ANALECTA PRAEHISTORICA LEIDENSIA

1982

XV

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PUBLICATIONS OF THE INSTITUTE OF PREHISTORY
UNIVERSITY OF LEIDEN

PREHISTORIC SETTLEMENT PATTERNS AROUND THE SOUTHERN NORTH SEA

Papers presented at a colloqium, held in honour of
Professor Dr. P.J.R. Modderman, Leiden,
3-7 May 1982

1982

LEIDEN, UNIVERSITY PRESS

This volume is published with a grant of the foundation Leids Universiteits Fonds

ISBN 90 04 07 148 2

Printed in The Netherlands

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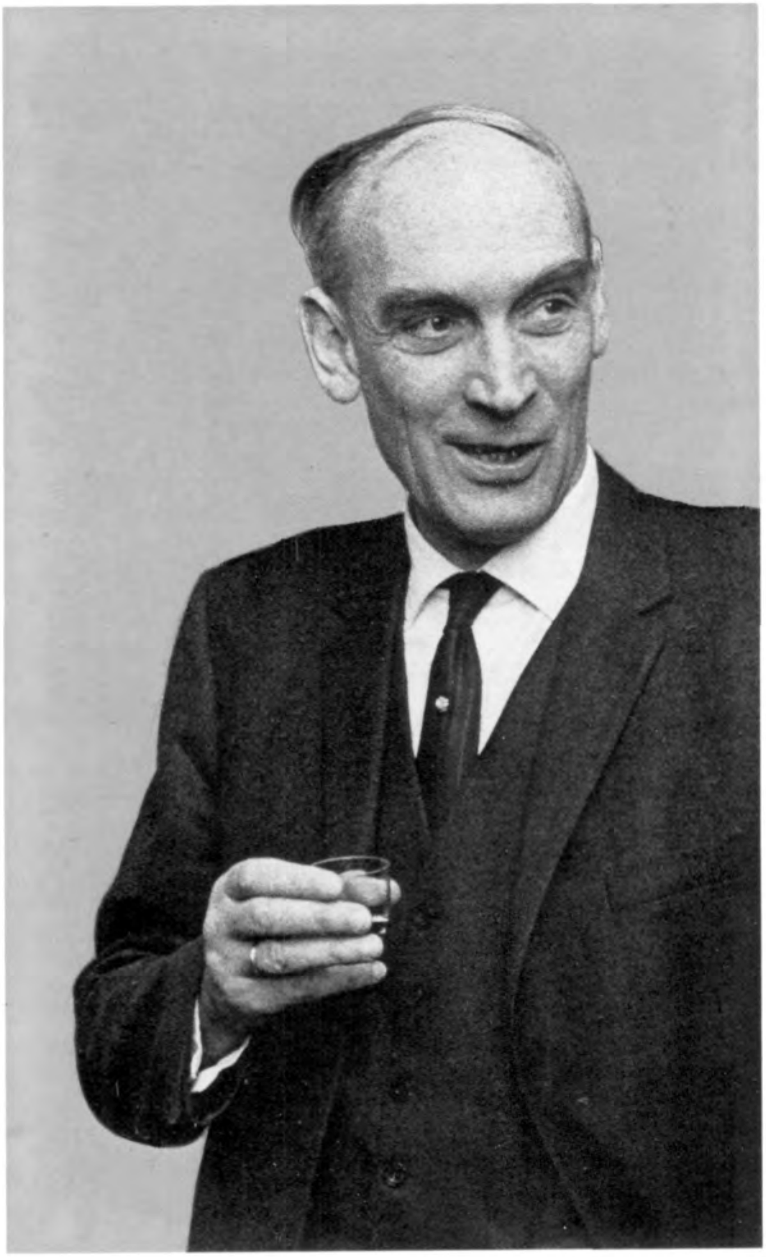

DEDICATION

From 3 - 7 May 1982 some 40 archaeologists from Belgium, Denmark, England, France, Western Germany and the Netherlands were invited to attend a conference on the subject: Prehistoric Settlement Patterns around the southern North Sea. This conference was organised by the Institute for Prehistory of the Leiden University on the occasion of the retirement of

Pieter Jan Remees Modderman

since 1962 Professor in Prehistory at the University.

Discussions during the conference were centered on twelve papers presented by as many colleagues from around the southern North Sea; of these papers eight are presented here in this special volume of Analecta Praehistorica Leidensia. We gratefully dedicate this volume to the man who founded the Leiden Institute and this series, our teacher Professor Dr. P.J.R. Modderman

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RESEARCH INTO THE BANDKERAMIK SETTLEMENT OF THE ALDENHOVENER PLATTE IN THE RHINELAND

J. LÜNING

The research project "Aldenhovener Platte" (Rhineland) lasted for 15 years (1965-1970). After describing the present day geology and geography of the landscape, a reconstruction of soils and vegetation in bandkeramik times is given. Then different levels of the settlement system are discussed: Houses and farmsteads, the distribution of finds within these units and the function of different types of houses; the settlements, their internal structure and history; the Merzbach valley settlement cell and its history and the differences in function and importance of the settlements; and, at last, the distribution of the settlements within the region of the Aldenhovener Platte. At the end there follow some calculations on population density.

The State of Research

Research into the settlement history of the Aldenhovener Platte during the Neolithic began in 1965 when, encouraged by H. Schwabedissen, R. Kuper was looking for a suitable Rössen settlement to excavate. His attention was drawn by the first finds made by H. Löhr on the perimeter of "Tagebau Inden", a brown coal opencast mine about 50 km west of Cologne in the middle of the fertile Jülicher Loessbörde. During an 18 month excavation from 1965-1967, R. Kuper uncovered a total area of 6 hectares of the first and as yet only fully excavated Rössen settlement (Inden 1; fig. 1).[1]
During the excavation, the exceptional technical and organisational potential for settlement archaeology research on the edge of the opencast mines was realised. The perimeters of these mines, several kilometres long, are in effect "free trial trenches" which can present a complete picture of all surviving prehistoric settlement remains. In addition, and of especial importance, is the opportunity afforded to establish areas completely devoid of settlement with considerable certainty.[2]

The recent research in the Aldenhovener Platte which started with this excavation can be divided into three sections (fig. 2):

1. The excavation of individual settlements (1965-1968). This type of research began with Inden 1 and continued with the Rössen settlements of Inden 2, Inden 3 and Aldenhoven 3.[3] The discovery of settlements of the same culture so surprisingly close to Inden 1 led to questions about the basic structure of Rössen settlement, and from this arose the need to define and divide the site better in the landscape. An early rescue excavation in the neighbouring Bandkeramik settlement Lamersdorf 2[4] was the motivation for extending this to the whole of the Neolithic period.

2. The discovery of the settlement landscape of the Merzbach valley (1969-70) When "Tagebau Inden" was closed down in 1968, archaeological interest shifted to the neighbouring mine, "Tagebau Zukunft-West". At this time, the 3 km long perimeter of the mine was moving down the Merzbach valley, revealing considerable Neolithic settlements on both banks. A working group was set up at the *Institute für Ur- und Frühgeschichte* at Cologne University, consisting of people working on doctoral theses on the Neolithic, under the direction of R. Kuper and J. Lüning. They established the aim of systematically observing the perimeter of "Tagebau Zukunft-West" and immediately excavating all the material, in order at least to be able to

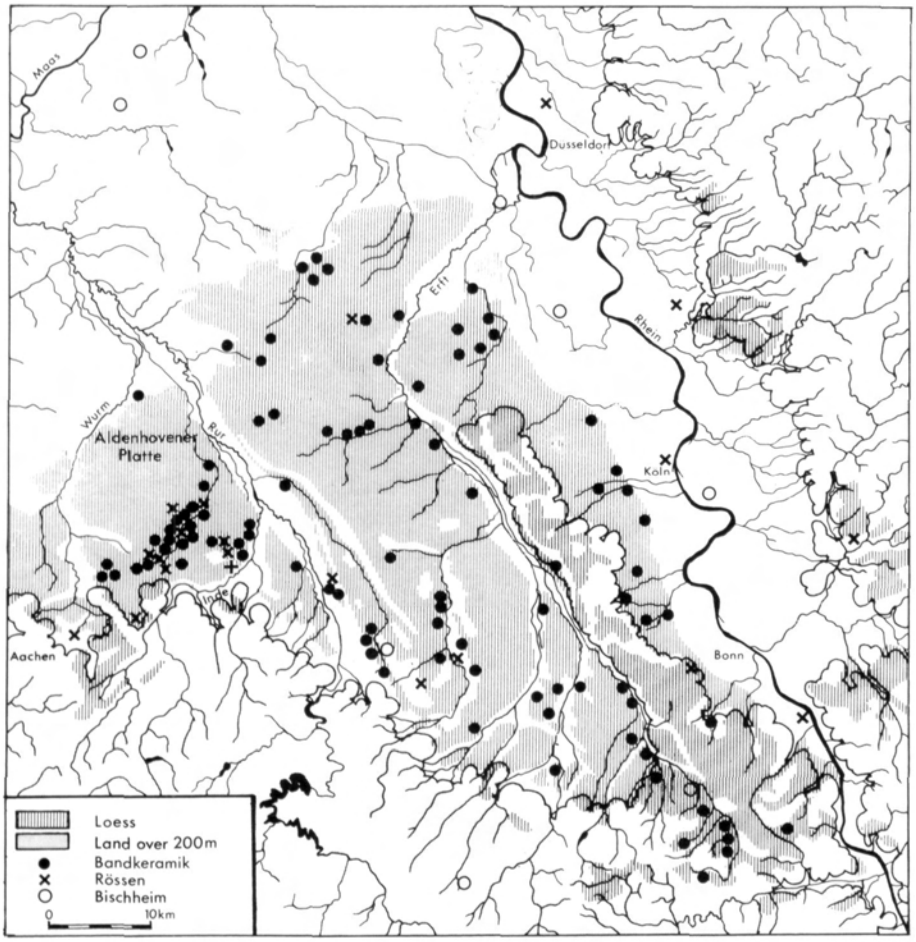


Fig. 1. The Lower Rhine Bay. Distribution of the Bandkeramik (after Dohrn-Ihmig with additions) and the Rössen and Bischheim Culture (after I. Eckert-Schröter). Vertical cross - Inden 1. Scale 1:750 000

date it.[5] In this way in two years a 0.8 km long section of the Merzbach valley (plus a 1.2 km long section of the Langweiler Fliess) was investigated, revealing finds from almost all periods of the Neolithic.[6]

Observations and finds from almost all prehistoric and early historic periods were made, so that it became clear that the Merzbach valley was a representative settlement cell for the archaeological history of the Lower Rhine Bay. However, demands on the time of the members of the working group were considerable, and at the same time it appeared to be unjustifiable to continue the rescue excavations longer than necessary, and as a result accept the unobserved destruction of the greater part of the archaeological material.

3. The Project "Settlement History of the Neolithic of the Aldenhovener Platte" (1971-81). The numerous discoveries of the preceding years and the excellent opportunity afforded for the total excavation of a small landscape unit prompted the proposal to apply to the *Deutsche Forschungsgemeinschaft* to set up a long and comprehensive project in settlement archaeology.[7]

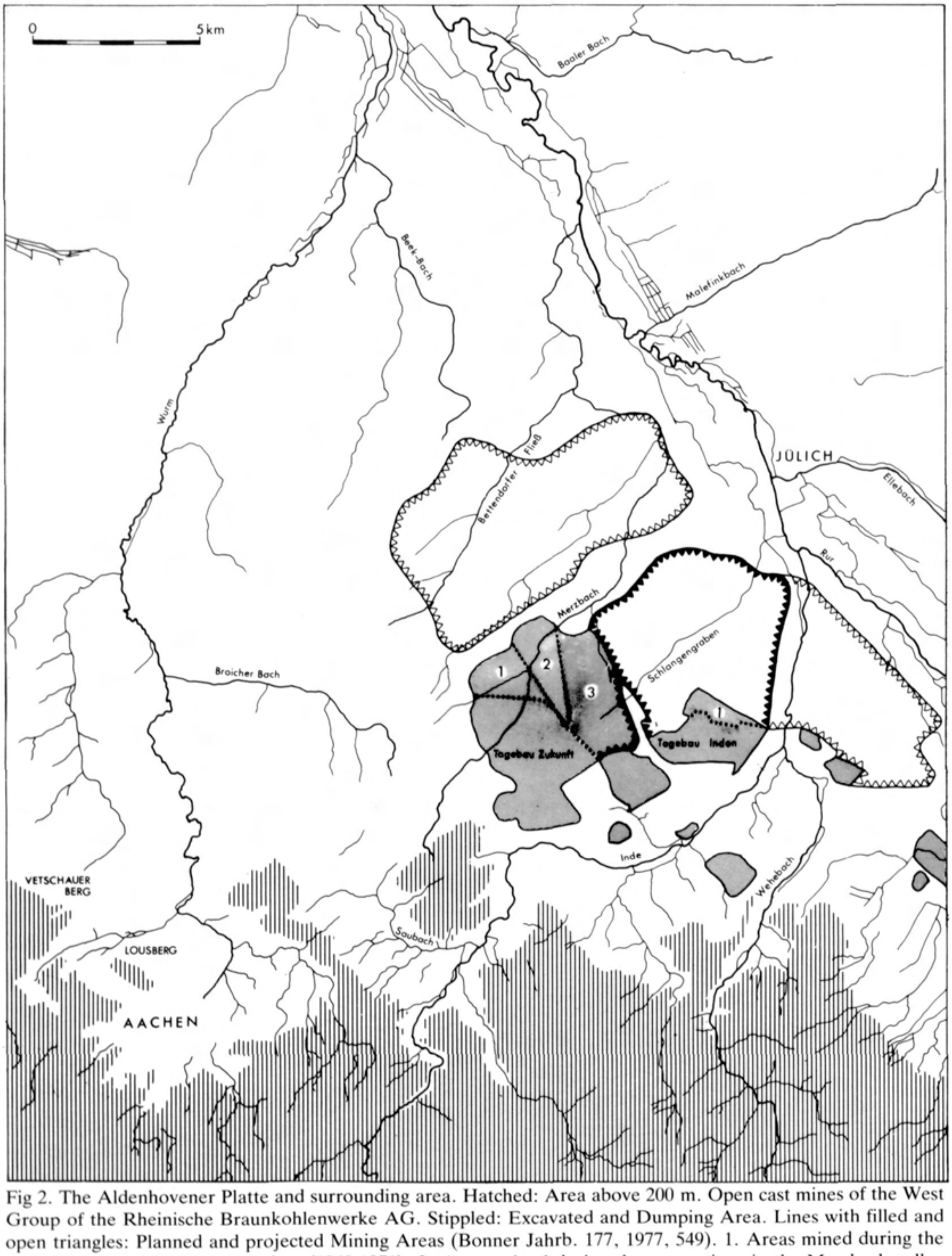


Fig 2. The Aldenhovener Platte and surrounding area. Hatched: Area above 200 m. Open cast mines of the West Group of the Rheinische Braunkohlenwerke AG. Stippled: Excavated and Dumping Area. Lines with filled and open triangles: Planned and projected Mining Areas (Bonner Jahrb. 177, 1977, 549). 1. Areas mined during the first phase of the Research Project (1968-1971). 2. Areas mined during the excavations in the Merzbach valley (1.10.1971-1.10.1973). 3. Areas mined from 1.10.1973-1981. Scale 1: 200 000

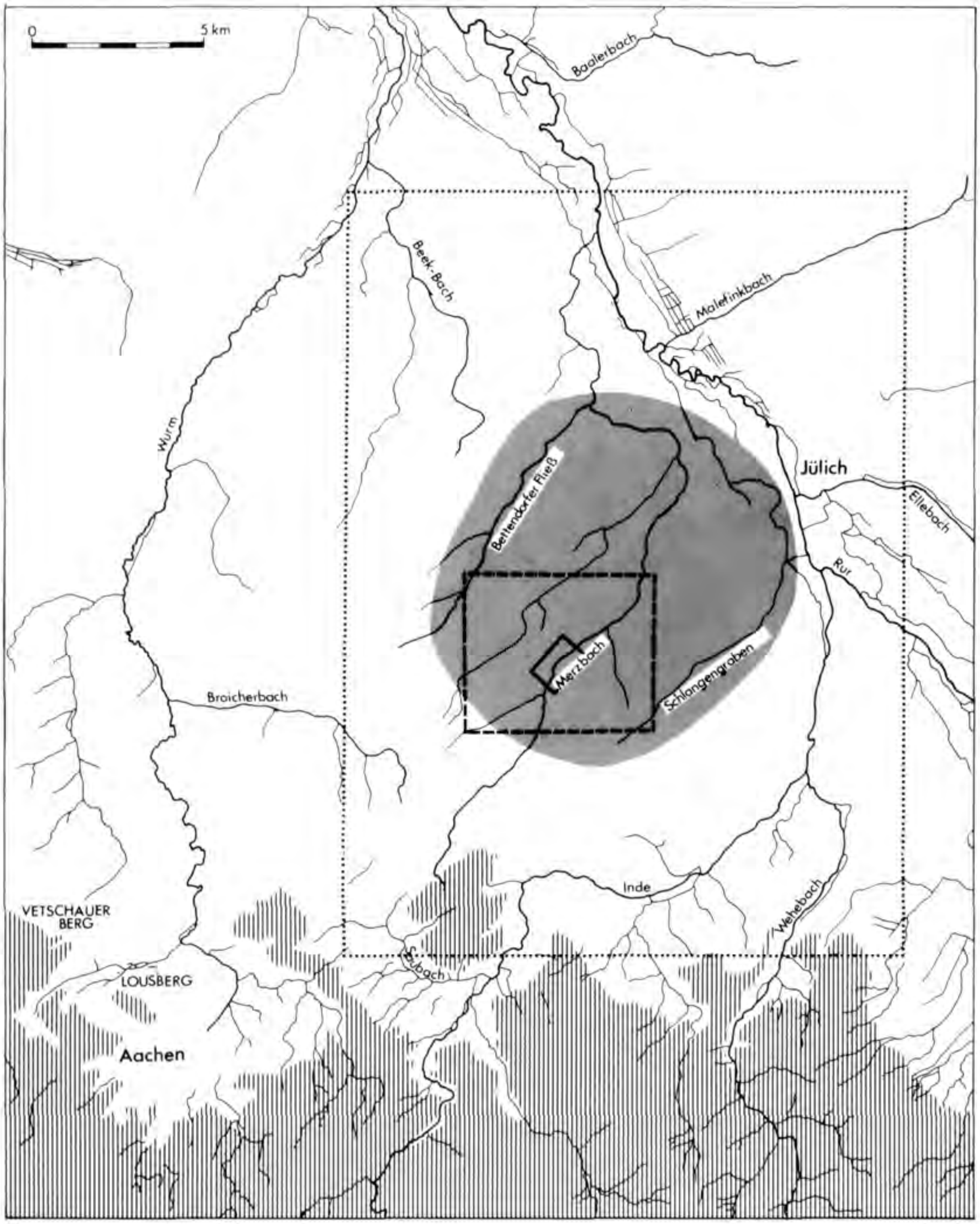
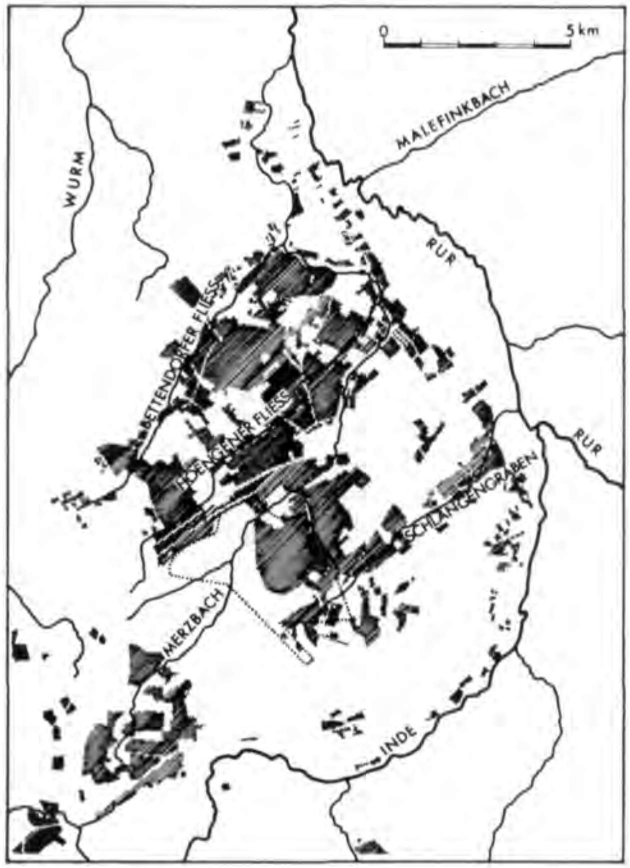


Fig. 3. The Aldenhovener Platte and surrounding area: Area of research (980 km²). Hatched: Area above 200 m. Dotted line: Limits of extensive survey area (350 km²). Stippled: Intensive survey area (85 km²). Dashed line: Map published in Bonner Jahrb. 174, 1974, Beilage 1 with excavated area of Merzbach valley indicated (Bonner Jahrb. 179, 1979, 553). Scale 1: 200 000

Fig. 4. The Aldenhovener Platte. Hatched: areas surveyed up to end of 1979. Dotted line: Open-cast mine "Zukunft-West" (controlled data collection since 1968) (Bonner Jahrb. 180, 1980, 300). Scale 1: 200 000



The object of this project was to excavate totally the sections of the Merzbach valley which would be destroyed by mining in forthcoming years and, combined with research in the surrounding area, to build up a settlement history of the Aldenhovener Platte.

During the first two years of the project (1971-73) an area of 24 hectares of the Neolithic settlement in the Merzbach valley was excavated.[8] Surprisingly this consisted exclusively of Bandkeramik settlements and a contemporary gravefield, so that during the next few years it was necessary to extend the picture by added excavation outside the area of mining, increasing the area to 39 hectares. Large settlement areas of the Grossgartach and Michelsberg cultures were discovered and excavated, while only minimal traces of the Late Neolithic Wartberg, Seine-Oise-Marne and Beaker groups were found.

Of importance was a survey programme which ran from 1973 to 1981 (fig. 3). An area of 85 km² adjacent to the main area of excavation in the Merzbach valley was systematically and intensively surveyed (fig. 4). As most Neolithic sites are rich in flint material, it is probable that at least the largest settlements were more or less completely recovered.[9]

In parallel to the fieldwork the material was analysed and published. The aim was to publish the excavated settlements in monographs. This, as always, was far more expensive in time, personnel and money than the excavations themselves. So far two monographs have been publish-

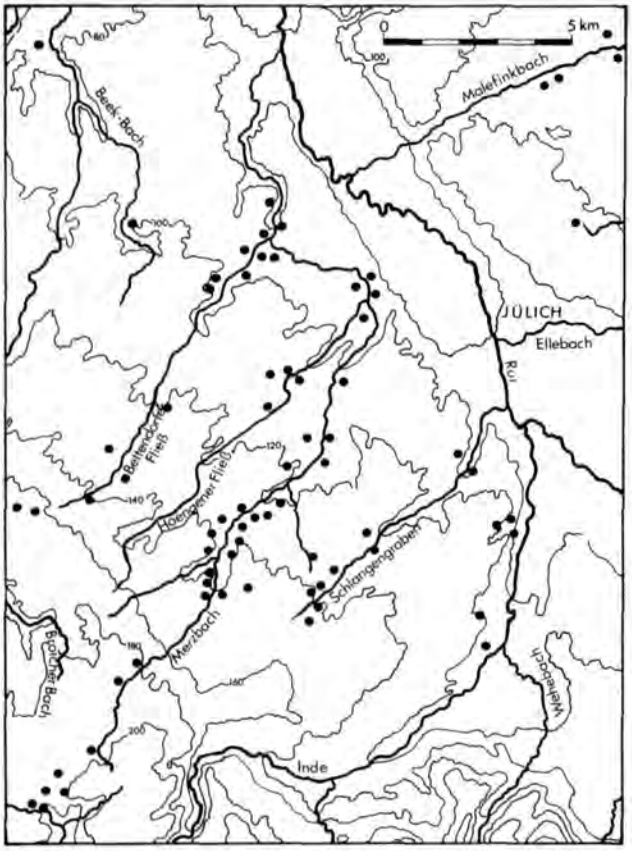


Fig. 5. The Aldenhovener Platte. Hydrographic network, relief and Bandkeramik distribution. Scale 1:200 000.

ed.,[10] and more are in preparation. Several smaller sites have been published in the annual reports. The following account is based on the excavation results alone, as the results of the survey have as yet to be written up.

The Geology and Soils of the Aldenhovener Platte

The Aldenhovener Platte is situated in the south-west of the Lower Rhine Bay in the triangle between the rivers Rur, Inde and Wurm and the north foot of the Eifel, an area of 370 km². The landscape[11] consists of a plateau dissected by dry water courses which falls gently to the northeast (fig. 5).[12] The lowest strata are the brown coal levels, which are overlain by thin strata of early Pleistocene sands and gravels. The sands and gravels are covered by a layer of loess up to 5 m thick. The loess is the parent material for post-Pleistocene soil development, and is now usually 1.5 to 2 m deep, weathered and decalcified to clay loes or *Loesslehm*. The deposits in the Merzbach valley are up to 6 m thick. In the lower part they consist of water deposited loess and alluvial clay, in which occasionally gravels or organic deposits (*Niedermoor* in places under the water table, *Anmoor* in places with fluctuating water table) are laid down. These deposits are overlain by a 3-5 m thick colluvium of redeposited clay loess. Most of these deposits were washed down from the higher areas into the valleys in post-Roman times.

The loess landscape of this area has been con-

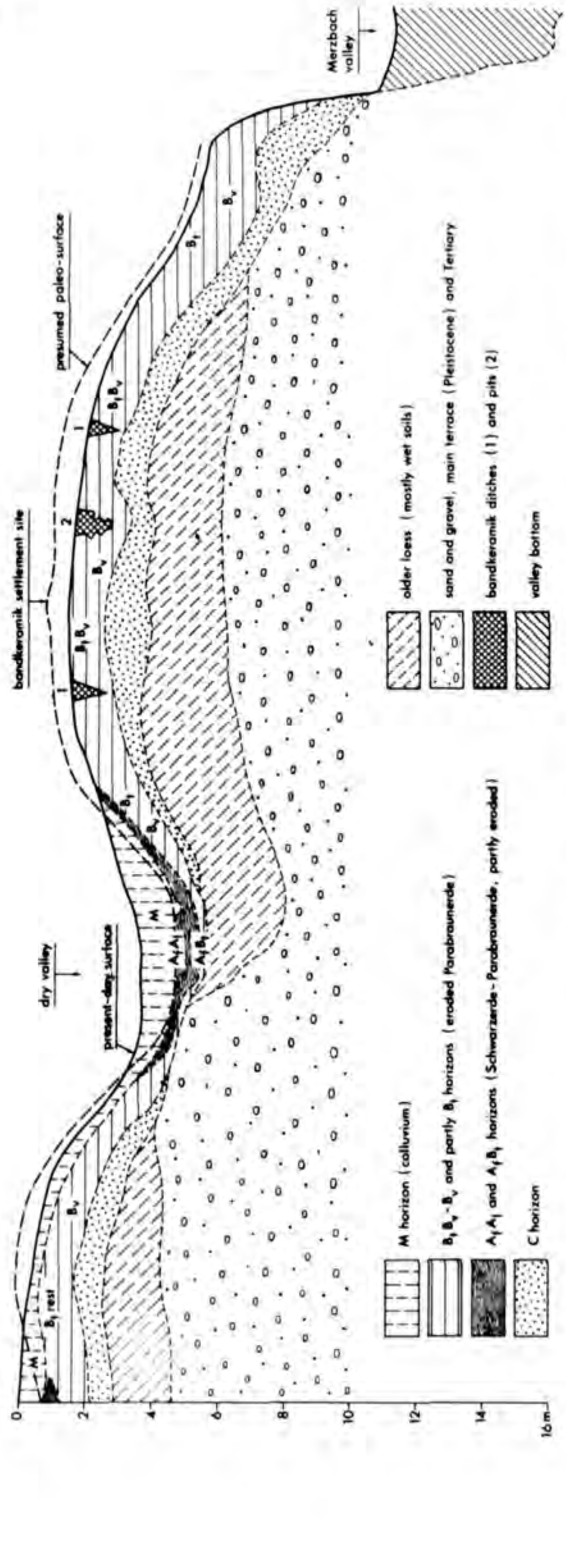


Fig. 6. Langweiler 9. Semi-schematic profile of the loess landscape in the settlement area of Langweiler 9 (after J. Schalich, Langweiler 9).

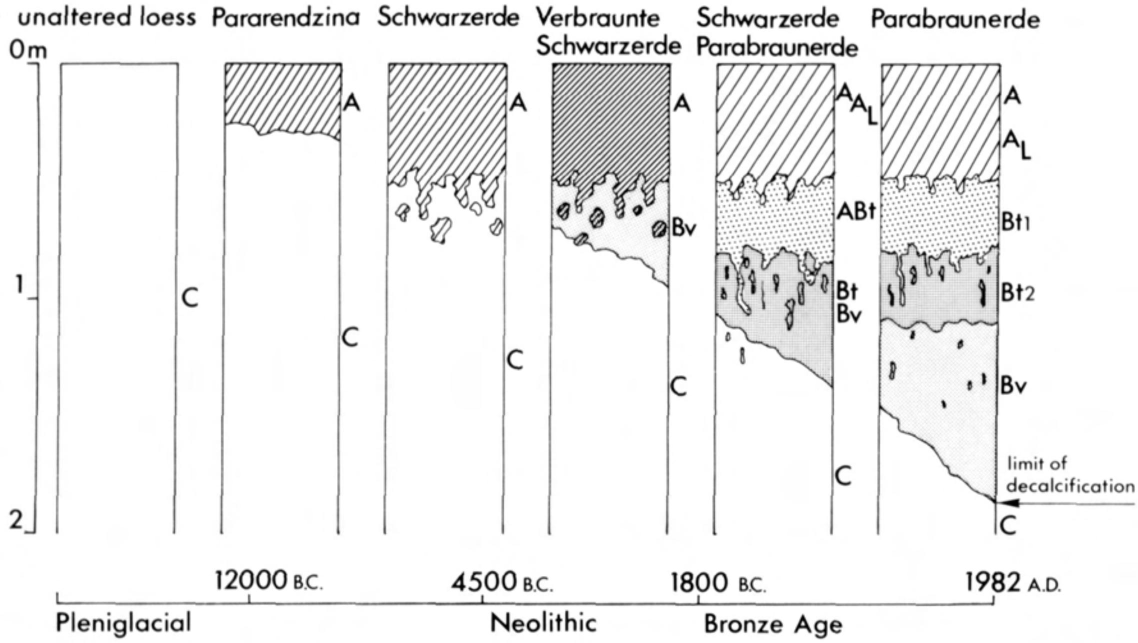


Fig. 7. The Aldenhovener Platte. Soil development from the Weichsel Ice Age to present (after J. Schalich, Langweiler 8).

siderably smoothed by environmental and anthropogenic factors (erosion and deposition). As a result the characteristic soils of the plateau are eroded *Parabraunerden.*

The eroded soil material has to a large extent been redeposited in the valleys, water courses and other depressions in the loess area as colluvium, partially covering Neolithic fossil soils (fig. 6). Continuous observation of the morphology of the settlements themselves showed that in the post-Neolithic period soil erosion of 0.60 to 0.85 m had occurred, which removed the old land surface and the upper part of the ditches, pits and postholes. In level areas, the erosion was minimal, so that the present land surface is practically identical with that of the Neolithic. In such areas the traces of the houses were preserved to a depth of up to 1.40 m. In sites on knolls or slopes the erosion could be as much as 1-2 m, as in the area of the earthwork Langweiler 8.

On the aeolian loess deposits laid down in the Weichsel Ice Age the first black earths developed in the late glacial and early Holocene climate under steppe and forest vegetation. These black earths had a humus rich horizon directly on the calcareous loess (C-horizon) (fig. 7). During the later Atlantic, and thus essentially the post-Bandkeramik period, the black earth degraded to a depth of 0.8-1.0 m (by the end of the Neolithic).

During the Bronze Age this process of degradation continued (black earth – parabraunerde), forming the present parabraunerden which have been in existence since at least the Hallstatt period.

These erosion processes which were so important in the morphological and soil development of the area have their basis in the system of valleys and water courses of the loess landscape. Erosion started immediately from these and, with increasing afforestation, continued in a form of retrogressive erosion to the plateaus, where levelling processes had already started to a limited extent. The eroded material was redeposited as colluvium in the valleys, channels

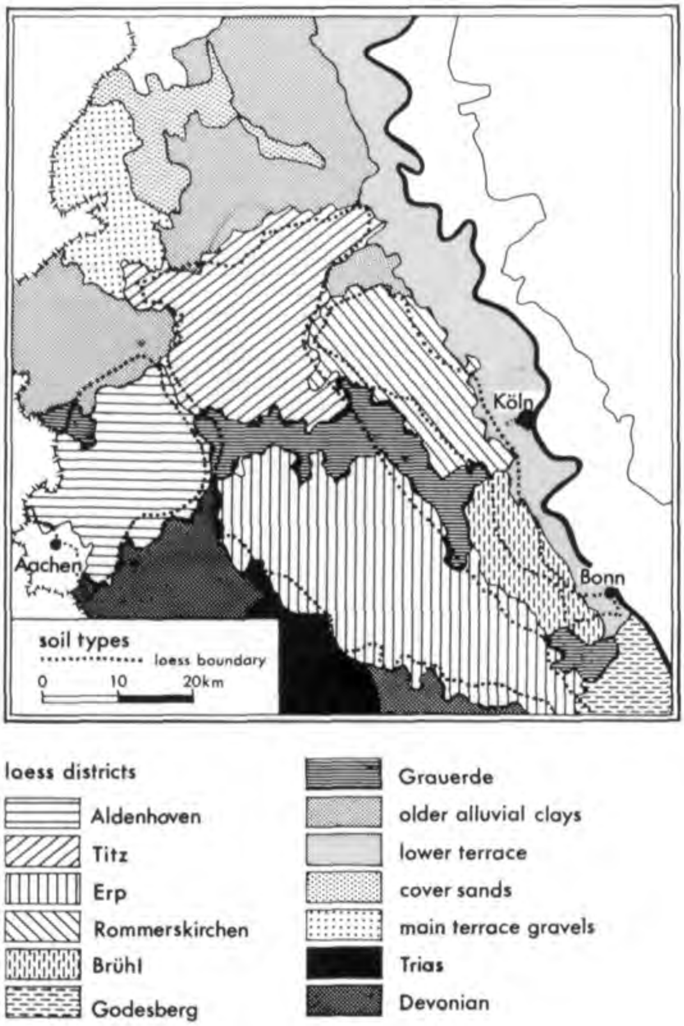


Fig. 8. The Lower Rhine Bay. Soil types compiled from the dominant soil type per parish with the loess areas of the Rhineland indicated by a dotted line (after P. Imhoff). Scale 1: 1 000 000

and depressions. Already by the Bandkaramik there were small colluvial deposits. In the Merzbach valley since the Roman period 3.0-4.5 m colluvium of redeposited loess had been laid down, with up to 2.0 m in the tributary water courses. This means that in the Neolithic the morphology of the loess landscape of the Aldenhovener Platte was considerably more pronounced than today.

The Present Day Geography of the Aldenhovener Platte

The loess area of the Lower Rhine Bay[13] of the Rhine is divided into several smaller areas by rivers and streams flowing from the Eifel, and by the Vorgebirge, which is covered only by a thin layer of completely degraded loess. These areas are to some extent clearly divided from each other both morphologically and economically. In this way five loess areas can be distinguished; the Aldenhovener Platte is the wes-

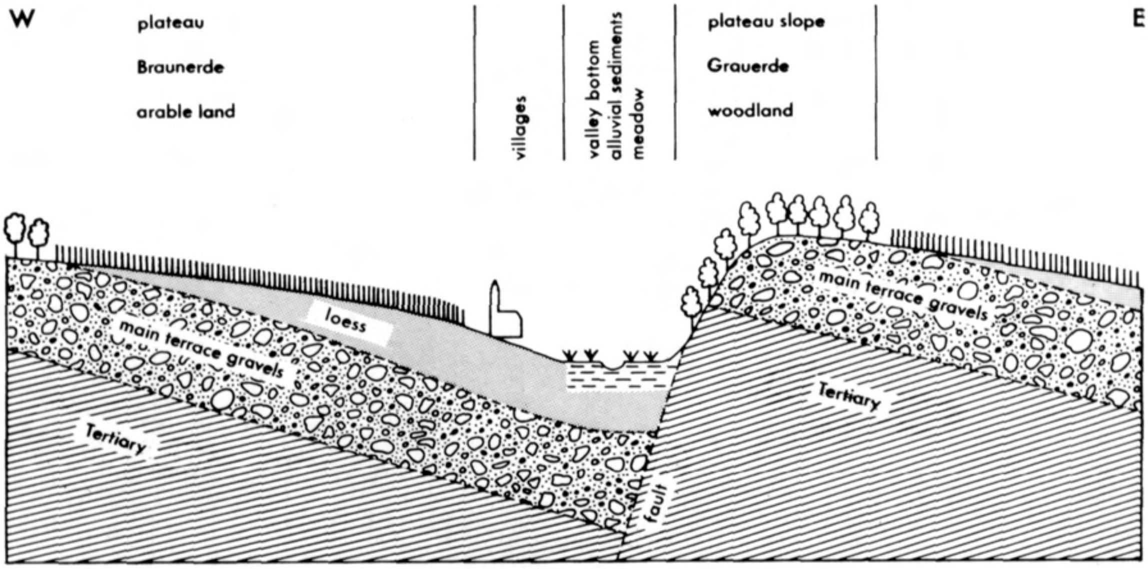


Fig. 9. The Lower Rhine Bay. Schematic profile of the modern landscape (after H. Becker).

ternmost of these (fig. 8). It is distinguished by a gently rolling surface. Gentle elevations alternate with broad, mostly dry valley basins. The few, mostly dry streams, have usually cut deep channels with vertical sides.

As in the whole of the Lower Rhine Bay, asymmetric valley forms are characteristic. Valleys running north-south have steeper eastern banks, while those running east-west have steeper northern banks. These steep east and north slopes are usually free of loess, while the flat west and south slopes are often covered by deep loess (fig. 9).

The climate of the Lower Rhine Bay is determined by its western location in the continental land mass. The Hohe Venn in the Eifel is of great importance in determining the amount of rainfall. Oceanic air currents can flow mostly unhindered over the greater part of the area. Occasionally, in short periods of usually only a few days, continental climatic influences are important (fig. 10).

This is clearly observable in the distribution of prevailing winds per month. In all months the prevailing winds are south-west and west, especially south-west (fig. 11). In spring the north-east wind and in autumn the south-east wind increases. April and May are the months with the most east wind.

The west winds bring warmth in winter and cool air in summer. Their dominance during the whole year ensures the moderate temperature curve in the Lower Rhine area. The Hohe Venn keeps back the oceanic winds. The temperature curve therefore becomes more continental towards the south.

For agriculture the late occurrence of autumn frost is of great importance. The first day of frost occurs on average on the 1st November. Winter wheat can be planted until late in the autumn; there is therefore little summer wheat. Cold phases occur not infrequently in May, but they are of little importance as because of the earlier warm weather the grain is usually too far advanced to be affected by frost. Despite the relatively high rainfall, its distribution is relatively unsuited for agriculture; instead of high spring rainfall until June (for growing crops) and low summer rainfall in June and July (for ripening crops), the situation is reversed

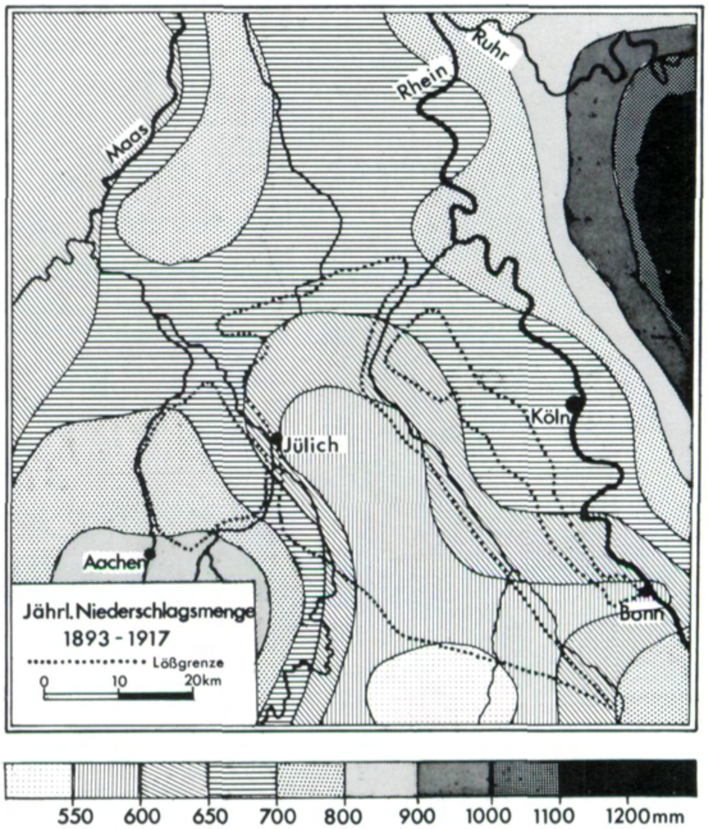


Fig. 10. The Lower Rhine Bay. Annual Rainfall 1893-1917 with border of loess indicated by a dotted line (after P. Imhoff). Scale 1:1 000 000

(fig. 12) and there are often problems with a too dry spring and wet summer.

The Aldenhovener Platte in the west shows some exceptions to this picture. Here there is the highest rainfall of the loess zone (fig. 10). The effect of this can be seen at the present day in the Aldenhoven loess zone, which has 30% grazing land, while there is only 17% grazing land further east. There is accordingly more cattle farming in the west than in the east.

The climate of the Aldenhovener Platte is monitored by measurements taken in Jülich.[14]. The mean annual temperature is 9.4°C. The mean January temperature is 1.6°C and the mean July temperature is 17°C (fig. 12). The mean annual rainfall is 700 mm, and the mean humidity 79%.

Bandkeramik Settlement in Relation to Geology, Soils, Geography and Topography

In the Bandkeramik period the Aldenhovener Platte was in a unique position in terms of network geography (fig. 13). The loess area of the Lower Rhine Bay, which is almost identical with the Bandkeramik settlement area, narrows immediately west of the Aldenhovener Platte to a strip of loess only 15 km from north to south. Through this "bottleneck" ran all the networks between the Rhineland-Westphalian and the Dutch-Belgian Bandkeramik, so that cultural differences of all sorts should occur representatively in the area. This can be clearly seen in the influence on ceramic styles; links from far to the west (Limburg pottery)[15] and far to the south-east (Grossgartach pottery)[16] can be

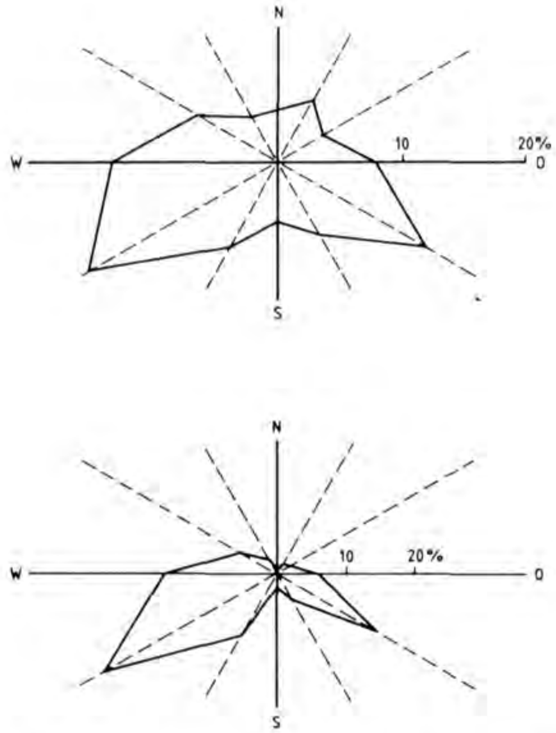


Fig. 11. The Aldenhovener Platte. Jülich meteorological station: frequency distribution of wind direction 1967-1973. Above: All wind speeds. Below: Wind speeds >6m/s (after Geiss, Horbert and Polster).

