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Mortens Sande 2

– A Single Grave Camp Site in Northwest Jutland

by DAVID LIVERSAGE

In 1984 a thin, charcoal-rich stratum appeared in the cliff cut by the North Sea into the dunes in the northern part of Lodbjerg parish, which is close north of the western end of the Limfjord. A small test excavation by the National Museum showed that it came from a sealed Single Graves settlement deposit with structural traces, carbonized grain, amber working, etc.

It was decided the next year to remove a substantial amount of the overburden and obtain as complete a plan of the structures as possible. The actual removal was effectuated with great efficiency by a driver and machine from the Jutland Engineering Regiment, to whom we are greatly indebted. It enabled us to investigate an area of about 63 m^2 buried under three or four meters of blown sand and otherwise inaccessible. Part of the site had already been washed away by the North Sea, and it was found that damage had also been done by earlier wind erosion, but it is still one of the best-preserved Single Graves settlements discovered so far. As an unexpected piece of luck it was found that later archaeological horizons lay above the original one, so three separate find-bearing layers were stratified above one another.

EXCAVATION

Method of excavation

Excavation of sandhill sites presents the special problem of sifting sand that blows in over cleaned surfaces and can fill up the excavation overnight. For this reason the site was dug in 1985 in a grid of meter squares, which could be excavated to the bottom one at a time if required. This made it possible to produce layer by layer maps of find distribution (fig. 6), but it would have been interesting if we had been able to expose the finds *in situ* over larger areas before removing them. The first stage of the excavation was to dig the grid meters that exposed a section running inward from the cliff (fig. 2). Afterwards the whole area was cleared to the stage shown in fig. 4, and finally the postholes and stakeholes were sectioned (fig. 5). The test excavation in 1984 was done without grid.

Stratigraphy

The stratigraphy is shown by a section at right angles to the coast (section A-B, fig. 2, position shown in fig. 1) and a photograph of part of the same section (fig. 3).

The main occupation layer, find stratum O, consisted of slightly sticky black-brown sand (10YR 3/2) with much finely-divided charcoal. In the western 1–1.5 m of the section it was about 6 cm thick and fairly rich in flint and pottery. Further east it was thinner and poor in finds, though it still contained a good deal of charcoal. The finds and charcoal lay in the top part of a soil layer (a podzol), showing that sand accumulation had ceased and soil formation begun some time before the occupation took place.

The podzol had formed on the surface of an approximately 1.5 m thick layer of blown sand, which rested on another humic horizon formed on the top of a raised beach after the sea had withdrawn from it. The thickness of the beach sand is unknown as the bottom was not reached. Because of the distance to a geodetic benchmark it was not practicable to level in its surface, but it was approximately 5 m above sea-level.

Find stratum O was overlain by about 20 cm of clean blown sand. On top of this lay another soil layer, this time much paler (greyish yellow-brown, 10 YR 6/2), containing charcoal and artifacts in less concentration than in find stratum O. This is called find stratum A. The pottery does not suggest it was much younger than find stratum O.

The next settlement layer upwards, find stratum B,

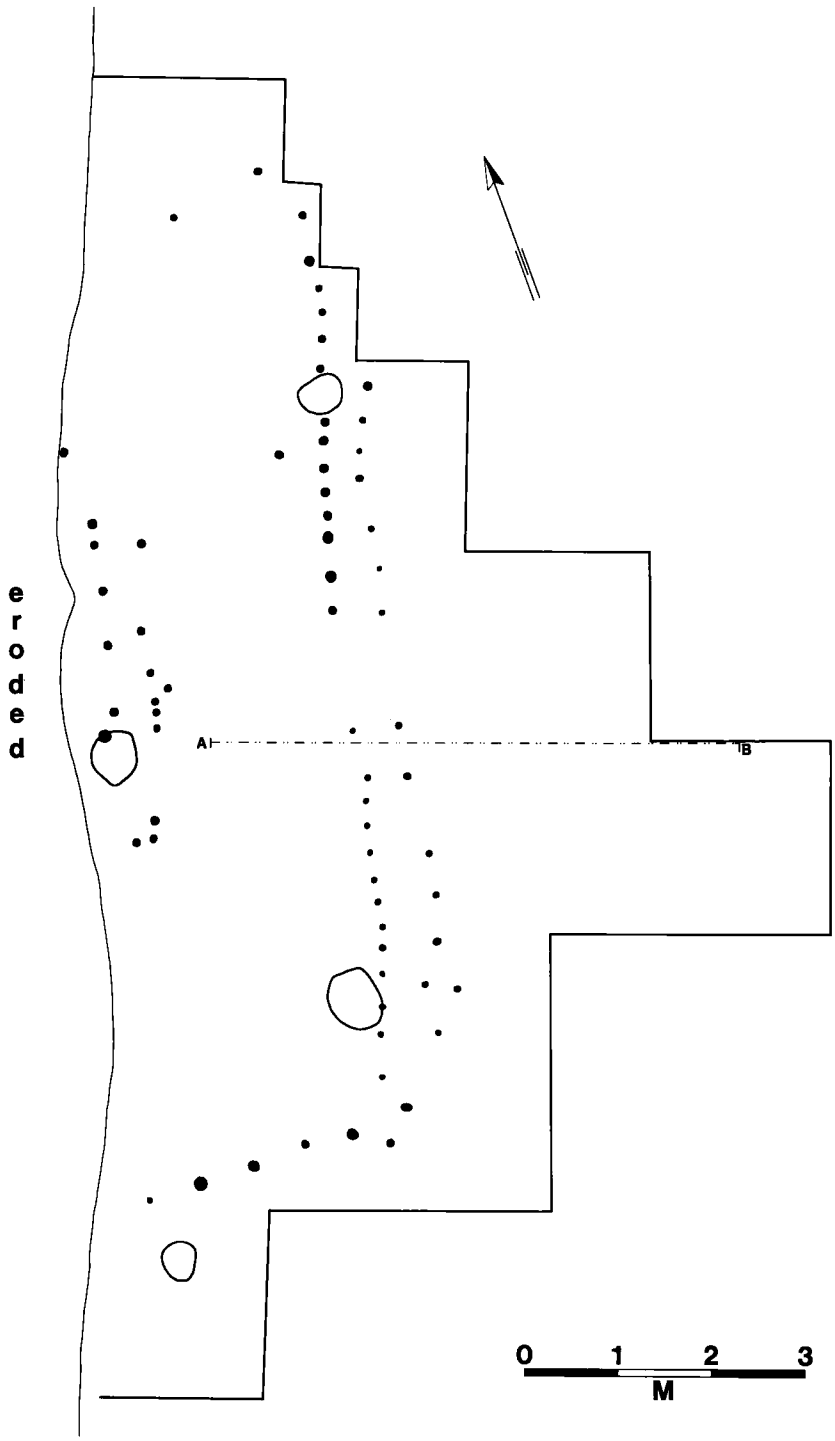

Fig. 1. Mortens Sande 2: excavation plan. The E-W row of stakeholes at the S end of the site is from a younger layer than the others.

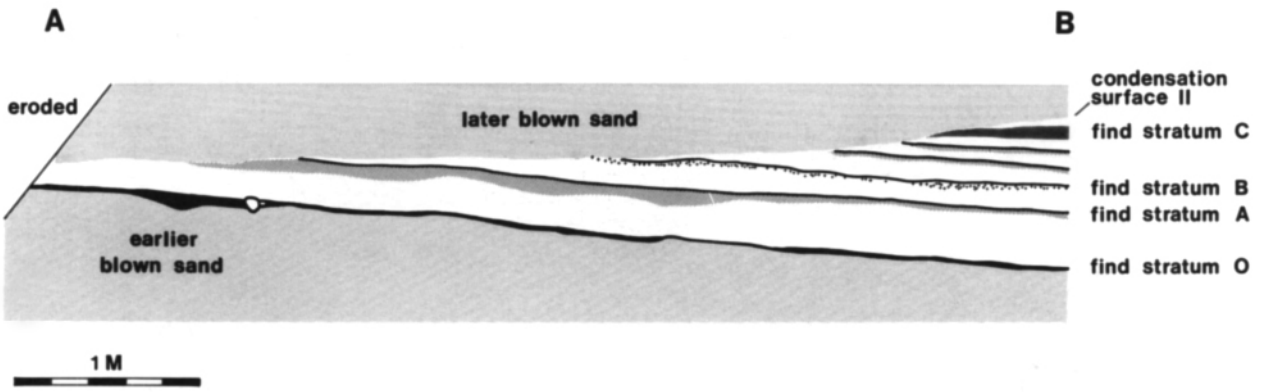

Fig. 2. Mortens Sande 2. Section A-B.

was separated from find stratum A by another thin layer of clean blown sand. Find stratum B did not seem to be a soil horizon at all, and may only have been charcoal redeposited by the wind from hearths near by. The artifact material was very small.

Above find stratum B followed two slight humic layers, which were archaeologically sterile, and at the top another soil layer, brown in colour (7.5YR 4/3), containing a few artifacts (find stratum C). A stake-hole was found in this layer when probing further east a year afterwards, and the amount of pottery seemed to be increasing. Possibly a new site will emerge and be washed away here as coastal erosion continues.

These regular strata had been disturbed by two phases of wind erosion, during which the sand had been blown away and artifacts left behind on denuded surfaces cutting obliquely across the layers. Condensation surface II is thought on account of the character of the overlying sand to be fairly new, and is seen at the top of section A-B cutting obliquely across find layers O to C. Further south and west it had destroyed all layers, including O. The mixed flint and stone on this surface was derived from all the layers that had been blown away.

Condensation surface I was only present in the northwestern part of the excavation and does not appear in section A-B. It cut across strata A and O, while its relationship to strata B and C is unknown because the contact between them was later destroyed by erosion II. The sand that overlay condensation surface I was humic and very like the old soil layers in the immediate vicinity. Condensation surface I was certainly ancient and probably strictly local, while condensation surface II belonged to an erosion phase that had denuded the early layers over a long stretch of cliff and is probably recent.

Structural remains

After removal of the find layer the underlying surface was cleaned, as seen in fig. 1. Altogether 65 stake-holes, 3 larger postholes, and one small pit came to light. The stakeholes were 5–10 cm across and 20–40 cm deep. They narrowed at the bottom, and were clearly the marks of pointed stakes driven into the sand (fig. 5). As seen in the excavation plan, they stood in several straight rows. In the northeastern part of the excavation is seen a slightly over 4 m long alignment of 14 stakes accompanied half a meter to the east by a parallel row, of which seven stakeholes were uncovered, and others may have been lost further north in a corner where it would have been unsafe to dig. The two rows obviously belonged together, and the holes in the western row were slightly larger and deeper than those in the eastern, and also more closely and regularly spaced. They came down from find stratum O and were sealed by the clean sand that separated strata O and A.

