

# *Ploughing in the Iron Age. Plough Marks in Store Vildmose, North Jutland*

by VIGGO NIELSEN



In the late 1930s A.E. van Giffen and Gudmund Hatt demonstrated the existence of prehistoric ploughmarks under barrows and settlements to the archaeological world and the world in general. It soon became apparent that ploughmarks would become an extensive source of information.

Plough marks were revealed under barrow after barrow and in other contexts from all periods of agricultural prehistory, from the Neolithic, Bronze Age and Iron Age. Quantification of a number of examples was undertaken in 1960 by Johs. Pätzold, and a summary of the north European finds including those of Denmark was given by Michael Müller-Wille in 1965 and by Peter Fowler in 1971.

An ever more extensive material has subsequently appeared in Denmark. Plough marks have been revealed under most burial mounds or remains of mounds to be excavated. Plough marks have been found under prehistoric field boundaries, and covering large areas under settlements during modern excavations by machine. One such example occurs under the settlement and field boundaries at Rønne Plantage (Nielsen 1984, 139), but foremost among these are the marks found during the excavations at Grøntoft in West Jutland (Becker 1971).

In all these excavations the plough marks appear as an interesting by product of the main aim of the excavation (such as the investigation of a mound). Because the layers that seal the marks are of such limited extent, there is of course a corresponding limit to the information that can be obtained. An excavation will almost always have another main aim in view, even though a good excavation will never leave any material unrecorded.

The chance for an investigation directed primarily at the elucidation of prehistoric plough marks occurred in 1967 in the bog of Store Vildmose, in Vendsyssel in northern Jutland.

## THE LANDSCAPE

Store Vildmose used to be Denmark's largest raised bog. It grew on low lying land, the raised sea bed of a shallow marine embayment extending from the south during the Litorina period, when Vendsyssel lay lower than it now does and was broken up into a series of islands. The area covers some 60 km<sup>2</sup>, and still has the appearance of dried sea bed. Standing on it one continually has the sensation of looking towards land when facing the old marine cliffs and their foreland.

The bog and the slightly higher lying adjacent water meadows are delimited to the east, north and southwest by the just slightly falling Ryå River, which runs near the raised beach of the Litorina Sea.

The base of the bog, the sandy Litorina sea bed, is very flat. With a few variations, it drops very gently from the north or northeast. At Grishøjgårds Krat the base is at 6.40 m above sea level; 5 km to the southwest at Centralgården it is at 5.30 m; and 2 km further to the southwest off Åby Bjerg it is at 4.70 m.

The Litorina sea bed is formed by a variety of littoral and marine deposits, including pure sand, clay sand, thin clay, and marl containing chalk. Many deposits contain marine shells. Large and small stones are found everywhere, most probably carried out from the coasts by the movement of ice. The depth of these deposits varies greatly, but can be as much as 9 m. At Centralgården they measure 5.5 m, and cover much deeper deposits laid down by glacial seas.

As the land had begun to rise by 2000 bc, peat began to form in the basin, leading to the appearance of the Store Vildmose bog.

Major geological or geobotanical investigations have twice taken place in the bog.

The most recent of these has been carried out within the last decade by Bent Aaby of the Geological Survey of Denmark, using all modern methods: pollen analy-

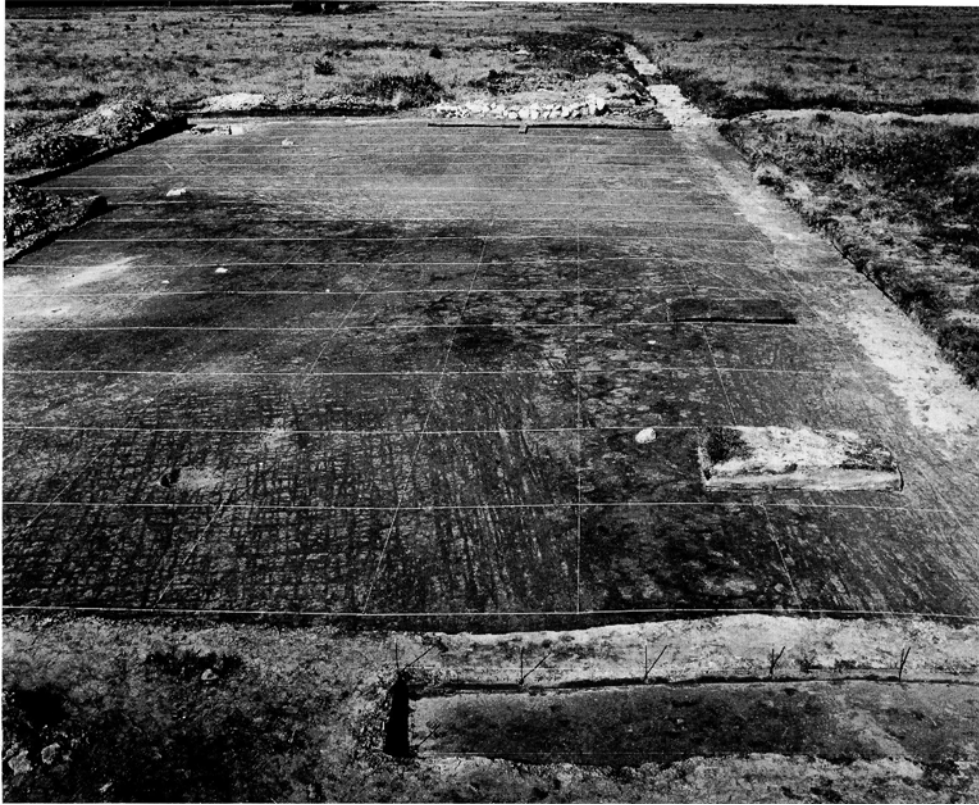


Fig. 1. Store Vildmose. View of field x185–y380, seen from the East. In the background barrow W.

sis, the identification of fossil wood, carbon 14 determinations, examination of charcoal and humification, and also the incorporation of an ever larger archaeological material from investigations in the bog.

The earlier investigation was carried out by the botanist Knud Jessen, during preparations for the drainage of the bog which was begun in 1920 after the Danish government had acquired most of the area with a view to cultivation.

Knud Jessen's investigations were only to some extent carried on and published (Jessen 1945). A general view of the development of the bog and the region thus rests on the extensive investigations of Bent Aaby. Some major aspects are however certain.

After the raising of the land and the formation of the coastal meadows, a forest peat was formed in the central southern part of the bog with stumps of alder, birch and (near the edges) oak. In and under the forest peat were limited layers of carr or fen peat, with among other things numerous remains of reeds. Fen peat was also found in the northeastern part of the bog, forming a basal layer over the sand.

Above the forest peat and the fen peat was a raised bog several metres thick. This was divided into a lower layer of dark brown, sterile, sandy material, and a very thick upper layer of pale brown peat which stretched much further to the north and northeast than the underlying layers and so defined the extent of Store Vildmose. The younger raised bog peat supported the vegetation which gave the bog the appearance described in older accounts; small areas which remain uncultivated can still give an impression of this.

Knud Jessen assumed that the formation of the first peat, the forest peat, took place during the sub-boreal, in the Bronze Age; and that when the raised bog began to be formed, it spread (except with one break) continuously and irresistibly over an ever larger part of the flat area. This assumption, supported by finds of earlier and later Iron Age date under the raised bog peat, has now been proven by Bent Aaby's work. This shows a continuous advance of the raised bog of around three metres per year during the earlier and later Iron Age and into the Middle Ages.

## THE ARCHAEOLOGICAL INVESTIGATIONS AND DATINGS

Much archaeological material has been found during recent activities in the bog, particularly in the northern and northwestern parts. Most striking among a series of single finds is a Pre-Roman Iron Age bull's head made of bronze, found in the western part of the bog. Settlements have also been found, as well as a series of stepping stones, but first and foremost it has turned out that the bog covers a large number of burial mounds. These appear to grow out of the bog as the peat shrinks or is removed; they are most common in the northern part of the bog, but are also present in the central and western parts. A few of the mounds are from the Roman Iron Age, but in the northern part the great majority are of earlier Germanic Iron Age date. They are generally small, 0.5–1 m in height, with kerbstones indicating a diameter of 8–10 m. A number of these have been excavated, while others have been preserved.

Several of these buried barrows appeared in the early 1960s in a so far uncultivated area in the northeastern part of the bog, at Grishøjgårds Krat (Tolstrup parish, North Jutland county) where clearing of scrub had begun in order to undertake cultivation (Danish "krat" = scrub or coppice). The area comprised c. 200 ha. During an investigation of some of these mounds by the Vendsyssel Historiske Museum (Bech 1971) in the summer of 1966, plough marks were observed in the sand under the barrow, stretching out under the kerbstone ring. It thus seemed that the area could be suitable for a systematic investigation of plough marks.

The author therefore organised the excavation of test pits that revealed several hectares of plough marks after talks with the National Museum and with support from the Danish State Research foundation. Excavations proper in the years 1967–69 and 1970–72 were supported by the Carlsberg Foundation. These investigations provided stimulus for the investigations of Bent Aaby, and for the systematic recording of finds and further investigations in Store Vildmose as a whole. Furthermore, the whole of the 200 ha uncultivated area in this part of Store Vildmose was acquired by the nature protection administration, now the Ministry of the Environment, as an archaeological reserve open for future research on prehistoric fields and problems to do with ploughing.

The site was subjected to study in the following way: A measuring grid in squares based on the national grid

(System 1934) was set up, and concrete marker blocks placed every 100 m. Trial pits were dug to the subsoil every 50 m in this grid to search for plough marks, and to obtain soil samples for phosphate analysis.

Plough marks appeared all over the 200 ha area. Further surveying in the neighbourhood revealed plough marks in almost all places where the surface of the subsoil sand had not been damaged by modern activity. It is thus plausible that prehistoric cultivation took place over most of that part of Store Vildmose which was not covered with peat in the sub-boreal period, i.e. perhaps 20–30 km<sup>2</sup>.

Phosphate analyses of the soil samples, which came from an area of over 35 ha, generally gave very low values (2 or less), indicating a very poor soil. Slightly higher values (around 4) in a strip in the northern part of the area could suggest that there was a settlement in the area, and very high values (8 and 19.5) in the south-eastern peat-covered area must mean that there was a settlement here.

Normal archaeological surveying and recording also revealed settlements from the earlier Iron Age, both in the southwesterly end of the uncultivated area and also to the north in cultivated fields – in this case from the Pre-Roman Iron age. The investigated area itself thus seems to have been some distance away from the settlements from which the cultivation was carried out.

The palynological geology of the site was a further basis for the investigation and its interpretation. The Natural Scientific Section of the National Museum took samples from a trial trench, which gave a typical picture of the stratigraphy:

Layer 1, below 5.97 m:	stratified sand.
Layer 2, 5.97–6.12 m:	outwashed sand, containing plough marks.
Layer 3, 6.12–6.295 m:	sandy humus (cultivation layer).
Layer 4, 6.295–6.38 m:	podsolised sand.
Layer 5, 6.38–6.46 m:	sandy humified fen peat.
Layer 6, 6.46–6.555 m:	peat and fen peat mixed with sand.
Layer 7, 6.555–6.72 m:	disturbed raised bog peat.