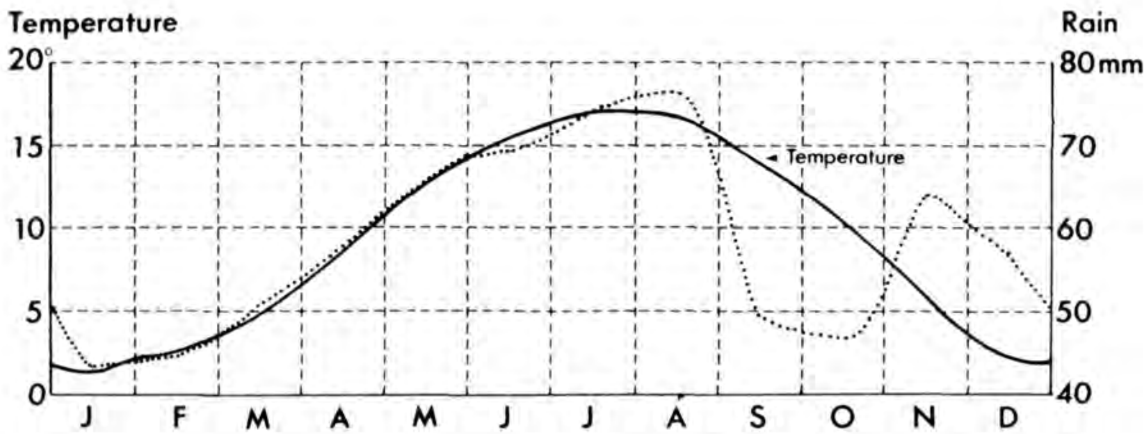


Fig. 12. The Aldenhovener Platte. Jülich meteorological station 1961-1973: Average annual temperature and rainfall distribution (after Geiss, Horbert and Polster)

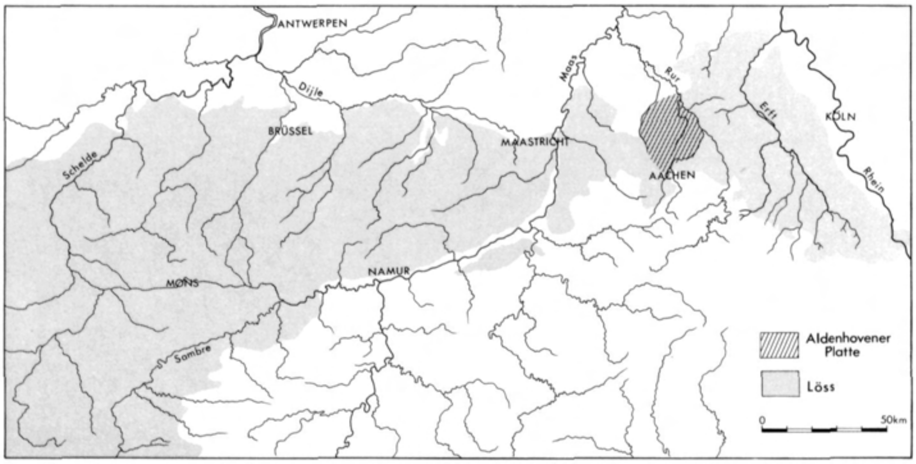


Fig. 13. The Rhenish and Dutch-Belgian loess areas and the location of the Aldenhovener Platte: network geography. Scale 1:3 000 000

recognised. In particular the continually changing methods of raw material exploitation for stone tools enables the types and extent of exchange to be reliably recognised.[17] In all 98 Bandkeramik settlements in the Lower Rhine Bay, as studied by M. Dohrn-Ihmig in 1979[18], are located on loess, including very poor loess soils.[19] On the Aldenhovener Platte the Bandkeramik settlements occur on two different types of location; on the gently sloping west and north-west slopes of the valleys with deep soils, or on the east and south-east steeper slopes on thin loess, often mixed with gravels (fig. 9).[20]

J. Schalich has prepared an exact soil map of the excavated area of settlement,[21] showing that Bandkeramik settlements occur almost exclusively on parabraunerden; both on the deep soils (L 3_1) and shallower soils (L 3_2). In the early Neolithic these parabraunerden were still black earths, which have since degraded (fig. 7). The present day parabraunerden show the extent of this degradation and the erosion from the valleys and water courses. The current extent of settlement features is therefore certainly smaller than in the Neolithic; it is therefore important to take this into consideration when reconstructing the exact settlement extent.

The argument that the present day spread of settlement is smaller than in the Neolithic is based on both soil science and archaeology. For example on the settlement Langweiler 9 (fig. 14) it can be seen that almost all the house remains lie on parabraunerden types L 3_1 and L3_2, and are therefore well preserved. Only two houses in the south were found under a thin layer of colluvium of type K 3_2. It is therefore necessary to recognise that in such areas strongly eroded but still present parabraunerden were covered by later and shallow colluvium. During excavations it is important in certain cases to consider carefully these border areas.

Fig. 14 shows that in most places the perimeter of the settlement has been securely defined. If the settlement had been larger, the good preservational qualities of the soil would have ensured that features would have been found; therefore in this case the present day distribution of settlement features coincides to a large extent with the original settlement spread.[22]

The Aldenhovener Platte is dissected internally only by the south-west to north-east running system of small water courses and channels described above (fig. 5). It therefore formed a relatively homogenous and neutral background for the system of Bandkeramik settlement. The

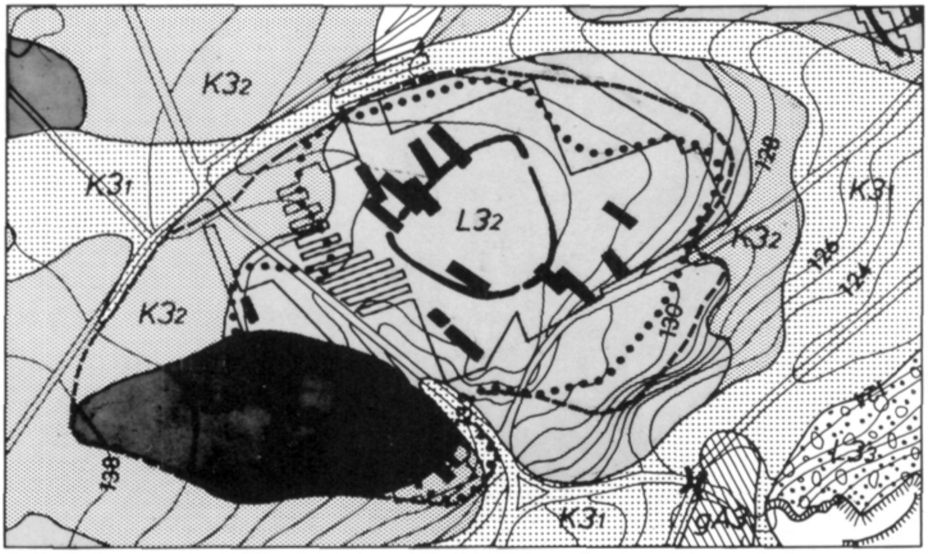


Fig. 14. Langweiler 9. Section from the soil map by J. Schalich with house plans and limits of excavation. Dashed line: Largest possible extension of the settlement based on soil types (after J. Schalich). Dotted line: Limit of archaeological features. Scale 1:5 000
L 3_1: Parabraunerde. Silty loess-loam, 17->20 dm.
L 3_2: Parabraunerde, often to a greater or lesser extent eroded. Silty loess-loam, 12-17 dm.
L 3_3: Parabraunerde, mostly considerably eroded. Silty loess-loam with some gravel, 3-10 dm.
K 3_1: Colluvium of displaced loess and clay-loess, often above alluvial clay or water deposited loess. Silty loess-loam to loamy loess-silt, 15->20 dm.
K 3_2: Colluvium of displaced loess over eroded Parabraunerde. Much silty loess-loam, 6->10 dm.
gA 3: Brown alluvial soil, gley or gleyed colluvium of alluvial clay or clay loess. Loamy loess-silt to silty loess-loam, 5->20 dm.

settlements are not found on the edges of the large alluvial rivers, the Wurm and Rur, which surround the Aldenhovener Platte, but only on the smaller streams within the plateau; the Inde is the largest water course with settlement.
Certainly there would also probably originally have been small tributary water courses here suitable for settlement, as altogether a good source of drinking water must have been of primary importance; the small streams would have ensured this.

Botanical studies have shown that the vegetation of the valley bottoms of the Rur, Inde and Wurm consisted of hard wood ash/elm with alder in the wetter areas and a diverse undergrowth. Flooding occurred once or twice a year on these rivers flowing from the Eifel. The smaller water courses, originating in the loess plateau itself, had predominately oak forest, reflecting their drier location.[23] A pollen profile from the Rur valley shows that the large river valley bottoms were exploited, certainly for elm leaf fodder.[24]

The topographical location of the settlements (fig. 15) is either on a spur in the triangle formed by confluent streams (Langweiler 3, 2, 16, 9), or, as with Langweiler 8, on the plateau and slope, with the houses in the upper and middle area, and the earthwork ring on the lower slope. Settlements such as Laurenzberg 7 and Niedermerz 4 are located differently on the edge of the plateau above the steeper bank of the Merzbach. The houses are at the most 500 m away from water. This provisional sketch of settle-

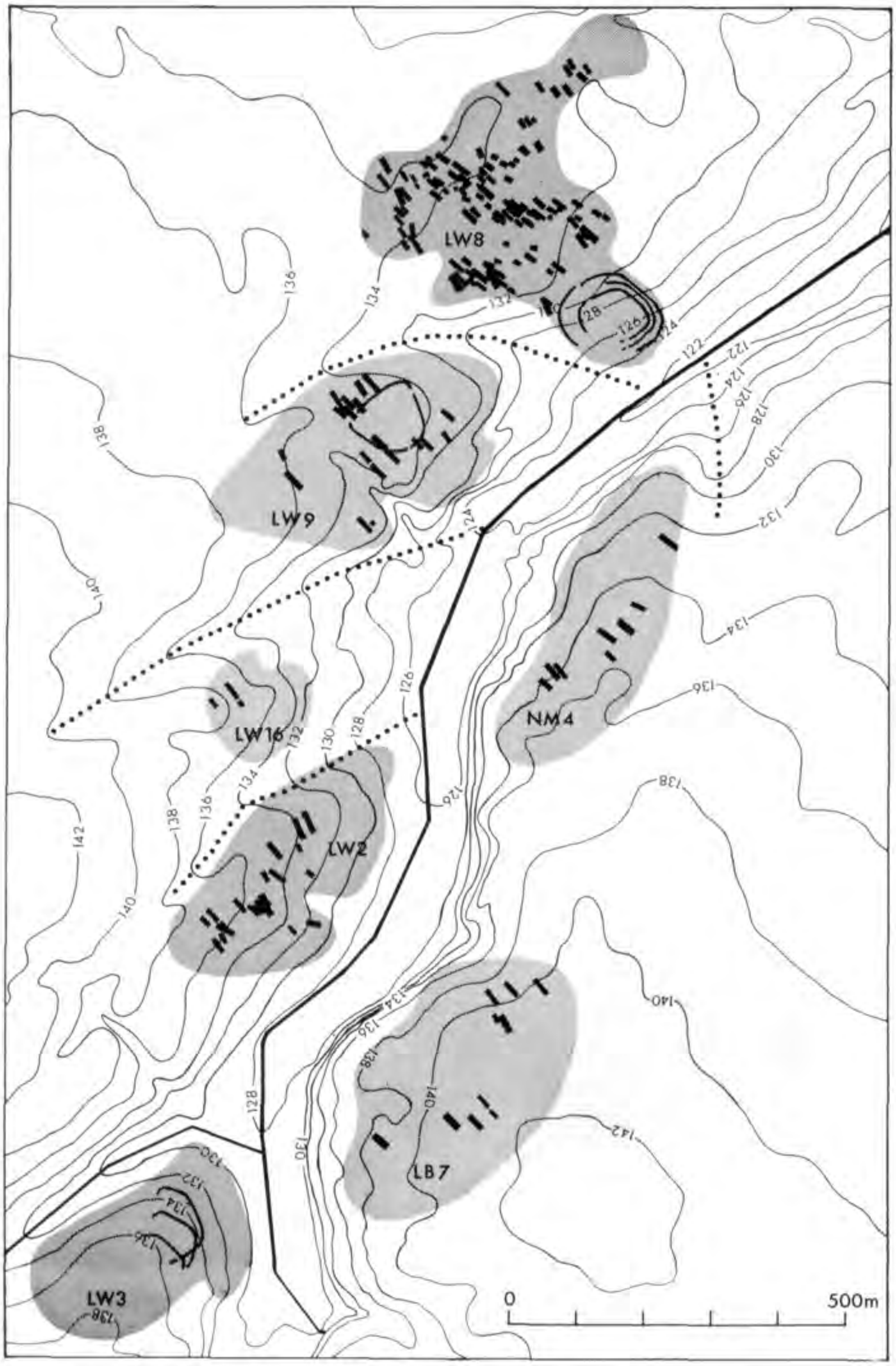


Fig. 15. The Merzbach Valley. Topographical location of Bandkeramik settlements and houses.

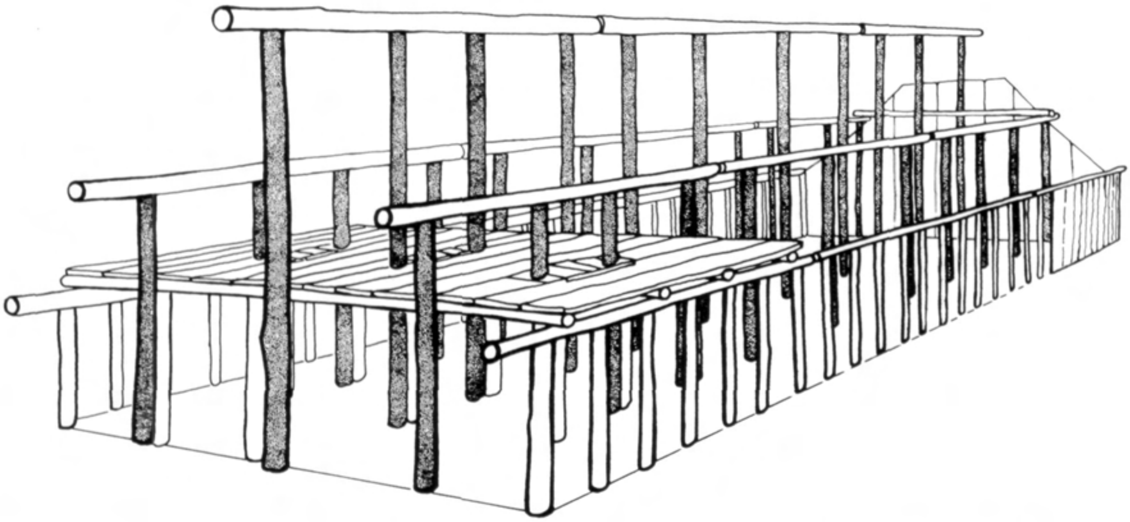


Fig. 16. Reconstructed internal structure of a Bandkeramik longhouse (Type 1) with storage floor in the south-east section

ment location must suffice here; a complete study of the whole survey area is in preparation.[25]

House and Farmstead

P.J.R. Modderman's threefold classification of the Bandkeramik houses in the Dutch Limburg (small, medium and long houses) is also valid for the Rhineland. In the Merzbach valley the three types are found in the approximate ratio 83:12:5. There are thus considerably fewer medium and small sized houses than in the neighbouring Netherlands, where they occur in percentages of 25.5% and 15% in the earlier Bandkeramik and 35.5% and 23,5% in the later Bandkeramik.[26] The temporal development of the house forms will be fully published elsewhere. It appears that the few medium sized houses (type 2) in some settlements (e.g. Langweiler 2) occur more frequently than in others, and that altogether they are found only in the middle and later Bandkeramik phases. The situation appears to be the same for the small houses (type 3) while the longhouses (type 1) occur in all periods. 19% of all the houses are longhouses of type 1a; it is not the case that there was only one longhouse in each settlement at any one time.[27] In the extensive settlement Langweiler 8 in several phases there are no longhouses of type 1a, and in some phases two.

P.J.R. Modderman has also divided the houses internally, in the longhouses observing a division into three sections; north-west, central and south-east sections. The medium sized houses consist of the north-west and central section, and the small houses of the central section only.[28] This interpretation is directly applicable to the Rhineland. There is no direct evidence as to the reason for this threefold division, but it must be certain that each section had a different function and that they were not therefore purely domestic habitations with numerous people in each house. The south-east section has probably correctly been interpreted as a storage area (fig. 16), so that the longhouses can be seen as domestic/storage buildings. From the evidence of the foundations it is less probable that there were cattle stalls in the houses. Since there are no special buildings serving as stalls, including all types of neighbouring buil-

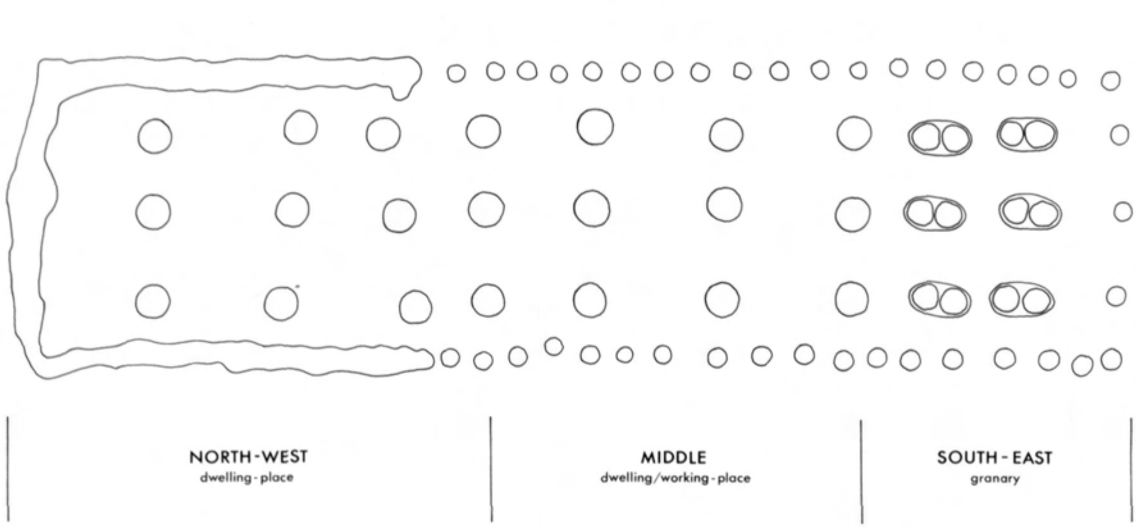


Fig. 17. Plan and probable functional division of a Bandkeramik longhouse (Type 1b).,

dings, there cannot have been any stalling of cattle in the Bandkeramik.

The north-west section was especially "expensively" built; that is, as the walls were built of split logs much building wood was expended (fig. 17). These walls must have been covered with clay daub, so that from outside they looked no different from the adjoining wattle and daub walls, and were probably no more weatherproof. It is probable that this section was built massively for traditional reasons, surrounding the "most distinguished" part of the house. It is therefore probable that this section can be interpreted as the living/sleeping area, in which perhaps also goods of particular value were kept.

The central section of the building, the only one which occurs in all three types of house and was therefore essential, is probably best interpreted as the living/working area. It can only be postulated that there was a fireplace here, but there is much evidence for hearths in the numerous remains of untempered loess with a smooth and heavily burnt surface found in the rubbish pits around the houses.

If the interpretation of the south-east section of the longhouses as a storage area is correct, then the houses without this section must have had a different economic function. It is clear that these and other functional questions must be answered by the finds and their spatial distribution within the settlement. Langweiler 8 has shown remarkable differences between buildings with and without storage areas.[29] The longhouses have on average more pits than the medium sized and smaller houses, and they are richer in material. The houses without a south-east section have a considerably smaller proportion of decorated pottery, and there are differences in the proportion of plant remains, as the longhouses have clearly more weeds and wheat chaff (fig. 18).[30] Against this the number of wheat grains is about the same, as is the number of quern stones. It must be concluded that the cleaning and production of the grain was carried out mostly by the occupants of the longhouses, but that it was consumed in both types of house. It is still unclear as to what economic function the occupants of the houses without the south-east section had.

It has been known for a long time that the long pits are associated with specific Bandkera-

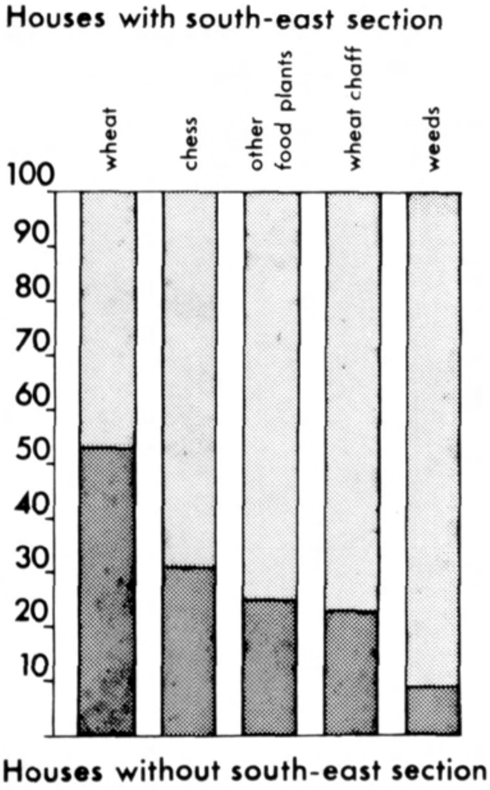


Fig. 18. Langweiler 8. Frequency of plant remains in pits of houses with and without south-east sections (after K.-H. Knörzer).

mik houses. The "north-east pit" has also been recognised recently as a characteristic type.[31] In Langweiler 8, U. Boelicke has identified an activity zone, which consists of an oval of radius 25 m from the houses (fig. 19). In this farmstead area there is at least one pit in a consistent location to west, north and east. Further pits ("others") are more randomly located, but they are often found to the south of the houses.

A careful study by U. Boelicke has shown that specific categories of finds are divided in unequal proportions among the pits, and, extrapolating from this, in the different sections of the houses. An example of this is illustrated in fig. 20, showing the pottery, and especially the undecorated pottery, dominating to the south of the houses, whereas to the north flint tools and artefacts are found in above average quantities. These two zones cut across each other in the areas of pits to the west and east. North and west of the houses there is a preponderance of stone rubble. This sort of difference in the spatial location of finds must reflect a difference of activity areas in the houses themselves, because at least a proportion of the finds must come from these. Thus the functional division apparent in the house foundations is reflected in the finds. It is to be hoped that an exact analysis of their material and their functional interpretation as shown in fig. 17 will be fruitful.

Settlements

As of the excavated settlements in the middle Merzbach valley, two have already been published[10] and the rest have been fully analysed, most of the results have come from this area. In principle it has been possible to build chronologies for the individual farmsteads; *i.e.* finding adjacent to each house an immediate predecessor or successor. Such chronological series can incorporate up to 12 buildings, and the area encompassing this can be 60 - 120 m across. Some settlements (*e.g.* Langweiler 16) consist of only one such farmstead, while others have more; Langweiler 8 for example has 11 contemporary houses.

As the Bandkeramik in the Rhineland lasted for *ca.* 450 years, and 14 house generations have been identified at Langweiler 8, which lasted for the whole of this period, each house stood on average for 30 years.[32] Merely the fact that the farmsteads can be identified indicates this continuous settlement, and thus a site like Langweiler 8 with four and a half centuries of continuous occupation demonstrates a settlement continuity which in prehistoric and early historic terms is frankly astonishing. Under these cirumstances shifting cultivation or cultivation with shifting fields can be completely excluded.[33] The basic settlement continuity does not of course exclude mobility and population dynamics or occasional abandonment. An example of the history of one settlement is that of Langweiler 9, which is already published.[34]

The settlement of Langweiler 9 begins in Phase 5 of the 15-Phase Merzbach chronology[35] with three houses, which are 130-150 m away from each other (fig. 21). The successors in Phase 6 are the buildings 2, 3 and 16. There is then a break in Phase 7 of at least one house generation, *i.e.* at least 30 years, whose cause is unclear. On the neighbouring sites of Langweiler 2, 16 and 8 there was settlement during this phase.

The resettlement of the site began with house 10 in Phase 8. This house is however also contemporary with house 12 in Phase 9, as shown in fig. 21. In Phase 10 there follow houses 7 and 17; *i.e.* both the Phase 9 houses had immediate successors. In Phases 11 and 12 there are three houses in each, with house 14 probably standing alone at the end.

From this succession of houses it is possible to construct informally several farmstead traditions. The clearest is shown by the concentrated grouping of Farmstead 1 in the north. Here, in spite of the discontinuity of two phases there must have been an especial reason for continuity in this particular place which was probably related to rights of land; it may be that a "Family Tradition" can be recognised in the find material.

Farmstead 2 consists of houses 1 and 2, Farmstead 3 of houses 5 and 3/4; both of them ending with the gap in Phases 7 and 8. The resettlement begins in the east with house 10 on previously unused terrain, and shortly afterwards also on Farmstead 1. From house 10 in Phase 9 there appears to be a tradition leading to house 7 in Phase 10, so that for a short period the whole south-east area can be seen as one large farmstead. In Phase 11, with the contemporary houses 6 and 9 the area is once again divided, and this continued in Phase 12. Houses 10 and 7 therefore formed the nucleus of the two later Farmsteads 4 and 5.

The history of the settlement can be seen therefore to be very complex. Next to farmsteads with a life of only two generations (Farmsteads 2 and 3) and three generations (Farmstead 4) there is the six generation long Farmstead 1, which however has a break of 60 years, and Farmstead 5 with three houses which was also abandoned for 30 years. In both cases of local discontinuity there appears therefore to have been a continuous "claim" on the part of the settlement abandoned. Farmstead 1 with its close grouping of houses supports this contention, while Farmsteads 4 and 5 appear to merge into a large unit in Phases 9 and 10. It would be of considerable importance to link this relatively formal picture of houses and farmsteads with kinship, social and economic relations by linking the associated material.

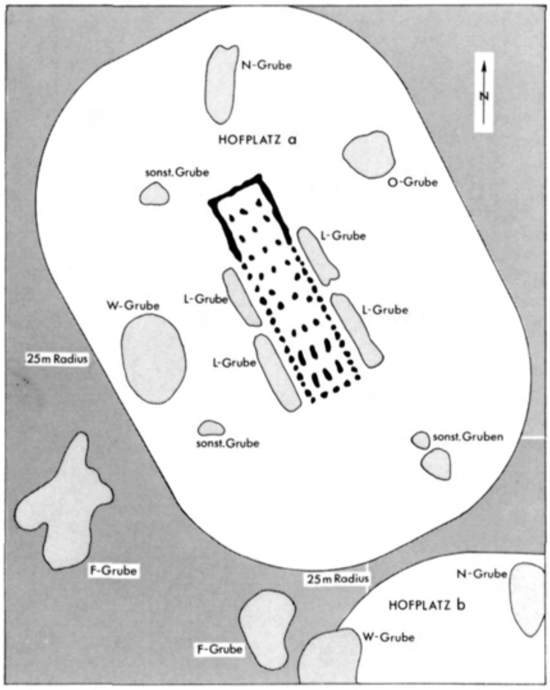


Fig. 19. Langweiler 8. Model of a Bandkeramik farmstead with associated pits (after U. Boelicke).

The Merzbach Valley Settlement Cell

The Merzbach valley is the central water course in the south-east part of the Aldenhovener Plat-

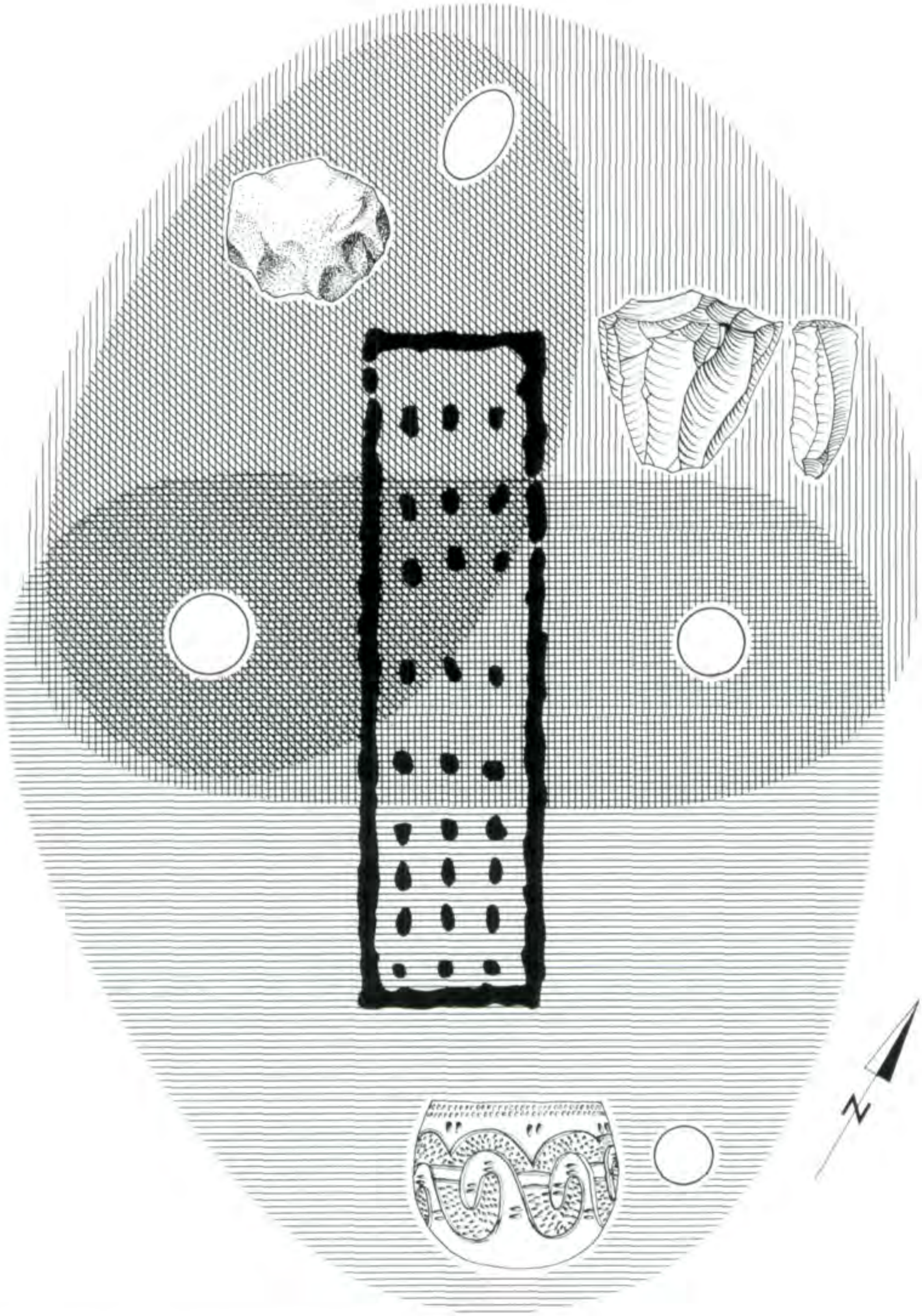


Fig. 20. Langweiler 8. Model of some of the activity zones round a Bandkeramik house (after U. Boelicke).

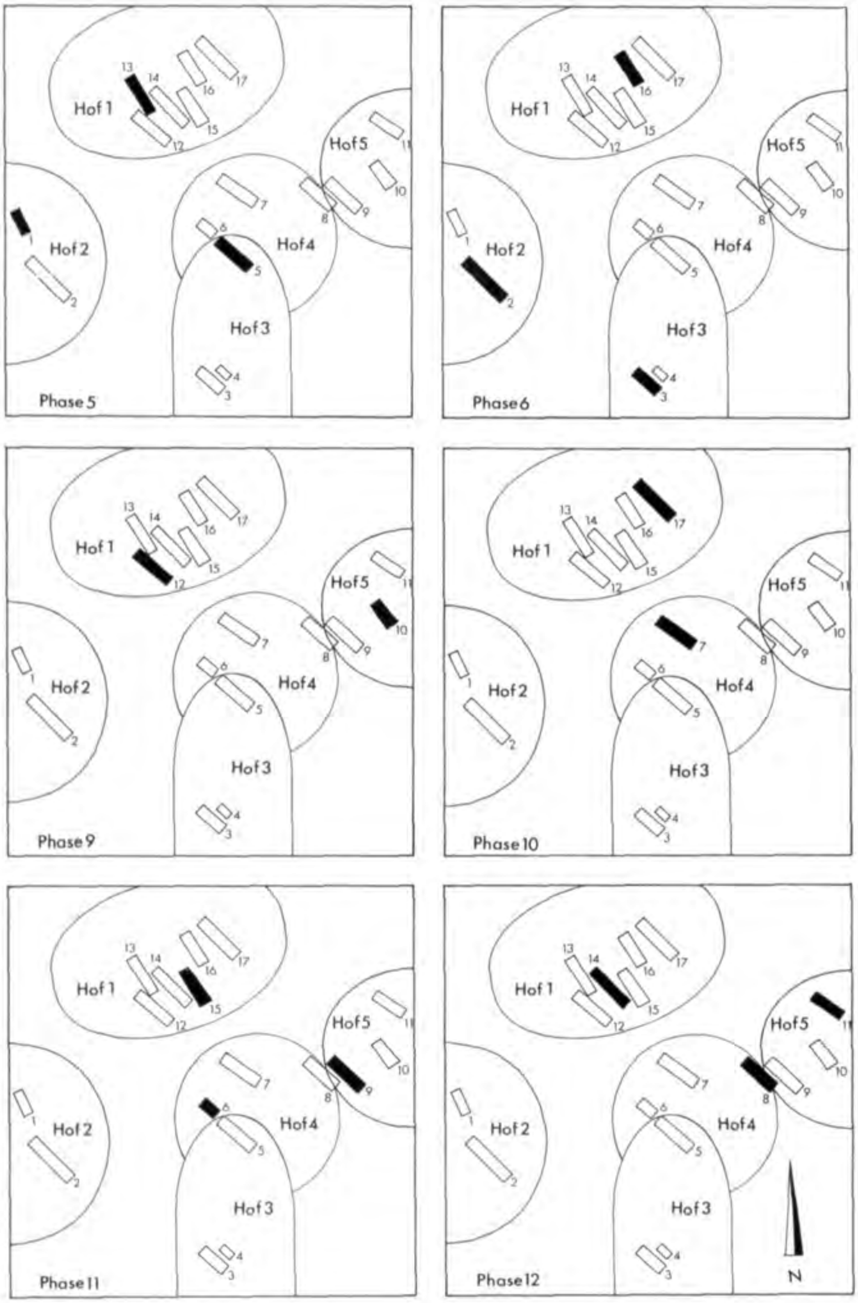


Fig. 21. Langweiler 9. Settlement development during Phases 5-12 of the Merzbach chronology. Scale 1: 5 000

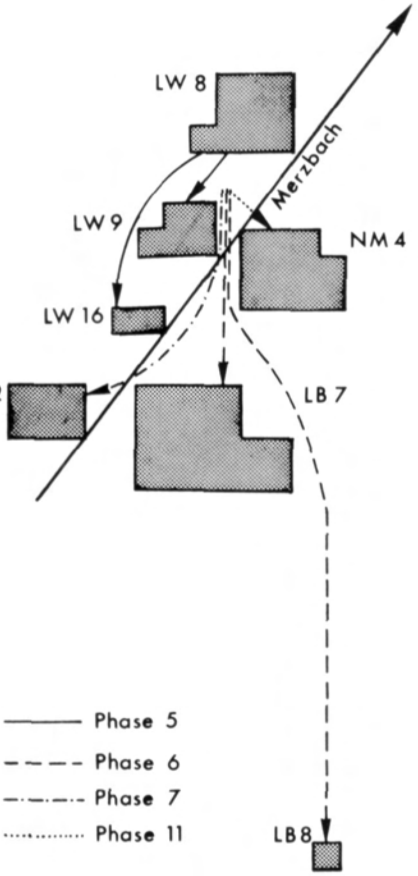


Fig. 22. Merzbach Valley. Spread of settlement upstream from Langweiler 8 to the other settlements.

te. The excavated area is on the interface between the upper and middle course of the *ca.* 23 km long valley. It must be emphasised that this area is only 1.3 km long, and thus comprises only 5.7% of the whole valley (fig. 3). Apart from this, a 12 km long stretch (51%) has been covered by survey and rescue excavations. As noted above, as the survey material is as yet unavailable, the following picture is based only on the excavated material.

Of the seven excavated settlements, four are on the left bank and two on the right bank of the Merzbach, while the seventh (Laurenzberg 8) was found about 1 km away on the loess plateau (figs. 5, 15).[36] Apart from this no house lies further than 500 m away from the Merzbach. On the left bank, all the spur locations have settlement remains, divided from one another by small tributary streams. On the higher right bank there is no topographical division between Laurenzberg 7 and Niedermerz 4, so that the sites could have been linked. There is a similar "random" division between settlements further downstream on the right bank, where the survey results indicate that between Niedermerz 6 and Aldenhoven 3 there is a 1.8 km long stretch apparently without Bandkeramik settlement.[37] It is therefore not possible to assume a continuous settlement of both banks, and there were certainly discontinuities, especially on the right bank.

On the excavated area of the Merzbach (fig. 15) there are two single farmsteads (Langweiler 16 and Laurenzberg 8), several small grouped settlements with 2-3 farmsteads (Langweiler 2 and 9, Laurenzberg 7) and the largest site, Langweiler 8, with 11 contemporary farmsteads at its peak.

P. Stehli's research has shown that the settlement of this section of the Merzbach valley began with Langweiler 8 with 3 houses, and grew during the first four house generations (120 years) to 7 houses. In Phase 5 settlement extended for the first time to the neighbouring Langweiler 9 and 16 (fig. 22) and in Phase 6 it spread over the stream to Laurenzberg 7 and 8. Langweiler 2 was first occupied in Phase 7, and after a period of four house generations Niedermerz 4. Only Langweiler 8 was occupied for the whole Bandkeramik; the other settlements either began later or ended earlier.

This development is fully described elsewhere. Here fig. 23 simply shows how the number of houses in the seven sites has changed through time. The frequency distribution shows two peaks. After a continuous growth from 3 to 17 houses in 210 years (Phase 7) there was a reduction for 120 years to 12-13 houses; then in Phases 11 and 12 there was a further sudden increase to 16 houses, and finally a gradual reduction to 7 houses in Phase 14. In this last phase the first earthwork appeared (Langweiler 8) with Langweiler 15 following in Phase 15; the dating of the Langweiler 9 enclosure is not so precise, but it is certainly late.

The reasons for this form of development are as yet unclear. Perhaps the depression between the two peaks is linked with the Bandkeramik expansion to the west as far as the Paris Basin; however it is not possible at present to synchronize the two areas. The late Bandkeramik development and its links with the Grossgartach Culture are also not clear. It is important to note that Langweiler 8 was not only founded as the first settlement, but alone lasted for the whole period and grew to become the largest.

Langweiler 8 therefore probably had a particular central importance. A. Zimmerman's research has shown that on this site a higher proportion of unworked flint was imported, so that it can be seen as a distribution centre.[38] Contemporary houses here have an average distance of 66 m from each other, with successive houses in the farmstead area an average of 34 m away. In Langweiler 9 the respective figures are 131 m and 42 m, so that the settlement density is significantly lower. A larger and more concentrated population in Langweiler 8 afforded from the start a better basis for social and economic differentiation, so that from this point of view it is also possible to see this particular settlement as having had a central function.

An exact comparison of all the Merzbach settlements has yet to be completed, so that the latter problem can only be touched on. For example on Langweiler 2 there is evidence for distinct local specialisation, with a relatively higher number of long narrow pits *(Schlitzgruben)* and of houses of Type 2. On Laurenzberg 7 there is much more flint than on other sites. Because of the topographical location on the higher bank and on thinner loess of some sites on the right river bank it can probably be expected that there was a different economic emphasis between sites on either side of the valley.

In the excavated 1.3 km section of the Merzbach there was a maximum of 17 contemporary houses, with up to 15 on the left bank; the distribution between the two banks is therefore different. This is however locally variable. Just 3 km downstream is the large settlement Aldenhoven 3 on the right bank (fig. 5).[39] Because of the dispersed nature of the houses and settlements, the question naturally arises as to how they can be divided into separate sites. Topographical features such as the small tributary streams dissecting the left bank have little importance in the "administrative" or social ordering of single farmsteads like Langweiler 16 or "hamlets" like Langweiler 2 and 9. An exact analysis of the finds may be of use here. The late Bandkeramik earthworks would appear to be evidence of co-operative labour, as that of Langweiler 8 appears to have been used by the inhabitants of Langweiler 2 and 8 and Niedermerz 4.

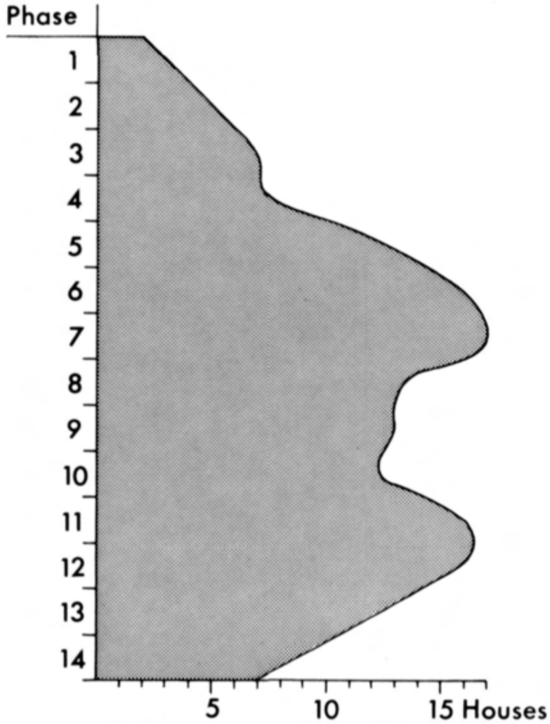


Fig. 23. Variation in the number of houses in the 7 settlements in the excavated section of the Merzbach valley.

The Aldenhovener Platte

Only the south-east part of the Aldenhovener Platte has been systematically surveyed; of 370 km^2 only 85 km^2 (23%) has been covered. The following conclusions relate only to this smaller area. The Bandkeramik distribution on Fig. 24 is based on sites with pottery; more sites may be added to this when the stone material has been analysed.

In the survey area 48 Bandkeramik settlements have been identified, located along the valleys of the Merzbach, the Schlangengraben and the Bettendorfer Fliess; it is certain that these valleys can be construed as separate settlement cells. These narrow settlement "corridors" were not continuously occupied along their length; as the excavated section of the Merzbach shows, there were discontinuities. Which of the discontinuities shown in fig. 24 show the real situation and which are caused by lack of fieldwork wil be fully discussed in forthcoming publications. Meanwhile here only a rough generalization can be made, pointing out that along the streams named above there was a 500 m broad strip of potential land suitable for the building of houses and farmsteads.

The three settlement corridors are 3 km from each other. That this is no chance occurrence and not dictated by the hydrographic network is shown by the Hoengener Fliess which flows between the Merzbach and the Bettendorfer Fliess. On its upper reaches there is no Bandkeramik settlement, although in the Middle Neolithic there was a Rössen settlement, indicating that it offered suitable site locations. This picture probably only means that the economic exploitation area of the Merzbach and Bettendorfer Fliess reached to here, and that there was therefore no available agricultural land to support settlement.