The same pattern repeated itself in the south-eastern part of the excavation. Here also there was a main western row nearly 4 m long with 13 stakeholes, and a subsidiary eastern row of 7 or 8 holes. These two rows are removed very slightly to the east out of the line of the first rows, and are separated from them by a little over a meter with no holes. Their stratigraphical position was the same as that of the north-eastern rows.

A fifth row ran in a roughly east to west direction

Fig. 3. Section A-B seen from SW.

Fig. 4. Stakeholes and postholes in the underlying surface after removal of find stratum O. Seen from S.

Fig. 5. The main north-eastern row of stakeholes sectioned. Seen from NW.

across the southern part of the excavation. Six stakes were preserved giving a length of under 3 m, but the western end of the row may have disappeared already into the North Sea. It was only a single row, but the stakes were larger than in the other cases. In this area all the stratigraphy had been denuded, but the radiocarbon dates show that this feature was too young to belong to find stratum O and probably belonged to find stratum A (see p. 123).

Yet another double row of stakeholes was found in the 1984 trial excavation in the western part of the plan. Stratigraphically it belonged to find stratum O. The western row was just over 4 m long. It is not known for sure whether there was any consistent difference in the size and depth of the two rows dug in 1984.

The three postholes were larger than the stakeholes. Two of them are clearly seen in fig. 4, because the black occupation layer has sunk into them. When sectioned they were found to be very indistinct at lower levels, but it was just possible to see the "shadow" of the posts, which was about 20 cm wide, and the outline of the holes themselves, which had been about 40–50 cm in diameter and 50–60 cm deep. Each posthole was associated with a particular row of stakes. One was at about the middle of the north-eastern alignment, another was a little south of the middle of the south-eastern alignment, while the third was close south of what might before erosion have been the middle of the southern alignment.

During the 1984 test excavation a hole of similar size, but only about 40 cm deep was found in the western alignment. It seemed however only to be a small cooking pit with sides and base lined with a burned layer a centimeter thick, and refilled with alternating clean and dirty deposits of sand with artifacts. This sand contained charred grains and seeds. Perhaps a cooking pit had been deliberately sited on an old post, but as no deeper part of the hole was observed during the test excavation no clear conclusion is possible. In all events its placing in or close to a line of stakes corresponded to that of the other three postholes.

It is not immediately clear what was the purpose of all these post and stake holes. The plan may give a rapid impression of a N-S orientated long house, but this cannot bear closer scrutiny. The house would have been only about 2½ meters wide, there are too many gaps where there should be walls, and the position of the large posts is not compatible with an intelligible roof

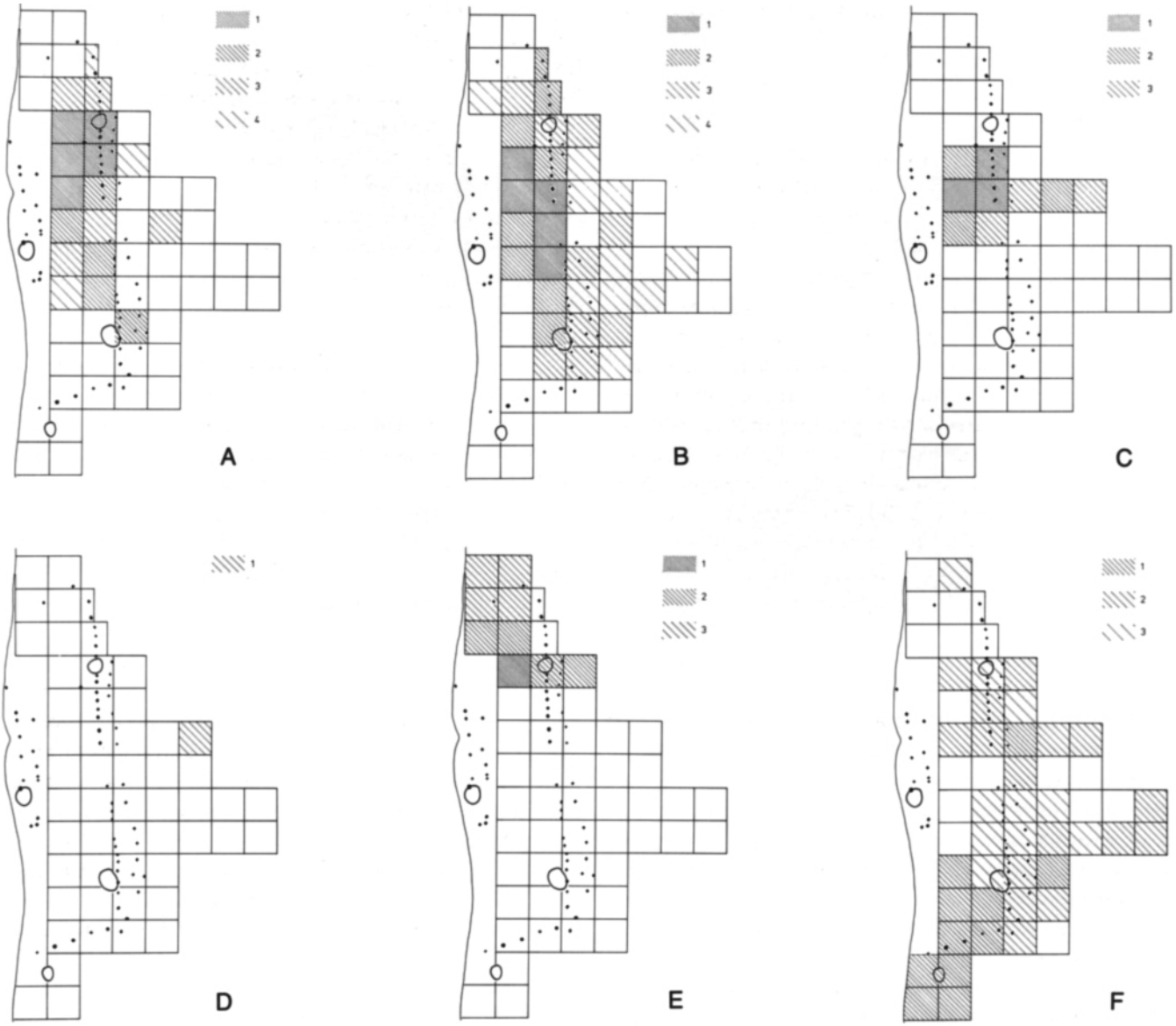

Fig. 6. Mortens Sande 2: distribution of finds in the meter grid. A – find stratum O, pottery: B – find stratum O, flint: C – find stratum A, pottery: D – find stratum C, pottery: E – condensation surface I, pottery: F – condensation surface II, pottery.

construction. Most probably we have separate and consecutive structures, each consisting of a single or double stake alignment combined with a single larger post. The three belonging to find stratum O must have been close together in time, but the southern row was substantially later.

This interpretation is supported by other small details. The holes in the NE alignment were bigger and blacker than those in the SE one. Unfortunately those in the western alignment could not be compared directly, as they were excavated the year before. The holes in the southern alignment were paler, larger, and stood in a single row only. Also they were less deep as a result of denudation of the surface. The difference of colour points to difference of age, as later holes tend to have dirtier fill than earlier ones owing to the increasing

amount of charcoal and organic matter during the course of settlement.

Nature of the Structures

What kind of structures are indicated by these single or double stake alignments with one larger post each? Attention should be called to the following clues. The spacing of the stakes would be suitable for hurdling made by weaving horizontal branches back and forth between them. It is fairly definite that they formed barriers to the spread of artifact material. This is shown by some of the find density diagrams in fig. 6, in which diagram A shows by grid squares the weight of pottery and diagram B the number of pieces of flint in find stratum O. West of the north-eastern and to a lesser extent south-eastern rows of stakes the values were high, with over 40 g of sherds and over 50 pieces of flint per square meter being common. The values fall very sharply as soon as the rows of stakes are passed, with levels of flint under 16 and frequently under 4 pieces per m^2, and pottery often completely absent. There was also a difference in the character of the black layer, which was thinner and less greasy east of the rows. The rows of stakes must therefore have marked a physical boundary to the area with intense settlement activity.

Near the southern alignment the find strata had been completely blown away, and the find distribution is revealed only by the flint scatter on erosion surface II shown in fig. 6, F. Flint was present equally on both sides of the stake holes, but while the concentration north of them is likely to have belonged with the south-eastern alignment, the flint in the extreme south of the excavation can have belonged with the southern alignment, in which case this also bounded a concentration of settlement rubbish.

Unfortunately the western alignment lay close to the cliff and information is a little unclear. However there were plenty of finds west of it as well as east, so perhaps it was the eastern boundary of yet another concentration.

If we take as a working hypothesis that the remains belong to consecutive structures, each with a single hurdling wall that confined most of the flint chips and broken pottery and much of the crushed charcoal to one side of the hurdling, then the obvious explanation of the large posts would be that they held up something too heavy to be borne by the stakes, and presumably this could best be the roof. Since there is no sign of walls on any other side than that indicated by the hurdling, we may imagine a number of radiating struts going down to the ground, giving semi-circular structures with one straight hurdling wall about 4 m long. The roofing may be supposed to have been of thatch or hides. The subsidiary outer rows of shallower and less regular posts could have supported jutting eves giving little porches for storage or sheltering small stock. There was no unburned clay or burned daub, so the hurdling cannot have been made windproof by daub.

In our climate structures like these can hardly have been houses for use all year round, and it is reasonable to see them as intended for use in the summer half of the year only. From this it is only a short step to regarding the site as a seasonal one connected with some specific activity. The existence of specialized hunting sites is now accepted in the early Neolithic. The specialised activity easiest to imagine at our site is herding. Admittedly there is not a great deal of direct evidence, and it is hard to see what form such evidence could take. A badly preserved cow jaw (determination by Tove Hatting) was the only identifiable faunal remains, but as all neolithic communities are known to have consumed cattle this does not get us very far. However it is justified to suppose that stock keeping was an important economic activity in all prehistoric societies, perhaps the most important, and though the idea of shielings or säter does not normally enter into our picture of prehistoric life in Denmark, perhaps it should do. It is likely, though not yet certain, that this and similar sites with light dwelling structures were seasonal encampments connected with transhumance.

The upper layers

Find stratum O was the richest in finds, but as seen in the section, fig. 2, a whole series of soils were preserved above it. These represent pauses in blown sand deposition, and were separated from one another by a few centimeters (at most 20) of clean sand. Some of the surfaces had been occupied during the course of the Single Graves Culture, giving a stratigraphical sequence. A large part of these upper layers had been destroyed already by wind erosion, and Bell Beaker sherds on the eroded surfaces showed the age of some of the destroyed layers.

