = thickness. Values: maximum – minimum (average).

1952) and contemporary sites from the Netherlands (van Zeist 1968). All of the sites mentioned above are, like Mortens Sande 2, on sandy soils, and although it is not sure and perhaps unlikely that the crops were cultivated locally in the dunes, poor soils may in part account for the small grain size.

Other plant remains

Seeds and fruits of weed species, that is species which grow in disturbed habitats such as found on cultivated ground and around human settlements, were rare in the layers and those which were present are rather difficult to interpret. Layer O produced 1.5 seeds of *Urtica dioica* (stinging nettle) in total. *Urtica dioica* is not a normal crop weed but it is a plant which grows on the enriched soils around human habitation sites. The seeds were probably charred by accident on a hearth. Its presence does suggest however that settlement and activity in the area had been such that there was sufficient enrichment of the soil to allow *Urtica* to grow.

Only the pit contained remains which can be considered to represent a weed flora and these could well have originated from a source other than the barley field. Weeds would have been an integral part of the environment around an established settlement such as this and the possible means by which their seeds could become carbonized and preserved are almost countless. The common arable and wasteland weeds, *Anthemis* (mayweeds), *Polygonum* (persicarias), *Galium* (bedstraws) and *Vicia* (vetches) were present. *Rumex acetosella* (sheeps's sorrel) is a also weedy plant but can be found on grazed pastures. *Solanum nigrum* (black nightshade) favours damp shady places, and grows well on rich manured soils. It is a common weed of cultivation today, particularly in gardens.

The purity, that is absence of weed seeds, of Neolithic crops has been commented upon by Jørgensen (1976) and Rowley-Conwy (1978). There are several possible explanations for why this should be so. Jørgensen (1976) considers that aspects of the sowing, weeding and, in particular, harvesting of the crop were responsible, although crop processing in the form of winnowing and sieving may also have been involved. At Mortens Sande 2 it appears likely that the ears of barley were harvested individually, possibly with the straw and attendant weeds being harvested at a later date (cf. Hillman 1985). This selective harvesting would, in addition to reducing the number of weed seeds in the harvest, have the added advantage of reducing grain-loss during harvest, which is always a major consideration with free-threshing cereal such as naked barley. Cutting the crop at the base of the straw and transporting it in this form can lead to enormous grain losses. This interpretation also fits in well with what has been said previously about the grain being slightly unripe and still on the ear when it was carbonized; the grain would have been much easier to harvest in this state.

A small number of remains of herbaceous species were recovered which were not obviously from cultivated or weedy habitats. *Cirsium heterophyllum* (melancholy thistle) is a plant of open scrubby woodland and streamsides although it can occur on grazed pastures. The presence of carbonized *Viola* (violet) seeds, *Carex* (sedge) nutlets and possible *Ranunculus ficaria* (lesser celandine) tubers, suggests the proximity of a damp shady area with a reasonably rich mull soil such as might be found in damp deciduous woodland. It is a little difficult to imagine how the tubers of *Ranunculus ficaria* came to be carbonized. The plant does have a long history of use medicinally, notably in the treatment of haemorroids, but it is not known how far back in time this practice extends.

Charcoal

All the samples examined contained substantial amounts of charcoal. No attempt was made in this study to make a systematic identification of the fragments, however a number of obvious stems of *Calluna vulgaris* (heather) charcoal were picked out from the pit. Charcoal fragments in samples from stratum 0, submitted for radiocarbon dating, were identified by Claus Malmros (pers. comm.) and the following species were recorded: *Corylus* (hazel), *Tilia* (lime), *Quercus* (oak), *Alnus* (alder) and *Pomoideae* (apple family). No heather charcoal was apparent. Although these samples may be far from representative with regard to the local vegetation, the analyses do suggest that there was both deciduous woodland and heath somewhere in the vicinity. The question of the origin of heaths in western Jutland and man's involvement in this, has been discussed by Odgaard (1985, 1986) in relation to his regional pollen diagram from Solsø and local pollen diagrams from fossil soils below burial mounds at Skarrild and Harreskov. At Solsø the changeover from forest to heath began

around 5000 bp and this date is supported by preliminary pollen counts from Gjævhul Sø (Robinson, work in progress), a lake deposit buried under blown sand and now exposed on the foreshore c. two km south of Mortens Sande 2. Charcoal dust is present in the Solsø deposits and this is interpreted as being from the repeated burning of heath to maintain it in an optimum condition for grazing, which Odgaard considers to have been a major requirement at this time (Odgaard 1986).

CONCLUSIONS

Although caution should always be exercised when evaluating finds such as these described here, the macrofossil analyses from Mortens Sande 2 do provide some solid evidence for the importance of the role played by naked barley in the agriculture of the Single Grave Culture. The samples are overwhelmingly dominated by this cereal type. It is suggested that the crop was harvested by picking the individual ears, possibly in a slightly unripe state and it was in this form that they became carbonized. Collectively this would explain the virtual absence of weed seeds in the samples, the many very swollen and exploded carbonized grains and the fact that fragments of lemma were still attached to the surface of many naked barley grains, something which would be virtually impossible if the grains had been fully ripe. It is also suggested that the grain became carbonized accidentally at the site during the normal activities of crop processing and food preparation.

Other macrofossils recovered from the samples, notably charcoal of heather and deciduous woodland trees, allow the tentative suggestion that the local vegetation was a mosaic of heath and damp deciduous woodland.

David Robinson & Dorthe Kempfner, The National Museum, Dept. of Natural Science, Ny Vestergade 11, DK-1471 København K.

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