The economic exploitation behind the settlements must therefore have extended to 1.5 km; this is shown in Fig. 24 with corresponding "boundaries" indicated. This boundary line shows another remarkable situation in the lack of finds on the lower Merzbach before the confluence with the Bettendorfer Fliess (fig. 24, point A). Here, as with the corresponding find gap on the bank of the Rur (fig. 24, point B), it is clear that the area was taken up by the neighbouring valleys and thus allowed no concentrated settlement. The situation in the middle Merzbach (fig. 24, point C) is also interesting, as although good environmental conditions are found on the left bank there are no settlements. Clearly this area was used by the four settlements which lie immediately to the west on the lower Hoengener Fliess.

In the excavated section of the Merzbach on a 1 km length of the left bank there were 10-15 contemporary houses during the Middle Bandkeramik. Allowing for a depth of exploitation behind the settlements of 1.5 km there was an area of 150 hectares available; *i.e.* 10-15 hectares per house. Of this about a third consisted of the valley bottom, slopes and settlement area, thus leaving 7-10 hectares behind each house for agriculture and stockbreeding. The valley bottom of the Merzbach was several metres deeper during the Bandkeramik, and was at its maximum 100 m wide. On each bank therefore in a length of 1 km there was an exploitation area of 5 hectares; *i.e.* 0.3-0.5 hectares per farmstead.

It must therefore be asked as to how the land behind each settlement was used. If a minimum number of occupants for each house is reckoned as a nuclear family of 5-7 people, and 0.5 hectares were needed *per capita* for grain,[40] then the land requirement for agriculture for 10-15 farmsteads was in the order of 30-45 hectares. These fields must have been on the plateau and not the valley bottom, which means that there was a further 50 hectares of woodland left over (3-5 hectares per farmstead).

This area of woodland could have been used in the summer for cattle grazing. There is not a great deal known as to how much grazing a wood can take. If figures from East Prussia in the 18th century are used,[41] then for each head of horned cattle and oxen 0.28 hectares of deciduous forest and 0.58 hectares of coniferous forest with alder clearings and glades were nee-

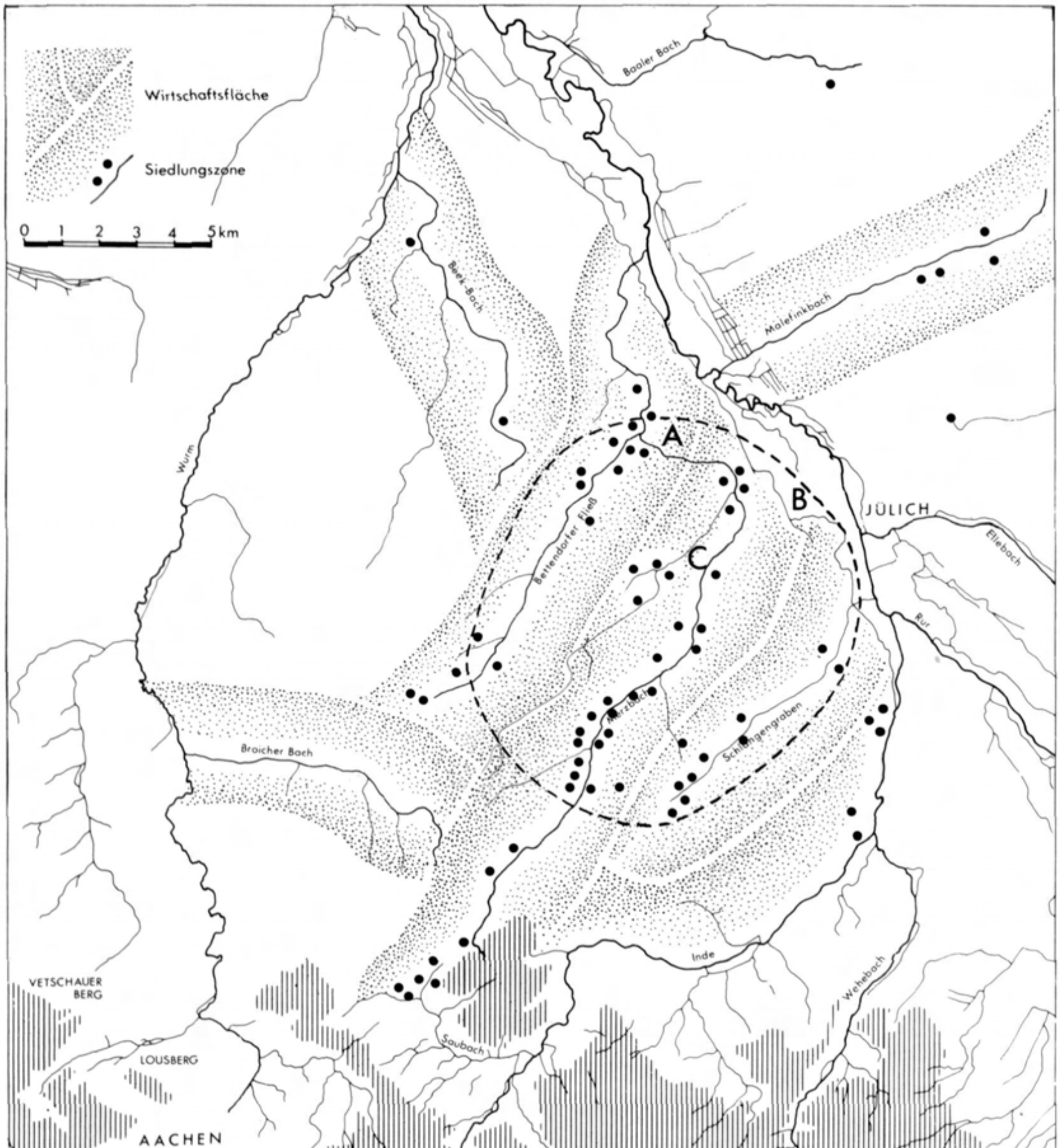


Fig. 24. Aldenhovener Platte. Distribution of the Bandkeramik with settlement zones and zones of exploitation. Dashed line: Limit of the survey area. Scale 1: 100 000

ded. The Atlantic lime forest was probably more similar to the latter, although there were increasingly more clearings during the course of the Bandkeramik. On 50 hectares of woodland therefore 100-150 head of cattle could have been grazed in summer. If fallowed fields are added to this, of which in East Prussia 1.16 hectares were necessary for one head of horned cattle, and the empty areas within the settlement cell are considered, then it must be reckoned that the Aldenhovener loess area was sufficient for a very large number of cattle. From the same East Prussian sources, one head of horned cattle used the same grazing as two young cattle or ten sheep, so that it is possible here to consider the amount of sheep and goat in the Bandkeramik. A limiting factor for the size of the herd was undoubtedly the provision of winter fodder, which had to be obtained by cutting leaves to make leaf hay, and was therefore dependent on human work capacity. If the winter requirement for a cow of 150 kg is estimated at 1000 bundles of leaves and twigs each weighing 1 kg[42], then it is clear that the size of the herd indicated required considerable work to bring it through the winter.

It is clear that these theories must be tested more rigourously, especially in conjunction with palaeobotanical studies. Theoretically the adjacent Eifel could also have served for summer pasture. From the archaeological evidence however it was not occupied until the late Middle Neolithic[43] and only intensively in the Late Neolithic;[44] no Bandkeramik material has as yet been found.

The Bandkeramik cultural landscape on the Aldenhovener Platte can be described as a linear system of settlement corridors, orientated on water courses which are 3 km apart from each other. The necessary fields must be reconstructed as having been immediately adjacent to the settlements, so that behind the fields there was a strip of woodland about 1 km wide which divided the settlement cells but must have been intensively exploited.

Such a landscape type was still in existence in the first half of the 19th century in the Lower Rhine Loessboerde (fig. 25). The woodland known as the "Friesheimer Busch" between Rothbach and Erft divided the field boundaries of the settlements which were located on the streams. Because of pasturage and wood cutting it was already at this time fully degenerated. Already by the middle of the 18th century there was no oak suitable for house building, almost no beech, and the copses (for firewood) were in poor condition.[45] The map shows a typical "Bandkeramik" settlement location on the edge of the valley bottoms, which in this case were used as pasture. There are some "twin" settlements; villages opposite each other on either side of the valley, such as Lommersum and Derkum and Klein- and Gross-Vernich. At Lommersum there is also a cluster of smaller and larger sites. However, such analogies with a different political and economic system must not be taken too far. The general structure is comparable though, as the basic requirements of an agricultural economy are similar.

As a conclusion to this short survey of some of the results of settlement archaeology research on the Aldenhovener Platte there follows an estimation of population density. If the period of greatest settlement extent in the Merzbach valley is taken, and a population estimate based on 6 inhabitants per house is made, then in the Lower Rhine Bay there was a population of 26 800. Extended to the whole of the Federal Republic of Germany the total figure is 360 000 inhabitants in 60 000 houses and about 15 000–20 000 settlements, if 3–4 houses are estimated per settlement.[46] This means a population density of 1.45 per square kilometre; the modern figure is 247. If only loess areas are included, which appears more valid as these formed the basis for settlement and economy, then the figure is 16.7 people per square kilometre. This figure is highly significant when compared with estimates for the later Medieval period (pre 1500 AD).[47] At this time the population was 30 per square kilometre of arable land.

This seems to support the contention that during the florescence of the Bandkeramik the loess areas and their resources were intensively

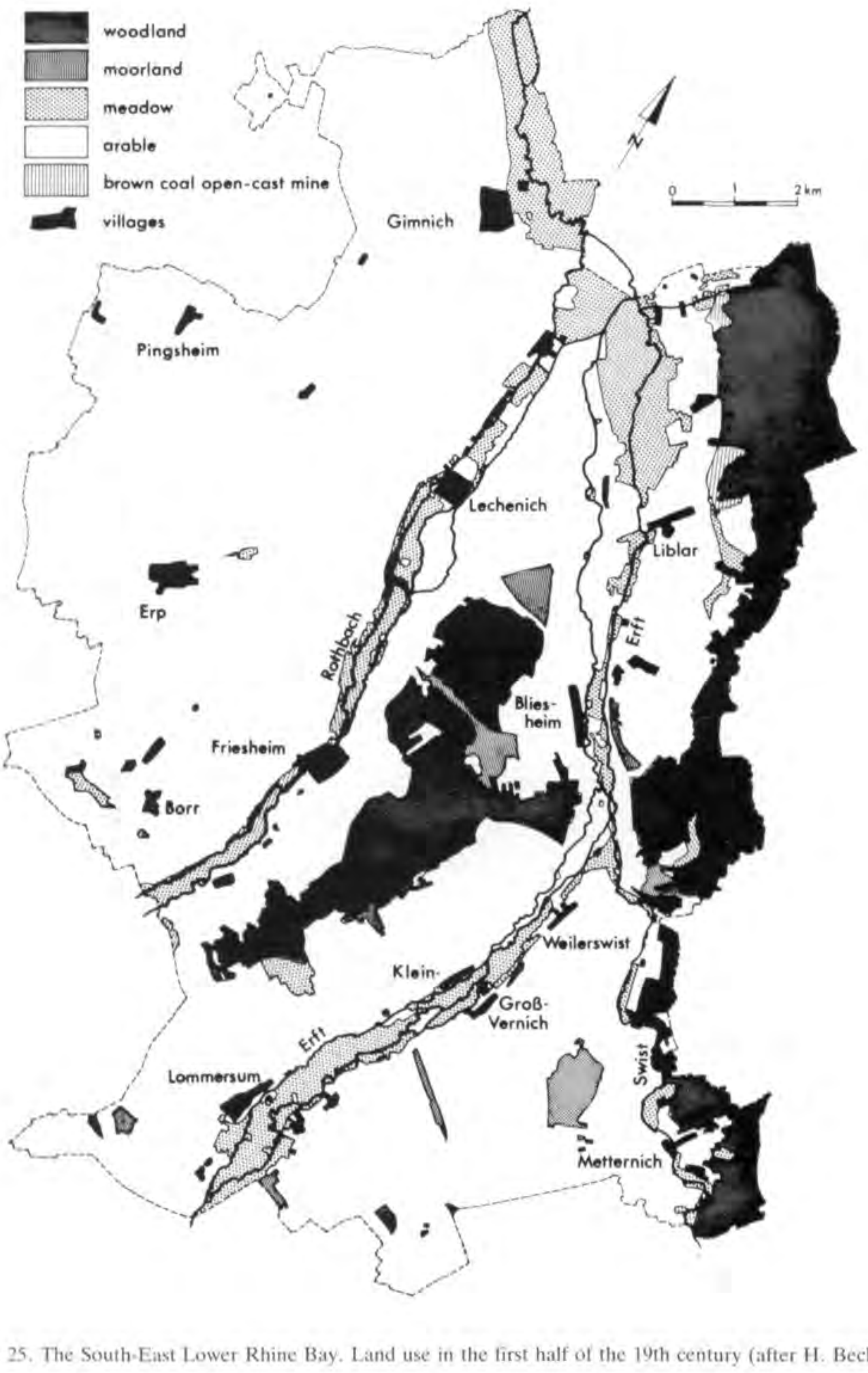


Fig. 25. The South-East Lower Rhine Bay. Land use in the first half of the 19th century (after H. Becker).

exploited, and that possibly already the limits of their carrying capacity at that time were reached.

(Translated by N.J. Starling)

NOTES

1. R. Kuper, Der Rössener Siedlungsplatz Inden 1. Dissertation, University of Cologne (1975). Limited printed edition (1979).
2. For sampling problems see F.W. Hamond, The Interpretation of Archaeological Distribution Maps: Biases Inherent in Archaeological Fieldwork. *Archaeo-Physika* 7 (1980) 193-216.
3. In previous years, spectacular finds had been made in excavations carried out by the *Rheinisches Landesmuseum*,4. Bonn, which showed from other mines the possibilities afforded to archaeologists by opencast mining for brown coal; cf. A. Herrnbrodt, Der Husterknupp. *Beihefte der Bonner Jahrbücher* 6 (1958); H. Hinz, Die Ausgrabungen auf dem Kirchberg in Morken, Kr. Bergheim (Erft). *Rheinische Ausgrabungen* 7 (1969); W. Piepers, Ausgrabungen an der Alten Burg Lürken. *Rheinische Ausgrabungen* 21 (1981).
4. *Bonner Jahrb.* 171, 1971, 612-616.
5. The *Arbeitsgemeinschaft* was energetically supported by F. Schmidt of Aldenhoven, who at that time was a private collector. In 1968 he had begun to make observations at the mine "Zukunft-West". The *Rheinisches Landesmuseum* reimbursed travelling costs.
6. The results were published in a summary report (*Bonner Jahrb.* 171, 1971, 558-644), the first of 12 annual reports by the Aldenhovener Platte Project. cf. Report 12 in *Bonner Jahrb.* 182, 1982, 307-324.
7. The application was in the hands of J. Lüning; it was supported by the directors of the *Rheinisches Landesmuseum* Bonn and the *Institut für Ur- und Frühgeschichte* of the University of Cologne. The Project was directed from 1971-75 by R. Kuper and J. Lüning, and from 1976-1981 by J. Lüning. It was financed by the *Deutsche Forschungsgemeinschaft,* with considerable financial help also by the *Rheinische Braunkohlenwerke AG;* this contribution was at times as much as 30%. The *Rheinisches Landesmuseum* Bonn also supported the Project as far as possible in every respect.
8. The excavation techniques, using much mechanical help, and the special recording system, are detailed in *Bonner Jahrb.* 173, 1973, 226-256.
9. cf. the description of the survey method by W. Schwellnus in *Bonner Jahrb.* 177, 1977, 546-558.
10. J.P. Farrugia, R. Kuper, J. Lüning, P. Stehli, Der bandkeramische Siedlungsplatz Langweiler 2. *Rhein. Ausgrabungen* 13 (1973); R. Kuper, H. Löhr, J. Lüning, P. Stehli, A. Zimmermann, Der bandkeramische Siedlungsplatz Langweiler 9. *Rhein. Ausgrabungen* 18 (1977). A comprehensive bibliography is published in *Bonner Jahrb.* 182, 1982, 308-312.
11. The following is taken partly direct from J. Schalich, Boden- und Landschaftsgeschichte. In: Langweiler 9, (Note 10) 9-14. The unpublished contribution by J. Schalich in the monograph Langweiler 8 was also used.
12. The Merzbach from source to mouth falls 140 m in a direct line of 20 km, *i.e.* 0.7%.
13. This section follows, partially word for word, the publication by P. Imhoff, *Das niederrheinische Lössgebiet.* Dessau (1932). cf. also K. Gatzen, *Die Ackerbaulandschaft der nördlichen Rur-Erft-Platte* (1957); K. Gatzen, *Die Aldenhovener Platte; Ackerbörde und Kohlenrevier. Wirtschafts- und sozialgeographische Themen zur Landeskunde Deutschlands.* Festschr. für Th. Kraus (1959) 225 ff.; H. Becker, Die Agrarlandschaften des Kreises Euskirchen in der ersten Hälfte des 19. Jahrhunderts. *Veröffentl. des Vereins der Geschichts- und Heimatfreunde des Kreises Euskirchen e.V.* (1970).
14. H. Geiss, M. Horbert, G. Polster, Geländeklima und Lufthygiene. Ökologisches Gutachten über die Auswirkungen eines Tagebaues Hambach auf die Umwelt. *KFA-Jülich* (1975).
15. cf. contributions by P.J.R. Modderman et al. in *Helinium* 21, 1981, 136-175.
16. P. Stehli, Grossgartacher Scherben vom bandkeramischen Siedlungsplatz Langweiler 8, Kr. Düren. *Arch. Korrespondenzblatt* 4, 1974, 117 ff..
17. H. Löhr et al., Die Rohstoffversorgung von Langweiler 9 im Vergleich mit anderen bandkeramischen Fundplätzen. In: Langweiler 9 (Note 10) 165 ff..
10) 165 ff..
18. M. Dohrn-Ihmig, Bandkeramik an Mittel- und Niederrhein. *Rheinische Ausgrabungen* 19 (1979) 191-362, Fig. 2 (Soil map).
19. For example the shallow and gleyed "grey earths" in the Hambacher Forst (Fig. 8).
20. An extreme example of this type of location is the settlement Barmen 1A on the gravel plateau of the Barmer Heide. cf. *Bonner Jahrb.* 179, 1979, 304 ff..
21. This will be published in the monograph of Langweiler 8. The map, Fig. 14, is an excerpt of this.
22. For the exact determination of this settlement boundary see J. Lüning, J. Schalich and P. Stehli, Ausdehnung des Siedlungsplatzes. In: Langweiler 9 (Note 10) 17f.
23. Information from A.J. Kalis, Utrecht.
24. Information from A.J. Kalis, Utrecht and L. Castelletti, Como.
25. W. Schwellnus, A. Zimmerman (in preparation).
26. P.J.R. Modderman, *Linearbandkeramik aus Elsloo und Stein* (1970), 101 ff. and table p. 112.
27. Op. cit. p. 110.
28. Op. cit. 100 ff. and table, fig. 12.
29. This is presented fully by U. Boelicke in the monograph Langweiler 8 (in press). cf. also U. Boelicke, Gruben und Häuser: Untersuchungen zur Struktur bandkeramischer Hofplätze. In: *Siedlungen der Kultur mit Linearbandkera-*

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34. cf. note 10 above. In the light of the new complete chronology of the Merzbach valley the local chronology published in 1977 has had to be somewhat changed; in particular a gap in settlement of one house generation had become apparent. Also more pits have been assigned to specific houses than before, so that some can be dated differently. An exact description of the new Langweiler 9 chronology is in preparation.
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43. Bischheimer Funde aus der Kartsteinhöhle bei Weyer, Kr. Schleiden. *Bonner Jahrb.* 155-156, 1955-1956, 437 f., Fig. 8.
44. Finds in the school collection at Kleinhau, Kr. Düren.
45. This is presented fully in H. Becker, *Die Agrarlandschaften des Kreises Euskirchen in der ersten Hälfte des 19. Jahrhunderts* (1970) 124 ff..
46. Using a similar method of calculation the Central German loess area had a population of 210 000 *i.e.* ten times as many as has been recently estimated for the area. *cf.* H. Behrens, *Die Jungsteinzeit im Mittelelbe-Saale-Gebiet* (1973), 213 (10 000-25 000 inhabitants).
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THE SETTLEMENT SYSTEM OF THE DUTCH LINEARBANDKERAMIK

C.C. BAKELS

Dutch Linearbandkeramik settlements are analysed on three levels. The first level includes a description of the individual settlement. This is followed by the analysis of a cluster of settlements; the cluster is thought to have functioned as a kind of unit. The third level involves comparison of the Dutch cluster with neighbouring clusters of settlements.

Introduction

Up till 1982 thirty two Linearbandkeramik sites have been discovered in the Netherlands and these are entirely restricted to the southeastern part of the country. The "sites" are defined by the occurrence of pottery. Many have been demonstrated to be real settlement sites with houses, and further investigation may well prove that this was also the case with the remainder. Isolated finds of flint tools and adzes are not considered here.

Leaving aside their internal structure, these settlements can be studied on three levels. The first level involves analysis of the settlements as individual units. The second level examines the degree of association between settlements, and the third level involves comparison with neighbouring settlement systems.

The individual settlement

Locational analysis forms the basis of the first level of investigation. The geographical setting can be described, and an attempt can be made to establish the relationship of the settlement to its environment. The three Dutch settlements of Sittard, Stein and Elsloo have already been studied in this way (Bakels 1978).

All three are located 1. on the edge of a loess-covered plateau, 2. within 750 metres of a perennial watercourse, and 3. on more or less flat terrain (fig. 1a, 1b). All the settlements were surrounded by dense woodland. Further investigation shows that these geographical factors apply to twenty six of the thirty two Linearbandkeramik sites.

Such factors do not, of course, cover all aspects of individual settlement location, but a more complex approach is not easy. Reconstruction of economic aspects, for example, is inevitably superficial and it is almost impossible to deal in terms of quantitative data. This problem will be returned to below.

There are six exceptions to the general locational rules, involving either the distance to the watercourse or the nature of the substrate. Two sites lie relatively far away from perennial water in the middle of a loess-covered plateau. It is unclear whether these were settlements with real houses. Despite careful investigation, the settlements have never produced more than a few rubbish pits. The sites are Urmond-Graetheide and Urmond-Hennekens (Bakels 1978, p. 50 and p. 130). The other exceptional sites are distinguished by a different substrate. Two are situated on a sandy subsoil and two on Meuse floodloam deposits. The sites on sand, both called Montfort, are possibly real settlements, but have yet to be excavated. The sites on loam, Horn and Heel, are at present just find spots with a few sherds. They might, however, fall into the category of "unknown and unexpected settlements in river valleys" described by Quitta for the German river valleys (Quitta 1969). Even then it remains to be seen whether they are real, permanent settlements with the usual houses.

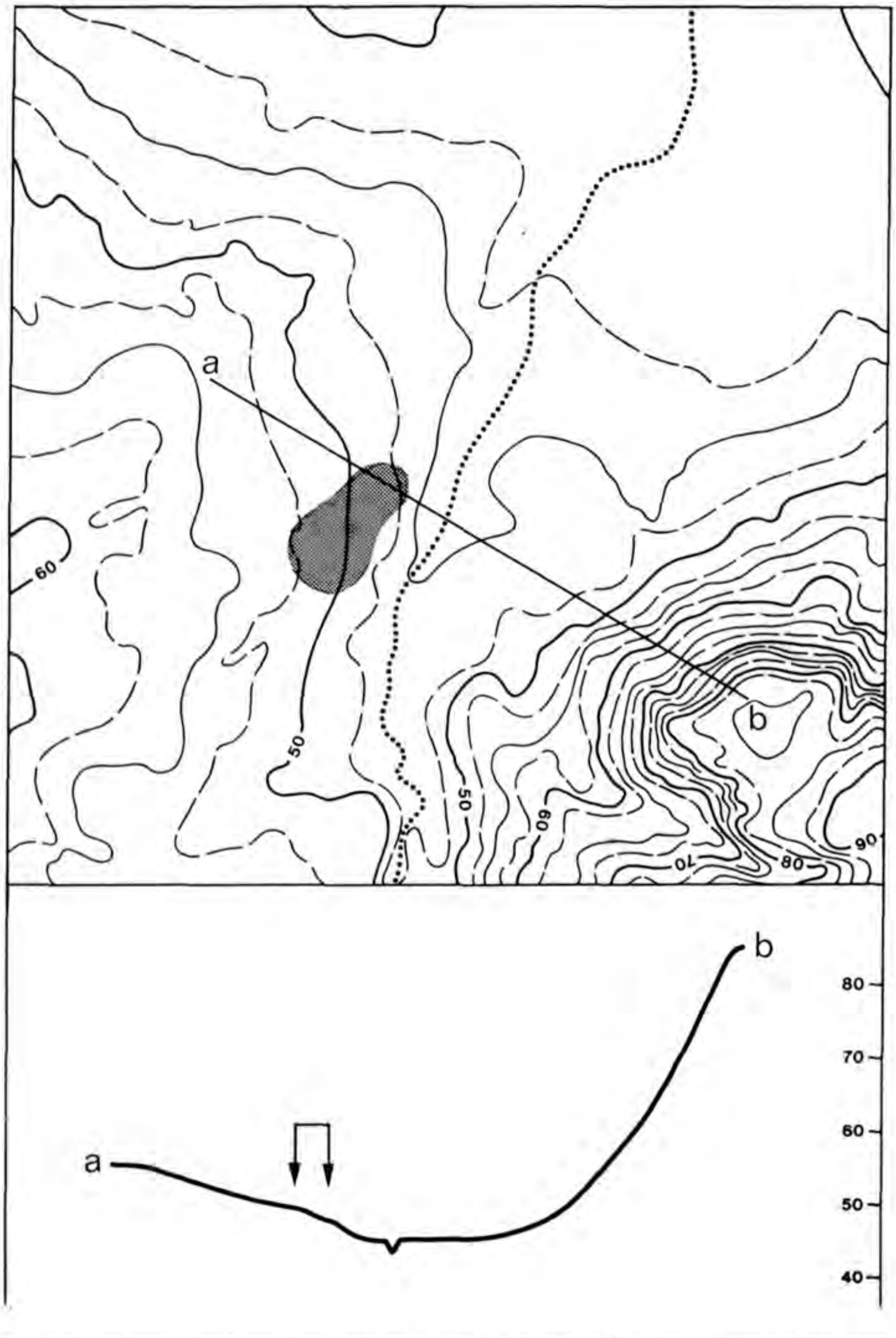


Fig. 1a. The location of Sittard. The settlement area is shaded on the contour map and indicated by arrows on the section. The watercourse is represented by a stippled line. Scale of map 1 : 25 000, height in metres.

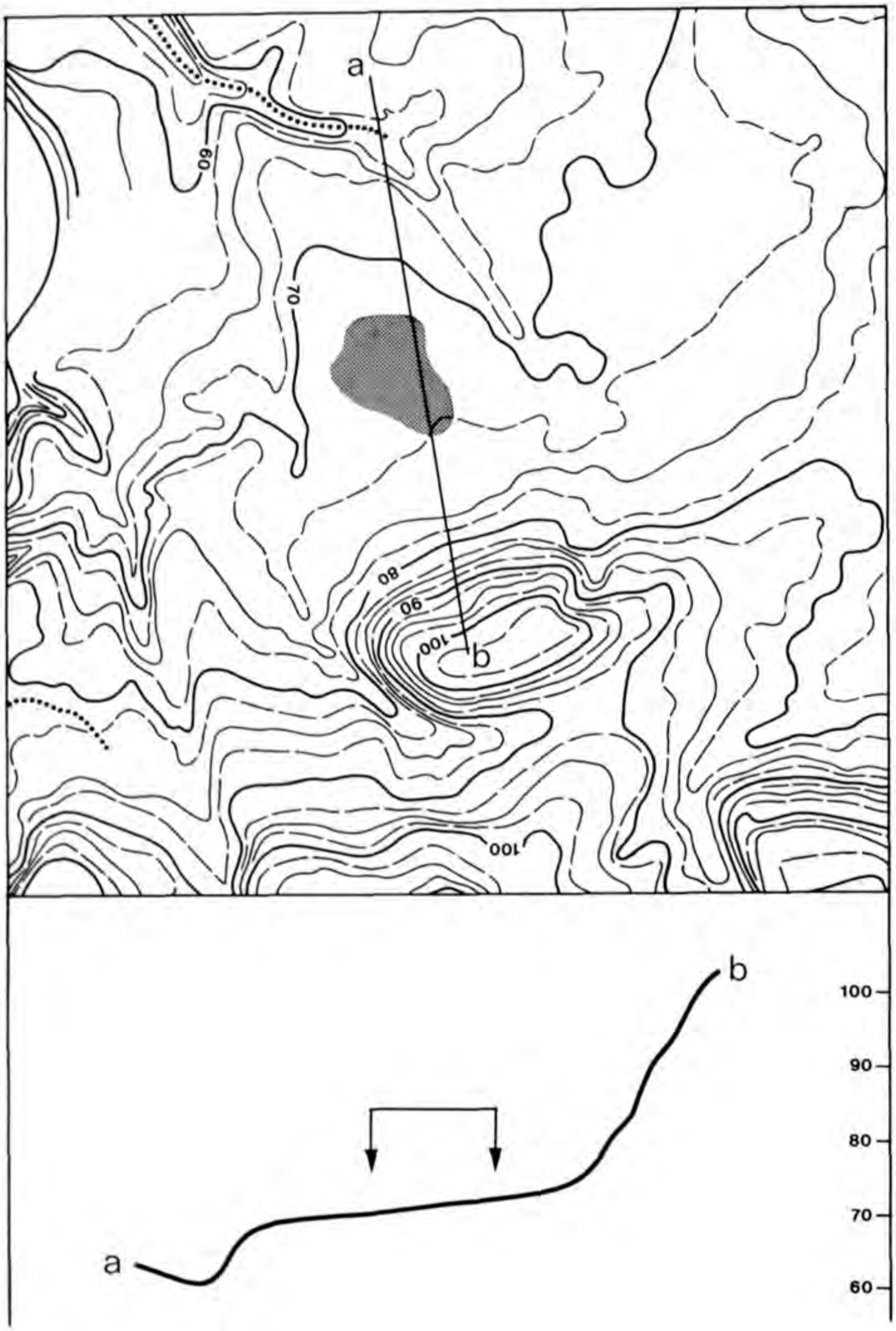


Fig. 1b. The location of Elsloo.

The cluster

The second level of analysis investigates whether the settlements or sites are independently located or are clustered within the landscape. Fig. 2 illustrates the Dutch situation. The distribution map clearly shows that traces of Linearbandkeramik occupation are not evenly spread over the southeastern Netherlands, but that they cluster between the rivers Geleen and Meuse. The only outlying sites are the four mentioned above with different subsoils, and one other site: Caberg. The latter site is situated in the south near the Belgian border and may belong to another cluster.

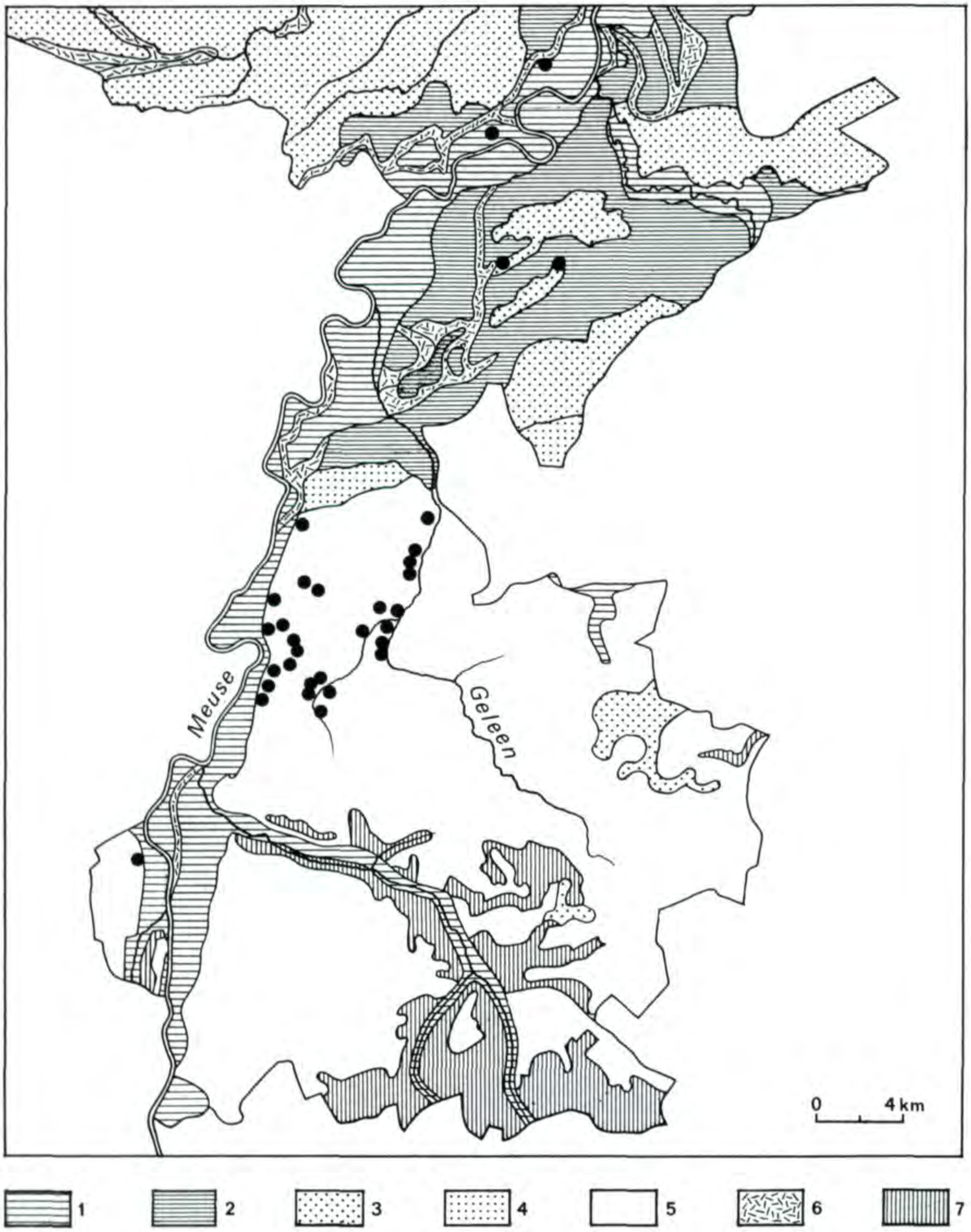
There is always a possibility that these clusters result from uneven survey. People tend to survey regions which have already produced sites. This does not seem to have been the case here. Much archaeological survey has taken place outside the area between the Geleen and Meuse, and the cluster appears to be real.

What factors confined the settlements to a certain area? Geographical constraints might indeed explain the clustering, and such constraints are certainly present. The landscape to the south of the cluster is without easily accessible open water; the only available river has very steep banks. The region to the west, across the Meuse, has no loess deposits, and this is also the case with the region to the north. On three sides the preferred type of location was not available. It is difficult, however, to explain the absence of settlements to the east. Climatic factors cannot be invoked, and the explanation must lie elsewhere (Bakels 1978, p. 135).

The cluster consists of 27 sites with concentrations of features and domestic rubbish. This does not mean all 27 sites were contemporary. The only way to unravel the cluster is to use Modderman's phase-division, which is based on variations in pottery decoration and house-plan (Modderman 1970). C14 dating is still of little use for establishing chronological phases within the Linearbandkeramik.

Fig. 3 shows the chronological development of the cluster. Some settlements, or rather sett-

Fig. 2. The distribution of Linearbandkeramik settlements in the southeastern part of the Netherlands.
1. younger alluvial clays; 2. older alluvial clays; 3. sand; 4. sandy loess; 5. loess; 6. former river beds; 7. remaining deposits. Scale 1 : 300 000; map after the Bodemkaart van Nederland.


Meuse
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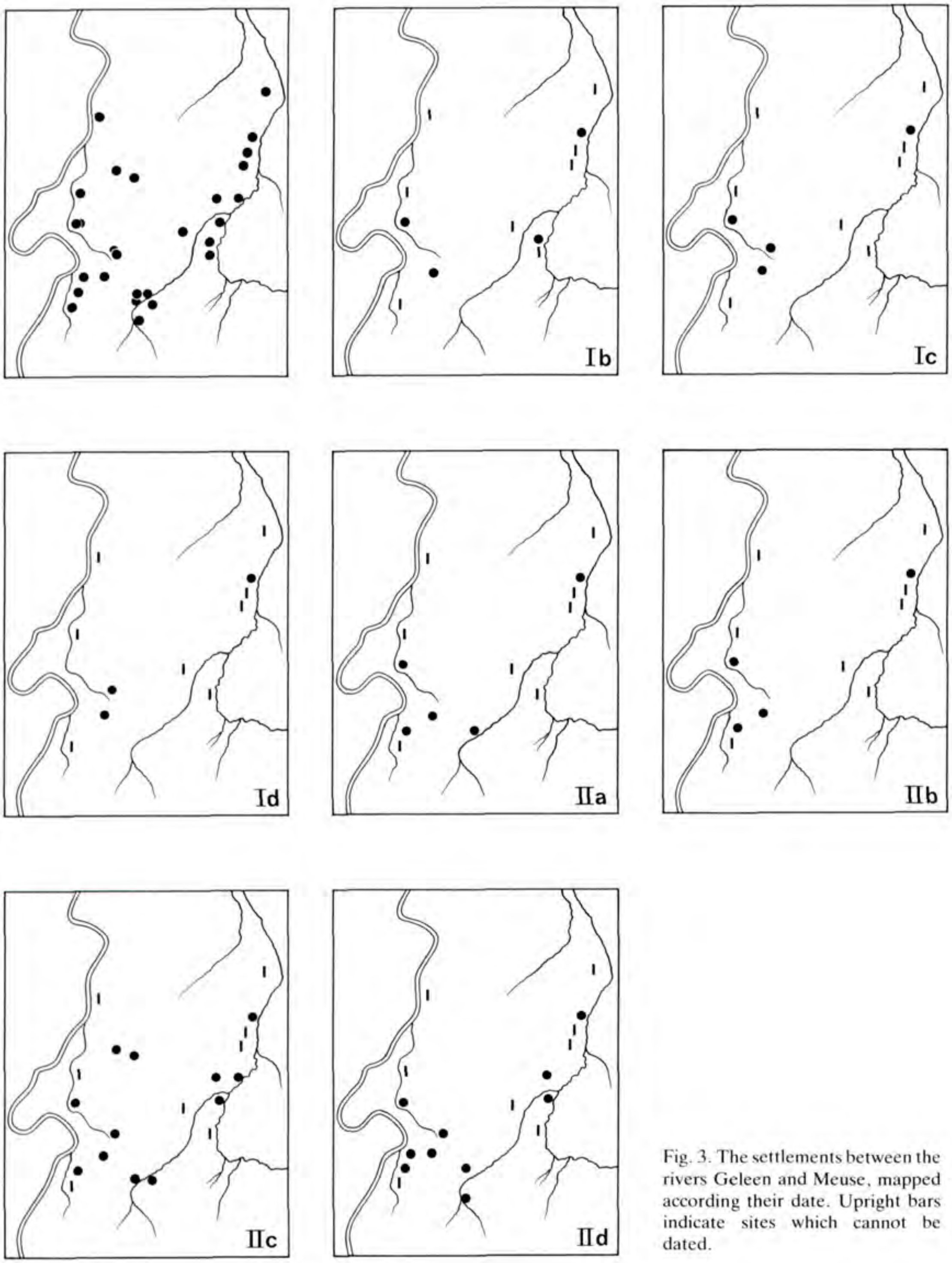

Fig. 3. The settlements between the rivers Geleen and Meuse, mapped according their date. Upright bars indicate sites which cannot be dated.

lement areas, remain in use; others appear or disappear in the course of time. The picture is far from complete since not all the sites have been equally well investigated, and several small find spots with an apparently restricted duration might be "windows" on a larger settlement area that was occupied much longer. Nevertheless, the map suggests that the number of settlements was stable, at perhaps five or slightly more, for some time. From phase IIc onwards the number appears to double. Is this a sign that the quantity of settlements increased from phase IIb to phase IIc? The answer is not simple. One problem is that the duration of the phases is unknown. However, to suggest that phase IIc and IId lasted twice as long as the earlier phases would imply that the rate of change in pottery styles and house construction slowed down towards the end of the Linearbandkeramik. There are no arguments or parallels in support of such a phenomenon. The conclusion that the number of sites increased in the later phases may well be correct.

The next problem is whether or not all the settlements in the cluster functioned independently within their own territories. The topography of the terrain occupied by the southern part of the cluster suggests the existence of territories (fig. 4). Their surface area ranges from 60 to 170 ha. Would it have been possible for a settlement to have had a totally self-sufficient economy within a territory of this size? With the kind of food-producing system based on crops and animal husbandry generally assumed for the Linearbandkeramik, the answer may be no.

A very simplified model for the amount of land needed for Linearbandkeramik agriculture has already been presented (Bakels in print). Agriculture is reduced in this model to wheat growing and cattle raising. Wheat is the plant most frequently found in Linearbandkeramik settlements, and cattle usually constitute the majority of the bone material. The importance of cattle is further increased when quantities of meat are taken into consideration.

A set of calculations are given in table 1. The figures are based on the requirements of the

Table 1

The minimum amount of land needed by 50 persons for agriculture and cattle herding.

50 persons wheat in food	65%	80%
fields, yield 800 kg/ha	11 ha	14 ha
fields, yield 1600 kg/ha	5.5 ha	7 ha
grassland	150 ha	90 ha

"average people" of the FAO (FAO 1957), and calculations are made for diets which consist of 65% or 80% wheat (see Bakels 1978, p. 145). Yields of consumption wheat (seed for sowing deducted) per hectare are taken from historical Canadian and Russian sources and from the results of experiments. The highest yield is derived from experiments with einkorn on Butser Farm (Bakels in print). The area needed for summer grazing and winter fodder for cattle is expressed in hectares of pasture and meadow; data are from historical sources (Slicher van Bath 1963 and Henning 1969, for example). The calculations are made for groups of 50 persons, which is perhaps an acceptable figure for the number of inhabitants of an average Linearbandkeramik settlement.

It is obvious that sufficient agricultural land can be found within the 60-170 ha available to each settlement. However, the necessary grassland is clearly missing. The countryside was densely wooded, and there is little natural pasture in this kind of landscape. A possible conclusion is that either the agricultural or the dietary model is incorrect. The role of cattle in the diet cannot be replaced by other domesticates, or by game and fish. The sheep and goats kept by the Linearbandkeramik would have required grazing as well. The fact that a sheep or goat eats less is counteracted by the fact that they provide less meat than cattle. The conditions for pigs were hardly better, as the local forest consisted mainly of lime. Oak was confined to the river valleys and beech was absent or very rare (Bakels 1978, p. 34; Kalis in print). The density of big game must also have been low, and the small watercourses in most of the territories would not have provided sufficient fish.

The population may of course have been smaller, but the fact remains that Elsloo, the only settlement where a population estimate is really feasible, probably contained more than fifty inhabitants. A further possibility is that the Linearbandkeramik people were vegetarians. A more plausible explanation is that cattle were tended partly within the territory (stubble fields included) and partly beyond the territorial limit.

Table 2

The minimum amount of land needed by the inhabitants of the cluster during phase IIc or IId.