Experimental pollen analysis of samples from several layers showed the following:

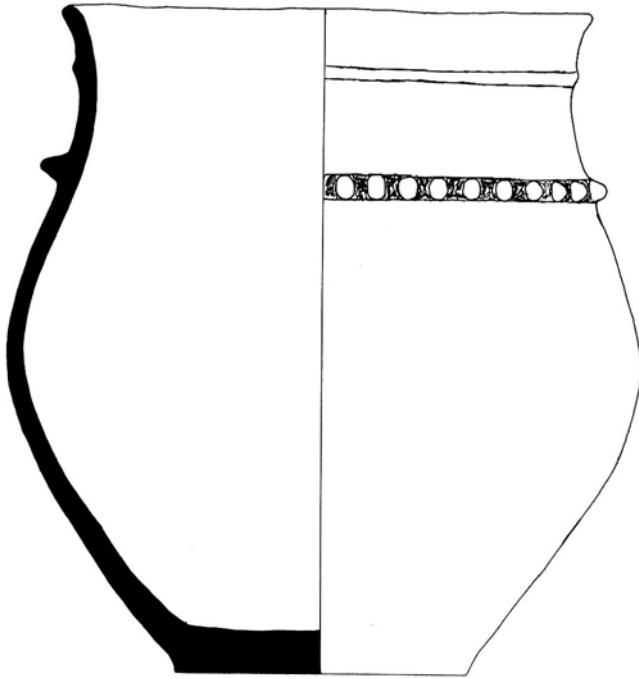


Fig. 2. Pot, c. 40.5 cm high, from the pit in the SW corner of the field X185–Y380, referred to period I of the Pre-Roman Iron Age. Drawing: Per Lysdahl.

- Layer 2: 72% arboreal pollen, late *Litorina* period.
- Layer 3: Arboreal pollen reduced to 7–8%, grass pollen 60%, and also 4% heather. Several annual weeds, including *Polygonum* and *Spergula arvensis*. Also cereal pollen, probably of several types.
- Layer 4: Increase in sedges, and doubling of heather to 8–9%.
- Layer 5: Heather increases to 27%, grass 30%, sedges 10%, a few *Polygonum* and *Spergula arvensis*. Willow appears at 6%.
- Layer 6: Increase of sedges such as *Carex* and *Eriophorum*, but *Sphagnum* does not yet appear.

The transition from layer 4 to 5 is radiocarbon dated to AD 400, the upper part of layer 5 to AD 1040, and the middle of layer 6 to AD 1290, all calibrated (Clark), and  $\pm 100$  years. The cultivation horizon (layer 3) thus dates from the earlier Iron Age, and at this site the formation of the raised bog with *Sphagnum* did not begin until the High Middle Ages.

Although it is not particularly relevant for a more

general understanding of plough marks and ploughing methods in the earlier Iron Age, the period of cultivation can be fixed rather more precisely. During the excavation a pit was found, containing pottery referred to period I of the Pre-Roman Iron Age (fig. 2). The plough marks went over the top of the pit after it was infilled. The ploughing is thus roughly contemporary with or later than the earlier part of the Pre-Roman Iron Age. A radiocarbon date on charcoal from the pit of 80 b.c. is presumably unreliable. In the southeastern part of the same field was a hole resulting from the removal of a large stone, surrounded by a heap of pot sherds several metres across. The sherds lay in and on top of the cultivation layer, overlying the plough marks. The sherds from this site of votive offerings thus either post-dated or were contemporary with the cultivation. Apart from a few younger sherds, the pottery in this heap most likely dates from period II of the Pre-Roman Iron Age

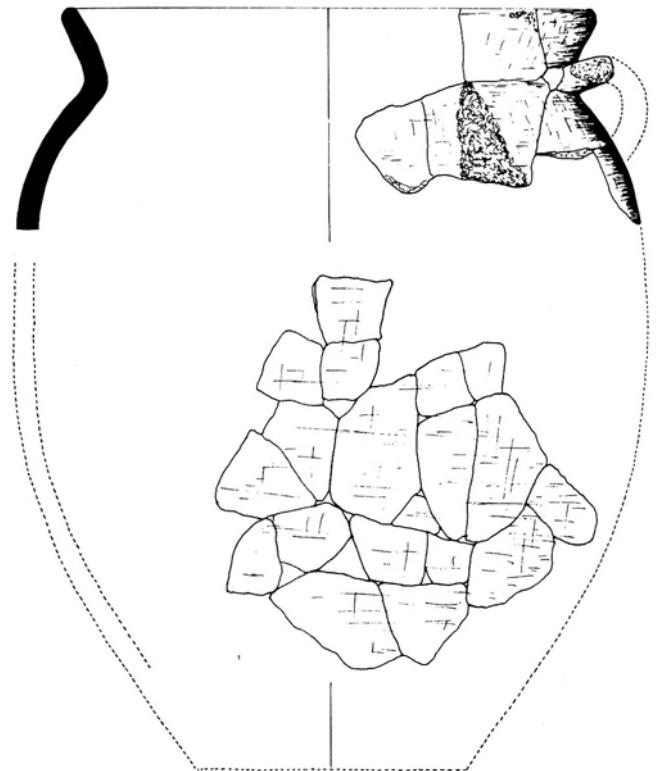


Fig. 3. Pot, estimated height 31 cm, from the heap of pot sherds in the field X155–Y365. The sherds overlay the plough marks and are interpreted as votive offerings at a large stone. They most likely date from the period II of the Pre-Roman Iron Age. Reconstruction and drawing: Anne Preisler.

(Preisler 1982; Nielsen 1980, p. 218). Unless there was any ploughing which has left no trace in the existing pattern, the heap of sherds must be regarded as dating from the end of the period of cultivation (fig. 3).

The cultivation thus took place between the 5th and 3rd centuries b.c., and after its cessation the area was covered with grass and heather. Several burial mounds were established on this around AD 400, contemporary with a major increase in heather.

The soil, the surface of the raised sea bed, was poor. Cultivation must therefore have been relatively extensive. Although some manuring may have been carried out, the area must have layn fallow at times. The high water table and the flat nature of the terrain would have made the area vulnerable to variations in rainfall. Store Vildmose is also one of the coldest areas of Denmark, with a shorter growing season than areas further south and east.

#### METHODS AND DOCUMENTATION

The main aim of the investigation was the documentation of the plough marks.

The size of the documentation project was however so great, and the areas uncovered so large, that some decisions had to be made. This was the case for the method of uncovering the area, which was carried out as far as possible by machine without disturbing the subsoil sand. The same was true regarding the depth to which the site was uncovered. The chosen depth was that at which most plough marks appeared most clearly. This could result in the removal of some plough marks. For every millimetre scraped away, a mark will become narrower or will disappear, or perhaps a new one will appear.

As the sole method of documentation, photography was chosen. Drawings of the marks would involve an on-the-spot analysis of ploughing direction and relative chronology, and hence constitute a much more subjective and imprecise form of documentation. It is, furthermore, expensive and time consuming. Drawings were only used at the beginning of the work, on an experimental basis (fig. 4).

In order to obtain a form of documentation that could be built on by future work, vertical photography in 6 × 6 cm format was chosen. Square areas were photographed, measuring 2 × 2 m in the first two seasons, 5 × 5 m in the 1970s (fig. 5). These squares were linked

into the established co-ordinate system, so that they could easily be put together. The black and white photographs were enlarged to a scale of 1.40 and mounted on boards of 50 × 50 cm, which, when complete, would each represent an area of 400 m<sup>2</sup> of the excavation (fig. 10). These boards can be archived (and reproduced) according to their place in the co-ordinate system.

Preparation of the areas for photography demands fine cleaning so that the results will not be blurred. Any impurities, drops of water, or sunshine will also spoil a picture. The photographs therefore had to be taken in overcast weather, after sunset, or with the whole area shaded from the sun.

The uncovering of the subsoil started with the digging of two trenches, 100 m long and 1.75 m wide, in the shape of a cross oriented NS-EW, in order to get an impression of the state of preservation of the plough marks and to locate some field boundaries. In 1968 a 700 m<sup>2</sup> rectangle was excavated in the SE quadrant; in 1970, 160 m<sup>2</sup>; in 1971 and 1972, 3430 m<sup>2</sup>; and in 1978–79, a further 300 m<sup>2</sup> were uncovered.

The state of preservation of the plough marks varied in the different parts of the area. In some places where the sandy mould was thin or lacking certainly because of wind erosion after the breaking up of the surface, the subsoil surface seemed to have been waterlogged. In these cases the contours of the marks were effaced or the edges amorphous. In other areas as well the nature of the soil as the earlier vegetation appears to have had an important effect on the coloration of the mould.

#### EXAMINATION OF THE INDIVIDUAL PLOUGHED UNITS

The uncovering of this roughly 5000 m<sup>2</sup> area of ploughmarks should form the best basis so far available for recognizing patterns in the plough marks in cultivation units or fields (fig. 6). As the basis for an evaluation, the main structure of each cultivation area in the uncovered section will be described. Description moves from the N towards the S and W, starting in the northernmost corner of the uncovered area. The individual fields are designated by a co-ordinate lying within their boundaries (fig. 7).

As for a frequently occurring phenomenon, here termed “bunch of parallel marks”, see further below under “The Boundaries”. The term is chosen to indicate a clear distinction to other sets of parallel marks.

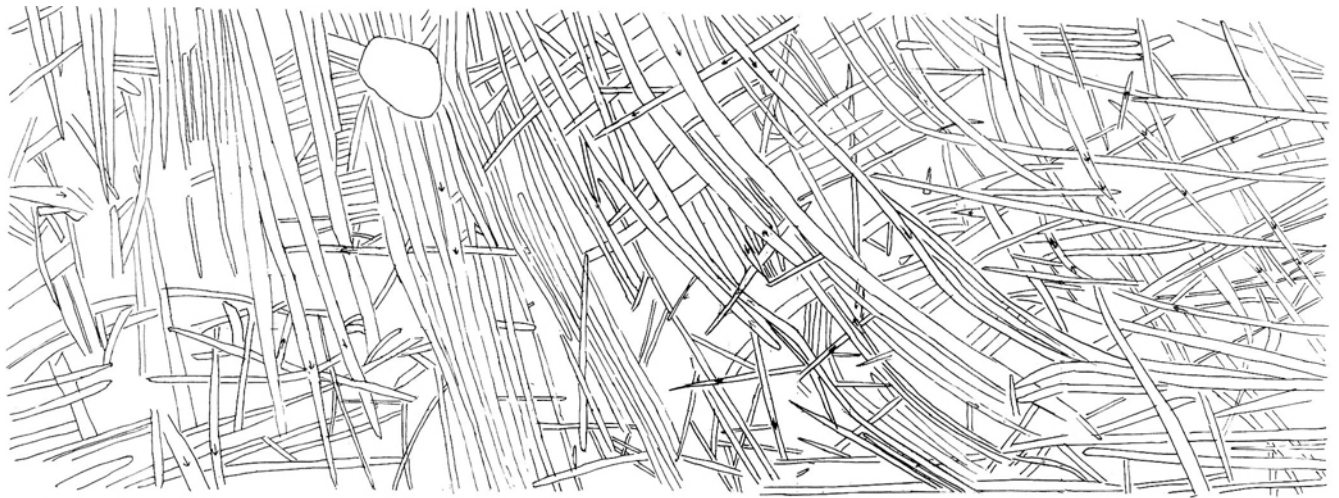


Fig. 4. Sample drawing of plough marks in the cross trenches excavated in 1967. Drawing: Gudrun Nielsen.