We may begin with find stratum A. The grid-distribu-

tion of the pottery is shown in fig. 6, C, but what we see in the figure is really only a remnant of the original distribution, as the deposit was cut off in the north by condensation surface I and in the south by condensation surface II. Eastwards it did not diminish so abruptly as find stratum O. Structural remains were in all probability represented by the E-W row of stakeholes at the southern end of the site and their accompanying posthole.

Find stratum B did not yield determinable pottery, but contained varying amounts of charcoal, not *in situ* where burned, but transported by wind from settlement presumably not very far away. The distribution of the charcoal was irregular as though blown into drifts, and it was not associated with a find layer and occupation earth in the usual way, but rested in fairly clean sand.

Find stratum C had been blown away everywhere except in the extreme east of the site (fig. 6, D). It may in the future yield interesting finds, as the coast erodes further.

Condensation surface I had cut away find stratum A in the northern part of the site, and in the extreme north it cut so deep as also to cut away find stratum O (fig. 6, E), as seen in the distribution diagrams for those layers. Probably many of its sherds derive from find stratum A, but in only a few cases were sherds of the same pot found in both contexts.

Condensation surface II had cut down through all layers in the southern part of the site, including find stratum O. The concentrated flint in it in this area must have derived from this (fig. 6, D), but most of the pottery had been destroyed by sand blasting in the wind. Further north it overrode both find stratum A and condensation surface I, so the material on it must derive from still younger layers that have been completely destroyed.

Phosphate analyses and carbonized grain

With the collaboration of P. Nørnberg from Århus University Geological Institute a trial was made to see if there was any clear patterning of phosphate values in find stratum O. Six soil samples were analysed – three west and three east of the lines of stakeholes. The results are shown in Table I. It can be seen that the P-values before ignition exactly follow the order of the values for ignition loss in the column to the left of them. As the ignition loss indicates the organic content of the sample by weight it is clear that organic content has an important influence on phosphate measured this way, and this is the way archaeological phosphate values are usually measured. To avoid this problem the values can be weighted in the way proposed by Nørnberg in Liversage, Munro, Courty and Nørnberg (1987), which gives the values shown in the last column of Table I. Unfortunately here the values do not suggest any significant patterning of phosphate around the site, and they are given mostly as an example of the level of phosphate to be expected in anthropogenic deposits of this kind.

The archaeobotanical study was more successful. About 100 liters of sand from find stratum O was processed, giving a yield of 318 cereal grains and 2½ other seeds. They were found both inside and outside the huts, being somewhat commoner outside, probably because more crushed underfoot inside. The place with most corn was the refill of the pit in the western stake alignment, a 20 liter sample of which produced 283 grains. Sampling methods and the results are dealt with by Robinson and Kempfner in this volume, so here it will be enough only to give their most important conclusions.

The material was nearly pure naked barley. One grain of emmer, 5 of hulled barley, and 3 of oats (likely

	sample no.	ignition loss %	phosphate content as P before ignition ppm	after ignition ppm	difference	difference / ignition loss
	p1	3.05	239	396	157	51
A	p2	1.76	152	252	100	57
	p6	1.04	74	150	76	73
	p3	1.12	109	186	76	68
B	p4	0.70	58	101	43	61
	p5	1.16	76	116	40	34

Table I. Phosphate analyses. Group A from rich occupation deposit of find stratum O. Group B from poor part of same layer east of stakeholes.

to be wild) form an only insignificant admixture. There were also a number of weed seeds, especially in the sample from the pit, but on the whole the proportion of weed seeds is low. They could perhaps be crop weeds brought in with the harvest, but could equally well be from plants that grew at the site, if some seeds of these had accidentally blown into the embers and thus been carbonized.

David Robinson reports that the crop, or part of it, had been harvested unripe, which would reduce losses owing to the ease with which naked barley falls out of the ear. The ears may have been cut or plucked individually into (for example) baskets. Suitable tools for cutting straw near the ground were not yet known at this time.

It is interesting to find a virtually pure crop of naked barley, because at the few hitherto-studied neolithic sites in Denmark barley played second fiddle to wheat. This is illustrated by the diagram, fig. 7, of Rowley-Conwy (1978), which shows wheat dominant in the Early Neolithic but beginning to give way to barley in later Middle Neolithic times. Three further studies that have since become available confirm the same tendency and show a more marked change-over to barley cultivation in final Funnel Beaker and Single Grave times, from which samples had earlier been lacking (Jørgensen and Fredskild 1978; Rostholm 1986; Robinson and Kempfner in this volume). Then the pendulum seems to swing the other way, with both wheat and barley present in the Late Neolithic and Bronze Age, with a greater variety of subspecies and evidence that different crops were grown and stored separately at the same farm.

However in other parts of northern Europe naked and also hulled barley play an important part even before the development of the Funnel Beaker Culture, and so does bread wheat (see Willerding 1970 for summary). Close in space and time there is a good deal of barley at Fuchsberg (EN/MN transition), and at Oldenburg-Dannau in eastern Holstein (middle of MN) barley already exceeds wheat (Kroll 1982). A large sample of impressions in pottery of the Corded Ware Culture in Saxo-Thuringia shows not nearly pure barley, as in contemporary Denmark, but wheat with a slight lead (Matthias 1969). It will be interesting to see if the pattern that is now emerging in Denmark will turn out to be the real one, or if it is just the result of insufficient sampling.

THE FINDS

Pottery (figs. 7–10)

Horizon O. About 4.5 kg of pottery was found in Horizon O from hardly more than 14 different pots, of which one by itself accounted for nearly half the sherds by weight. Probably this was the last pot broken before the site was abandoned, while the other broken pots were pulverised by being trampled on the floors of the huts.

The pottery is fired reasonably hard and except for pots 2 and 3 is gritted with small angular pieces of quartz, felspar, and mica, no doubt obtained by breaking up granite. The general impression is that the potters did not care much about the appearance of their wares, which are coarse and unsmoothed. Colour ranges from brownish black to dull yellow-orange. The following categories are present:

Storage jars (4 pots)
Globular vessels (about 3 pots)
Beakers (5–7 pots)

A further breakdown of the beakers gives 1–2 corded beakers, 2 with cardium ornament, 1 herringbone beaker, 1 with sparse jabs, and 1–2 with horizontal grooves. All these were archaeologically speaking contemporary.

Pot 1: most could be fitted together (ca. 2 kg sherds), but at the base only a single sherd survived. It was a fairly big vessel with a diameter of 26 cm and a height of about 33 cm. The rim is thickened and ornamented with fingertip impressions and the foot protrudes slightly (fig. 7).

Pot 3: a single large sherd with "short-wave" moulding and one of the two pots without a lot of stone grit. The 'short-wave moulding' is made by pressing a cordon first one way and then the other with the end of the finger (fig. 8:2).

Pot 15: this was represented by 3 sherds indicating a large, fairly straight-walled pot with a slight cordon under the rim. It was ornamented with fingertip impressions showing a long fingernail (fig. 8:6).

Pot 10 was only a single thick bulging belly sherd with irregular fingertip fluting, but it falls best into the storage jar category (fig. 8:10).

Pot 7: a globular-bodied vessel represented by the following: 3 sherds having a ledge shoulder with faint squarish impressions, 4 sherds with small applied knobs, a single small rim sherd (angle unsure), and about 20 other small sherds. Unfortunately it is not really sure where the knobs belong, and the diameter cannot be safely measured (fig. 8:1).

Pots 8 and 8a are two shoulder sherds similar to pot 7, but thinner and impressed with a smaller tool, a base sherd with similar impressions, and a plain rim sherd, all of which appear to derive from two or more further globular vessels (fig. 8:4, 8, 9, 11). These globular-profiled pots were smaller than the storage jars, but are so scrappily preserved as not to be closely measurable.

The 5–7 beakers were so far as can be seen of the tall-necked variety, but this cannot always be shown because of the small size and number of sherds.

Pot 2: this was the fitting rim and belly of a beaker with

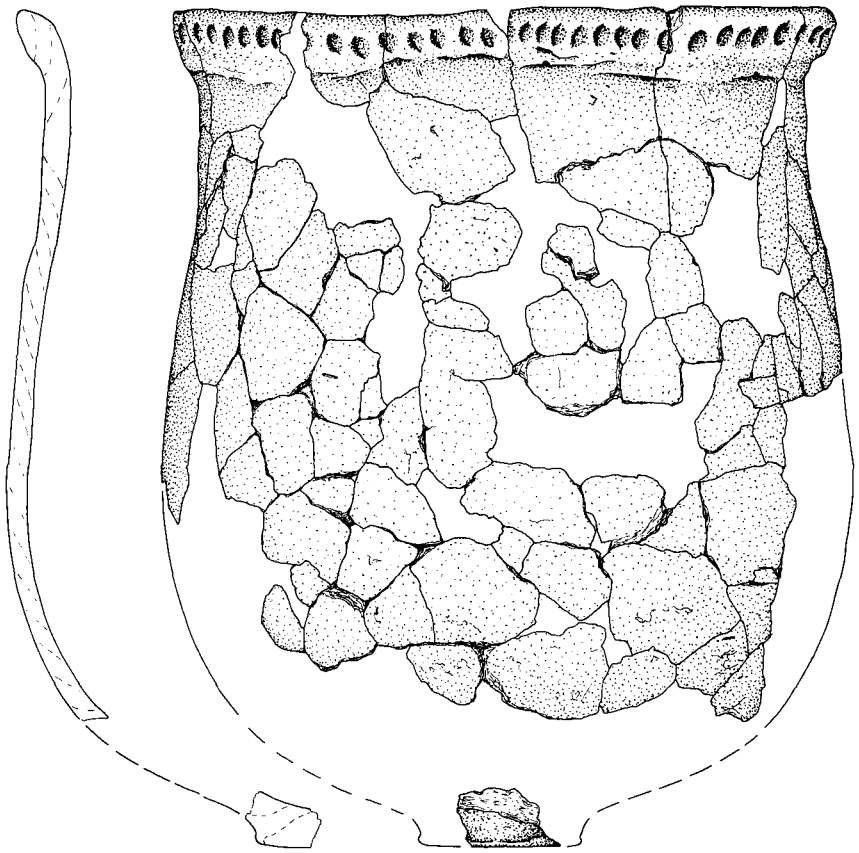

Fig. 7. Mortens Sande 2: pot 1. Scale 1:3. Drawn by Eva Koch Nielsen.

swayed profile and tall neck ornamented with a rough impressed herringbone pattern. Rim diameter about 14 cm. A separate sherd from the same pot has a small round pit bored almost through it after applying the herringbone ornament but before firing. The technique recalls that used to make holes in amber. This beaker was gritted only with a little sand and limestone (fig. 8:7).