500-2000 persons wheat in food	65%	80%
fields, yield 800 kg/ha	110- 440 ha	140- 560 ha
grassland	1500-6000 ha	900-3600 ha

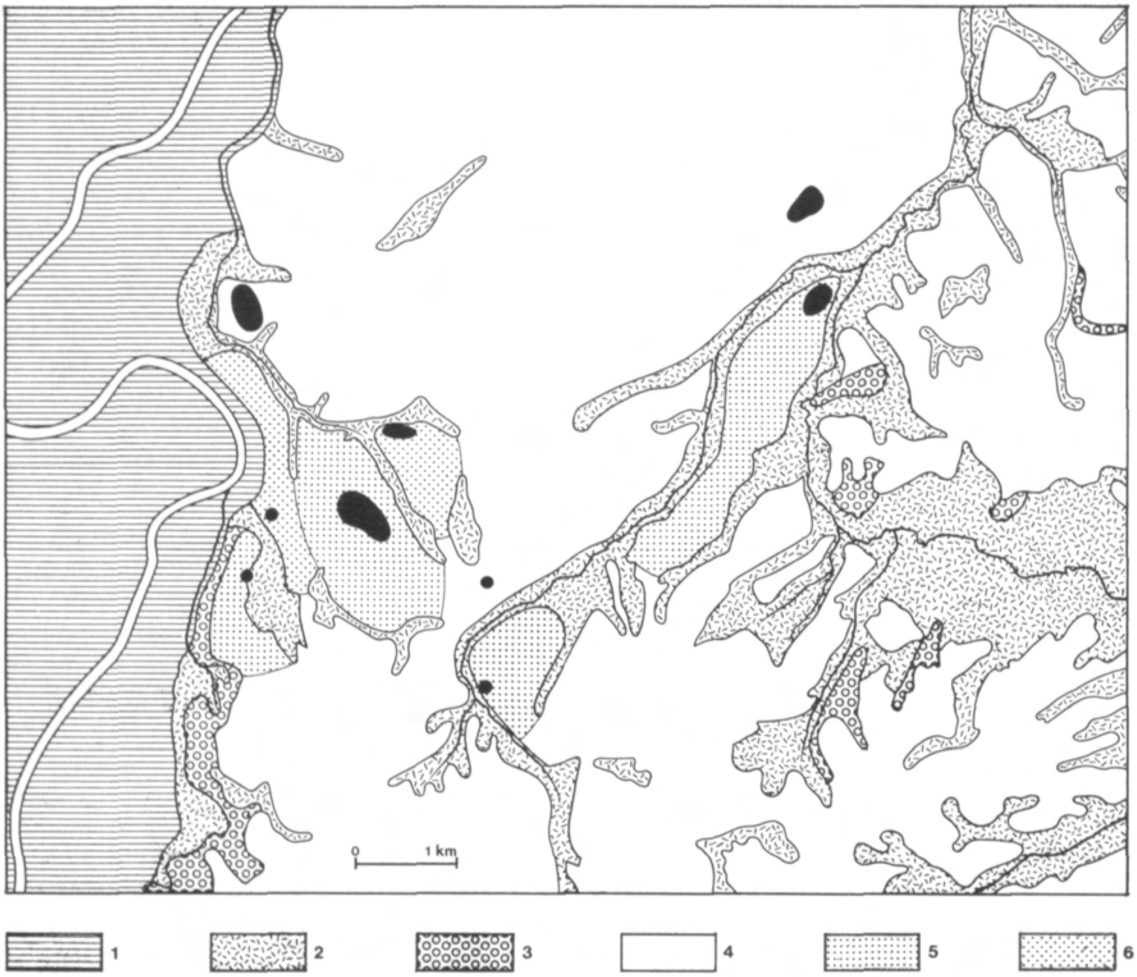

Fig. 4. The southern part of the cluster area, showing possible site territories in phase IId. The settlements shown are those of Stein, Elsloo, Beek and Geleen.
1. alluvial clay; 2. valleys and dry valleys; 3. sands and gravels exposed in slopes; 4. loess; 5. and 6. territories. Scale 1 : 75 000; map after Bakels 1978.

If the same calculations are made for the whole cluster of settlements in the densely populated final phases, the figures listed in table 2 are reached. There were at least 10 contemporary settlements at this time and perhaps even 20 if the undated sites are taken into account. Further settlements may await discovery under deep colluvial deposits. An estimate of the cluster's total population might lie between 500 and 2000. The latter figure is based on the assumption that all the settlements were of similar size to Elsloo, which contained a possible 100-200 inhabitants during its final phases (Modderman 1970; Bakels 1978).

The plateau between the Geleen and Meuse covers 5700 ha. With the exception of the two sites mentioned above, the settlements are located on the edge of the plateau. Fig. 5 shows

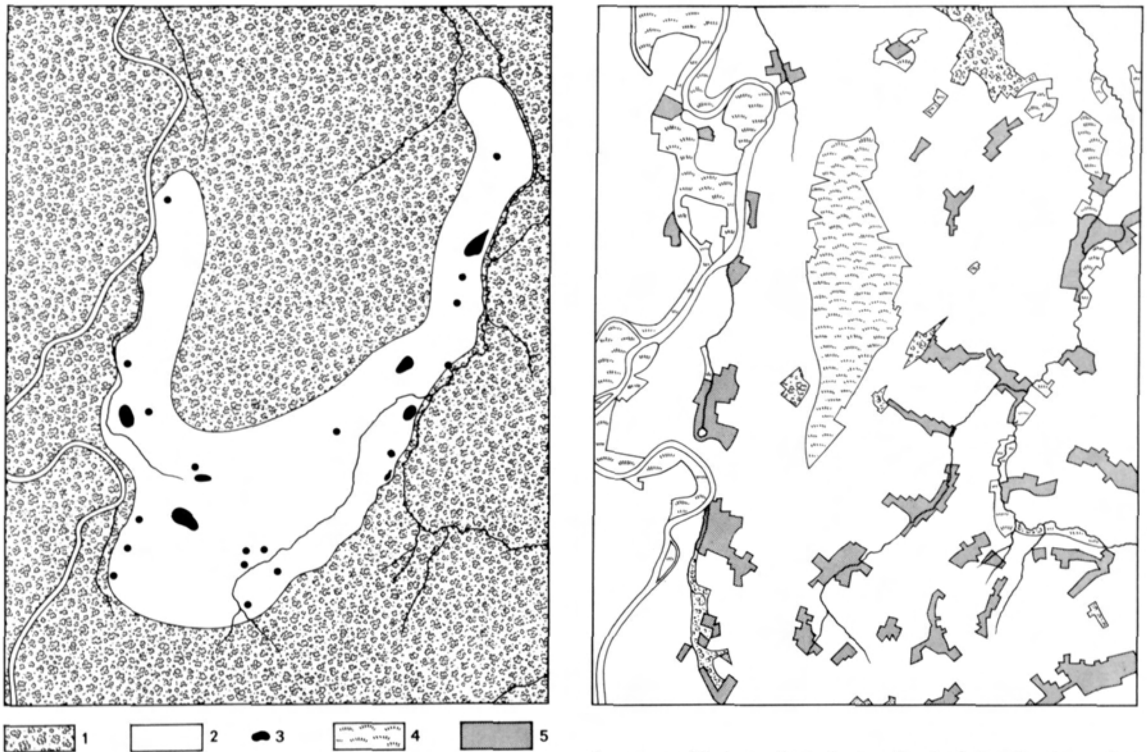

Fig. 5. The loess-covered plateau between the rivers Geleen and Meuse. Left: the situation during the Linearbandkeramik. Right: the situation in 1804 after Tranchot.
1. deciduous woods; 2. area used for agricultural purposes; 3. Linearbandkeramik settlements; 4. meadows, pastures and rough grazings; 5. nineteenth century villages with surrounding orchards. Scale 1 : 150 000.

how the land may have been exploited: a belt of land used for fields and grazing, with the interior used only for grazing. This type of land-use is well known from historical times. Fig. 5 illustrates also the situation on the plateau as mapped in 1804. The digging of wells had made occupation of the interior possible, but the centre of the plateau was still needed to graze the cattle belonging to the surrounding communities. The difference is that in Linearbandkeramik times the interior is thought to have been covered with dense woods, whereas in historical times the woods had completely vanished.

In historical times the inner area may have been sufficient but it is doubtful whether the same holds true for the Linearbandkeramik economy. It is the woodland that is problematical. The available pollen diagrams do not indicate large-scale deforestation and the forest itself cannot provide food for a substantial herd of cattle. It is thus possible that an area outside the plateau containing the cluster of settlements was required for economic purposes. This may well explain why the land to the east of the cluster was never settled. It was a matter of economy rather than unsuitable geographical conditions. The settlements needed to be surrounded by an empty zone.

If the hypotheses about the area needed for cattle are correct one must conclude that the inhabitants of the settlements could not depend entirely on their own 60 to 170 hectare territories. They had to share their surroundings. In the following it will be shown that they shared these not only for food-producing activities but also for the procurement of various raw materials.

Table 3

1. firewood wood for houses loam for houses loam for pottery	2. wood for houses rock for querns rock for grinding-stones pebbles quarzite for adzes (minor source) chert (minor source)
3. chert	4. amphibolite made into adzes basalt made into adzes lydite made into adzes hematite

Table 3 lists the materials known to have been used in the Dutch settlements. They fall into four categories. Category 1 includes materials found within the postulated territory of each settlement. Category 2 contains materials found within the cluster area. Category 3 includes materials that are not found within easy reach of the settlements but still within six hours walking distance (i.e. a day's return journey). Category 4 comprises the real long-distance imports. Category 1 and 2, the local materials, are the most interesting here. Rock is the best known material, and the most important source for the rocks was the bed of the river Meuse. All the settlements in the cluster obtained the bulk of their rocks from the Meuse gravel bars. As not each territory is adjacent to the river, people in the cluster had to share this local commodity.

It is argued here that the whole cluster of settlements between the Geleen and the Meuse might be considered, in part at least, as a form of economic unit. This is not to suggest that the inhabitants shared all they needed for their daily life. The supposition is that they encountered each other frequently and were interdependant both economically and in other ways as well.

The ideas discussed above do not, of course, explain why there was a cluster at all. The explanation must be sought in social and demographic aspects of living and working together. One small settlement cannot have survived on its own, if only for demographic reasons. Here we are straying outside the scope of this paper, but one remark is worth making. Up till now only one cemetery has been found in the region. Apart from two or three possible graves in the settlement at Geleen-Rijksweg (known also as Geleen-Kermisplein and Geleen-Haesselderveld), and some hypothetical ones at Stein, Elsloo is the only cemetery within the cluster (for Geleen see Bakels & van den Broeke 1980-1981, for Stein Modderman 1970, p. 78). The cemetery may only have been used by the inhabitants of the Elsloo settlement, and the absence of cemeteries elsewhere may be due to the fact that graves contain less artefacts than rubbish pits and are therefore less easy to detect. It is striking, however, that there are far more Linearbandkeramik settlements than cemeteries. An explanation might be that settlements in a cluster shared one burial ground. The relatively low number of graves in the Elsloo cemetery, which led to the conclusion that it belonged to one settlement, may also reflect the fact that not everyone had the status to be buried there.

Comparison with neighbouring clusters

The third level of investigation is the comparison of the Dutch cluster with settlements belonging to adjacent regions. The present evidence suggests that the neighbours tended to live in clusters as well. The nearest clusters are on the Aldenhovener Platte, 30 kms to the east in Germany, and around the Heeswater, 20 kms to the south-west in Belgium. The former is very well documented. In Belgium only Rosmeer and Vlijtingen have been investigated to any extent.

Although the Aldenhovener Platte cluster is much larger than the other two, the clusters are very much alike. The settlements occupy comparable locations and were founded at the same time (Modderman phase Ib). Do the clusters differ in any way? Regional variation within the Linearbandkeramik can involve 1. agriculture as reflected in carbonized plant remains, 2. house-plans, 3. pottery, 4. flint tools and 5. rock sources. As far as 1. and 2. are concerned there appear to be no important differences between the three clusters. A comparison of pottery and flint tools will be possible in the near future when data from Rosmeer and Vlijtingen have been published. The data from the Aldenhovener Platte indicate that differences were certainly present. In theory local rock sources can be differentiating. Materials from long distance sources are expected to be the same. A clear result of comparison of the German and Dutch clusters is that the rocks used for the manufacture of local artefacts such as querns and certain adzes differ from one cluster to the other. Differences between the Dutch and Belgian cluster are less easy to distinguish. This probably because the inhabitants of the Belgian settlements used the gravel bars of the Meuse as their main source of material; these gravels are similar to the Dutch ones. If this is the case it will not be possible to differentiate between Dutch and Belgian material. In the absence of more detailed investigation into this problem it is perhaps unwise to say more. The imported rocks are better known and the same rocks are indeed found in all three clusters.

It is to be expected that it will always be much easier to detect similarities than differences between neighbouring clusters. The changes from cluster to cluster are perhaps so gradual as to be virtually invisible. Differences stand out better on a wider, regional scale, and this brings us to a fourth level of analysis: the interregional comparison of sets of clusters. Whilst the fourth level may appear more rewarding, little work has been carried out on the third level and its importance should not be underestimated.

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THE LATE BANDKERAMIK OF THE AISNE VALLEY: ENVIRONMENT AND SPATIAL ORGANISATION

M. ILETT, C. CONSTANTIN, A. COUDART AND J.P. DEMOULE

The river valleys of the Paris Basin provide a rather different geological and topographical context for settlement than the loess regions typically occupied by the Bandkeramik Culture in central and west-central Europe (Modderman 1958/1959; Sielmann 1972; Kruk 1973; Kuper and Lüning 1975; Bakels 1978a). In the Aisne valley (fig. 1) a relatively complete picture of Bandkeramik settlement has emerged as a result of a series of rescue excavations in the 1960s (Boureux and Coudart 1978) and the current Paris University/C.N.R.S. project, founded by the late Bohumil Soudsky shortly after his arrival to teach in Paris in 1971 (F.P.V.A. 1973-1981). This article is mainly concerned with the relationship between the sites and the local environment, and with their distribution along the valley. A preliminary account will also be given of work in progress on the internal organisation of the settlements.

Cultural and chronological background

In view of the special nature of settlement distribution in the valley and its relative isolation from centres of Bandkeramik population in the Low Countries and Germany, it is important to underline the originality of the material culture of the Aisne Late Bandkeramik. This introductory section summarises the main characteristics of the ceramics, the lithic industry, and the houseplans. Bone and antler artifacts have yet to be studied in detail.

The excavations at Cuiry-lès-Chaudardes have provided by far the greatest quantity of pottery. Almost all this material occurs as rubbish in the construction pits flanking longhouses. The pottery can be divided into three basic categories; decorated fine ware, undecorated fine ware, and larger, more coarsely made pots. In terms of minimum numbers of identifiable vessels, the three categories appear to exist in more or less equal proportions. The originality of the assemblage is most clearly seen in the decorated fine ware. The overwhelming majority of these vessels are decorated with comb impressions, often combined with incised lines (Ilett and Plateaux in press). Two- and three-toothed combs are the most frequent; four- and five-toothed instruments are relatively uncommon. The comb was almost always pivoted across the damp surface of the clay. Rim and neck decoration includes various combinations of horizontal comb impressed bands and incised

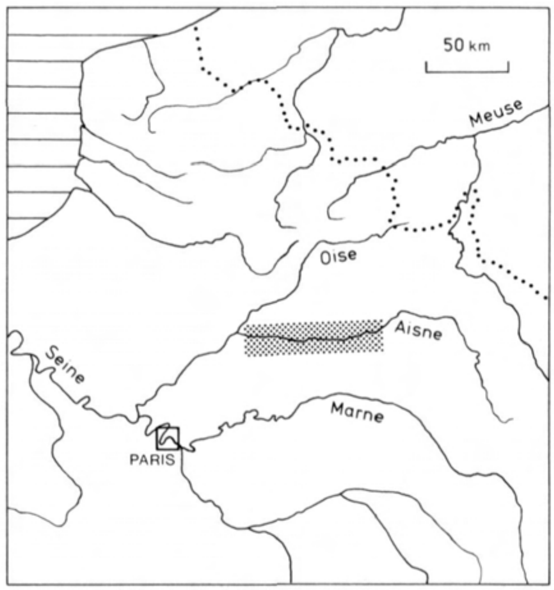

Fig. 1. North-east France and part of Belgium. The shaded area represents fig. 3.

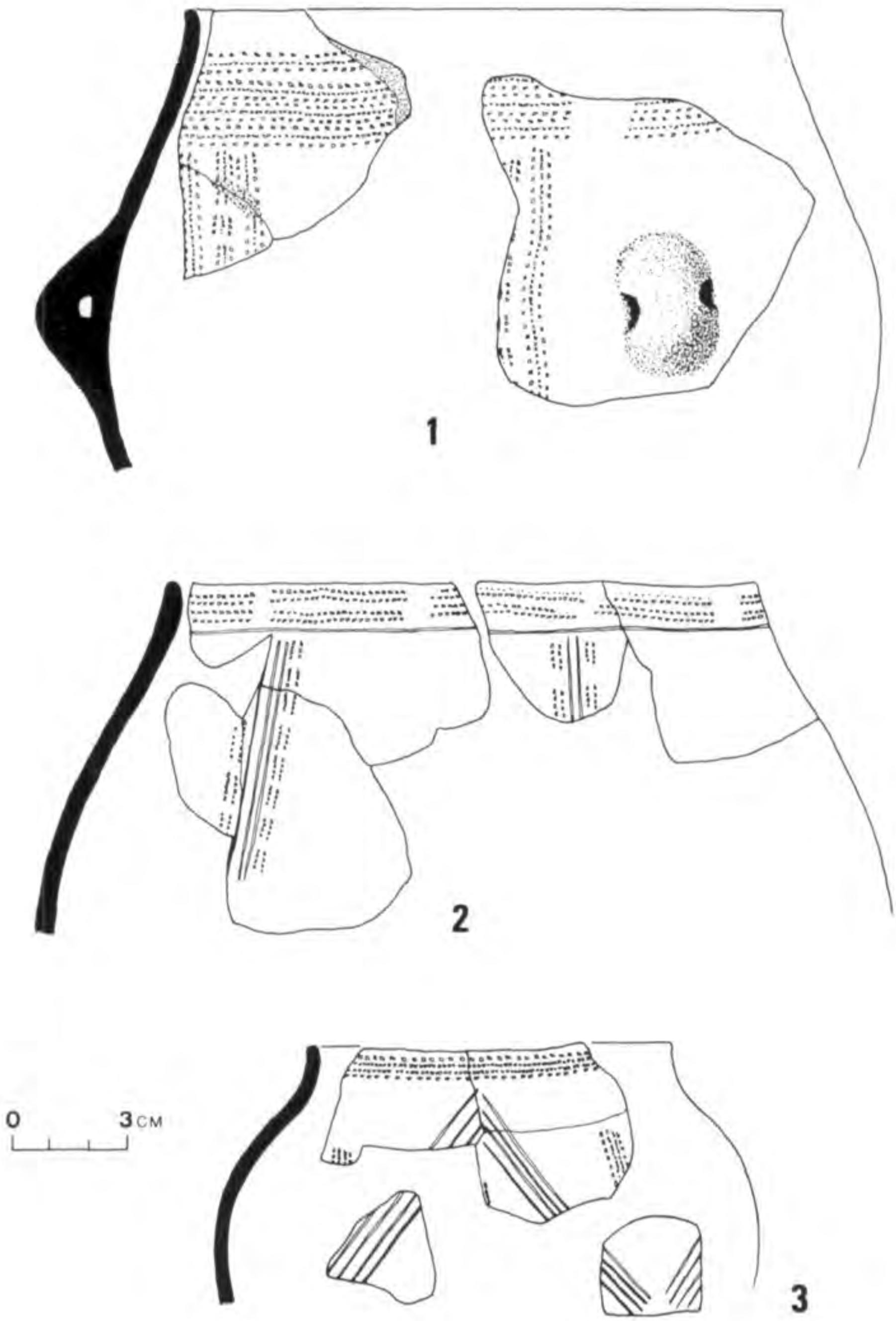

Fig. 2. Characteristic decorated fine ware from Cuiry-lès-Chaudardes. Decoration technique: 1. pivoted three-toothed comb 2. pivoted two-toothed comb and incised lines 3. incised lines and pivoted four-toothed comb. All three pots are from pits belonging to house 225.

lines. The main decoration on the body of the pot is characteristically composed of either vertical bands of comb impressions, vertical bands of comb impressions on either side of incised lines, or oblique incised lines forming an inverted "V" pattern (fig. 2). These three motifs account for almost 80% of the decorated vessels at Cuiry-lès-Chaudardes, and their relative frequency seems to depend on a chronological factor (see page 57 below). Vertical band motifs are always in the majority, however, and it is this feature, together with the predominance of the pivoted comb decoration technique, that clearly distinguishes the Aisne valley assemblages from the Late Bandkeramik of the Low Countries, the Rhineland and Alsace.

Sherds of "Limburg pottery" have been found in almost all the pits at Cuiry-lès-Chaudardes. On average there is about one Limburg vessel for every thirteen ordinary decorated pots. The Limburg pottery stands out by its bone temper, open shapes with thickened rims, and distinctive grooved decoration (Constantin et al. 1981).

In general terms the flint industry closely resembles that of the Late Bandkeramik elsewhere (Plateaux 1982). However, blades with silica gloss include obliquely retouched or truncated forms that only occur in Rössen contexts in the Rhineland (Fiedler 1979). Another original feature of the flint industry is the relatively high proportion of both burins, rarely reported from Bandkeramik sites elsewhere, and arrowheads. Out of a total of over three hundred and fifty retouched tools from Cuiry-lès-Chaudardes there are only four Tardenoisien artifacts. The same site has so far only produced three fragments of two polished stone adzes. A study has yet to be made of the raw materials used for these flint and stone artifacts. We will return to the question of the production and distribution of flint tools within the settlement at Cuiry-lès-Chaudardes at the end of this article.

Houseplans from the Aisne valley clearly fall within the Bandkeramik tradition (Coudart 1982). The buildings are orientated east-west with the west end pointing slightly towards the north. Most houses are between 10 and 30 m long; the maximum length is 39 m (house 225, Cuiry-lès-Chaudardes). Many of the groundplans are slightly trapezoidal. At Cuiry-lès-Chaudardes the lay-out of the internal, load-bearing posts conforms to a remarkably uniform pattern. With few exceptions each houseplan includes two pairs of closely set transverse post rows. One pair occurs at the eastern, entrance end of the house; the other pair is located at about two-thirds the length of the building, separating the central and western part (fig. 6).

The immediate post-Bandkeramik sequence in the Aisne valley, as elsewhere in the Paris Basin, is still very unclear. No settlements of this date have been extensively excavated, and ceramic groups are being redefined (Constantin and Demoule 1982). The term "Culture de l'Aisne" (F.P.V.A. 1974-1977; Boureux and Coudart 1978) has been abandoned.

Analysis of the large assemblages of decorated pottery that have recently become available from Cuiry-lès-Chaudardes, together with the recognition of Limburg pottery on the same site, have shown that it is unrealistic to separate the material originally used to define the "Culture de l'Aisne" from the Late Bandkeramik (F.P.V.A. 1981). Radiocarbon dates on bone collagen appear to confirm the relatively late position of the Aisne Bandkeramik within the west European sequence. Nine out of twelve dates with acceptable standard deviations from Cuiry-lès-Chaudardes fall between 4050 and 3850 bc (Evin, in press). The decorated pottery from this site is broadly representative of the Paris Basin material attributed by Bailloud (1964; 1971) to the Late Bandkeramik. Rather earlier Bandkeramik material has recently been found in the south-east of the Marne département (Chertier 1980; Chertier and Tappret 1982). Nevertheless, in the Aisne valley the major research gap in terms of both absolute dating and the clarity of the ceramic sequence, falls between c. 3800 and 3400 bc, when settlements belonging to the epi-Rössen horizon appear (Dubouloz et al 1982). The following discussion of settlement includes all the sites in the Aisne valley which have produced Bandke-

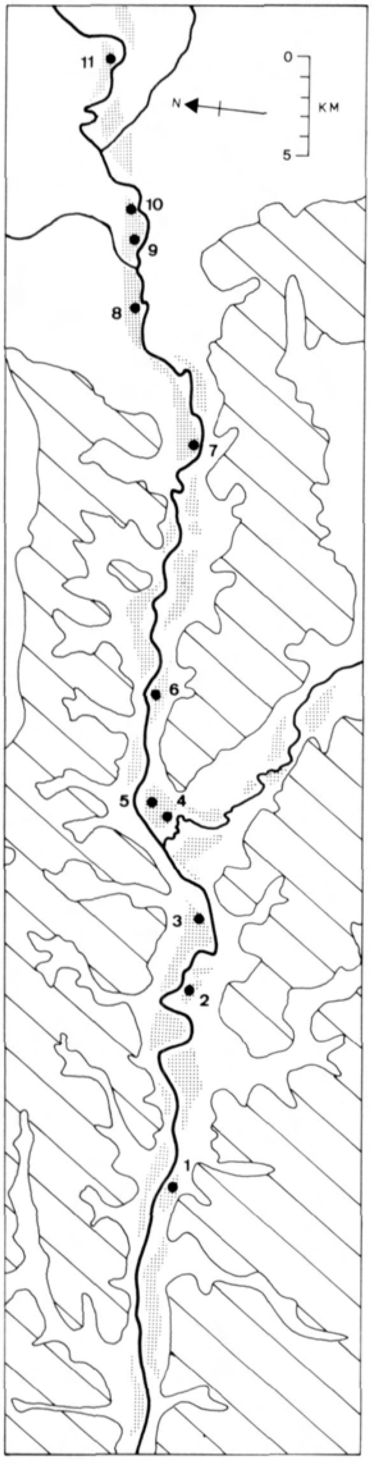

Fig. 3. Distribution of Late Bandkeramik settlements in the Aisne valley. Oblique lines indicate limestone plateaux; shading indicates gravel terraces. 1. Pernant 2. Villeneuve-Saint-Germain (suburb of Soissons) 3. Missy-sur-Aisne 4. Chassemy 5. Vailly 6. Cys-la-Commune 7. Cuiry-lès-Chaudardes 8. Pontavert 9. Berry-au-Bac "Le Chemin de la Pêcherie" 10. Berry-au-Bac "La Croix Maigret" 11. Menneville.

ramik-type houseplans and/or Late Bandkeramik pottery.

Environmental background

The sector of the Aisne valley under study stretches from the small town of Neufchâtel in the east to the confluence with the Oise, about 80 km to the west. For about three-quarters of this distance the valley cuts through Tertiary limestone plateaux, forming a flat-bottomed corridor of an average width of 3 km. In the east, relief is less marked as the river flows through the rolling chalk landscape of northern Champagne.

Simplifying geology, relief, and hydrology, the major part of the valley can be divided into three landscape units; 1. the limestone plateaux and slopes, 2. the gravel terraces, and 3. the river and its flood-plain.

1. The limestone plateaux are about 100 m above the valley floor. The plateaux edges on both sides of the river are characterised by heavily dissected relief, with numerous small side valleys and slopes of varying steepness. There is very little open water on the plateaux and the water table is low; present-day agriculture can be seriously affected by drought. The absence of water explains why, even today, there is comparatively little settlement on the plateaux. Many of the spurs overlooking the valley, however, have revealed evidence of earlier 3rd millennium bc and Iron Age occupation. Loess deposits of varying extent occur on the plateaux, particularly to the south of the river Aisne.

Deep colluvial deposits are located at the foot of the slopes.

2. The Pleistocene gravel terraces of the Aisne cover extensive parts of the valley floor and were the focus of settlement from the Neolithic through to the earlier Middle Ages, when much settlement shifted to the foot of the valley sides. The terraces lie about 5 m above the level of the river. Today, the calcareous brown earths on the gravel terraces provide some of the most fertile agricultural land in the region. It is clear that a considerable degree of erosion and substantial changes in the soil profile have taken place over the last six thousand years (Boureux and Coudart 1978, 343). Neolithic features have normally only survived when they are cut into the gravel or flood loam C horizon. Bandkeramik features are characterised by a very dark fill, presumably reflecting the colour of the original Atlantic forest soil. Preservation of bone is excellent.

3. The river Aisne now flows in a permanent channel between 30 and 50 m wide. The river and its flood-plain must nevertheless have presented a rather different aspect in later prehistory. While the Atlantic flood-plain landscape is masked beneath recent alluvial deposits, it is unlikely that its horizontal limits, as defined by the edge of the first gravel terrace and the valley sides, have changed to any significant extent since the neolithic.

The present day climate of the Aisne valley, as of much of Picardie, indicates an interplay of continental and oceanic influences. Mean annual rainfall varies between 650 and 750 mm. The prevailing and strongest winds blow from west to east along the valley, a factor that is reflected in the orientation of the Bandkeramik longhouses.

Location and distribution of Bandkeramik settlements

It is against the background of these three landscape units that the distribution of Late Bandkeramik settlements along the valley can be examined. The distribution map (fig. 3) currently shows eleven sites, located on or near the edge of the first gravel terrace. Before looking more closely at these sites, two important questions must be raised. Firstly, to what extent are the terrace edge locations, to the exclusion of other possible locations in and around the valley, representative of the original settlement pattern? Secondly, to what extent does the surviving sample of sites reflect the original settlement density? Whilst neither question can be very satisfactorily answered in the present state of research, a number of factors relating to the discovery of sites must be considered.

With very few exceptions, the sites have been found through the surveillance of gravel pits; the sites were unknown before gravel extraction started. The exceptional sites were either discovered through aerial survey during the drought of 1976 or through the excavation of later features. On this evidence it could be argued that the distribution map is very biased and reflects the location of gravel pits rather than Neolithic settlements. Furthermore, extensive gravel-working has in the past destroyed large areas of terrace in certain parts of the valley. There was little archaeological surveillance and sites may have disappeared without trace. This is particularly the case with two of the largest blanks on the distribution map, between Soissons and the Oise confluence, and between Cuiry-lès-Chaudardes and Cys-la-Commune. Other settlements may of course have disappeared beneath modern villages and towns. Soissons, for example, covers a large area of gravel terrace.

A programme of field-walking has only recently been instigated on the terraces that are still largely intact. It is too early to expect spectacular results, but for the moment no new Bandkeramik sites have been discovered by this means. Deep-ploughing is infrequent, and the considerable density of natural flints in the topsoil hinders the recognition of artifacts during field-walking. Survey is thus a great deal more difficult than on loess-based soils. Neither the limestone plateaux, nor the side valleys and slopes, nor the banks of tributaries flowing across the flatter chalk landscape, have been systematically surveyed in the course of the current project. As has already been indicated, there is very little surface water on the plateaux, and relief is quite dissected. Both factors may well have rendered this landscape unit unsuitable for Bandkeramik settlement (Bakels 1978a, 131). Parts of the plateaux have been walked by local collectors, but none of the flint scatters listed by Parent (1971) include Bandkeramik artifacts; most of these sites seem to date to the 3rd millennium bc. The only Mesolithic flint scatter to have been discovered in the Aisne valley is located on the plateaux slopes across the valley from Cys-la-Commune.

Taking all these factors into consideration, and bearing in mind the possibly biased nature of the available sample, the evidence for Bandkeramik settlement distribution can be summarised as follows. All the sites are located on or near the edge of the first gravel terrace, just out of reach of today's worst flooding. The maximum distance to the present-day river channel is 500 m; usually this distance is substantially less. Several settlements occupy locations where a bend in the river brings the water close to the terrace edge, but which at the same time are adjacent to the larger expanses of flood-plain. The sites at Cuiry-lès-Chaudardes and Berry-au-Bac "La Croix-Maigret" are good examples of such locations. The ease of accessibility to water would have been important in livestock management, and it also seems likely that the rich plant and animal resources of the flood-plain would have exerted a pull on the location of the settlements.

Another important feature of the site locations are the bands of Pleistocene flood-loam overlying the gravel terrace. It is possible that the flood-loam originally covered more extensive areas, and that only the thicker deposits have survived erosion. At Cuiry-lès-Chaudardes the maximum depth of the band of flood-loam that crosses the settlement is about 50 cm. This rather silty deposit would have replicated many of the qualities of loess as an enhancer of soil fertility, as well as providing material for daub. It is worth mentioning that contractors operating without archaeological supervision always remove the layer of flood-loam with the topsoil prior to opening a gravel pit. This practice can have a disastrous effect on the preservation of Bandkeramik features, which often barely penetrate beneath the flood-loam.

Turning from site locations to the spatial relationships between settlements, two major difficulties arise. As we have already seen, the distributional evidence is possibly very incomplete, and, partly because of the varied scale and circumstances of excavation, it is very difficult to demonstrate on the basis of the ceramics which settlements were in operation at any one period of time. The distance between sites varies from 1 to 13 km. The average distance is 5,7 km, but this would be rather less if we were to suppose that sites have been lost in the parts of the valley where substantial areas of gravel terrace have been destroyed. As far as can be judged from the decorated sherds, all four of the sites that have produced sufficiently large assemblages were probably contemporary, or at least partially overlapped in time (Menneville, Berry-au-Bac "La Croix-Maigret", Cuiry-lès-Chaudardes, Cys-la-Commune). In architectural terms the houseplans at Missy-sur-Aisne (F.P.V.A. 1978, fig. 124) and Pontavert (Boureux and Coudart 1978, fig. 12) possibly belong to a relatively late stage in the sequence. Both excavations were very limited in extent. A few Bandkeramik sherds have recently been found in secondary contexts about 2 km to the west of Pontavert, on the same gravel terrace. In site territorial terms, all the settlements are potentially contemporary, but at present the data are insufficient to test this hypothesis.

How can the study of these sites contribute to the current debate on Bandkeramik settlement patterns and agricultural systems? Whilst a great many more sites are available for study in the loess regions outside the Paris Basin, analysis of settlement distribution in such regions is not without difficulty. A major problem is caused by the tendency for sites to build up through time towards the upper end of a drainage network, resulting in very dense concentrations in certain areas. To take the well-surveyed examples of the Merzbach and Bylanka micro-regions (Kuper and Lüning 1975; Pavlu 1977, fig. 1), settlement features can cover several tens of hectares, representing around five hundred years of continuous occupation. Such sites pose obvious excavational problems, and the complex space-time variables hinder analysis of settlement structure.

One advantage of the situation in the Aisne valley is that space-time variables are less complex. Although it is unclear exactly how long the Bandkeramik farming system lasted, it is certain that the valley did not undergo the long occupation of, say, the Rhineland. There was less opportunity for settlement sites to build up in the chosen gravel terrace locations. The most extensively excavated settlement, Cuiry-lès-Chaudardes, has revealed a low density of houseplans (see below). Of equal importance to this chronological constraint on the distribution of settlements are the various spatial constraints caused by the valley landscape. These constraints operate at two levels. At the widest level, the Aisne valley is separated from similar settlement micro-regions, by up to 60 km of dry, dissected plateaux which were probably unsuitable for Bandkeramik occupation. The Aisne and Oise micro-regions do, of course, blend together at the rivers' confluence, but this does not detract from the general observation that the available areas for settlement are distributed in a very different manner to those of the "classic" loess landscapes occupied by the Bandkeramik Culture elsewhere. Such landscapes are regularly networked by small streams and rivers, and although it is possible to isolate clusters of settlements separated by "empty" but potentially exploitable areas, the clusters are generally quite close together and the whole settlement region can cover several hundred square kilometres (Kruk 1973, map 4; Pavlu and Zapotocka 1979, fig. 1; Dohrn-Ihmig 1979, 269).

The second level of spatial constraints involves the size and distribution of the gravel terraces on which the sites are located. The terraces are defined by the meandering river and its flood-plain, by the slopes of the valley sides, and by small tributaries flowing at more or less right angles into the Aisne. In the sector of the valley under study, the terraces thus form a linear series of seventeen discrete, if irregularly shaped units (Boureux and Coudart 1978, 344). These units can be contrasted, for example, with the more continuous second gravel terrace of the wide Rhine valley. The latter terrace is covered by loess deposits and networked by small streams (Sielmann 1972, Abb. 12). The Aisne terraces therefore introduce a potentially quantifiable element into the analysis of Bandkeramik settlement systems (Ilett 1980).

Several theories have recently been advanced about the relative spacing of Bandkeramik sites and the quantities of agricultural land required by each settlement. Kruk (1973) noted the tendency for sites to occur in clusters up to 12 km apart in Little Poland. He assumed that most of the sites in the clusters were inhabited at the same time, and that they represented major and ancillary settlements functioning together as an economic unit. The excavators of Bylany have introduced the concept of the settlement "microarea", defined as "the minimum space where a community could live and lived permanently" (Soudsky 1973, 198). The microarea thus combined the village itself, the surrounding agricultural land, and whatever land was needed for pasture and the provision of building materials. 30 ha of loess-based soils were considered to provide enough cereals per year for a community of one hundred and fifty people.

The model proposed by Soudsky involved three discontinuously occupied settlement locations, with additional systems of field rotation, resulting in a microarea of about 200 ha for the Bylany community. The members of the Aldenhovener Platte project have put forward a rather different hypothesis about the nature of the settlements. They envisage a scattered series of single houses, or small groups of houses, along the 1,3 km stretch of the Merzbach that was fully investigated (Kuper and Lüning 1975; Lüning, this volume). It is suggested that the

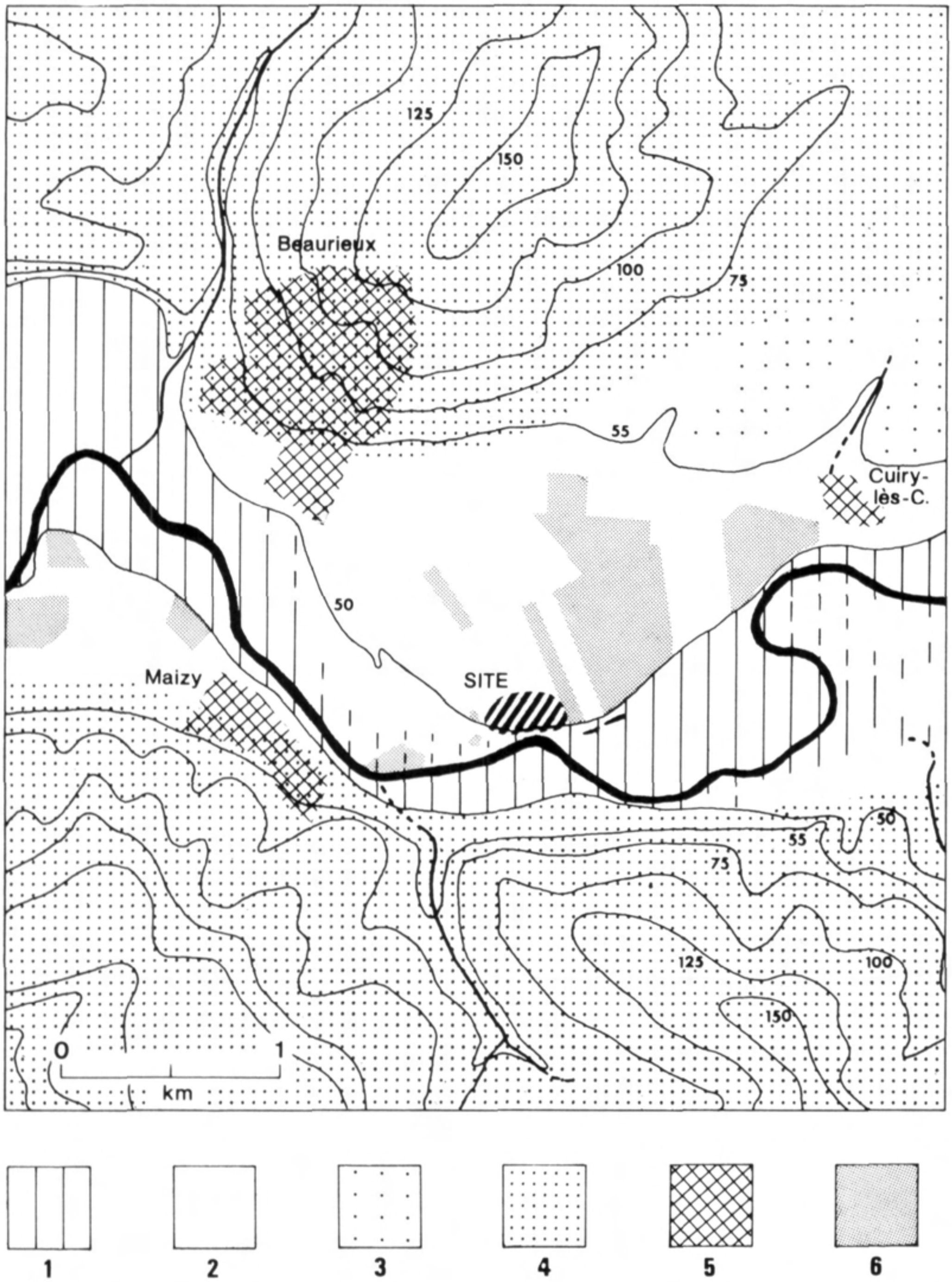

Fig. 4. Location of the settlement at Cuiry-lès-Chaudardes. 1. flood-plain 2. first gravel terrace 3. second gravel terrace 4. limestone plateaux and valley sides 5. modern village 6. gravel pit.

economic territory *(Wirtschaftsgebiet)* of the Merzbach "settlement" covered about 300 ha. Finally, Bakels has studied the location and distribution of Bandkeramik sites in Dutch Limburg and on loess covered terraces of the Danube near Hienheim in Bavaria. In the latter district, the average distance between sites is c. 1 km. Combining this observation with the relative spacing of the Dutch sites, probable cereal yields and dietary requirements, it was suggested that the "site territory" of a Bandkeramik settlement would have covered a maximum of 100-200 ha (Bakels 1978a, 146, and this volume).

The Aisne valley offers an opportunity, in our opinion, to test the parameters of these models. The terrace units are generally less than 2 km wide and 4 km long. The surface area of the majority varies between 110 and 300 ha. It has been put forward as a working hypothesis that each unit corresponds to the microarea, or site territory, of a village community (Boureux and Coudart 1978, 344). If this hypothesis were correct, we would not expect there to have been more than one settlement functioning at any one time on each unit, with the possible exception of the largest units. Whilst a complete reconstruction of the Bandkeramik settlement pattern along the valley is impossible, it is nevertheless interesting to comment upon the available evidence and in particular the terrace units where survey and excavation are still a possibility.

Nine of the terrace units contain Bandkeramik settlements (fig. 3). At present only two units provide clear evidence of more than one settlement. The site at Cuiry-lès-Chaudardes is located on the edge of one of the better surveyed terraces (fig. 4). Bandkeramik features extend over about 6 ha, while the terrace unit covers c. 220 ha. The latter figure does not include the narrow strip of terrace to the east of the modern village of Cuiry-lès-Chaudardes, as this is over 2 km from the site and thus unlikely to have been exploited on a permanent basis, if at all. The whole terrace unit consists of flat, fertile land which the site is optimally located to exploit. It is obviously important to be able to demonstrate whether or not this really is the only settlement on the unit. No finds of Neolithic date were reported when large areas along the edge of the terrace were destroyed in the 1960s, a period when archaeological surveillance was already taking place. No traces of Bandkeramik occupation came to light in extensive rescue excavations in advance of gravel extraction immediately to the east of the site. A gravel pit has recently opened at a potential settlement location just to the west of the modern village. Several hectares have been stripped of topsoil, but no Bandkeramik features were noticed. Elsewhere on the terrace, fieldwalking has so far failed to produce new sites. Combining all this evidence, it seems that we are not dealing with a scatter of buildings, or groups of buildings, along large areas of the terrace edge. Although over 3,5 km of terrace edge were available for settlement, the evidence points to a single, tightly delimited village site.

The example of Cuiry-lès-Chaudardes illustrates the potential offered by the Aisne valley for the analysis of the territories of Late Bandkeramik settlements. As more excavation and survey take place in the valley, it may eventually be possible to define the minimum area of terrace necessary for a single settlement. The Villeneuve-Saint-Germain unit is the smallest with evidence for settlement; its surface area is about 90 ha. At the moment nothing is known about size variation between the settlements. Only one of the sites has produced a ditched enclosure of Late Bandkeramik date. The enclosure at Menneville extends over about 6 ha, to judge from the aerial photographs. A very small percentage of this area has been investigated, and the chronological relationship between the Bandkeramik houses and the ditch system is unclear (F.P.V.A. 1976; 1977; 1978).