#### **X200–Y325**

The corner, c. 30 m<sup>2</sup>, of a field with well preserved marks.

This is marked off from the field to the S, X180–Y325, by a bunch of parallel marks. The southern part of this group may be part of the ploughing of this neighbouring field. It is bounded to the W by a lesser worked zone 0.5–1 m wide with a bunch of parallel marks on each side.

Ploughing directions are predominantly N-S and E-W, with slight curves E-W and N-S respectively. The furrows are very close together, as if they exclusively represent bunches of parallel marks.

#### **X200–Y340**

The southern part, c. 80 m<sup>2</sup>, with the SE and SW corners of a field with well preserved plough marks.

To the E this is bounded by a bunch of parallel marks along the lesser worked zone mentioned under X200–Y325. It is bounded to the S by a bunch of parallel marks 2–3 m wide, along an uncultivated area in a field boundary or weak lynchet running WWSW-EENE. To the W, about 30 m from the E edge, there is a boundary bank about 3 m wide (Nielsen 1970 fig. 1) with a bunch of parallel marks along and under it.

Ploughing took place in several directions. The plough marks clearly run parallel to the field boundaries, although with slight curving towards them. Besides these, there are also plough marks running NW-SE and NE-SW (Nielsen 1970, fig. 1) and in several other directions.

#### **X185–Y380**

The southern and part of the western section of an irregular field, estimated 40–50 m N-S and 30 m E-W. The marks are generally well preserved, although less so in the central part of the field. The area uncovered, which includes a stretch of the northern trial trench running N-S through the western part of the field, encompasses 5–600 m<sup>2</sup>.

The boundary to the E is the bank between this field and X200–Y340. The N boundary is assumed to have been the bunch of parallel marks which crosses the trial trench in a NE-SW direction about 30 m N of where this trench crosses the E-W trench. To the W the boundary is a bank running NNNW-SSSE, upon which the mound described on p. 191 is placed. Ploughing under the boundary bank is less intense along its central part. There are bunches of parallel marks 2–3 m wide each side of this central part. The boundary bank and the bunches of parallel marks run S as far as the pit described on p. 192, 10 m south of the mound.

This pit is approximately the western corner of the field's unclear southern boundary. Here ploughing runs up to a bunch of parallel marks, which form the boundary with the neighbouring field to the S for 12–15 m, but after this there is a 400 m<sup>2</sup> triangular area of uncultivated land. It was evidently this that determined the direction of the ploughing, forming an open area between the adjacent fields.

This unploughed triangle terminated to the NE in the narrow unploughed strip S of X200–Y340, and to the S in a similar narrow strip between two fields. There was no evidence as to why it had not been ploughed. The soil had the same consistency as in the adjacent fields. Only a slight difference could be seen in the colour of the sand, and animal burrows or runs were particularly numerous in the unploughed area. There were no traces either of banks or of a fence. As a probable result of erosion the level of the ploughed land was a shade lower than that of the uncultivated stretch. The line along which the ploughing stopped was not fixed, for the boundary of the ploughing could be seen to have changed at least twice.

The bunches of parallel marks marking the boundary run in different directions. One set, probably the oldest, runs in a definite s-shaped curve from the SW corner of X200–Y340 to the pit. The other, starting slightly to the N, has an opposing curvature.

The closely spaced furrows running in all directions in the irregularly worked area make an understanding of the ploughing difficult. An E-W ploughing can be discerned, however, with its main direction corresponding to the s-curved bunch of parallel marks. Another ploughing, running N-S, corresponds more to the phase marked by the bunch of parallel marks running N-S.

Two hearths were seen in the subsoil near the s-curve just described. One was c. 1.5 m, the other 0.6 m, in diameter. Both had been ploughed over, and their edges were ragged. They were thus older than or contemporary with the ploughing. A dark oblong patch immediately E of the barrow was probably made by a tractor. Some stakeholes were found in the axis of the bank running S from the barrow, perhaps indicating the presence of a fence with upright stakes (Nielsen 1970, fig. 7).

#### **X180–Y325**

The western part, c. 350 m<sup>2</sup>, of a possibly regular rectangular field, measuring about 35 m N-S. The state of preservation of the marks is generally very bad.

To the N the field is bounded by a bunch of parallel marks which run together with the southern boundary of X200–Y325 and X200–Y340. At the NW corner is the uncultivated strip between X200–Y340 and X170–Y345. On the W side is the bunch of parallel marks extending over c. 30 m, and to the S, at right angles to these, a similar E-W bunch. The poor conditions of preservation mean that it is uncertain whether this group runs further than 7 m to the E.

One ploughing direction is particularly clearly marked. This is E-W, with a curve towards the S near the edge of the field. The parallel marks are 25–30 cm apart, and stand out so clearly with regard to the others that it can probably be assumed that this represents only a single ploughing episode. A few traces are visible with different orientations, such as SE-NW and NE-SW, curved towards the northern boundary.

In general it would seem that the field was not intensively cultivated. The reason for this may have been the soil structure, but it may also be that it was the fact that the field was only lightly cultivated that caused a slight difference in soil structure from that in other, more thoroughly worked fields.

#### **X170–Y345**

A completely uncovered, more or less rectangular field oriented N-S and E-W. The N side is 26 m, the S side 25 m, the E side 32 m and the W side 30 m in length. The orientation of the sides varies somewhat. The W side is thus oriented a little more to the NW than the E side, and the N side a little more to the N than the S side.

The state of preservation of the marks is poor, particularly in the northern central part. Together with the fact that there were many closely spaced ploughings, this means that the directions of ploughings and the relationships between them are difficult to determine.

The boundary to the N is formed by the 1.5 m wide uncultivated area described under X200–Y340, along which runs a c. 2 m wide bunch of parallel marks.

The bunch of parallel marks on the W side form a right

angle with the N side, and run along the uncultivated triangle described under X285–Y380 for about 20 m, and a 1.5 m wide uncultivated strip for some metres further to the S. Where this strip ends there is a ditch patch 20 cm in diameter, which might be a stakehole. A similar patch is visible 4 m further N, at the southerly corner of the uncultivated triangle. Furrows from the neighbouring field, X155–Y365, run across the southernmost 10 m in an oblique direction towards the bunch of parallel marks, which meets those of the S side at a near right angle. It is interesting that, where the uncultivated strip ends, the bunch of parallel marks seems to stop and respect the plough furrows that intrude from the adjacent field to the W. In a zone along these southernmost 10 metres and down to the SW corner, the furrows on the adjacent field are weaker, and more animal burrows are visible. This could mean that this zone was left as an uncultivated field boundary for a period during the cultivation of field X170–Y345.

The southerly cultivation limit is marked by a bunch of parallel marks c. 2 m wide, dividing this field from the neighbouring X145–Y335. It becomes narrower and more diffuse to the E. It runs at least some metres beyond the right angled junction with the E edge of the field, evidently in connection with the cultivation of the adjacent field.

The E side is marked by a gently curved bunch of parallel marks c. 2 m wide, which also marks the limit of cultivation of the neighbouring field to the E, X180–Y325.

The bunches of parallel marks in general follow the fairly straight N-S and E-W alignments of the field's boundaries.

The other ploughings, which took place before the bunches of parallel marks were made, were multiple and have therefore left many closely-spaced marks. Generally these are oriented with the field boundaries, i.e. N-S and E-W. Running in these directions can be seen uniform furrows with a consistent spacing (25–30 cm), paralleling and crossing each other and suggesting cross-ploughing. The ploughing was not carried out quite so systematically, however. To some degree they do run up to the field boundaries more or less at right angles, but they often curve away in an arc near the edge of the field. This means, in a relatively small field such as this, that some furrows follow a gentle curve from one side of the field to the other. Along the W and S sides these curves get shorter near the mid parts of the sides, as if the intention was to plough a small remnant area. This presumably means that ploughing started in the N and E, where the furrows more or less follow the directions of the sides, and ended in the S and W where the curves become stronger. The initial profile at the edge of the field is followed by the subsequent parallel furrows, and may therefore have determined the shape of the field.

In the plough soil (the sandy subsoil) is a number of stones, often about the size of a fist or head and often surrounded by a patch of dark soil. The large stone in the NW corner has been mentioned. It would seem that no efforts were made to remove these stones. Any stones collected from the fields would have been dumped on the field boundaries; but there are no more stones here than in the fields themselves.

Besides the plough furrows, there are other dark markings in this layer. It is assumed that some broad, parallel marks