Pot 6: represented by four small fitting rim sherds ornamented with rows of oblique cardium impressions. The pattern must be related to herringbone, but the alternation of tilt has been neglected, at any rate in the two rows preserved. Carelessness about tilt alternation is also seen on pot 2. Rim diameter about 10 cm. it is hard to complete the profile as a Single Grave beaker without allowing a tall neck (fig. 8:3).

Pot 11: fitting sherds from the middle of a neck, which must likewise have been fairly tall. It is ornamented with stacks of curved cardium impressions (fig. 8:12).

Pot 5: several sherds probably of a single small beaker with rim diameter about 14 cm, including a tall neck with a little below the rim a row of fingertip impressions with nail (fig. 8:5).

Pot 4: this may really be 2 or 3 separate beakers present only as a few very small sherds each. Horizontal cord lines on the neck and a closing row of impressions under the lowest of them are indicated (fig. 8:13).

Find stratum A. Only seven pots with recognizable traits could be distinguished in the 1.2 kg of pottery from this layer. They fall into the same categories as in find stratum O, and there does not seem to be any fundamental difference between the types present in the two assemblages.

Storage jars with thick straightish walls are indicated by pot 19, which had a slight cordon under the rim and scattered impressions made with a round-ended tool (fig. 9:3), and pot 20, which seems to have been similar, but only body sherds are present, one of them ornamented with flat round impressions (fig. 9:8), and pot 21, of somewhat different ware, with D-shaped impressions (fig. 9:6). The thick, grooved sherd, pot 23 (fig. 9:7), is probably also from a storage jar.

Globular pots are represented only by pot 18 (fig. 9:2), but these sherds give a better idea of the profile than the sherds in find stratum O. The shoulder had a row of impressions as on pots 7–8, there were little vertical applied strips with cross marks, and there were little notches on the outer edge of the rim.

Fig. 8. Mortens Sande 2: pottery from find stratum O. Scale 1:2. Drawn by Eva Koch Nielsen.

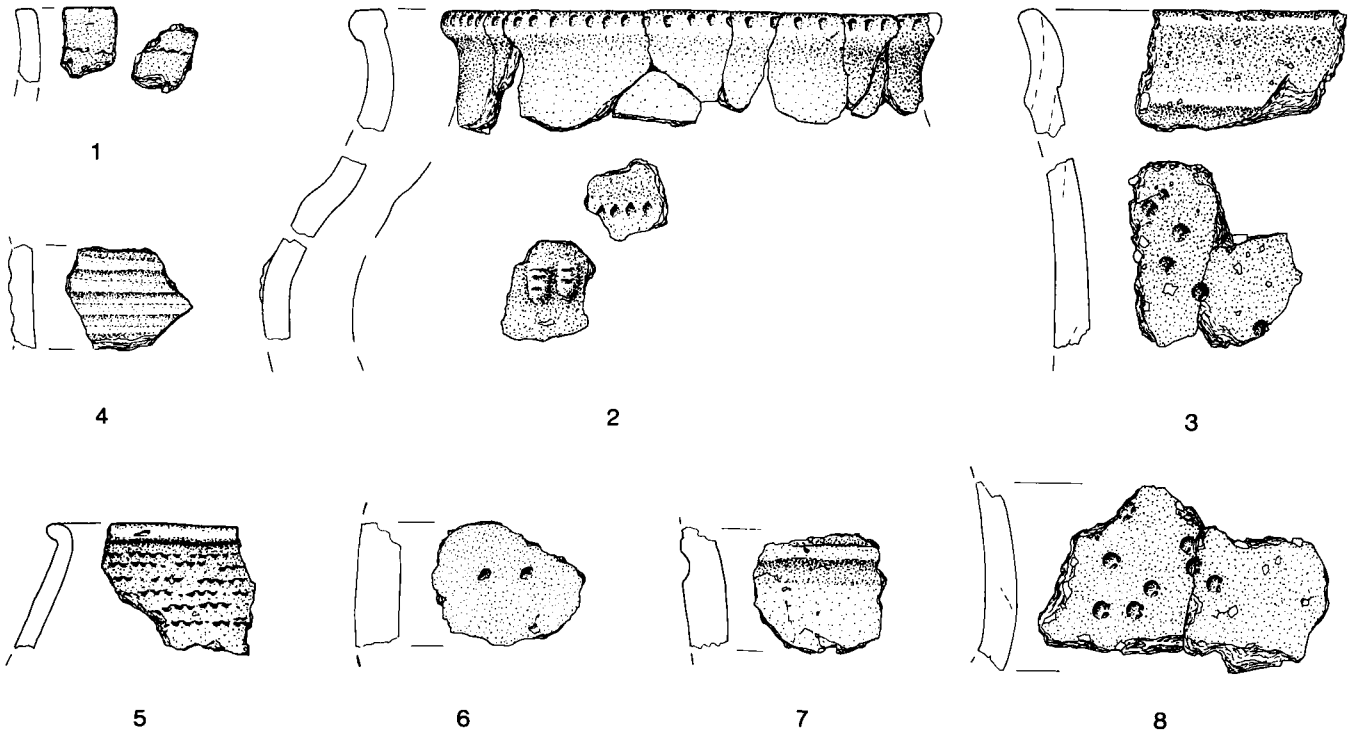

Fig. 9. Mortens Sande 2: 2–3 and 6–8, pottery from find stratum A. – 1, 4 and 5, pottery from find stratum C. Scale 1:2. Drawn by Eva Koch Nielsen.

Find Stratum C. There was no pottery from find stratum B, but that from find stratum C was quite informative considering that only 0.035 kg of sherds were found.

The rim-sherd (fig. 9:5) suggests an ovoid form. It is ornamented with cardium impressions. There are also two small beaker sherds with horizontal cardium lines (pot 39a, fig. 9:1). Seven body sherds (fig. 9:4) have horizontal grooves that have been smoothed over to give a corrugated effect rather than one of separate channeled grooves. The pottery seems to have developed appreciably since stratum A, but a larger sample would be desirable.

Pottery from the erosion surfaces. The pottery from the erosion surfaces is a mixture left behind from different overlying layers destroyed by wind erosion. Sherds belonging to pots from the find strata have been treated with them above. Some however belonged to vessels from which no sherds were found in situ, and some may even have originated in settlement layers younger than those preserved intact.

Pot 26: this is many small sherds indicating a straight-walled beaker. It is ornamented with oblique strokes on the rim, and horizontal toothed-stamp lines on the body. It comes closest to Glob's type K5, assigned to the Uppergrave period (fig. 10:10).

Pot 35: of this there are two thin but rather coarse sherds with ornament in Bell Beaker style consisting of narrow cross-hatched zones on the neck and a metopic pattern with hatched triangles lower down (fig. 10:6).

Pot 36: this is an unusual sherd of smooth, dark ware, which shows a fragment of a zone tightly filled with comb-like impressions made with some special stamp or by special application of an ordinary toothed stamp (fig. 10:7).

Pots 22 and 28 were ovoid beakers with recurved neck, and were ornamented with horizontal grooves (fig. 10:3 and 9). Further grooved sherds (fig. 10:1, 4, 8, 11) were probably from similar pots.

Pot 30 was a single rim sherd of a storage jar with fingertip impressions with fingernail near the rim (fig. 10:5).

Pot 37 was two sherds indicating a fairly large pot with horizontal cord lines (fig. 10:12).

Most of this pottery was from erosion surface I. The plain open bowl indicated by the rim sherd (fig. 10:2) is the only example of this form at the site. It was found on erosion surface II.

The typology of the pottery from Mortens Sande 2 can be summarised as follows. There are three main classes of pots – storage jars, globular-bodied vessels, and beakers. The storage jars are characterized by their larger size, thicker walls, and generally fairly straight profile. Fingertip decoration was common, sometimes taking the form of a "short-wave moulding". The globular-bodied vessels have everted rim and were decorated with notches or impressions at the rim, transition from neck to belly, and foot, and with small knobs or vertical ribs. The beakers in the main layer (O) appear to be of the long-necked variety and were ornamented with cord, cardium, jabs,

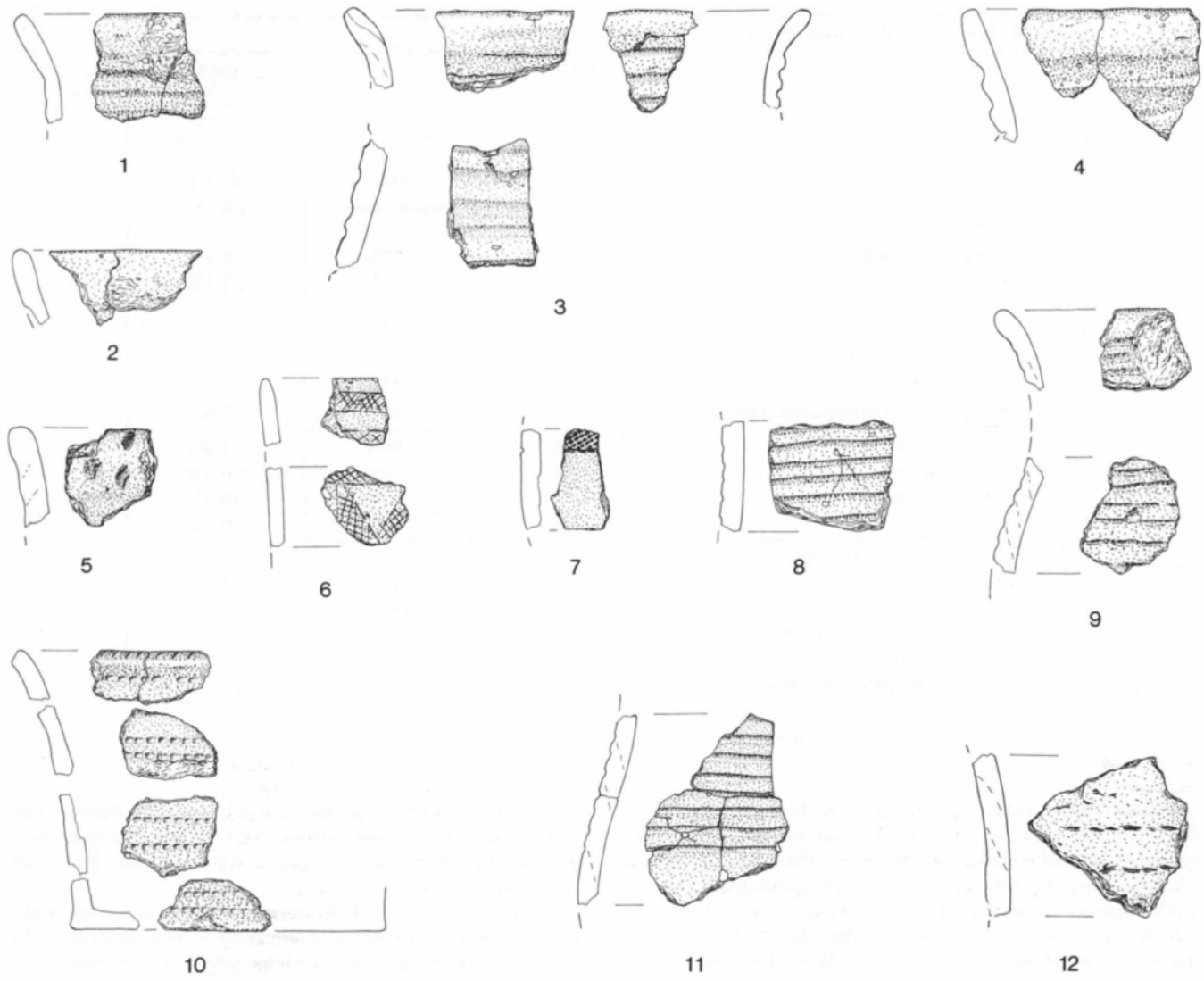

Fig. 10. Mortens Sande 2: pottery from condensation surfaces. Scale 1:2. Drawn by Eva Koch Nielsen.