To end this discussion of settlement pattern in the Aisne valley, it is worth summarising the evidence for both the vegetation in the vicinity of the Late Bandkeramik sites and the plants and animals exploited by their inhabitants.

There are unfortunately no suitable stratified

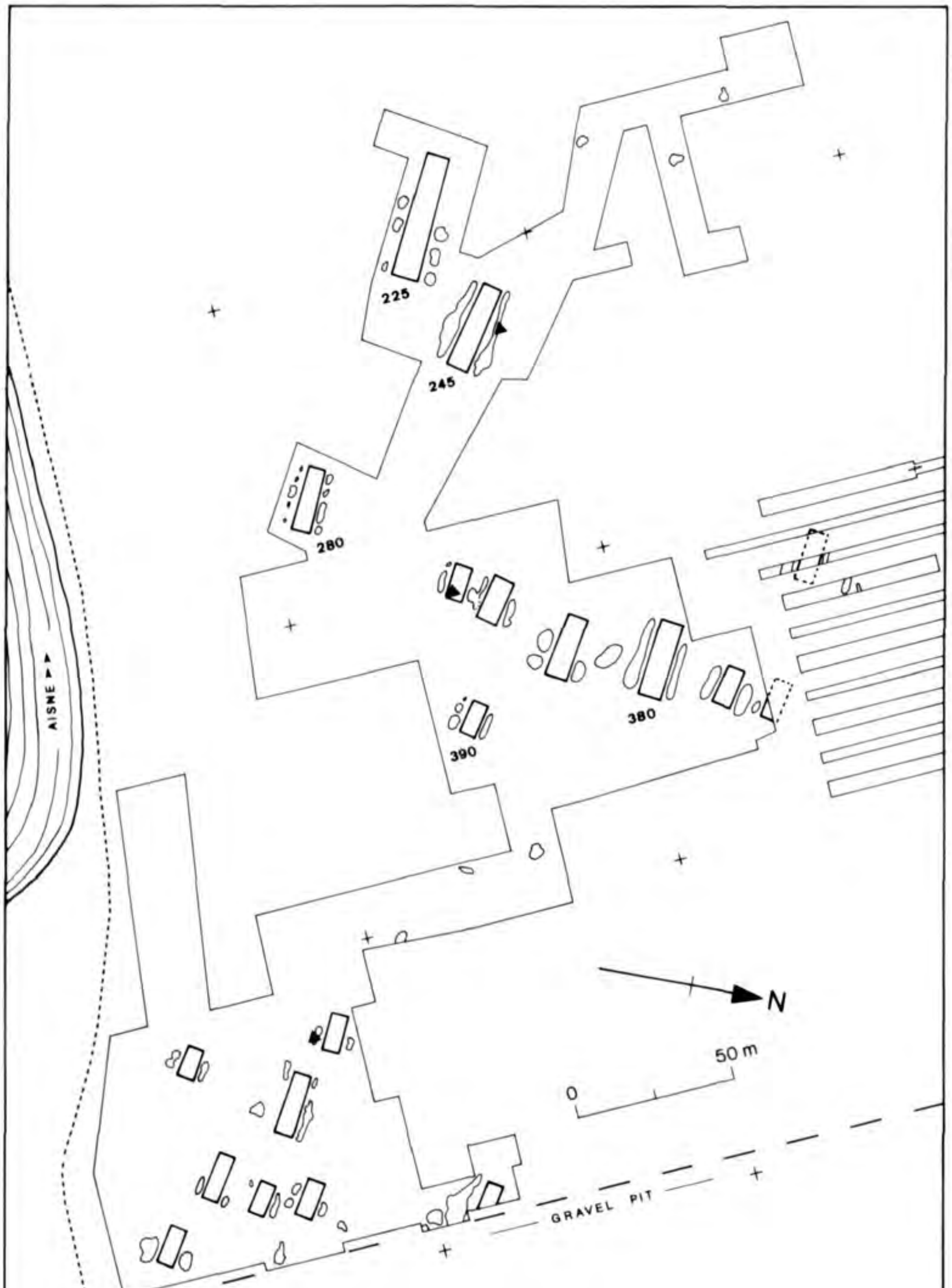

Fig. 5. Schematic plan of Late Bandkeramik features at Cuiry-lès-Chaudardes (1972-1981 excavations). Black triangles indicate child burials. The dotted line represents the edge of the gravel terrace.

peat deposits near the settlements. However, pollen and sub-fossil snails are well preserved in the fill of pits, and several analyses have already been carried out. Single pollen samples from five construction pits at Cuiry-lès-Chaudardes, Menneville, and Villeneuve-Saint-Germain each contained less than 24% tree pollen (Firmin 1976; 1977). The tree pollen reflects a mixed oak forest dominated by lime. The non-arboreal pollen occasionally includes grains from cereals and aquatic plants, but the majority are from *Compositae*. The snail assemblages from Cuiry-lès-Chaudardes also reflect a relatively open environment (Puissegur 1976), but, as is the case with the pollen, all the samples were taken from pits within the settlement.

Soil samples from construction pits have so far produced very little carbonised plant material. Emmer, naked barley, and possibly pea have been identified at Menneville (Bakels 1978b). Hazel nut shells were also found. The presence of barley is noteworthy, as this cereal is very rare in western Bandkeramik contexts. In the Rhineland, for example, carbonised barley has only been found on Rössen sites (Knörzer 1971).

The main palaeoeconomic interest of the Aisne valley settlements stems from the excellent preservation of animal bones. The 621 identifiable bones from the 1972-1973 excavations at Cuiry-lès-Chaudardes (Desse 1976) can be divided into 80,7% domestic species (cattle, ovicaprids, pig), 13,7% large wild species (red and roe deer, aurochs, pig), and 4,5% small wild species (wolf, beaver etc.). Fish bones are also present.

Cattle bones predominate in the domestic category. In so far as such data can be taken to accurately reflect the animal-based economy of the site, hunting appears to have played a relatively important role in comparison with Müddersheim, where the sample of bones is smaller (Clason 1972, Table III). It must be stressed, however, that these figures are based on a very small number of the bones now available from Cuiry-lès-Chaudardes. Judging from the proportion of identifiable bones from the 1972-1973 excavations, the total number of identifiable bones now stands at around eight thousand. With such data we can expect a whole range of detailed information about the animals that were herded or hunted by the inhabitants of the village.

Internal settlement organisation

The final section of this article presents some preliminary results of research into the internal organisation of the settlement at Cuiry-lès-Chaudardes.

About half of this 6 ha site has been investigated, but as the excavations cover the complete length and width of the settlement, it is reasonable to assume that we are dealing with a representative sample. The density of buildings is quite low; one house per 1600 m^2 excavated (fig. 5). So far nineteen houseplans have been uncovered (1972-1981). The minimum distance between houses is 5,5 m, although the vast majority are over 8 m apart. In only one case do the construction pits of two houses touch; no stratigraphy was visible. The low density of features must reflect the short duration of the settlement in comparison with many Bandkeramik sites outside the Paris Basin. While the absence of overlapping houses and pits has certain disadvantages for the chronological ordering of the site, the risk of mixed assemblages is reduced. For example, decorated sherds which evidently belong to the same vessel are often distributed along the pits on both sides of a house, but only two examples have been identified of such sherds occurring as "intrusions" in the construction pits of neighbouring houses. In both cases the distance involved was about 20 m. All this has important implications both for the chronological analysis of the finds and for the identification of possible activity areas within the settlement.

Another characteristic of the site plan is the rarity of isolated pits. The plan consists almost entirely of longhouses and their associated construction pits. The virtual absence of large, iso-

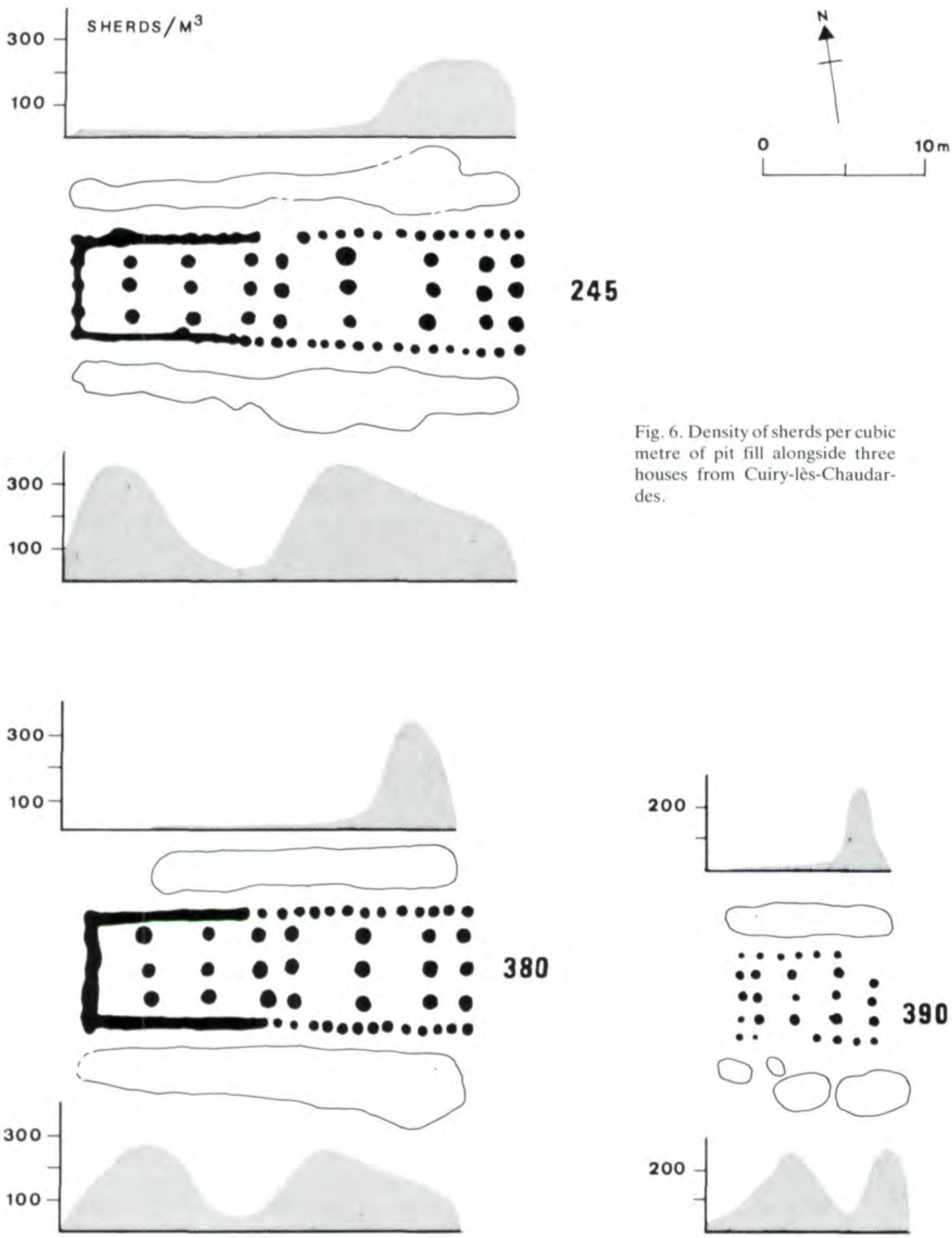

Fig. 6. Density of sherds per cubic metre of pit fill alongside three houses from Cuiry-lès-Chaudardes.

lated pits is possibly related to the nature of the subsoil, and it is noticeable that the few isolated pits that have been found are located on the band of flood-loam which crosses the site on its east-west axis. These pits contain few finds. All the dateable storage pits belong to the later Michelsberg settlement. The situation contrasts markedly with most Bandkeramik settlements on loess subsoils, where large pits are quite frequent outside the immediate vicinity of the buildings. In some cases it is these pits that contain the greatest concentrations of settlement débris (e.g. Farruggia et al. 1973; Kuper et al. 1977). If most of the pits were originally dug to provide daub for the houses, it is perhaps surprising that pits were dug, occasionally to depths of over 50 cm, into the gravel subsoil at Cuiry-lès-Chaudardes and elsewhere in the Aisne valley. The experimental reconstruction of a longhouse demonstrated, however, that the construction pits serve an extremely useful role in the preparation of daub (F.P.V.A. 1977). They provide conveniently large mixing basins adjacent to the walls of the houses.

An understanding of the chronological development of the site is obviously essential to the analysis of its spatial organisation, and the key to chronological structure lies in the assemblages of decorated pottery. There are on average about twenty-five decorated vessels per house. Four houses are each associated with over forty vessels. A preliminary seriation of the "richest" houses, largely based on the percentage occurrences of the three main motifs described above (page 45), has been attempted (Ilett and Plateaux, in press). This sequence is independantly supported by non-ceramic chronological traits - the presence of typologically late sickle blades in certain of the pits and the most trapezoidal groundplans. The ceramic assemblages of the "early" houses are characterised by high percentages of vessels with vertical band decoration (comb impressions with or without incised lines), and the "later" houses by relatively high frequencies of incised, inverted "V" decoration.

An interesting outcome of the seriation is the apparent succession of the three largest houses in the western sector of the site (380-245-225). Houses 380 and 225 are widely separated in the seriation, and in view of their proximity and relative positions, houses 245 and 225 are unlikely to have been contemporary. It is tempting to suggest that we are seeing the repetition, throughout the site's duration, of a particular type of village structure, with a large house at the head of a group of smaller houses. Some of the Bylany phases show this type of structure very clearly (Soudsky and Pavlu 1972, fig. 2).The three buildings at Cuiry-lès-Chaudardes become successively longer, and they suggest a gradual movement of the village in a westerly direction. On the basis of its architectural properties and its ceramics, the smaller trapezoidal house 280 belongs, with house 225, to the final phase of the settlement. Both groundplans indicate a slight shift in orientation towards the south. There are several incomplete lengths of post-hole palisade on the site, but it is not clear how these relate to the development of the settlement. They are possibly of Michelsberg date. There is no evidence to suggest that the Late Bandkeramik occupation was discontinuous, and although it is not yet possible to estimate how many houses were standing at any one time, the number was probably quite small.

Child burials are associated with three of the buildings (fig. 5). Two occur in construction pits and the third is located inside a house, towards the east end. One burial contained perforated shells and shell beads (F.P.V.A. 1974, 85), another no grave goods (F.P.V.A. 1977, 25), and the third a bone point. All the graves were ochred. No adult burials have been discovered within the settlement at Cuiry-lès-Chaudardes, although there are isolated examples from other settlements in the Aisne valley (Agache 1968, fig. 3; F.P.V.A. 1981).

Unlike the child burials, the adult graves cannot be directly associated with particular houseplans. Both an adult and a child burial were found in the Late Bandkeramik ditch at Menneville.

One of the main research objectives at Cuiry-lès-Chaudardes is the spatial analysis of material both within the construction pits, and between the various houses of the settlement. Perhaps the simplest approch is to study the density of finds in the pits. The identification of prefered rubbish disposal areas can provide important information about the buildings and the behaviour of their occupants. At a more complex level the various interrelationships of flint and bone artifacts, and flint and bone waste, can be investigated. Although the rubbish in the pits is not in a primary context, it may eventually be possible to isolate particular activity areas within the settlement, and to identify functional differences between the buildings. Research into these aspects is still in a very preliminary stage, but a brief account can be given here of work that has just begun on sherd density within the construction pits and on the distribution of flint tools and waste produce within the settlement.

To deal with sherd density first, three buildings with more or less continuous construction pits along both walls have been examined (fig. 6). Houses 390, 380, and 245 are respectively 11, 24, and 28 m long. The pits of house 380 were dug into flood-loam; the other pits were dug into terrace gravel with superficial patches of flood-loam. Six hundred sherds were found in the pits alongside house 390; houses 380 and 245 are associated with about four thousand sherds each. When sherd density per cubic metre is plotted along the construction pits, the three houses display a very similar pattern. Most of the material in the northern pits is concentrated at their east ends, nearest the presumed entrances of the buildings; west of this point the quantity of sherds falls off abruptly. Considerably more sherds are found in the pits along the southern side of the houses, and there are two main concentrations. The first occurs at about one third the length of the house (counting from the east end) and the second is located towards the west end of the building. It is unclear whether this bimodal pattern reflects prefered rubbish disposal areas, a predominance of outdoor activities on the warmer, south side of the houses, or some form of opening in the south wall near the west end. The lay-out of posts in the south wall does not suggest a doorway at the west end, and in any case the pits would have hindered access to and from the building.

Analysis of the distribution of flint tools and waste products poses more complex problems, despite the uniform depositional context of the material. For example, it is perhaps unreasonable to assume that the few tools lost or discarded in construction pits will be representative of activities carried out in and around a house that was probably occupied for a minimum of twenty-five years. An additional complicating factor is the unknown effect of erosion on the former contents of the pits. Nevertheless, an initial study of the lithic material associated with fifteen of the buildings at Cuiry-lès-Chaudardes has been completed, and two interesting points emerge from this research (Plateaux 1982).

Firstly, the large house 380 is distinguished by the sheer quantity of waste products in its pits. The two long pits contain over half the waste flakes and blades, and over half the cores of the whole site. The house also has an exceptionally low ratio of tools to waste products. Houses 245 and 225, dating to later phases of the proposed settlement sequence, produced similar quantities of ceramics to house 380, but a great deal less lithic material.

The second point is that the principal tool types do not appear to be randomly distributed either within or between the house assemblages. Two possible "tool kits" have emerged from a preliminary statistical analysis of the six main tool types in the eleven houses associated with more than eight tools. The first "tool kit" consists of arrowheads and borers; scarred flake tools *(pièces esquillées)* and burins constitute the second. Finally, two groups of houses can be separated on the basis of their associations with the "tool kits".

Conclusions

1. Although various biases may have affected the discovery of Late Bandkeramik sites in the Aisne valley, all the present evidence points to a standardised type of site location, on or near the edge of the first gravel terrace overlooking the river and flood-plain.
2. The currently available data suggest that these sites represent small villages, optimally located for agricultural purposes and for the exploitation of the natural resources of the valley floor. The relatively short duration of Bandkeramik occupation simplifies the analysis of settlement pattern, and the river terrace topography presents a valuable opportunity for the study of site territories. It is unclear whether or not all the potential settlement areas along the valley were exploited during the Late Bandkeramik.
3. Only one site, Cuiry-lès-Chaudardes, has been excavated on a large enough scale to provide adequate information about internal settlement organisation. There is some evidence to suggest that each settlement phase consisted of a small group of houses, accompanied by a rather larger house at the western edge of the village. Work is in progress on the analysis of rubbish density in the pits alongside buildings. Preliminary results of the study of the distribution of flint tools and waste products seem to indicate some degree of functional variation within the settlement. It is hoped that a clearer picture of this variation will emerge when processing of the large quantities of faunal remains, bone artifacts and manufacturing waste has been completed.

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SETTLEMENT AND LAND USE IN EARLY NEOLITHIC DENMARK

TORSTEN MADSEN & HELLE JUEL JENSEN

This paper takes its starting point in a newly excavated well preserved Early Neolithic settlement site in eastern Jutland. Through a series of analyses it seeks to demonstrate how it is possible to gain detailed information concerning site structure, number of inhabitants, duration of occupancy, and types of activities on the site. The paper proceeds to show how the site can be fitted into a local land use pattern when it is analyzed together with other sites. Finally a model for early neolithic land use is sketched.

While the settlement system of the Early Neolithic in Central Europe is beginning to be well understood (Modderman 1970; Kuper & Lüning 1980; Soudsky 1966; Soudsky & Pavlu 1972), the same is certainly not true in Northern Europe.

In Denmark there have been suggestions of Early Neolithic settlements consisting of one (Skaarup 1975) or two communal long houses (Glob 1949). Recently, however, it has turned out that the long houses can be better understood as mortuary structures placed on older settlement sites (Glob 1975; Madsen 1979; Liversage 1981). Concerning the few other claims for house structures on Early Neolithic settlement sites, one must for reasons of documentation have strong reservations against those from Strandegård (Broholm & Rasmussen 1931), Ørnekul (Becker 1953) and Knardrup (Larsen 1958). This then leaves only the structures from Muldbjerg (Troels-Smith 1960), Lindebjerg (Liversage 1981) and Mosegården (Madsen and Petersen in press) to be considered.

The lack of acceptable house structures from the Early Neolithic period presents a problem, as settlement sites do occur in some quantity. Rather than regard this sparsity as a stroke of bad luck, we will try to demonstrate that it should be seen as a result of the specific nature of the house structures of that period and the way in which the entire settlement system was organized.

The basic information to be used comes from a settlement site found beneath a long barrow at Mosegården, 10 km east of the town of Horsens in eastern Jutland (fig. 1). This site, extremely well preserved as it was, supplies us with a body of information of great importance for our understanding of the Early Neolithic settlement system in Denmark even though no organic material was preserved on the site. Thus the main theme of the paper is firstly to present the Mosegården site in some detail, and secondly to use the site in conjunction with further data as a starting point from which to build a generalized model for the Early Neolithic settlement system.

The Mosegården settlement site

The excavations at Mosegården took place during 1978 and 1979. Our original intention was to excavate a ruined megalithic tomb, but soon it turned out that we were dealing with two megalithic tombs placed in an older long barrow, which covered a settlement site (Madsen 1979; Madsen & Petersen in press). The long barrow was surrounded by a palisade trench which held split timber trunks. A Carbon-14 date of 3130 ± 90 B.C. (K-3463) dated charcoal from these trunks in an area where the palisade trench cut the settlement site. Even allowing for exceptionally mature wood and for a variation of two standard deviations, it is

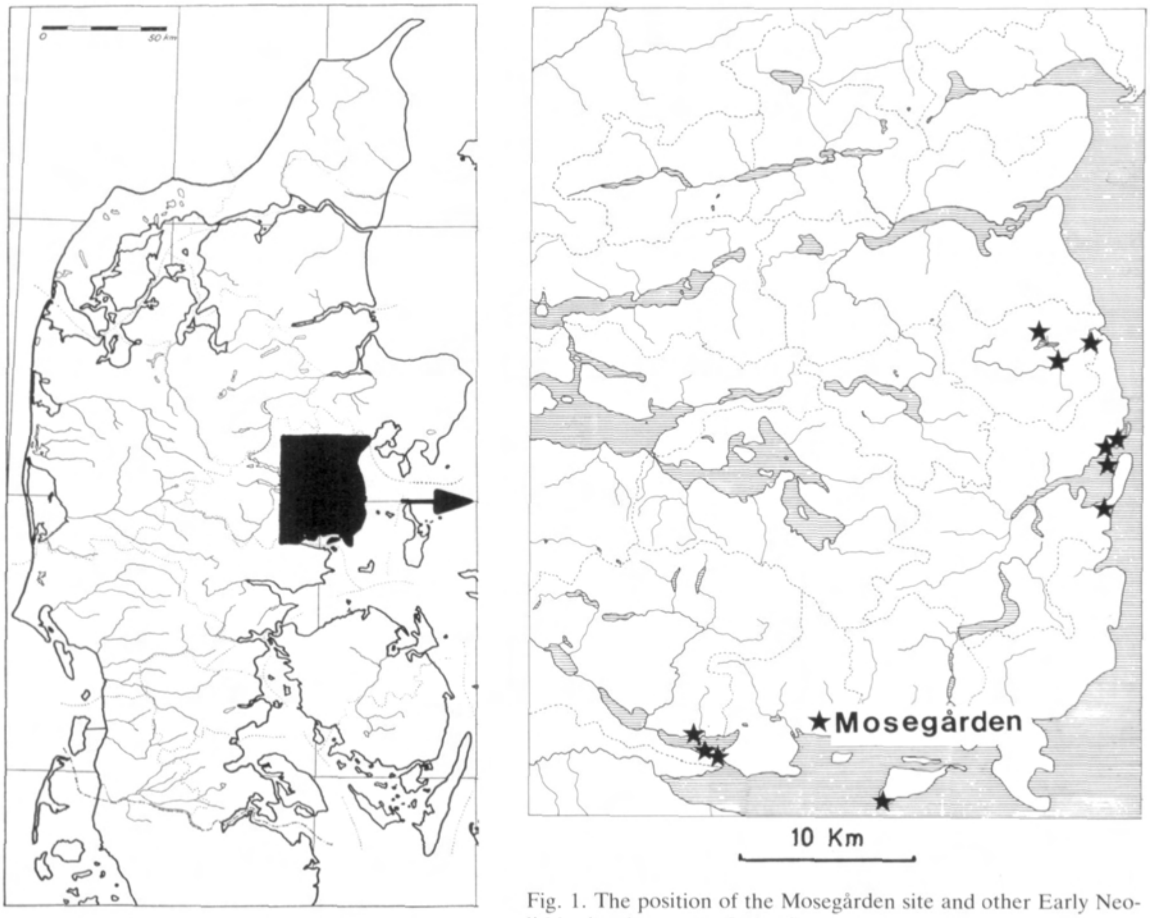


Fig. 1. The position of the Mosegården site and other Early Neolithic sites in eastern Jutland.

hardly likely that the palisade should be younger than 2900 B.C. The settlement site then, being older still, is dated among the earliest neolithic sites in Denmark.
In the following paper only information pertaining to the settlement is taken into consideration, and all structures related to the long barrow or the tombs are left out of the site plans. Areas where they have caused disturbances are left blank.

The outline of the site was primarily determined by the colour of the soil (fig. 2). The cultural deposits were in general characterized by a reddish-brown colour containing numerous small specks of burned clay as well as many larger lumps. In a limited area to the east the colour changed abruptly to one of heavy black. This deposit was composed of organic material rather than charcoal. An old land surface which bordered the cultural deposits could be detected on most sides as a thin greyish coloured band. Where this occurred beneath the barrow (between the two palisade trenches marked by long blank stripes in fig. 2) it can be regarded as contemporary with the settlement and thus constitute an effective delineator for the site. Where it occurs outside the barrow it may be a later formation and thus of no delineating value.

Inspection of the overall plan suggests that most of the site has been preserved. Only in an

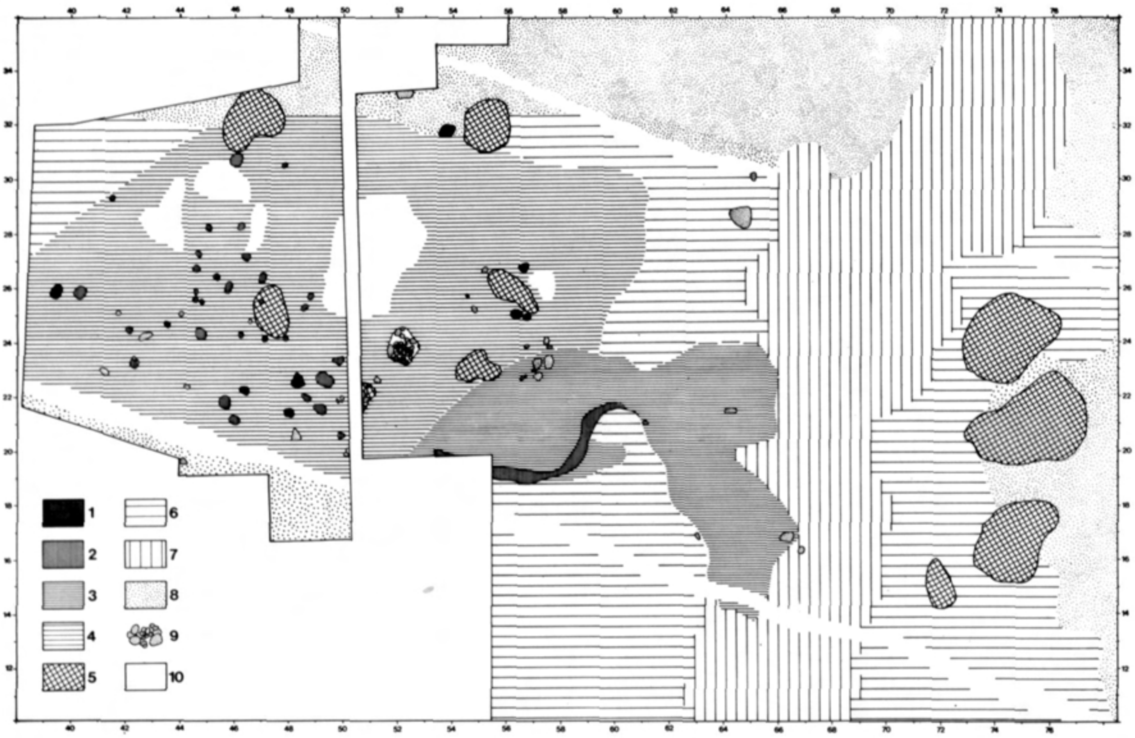


Fig. 2. Plan of the Mosegården settlement site. 1. postholes deeper than 15 cm. 2. postholes and foundation trench less than 15 cm deep. 3. black cultural deposit. 4. reddish-brown cultural deposit. 5. pits. 6. old land surface. 7. natural depression. 8. areas with old land surface destroyed. 9. fireplace. 10. disturbances. Scale along edges is in metres.

area to the south may a part have been cut away and unless the site was very elongated in that direction, only minor portions have been removed. It should also be added that the barrow fill did not contain any cultural material, nor was there material to be found on the surface of the field indicating serious disturbance from ploughing. We will then hold it to be true that the site was never substantially larger than the area shown by the excavation.

Turning to the distribution of flints and pottery we find that it follows the outline given by soil colouration fairly closely (fig. 4 and 7). Only to the east there is a scatter of flint and pottery onto the old surface, indicating activities spreading out beyond the central part of the settlement site.

Allowing for a missing part of the settlement to the south, its central part marked by soil colouration can hardly have been larger than 400 m^2, and including extensions due to marginal activity areas the size of the complete site could not have been more than 5-600 m^2.

Site description

The most prominent feature of the site was a fireplace consisting of a single layer of stones packed in red-burnt, heavy clay. It measured 1.0 - 1.2 m across. In an area immediately to the west of the fireplace the soil was somewhat darker due to charcoal colouration than anywhere else in its vicinity.

During excavation of the cultural deposit it was not possible to distinguish other structures

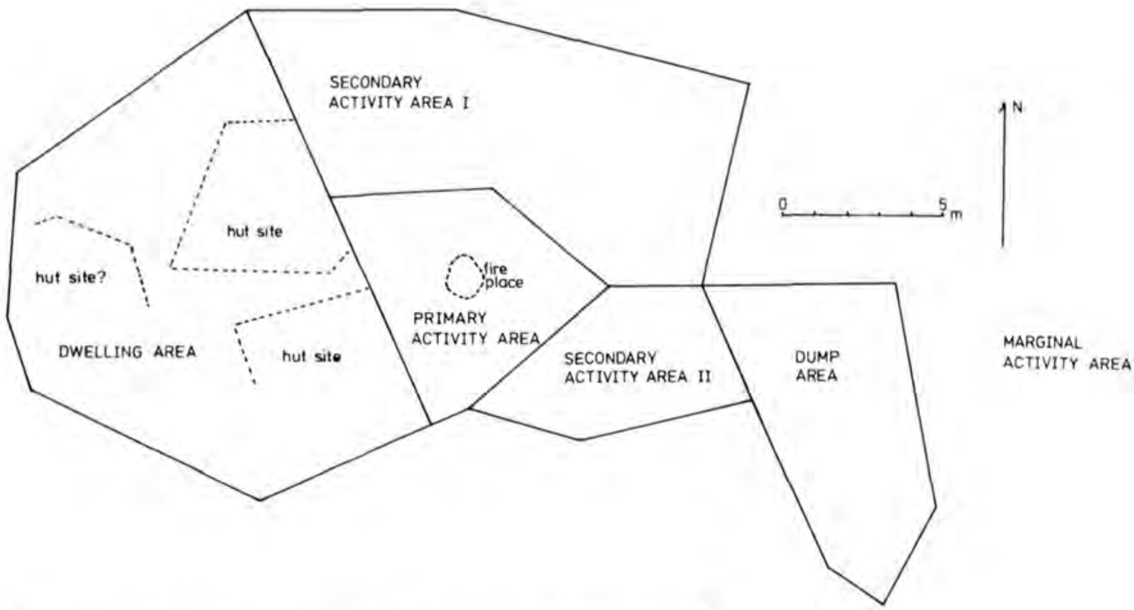


Fig. 3. Suggestion for a division of the Mosegården site into activity areas.

than the fireplace. However, when the site was stripped to the subsoil a series of features became visible:

– Three wide and very shallow pits to the east, south and west of the fireplace. No clear purpose can be attached to these.

– Three 30 cm deep pits in the north and northeastern part of the site. Adjacent to each of these pits were some very clear postholes, three were associated with one of them and one at each of the others. Undoubtedly these pits in combination with some sort of rack had a functional purpose, but it is not possible at this time to make any convincing suggestions regarding their actual use.

– A scatter of 34 small pits with measures ranging from 10 to 50 cm across and from 5 to 29 cm in depth, were all located west of the fireplace, where they formed two main clusters with some western outliers. Many of these pits were definitely postholes and most of them might represent at least the bottom of postholes, their upper portions being unrecognized in the cultural deposit. It seems justifiable to regard the two separate clusters as indications of two hut sites with a possible third one beyond them to the west.

– A slightly "S" bent, 8-9 m long shallow trench made up the southern boundary of part of the black cultural deposit. The trench very probably represents the foundation for a fence, but it remains uncertain whether this was just a windbreak or it had a more important function.

– In the easternmost outskirts of the site 4 pits were found. Three of these were only 10-40 cm deep, but the fourth had a depth of 172 cm, cutting through a local deposit of clay in the sandy soil. The pit had evidently been dug for clay extraction, although the quality of the clay was not good enough for pottery production. The other three pits may merely have been testpits for finding a suitable place to extract the clay.

Using the different features revealed during excavation, the different colouration of the cultural deposits and the general distribution of artefacts, the following division of the site may be suggested (fig. 3):

Dwelling area. The area contains 85% of all conceivable postholes on the site. The above mentioned two separate clusters of holes may be seen as indications of two huts with a third one more uncertain.

Primary activity area. This is the area of the fireplace and its immediate surroundings. It contains the highest density of pottery and a relatively high density of waste flints.

Secondary activity area I. This area to the northeast of the fireplace is almost devoid of cultural material although the colour of the soil clearly shows it to be part of the site. We also find the three pits with adjacent deep postholes in this area.

Secondary activity area II. This area is characterized by the black colour of the deposit and by its clearcut boundary to the south made up by the "S" bend foundation trench.

Dump area. This elongated narrow area contains a 40 cm thick black cultural deposit (twice as thick as anywhere else on the site) filled into a natural depression in the ground. It contains many pieces of pottery, waste flint and tools.

Marginal activity area. The area to the east around the four clay extraction pits may be termed marginal activity area. A small amount of flint and pottery was also found here.

Site size and dwelling type

With its estimated 5-600 m^2 area the site of Mosegården is definitely, what one must term, a small site. Likewise the two clusters of postholes must stem from rather small dwellings which could only have accommodated a few people. Unfortunately, the postholes do not indicate clearly whether we are dealing with rectangular or circular structures. Along the southern part of the northern cluster it is possible to fit a straight line through six of the postholes. More convincing, however, one may also fit a circle with a diameter of 5 m through 10 postholes in the northern cluster, and the four western outliers fit a circle of the same diameter. For the southern cluster nothing definite can be suggested.

Regardless of the form of the dwellings we may estimate a size of approximately 20 m^2 for each hut from the distribution of postholes. Dependent on which method we choose for estimating the number of people in a hut we reach a figure of 4-7 persons (Naroll 1962; Cook 1972; Casselberry 1975), and dependent on whether we accept two or three huts on the site, we end up with a total site population between 8 and 21 with a mean estimate of 15.

We can merely guess on the building technique of the dwellings. Taking the size into consideration it is hardly likely that timber played any significant role. Daub, on the other hand, is bound to have been in use. This is clearly suggested by the clay extraction pit as well as by a few pieces of burnt daub.

Another very likely material is reed. It is an easily available, light building material demanding no elaborate structures to support it, and it has very good insulating properties.

As mentioned in the opening paragraph, it is not easy to find other sites with reliable Early Neolithic dwelling structures in Denmark. However, we should mention Lindebjerg (Liversage 1981), where, precisely as at Mosegården, a preserved cultural deposit was unconvered beneath a ruined megalithic tomb. A cluster of postholes indicated the position of a dwelling structure, but again it was not easy to say anything definite about the form, whether rectangular or circular, or the size, which could be anywhere between 12 and 30 m^2, depending on how one looks at the cluster of postholes. However, as the excavator stated (Liversage 1981:116) "The small size and irregular arrangement of the posts shows that it must have been a light building of a probably rather improvised character."

Another example is the hut from the very carefully excavated Muldbjerg site (Troels-

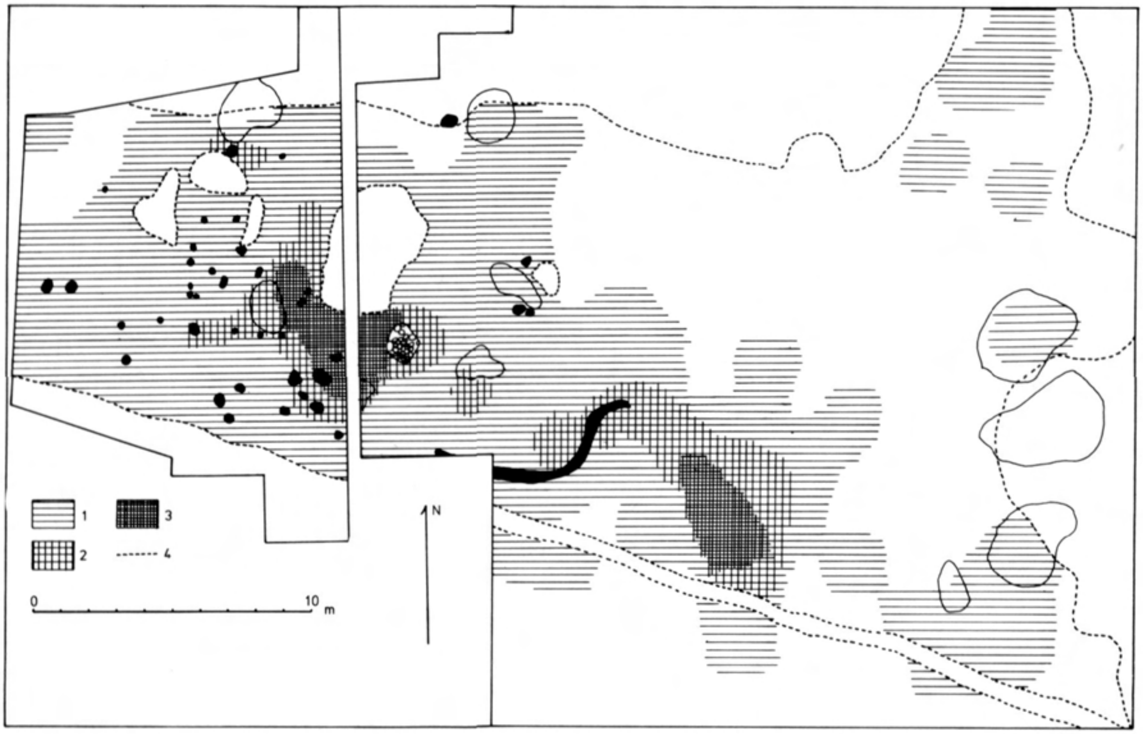


Fig. 4. A smoothed density map of pottery on the Mosegården site. 1. 0-100 g pr. m^2. 2. 100-200 g pr. m^2. 3. 200-400 g pr m^2. 4. Limit of preserved deposits.

Smith 1960). Here a rectangular 6-7 m long and 3 m wide hut was revealed, evidently built of very light materials, presumably reed.

Taking an unprejudiced view of the problem of Early Neolithic dwelling structures in Denmark we may justifiably reach to the conclusion that rather small and lightly built huts without stone foundations were in use. The reason why this has not been acknowledged earlier is partly due to the difficulties in recognizing the faint evidence of these structures and partly due to a firm belief that parallels to the vast long houses of Central Europe ought to be present in Denmark.

If small huts turn out to be the preferred form of dwellings in Early Neolithic Denmark, how then is it with site sizes? Is the small Mosegården site a unique case, or is it the rule more than the exception? This question is very difficult to answer. Often there is no reliable information concerning the size of the sites, and even if we are left to understand that a particular site is a large site, we can seldom if ever be certain that we are not dealing with a site consisting of several small, temporarily differentiated settlements.

An illuminating example is the Lindebjerg site. Early Neolithic pottery was found over a larger area, but it turned out, that there was a clear stylistic separation between different parts of that area indicating temporal difference in the deposits (Liversage 1981:129). The same may be true with other sites mentioned in the literature, but unfortunately the problem is hardly ever commented upon, nor is the information for their elucidation made available. Today, then, we do not know if small site sizes were more the rule than the exception, but we may bring forward two newly excavated Early Neolithic sites in eastern Jutland in support of

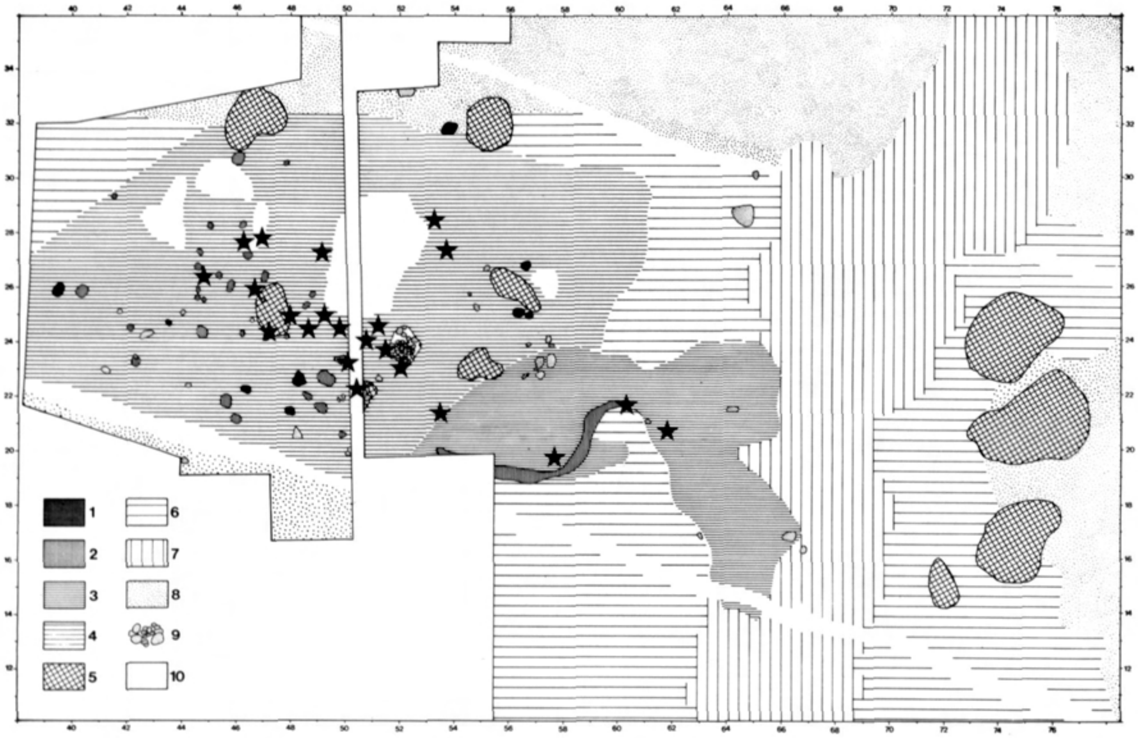


Fig. 5. Distribution of the more well preserved pots on the Mosegården site. The legend for the plan corresponds with fig. 2.

the proposition, that the small size of the Mosegården site is not a unique case. These are the sites of Mosegård Skovmølle and Langballe, both of which had a stylistically homogeneous pottery (Madsen & Petersen in press). The distribution of flints on the surface of these partly plough-disturbed sites indicated that both of them covered less than a 1000 m².