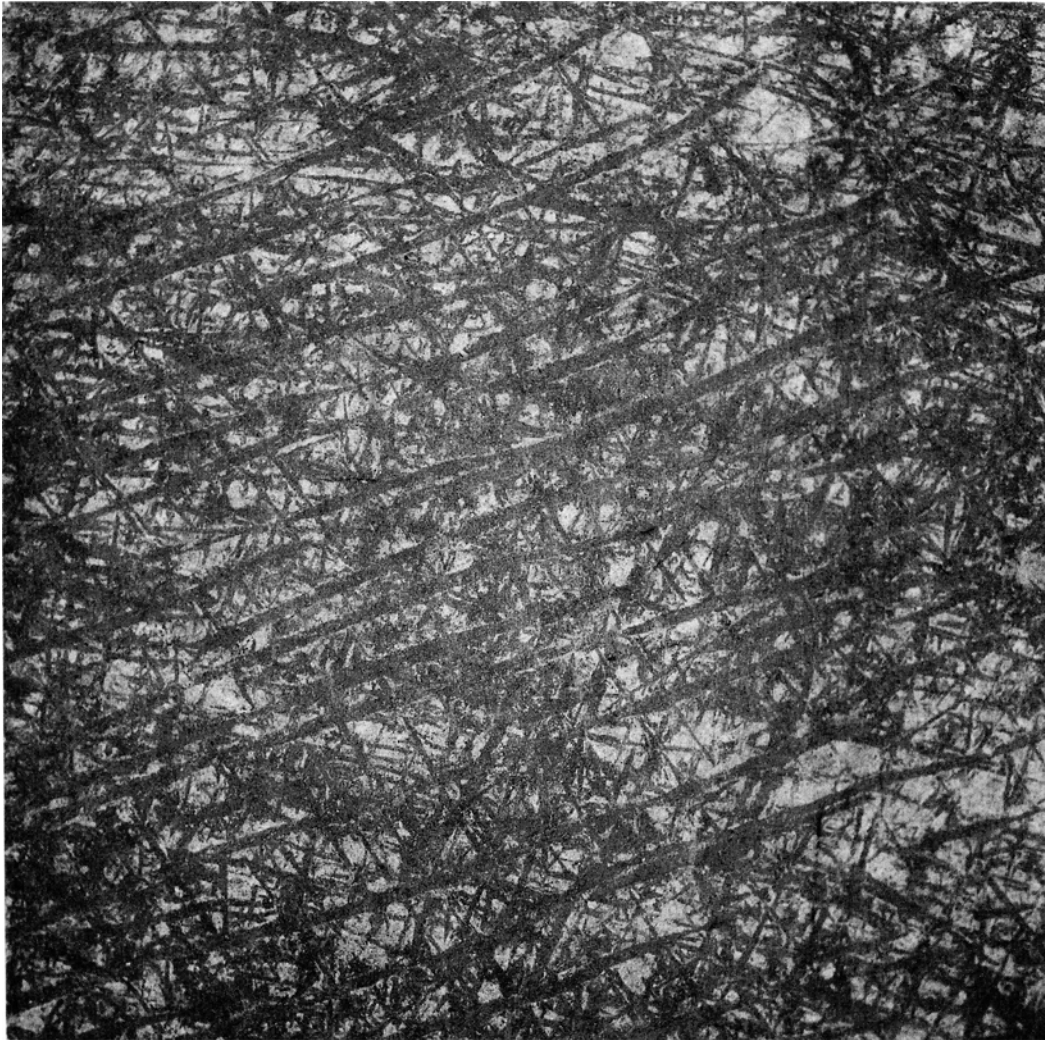


Fig. 5. Square of 5 × 5 m in the field X105–Y365. Only one square at a time can be prepared for photography. In this one is seen ploughings running N-S and E-W as well as very clear ploughing aligned ENE-WSW and less distinct ones running NW-SE and WNW-ESE. Photo: Gudrun Nielsen.

running N-S were made by tractor wheels when the bog was prepared for cultivation. Others are patches stained with charcoal, resulting from downward penetration from the hearths on the field surface.

#### **X155–Y365**

A 5–10 m wide N-S strip of the eastern part, and also parts of the northern rim of the c. 55 m long field adjacent to X170–Y345. C. 350 m<sup>2</sup> were uncovered. The plough marks are generally badly preserved. There were deposits of silt in several places on the uncovered surface, and many pebbles.

The northern boundary is formed by the bunch of parallel marks that runs in a curve to the SE, from a point a little to the W of the pit described in X185–Y380 to run obliquely into the

W boundary of X170–Y345. There is no independent marking of the boundary further S, along the common boundary with X170–Y345. The possibility that X170–Y345 has simply cut away the NE corner of the field cannot be excluded. The boundary reappears with a slight change of direction beyond the SW corner of X170–Y345: a bunch of parallel marks run along a gently curving 1–2 m wide strip (which has many animal burrows and few plough marks), forming a corner at right angles to a 2–3 m wide bunch running E-W and forming the boundary of field X105–Y355.

The shape of the field cannot be determined more precisely on this basis. The strongly curved N side is clear; so is the rather irregular E side, and the rudiments of the S side; but the breadth of the field, and the W boundary, cannot be determined.



As mentioned, the parallel group along the N side curves strongly towards the SE. Some of the curved furrows postdate others aligned nearly E-W. These E-W furrows, and others at right angles running N-S, dominate the pattern. The N-S ploughing is not completely regular, but shows a faint s-curve partly corresponding to the field boundary and with slight curves towards the end of the field. Slight curves both to N and S can also be seen from various of the E-W furrows. Here and there faint traces can be seen of furrows in other directions.

On the surface of the field a few metres W of the boundary was the hole described above that had contained a cultic stone, blasted and removed before the excavation. The furrows ran towards the site of the stone without any deviations.

#### **X145–Y335**

A virtually trapeze shaped field, completely uncovered, with N side measuring 30 m, S side 35 m, W side 45 m and E side 55 m. The sides are all aligned differently: the N side has a slight angle towards the NE, the S side correspondingly towards the SE, the W side towards the SW, while the E side runs N-S except for about 10 m in the middle where it bends slightly to the SE.

The plough furrows are reasonably well preserved, particularly in the southern part.

Evaluation of the ploughing pattern and particularly of the W side of this field is complicated by the fact that a smaller field, X125–Y350, was later established and worked within its boundaries.

The N side is formed by the 2 m wide bunch of parallel marks (described above), which forms the S side of X170–Y345 as well, except for 5–7 m at its eastern end, where it projects beyond X170–Y345 and thus only belongs to the field described here. There is a sharp right-angled corner to the bunch of parallel marks forming the E side, which as mentioned runs due N-S except for the kink in the middle. During its course to the SE corner, it is joined at this kink by a bunch of parallel marks coming in from the E, and by another 10–12 m further S. The S side is not as clear. The outer part of the corner was not exposed. From here towards the E is a strip which is less worked – although it does have closely spaced parallel furrows – which has bunches of parallel marks running along both sides, both in this field and in the 2–3 to the S of it. The bunch on the W edge forms a right angle to this. The W boundary (also the E boundary of X155–Y365) appears also to be the boundary for the later field X125–Y350.

Several major orientations appear in the densely ploughed area of the field. A N-S ploughing is most prominent, together with a corresponding E-W one. The N-S furrows run parallel to the E boundary, except that they continue due S where this kinks. The ploughing to the E of this boundary takes the kink as its starting point, however, and runs N-S from here. In some places the N-S furrows show the usual curves, both to the E and the W. Where they run up to the N boundary of the later field X125–Y350, however, they are abruptly cut off. The same is true of the approach of the E-W furrows to the E boundary of the main field; but they run straight into the boundary of X125–Y350.

Besides these furrows aligned with the boundaries, two other directions are clear. One runs NNE-SSW, the other (the clearest) NW-SE; both are variable, particularly in the corners. The latter is prominent in the narrow area between the N boundary and field X125–350. These NW-SE and NE-SW furrows are also cut across by field X125–Y350.

It is doubtful whether the area in the NW part of the field, only 7 m broad, could have been cultivated at the same time as X125–Y350 was in use. It is therefore probable that X125–Y350 was laid out later, at a time when X145–Y335 was lying fallow.

#### **X125–Y350**

A completely uncovered field, lying within X145–Y335, with straight N, W and S sides, respectively 12 m, 35 m and 22 m long, and with a curved E side c. 37 m long. The plough marks are well preserved.

All the boundaries are marked by bunches of parallel marks 1–2 m wide. The W side also forms the W side of field X145–Y335.

The corners are more or less rectilinear, except for the NE one, where the curved side approaches the N boundary at an angle of 120°. It may have been aligned on a stone a little further N, which protruded above the ground surface.

Ploughing is generally parallel to the sides, the N-S ploughing in the curve dictated by the outer edge. This probably means that ploughing began here, and went from S to N. The distortion means that the furrows get shorter the more the ploughing was constricted to the W and S. The E-W ploughing is at right angles, and has slight curves towards the edges. Besides this, a NNE-SSW oriented ploughing is also visible, forming parallel furrows covering the whole of the field but clearest in the northern part, with some variability in orientation especially in the corners. Less clear furrows are visible aligned ENE-WSW, clearest in the southern part, and finally some aligned WNW-ESE and particularly clear in the northern and western part.

#### **X150–Y320**

West side of a field, the extent of which cannot be determined from the area so far uncovered, which has revealed c. 150 m<sup>2</sup> of it. The state of preservation of the marks is very poor; they can only be discerned here and there.

The boundaries are problematic to the N, S and W. For the N boundary, it might be assumed that this was formed by a continuation of the N boundary of X145–Y335, but the traces are too faint to permit conclusions to be drawn – there is a theoretical possibility that this field was the same as X180–Y325. The W boundary is marked by a bunch of parallel marks that separate this field from X145–Y350. The S boundary, finally, takes the form of a bunch of parallel marks running NNW-SSE, separating this field from X125–Y315.

In the northern part of the field traces of furrows are visible aligned NNW-SSE. Further S, however, there are parallel furrows running NE-SW, and close to the S boundary there is cross-ploughing running E-W and N-S.

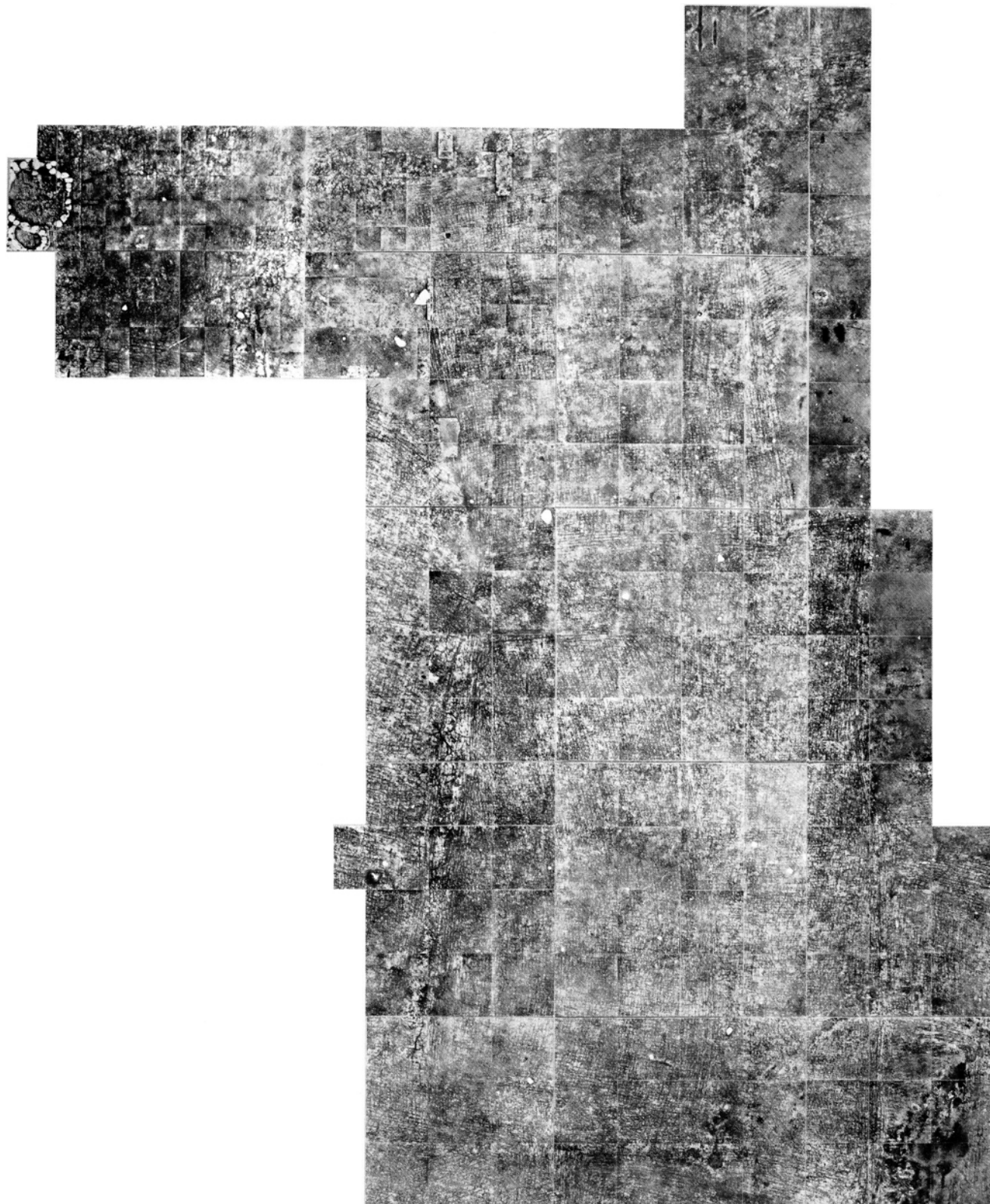


Fig. 6. The area excavated 1968–72 composed of photographs of  $5 \times 5$  m squares and in NW  $2 \times 2$  m squares. Reproduction and montage: Svend Thomsen.