or fingertip impressions. The patterns included herringbone and horizontal lines. In higher layers there were sherds of a straight-walled beaker and Bell Beakers with toothed stamp ornament, and also of ovoid beakers with horizontal grooves. These elements are confined to the later settlement layers.

Flint (figs. 11–14)

The special interest of the flint industry is its unusual character. It differs for instance from the two assemblages in the same cliff section studied by Liversage and Singh (1985). A summary of the material is given in table II. Here follow some remarks.

1. The raw material was morainic flint of a variety of colours and qualities. Mined flint is not present, and beach pebbles were apparently used only as hammer stones. The poor selection of raw material must have been one of the reasons for the poor quality of the working.

2. Flaking technique was somewhat rough. This shows in the frequent broad, randomly placed, striking platforms and obtuse angles between the striking platforms and the bulbar surface. A hard-hammer technique was used, giving big, swelling, and sometimes sharply localized bulbs. The cores are mostly very irregular, but a small number show residual blade technique. The treatment of the flint is much less skilled than usual at Danish sites, which could support the theory that the inhabitants were newcomers who lacked experience in the daily manipulation of flint.

MORTENS SANDE 2: find stratum O				
A	total number of pieces	1263		100%
	of these tools	96		7%
	cores	68		5%
		number	% of clear implements	% of total pieces
B	transverse arrowhead	1	2%	0.1%
	scrapers	14	31%	1.1%
	pointed tools: borers 2 drills 10 picks 3	15	33%	1.2%
	burins on flake	15	33%	1.2%
	(total of clear implement types)	(45)	(99%)	(3.6%)
C	burins on core	36	80%	3.0%
	notched pieces	4	9%	0.3%
	denticulated pieces	6	13%	0.5%
	various	6	13%	0.5%
D	flakes struck from polished axes	4	9%	0.3%
	burin spalls	19	42%	1.5%
	waste flakes	1075	2389%	85 %
	cores: residual blade technique 12 flattish 3 not further classified 53	68	151%	5 %

Table II. Mortens Sande 2: worked flint from find stratum O.

3. The biggest surprise, however, was the large number of burins. These appear to have been made without distinction on flakes and on suitable flattish cores. The burins on flakes (fig. 11:1–2, 5–6) show quite a lot of morphological variety. Both single-blow and multiple blow forms occur, and they are struck sometimes on a retouched edge (fig. 11:6) but more usually on a simple one (fig. 11:1,5). With the majority the there is a smaller group where it is nearer to 60°; in these cases the edge is situated medially near the axis rather than at a corner, as it is when the angle approximated to 90°. The working edges are frequently rather ragged, and examination under a binocular microscope sometimes reveals smoothing or rounding due to use.

The core burins (fig. 11:2,6 and 7) also usually have the working edge at a 90° corner but in some cases have a 60° angle and a medial placing. They are distinguished from other cores by the total shape of the implement and the narrowness of the burin facets, which are narrower than the scars found on cores, but there are transitional forms which create a demarcation problem. Like the flake burins, the core burins are found with single or with multiple burin facets.

The sharpening of burins created as by-product the small thick blades known as burin spalls fig. 13,1–3. Some of these were used as blanks for making drills.

4. The implements with working point are not a homogeneous group but belong functionally to three quite different classes, here called awls, drills, and heavy core points. Also some miscellaneous pieces from part C of the table must have been used for piercing or boring, as traces of wear shows that the points were used.

The two awls (fig. 12:1–2) on respectively a core and a flake weigh 23 and 9 g (compare other examples of weights given by Liversage and Singh, fig. 6). Quite different were three very large core tools with spike of which the largest (fig. 12,4) weighed just over a kilogram.

The commonest pointed tools, however, were narrow little drills recalling microliths (fig. 13:4–7). They were suitable for mounting in a wooden shaft and could have been used to bore holes in amber, as has been shown by experiments (Liversage and Hirsch 1987). The drills are usually made from burin spalls, which were given a minimum of retouch at the point. This raises the question whether the surprisingly many burins at the site were really only cores from which blanks had been struck to make drills for working amber. However some of the burins show traces of use, so it cannot be asserted that they were exclusively waste products. Nevertheless there may still be a connection between the large numbers of drills and of burins at Mortens Sande 2.

5. Scrapers occur with a lower percentage than usual in the Neolithic (1.1% of the total material, as against 3.1% at Penbjerg and 2.4% at the Barrel Site). There is also a difference in quality. The blanks were usually smaller, thicker, or less regu-

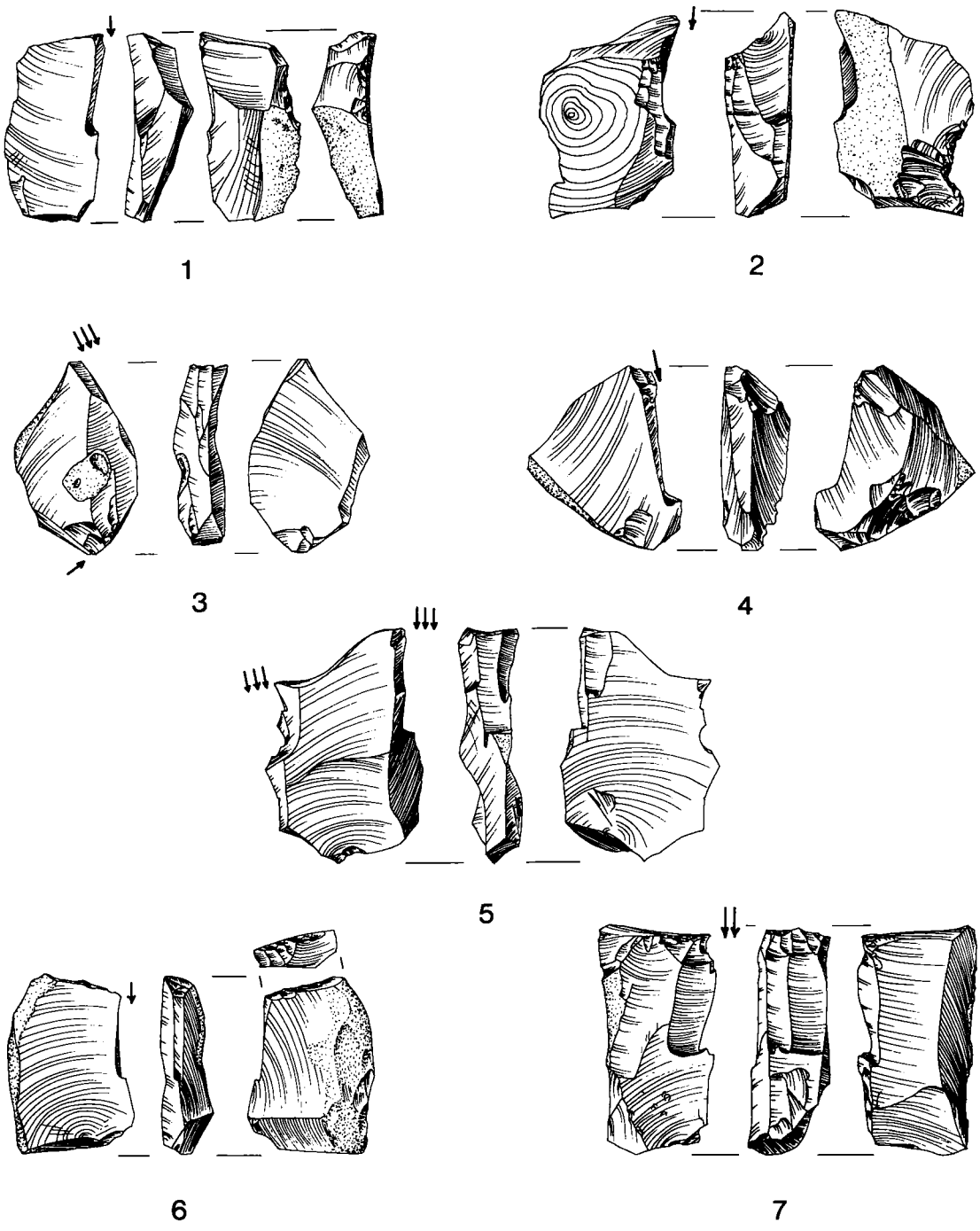

Fig. 11. Mortens Sande 2: worked flint from find stratum O. 1–7 burins. Scale 2:3. Drawn by Eva Koch Nielsen.