To conclude this chapter we will propose that the Mosegården site is very likely to be a typical Early Neolithic site, with regard to its size of approximately 500 m², its small, lightly built dwellings without stone foundations and to its mean population estimate of 15.

Pottery use and breakage patterns

A fair amount of pottery was found on the site and this was predominantly situated in two discrete areas. One concentration was located in the dump area, the other in the primary activity area west of the fireplace (fig. 4). The distribution of single pots isolated by the presence of at least 10 sherds and a standard deviation of less than 4 m on the scatter of the sherds, shows a slightly different pattern (fig. 5). We find a clear concentration of pots west of the fireplace extending well into the dwelling area, a few pots in the secondary activity area and only one in the dump area (even though the general distribution of pottery showed a marked concentration there).

It will be assumed that the means of the scatter of sherds from single pots given in fig. 5 shows the approximate location of breakage. By this method we find it clearly indicated that an area to the west of the fireplace, between it and the huts, and including one of the huts, was the primary area of pot-using activities. This distribution would suggest the preparation and storage of food in this area.

The 22 pots in fig. 5, however, are only a few of the total number that must have been present on the site. From the 158 rimsherds preserved it can be established that at least 105 pots have been present. Most of these are only represented by one or a very few sherds, indicating a very complete destruction. How are we to interpret the difference of preservation between these "one-sherd-pots" and the more completely preserved ones in fig. 5?

It should be stressed that the Early Neolithic pottery is very lightly fired and that such sherds are therefore subject to relatively rapid destruction if soaked with water and then frozen. Consequently, sherds lying on the surface are liable to disintegrate within a few years. Only sherds that are trodden into the soil or otherwise buried stand any chance of survival. The main rule then is quick destruction and disintegration after breakage. However, the firing temperature in open fires may vary considerably and some centrally-placed pots in the fire may occasionally be substantially better fired than others. These will disintegrate more slowly and be better preserved than other pots. Also, those pots that were the last to be broken may be better preserved than others, provided that they were protected with covering sediments shortly after the site had been deserted. This is probably true at Mosegården where the overlying long barrow seems to have been constructed immediately after the settlement site went out of use. The 22 pots in fig. 5 can then be said to constitute a population of its own, the preservation of which, for the two above mentioned reasons, was better than for other pots.

In the other population we find at least 83 pots represented by 105 rim sherds. Of these, 69 pots have only one rim sherd, 9 have two, 3 have three and 2 have four rim sherds preserved. It is evident from these figures that there must have existed pots on the site that are no longer represented by any rim sherds. Can we make a minimum estimate of the number of missing pots? Accepting the following two restrictions it should be possible:

– After breakage the likelihood of any rim sherd being buried in the soil is the same.

– The likelihood of any buried rim sherd being destroyed is the same.

These two points amount to say that the likelihood of any rim sherd being preserved of the original number of rim sherds present after breakage is the same. Provided that the individual pots are broken into more or less the same number of rim sherds, we may state that whether nil, one, two, three or more rim sherds from the same vessel is preserved is more or less determined by a random process.

To assess the minimum number of pots we may simulate the preservation of sherds on individual pots by random generation. We have 83 pots represented by 105 rim sherds, so we start the simulation with 83 pots to which we randomly assign 105 rim sherds. We may then count how many pots in the randomly generated population which show nil, one, two and three or more rim sherds, and compare these with the number of pots represented by one, two and three or more rimsherds in the actual population.

Using the latter counts as the expected values we may asses the goodness of fit of the simulated values through an χ^2 test.

The simulation then proceeds by progressively raising the number of pots with one and each time randomly assign the 105 rim sherds anew followed by a χ^2 test. The result is a series of χ^2 test with two degrees of freedom (fig. 6).

The χ^2 values start out at a relatively high level, but drop quickly as the number of pots is raised. Gradually the curve flattens and finally it runs parallel to the horizontal axis. The simulation is not continued from there, but if it was we would have seen the curve raise slowly again and finally converge on a value of 31.8. It is only the first part of this exercise which is of interest. In fig. 6 the 2.5% level is marked by a horizontal line, and it is at this level that the curve flattens appreciably. It happens at a population of approximately 170 simulated pots. Until that point the χ^2 values stay above

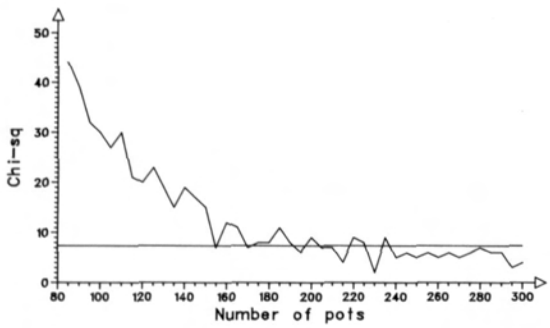


Fig. 6. Plotting of χ^2 values against number of pots from the comparisons between simulated and actual numbers of rim sherds pr. pot.

the 2.5% level, indicating that we should not expect less than 170 pots to have been present. To this we have to add the 22 pots that we initially subtracted. This gives us a total of 192 pots as our estimated minimum number. It is worth mentioning that the actual number may have been much larger, but we have no way of knowing how much.

Broken pots and the duration of site occupancy

One question that is always very difficult to solve in archaeological contexts is how long a site is occupied. Most estimates are based on ideas of how a site functioned in relation to the exploitation patterns of resources. Unsatisfying as this may be it nevertheless provides the best procedure in many cases.
However, if it is possible it is certainly preferable that the duration of occupancy is estimated directly from evidence on the site itself. If the site is well preserved, one way of doing this is to look at the amount of broken pottery on the site.

To estimate the duration of occupancy from broken pots we need information on four variables:
– the number of households at the site
– the number of pots that a household used in its everyday life
– the breakage rate of the pottery
– the number of pots broken during the occupancy
It is evident that exact numbers cannot be attached to these variables from the archaeological record alone. A fair amount of qualified guesswork as well as information taken from ethnography is needed.

As shown above there were possibly two or three dwellings at Mosegården, but this does not necessarily mean that the number of households was two or three. We should note that the distribution pattern of the more complete pots (fig. 5) included one of the dwellings, but excluded the others. Although this could indicate temporal differences between the dwellings, a more likely explanation is one of functional differences where pottery was only stored/used in one of the dwellings. This difference could, for instance, be a result of a division by sex in the dwelling pattern or that one of the huts was only a storage hut. The discrete complete pot distribution would suggest, however, that only one household was present at the site.

The number of pots that a household possessed can be expected to vary considerably in relation to the size of the household, and the importance of pottery as a utility product in the society. From ethno-archaeological sources we find variations from approximately 15 pots on the average in one society with a small household size but with frequent use of pottery (DeBoer & Lathrap 1979), to approximately 60 pots on the average in a society with relative large households and a very frequent use of pottery (Foster 1960).
It was suggested above that approximately 15 people inhabited the Mosegården site, which would mean a relatively large household. Furthermore, it is generally agreed upon that pottery is a very important utility product in the Early Neolithic. It seems reasonable then to assume that a household like the one at Mosegården possessed a large number of pots. We do this to ensure that the estimate can be regarded as a minimum estimate.

The breakage rate is mainly tied to three factors (Foster 1960:608). One is the strength of the pottery: whether it is a durable ware fired at high temperatures or a soft, easily breakable ware fired at low temperatures. The second is the use of pottery: there is a big difference between pots used for drinking, especially alcohol, and those for eating or for storing. Pots used for the former purpose have a very short existence, whereas storage pots may last for many years. The third factor is the mode of use combined with the cause of breakage: if the pots are used at ground level they are more likely to break than if they are used at a table or other kind of raised surface. Furthermore, if pots are used at ground level it is of crucial importance whether domestic animals are allowed to move freely in the same area where the pots are used.

It is certainly the breakage rate that has the greatest influence on the amount of pottery we find. In ethno-archaeological studies we find it to vary considerably from society to society. Among the Fulani of North Cameroon the median age of a pot is 5.4 years (David 1971; David & Hennig 1972), while among the Shipibo-Conibo of Peru it is only 0.8 years (DeBoer & Lathrap 1979). At Mosegården we may clearly expect a very high breakage rate. The pottery is of a lightly fired, easily breakable quality. Furthermore, we may be confident that most use took place at ground level, and we have no reason to believe that domestic animals did not roam freely on the settlement site. In some aspects the situation must be very much like the one we find among the Shipibo-Conibo, not least with regard to the strength of pottery. In both cases we are dealing with coiled pots fired in open fires. An important difference may, however, be the significance of domestic animals. Among the Shipibo-Conibo they are unimportant, whereas we know that both cattle, pigs and sheep/goats were present int the Danish Early Neolithic and pigs especially may have been numerous (Madsen 1982). In consequence the breakage rate has probably been higher at Mosegården than among the Shipibo-Conibo's. It should be realistic then to put the median age of pots as low as 0.5 years.

We may now try to estimate the minimun duration of occupancy from the above figures. The minimum number of pots was set to 192. With 80 pots in one household and with a median age of pots of 0.5 years we get an estimate of 2.4 years for the minimum duration of occupancy. It is very likely that the actual duration was longer, but how much longer is difficult to estimate. However, it should be noted that the strict organization we observe on the site would probably not have been present if the site had been occupied for many years. Some kind of reorganization would likely have taken place over time, which would blur our distinct picture of order. The Mosegården site is clearly a short term site and we doubt very much if it could have been occupied for more than perhaps ten years. In conclusion we may suggest that the duration of occupancy was somewhere between three and ten years.

Flint waste and -tools

Compared with the amount of pottery found at the Mosegården site, the number of tools and waste flints found was surprisingly small. Only some 850 pieces of waste and 83 flint tools were found *in situ*. The reason for this disproportion should probably be seen in the good conditions for preservation of pottery in relation to what is normally the case. The density (fig. 7) of waste flint taken by itself is, however, very low if we take into consideration that the duration of occupancy is at least two and a half years. An explanation for this may be that not all flint working took place on the site.

Turning to the distribution pattern of the waste flint we find a couple of notable concentrations when seen in relation to the average density (fig. 7). One concentration is located in the dump area and another is found in a semicircle west of the fireplace. The latter concentration is especially interesting as it probably marks an activity area in connection with the fireplace where people sat working.

Approximately 30% of the flint tools are scra-

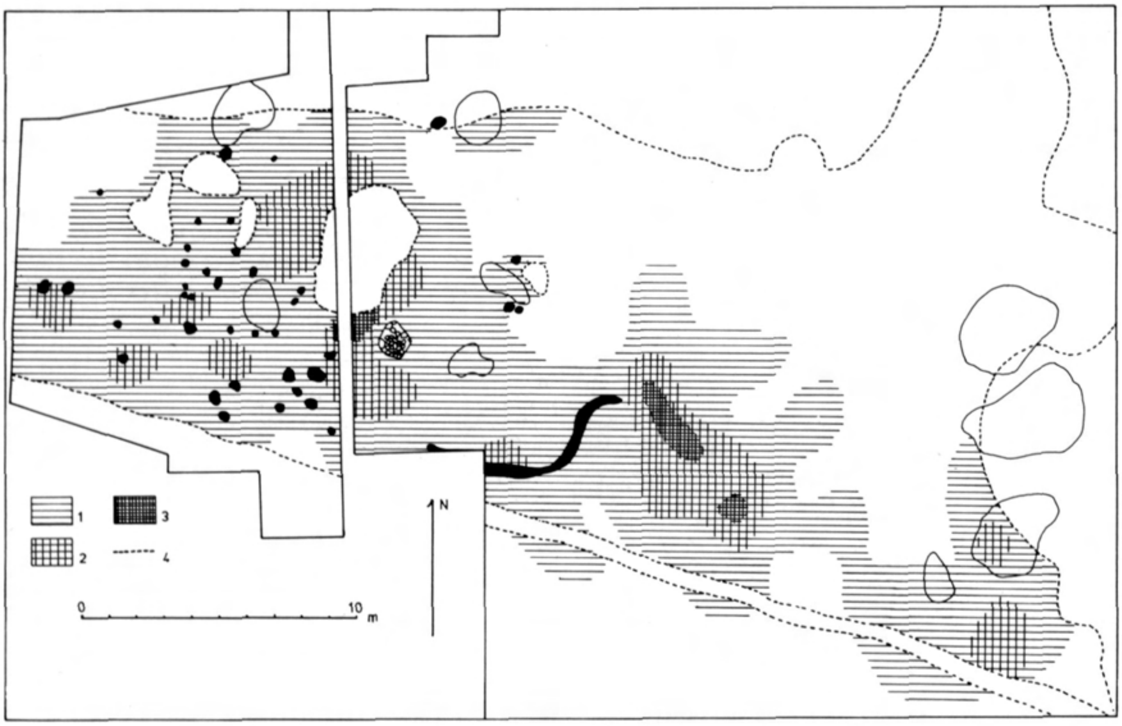


Fig. 7. A smoothed density map of flint debris on the Mosegården site. 1, 0-3 pieces pr. m². 2. 3-6 pieces pr. m². 3. 6-9 pieces pr. m². 4. Limit of preserved deposits.

pers. Another 30% is made up of a rather heterogeneous group of knives with various forms of backing and retouch in the distal end. A third very important group, comprising approximately 20% of the tools, is constituted of some very finely denticulated pieces. A last regular group of approximately 10% is made up of awls.

A functional analysis of scrapers and denticulates

A reconstruction of the subsistence and task performances that took place at the site of Mosegården naturally involves a detailed analysis of the lithic inventory. Besides the evidence given by morphological and locational studies, an important body of information can be extracted from the stone implements by means of use-wear analysis.

In the following a few results of the functional analysis of tools from Mosegården will be presented. The present study has concentrated on scrapers and denticulates. Obviously this presentation is given only as an example of the interpretative potential of use-wear, while more general statements about the range of activities at the site as represented by the flint artefacts must wait until the total amount of tools and debitage have been examined.

The wear study follows the method presented by Keeley (1980) and the interpretations of the microwear are furthermore based on one of the authors (H.J.J.) own observations on more than 100 experimentally used tools, made from local Danish flint. The analysis was carried out by means of a reflected light microscope, type Olympus BHM, at magnifications between 100 and 400 x.

A total of 34 scrapers were found at Mosegården. For various reasons 11 of these were

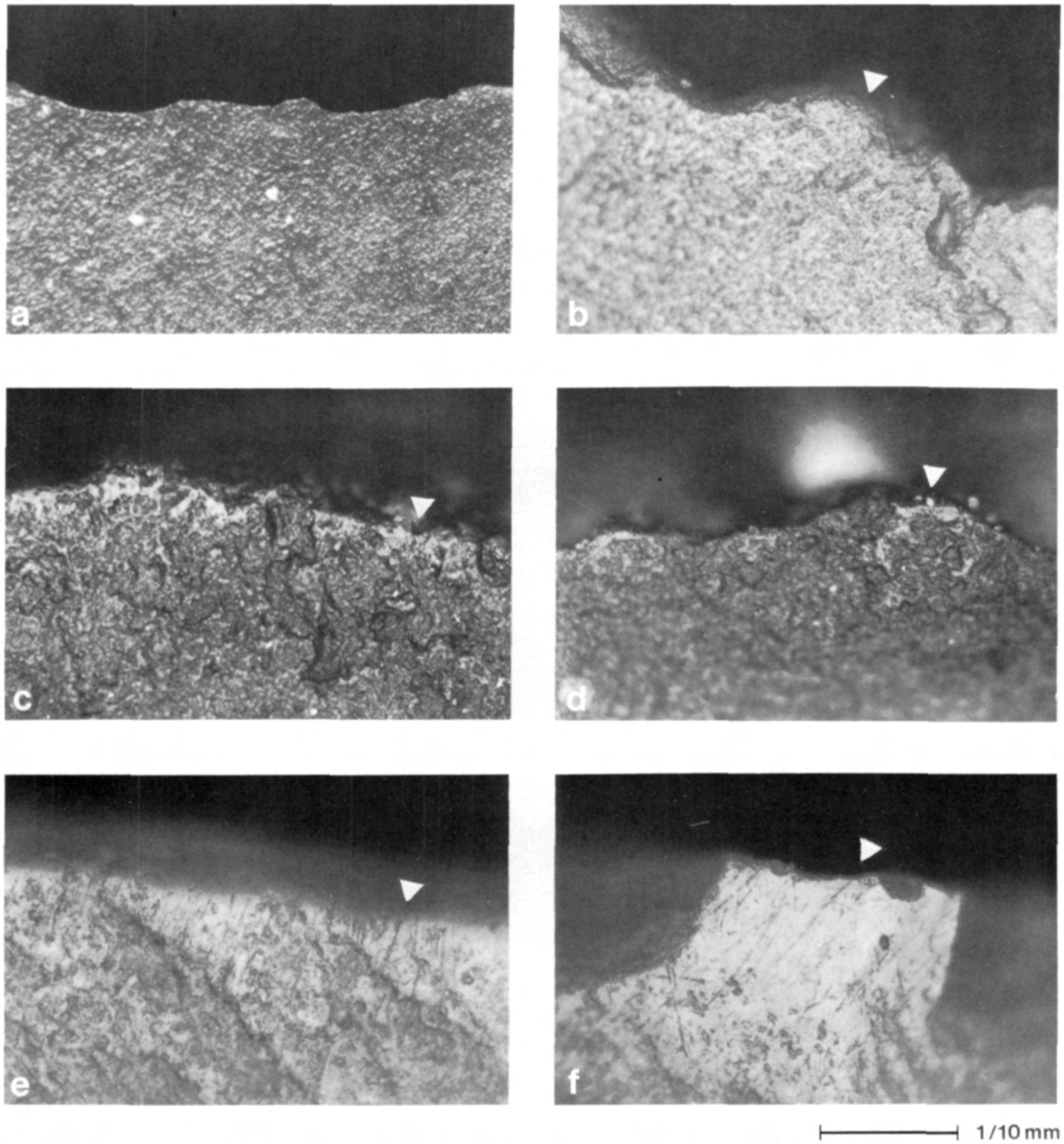


Fig. 8. Micrographs of flint tools.
a. Fresh tool edge, showing the dark, uneven surface typical of unused flint.
b. Edge of a scraper from Mosegården (2052 KH). Note the matte polish and the rounding of the very edge (arrow), caused by the working of hide.
c. Edge of an experimental scraper used on wood. The bright and smooth polish which has developed on the elevated parts of the micro-topographic surface stands in contrast to the original dark structure of the flint (arrow).
d. Wood polish at the edge of a Mosegården scraper (arrow) (2052 SV).
e and f. Edge of a denticulated piece used for plant working (2052 OD). Note the bright and reflective surface and the striations, that indicate the direction of use (arrows).

excluded from the analysis: due to natural or mechanical action 9 pieces showed a shiny lustrous surface which covered possible work polishes, and two scrapers were made on a white chalky flint that turned out to be too reflective in the microscope. The results of the analysis of the remaining 23 pieces are as follows:

Hide (fresh)	4
Hide (dry)	7
Wood	7
"Hard material"	2
no wear traces	3
total	23

As shown in the table, three scrapers were not utilized, while the rest showed more or less well developed wear along the retouched edge. In all instances the polish and the striations were oriented perpendicular to the front indicating a scraping or planing movement of the tool.

Eleven pieces were used for hide working (fig. 8b). With the exception of 4, the polish was interpreted as coming from dry hide, suggesting that these implements functioned mainly in the secondary or "currying" part of the hide processing.

Seven scrapers showed traces of wood working (fig. 8c and d). As for the last two pieces the function was classified as scraping of "hard material", since it could not be decided whether the polish was caused by the working of dry wood, bone or antler.

Although the sample is small there seem to be some differences in edge angle and edge thickness between hide scrapers and wood working tools. The edge thickness only considers the first 5 mm of the front. Measures are taken at two points along the edge, *i.e.* at 1/3 and 2/3 down the length of the retouch. The final edge value constitutes an average of the two figures attained. In general the edges of hide scrapers tend to be more acute than do the wood working scrapers. The mean edge angle on hide scrapers is 57.5° and the mean thickness of the edge is 5.5 mm, while the mean edge angle and edge thickness on wood scrapers are 66,7° and 7 mm respectively. This correlation between edge and function has been observed on other samples of neolithic flake scrapers. The relationship is even more pronounced on scrapers from the Middle Neolithic site of Sarup (Andersen 1981), where all the analysed hide scrapers were flat or thin edged while scrapers with thick edges primarily were found to be wood working tools (Jeppesen in press). In this case the author only used the measure of thickness of the retouched front, but in most instances it is reasonable to consider the two kinds of measures - *i.e.* edge angle and edge thickness, as supplementary.

The denticulates constitute another important tool group at the site. The type is made on more or less irregular flakes often with one concave lateral edge, which has been given a saw-like denticulation, formed by numerous small, closely spaced notches.

Of the 15 pieces found at the site only 9 showed traces of wear. In all cases the polish was created by the working of highly siliceous plant material. Although the polish was so well developed that in most instances it could be detected with the naked eye, it did not extend far back on the surface of the piece but was confined to the first 1½-2 mm of the very edge. The direction of the polish, as well as that of the striations, was oriented perpendicular or at high angles to the edge indicating a scraping, splitting of shaving movement. The striations and the most heavily developed wear were found at the ventral face of the tools which must have constituted the leading side (fig. 8 e and f). In all cases the polish was restricted to a short section of the edge line - between 0.5 and 1.6 mm, and it is reasonable to assume that these measurements constitute the width of the material worked.

Although the number of analysed pieces is limited, a few interesting conclusions can be drawn from the study of the Mosegården flints.

The first observation concerns the role of denticulates. This tool type seems to be very common at many Early Neolithic sites in Denmark and in the Fuchsberg phase at the beginning of the Middle Neolithic (Liversage 1981:140; Madsen 1978:173; Skaarup 1975:63 and 138). Since quite a number of denticulated pieces show distinct traces of gloss along the notched edge, they have traditionally been classified as "sickles" and taken as evidence of the growing and harvesting of cereals (Skaarup 1975:63, 138 and 201). Now, use-wear analysis of the Mosegården pieces suggests that these tools were used for *processing* some kind of siliceous plant material - possibly for matting, basket making or hut building. The functional interpretation of the type as a cutting tool, employed in a harvesting agrarian activity, therefore has to be revised.

The second observation is related to the function of the scrapers. The range of materials worked seems to conform to the use-pattern otherwise found on Danish scrapers, with hide and wood being the most common causes of wear. However, the ratio between the two materials is not the same from one site and time to the other. Thus observations on 122 scrapers found in a single ditch at the Middle Neolithic site of Sarup showed a different distribution with wood-working scrapers being by far the most dominant functional type (84%), while traces of hide working were found on only 14% of the scrapers (Jeppesen in press). Likewise, analyses of samples or total collections of scrapers from a series of Danish mesolithic sites show significant differences in the hide/wood ratio from one site to the other (Juel Jensen 1981, 1982a and b; Rasmussen 1981).

If we turn to the distribution of the scrapers and denticulates at the Mosegården site with reference to their use, we apparently do not find significant trends in the distribution of the different use-wear types (fig. 9). There is, however, one remarkable observation to be made. Almost all of the unused pieces are found in or around the dump area, where there are only a few pieces with use-wear. It is hard to give any satisfying explanation to the phenomena, but it clearly indicates that there is a real functional difference between the black and the reddish-brown coloured cultural deposits.

From site to site catchment area

We now have a detailed picture of the Mosegården site. We know its size, its approximate number of occupants and its organization into different functional areas. We have a fair idea of the duration of its occupancy and we know some of the activities taking place on the site. None of this information, however, has helped us directly to any understanding concerning the exploitation pattern of the surrounding land. If bones and other organic materials had been preserved we would have had some clues to the subsistence activities taking place from the site, but it is doubtful whether that alone would give us any significant knowledge beyond what we could safely assume anyhow. A few kernel impressions in the pottery suggest grain growing and data from other Early Neolithic sites suggest that we may expect the presence of domestic pig, cattle and sheep/goat as well as wild animals, but nowhere is information available to show the relative importance of these factors.

Important insights relating to the land use patterns could have been derived from a local pollen diagram directly correlated with the site, but such a pollen diagram has not been obtained and, in fact, no such diagram has so far been published from any Early Neolithic site in Denmark. Isolated pollen samples from the buried land surface beneath the barrow could have been even more profitable, but samples were not obtained and, apart from a partially unsuccessful attempt at Lindebjerg (Liversage 1981:144), this sort of pollen investigation has not been carried out in relation to neolithic sites in Denmark.

A third possibility is a site catchment analysis (Vita-Finzi & Higgs 1970). This type of analysis is not basically dependent on excavations of a given site, but only on the resources surrounding it and the distance to these, combined with a notion of the basic type of economy involved (Vita-Finzi & Higgs 1970; Higgs & Vita-Finzi 1972). The underlying premise is that man acts rationally in his exploitation of the surrounding resources. This means that the total exploitation

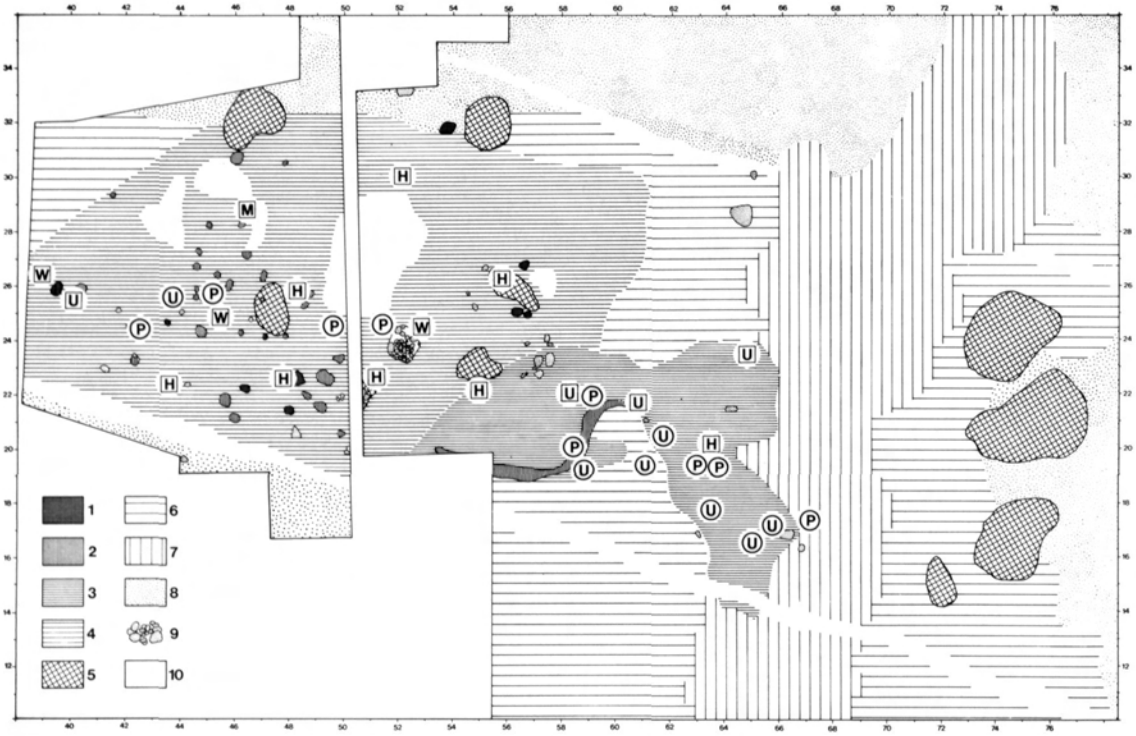


Fig. 9. Distribution of scrapers (rectangles) and denticulates (circles) on the Mosegården site with their functional categories marked: H. hide. P. plant. M. missing observation. U. unused. W. wood. The legend for the plan corresponds with fig. 2.

of available resources from a site will be optimized under the limitation of the current technology, the basic type of economy and the distance factor from site to resources.

Site catchment analysis in its traditional form, however, cannot be accepted. A main problem is the assumed rationality of man. Indeed, in a general way we may say that man acts rationally if we thereby mean that he acts from some kind of motivation, but it is incorrect to assume that he always should be rational in the sense that he optimizes or maximizes the exploitation of his surroundings. It would be far more correct to say that man acts economically (Madsen 1982), which is an entirely different matter, for such a strategy would often result in minimization of exploitation and in underproduction (Sahlins 1972: 41-99).

A very critical review of the method of site catchment analysis has been given by Hodder & Orton (1976:229-236) and their discussion gives a very convincing argument against the use of site catchment analysis in the way suggested by Vita-Finzi and Higgs, that is as a means to determine land use patterns for individual sites.

Without organic materials preserved on the Mosegården site, without pollen analysis and with the weaknesses of site catchment analysis recognized, there is no direct way to reconstruct the land use pattern connected with Mosegården. If, however, we accept that man acts rationally in the sense that he is making motivated choices, and that his choice of settlement site location - implicitly or explicitly - generally leads him to settle in the vicinity of those resources which he exploits, then by investigating a larger number of sites within a limited area we may on a statistical basis be able to point to those resources, which were of importance in the land use system. We would then be making a "top-down" solution to the problem. That is, we should start out with a reconstruction of the complete settlement system and only later try to assign a role in this system to the individual sites.

Recently, one of us (Madsen 1982) undertook an analysis of the whole of the *Tragtbaegerkultur* (TBK) in a 1600 km^2 large area of Eastern Jutland within which the Mosegården site is situated. A total of 43 settlement sites and 204 graves, mostly megalithic tombs, could be assigned to the TBK. The location of these were analyzed in relation to soiltypes, coastlines, major water courses and watersheds. The reason for analyzing the graves in the same way as the settlement sites was that the monumental tombs of the TBK can be expected to have functioned as symbolic markers of rights to land. That is they can be expected to have been placed close to or directly on the most valuable land (Chapman 1981, Madsen 1982).

The results of the analyses were:

- There is a considerable concentration of graves in the coastal zone with large empty spaces and smaller local groups inland.
- There is a marked tendency for the graves to be situated close to the major watercourses and away from the watersheds.
- Both settlement sites and graves tend to be placed on more sandy soil than would be expected from a randomly distributed sample of sites.
- Both settlement sites and graves are placed in areas with a greater than average number of different soil types in the vicinity and thus are characterized by a greater than average diversity of environment.

The general conclusion was that low lying areas close to major watercourses and mainly in the coastal zone were preferred for settlement. Furthermore, a diverse environment was sought after with a slight preference for sandy soil in the actual settlement area.

A closer investigation of the 43 settlement sites suggested that three different types of sites could be isolated:

- One type, termed catching sites, included sites which are located directly on the sea or lake coast. They are typically placed immediately behind the beachline, often in connection with a low cliff face and are, when on the sea coast, accompanied by shell middens.
- The second type was termed residential sites and included sites on flat ground, often close to a watercourse, sea or lake, but not located directly on the shore.
- The third type was termed centres and consisted of huge and very rich sites placed on promontories stretching out into narrow fjords, lakes and bog areas, or between two confluent watercourses.

Of these three types, only examples of the former two could be attributed to the Early Neolithic. A total of 14 sites belong to this period and 12 of these are situated less than 3 km from the coast (fig. 1), the remaining two being far inland. Among these 12 sites we find the Mosegården site categorized as a residential site. In the following we will take a closer look at the properties of the areas surrounding these 12 sites.

We have chosen to isolate six variables. These are sandy soil, clayey soil, damp areas, coast, stream channels and sea area. We could have made a more detailed distinction between soil types than just sandy and clayey soil, but with only 12 sites in the analysis this would be to overdo things. The distinction between sandy and clayey soil was decided from the newly published soil classification sheets (Landbrugsministeriet 1978-79). The extent of the damp areas was taken from an 1:20.000 ordnance survey map drawn in the later half of the last century. This should ensure that the coverage of damp areas is as close to prehistoric conditions as is possible, as drainage programs had not yet started at any great scale when the maps were drawn. By the "coast" we mean a 50 m broad zone from the beachline inland, and by "stream channels" we mean those channels that are created at narrow passages in fjords by the tide current. Finally by the "sea" is meant what

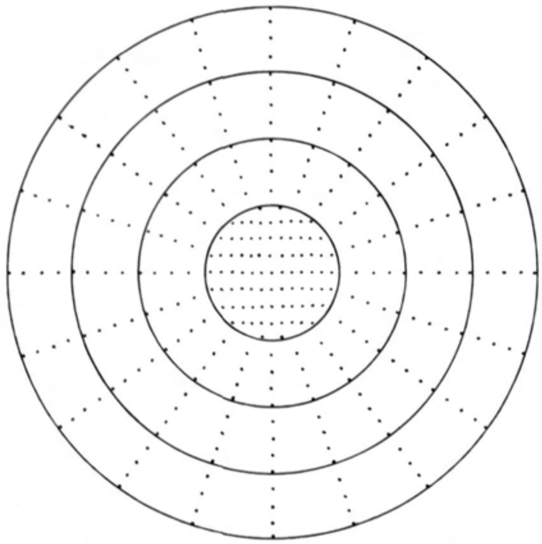


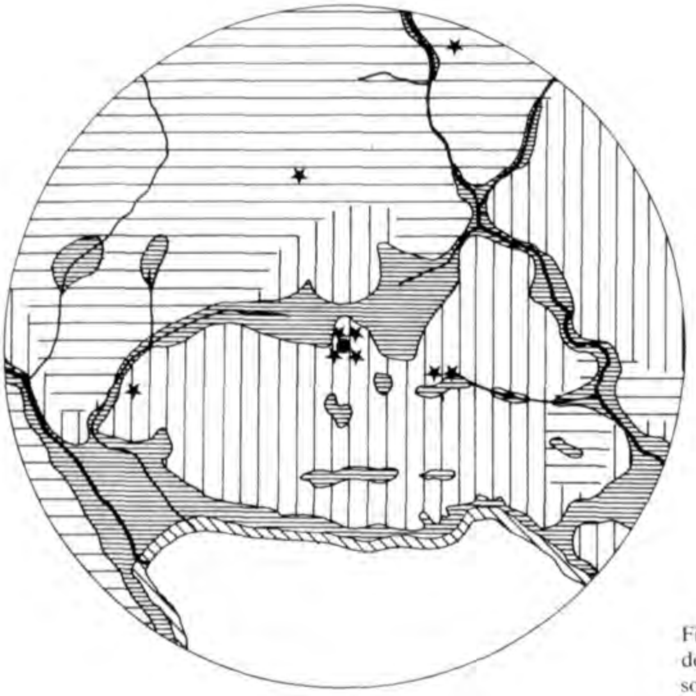
Fig. 10. Dot planimeter as used in the area analysis.

remains of salt water areas when the stream channels are deducted.

To analyse the area around a site poses many operational difficulties apart from the isolation of the variables to be used. The first and most critical point is how do we measure the variables? If, for instance, we decide to measure the variables within a radius of 2 km from the site and we do it straight forwardly by measuring the area of the variables, then the area to be found between 1.5 km and 1 km will count seven times as much as the area to be found within the first 0.5 km from the site. This is by no means reasonable. No matter where we decide to put the outer limit of our area of measurement we will have a situation where the resource areas furthest away from the site are those given the greatest importance in the analyses. A better solution is to weigh the importance of the measured areas as a function of the distance from the site. We decided to give all area within 0.5 km from the site an equal weight but from there outwards to weigh the areas progressively in such a way that their additional contribution to the overall description of the site environment is kept proportional with the growth in distance from the site. To make this operational we constructed the dot planimeter shown in fig. 10 (for the use of a dot planimeter see Monkhouse & Wilkinson 1971:75). Within a radius of 0.5 km from the centre the dots are evenly spaced (83 in all). From there on they are placed in radiating lines with 80 dots within each consecutive 0.5 km band. To do the actual measurement a map for each site (fig. 11 and 12) showing the distribution of the six variables was compiled, and a transparency of the dot planimeter was placed over the maps.

A second problem is how large an area around a site one should cover with the analysis. Is a 1 km radius sufficient or is a 5 km radius needed? It is impossible to give a simple answer to that question. In fact, the answer for the most part must be sought in the results of the analysis itself. We need, however, to set some upper limit for the analysis. In the instances where we are dealing with small settlement units we have not found it necessary to analyse areas further away than 2 km from the sites. To grade the analysis we made four different data matrices, one for each of the four areas around the site, with radii of 0.5, 1.0, 1.5 and 2.0 km. Each data matrix then consists of dot frequencies counted on the planimeter for each site separately across the six area-type variables.

A third and final problem is to find a relevant analysis to deal with the data. We have chosen the multivariate correspondence analysis (Hill 1974; Bølviken et al. 1981 and in press). This type of analysis, which operates on abundance data, is closely related to the principal component analysis (Doran & Hodson 1975: 190-197). There are, however, important differences from the latter (Bølviken et. al. 1981: 43-44). The distance concept used is the χ^2-distance instead of the Euclidean distance used in principal component analysis. Secondly the size of the units influences the direction of the principal axes. That is, a large unit with many counts on the variables, weighs heavier than a small unit with few counts. A final and most important difference is that the correspondence analysis is symmetric with regard to units and variables. We



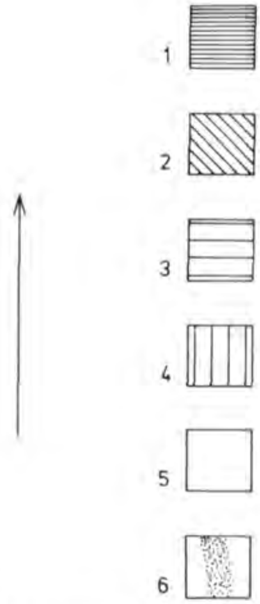


Fig. 11. Resource-type distribution at the Mosegården site. 1. damp areas, 2. coastal zone. 3. clayey soil. 4. sandy soil. 5. sea. 6. stream channels. Stars, megalithic graves.

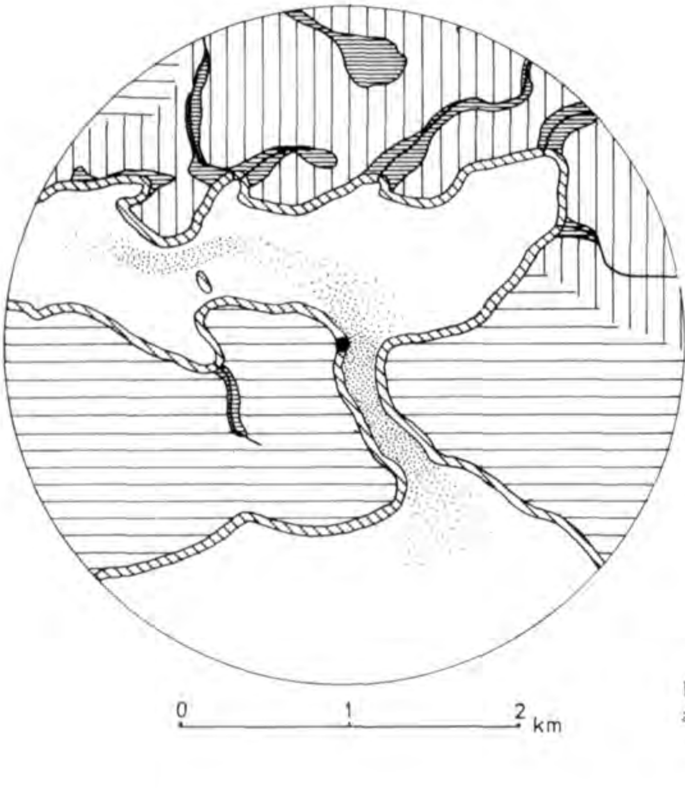


Fig. 12. Resource-type distribution at a catching site at *Stensballe Sund*. Legend as *in Fig. 11*.

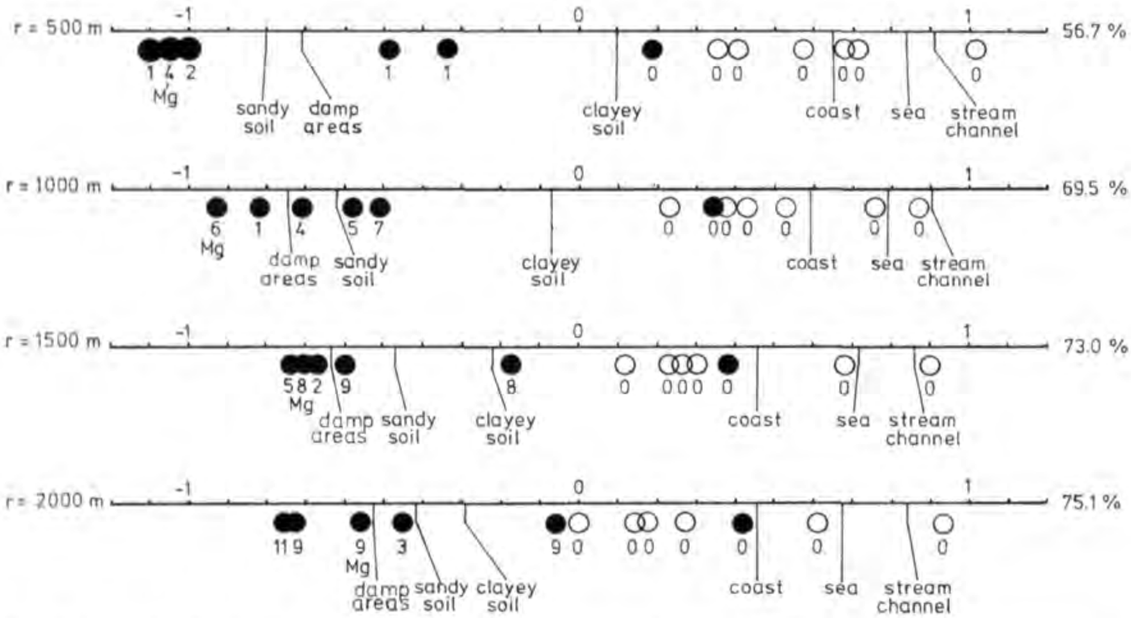


Fig. 13. A plot of each of the first principal axes from the four correspondence analyses. For further explanation see the text.

may perform the analysis so to speak with the variables as the units and the units as the variables, and the result we receive is equivalent to that defined in terms of the units as units. This means that it is possible to consider units and variables together in the reduced material in a meaningful way. The analysis establishes a sort of correspondence between units and variables and it is possible to plot both units and variables on the same axis for an immediate visual interpretation, which then can be supported by different tables with diagnostic information. The analysis was performed by a program written in GENSTAT by Erik Bølviken, Tore Schweder and Leiv Solheim at the university at Tromsø.

A correspondence analysis was performed on each of the four datamatrices mentioned above. In fig. 13 we have shown the twelve sites and six variables plotted together on the first principal axis of each of the four analyses. To the left the radius of the area analyzed is given and to the right the percentage of the total variance explained by the axis. Each site is represented as either an open circle, indicating that sea shells have been found on the site, or as a solid circle, which means that shells are missing. Beneath each site a figure gives the number of tombs located within the area analyzed. The Mosegården site is marked with an MG in the plots.

It is evident from the plots that we are dealing with two populations of sites, which are discriminated by differences in the composition of resource variables. The discrimination is very marked especially at 500 and 1000 m radii and must be accepted when considering the extremely high explanation percentage of the axes. Furthermore, it is backed by a corresponding clear separation in the number of tombs and the presence of shells on the sites.

One group which consists of five sites is characterized by damp areas and sandy soil. There are no shells on these sites and they have from 1 to 4 tombs within the 500 m radius and from 3 to 11 within the 2000 m radius. The other group, which consists of the remaining seven sites, is primarily characterized by stream channels, the sea and to a lesser degree coastlines. Shells are known from six of the sites in the latter group and none of them have tombs within the 2000 m radius.