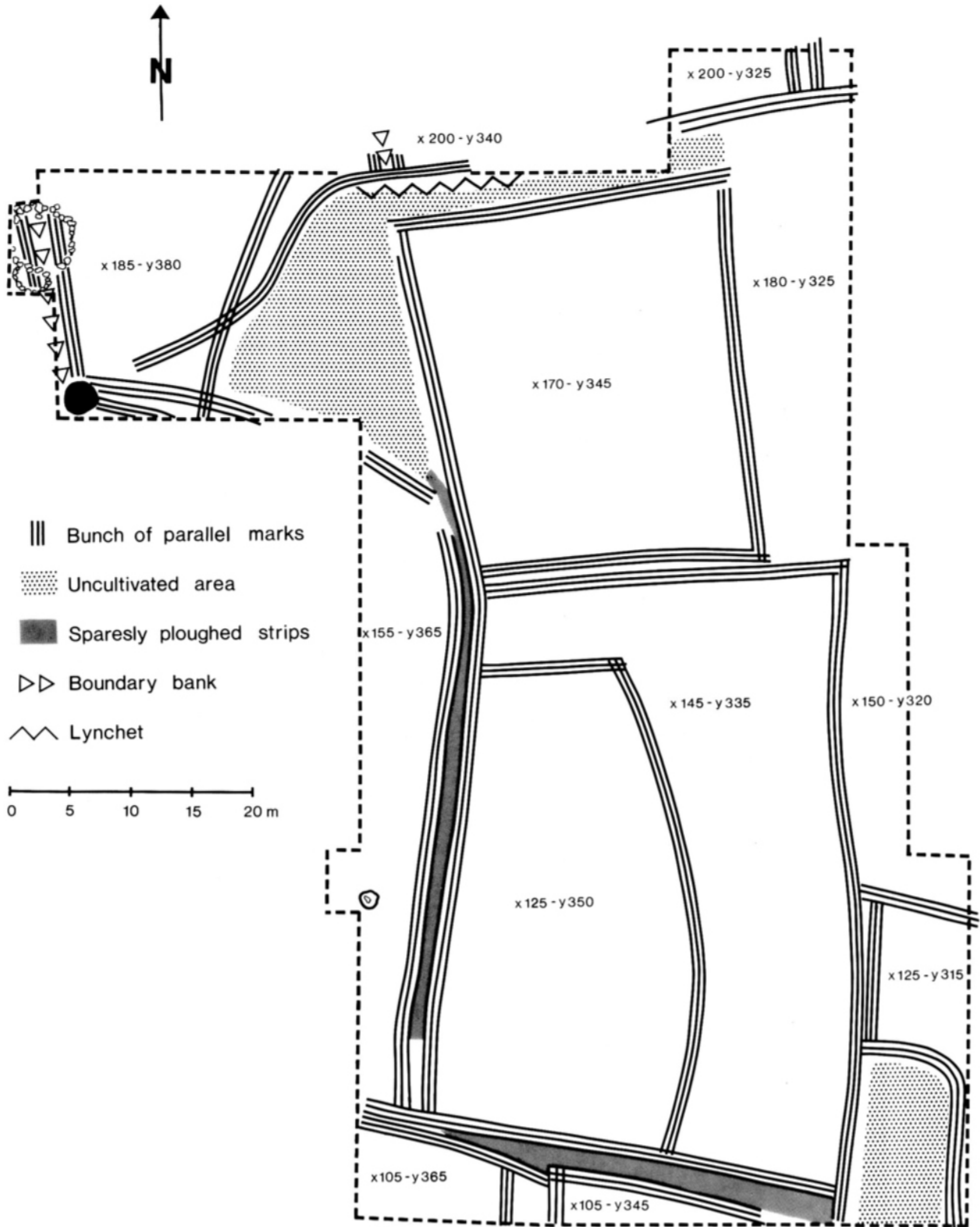


Fig. 7. Sketch showing the boundaries of the fields and the co-ordinates used for designating the fields in the following description. Also shown are the kerbstones of the barrow W of X185–Y380, the pit in the SW corner of the same field, and the site of the heap of pot sherds in the field X155–Y365. Drawing: John Falck.

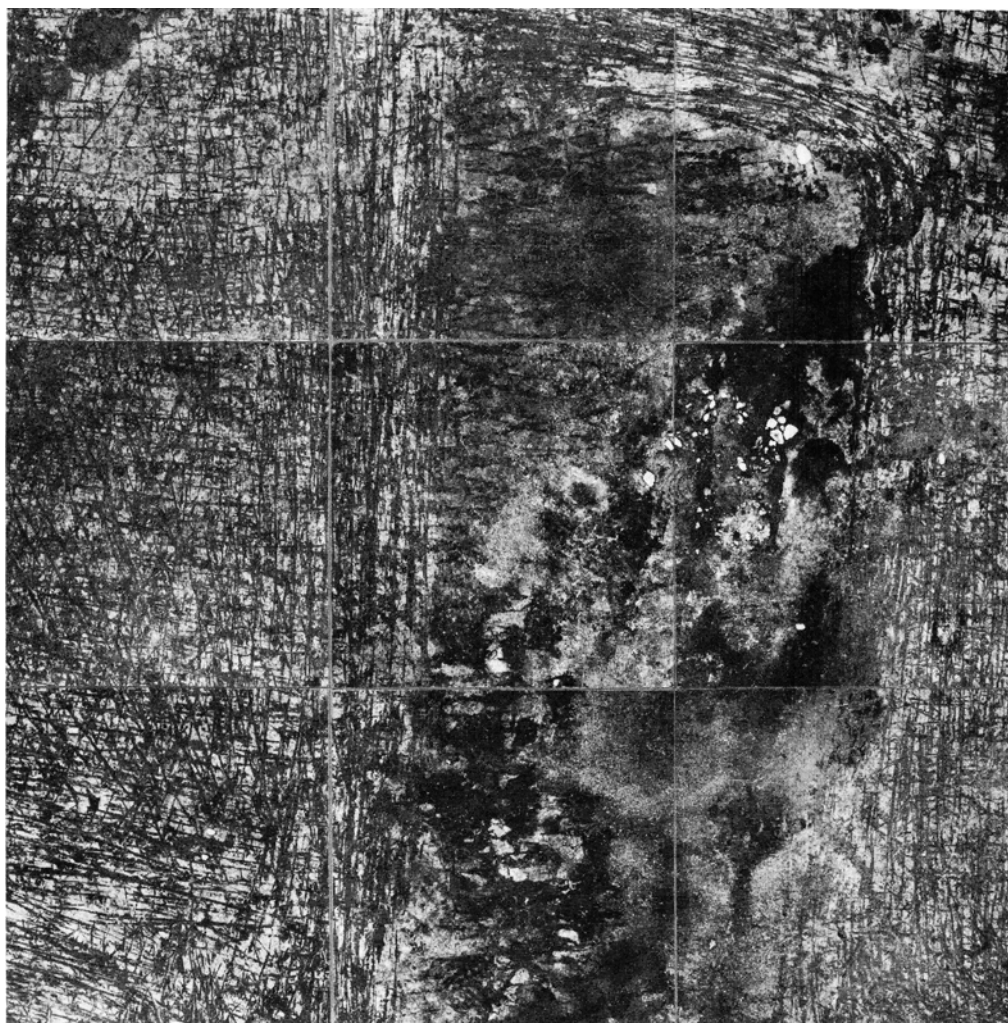


Fig. 8. 225 m<sup>2</sup> of the excavated area showing the SE part of X145–Y335 and the strip separated off from X125–Y315. Photo: Gudrun Nielsen.

### **X125–Y315**

A c. 10 m wide western section of a field, which extends c. 30 m N-S. In its southwestern part, for over 15 m along the E edge of X145–Y335 there is a 7–8 m wide strip not included in the cultivation that characterises the rest of X125–Y315. The exposed area totals c. 150 m<sup>2</sup>, including 100 m<sup>2</sup> of the strip.

The preservation of the marks is reasonably good, except in the area separated off, where the soil is porous and has much downwashed charcoal dust; traces of earlier ploughing are effaced.

The field is clearly delimited to the N by a 2 m wide bunch of parallel marks, aligned E-W with a slight tilt towards NW-SE. It runs straight or slightly curved into the bunch of parallel marks that also forms the E boundary of X145-Y335, just S of where this changes direction slightly. 10–12 m further S on the W boundary the field is bounded by a bunch of parallel marks,

which to the N and S surrounds the separated area of the field. This bunch runs E-W for c. 7 m as the N boundary, and turns to the S for 12 m, curving slightly. Test pits to the S reveal that this curve marks the S edge of the field.

The very closely spaced plough marks are completely dominated by two main directions, corresponding to the edges of the field. One is N-S, with a slight curve, the other at right angles, similarly curving as it approaches the W boundary.

The state of preservation and the structure of the bunches of parallel marks are similar to those in the field to the N and in X180–Y325.

The exposed surface contained much charcoal dust, and there were many small pebbles in the central part. There were no traces of any constructions. It was clear that the ploughing was at least in part later than the charcoal, and also that this ploughing preceded that on neighbouring fields.

The 7–8 m wide strip, specially segregated from the rest of the field, seems from the test pits to have been c. 20 m long N-S, and may have had a further extension towards the SW. This strip also had plough furrows: running E-W, curving a little N and S respectively, and at right angles to these running N-S. No continuation of the E-W furrows could be seen outside the strip. On the other hand, it seems unlikely that such a narrow strip would have been cultivated specially.

Charcoal coloured patches were also visible in X125–Y315, as if forming an extension of those visible in the adjacent X145–Y335.