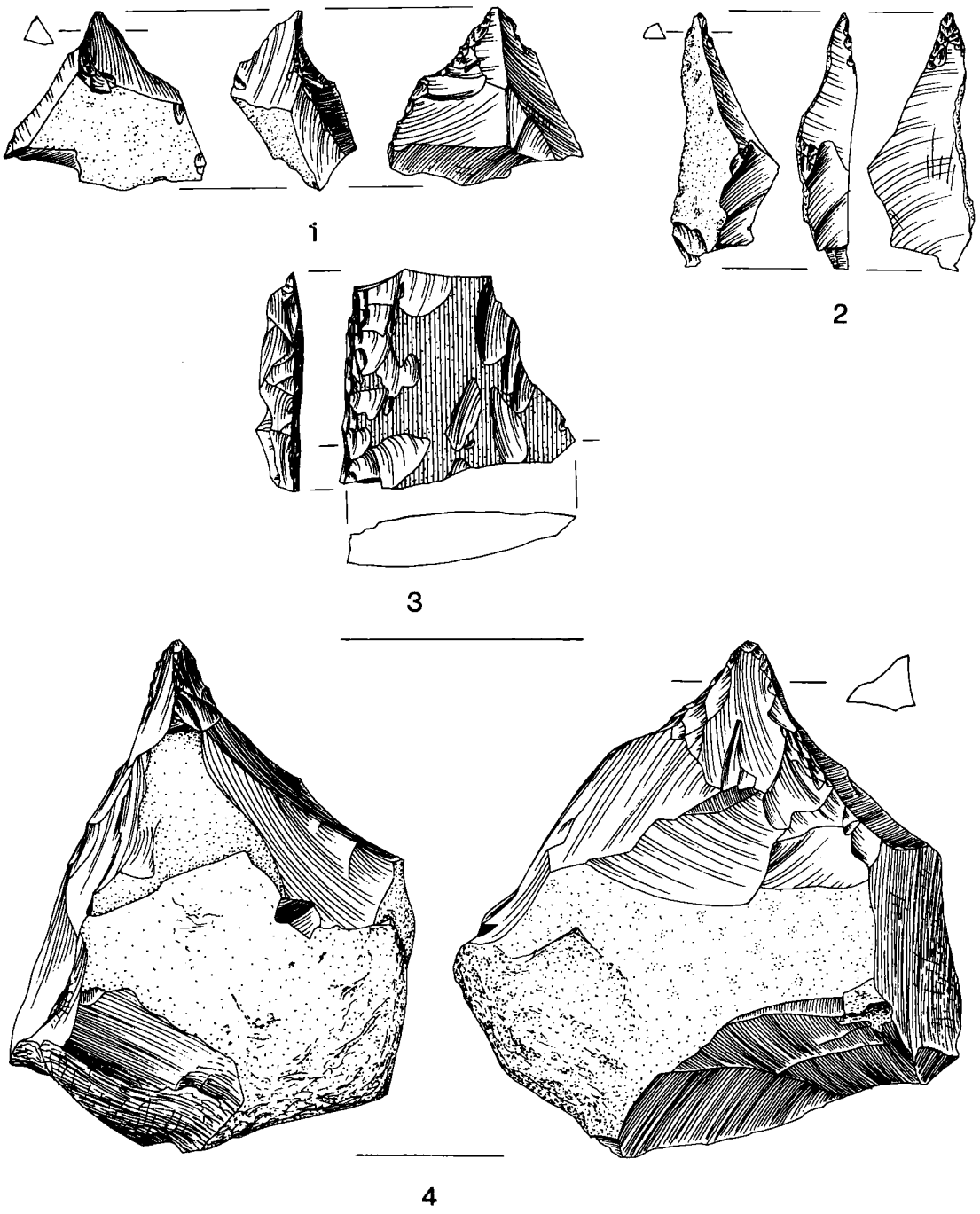

Fig. 12. Mortens Sande 2: worked flint from find stratum O. 1–2 borers, 3 flake from polished flint axe, 4 heavy core point. Scale 2:3. Drawn by Eva Koch Nielsen.

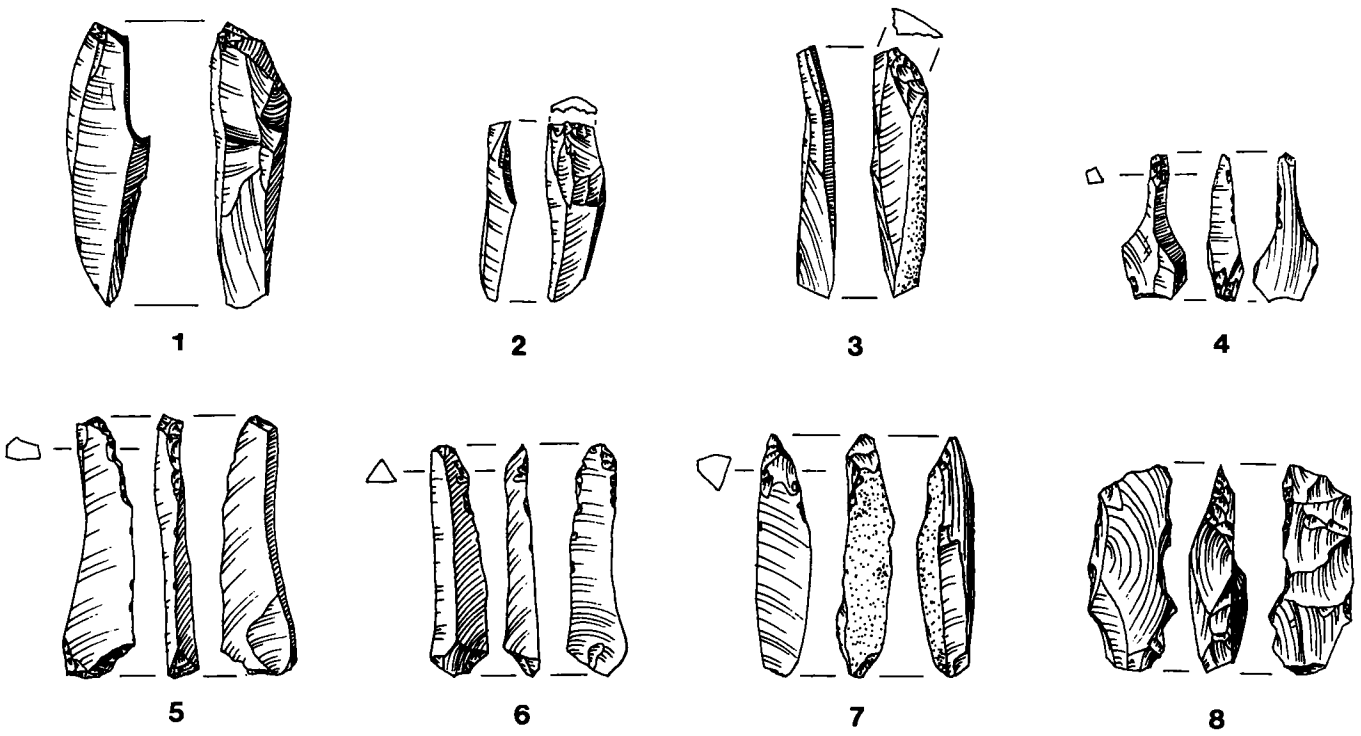

Fig. 13. Mortens Sande 2: worked flint from find stratum O. 1–3 burin spalls, 4–7 fine drills, 8 transverse arrowhead. Scale 1:1. Drawn by Eva Koch Nielsen.

lar than usual with scrapers in Denmark, and less edge was retouched (fig. 14: 1–4).

6. Attention may be called to a very poor transverse arrowhead (fig. 13:8), a form sometimes found in graves of the Single Graves Culture.

7. Part C of the diagram is used for those retouched tools that are difficult to define accurately or treat consistently. The core burins are included here, and also some other retouched forms that were made indifferently on flakes and cores. Use wear can be seen in some cases; also some of the unretouched waste seems to have been subjected to use. Fig. 14:5 and 7 may be described as notched and fig. 14: 6 and 8 as denticulated.

8. Cores: 12 out of the 68 cores showed broad blade scars struck in parallel from a platform. The majority however were very rough with much shattering, and without visible system.

9. A flake was found from a large polished axe (fig. 12:3), but is not big enough to show the axe's type.

The most characteristic traits of the Mortens Sande 2 flint industry was its rough flaking technique and numerous burins. Blunted-back knives seem to be absent as does flat retouch. The proportion of scrapers is lower and their workmanship poorer than in other Neolithic industries.

If further study shows that this distinctive flint industry is not an isolated occurrence, but is typical of the Single Graves Culture, it may be possible to identify Single Grave settlements by their flint alone when the pottery has all been destroyed. This could make new advances possible in the study of the culture and its settlement pattern through surface survey, as well as helping to identify sites for excavation.

Amber

In find stratum O there were abundant remains from working raw amber into ornaments. There was only a little amber in the other layers, but enough to show that it was still being used. Only in find stratum O was a workshop actually struck.

In this were found the following: a perforated disc; 3 beads, unfinished, but which look as if they could have been finished off if wished; 8 unfinished beads either with unfinished hole or broken when the hole was being bored; over 30 pieces with signs of working but without hole or final shape; 14 natural pieces of amber discarded at the site unworked; and finally an abundance of tiny crumbs and slivers hardly visible to the naked eye but recoverable when soil samples are sieved in water. The disc, the unbroken beads, and a few examples of broken beads-in-the-making are shown in fig. 15.

Experiments in amber working have shown that cutting and scraping with flint implements produces the same kind of waste as was sieved out of the soil samples and leaves marks like those found on the originals (Liversage and Hirsch 1987). There is no indication that amber was polished at this site – all