A plot for the 1000 m area of the two first principal axes together explaining as much as 94.9% of the total variation is shown in fig. 14. That is, in fact, almost all of the variation accounted for in one plot, and it shows clearly the separation of the two groups and it also gives the relationships of the individual sites to the resource variables. To give an idea of the magnitude of the individual resource areas in relation to the two groups of sites at different distances, Table 1 has been compiled. It shows the average relative frequencies, and it emerges that those resource variables that were found to be characteristic of the two groups respectively reach their highest relative frequency closest to the sites and systematically decline as successively larger areas are taken into consideration. This indicates that the sites were placed deliberately in a position where the availability and the access to certain resource variables was optimal. For the group of seven sites which are identical with the catching sites mentioned earlier it is the stream channels, the sea and the coastline which are the crucial variables for deciding site location. For the other group identical with the residential sites mentioned it is the damp areas and the sandy soil which are the variables determining site location.

Land use patterns of the Early Neolithic farmers

An attempt to reconstruct the land use patterns of the early farmers must naturally take the palaeontological record into consideration, and from this we learn for Denmark in general two most important things. Firstly, that the forest was almost totally unaffected by the activities of the earliest farmers, and secondly, that those activities that did occur before the general "landnam" developed at the beginning of the Middle Neolithic only resulted in shortlived local cuttings that quickly regenerated into forest again. If we combine this with the detection made by Johs. Iversen, that the forest clearings of the TBK probably were part of a slash and burn system, we get an indication for the Early Neolithic as having a small scale, mobile, slash and burn economy (for details and references see Madsen 1982).

If we turn to the Mosegården site we find this indication highlighted by the evidence as outlined above. We do indeed have a small scale site with a very short duration of occupancy, which seems to fit perfectly into the pattern suggested by the palaeontological record. That is the Mosegården site must be regarded as a site from which slash and burn agriculture was practised.

This, however, can only account for part of the observed covariation among the resource variables in the correspondence analysis and also the lack of sickles among the artifacts indicates that grain growing was probably not all that important. The Mosegården site fell in a group of five sites characterized by sandy soil and damp areas. Whereas the former attribute very well may be explained by the slash and burn activities where the lighter soils may have been preferred, the latter, however, cannot be explained in this way. We ought here to remember that we are not dealing with an open countryside, but a totally forested area mostly covered by a dense and dark lime forest. Only in and around the damp areas a varied and more light open vegetation could be found. It was here that the highest natural feeding potential for animals could be found and it is most probably here that the early farmers held their livestock. This they could do without interfering much with the natural environment provided that their territory was large enough (Madsen 1982). Pigs especially, would feed well on the low damp ground, but cattle also could do well there. It should seriously be considered whether this type of land use was a much more prominent and important part of the early farming economy than was grain growing on a slash and burn basis (Madsen 1982). Despite their small number, scrapers also seem to indicate a much

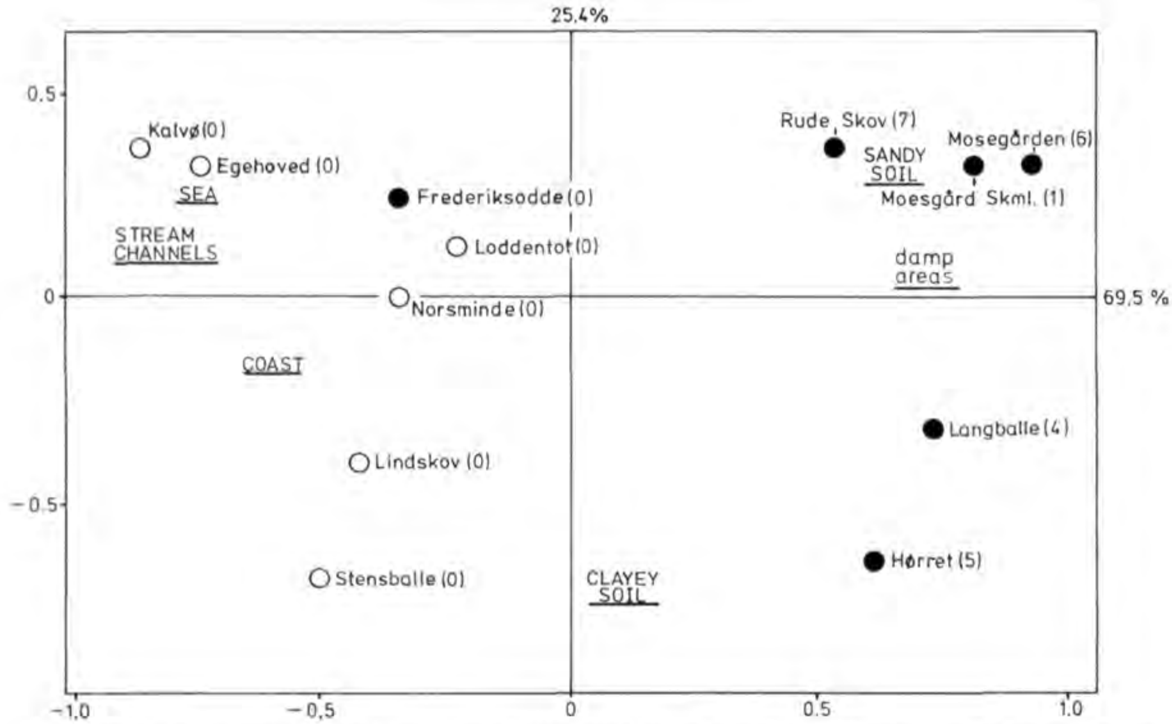


Fig. 14. A plot of the first two principal axes from the correspondence analysis of the 1000 m area. For further explanation see the text.

higher index of hide working than is the case later on during the Middle Neolithic. Whatever it may be worth statistically, this can be taken as a point in favour of a relatively high dependence on animals.

Damp areas, although not uncommon in Denmark, are a far more scarce and confined resource than sandy or clayey soil. They may, therefore, quickly have become a highly valued and sought after resource in a society dependent upon feeding domestic animals from their vegetation and the vegetation of their surrounding perimeter. Competition for such a resource could, apart from violence, be controlled by recognized symbolic markers of rights to land. The monumental tombs of the TBK may be viewed as such markers (Chapman 1981) and we find them constantly situated close to the main watercourses and hence close to the major part of the damp areas (Madsen in press). As shown above, there were many tombs in the vicinity of those sites characterized by damp areas, that is the five residential sites. Most of these tombs are probably later than the settlement sites, presumably dating from the beginning of the Middle Neolithic. They do, however, point to those specific areas, which when a growing population came under stress, would have been most highly valued resource areas, and it seems reasonable to assume that these areas from the outset were sought for.

The Mosegården site should then be seen as the base camp of a small group of people - an extended family of approximately 15 individuals. They lived in a few huts of a rather light construction, which were probably not built to last long as the site was only intended for a few years of occupancy. The land use of the inhabitants probably included two different activities. One was slash and burn agriculture on the sandy soil and the other was animal husbandry utilizing the natural resources of the forest. Low ground with damp areas was certainly of importance in that connection. It may be expected that pigs were especially raised, but cattle also may have been of notable significance. Of these two types of land use it may well turn out that the latter was the more important. Apart from the food producing activities it may also be expected that some hunting and gathering took place from the site, but we have no positive information to rely on.

It is apparent that while the site was inhabited a stable site structure continued which resulted in the orderly lay out encountered at the excavation. This probably could not have happened if the site had been inhabited for many years. Nevertheless, the amount of pottery left suggests that the duration of occupancy was at least two and a half years. So we may cautiously suggest that the site was occupied for a few years before its location shifted. This shifting of site location need not have anything to do with exhaustion of resources. The motivation for frequent shifts could be anything, but it does indicate that rather large territories were available for resettlement.

The Mosegården site itself was probably not the only site involved in the yearly circle of the inhabitants. Since Skaarup (1973) first pointed to the existence of catching sites in the TBK, it has been evident, especially for the Early Neolithic, that these sites were a permanent and important part of the early farmer's everyday life. In the analysis we could point to seven such sites all characterized by being placed in optimal positions in relation to stream channels, sea and coast, and all but one are accompanied by shell middens. It is evident that especially fishing and gathering of molluscs took place from these sites, which is also attested from excavated sites.

Optimal resource areas of this type are much more scarce than even damp areas, and we could expect that they boldly would have been marked from the outset. This, however, does not seem to have been the case. As shown in the analysis, there is a conspicuous lack of tombs in the vicinity of these sites and the resource areas they control. This could either be because the resources available there were not really valued or, much more probable, that they were regarded as communal resources. This would mean that many different groups residing in different areas would freely gather here and utilize the same resources from the same sites or from different sites nearby each other.

The inhabitants at Mosegården would then probably move at certain times of the year to selected locations along the coast, where fishing and shell gathering was optimal. They need not have moved very far. The nearest catching site we know of is only 5 km away and the nearest optimal location for a catching site may be only 3 km away. With such short distances it may have been mostly occassional visits that were made at certain times of the year. It may also have been only part of the group that moved leaving the rest to tend for the animals.

The picture drawn here of the way of life of the earliest farmers in Denmark, mainly based on the excavations at Mosegården with supplementary evidence from other sites chiefly in central eastern Jutland, is new in many aspects. It breaks completely with the idea of large village communities that has so far prevailed and stresses the importance of small residence units in the Early Neolithic which, of course, still may be part of a tribal community. The origin of the idea of large village communities from the outset of the Neolithic should partly be found in the misinterpretation of the Barkaer structures, and partly in a misapplied analogy with the Bandkeramik. We feel, however, that the archaeological evidence now very strongly supports a different interpretation, and suggestions for a new model have been given in this paper. Included in this model is also a new attitude towards the land use patterns. We would like to see the farming system as one closely adapted to the forest environment, and not as often has been the case, as a typical open land system placed in a clearing in the forest.

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TRB SETTLEMENT PATTERNS ON THE DUTCH SANDY SOILS

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The TRB (Funnel Beaker) culture reached its westernmost extension within parts of the Netherlands between 2700 and 2150 bc.
Its boundaries, unequal distribution and site location on various sandy soils within this country are the subject of this article, along with the relations and axe trade between TRB and neighbouring cultures. The argument starts with small scale maps for the overview, while successively larger scale maps[1] allow more intricate discussion. The original map scales (not those of reproduction) are given in the text. TRB settlement was on dry sandy soils, but subsequent podzolisation has left us, until now, with no house plans, very few refuse pits, and no unburnt organic remains. Research has concentrated on megalithic tombs, flat graves, the (often partial) excavation of half a dozen settlements, palynology, and, recently, the distribution of sherd finds as related to physiographic maps. This article is mainly concerned with the last issue – an empirical detection of physiographic factors which may have determined the choice of terrain by the TRB population. In combination with palynology (which has guided thinking on the Neolithic environment since the last war) such map studies will eventually lead to a detailed understanding of the landscape in TRB times. Future research should also be directed to social and economic factors, which are merely touched upon in the present study. For most sites the kilometre co-ordinates of the Dutch grid are provided in brackets to enable location on the maps.

Contents

I. *General TRB distribution, relations to neighbouring cultures and axe trade (original map scales 1:2.5 to 1.5 million)*

The distribution of remains of the Neolithic TRB culture in the Netherlands is disparate (fig. 1). The megalithic tombs, the *hunebeds,* concentrate on the Drente Plateau, where they have been legally protected since 1734, while scattered hunebeds elsewhere in the TRB area may have been demolished before their presence could have been noted. There is hardly any proof of their former presence in these areas, although they are found across the German border as far south as the river Emscher (halfway between the Ruhr and the Lippe).

Votive hoards of large flint axes imported from northern Jutland and of pots with food (in peat bogs) are also exclusively found on the Drente Plateau and Randsborg's idea (1975) that such deposits are typical of the more densely settled regions may be relevant here. Apart from very few exceptions, the findspots of TRB pottery, battle-axes, axe hoards, and hunebeds are confined to the Pleistocene sandy soils north of the rivers Emscher, Rhine, Kromme Rijn, and Oude Rijn. They are conspiciously absent from what remains of the contemporary sandy coastal barriers between Alkmaar and The Hague. In the Ruhr area the northern limit of the loamy soils is not crossed, neither were the heavy clayey soils around Münster in Westphalia (which were not colonized until Medieval times (Burrichter 1980).

The TRB distribution coincides almost perfectly with the area once covered by the glaciers of the Ice Age. Thus, almost everywhere granite and other erratic rocks were available for the making of axes, battle-axes, querns, grinding stones and small flint tools. Similarly, granite and other erratics could be crushed or burnt for pot temper, and in certain areas, there were enough megalithic boulders for the construction of hunebeds. Perhaps the lack of several of these resources in the sandy regions across the Rhine and the Maas is a reason why TRB groups did not settle there also; but this can hardly be the only reason. Obviously a major obstacle was formed by the Rhine, as erratic stones are found over a 5 to 10 km wide strip along the southern Rhine bank, from Nijmegen to the area opposite Duisburg, Germany (fig. 1d), where intensive archaeological activity has never produced any TRB finds.

In the Ruhr area limits may have been set by the loess boundary, as in this border zone TRB groups restricted themselves to the sandy islands. Perhaps this was because the TRB population "possessed the formula" for subsistence on sandy soils, but not on the more loamy soils. One may suggest differences in the appropriate methods of tillage, reclamation and weed control. It seems much less certain (though it cannot be excluded) that a local population on the loamy soils, but without interests in sandy soils, prevented TRB intruders settling on their land (Bakker 1973, p. C10). A similar argument may also be proposed for the non-occupation by TRB groups of Noord-Brabant, but unfortunately the indigenous cultures in both these regions, the Westphalian Gallery Graves or the Wartberg Group (Schwellnus 1979), and the Middle Neolithic of Limburg (Van Haaren and Modderman 1973) or "Stein culture" (Louwe Kooijmans and Verhart, in preparation), are still poorly understood. One could also argue that TRB settlement thinned considerably towards the natural boundaries described above, so that little necessity, desire, energy and impetus were left to cross them; but this also seems an over-simplification, for the Ruhr area was only reached by TRB expansion in the later phases of the culture. There are no signs of loss of momentum here: southwestern Westphalia was densely occupied by Phase E, the pottery was well made and stylistically perfect, and perhaps only in this region hunebeds were still being built at this time.

The impression that western TRB disliked loess loams should be checked carefully in the region between Osnabrück and Hanover where the densely occupied TRB area stops near the loess boundary and at the Mittelgebirge. Comparison of the distribution of stone tools of TRB type and the available soil map on a scale of 1:200,000 gave Schlüter the impression "that a TRB population without megalithic tombs had settled in the lowlands and partly also in the loess regions" (1979, p. 233). In the Uelzen area on Lüneburg Heath, Schirnig (1979) found that megalithic tombs and settlement of the Altmark TRB group did not completely avoid the *Sandloess*, especially when thin layers on sand were concerned. He used a 1:100,000 soil map. Clearly only a closer study of such situations can teach us what granular composition, hydrography and soil profile generally attracted or repelled TRB settlement.

The number of TRB sites from the Netherlands now lies between 300 and 350, if the findspots

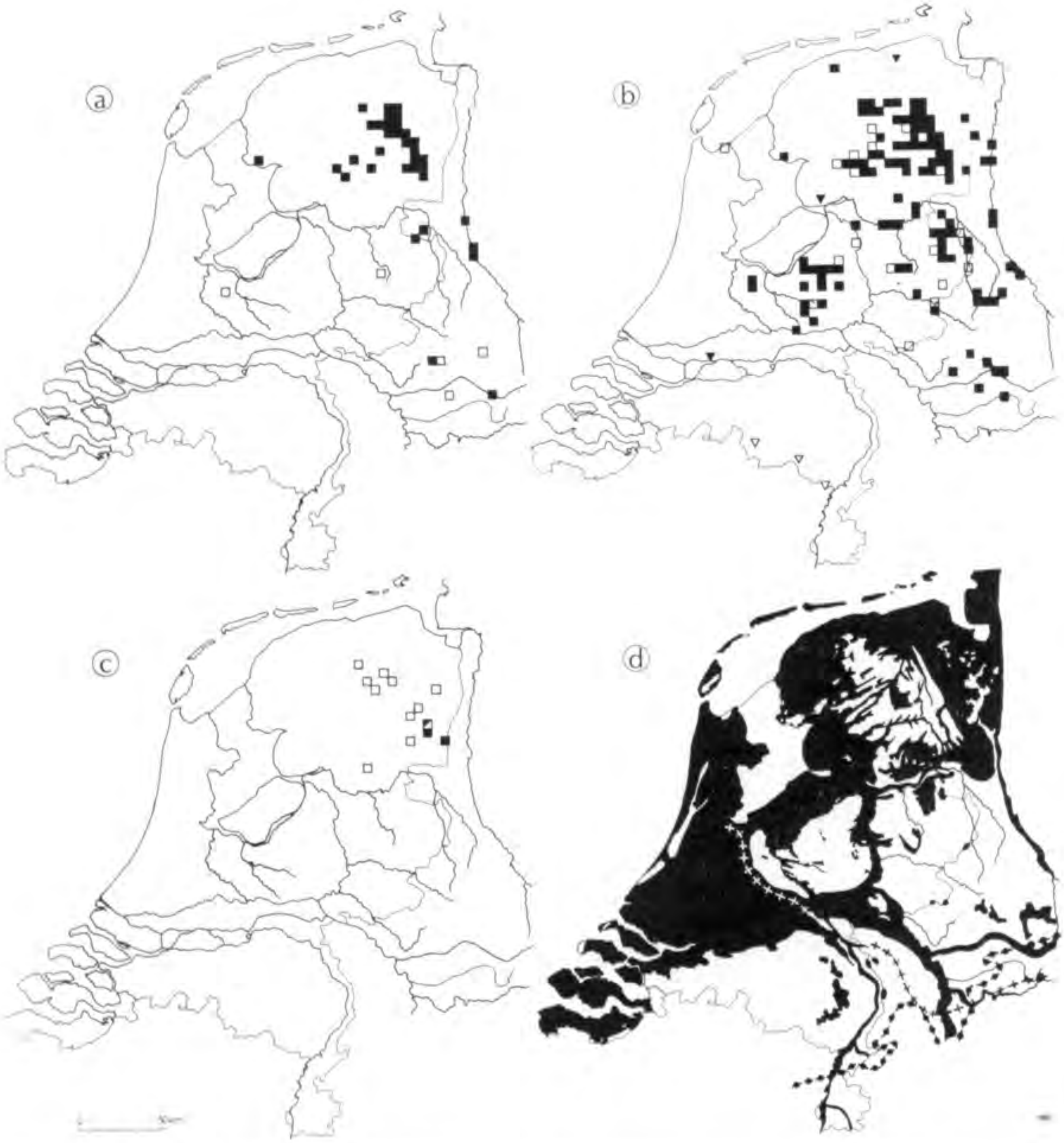


Fig. 1. TRB distribution in the Netherlands and in adjoining parts of Germany per 5 x 5 kilometre blocks of the Dutch national grid (December 1980).
(a) Hunebeds (open: uncertain).
(b) Finds of pottery (black) or battle-axes (open, but only given in blocks without pottery finds). Triangles: isolated finds outside the main TRB area.
(c) Hoards of flint axes (open) and votive deposits of pottery (black), mainly in or along peat or other wet places.
(d) Geology. Black are clays, peat bogs and other wet deposits, white the contemporary sands. The crossed line indicates the southernmost extension of the Saale/Riss glaciers, the dotline the northern limits of the loess zone.

of one or more recognisable sherds, battle-axes, graves and hoards of pottery or flint axes (but no stray finds of single flint or stone axes or trapezoidal arrowheads) are included. A preliminary survey of these sites per sheet of the 1:50,000 Dutch Ordnance Survey Map allows us to draw lines of equal density (fig. 2, left). Again the Drente Plateau is seen as an area of main concentration. If hunebeds are omitted from the picture, it would reduce the numbers in this area greatly, but the overall impression of concentration would remain.

On the other map (fig. 2, right) the sites of cultures contemporary with TRB (Vlaardingen, Stein and some flint mines) are assembled more provisionally. The contour lines are distorted at state boundaries because Belgian or Rhineland finds were omitted. Flint mines are confined to the chalk of the extreme south of the Province of Limburg; the isolated sites between this area and the continuous distribution of the Vlaardingen culture are assigned to the Stein culture. Perhaps the owners of the four knob-butted TRB battle-axes along the Belgian border (fig. 1b) also belonged to that culture, for these prestigeous implements are made from diabase (a rock type lacking there) and may be considered as TRB gifts to trade partners in the Weert region. Perhaps the knob-butted axes appealed to local tastes, for in a way they resemble the battle-axe-like deer antler sleeves of stone axlets with ring-like "knobs" at the hammer ends of the Seine-Oise-Marne culture (Bakker 1979b; cf. Mariën 1981, fig. 9).

The Vlaardingen culture. The much better known Vlaardingen culture flourished in the wet regions between Nijmegen (187/428) and the coast. Its northern limits seem to have been determined by the estuary and lagoons of the Calais IVb transgression in the present Zuiderzee/IJsselmeer basin, c. 2450 bc, and by the sand ridges of Texel, Wieringen and Western Friesland (cf. fig. 6, symbol 7). That the northernmost settlement, Zandwerven (125/521), was discovered first (1928) is only understandable in the context of the history of Dutch archaeological research.

Research since the war has shown in great detail how ably the Vlaardingen culture adapted to the different ecotypes of these "highly deterministic wetlands" (Pryor, this volume). Whereas TRB groups tempered the pottery with crushed granite and other pied erratic rock, Vlaardingen communities initially used (almost exclusively) pieces of broken white quartz which were subsequently replaced by sand and then by grog (research by Groenman-van Waateringe at Voorschoten (90/460; cf. Van Beek 1977, figs. 3-5) and by Louwe Kooijmans at Hazendonk (116/430) and elsewhere). This quartz was probably collected in the sandy regions south of the Maas, or in the middle Maas bed, since "northern" erratics are rare, or absent, among the other stones used in the settlements. The same is true for flint artefacts. All flint axes seem to have been imported from Benelux flint mines, directly or indirectly, and smaller implements were made from worn-out axes or from nodules imported from the same area.

Contacts between Vlaardingen and TRB. The borderline between TRB and Vlaardingen was strikingly sharp during the five hundred years of their proximity. It is as if Vlaardingen ventured as little into the endless primeval oak woods of the drier sandy soils as TRB did into the wetlands. Yet there are signs of contact. At both Kootwijk (182/466) and Neede (237/461) a quartz tempered Vlaardingen pot was buried intact in isolation (Neede: Bakker 1979a, fig. 63 and Louwe Kooijmans 1976a, fig. 21). On the other hand three TRB pots were recognised by their tiefstich decoration in the Vlaardingen 1b settlement on the Hazendonk (116/430; Louwe Kooijmans 1976a, fig. 23; cf. Bakker 1979a, p. 165, n. 3:10). This small isolated dune *(donk)* can hardly have housed more than one or two nuclear families. Because the TRB pots are tempered with very small fluviatile quartz pebbles instead of crushed granite they were probably made locally and one wonders if a TRB family visited this tiny and unattractive

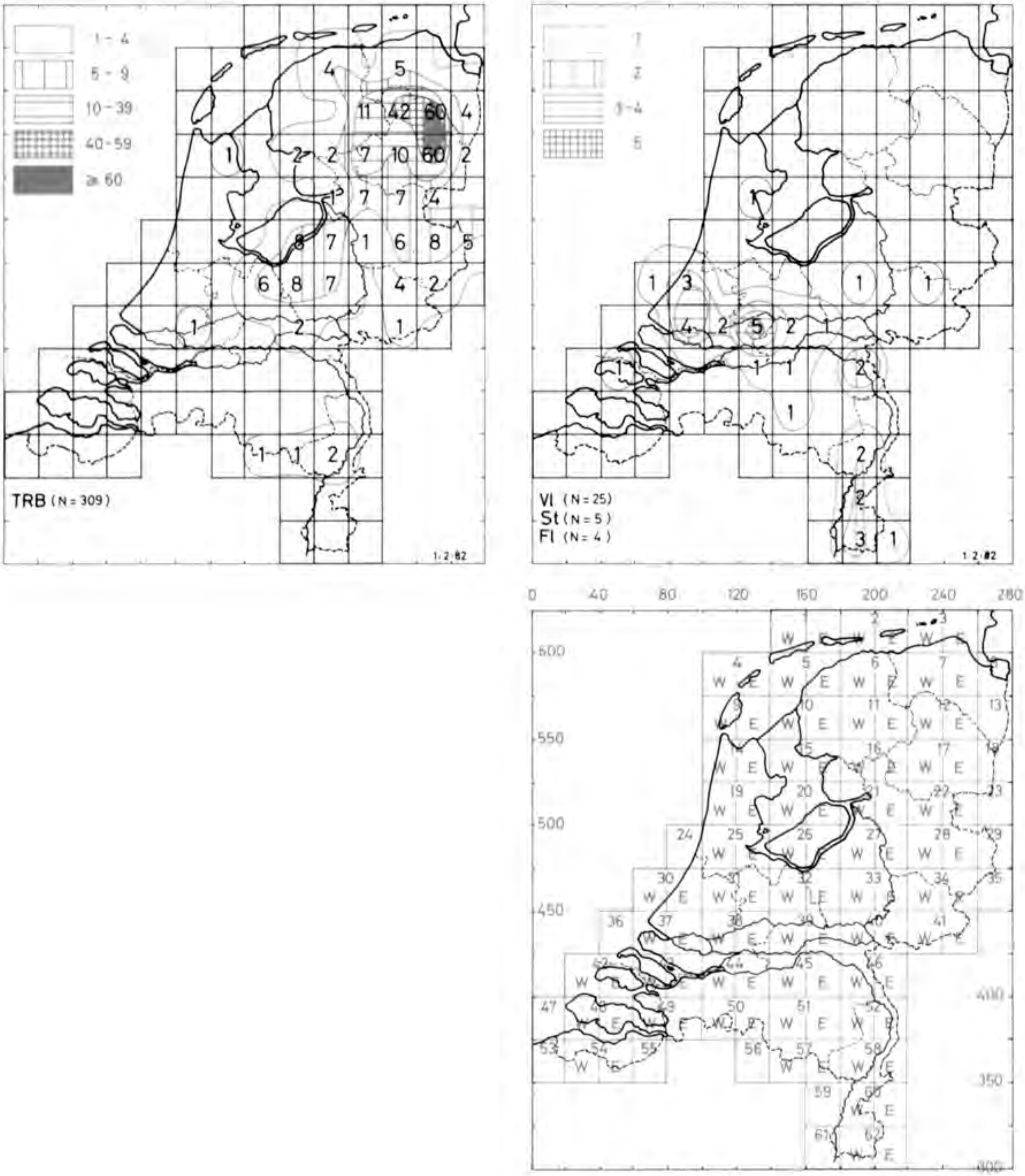


Fig. 2. *Left:* the number of known TRB sites per 1:50,000 map sheet and "lines of equal density". *Right:* the same for the sites of the Vlaardingen, Stein and SOM cultures and for flint mines, but more provisional. Finds in Germany and Belgium were omitted. *Below:* co-ordinates and sheet numbers of the Topographical Map 1:50,000.

site in the middle of the wetlands, or whether a TRB femal potter was incorporated into the Vlaardingen families; but one also wonders why she did not immediately start learning to make the normal Vlaardingen pottery.

Apart from baking-plates, true Vlaardingen pottery carried no other "decoration" than knobs and a single line of perforations below the rim. One unpublished Vlaardingen pot from Vlaardingen (81/435) with a zigzag line below the rim in a very negligent stab and drag technique may, perhaps, reflect some TRB influence.

But these were individual exceptions. Proof of more general contact is provided by the baking-plates of the Vlaardingen culture. Their dimensions, holes, perforations and decoration conform almost exactly to those of the TRB West Group and those of the North Group, where Davidsen (1973) described thousands of fragments (Van Regteren Altena et al. 1962, p. 218, fig. 12 and Bakker 1979a, p. 57-59).

Axe trade. Other evidence for continuous contact between Vlaardingen and TRB seems to be provided by the distribution map of the "Buren Type" flint axe (fig. 3). This type was previously called Vlaardingen Type (Bakker and Van Regteren Altena 1962; Bakker and Van der Waals 1973; Bakker 1979a, p. 85) because it seemed (from one complete item and numerous refashioned fragments) to be the main axe type used at Vlaardingen. The name "Vlaardingen" however, proved confusing because axes of this type were produced by Benelux flint mines roughly between 3500 and 2000 bc. Naturally they were not only used by the Vlaardingen culture – as their former name might erroneously suggest – but also by others: Michelsberg, S.O.M., Stein, Vlaardingen and TRB (along its western fringes) used it, according to closed finds and open associations. No associations with the "Jungneolithikum 2" of the Aldenhoven Plateau or with the Chassey of the Paris Basin are known, but they may be anticipated.

Fig. 3 shows the distribution of Buren axes and is probably representative of the Netherlands, the greater part of Belgium and Lower Saxony. In the latter area no typical items could be traced other than the two near the Dutch border, according to Brandt's unpublished data (personal communication Dr. K.H. Brandt). On the other hand, the map is certainly incomplete for the Rhineland (where many of Hoof's S2 and S3 axes (1970) must represent the Buren type) and France. The curious empty zone in Dutch Overijssel and eastern Gelderland may not be a coincidence as Brandt's map 22 (1967) of the much wider and more leniently defined "thin-butted flint axes with oval cross-section" shows a similar empty zone between southwestern Westphalia and a zone of concentration stretching along the northern foreland of the Mittelgebirge and the river Hase towards Drente. It is as if these fine Benelux axes remained in the first densely populated TRB area and were not traded any further. It is not easy to understand, however, why an intermediate zone remained empty in western Westphalia and eastern Overijssel. This zone was rather heavily occupied by the TRB population and there are no signs why in this particular area alone, fewer Buren axes should have reached the museums than elsewhere.

The mountain region east of the Rhine must have hampered the spread of Buren axes towards the east, but why did this not happen beyond Duisburg into Westphalia and Lower Saxony? Perhaps "real" TRB axes gave enough counter pressure there, such as the large thin- and thick-butted flint axes with rectangular cross-section imported from N. Jutland, Schleswig-Holstein and Rügen, and the small *Flint-Rechteckbeile* ubiquitously made in the boulder clay regions west of the Elbe. Similar forms made from other erratic rocks were also involved (Brandt 1967, maps 24-27). Strikingly, the large "Nordic" flint axes are exceptionally heavily concentrated on the Drente Plateau, especially in axe hoards (fig. 1c). Nowhere west of the Elbe is a similar number of hoards found (Rech 1979, map 2; information Dr. W.H. Zimmermann), notwithstanding a tradition of archaeological collecting in N.W. Germany quite as long and intensive as in the northern Netherlands. Harsema (1979) has sought to explain the Drente concentration as being due to direct, professional, trade between Drente and Jutland, but why does the distribution of such axes in Lower Saxony (Brandt, l.c.) show a gradual dispersion overland (via the three to four crossing places of the Elbe) until one reaches the Drente Plateau with its sudden increase in density? This suggests to me a "down the line" handing-on of axes from settlement to settlement, without professional traders (1976).

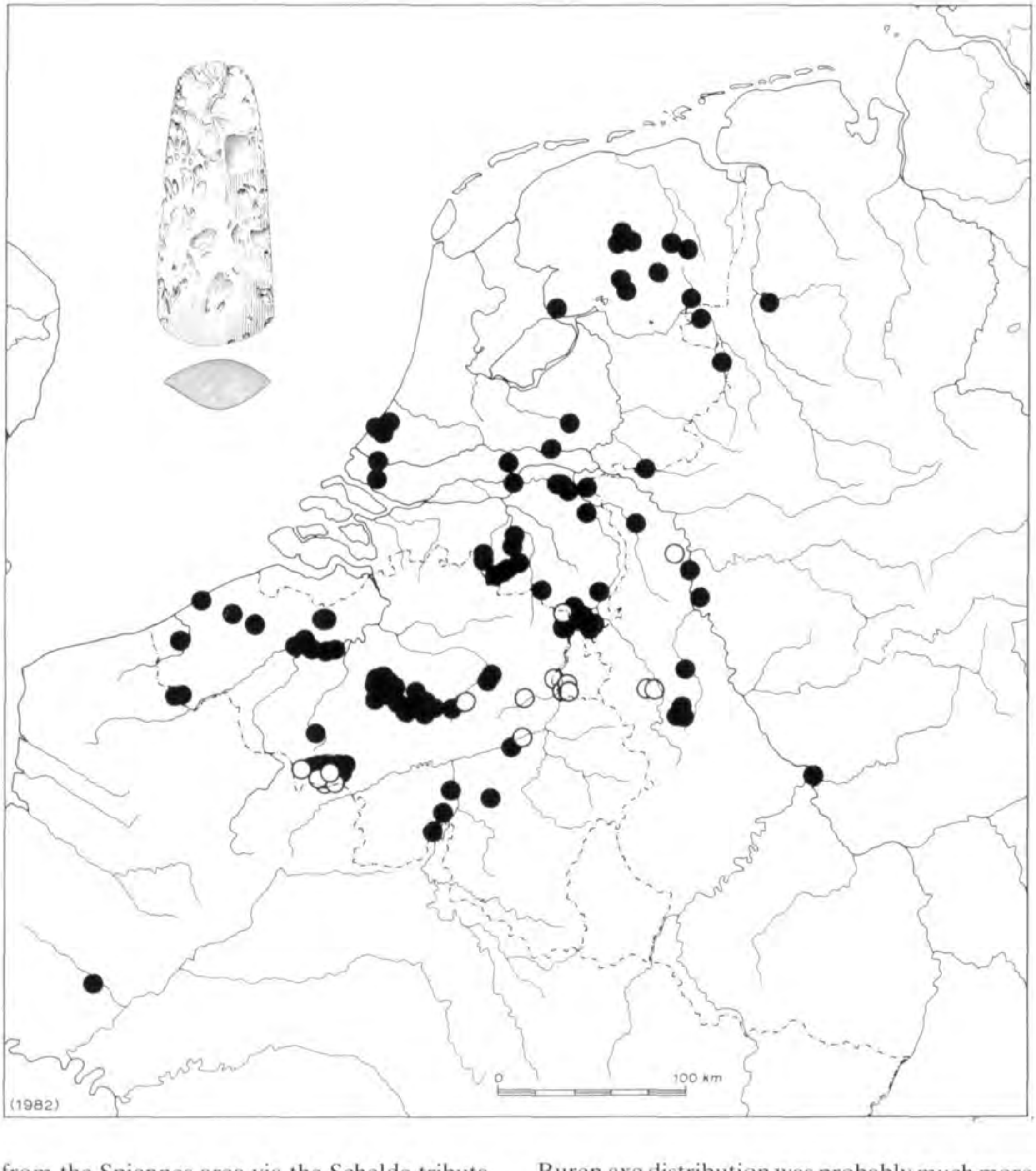
Overseas trade of stone axes from Cornwall to the English east coast gives a plausible explanation for their distribution pattern (Hodder 1974), and a similar explanation may be invoked for the north Swedish Nörrland flint axe hoards of Danish origin (Becker 1951; Malmer 1962); but another suggestion may be made for Drente. A constant down the line trickle of new axes, rough-outs and large nodules seems to have led to an accumulation at the end of the line, at the cultural boundary, for no such axes occur in Vlaardingen settlements (and "Nordic axes" are quite rare south of Rhine and Maas: Hoof 1970, map 8, p. 43; Åberg 1916, map 1; 1918, map 8; and even more so if Corded Ware and Bell Beaker axlets are omitted). If this were true, the maintenance of a process of exchange among TRB communities would have been more important than the normal supply and demand rate would presuppose, a phenomenon also observed in modern "Stone Age economies" (Sahlins 1974). Redlich (1958) made a similar remark in a totally different context.

Unpolished rough-outs of Buren axes were seldom found over 60 km away from the flint mine zone, and in their distribution area they are less common than finished polished axes. This suggests that the rough-outs were polished when they were resold further and further away and that this polishing had already started near the flint mines for at least some of the axes – or perhaps for all axes during part of their long period of production.

Unfortunately the origin of most flint sources from which Buren axes were made cannot be discerned with any confidence. The brown sugar-like, ox blood coloured, St. Symphorien facies and the dull, often chert-like grey Valkenburg flint, together with the general distribution demonstrate their production in the neighbourhood of Spiennes near Mons, in Dutch South Limburg, and in the intermediate Hesbaye, whereas Lousberg flint does not seem to have been used. The overwhelming majority of Buren axes are made from the originally bluish grey flint with white whimsical "panther" patches which may come from almost any flint mine between Rijckholt, Rullen, Spiennes and the Paris Basin. Neither optical nor laboratory methods offer solutions here.

Van Iterson Scholten (1981) has pointed out that the rock associations of wet settlement sites would show what parts of the hinterland were frequented by the contemporary inhabitants; this, in turn, may suggest where to look for trade routes and the production centres of the imported flints. This may also pertain to the Vlaardingen sites. Hooijer (1962) mentions from sections 1-12 at Vlaardingen 6.4 kg of slate, several quartz pebbles, 7 pieces of granite, 1 of Revin quartzite, 22 of quartzite, 3 of sandstone and 2 of lydite, which points to the Ardennes and the mountains along the Rhinegraben as an ultimate source. Only comparison of size and abrasion of these rocks from Vlaardingen and other sites with those found in Pleistocene sands and gravels will disclose which uplands were frequented. These studies might show an S-shaped axe trade route with canoes on the Sambre and Meuse (Van Iterson Scholten 1981). In the latter case, the Buren axes found in the Rotterdam area must have arrived mainly by way of Maastricht and Nijmegen.

If the distribution shown in fig. 3 is to be believed, an additional overland route branched off towards the west from Roermond-Weert, following a barely perceptible watershed south of the Peel peat bogs along the Belgian border, which is also marked by the distribution of the four TRB battle-axes mentioned above (fig. 1b). Flanders may have been supplied directly



from the Spiennes area via the Schelde tributaries, but also by an overland route leading from the Hesbaye and Brussels towards Ostend. Or was the concentration along the present E5 highway only due to dense settlement along loess- and sand/clay boundaries? Thus the Buren axe distribution was probably much more complex than a simple series of overlapping ovoid supply areas from each individual mine.

Modderman's map (1980) of the distribution of axes made from Lousberg flint (fig. 4) displays a simpler form. Lousberg axes did not

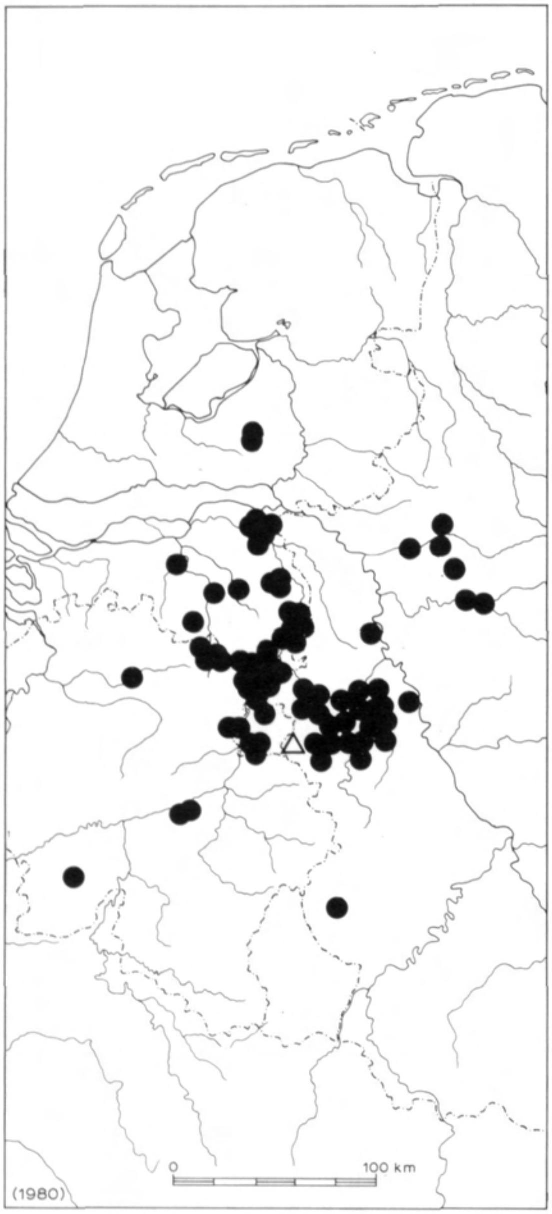


Fig. 3. *(opposite)* Distribution of Buren axes (see the text). Rough-outs are indicated by circles.

Fig. 4. *(left)* Distribution of axes made from Lousberg flint according to Modderman (1980). The flint mine of Lousberg is indicated by a triangle.

travel as far as the Buren axes and their parabola-shaped market area (considering that the northern Rhineland is underrepresented) did not reach beyond the Peel peat bogs bodering the left Maas bank from Weert towards the Nijmegen region. Apparently the short Lousberg axes could not compete in popularity with the splendid tall Buren axes.

However speculative some of the above remarks may seem, we may perhaps end this excursion into axe distribution by concluding that nothing is shown by fig. 3 of a cultural and physiographic boundary between TRB and Vlaardingen in the distribution of Buren axes. On the other hand, TRB axes do not seem to have been traded into Vlaardingen territory, which was much nearer the Buren axe production centres than was Drente to those of the large TRB axes. Perhaps apart from one example at Zandwerven (125/521) in the extreme North (Schermer 1973), the Vlaardingen population did not care to buy, mount, use and grind the "Nordic" axes with their unfamiliar balance and rectangular cross-section, whereas apparently the Drente TRB population did not object to using the better available (?) Buren and other Benelux flint axes with oval cross-section. They are found in graves, but not in axe hoards.

Concluding remarks: Notwithstanding these contacts, both TRB and Vlaardingen cultures kept their material cultural identities distinct in all their phases. Thus pottery and some other artefacts remain quite easily identifiable to us and nothing shows that they evolved towards a typological "merger". This instance is one reason why I consider attempts to abolish Childe's "culture" concept for the Neolithic of our region as ill-advised.

The fact that the cultural boundary is formed by a definite landscape boundary makes me less averse to the concept of "environmental determinism" of "environmentalism" than some social geographers seem to be. On a microscale, "determinism" is sometimes translated as "possibilism", specifically the aptitude of some populations to exploit their habitat as flexibly as possible (Taylor and Tatham, in Taylor 1952). The diversity of the wet Vlaardingen environment is sufficiently known, but we have only begun to discern the heterogeneity of the "dry sands" landscape occupied by the TRB culture.

II. *The TRB distribution considered at an original map scale of 1:600,000*

The Dutch-English *Atlas van Nederland* (1963-1977, to be called Atlas 1 hereafter) presents its one-sheet maps of the country on a scale of 1:600,000. They have the same (stereographic) projection and boxing as the Dutch Ordnance Survey "Topographical" maps of larger scales. The eastings and northings of the Dutch national grid can perfectly well be applied to these atlas sheets (although this is nowhere mentioned in Atlas 1 itself). For the present study a transparant film overlay on the same scale was prepared of the known TRB sites. This was laid over every relevant map in the Atlas to discern possible connections between TRB settlement and map features. Marginal situations were checked on larger scale maps (1:200,000; 1:50,000).

Initial cautionary remarks. The procedure outlined above depends on at least three assumptions. (1) That the TRB distribution is suitable to generalisations of this kind. In my opinion such generalisations are acceptable for any human behaviour. Individual deviations – which some societies find more permissible than others – may reveal themselves as incidental anomalies in our records; if they found no subsequent acceptance. Another matter that concerns us is at what remove within the TRB *Kulturkreis*[2] the "normal" or collective behaviour is similar in similar cases. The fact that the German peaty Dümmer basin was settled by the TRB West Group while the Dutch peat bogs were not, can best be explained by the different habitat potential of these landscapes. Perhaps a different case is presented by the flourishing of the TRB South and Southeast Groups on loess soils while the TRB West Group was more averse to loess. As long as no proof of essential environmental differences is given, we may have here an instance of poor information exchange between different "Groups" belonging to the same TRB "culture". Such cases may be expected where similar landscapes occur very far apart within a "culture" and are absent from the contact zone of the "Groups" concerned.