#### **X105–Y345**

Part of a field edge covering 75–100 m<sup>2</sup>, the NW part with well-preserved marks, bordering on X145–Y335. A test pit at point X100–Y325 revealed furrows running N-S, to the W of the uncultivated area described under X125–Y315; this suggests that the E-W dimension of the field was around 25 m.

The N boundary is the 1–2 m wide strip with a paler colour and rather less ploughing, described under X145–Y335. There is also a fireplace 1.2 m in diameter. It is cut through by several plough marks.

Along this strip is a 2–3 m wide bunch of parallel marks running E-W, with a curve towards the SE. To the W is a bunch of parallel marks running N-S, forming a right angle with the N boundary.

In this narrow field section there is a limit to what can be seen in the way of plough furrows, except some parallel to the N-S and E-W bunch of parallel marks with curves near the field edges. Some ploughing can, however, be seen running WSW-ENE, forming a rhombic pattern where they cut the others.

#### **X105–Y365**

Edge section, c. 100 m<sup>2</sup>, with the northeasterly corner of a field, which borders X145–Y335 and X155–Y365. The state of preservation of the many closely spaced furrows is unusually good.

The N boundary is also the S boundary of the two fields just mentioned, and is formed by a 2 m wide bunch of parallel marks. The E boundary is more complex. There is the bunch of parallel marks bounding X105–Y345, but 2–3 m W of this is another N-S bunch which forms a right angle with the N boundary. Although this bunch of parallel marks seems to be later, some furrows can clearly be seen running across it up to the more easterly parallel group. At some stage, therefore, the field has been cultivated over a smaller area than that given by the boundary to X105–Y345.

The main directions of ploughing are parallel to the boundaries, running N-S and E-W, slightly offset towards the NE and NW respectively, and slightly curved near the edges. There is also a very clear ploughing aligned WSW-ENE, and less clear ones running NW-SE and WNW-ESE.

#### THE CROSS SECTION

The two trial trenches with which work started in 1967, each 100 m long and 1.75 m wide and laid in the form of a cross, were recorded by vertical photography, and were also partially drawn (fig. 4). However, they contribute little to an understanding of the field system and the direction of ploughing. In one case a field boundary was revealed which probably showed the length of one of the fields in the area of excavation; but the information from the trenches is mostly more general, concerning soil conditions, state of preservation, and the relatively irregular orientations of ploughing.

These excavations thus reveal traces of ploughing in 11–12 fields or ploughed units, some of which were completely excavated (1).

#### THE BOUNDARIES

As is clear from the foregoing, several criteria have been employed to characterise field boundaries (fig. 7). The classic idea is that fields of this period were surrounded by boundary banks or lynchets. The method of excavation might make it difficult to see boundary banks. The cultivation layer itself may be thin or lacking at least outside the field boundaries (Nielsen 1970, fig. 1). This is to some extent certainly due to wind erosion after vegetational cover was broken up by the plough, but also later on the absorption of material from the former field surface into the fen peat mentioned on p. 191, layers 4–6. Boundary banks were, however, visible in some instances. This was the case with the N-S boundary between X200–Y340 and X185–Y380, where the sandy mould over the layer with the plough furrows formed a boundary bank. The E-W boundary between X200–Y340 and X170–Y345 is also a classic, in that an uncultivated strip 1–1.5 m wide separates the two fields, and also marks a drop of 0.08 m in the landscape from the N to the S field. Finally the W boundary of X185–Y380 seems to have been a bank, upon which the barrow was built over half a millennium after the end of cultivation.

On the ground traceable banks and lynchets thus only represent part of a system, which would also include divisions not formally marked on the ground. This certainly explains why the visible banks and

lynchets in other field systems very often appear to provide incomplete boundaries (Nielsen 1984, 161).

While bearing in mind the possibility that some may not have been recognized during excavation, it can be said that banks and lynchets were not a necessary form of boundary for the cultivated units. The material described here thus differs from other known sites, where lynchets or banks appear as uncultivated strips upon which is dumped waste from the fields – primarily stones (Nielsen 1984, 142 ff). In some cases there were strips or sections that were cultivated little or not at all; animal burrows were particularly common in these. This is the case for the N-S boundary between X125–Y350 and X155–Y365, and the E boundary between X145–Y345. The pit described above, and some fireplaces, lay in these areas. If these are more or less contemporary with the field system, one must imagine that burning took place just on the field boundaries.

Post holes were seen in a few cases. In the axis of the W boundary of X185–Y380 a row of stakeholes was found, perhaps indicating the presence of a fence with upright stakes (Nielsen 1970, fig. 7).

Thus it appears that the boundaries between the different ploughed units are traceable by traditional archaeological means only in a few cases. In some cases there were no obvious traces at all, except that there was simply no ploughing. This was observed regarding the almost triangular uncultivated area between X185–Y380 and X155–Y365.

In the foregoing description it was nevertheless possible to discuss boundaries between the ploughed units. This was because the plough marks themselves mark them.

As described, the ploughed units are almost without exception surrounded by up to 2 m wide belts with sets of closely spaced parallel furrows, the bunches of parallel marks. Adjoining fields may together have a belt up to 4 m wide. Bunches of parallel marks may be seen on both sides of uncultivated strips and boundary banks, and along other unploughed areas. The marks are very close together, often so tightly packed (and numbering up to 50 or even 100) that it may be difficult to distinguish individual ones.

These bunches of parallel marks indicate intense ploughing of the field edges, to tidy the furrow ends after the rest of the field had been ploughed, and to reduce weeds spreading from the uncultivated areas, among them the boundary banks.

There can therefore be assumed to have been boundaries where the bunches of parallel marks occur.

The direction of ploughing is to a degree also important with regard to the definition of boundaries. Most furrows run rather straight, but curve slightly when they approach the end of the field, presumably in the direction the draught animal was to turn when the end was reached and the plough lifted.

Finally, when ploughing simply stops along a line or at an uncultivated strip, this is also an indication of how far the ploughing reached. This can be particularly characteristic in special areas, such as those ploughed obliquely, but is also seen in more normal ploughing at right angles to a boundary.

#### SHAPE AND LAYOUT

The boundaries of the ploughed units are thus fairly clear, so that the shape of individual units may be examined.

The starting point is that the terrain is almost completely level, with relatively minor variations in soils. There were therefore no significant constraints regarding field layout, and it can be assumed that their shapes were determined mostly by the technical aspects of ploughing.

Determination of field shape must start from the corners. These are primarily marked by the junction of two bunches of parallel marks. In several cases the corners are clear and sharp, forming near right angles between two bunches of parallel marks. This is the case for the SW corner of X200–Y325, the SE and SW corners of X200–Y340, the four corners of X170–Y345, the NE, NW and SW corners of X125–Y350, the SW corner of X155–Y365, the NW corners of X125–Y315 and X105–Y345, and the two successive NE corners of X105–Y365. Variations involve degrees of curvature. In some cases, as with X170–Y345, straight lines converge, but in other cases there is slight curvature, and in a few, such as the SW corner of X200–Y340, the curves are stronger, so that it may seem as if the ploughing turned a corner.

At the NW corner of X125–Y350 the bunches of parallel marks intersect at an angle of 120°.

Two of the fields, X180–Y350 and X150–Y320, had relatively few and weak furrows, so the nature of their corners could not be examined. It seems that the NW

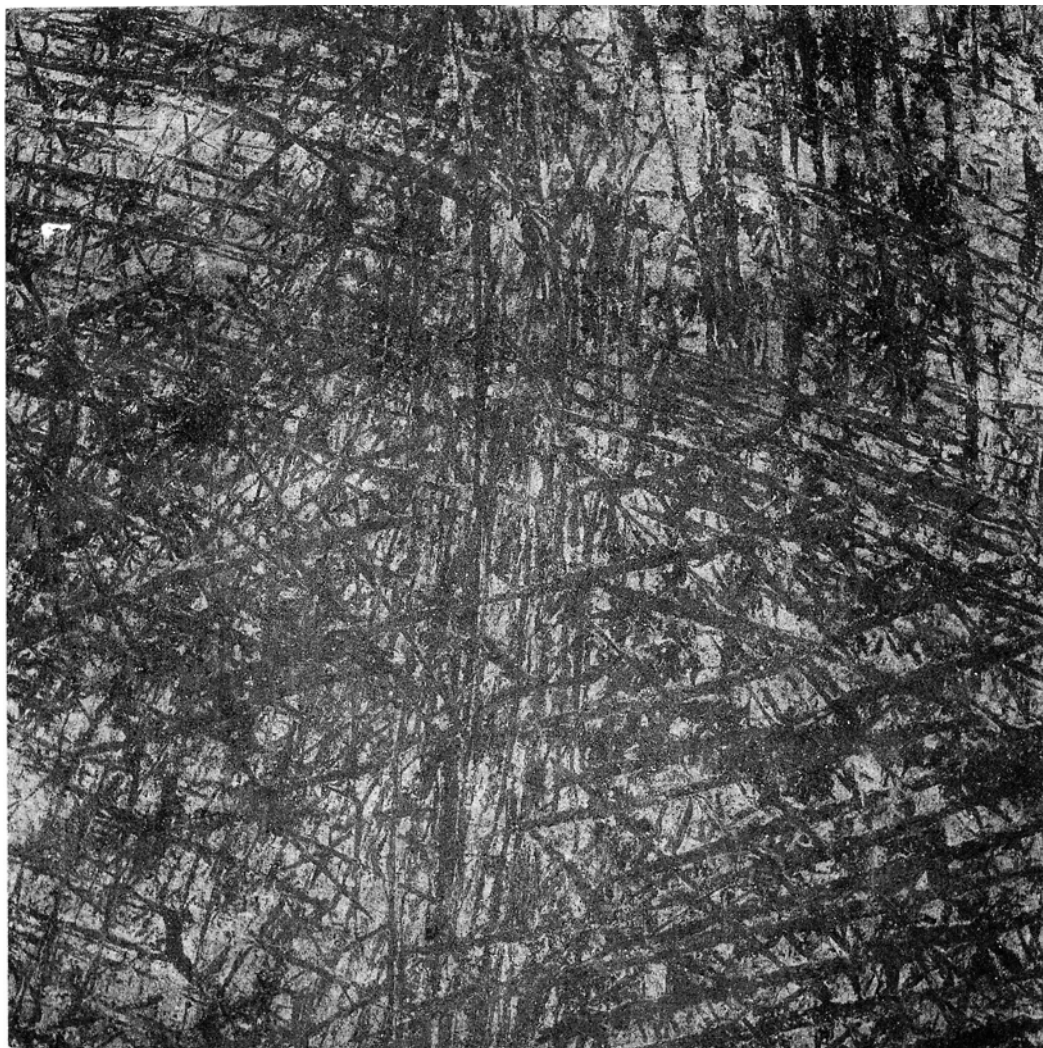


Fig. 9. Detail, 5 × 5 m square, from the boundaries between the fields X105–Y365 and X105–Y345. Photo: Gudrun Nielsen.

corner of X180–Y325 was rather diffuse. The uncultivated strip N of X170–Y345 runs into this corner.