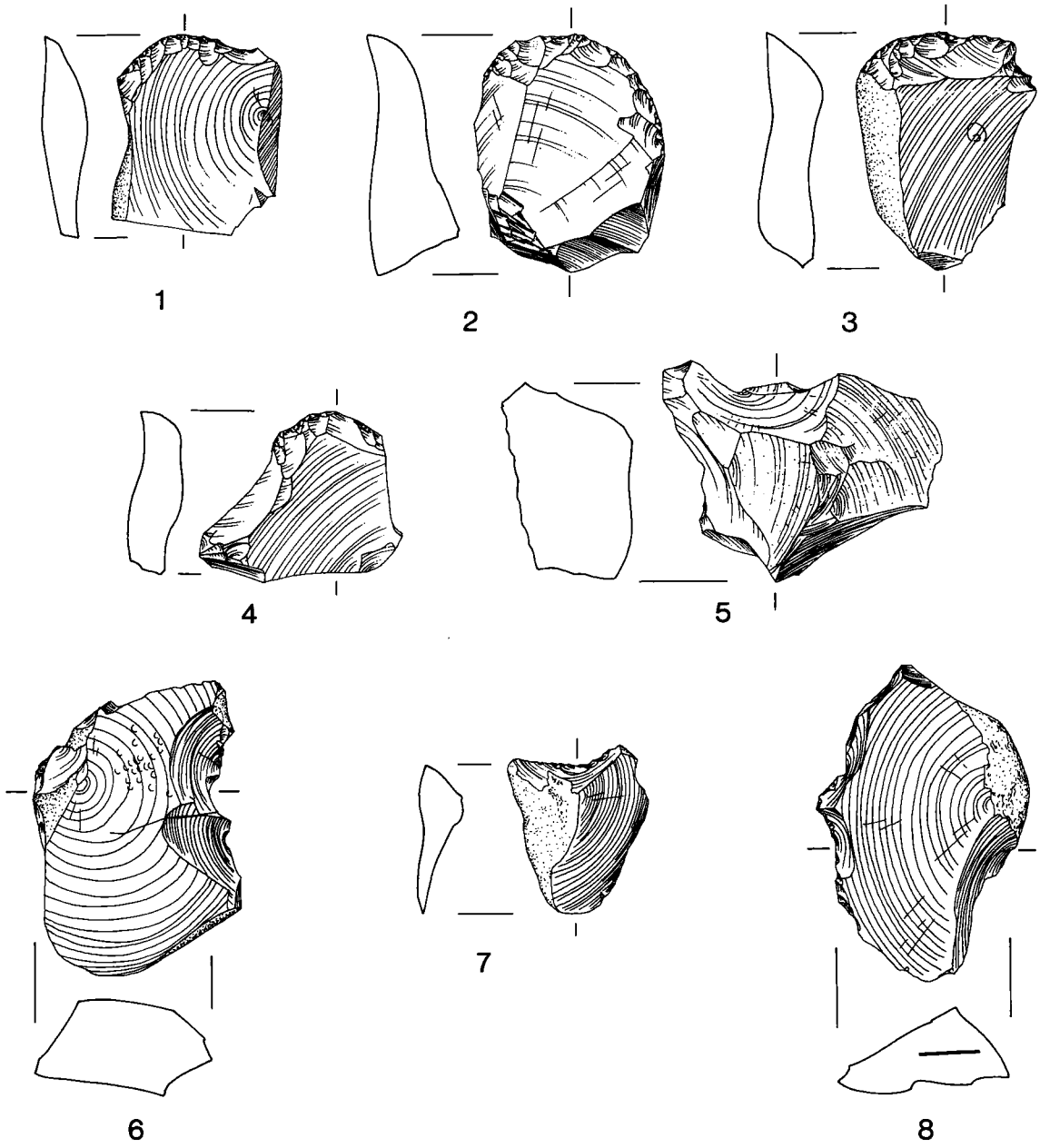

Fig. 14. Mortens Sande 2: worked flint from find stratum O. 1–4 scrapers, 5–8 miscellaneous. Scale 2:3. Drawn by Eva Koch Nielsen.

work seems to have been done by cutting, scraping and boring. The perforations in the beads were drilled, and fig. 16 shows an enlarged photograph of a bead that had broken through a hole. Similar marks can be produced using a pump drill armed with a narrow flint point like fig. 13:4–7, attached with resin to the end of the drill-shaft.

The most distinctive piece was the roughout for an amber disc, fig. 15:10. Finished examples are fairly common in male graves of the earlier part of the Single Graves Culture. The unfinished beads were rather uncharacteristic, but are not unlike the common beads from single graves (fig. 15:6–9). The fact that 14 natural lumps were discarded shows that the inhabitants were not very careful of their raw material, of which they probably had plenty (fig. 15:1–4).

The pendant, fig. 15:11, came from find stratum B, and the complete bead, fig. 15:5 came from condensation surface I. The hole is smaller in the last than in the other beads from the site.

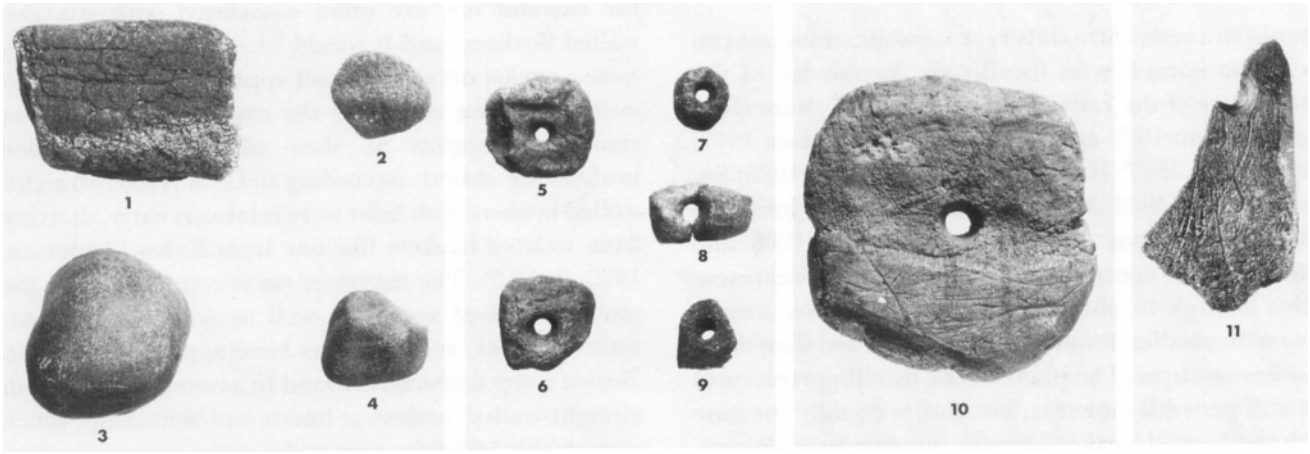

Fig. 15. Mortens Sande 2: amber. Scale 1:1. Phot. L. Larsen.

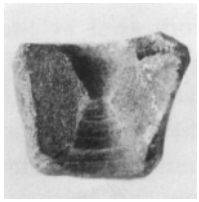

Fig. 16. Mortens Sande 2: Enlarged picture of a broken amber bead with drilled perforation. Scale 2:1. Phot. D. Liversage.

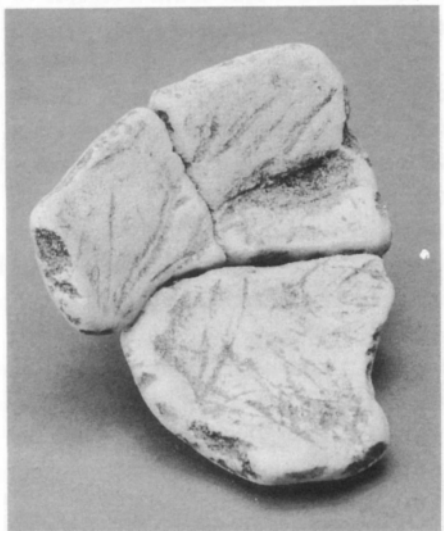

Fig. 17. Mortens Sande 2: Fragments from miniature stone bowl. Scale 2:1. Phot. J. Lee.

Other Materials

The three fitting fragments in fig. 17 have the shape of about one sixth of the side and base of a round-bottomed bowl about 2½ cm high and 5 cm in diameter. It is of a somewhat porous white material resembling limestone. Per Nørnberg of Århus University Geological Institute was kind enough to make a thin section from a fourth non-fitting fragment, and found it to be a decalcified limestone residue including the silicious skeletons of marine organisms. Such decalcified residues are not uncommon in the till. It is perhaps not quite certain that this one had been ground into a bowl, as only a small part is preserved and such objects have never been found before. The lines scratched on it are secondary and not from the original shaping. They include two horizontal lines under the rim that look like decoration, and parallel oblique scratches on the interior. The material is fairly soft and could probably be ground or rubbed to shape without leaving striations, or the striations have weathered away.

The only other objects were a small number of round quartzite pebbles that had been pocked by use as hammerstones, probably for striking flint.

CONCLUSIONS

Thanks to a series of mainly recent publications one can no longer complain of insufficient knowledge of the settlements of the Jutland Single Graves Culture (Jens Aarup Jensen 1973 and 1986; Karsten Davidsen 1977; Steen Hvass 1977; Hans Rostholm 1982 and 1986; Søren Andersen 1983; Mogens Hansen 1986; E. Johansen 1986; Lone Hvass 1986; John Simonsen 1986 and 1987). On the contrary, information is now representative enough to show that Single Grave settlement sites were smaller, fewer, and more scattered than those of other cultures. The plans of the dwelling structures are still generally unclear, but this is equally the case with the Funnel Beaker Culture (barring new discoveries on Bornholm, see Nielsen and Nielsen, 1985).

One of the special virtues of settlement sites is that they give a new dimension to the study of the material equipment, especially the pottery. Earlier the Single Graves Culture was seen mainly through its many graves, which gave a rather one-sided picture.

The available assemblages of settlement pottery are now divisible into broad chronological groups, with particular sets of traits being typical of each group. The results of a study of the published assemblages along lines indicates by Simonsen, (1967) is given in table III.

The following traits are important for chronological differentiation.

Short-wave moulding. This is made by impressing the finger alternately above and below a cordon or the edge of the rim, pushing it into a zig-zag. Simple rows of fingertip impressions are a closely related ornament. Ornament with finger impressions is linked with the large storage jars with fairly straight sides, and the presence or absence of these storage jars is chronologically significant.

Corded necks are linked with the beaker form and are chronologically significant. It does not emerge from the present material that short corded necks are later than long ones, but this was shown by Glob (1945).

Globular-bellied vessels with recurved rim have been shown by Simonsen to be one of the most characteristic forms at Single Grave settlements. They are rare in graves, and this has biased our understanding of the pottery of the culture.

Straight-walled beakers on the other hand are common in both graves and settlements and are very variously ornamented.

Three other traits, *collar*, *toothed stamp decoration*, and *flat decorated rim*, are often associated with straight-walled beakers, and it would be easy to suppose they were a packet of traits that all appeared together. However this seems not to be the case, for the last three sometimes appear at sites where straight-walled beakers are absent. According to Glob (1951) straight-walled beakers with *collar* were relatively early, deriving from waisted beakers like one from Kalvø (Andersen, 1983, fig. 8,2). The *flat-topped rim* is connected with the globular-bodied vessel as well as with the straight-walled beaker, and can thus have appeared before it. *Toothed stamp decoration* is found in assemblages without straight-walled beakers at Borris and Skinderup, which presumably indicates that it also came into use earlier.

Bowls occur both late and early. The late bowls are simple conical forms, while the early ones are more elaborate.

Following lines indicated by Simonsen the occurrence of these traits in twelve assemblages is shown in Table III. Lone Hvass (1986) and Mogens Hansen (1986) mention further settlement assemblages, but do not present them in enough detail for use here. The first and last sites, Lustrup and Myrhøj, belong to separate groups, so the table really only divides up the middle ten sites. In accordance with the diagram four chronological groupings can be set up for settlement pottery and named after Lustrup, Glattrup, Vindum, and Myrhøj.

The *Lustrup group* is only known from very small assemblages found in or under barrows (Rostholm 1986a). With its corded-neck beakers and large nearly straight-walled jars with short-wave moulding the Lustrup group stands out very clearly from the others.