The other intersections of bunches of parallel marks are more complex. X185–Y380 has very varied ploughing directions, and the SW corner has a bunch of parallel marks running N-S but none running E-W. The bunch that runs in from the E actually belongs to the field to the S, X155–Y365. There is more of a corner to the SE, where a bunch of parallel marks curves round strongly from the SW to meet at right angles the N-S boundary between X185–Y380 and X200–Y340. The NE corner of X155–Y365 forms an angle of c. 135°, perhaps because it was later cut through by X170–Y345.

The SE corner of X145–Y335 seems to form a kind of funnel running to the SSE and the open uncultivated area there.

It is unclear how the SW corner of X125–Y315 was laid out against the area separated off there.

Field corners only form the fixed points for shape determination in certain cases, therefore. There is a corresponding looseness on the courses of the sides. Straight lines are virtually non-existent. The short N and S sides of X125–Y380 can be said to be straight, as can a number of similar cases (e.g. the S part of the E side of X145–Y335, or the sides of X170–Y345), but in almost all instances the sides are somewhat irregular,

with curves, deviations or smaller kinks in their course. The curves may be quite clear, as with the E side of X125–Y350 or the N side of X105–Y345, which like the S side of X145–Y335 curves down towards a funnel-shaped exit. Very distinctive courses are followed by the curved edges of the areas separated off to the NW and SE.

Neither are the field sides uniform in length. It is characteristic that not even in the most regularly shaped field, X170–Y345, are the N and S sides, or the E and W sides respectively, of the same lengths. It might be because it is easy to keep going a little further than intended once ploughing has begun, so that some sides become longer, causing some irregularities in field shape as ploughing progresses.

Variations in side length mean that their orientation also varies. It is true that the ploughed units are broadly oriented N-S and E-W (when abnormalities along the uncultivated areas are ignored), but the fields in the N part of the excavated area clearly have a slight WSW-ENE inclination, while those in the S part incline more WNW-ESE.

All these irregularities of course make it more difficult to make a precise estimate of the sizes of the cultivated areas. There is a further uncertainty in that some ploughed units are later than others and are placed inside earlier, larger units.

Certain size classes do, however, seem to be repeated despite the quantitatively limited material. The two completely clear units X170–Y345 and X125–Y350 both contain c. 750 m<sup>2</sup>, although their proportions are very different. X145–Y335 is about twice this, at c. 1525 m<sup>2</sup>. If the estimated size of X185–Y380 is correct, the ploughed area of this would also be about 1500 m<sup>2</sup>. These sizes must probably be seen in relation to ploughing capacity. 750 m<sup>2</sup> may be about what can be ploughed over twice in a day, and thus correspondingly 1500 m<sup>2</sup> may be ploughed once.

Apart from these uniform areas, and the fact that sides are often around 25–30 m in length, there are no consistent figures, and no precise alignments.

The two areas that were separated off contribute to the variability of this system. One of these was not worked at all, the other only to a limited extent at an early stage. They would have caused the plough to manouever completely irregularly, for example at the funnel-shaped SE end of X145–Y335, and the strip between X200–Y340 and X170–Y345.

The reason for these areas being separated off is not clear. They can definitely not be explained by reference to the soil. They might have been due to vegetational growth, or they could have been for storing crops or dumping cleared weeds. The area to the SE had a strong coloration of charcoal. It could possibly be that they were used for the burning of turf or peat, for use as fertiliser. It is worth noting that ploughing took place after burning, because the furrows contain charcoal, and that the areas were not separated off until after this. Finally, it seems that the separated areas connect up with the uncultivated strips in between some of the fields. These strips might to some extent have been used for transport.

#### THE PLOUGHING

There is thus no regular system of fields and ploughing visible in the material. The degree of preservation is also highly variable even within the limited area uncovered.

Not all ploughings reached down to the subsoil sand, of course. Some were restricted to the mould layer. In some places in the sandy mould, the lighter streaks of plough marks not reaching down to the subsoil sand were seen. Similarly, although ploughing was generally carried out very evenly (as can be seen from sections along the longitudinal line of the furrows), it was common for the share now and then to be raised from the subsoil, so that the plough mark was interrupted. Only very few marks can in fact be followed for more than a few metres. It cannot be proved that the separate parts of a line form a continuous sequence, which naturally weakens their value as archaeological source material. Furthermore, it can often be seen how two or more marks run together in one track, or that what looks like a single mark is in reality composed of two or more marks running in the same line.

In most cases it is therefore necessary to deal with main orientations of the ploughing, in the form of sets of parallel furrows that seem to belong to the same ploughing episode. Furthermore there exists the possibility for determining direction provided by either the longitudinal sections or crossing furrows, as described elsewhere in detail (Nielsen 1970, 152, 159).

An elementary aspect is the ploughing of parallel furrows. This was necessary to ensure that the whole field



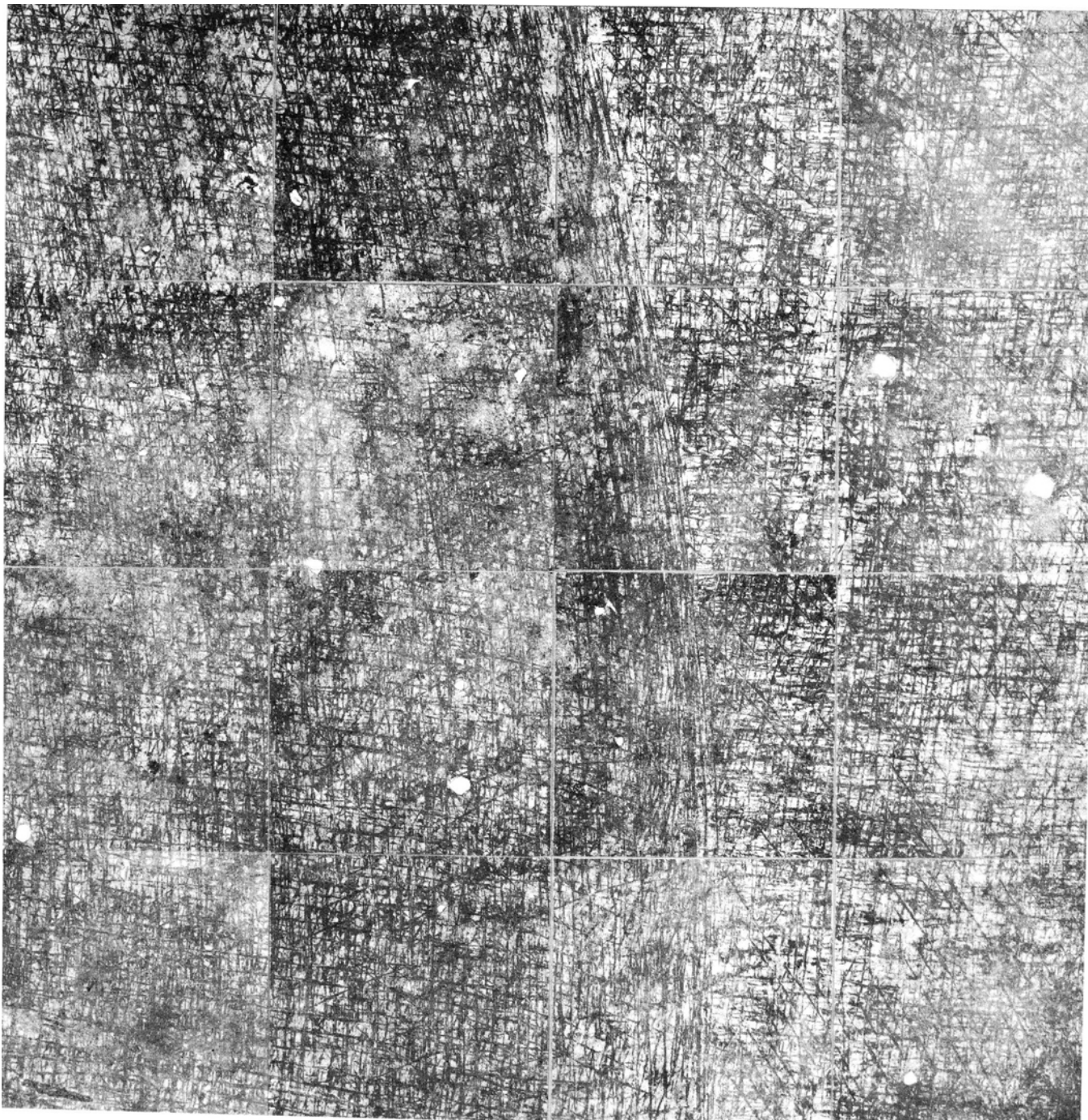


Fig. 10. 400 m<sup>2</sup> of the plough marks in the fields X125–Y350 and X145–Y335. To the W is seen the curved N-S ploughing of X125–Y350 and furrows at right angles to this as well as traces of ploughings in other directions. To the E are the furrows of the field C145–Y335 that may have lain fallow during the cultivation of the intruding X125–Y335. Photo: Gudrun Nielsen.

was cultivated, and the furrows also had to be evenly spaced so that the whole surface area was worked. When the sets of ploughmarks can with any confidence be regarded as deriving from the same episode, the furrows are normally about 25–30 cm apart, sometimes a little more, sometimes a little less. The ploughman would have had to concentrate hard on this if awkward and time consuming reploughing was to be avoided.

The distance between the furrows may vary, depending on whether the soil was being broken up or loosened, or whether seed corn was being ploughed in. For instance, during the ploughing in of seed corn it was important that the seed in a furrow was not further covered with soil from the neighbouring furrow.

It can frequently be seen that parallel marks, presumably from the same ploughing, run alternately in opposite directions. Ploughing was thus done from one end of the field to the other, where the plough was raised, turned about, and then taken back alongside the first furrow.

At the ends of the furrows the plough would be lifted or pressed down within a particular area, although not along a fixed line. The rather uneven ends of the furrows near the field boundaries are made more uniform by the ploughing of the bunches of parallel marks along the edges. These even out the irregularities, make the field edge usable as a seed bed, and also keep back the weeds that could otherwise infest the crops. The bunches of parallel marks are, as mentioned, of varying widths, but often c. 2 m, which must more or less be the length needed for the manoeuvre of turning the team of oxen. It is quite clear that these bunches of parallel marks run along and are synonymous with the edge of the ploughed area.

The pattern created by the ploughing has its functional starting point in the field boundary or the edge of the ploughed area. The direction of ploughing can only be described meaningfully in relation to this.

Field X170–Y345 is typical of the normal cases. It is almost rectangular and the furrows run parallel to the sides, except that they turn off slightly a few metres before they reach the bunch of parallel marks at the end boundary; this presumably indicates the turning direction, and causes the furrows to approach the field edge at a slightly oblique angle. There is no definite evidence of ploughing in any other directions in this field.

In principle the same pattern is visible in X125–Y350; one element is formed by the curved N-S plough-

ing, which is constricted from the NE towards the SW, and the other by furrows at right angles to this. This field, however, has clear evidence of other ploughings, at an angle to its sides. There are at least three: NNE-SSW, ENE-WSW, and WNW-ESE, with some variability particularly in the corners. Some of the furrows in the corners are so short that it is problematic whether there was space enough to turn with a team of oxen.

These marks at an oblique angle to the field edges can be interpreted as the result of ploughing to break the ground, in order to work over the whole field and break up the lumps and root systems. This involved the need for more ploughing than just that parallel to the field edges. The furrows were aligned obliquely so that the plough should not slide down into them during later cultivation. Breaking the ground like this may have been done in several phases, involving first the making of a cut, and then ploughing along it. Another explanation for oblique furrows – when they are both later than the standard ploughing and deep – might be that subsequent cultivation of the field took place with the soil loosened, so that the plough penetrated deeper. In this case, too, it would also have been important to avoid sliding into the earlier furrows.

The furrows in X145–Y335 seem to have followed the same pattern. This may have lain fallow during the cultivation of the small field inserted into it. This small field also contains numerous marks aligned with the boundaries, as well as two sets of diagonal marks, and weaker traces with yet another orientation. This means two to three episodes of ground breaking.

It is characteristic that some of the so-called ground breaking marks seem to be secondary, in that they run through furrows of earlier ploughings and are thus the youngest furrows in the field. This may mean that, after the initial ground breaking, cultivation only involved the working of the upper layer of soil, and did not result in mags being made in the sandy subsoil.

The foregoing has dealt with what one can call complete fields and their working. What can the rest contribute?

The small corner of X200–Y325 only shows ploughing in the directions of the field boundaries. The neighbouring field to the W, X200–Y340, has besides this at least two fairly prominent diagonal ploughings, NE-SW and NW-SE (Nielsen 1970, fig. 1). To the W, X185–Y380 has no clear southern boundary with the strange open area which decided the direction of ploughing. It

is clear that there was an intensive ploughing parallel to the N-S edges, and also (though somewhat curved) at right angles to this. In several instances furrows go down towards the boundary to the neighbouring field to the S, X155–Y365. One of these is marked by the deep furrows of a ground breaking episode, and curves to the W, so the open area in this phase was constricted into a funnel-shape towards the W. Another set of furrows curves towards the S. A similar but less diffuse ploughing is visible in X155–Y365. This is dominated by a N-S ploughing parallel to the sides, and has corresponding E-W furrows; the N side curves funnel-like towards the SE, but apart from ploughing parallel with this curve in the N part of the field, no other directions are visible.

X180–Y325 has only one definite main direction, oblique or strongly curved in relation to the field edge. This could be evidence that this field was only ploughed once; but an alternative explanation is that this represents a ground breaking episode, after which cultivation did not go so deep. The furrows in X150–Y320, rare as they are, do on the other hand appear oriented parallel to the sides, at least E-W and N-S, and the furrows in the separated area within X125–Y315 are partly aligned this way as well. X125–Y315 is, however, later in date than the two fields previously mentioned, and apparently only has furrows oriented parallel to the edges.

In X105–Y345 the ploughing is apparently similarly oriented, except for an oblique one running NE-SW, which diminishes to just a few metres in length in the corners. This oblique ploughing is later than the rest of the furrows. The same is true of X105–Y365, where two oblique ploughings that cross each other postdate those aligned parallel to the field edges. The broadest and deepest is the one oriented NE-SW, and is apparently the last ploughing of the field to have made marks in the subsoil.

#### SUMMARY

*Even though* the excavation only covered c. 5000 m<sup>2</sup> in all; *even though* conditions of preservation were variable in places and sometimes bad; *even though* the evidence from the furrows is limited because much cultivation would have taken place in the humus layer and would not have made marks in the subsoil; and *even though* the

deeper ploughing also varied in depth, so individual furrows cannot be traced; *still* the material has far extended our knowledge of prehistoric ploughing in Denmark, and contributed to a more varied picture.

The main pattern in the ploughings is a back-and-forth movement, creating parallel furrows immediately beside one another, and taking as their starting point a line – usually, but not always, a field boundary. The plough is lifted at the edge of the ploughed unit, turned about, and re-inserted; the turning operation is often begun with a slight curve away from the line a few metres before the plough reaches the end.

Generally, ploughing subsequently (or at the same time) took place at right angles to the original line, and this may have been sufficient to create a seed bed, particularly if the field had been ploughed several times and worked regularly.

Besides this cross ploughing, there are also oblique ploughings; in several instances these are prominent, and result from deep ploughing. This may have been part of a more thorough working, either part of the ground breaking process or at a later stage. In both cases it was important to avoid sliding into the earlier furrows.

The resulting patchwork pattern can be very hard to interpret, and indicates several ploughings within the same process. Interpretation clearly becomes even more problematic when several contemporary ploughings, perhaps with more than one plough, intersect each other.

The final piece of work was the ploughing along the edges of the ploughed units. This has left traces in the form of the bunches of parallel marks.

The boundaries of the fields or ploughed units seem somewhat random. In several cases there appears to be no boundary; in others they are formed by strips, worked less than the fields and in which the sandy subsoil appears paler; only rarely could boundary banks be recognised. With regard to the last point, the only possible conclusion from this material is that banks or other fixed boundaries were not a necessary part of the cultivation process, and were definitely unnecessary as far as the use of individual ploughed units was concerned. They may have served other purposes to do with ownership rights.

As a result of this, there is a considerable irregularity in the shape of the ploughed units, and in some cases this is connected with the existence of open areas which

were not ploughed. Another result was that boundaries of ploughed units could be moved. Despite this, one can talk in terms of broadly rectangular areas – an inevitable result of the ploughing pattern – measuring c. 750 m<sup>2</sup> and 1500 m<sup>2</sup> in area.

An enlargement of the excavation, and detailed study of the internal relationships between furrows, might extend the picture.

#### Acknowledgments

I take the opportunity to thank my many collaborators for their help:

The keeper of Vendsyssel Historiske Museum Palle Friis. The students, now M.A.'s: Jens Henrik Bech who has i.a. excavated the barrows; Per Lysdahl who has dealt with the ceramic from the pit; Anne Preisler who has excavated and for a M.A. thesis investigated the cult stone and the ceramics around it; and Henrik Vensild. Further Niels Bendsen, Vendsyssel Historiske Museum, and chiropractor Niels Thomsen in Hjørring who has done an excellent job in connection with the photographic documentation. But foremost I thank my wife Gudrun Nielsen who during the most extensive campaigns took care of the documentation work.

For inspiring talks and ideas I thank professor dr. Axel Steensberg, dr. J. Troels-Smith from the National Museum, Bent Aaby M.Sc. from the Geological Survey of Denmark, and Hans Ole Hansen M.A. as the experienced initiator of ploughing experiments.

*Translated by Peter Rowley-Conwy*

Viggo Nielsen, The National Agency for the Protection of Nature, Monuments, and Sites, *Fredningsstyrelsen*, Amaliegade 13, DK-1256 København K.

#### NOTES

1. The uncovered area with plough marks in Store Vildmose is probably the most extensive of its kind. The material can be extended almost unlimited within the 200 ha area where plough marks have been demonstrated to exist.

So far this material will to some degree be setting a standard, with due regard to differences in cultivation methods caused by topography or soil conditions.

The material to some extent confirms what could be concluded from earlier more restricted or fragmentary sites, including that of the first seasons in Store Vildmose (Nielsen 1970). This also applies to the interesting and important find of plough marks at Grøntoft (Becker 1971). Among the features common to the two sites were the dense ploughing parallel to the boundaries. But in the interpretation of this phenomenon there is a difference, in as far as I presume that they mark a finishing process for the edges of the fields. In Grøntoft is also seen the slight curvature of furrows towards the edge of the fields. The corresponding curvature in Store Vildmose

marks the initial phase of the turning manoeuvre, not continuation of ploughing along the boundary. Other common features are the fluctuations in respect to the ploughed units and thus the varying boundaries. Different from Store Vildmose are the clearer and more stationary limits seen at Grøntoft, i.e. boundary banks, lynchets, and trenches, and hence a more well defined framework for the ploughing. Probably the special conditions formed by terrain and soil in Store Vildmose may have caused the relative looseness characteristic for the ploughing as well as for the shapes of the fields.

This will be relevant to the extensive British finds as well. These are also confined by more established limits.

#### REFERENCES

- BARKER, G. 1985: *Prehistoric Farming in Europe*. Cambridge: New Studies in Archaeology.
- BECH, J.H. 1971: Små lave høje, *Brudstykker. Holger Friis tilegnet på årsdagen 15. oktober 1971*. Hjørring: Historisk samfund for Vendsyssel, pp 109–115.
- BECKER, C.J. 1971: Früheisenzeitliche Dörfer bei Grøntoft, West Jütland, *Acta Archaeologica* vol. XLII, pp 79–110.
- FOWLER, P.J. 1971: Early prehistoric agriculture in Western Europe. *Economy and settlement in Neolithic and Early Bronze Age Europe*, ed. by D.D.A. SIMPSON, Leicester, pp 153–182.
- 1983: *The farming of prehistoric Britain*. Cambridge.
- FOWLER, P.J. & J.G. EVANS 1976: Ploughmarks, lynchets, and early fields, *Antiquity* 41, pp 289–301.
- VAN GIFFEN, A.E. 1940: Oudheidkundige aanteekningen over Drentsche vondsten (VII). *Nieuwe drentsche Volksalmanak* Jaar 58.
- HAGEN, A. 1985: Om ard, kornavl og bosetningsutvikling, *Viking* XLVIII 1984, pp 44–69.
- HATT, G. 1941: Forhistoriske Plovfurer i Jylland, *Aarbøger for nordisk Oldkyndighed og Historie*, pp 155–165.
- JESSEN, K. 1945: Vildmosernes Geologi: Store Vildmose. *Vildmosearbejdet*. København: Det kgl. danske Landhusholdningsselskab, pp 22–29.
- MÜLLER-WILLE, M. 1965: *Eisenzeitliche Fluren in den festländischen Nordseegebieten*. Münster: Geographischen Kommission für Westfalen.
- NIELSEN, V. 1970: Iron Age plough marks in Store Vildmose, North Jutland, *Tools & Tillage* I, pp 151–165.
- 1971: Spor. *Brudstykker. Holger Friis tilegnet på årsdagen 15. oktober 1971*. Hjørring: Historisk samfund for Vendsyssel, pp 73–83.
- 1981: Sten i Store Vildmose. *Kuml* 1980, pp 217–226.
- 1984: Prehistoric Field Boundaries in Eastern Denmark, *Journal of Danish Archaeology* 4, pp 135–163.
- PREISLER, A. 1982: *Et offeranlæg fra ældre jernalder på Grishøjgårds Krat, Store Vildmose*. Unpublished M.A. thesis, University of Copenhagen, Institute of Archaeology.
- PÄTZOLD, J. 1960: Rituelles Pflügen beim vorgeschichtlichen Totenkult. *Prähistorische Zeitschrift* XXXVIII Bd., pp 189–239.