Also the late *Myrhøj group* stands out clearly. Several sites are known, including some in the cliff section close to Mortens Sande, but Myrhøj is far the richest. Flint daggers date the group to the beginning of the Late Neolithic and it is the north Jutland local group of developed Bell Beaker pottery.

The ten remaining sites fall into the earlier Glattrup and the later Vindum groups. Typical Glattrup group pottery consists of beakers with corded necks and storage jars with fairly straight profiles, but it differs from the foregoing Lustrup group in the presence of globular-bellied vessels. Sometimes other forward-looking traits like the collar are present.

The *Vindum group* followed, which was characterized

	short-wave moulding	other finger-impressed jar	corded neck	bowls	cardium impressions	round-bellied vessels	collar	flat decorated rim	toothed stamp	straight-walled beaker	ovoid beaker	Bell-Beaker ornament
Lustrup	+		+	+								
Mortens Sande 2	+	+			+	+						
Glattrup			+	+		+						
Hvolris			+		+	+		+		+		
Kalvø		+				+	+					
Nr. Borris					+	+		+	+			
Blegind						+	+		+		+	
Skinderup								+	+	+		
Vorbasse									+	+		
Vindum Skovmark						+		+	+	+	+	
Fur					+	+		+	+	+		+
Myrhøj				+	+				+	+	+	+

Table III. Single Graves Culture settlement pottery – occurrence of traits at twelve sites.

by both toothed stamp ornament and straight-walled beakers, though the two elements are not always associated. Globular-bodied pots occur in the Glattrup and Vindum groups alike, but not in the Lustrup or Myrhøj groups.

This is only a working system for present use, and it will be interesting to see if it is confirmed by future discoveries. It could be made more detailed by taking account of a larger number of traits, but these would be mostly details of the ornament of straight-walled beakers, and it is likely that many of these would be regional variations without great chronological significance. Moreover the larger the number of traits considered, the less importance can be attributed to negative evidence (absence of traits).

At the 1986 symposium on the Single Grave Culture in Denmark (Adamsen and Ebbesen 1986) some contributors seemed willing to modify Glob's chronological system. Its fivefold chronological division certainly seems ambitious, but a final judgement must wait until the entire material had been re-examined. The present author has elsewhere indicated that grave and settlement chronologies should be set up separately and only afterwards correlated to produce an integrated system (Liversage 1980). The Lustrup, Glattrup, and Vindum phases should on no account be regarded as directly equivalent to the Undergrave, Groundgrave and Overgrave periods. Any attempt to date Mortens Sande 2 more closely than to the Glattrup group would be meaningless.

Settlement archaeology is not the only aspect of the Single Graves Culture being illuminated by recent research. We may take it as established by Lanting and van der Waals that Bell Beaker pottery developed in NW Germany and Holland out of Single Grave pottery (latest presentation van der Waals 1984). Earlier theories of a diffusion from Iberia are now rejected. If the Single Graves and Bell Beaker Cultures are then really only successive phases of the same culture, the question arises of an exact definition of the area in which the development took place. How much of Germany was involved? Was Jutland included?

An example is the Middle Rhine area studied by W. Gebers (1978). Gebers recognized the Dutch hypothesis on the origin of Bell Beaker pottery, but considered that in the middle Rhine it was introduced already developed from outside. Perhaps this was an unnecessarily cautious judgement, for his illustrations, which

now enable the outsider to get a reasonable idea of the pottery in question, suggest that it developed through the same stages as in the Netherlands, so that the area of formation of the Maritime Bell Beaker style could very well include the Middle Rhine.

As for the situation in Jutland, Van der Waals showed that the Uppergrave period synchronized with Maritime beakers (perhaps beginning and ending a little later), and Developed beakers synchronized with an early part of the south Scandinavian Late Neolithic. The question is what kind of relationship did the Jutland Single Grave culture of the Uppergrave period have with its contemporary Bell Beaker cousin, and what was the significance of the appearance of Beaker pottery in Jutland when it finally did appear. Did it develop organically out of Single Grave pottery as happened in a not yet quite clearly defined Dutch/west German area, or did it not?

The relationship between Uppergrave and Bell Beaker pottery has been evaluated variously. When Glob dealt with the question (Glob 1945; 1952) it was still thought that Bell Beaker originated in Iberia and the whole chronological framework was somewhat diffuse. His pottery group K was defined by its supposed connection with Bell Beaker. However as Ebbesen (1978) pointed out, much of this pottery is not Single Grave, but Late Neolithic in Myrhøj style, and therefore not strictly relevant to the question of Bell Beaker influence on the Single Graves Culture. The rest of group K bears the simplest possible ornament of horizontal cord or toothed stamp lines, patterns so simple that they can appear nearly anywhere. More recently Lomborg (1977) tried to relate the horizontal cord decoration of K6 beakers specifically to the decoration of all-over corded beakers, but the motif could just as easily represent a continuation of the early Single Grave corded neck, and the argument cannot be seen as at all decisive.

Another of Glob's suggestions was that the low corded-neck beaker, and the use of broad chevron and narrow horizontal zones on "East Danish" beakers might reflect influence from Bell Beakers (Glob 1952, pp. 52–53). Also this is dubious. Some of the pots referred to relate to AOO rather than Maritime Beaker, and are therefore too early to be influenced by Bell Beaker, while nos. 426 and 427 of Glob (1952), both found in south Jutland close to the German border, fit in as epi-Maritime in Van der Waals' terminology and are probably too late to be relevant. These suggestions were put rather tentatively, for Glob treated the matter with caution.

A more recent paper illustrates how difficult it is to sort out the problems of chronology and cultural connections (Lomborg 1977). Lomborg saw two stages of Bell Beaker influence, one in Uppergrave times and the other at the beginning of the Late Neolithic. Unfortunately the pots which he regarded as bell beakers from Uppergrave times were really Late Neolithic, as in Myrhøj or related styles of developed Bell Beaker. Dealing with supposed stylistic influences on native pottery he rightly pointed out that Glob's group K6, if foreign at all, would show AOO rather than Maritime influences, but put forward the new idea that Glob's group L8 (straight-walled beakers with multiple chevron bounded by multiple horizontal lines) really did show Bell Beaker influence. This should be taken with a grain of salt, as real Bell Beakers with this pattern are rare and distant from Jutland and the motif has a rather wide geographical and chronological range. Cultural influences mean more than the occasional use of a widespread but not particularly common pattern.

Lomborg's second wave is dated to the beginning of the Late Neolithic and is said to be due to influences from "Western Europe", generally the British Isles. The typological arguments came from playing down the role of metopic ornament at Myrhøj and playing up the narrow zone ornament, giving a putative connection with English B-Beakers (*sensu* Abercromby). Emphasis was laid on the supposed origin of the Danish flint daggers in Britain, which was an important part of Lomborg's thesis. The daggers he cites from West Overton and Fakenham occur in an unexpectedly early context, but more would be needed to establish the derivation of the Danish daggers from Britain. In all events the style of the Myrhøj (and Bigum) pottery, with which daggers make their first appearance in Denmark, places them in chronological terms securely alongside the Veluwe beakers and therefore the British A and especially C beakers.

This does not exhaust the diversity of view about what constitutes Bell Beaker influence in Uppergrave times. Lone Hvass (1986) writes "Bell Beaker influence is felt in the shape of new pottery forms, close herringbone pattern, and use of the toothed stamp". This view was put with praiseworthy conciseness, but it can be objected that herringbone pattern is better parallelled in

Single Grave than Bell Beaker contexts, that the use of a toothed stamp is too generalized a feature to have much significance and in any case is coarser on Uppergrave than on Bell Beaker pottery. The pottery forms referred to are not specified, but possibly the waisted beakers of Groundgrave times were meant; they recall late English A-beakers several centuries younger.

What then really was the extend of Bell Beaker influence in Uppergrave times? Not very much it seems, and the best evidence comes from the settlements. Maritime Beaker pottery was found in a small apparently pure settlement assemblage from Husby in western Jutland, and a single Maritime sherd was found with Uppergrave sherds in a disturbed settlement deposit on Fur in the Limfjord (J.Aa. Jensen 1973; 1986). This shows the importance of settlement pottery as a separate source of information, for these are perhaps the only Bell Beakers from Denmark that can be assigned to the Uppergrave period. Otherwise Bell Beaker in Denmark seems to be Late Neolithic, with the possible exception of a very few Epi-Maritime beakers, which belong to the Schleswig-Holstein or insular Danish regional group and not to the Jutland Single Graves Culture proper (Glob 1952, nos. 426 and 427).

The answer to our original question then is that, unlike the northwest European group, the Jutland group of the Single Graves Culture did not develop smoothly into the Bell Beaker Culture. The Jutland culture was an isolated group little influenced by what was going on in other parts of Europe, and when Bell Beaker arrived in its area at the beginning of the Late Neolithic it did so very suddenly and in a rather massive way without having clear local antecedents. It is not intended to propose invasion theories, though population mobility may well have been greater in this period than in most others. What more than anything else would contribute to elucidating the question would be a better and geographically wider knowledge of the settlement pottery.

RADIOCARBON DATES

After near completion of this paper the following radiocarbon dates became available.

K-4768	2110 ± 85 bc (ca. 2590 B.C. cal.)
K-4767	1910 ± 85 bc (ca. 2465–2200 B.C. cal.)
K-4766	1880 ± 85 bc (ca. 2460–2140 B.C. cal.)

The first dating is of charcoal sieved out of find stratum O close west of the north-eastern row of stakes. This is the only date from find stratum O.

K-4767 is from charcoal sieved out of find stratum A, and suggests that a couple of centuries may have elapsed between these two occupations despite the apparent similarity of the pottery mentioned above.

K-4766 was from charcoal in the top of the large posthole at the southern end of the site, and was submitted in the belief that this hole and the row of stakes going with it were of the same age as the others. The date is, however, statistically identical with K-4767 from find stratum A, and as the occupation layers had been denuded at this end of the site and the posthole was sealed only by condensation surface II, we have concluded that the southern stake alignment belonged with stratum A. This is a warning of the pitfalls that lie in wait at multiple occupation sites. If strata O and A had not been separated by a little blown sand, it would never have been discovered that the post structures were not all contemporary, and the interpretation of both the structures and the finds would have been accordingly. All that would be left would be an inexplicable pattern of C-14 dates.

The dating gives the change from double to single-row shelters a potential chronological value, with the possibility that double-row shelters (with porch?) gave way later to more solidly built single-row shelters. It also suggests that structures of this kind were commoner than originally thought, and will encourage the search for more at other sites along the cliff.

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