(2) The assumption that the known TRB distribution is representative of the real distribution in prehistory. This is not quite true (cf. Bakker 1973, p. VII/17-36). Most pottery finds not stemming directly from hunebeds were only made after 1920, and none before 1845 (fig. 5). Such finds have generally become known due to an "effective archaeological activity" during the reclamation of heath and other waste lands. A very global map of such reclamations (Atlas 2, map 17) suggests that soil types indicated by the symbols 2 and 3 in fig. 6 were mainly reclaimed before 1800. Besides, the moister sandy soils were often reclaimed earlier in the 19-20th century than the drier sands (fig. 6, symbol 6). Thus it might seem that the conclusion drawn below, namely that the TRB population was averse to settling on such lands, is strongly biased by the finds' history. Fortunately, the very great activity since 1950 of amateur and professional archaeologists on precisely these lands (often in conjunction with reallotment and road or town construction), means that we are not completely blindfolded, for only very few TRB finds have come to light from such "exceptional" situations.

Much of our present knowledge of TRB distribution, especially in the centre of the country, devolves from the work of the few interested persons present at the first ploughing of the heathlands. So all Lage Vuursche finds (143/465) are known to us thanks to the collecting of the Hilversum historian Albertus Perk and the interest of the Leiden archaeologist L.J.F. Janssen, in the 1850s and 1860s. The Laren finds

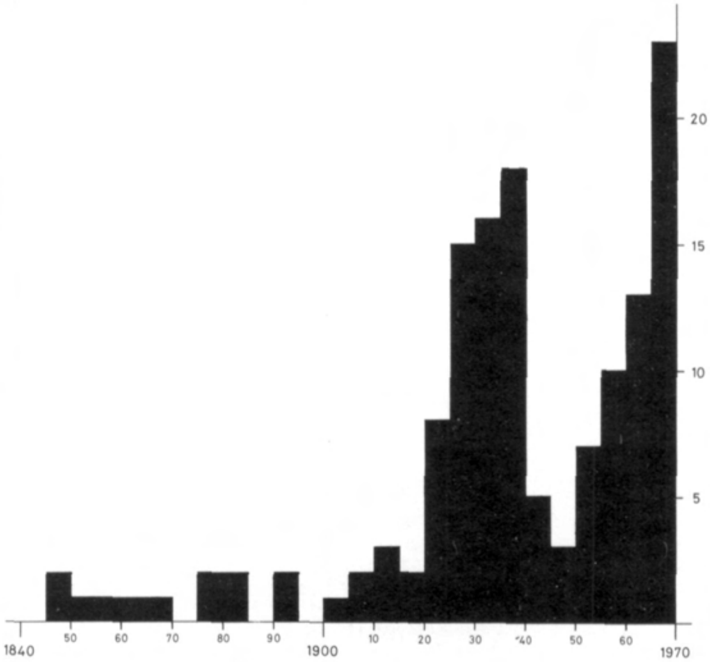


Fig. 5. Graph of the discovery of 138 find spots of TRB pottery outside the context of earlier known hunebeds, per 5 year period (Bakker 1973, fig. 7.5). From the second half of the 19th century to 1940/1950 heath reclamation was in full swing, the decreasing find numbers over 1940 to 1950 correspond to its decline (De Bakker 1979, fig. 30), but also to war influences and a shift of the official archaeological attention from the sands to other areas and, perhaps, a decreasing amateur activity. The steep rise from 1920 to 1940 reflects the activities of Van Giffen and many amateurs. Before 1920 the influence of Janssen, Pleyte and Holwerda of the Leiden Museum are visible. Since 1950 amateur and recording activity increased.

(142-144/471-473) all date from 1960-63, and the Uddelermeer (180/473) and Niersen-Vaassen finds (189-192/476-479) are due to the contacts between H.M. Queen Wilhelmina, the Leiden archaeologist H.J. Holwerda, and the Royal Forester around 1910 (cf. Van der Waals 1973). Only quite recently were new finds made in the latter two find clusters, during archaeological excavations. Such situations are a warning that the present "distribution pattern" is very "motheaten" and that in the more thinly occupied periphery it is hardly possible to draw inference about minimum inter-site distances.

One possibility for gathering negative evidence for the TRB distribution has not yet been explored. The total surface of Dutch archaeological excavations on sandy soils amounts to several hundreds of hectares. Although one has not always been prepared for observing Neolithic features while excavating much later (and sharper) soil discolourations, TRB flat graves with pottery can hardly have been missed; in addition, scrapers, querns and decorated sherds were quite often found on such occasions. When the B horizon is largely intact the lack of TRB finds seems sound evidence for inferring the absence of TRB settlement. For instance, it seems meaningful that the 4 ha Kootwijk excavations of medieval settlements (182/466) have only produced one Vlaardingen pot, some scrapers, one transverse arrowhead, one large Beaker "with short-wave moulding", one Veluwe Bell Beaker, and one Pot Beaker, but no TRB ware (personal information H.A. Heidinga).

(3) A third assumption is that present maps may represent prehistoric conditions. There is often a nice agreement between the distribution of present and prehistoric features, but it is not always easy to understand what has been the determining factor. Completely similar maps may display *indirect* relations. The breeding area of black woodpeckers north of the Rhine, for instance, conforms convincingly with the TRB area (Atlas 3, p. 218), but the black woodpecker has not settled here before the 20th century when the conifer woods planted on former heathlands had become large and old enough. The factor shared with TRB is of course the

sandy substrate (on which the black woodpecker also settles south of the Rhine).

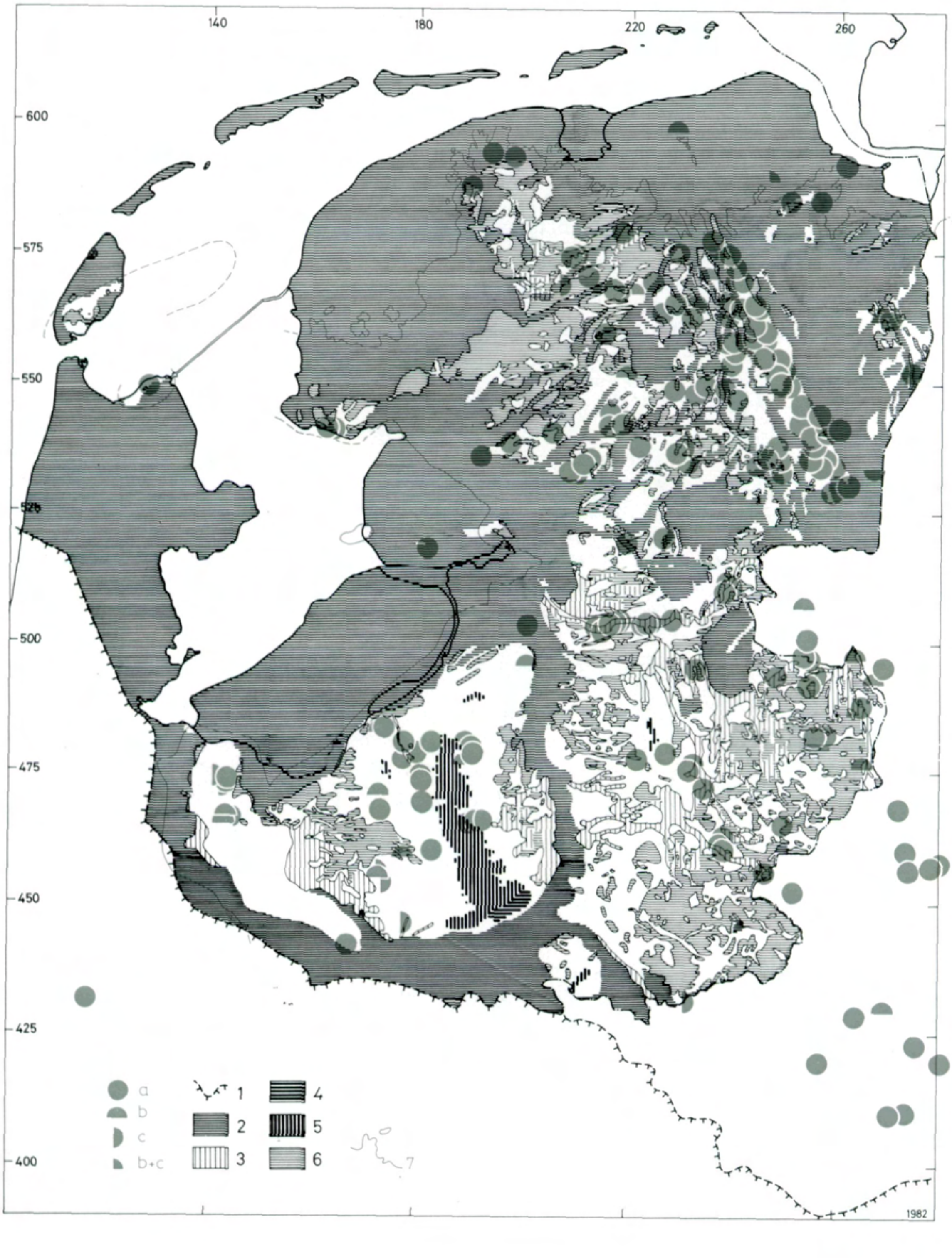
Another problem is that the topographic definitions of modern surveyors may more or less, but not completely, coincide with what was relevant to prehistoric man. In this context comparison of the maps of the same feature as researched by different authorities may be illuminating. The definition of "loam" for instance, may be different in Westphalia, Lower Saxony, Oldenburg, Schleswig-Holstein, Denmark, and the Netherlands, and per map edition. Some of the boundaries drawn for loam may then be more helpful than others.

The TRB area further defined. While playing with overlay and maps in Atlas 1 it became clear that TRB sites are found on continguous sandy soils, but with the following restrictions (fig. 6):
1. North of the rivers Emscher and Rhine, the Amsterdam-Rijn kanaal and the line Amsterdam-Alkmaar-Bergen aan Zee (symbol 1).
2. Not on the present coastal dunes (which did not exist at the time) or on then existing coastal barriers.
3. Not on peat, "mucky brook-soils" or clays, symbol 2 (Atlas 1, Pl. IV-12).
4. Not on "non-mucky brook-soils and gley soils" *(ibid.)*, symbol 3.
5. Not on loess soils *(ibid.)*, symbol 4.
6. In the Veluwe not on dry sands above 55 m above NAP (Dutch Ordnance Datum, identical to German NN, about at sea level), symbol 5.
7. Not on damp sandy soils, symbol 6 (Atlas 1, Pl. VII-6, winter ground water table below 70 cm).

There are some real and *quasi* exceptions to this: (a) the above-mentioned four battle-axes found along the Belgian border, on sandy soils. Another was found at Ste. Cécile in the Semois valley, on the Franco-Belgian border. (b) the TRB votive deposits on the Drente Plateau, which were frequently placed along wet places, which were later overgrown by peat. Several battle-axes also derive from wet places. (c) the above-mentioned TRB pottery from the Vlaardingen settlement on the small dune of Hazendonk, in the middle of the fluviatile Vlaardingen district. (d) sites which afterwards became covered by peat and sometimes subsequently by clay, but which lay originally at the well drained brink of the sandy Drente Plateau (Bornwird (192/594) and Steenendam (189/588) in Friesland: Fokkens 1980). *(See the Postscript).* (e) sites on isolated sandy outcrops which formed part of the large sandy districts at the time (Oostrum (199/594) in Friesland). (f) doubtful exceptions are the unbroken funnel beaker said to have been found in marsh clay at Lutjesaaksum (228/597), north of Groningen (Van Giffen 1957; Roeleveld 1974b) and a reused battle-axe at Woltersum (244/588), also found in clay of the same region, but which may have been a medieval import (Lanting 1977).

In general it can be said that very few contemporary clays lie at the surface and that the contemporary coastal barriers no longer exist northeast and east of the Calais IVb estuary and lagoons between Bergen aan Zee and Schokland. These tracts of water prevented further TRB expansion towards the coastal barriers between Alkmaar and The Hague, which were occupied by Vlaardingen groups. No doubt several finds of stone axes from the beaches of the Dutch-German Frisian Isles represent TRB habitation of now eroded coastal barriers (cf. Bakker 1976, p. 84-86). Much more is known from the coast between the Elbe and Esbjerg

Fig. 6. The TRB area further defined (see the text). Original scale 1:600,000 (Atlas 1). Date of compilation June 1982. The coordinates of the national grid (in kilometres) are given.
a - TRB artefact(s), findspot certain
b - idem, findspot not exactly known
c - uncertain TRB artefact(s), findspot certain
1 - line of the Emscher, Rhine, Amsterdam-Rijn kanaal, Amsterdam, Alkmaar, Bergen aan Zee
2 - peat, "mucky brook-valley soils" and clays
3 - "non-mucky brook soils and gley soils"
4 - loess
5 - area above 50 m above NAP in the Veluwe
6 - sandy soils with a winter ground water table below 70 cm
7 - contour line of 3.5 m below NAP for the top of the Pleistocene (see Postscript)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(Harck 1980, 1973; Harck et al. 1974; Müller-Wille 1981). Megalithic graves and other TRB finds are known there from Pleistocene sands. TRB axes, however, also stem from coastal barriers which must have carried TRB habitation. Some finds stem from contemporary peat bogs, but none are known from the little that is left of contemporary clays (*unterste Sedimentdecke:* Hoffmann 1980; Harck 1980). So the dubious Dutch finds on clay are without parallels elsewhere.

TRB settlements on a peaty island in the lake and on the wood peat along the river Hunte are well known from the German Dümmer basin, but no similar observations were made in the Bergummermeer basin or elsewhere in the Netherlands.

The Dutch data provide no good evidence by themselves for TRB avoidance of loess soils, because the only relevant area (fig. 6, symbol 4) borders on a very dry sandy region of the southeastern Veluwe which is also whithout finds. Strictly speaking the "non-mucky brook-valley soils and gley soils" (fig. 6, symbol 3) again occur in areas with too few TRB finds to be certain that they were avoided. Larger map-scale research clearly shows, however, that settlements occurred on the banks of small streams, where the refuse was dumped into the water (Modderman et al. 1976).

The absence of finds above 55 m above NAP is due to the hydrography on the Veluwe where the higher parts were too far away from drinking water for cattle and man (fig. 10), but this quasi-relationship does not apply for suitable higher locations along the eastern border, or in Germany.

The hydrography is very illuminating. Sheet VII-6 of Atlas 1 depicts the groundwater depths in the winters of 1952-1955 as a compilation of similar maps on a scale of 1:200,000 *(COLN map)*. There is a clear contrast between the generally low Drente Plateau where hardly any truly dry areas well removed from damp sandy soils and drinking water occur, and the large high and dry ice-pushed ridges of the centre of the country, where proximity of drinking water must have been a prime necessity (Groenman-van Waateringe 1978, figs. 6-7).

None the less, these hydrographic maps give only a very distorted image of the relative situation in TRB times. First, the modern use of drinking water, the digging of peat, the canalisation of streams and the making of ditches has rendered the country much drier than it was a few centuries ago. Second, the rise of the sea level since TRB times and the enormous spread of peat bogs in the Bronze and Iron Age and afterwards have clogged the Neolithic drainage systems considerably, especially in low places[3]. Some settlement sites have even been covered by peat. The Sub-Boreal climate was somewhat drier in the Neolithic period than in the Bronze Age, and certainly drier than in the Sub-Atlantic period and today. Dr. Zagwijn reminds me, in addition, of the fact that a primeval deciduous forest transpires much more water than heathlands, fields, or meadows. Consequently, dry regions were less dry and the wet regions were often less wet in the TRB period than now. Furthermore, conformities between TRB settlement and hydrographical maps in one landscape will not be completely applicable to others.

Later hydrography had direct consequences for the TRB sites. Barrow sections demonstrate that the podzolisation for the greater part took place *after* the TRB period on the drier sandy soils (Modderman 1975, Waterbolk 1964, Van Giffen 1941). Because of the different regional changes in the hydrography, the present podzol types have no complete general retrodictive value for the TRB soil types. What they once were should be the subject of further research.

III. *Regional surveys (original map scales 1:50,000, 1:100,000, 1:200,000)*

A soil map, geological map, and a geomorphological map are now being published on scale 1:50,000 to match the topographical map. Most sheets of the soil map are ready in published or in concept form. A small part of their most intricate legend for the top 1.20 m of the sandy

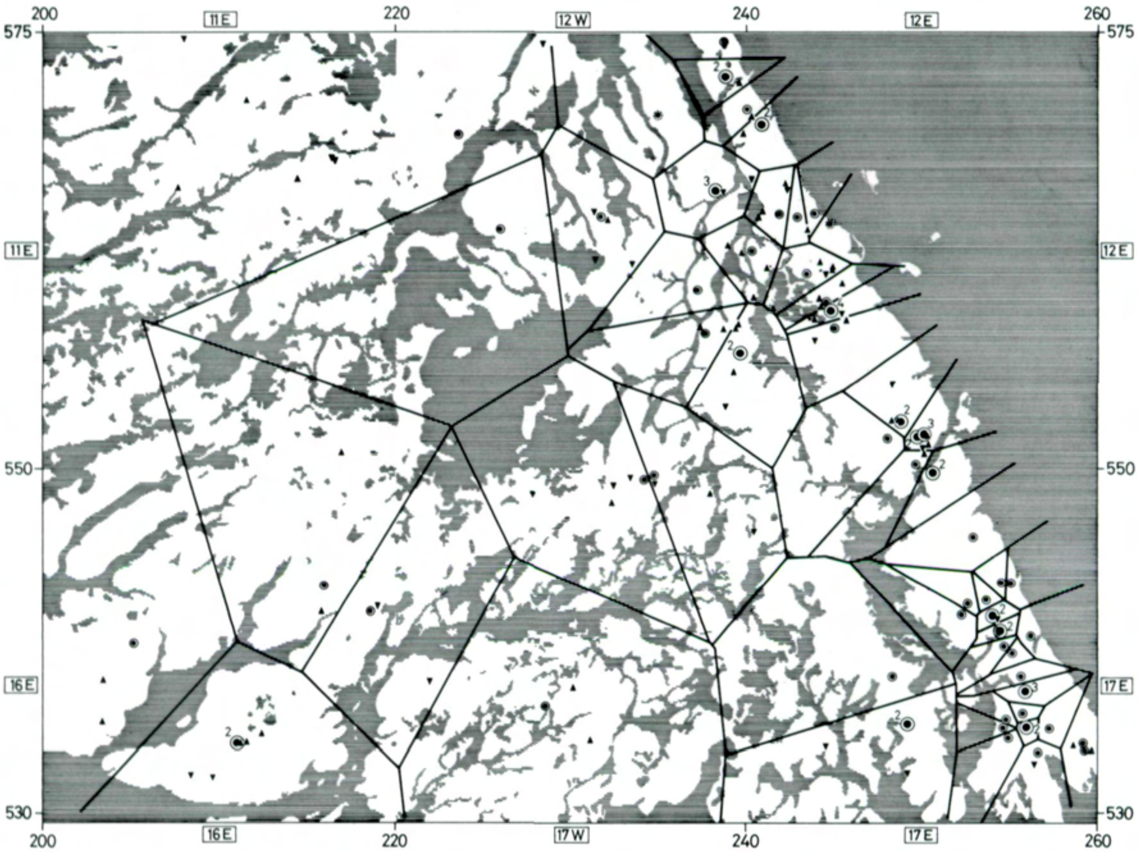


Fig. 7. Sand/peat division on part of the Drente Plateau. Standing triangles indicate stray sherds or settlement sites, hanging triangles flat graves and one stone cist, circled dots hunebeds. Because these passage graves were all in use during pottery phase D, Thiessen polygons around them should indicate contemporary "territories" according to Renfrew. Large numbered dots indicate a concentration of hunebeds. Sheet numbers and co-ordinates of the Topographical Map are in margin (Bakker 1980).

soils (De Bakker 1979) will be described below. Soil type, texture, and hydrography are indicated. Fewer sheets have appeared of the geological and the geomorphological maps of which the first also give deep vertical sections of the parent material of the soils, and the second classifies relief forms. The different aims realised by these maps make comparison most rewarding. This is also necessary because the minor omissions of one map may be rectified by another (Ten Cate et al. 1981 compared the three map types published for sheet 17E). Generally the concept soil maps are to be preferred to the published sheets because the latter were often simplified for the sake of clarity.

Because most of these maps were, and are, being surveyed after the small scale maps of Atlas 1 had been compiled, the latter will become obsolete in due course. The NEBO soil map 1:200,000 with a different key is an instance (Atlas 1, Pls. IV/1-12).

A. *The Drente Plateau.* The Drente Plateau again is not evenly covered by known TRB sites (fig. 7). Whereas the distribution of settlements, flat graves and findspots of one or more sherds are particularly biased by localised "effective archaeological activity" and display concentrations in the north; that of the hunebeds, however, is different. Most are found on the two easternmost ridges, the Hondsrug and the Ridge of Rolde. Lower concentrations occur in the southwest and in the north. Thiessen or Dirichlet polygons constructed around megalithic graves demonstrate the latter's unequal distribution clearly. The alignment of Hondsrug hunebeds is also very striking and is not unlike that of funeral monuments along prehistoric roads (cf. Bakker 1976, figs. 2, 7, 11).

Most of this disparity in the distribution of hunebeds is explained by the recently published sheets of the geological map (fig. 8). Boulders were available for hunebed contruction to prehistoric man where (a) Ice Age glaciers had deposed them, expecially in a layer of till or "boulder clay", (b) this boulder clay had been eroded by periglacial processes so that the stones were washed free, and (c) these loose boulders had not been completely covered by a layer of Late Glacial wind-blown coversands. Fig. 8 shows the distribution of partially and completely eroded boulder clay. The hunebed distribution shows a reasonable conformity to the occurrence of eroded till. Unfortunately a map of the depth of the top of the boulder clay, eroded or not, below the coversand surface is not available, but the sections in fig. 8 show that this relative depth increases towards the northwest, and that the plateau as a whole also dips into that direction.

The soil maps demonstrate that hunebeds are found in immediate proximity ot the erosion "escarpment" of the boulder clay cover, but that they were constructed upon well-drained coversands, or similarly textured preglacial sands, while the ill-drained till subsoils were avoided (Wieringa 1968). On the Hondsrug and the Ridge of Rolde the periglacial erosion of the formerly uninterrupted boulder clay layer has left a landscape of straight wet till ridges and of later often coversand-filled dry valleys between them (fig. 8). The straightness of the border zones between till and the dry sands which were preferred for hunebed building sufficiently explains the alignment of the hunebeds here. Their situation along roads has thus become superfluous as an explanation, but long distance roads may in fact have chosen such courses, demanding the least "relief energy" and a dry soil.

Three soil map sheets for the southeast corner of Drente (fig. 9e, cf. fig. 7 for their location) were used for a more detailed analysis of TRB site location. I refer to former studies (Wieringa 1968; Bakker 1980) and Table 1. The soil map 1:50,000 presents, simultaneously, a division according to three features: (1) soil type sensu stricto. The most important sandy soils are coded Y =*Holtpodzol,* "typical (non-humic) brown podzolic earth"; Hd =*Haarpodzol,* "humuspodzol", Hn = *Veldpodzol,* "typical (humic) gley-podzol"; and pZg or pZn =*Beekeerd, Broekeerd,* or *Gooreerd,* "typical humic-sandy gley soil". KX indicates a boulder clay or "pot clay" near the surface and "x" a depth of these between 40 and 120 cm. (2) The texture of the upper layer of parent material is coded: 30 = coarse sand, 23 = loamy fine sand, 21 = fine sand with little or no loam. "Loam" is the fraction smaller than 50 μ; symbol 23 has over 17,5% of it, and symbol 21 less. (3) The main ground water level is indicated by the ciphers VII (very dry) to I (very wet). The foreign user of the Dutch soil map is referred to the well illustrated *Major soils and soil regions in the Netherlands* (De Bakker 1979) which provides the multilanguage glossary from which Table 1 was compiled.

Thus a mapping unit may be coded Hn23x-VI. The types of properties 1-3 are correlative in principle, but the map displays an intricate spectrum of cross-combinations. The property types 1-3 were therefore considered independently of each other in the following statistics, in the hope that TRB preferences for present mapping units on these sheets would become apparent. Fig. 9d shows the "natural" distribution of the three types of properties, plus the presence of till within 40-120 cm depth (x) on the driest part of the Hondsrug, its southeastern tip between

Table 1

Glossary of the relevant Dutch sandy soil types

Dutch soil map 1:50.000[a]	*Holtpodzol* soil code Y	*Haarpodzol* soil code Hd	*Veldpodzol* soil code Hn	*Beekeerd* soil* code pZg	*Enkeerd* soil* code zEZ	*Duinvaaggrond** code Zd
Germany[b]	Rostbraunerde	Eisenhumus-podsol	Gley Podsol	Typischer Gley	Grauer Podsol-Plaggenesch	Podsol-Regosol
England and Wales[c]	Typical (non-humic) podzol brown earth	Humuspodzol	Typical (humic) gley-podzol	Typical humic-sandy gley soil	Sandy man-made humus soil	Podzolic sand-ranker
France[d]	Sol ocre podzolique modal	Podzol humo-ferrugineux	Podzol humique à gley	Sol humique à gley	Sol d'apport anthropique	Sol mineral brut d'apport éolien
U.S.A.[e]		Typic Haplohumod	Typic Haplaquod	Typic Humaquept	Plaggept	Typic Udipsamment

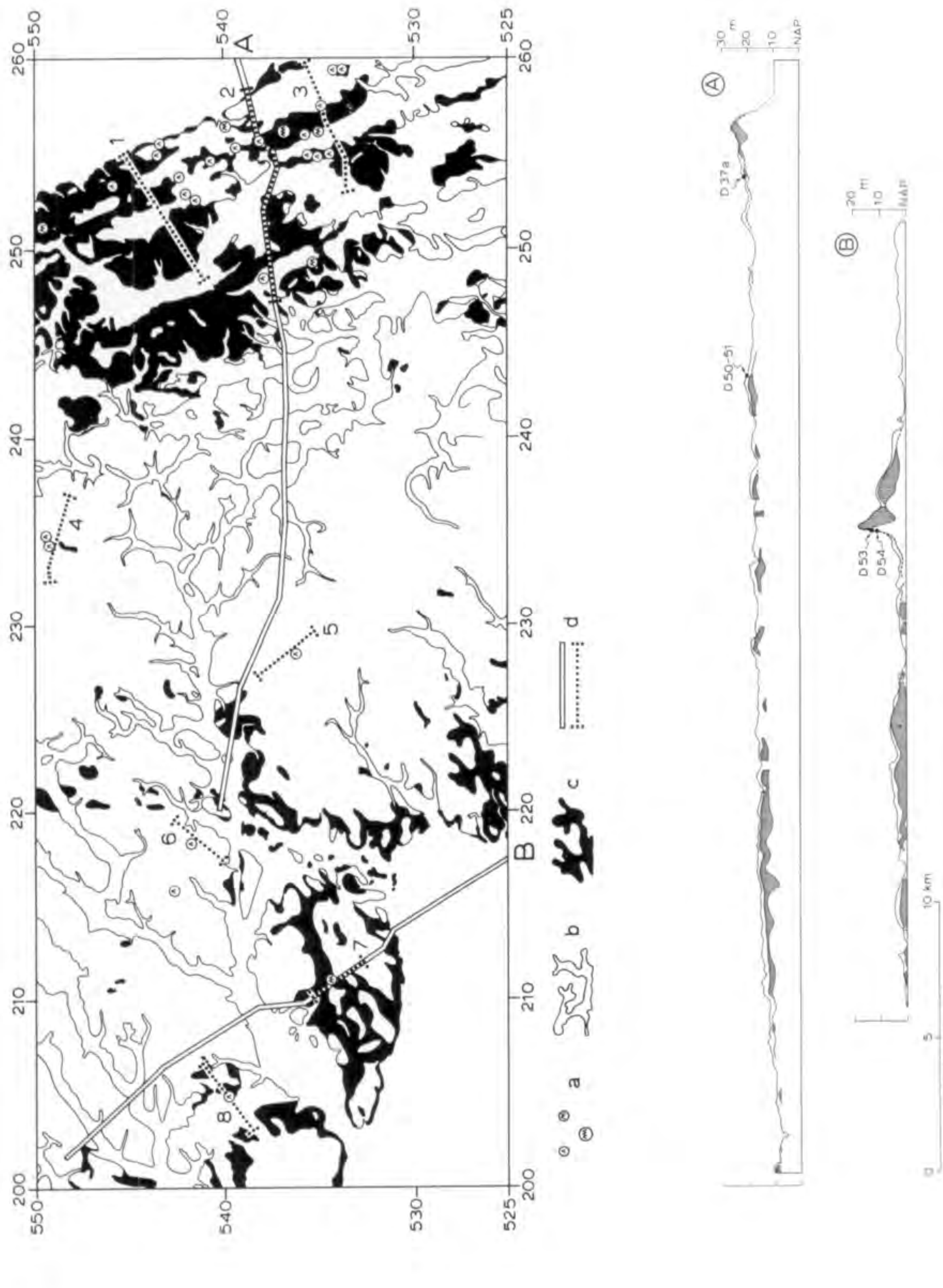
SOURCE: De Bakker 1979, citing (a) De Bakker and Schelling 1966 ; (b) Mückenhausen et al. 1977; (c) Avery 1973; (d) CPCS 1967; (e) Soil Taxonomy SSS 1975 (each of these terms preceded by 'sandy, siliceous, mesic').

* For *Broekeerd* and *Gooreerd* soils no glossary is given by De Bakker; they are closely related to *Beekeerd* soils. *Eerd* = earth, *vaag* = ranker, *grond* = soil.

Emmen (260/530) and the stream valley at Borger-Buinen (250/550). Beekeerd, Broekeerd, Gooreerd and KX soils were omitted because they were avoided by TRB settlement, as were peatbogs[4]. The results are presented in fig 9d in bar graphs per map sheet for the soils on which (a) hunebeds, (b) flat graves, and (c) settlement or find spots of stray sherds were situated. There is a clear preference for Hd, 21, and VII. It is also plain that known graves and settlement sites are quite unevenly distributed. Because the plateau dips towards the north and the west, Y, Hd and VII gradually give way to Hn, VI and V into these directions.
The preference for 21 instead of 23 suggests a preference for Younger Coversands which are loamless, instead of the slightly loamier Older Coversands. This may partly be a quasi-relationship, however. If the tops of coversand ridges were chosen, they usually consisted of Younger Coversand, which in turn usually overlay Older Coversand[5].

The tabulations thus only refer to the site on which a settlement was situated. While it must have been convenient to locate houses on dry non-sticky sand, it is quite possible that the fields were located on loamier or moister soils. Hardly any settlements are situated on places with x (till layer 40-120 cm deep). Exceptionally the location of the TRB settlement of Anlo (245/561), discussed by Harsema (this volume) is situated on Hn23x-VI. Perhaps a preference is indicated on the soil map for the borders of units with Y, Hn, x and VI, but the intricate patchwork of the Drente soils (where most soil types seem available everywhere) and the minute coding does not make it easy to perceive this. I have not yet found a relatively simple and objective method for detecting what soil types were used for arable plots, independent from the radius chosen for area calculations, or simplifications applied to the map code.

Unfortunately no soil map has yet been compiled for the densely occupied sheet 12W, but for the remainder of the Drente Plateau all soil map sheets are available in printed or concept form. The area can conveniently be divided into three landscapes. The southwestern fringe of the plateau consists of ice-pushed, boulderclay-covered ridges. Here the eroded till provided boulders for the construction of at least five hunebeds (fig. 8, sheet 16E), which again are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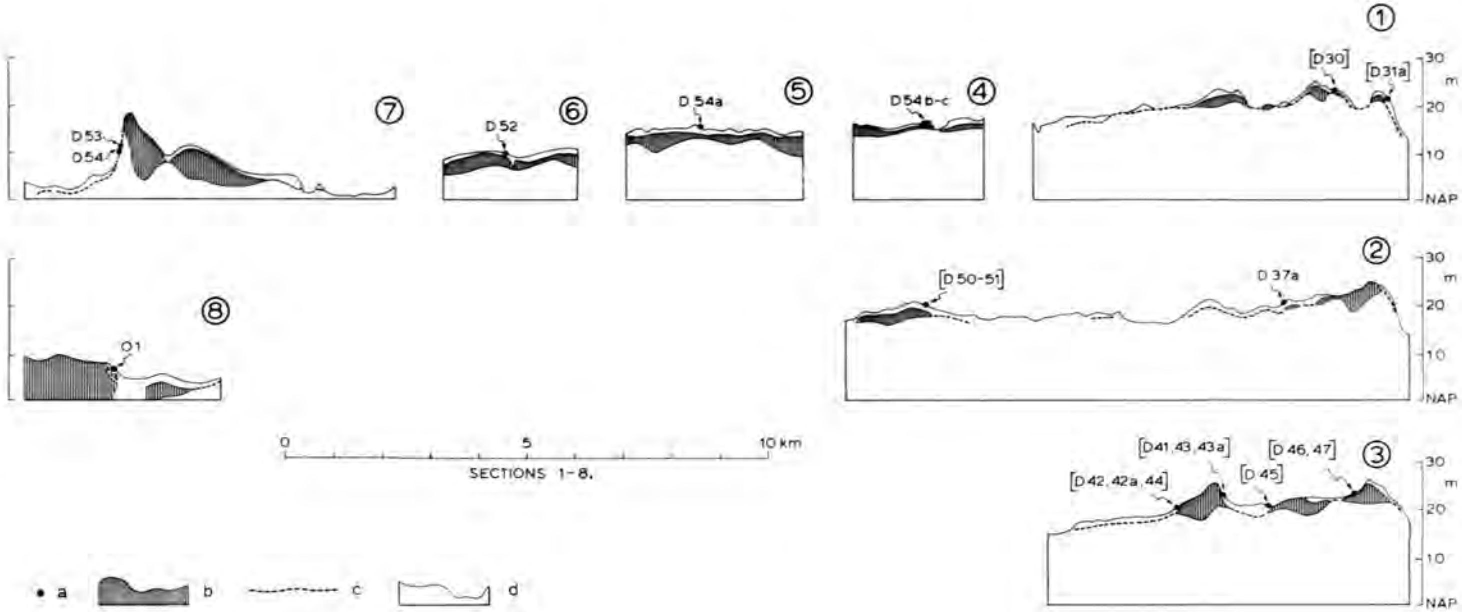


Fig. 8. Hunebeds were built where erosion had uncovered boulders from the till or "boulder clay" layer, and where later coversand deposition had not hidden them again.
Upper: map of the southern Drente Plateau (sheets 16E, 17W, 17E, cf. fig. 7). a - one, two, or three hunebeds, b - boulder clay, not (much) eroded, c - completely eroded boulder clay, d - position of the sections (below).
Lower: sections A-B and, enlarged, 1-8. The base line is on the NAP level. The plateau slopes towards the northwest. a - hunebed with registration number (in brackets those projected from some distance into the section), b - boulder clay, c - layer of boulders and smaller stones remaining from eroded till layer, d - other sediments, usually sandy (coversands are on top of boulder clay remnants). Peat, recent inland dunes and manmade enkeerd/plaggen soils are omitted. Source: M.W. ter Wee's geological map sheets 16E, 17W, 17E.

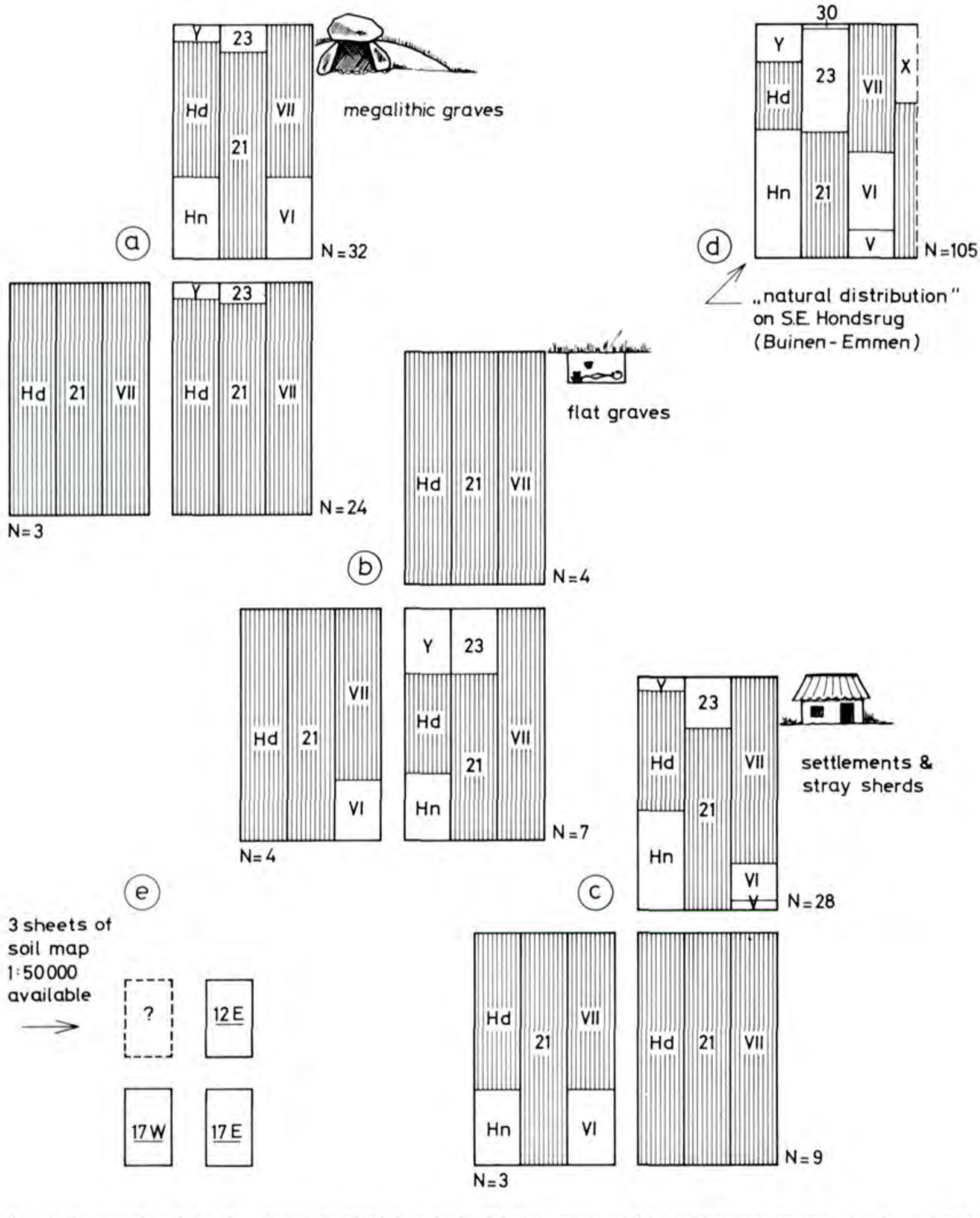


Fig. 9. Bar graphs of site characteristics of (a) hunebeds, (b) flat graves, and (c) settlements or stray sherds on the Drente Plateau, according to the sheets 12E, 17W and 17E of the 1:50,000 soil map (e). The present "natural distribution" of these features on the relatively dry sandy island in the lower right corner of fig. 7 is rendered by (d). The number of observations is shown by "N". See the text and Bakker (1980).

situated on coversand or similarly textured sands. The soil code is two times Hn21-VI. Two other sites have 21-VII while their present dune sand and Enkeerd cover may have replaced Hd. One has Hn23x-VI. The eleven grave, settlement and stray sherd sites on this sheet (including one on 16W and 22W each) give a similar picture: five on Hn, four on Hd, nine on 21, five on VII, four on VI and two on Hn23x-V. I suppose that in the last two cases the coversand was too thin, or the coversand ridge too narrow for inclusion in the map.

The other landscape is formed by low coversand ridges lying on the till plateau dipping to the north and west (sheet 11E). There are no hunebeds here and the two flat graves and five sites of settlements or stray sherds all lie on 21. Five are coded Hn, two Hd; six VII, and one VI.

The third landscape is the former fringe of the plateau, where two settlement sites near Dokkum (sheet 6W) are now overgrown by peat (Bornwird (192/594) and Steenendam (189/588): Fokkens 1980). Both represent TRB phases F-G which may have been precisely contemporary with the Corded Ware refuse found at the same places. At Bornwird fine ard-marks were observed belonging to one or both cultures. The sandy surface lay in the excavation pits at 0.8 to 1.6 m below NAP, but the lower margins of the ard scratches were not reached. Naked barley was grown here (Van Zeist 1970). Curiously the ard grooves appeared scratched into the leached layer of an Hd podzol in the higher parts and an Hn podzol in the lower parts of the excavation. Perhaps we have here an instance of secondary podzol formation (Waterbolk 1964) after the Neolithic occupation, but before peat growth started on top of the arable soil (1980 ± 50 bc, GrN-5295). Podzolisation must mainly have taken place since Bell Beaker times, according to the sections through hunebed barrows and through later barrows resting upon TRB flat graves. But this barrow evidence is restricted to the higher parts of the Drente Plateau and may have less relevance for its moister fringes. Further excavation of this peat-covered site may be advantageous, not only for the finding of seeds and for ascertaining the extent of the arable plots, but also for revealing postholes, because the house sites must have been situated in the immediate vicinity of the 1966 excavation considering the pot sherd frequency (I am grateful to Mr. H. Fokkens for this information). The Oostrum flat grave(s) of phase G east of Dokkum were discovered at the base of a removed and much later *terp* lying on a coversand outcrop (199/594).

B. *The sandy regions west and east of the Drente Plateau.* Gaasterland (161/540) in S.W. Friesland and Wieringen (127/548) and the isle of Texel (115/565) across the IJsselmeer are a continuation of the till-covered ice-pushed ridges of the southwestern fringe of the Drente Plateau. TRB finds are not yet known from Texel; from Wieringen comes one knob-butted battle-axe, and in Gaasterland we know of one destroyed hunebed (F1) and one probable settlement site (both on Hn21-VI).

The sandy region east of the Drente Plateau occupies to the north an area of similar boulder-clay-covered, ice-pushed ridges with a coversand blanket. Recent TRB finds (recorded by J.N. Lanting, BAI, on sheet 7E) at Hellum and Siddeburen (251-255/584) offer similar possibilities for peat-covered site excavations as along the N.W. fringes at the Drente Plateau *(see the Postscript!)*.

More to the south, the sands of Westerwolde are mainly coversand ridges framed by former peat bogs. Symbol Y is absent here, while Hd and VII are extremely rare (soil map sheets 13, 18, 23). The three well localised findspots on sheet 13 are located on Hd21-VII, Hn21-VII and Hn23-VI.

C. *The riverdunes along the river Vecht.* Much amateur activity since the 1960s has brought a fine series of findspots to the light (Van Beek 1970, and later finds), especially along the north side of the river (between 213/503 and 239/512). They are located on late Glacial coversand dunes along the important primeval valley of the Vecht south of the Drente Plateau. The soil map (22W) indicates that these soils have 21 and VII, but that the Hd podzol was generally covered by dune sand or Enkeerd arable soil in medieval and later times. The direct riverside was often chosen.

D. *The sandy soils between the Vecht, German border and the Veluwe.* There are two types of ice-pushed ridges here (cf. Atlas 1, Pls. II-3, III-1, IV-12, VII-6). Both have a north-south orientation. Those along the border are usually very moist and rich in streamlets, as they often consist of Tertiary clays or have a boulder clay cover. The western ones, in the middle of the district, are usually very dry and of the same type as the Veluwe ridges, but much smaller. Some western ridges, however, have boulder clay caps and are as moist as the eastern ones. This central zone of ridges blocks the drainage of the eastern intermediate coversand landscape considerably, which in turn is riddled by streamlets and some large peat bogs. Habitation occurs here on dry coversand ridges in wet areas or on coversand deposited on the lower slopes of the dry ice-pushed ridges.

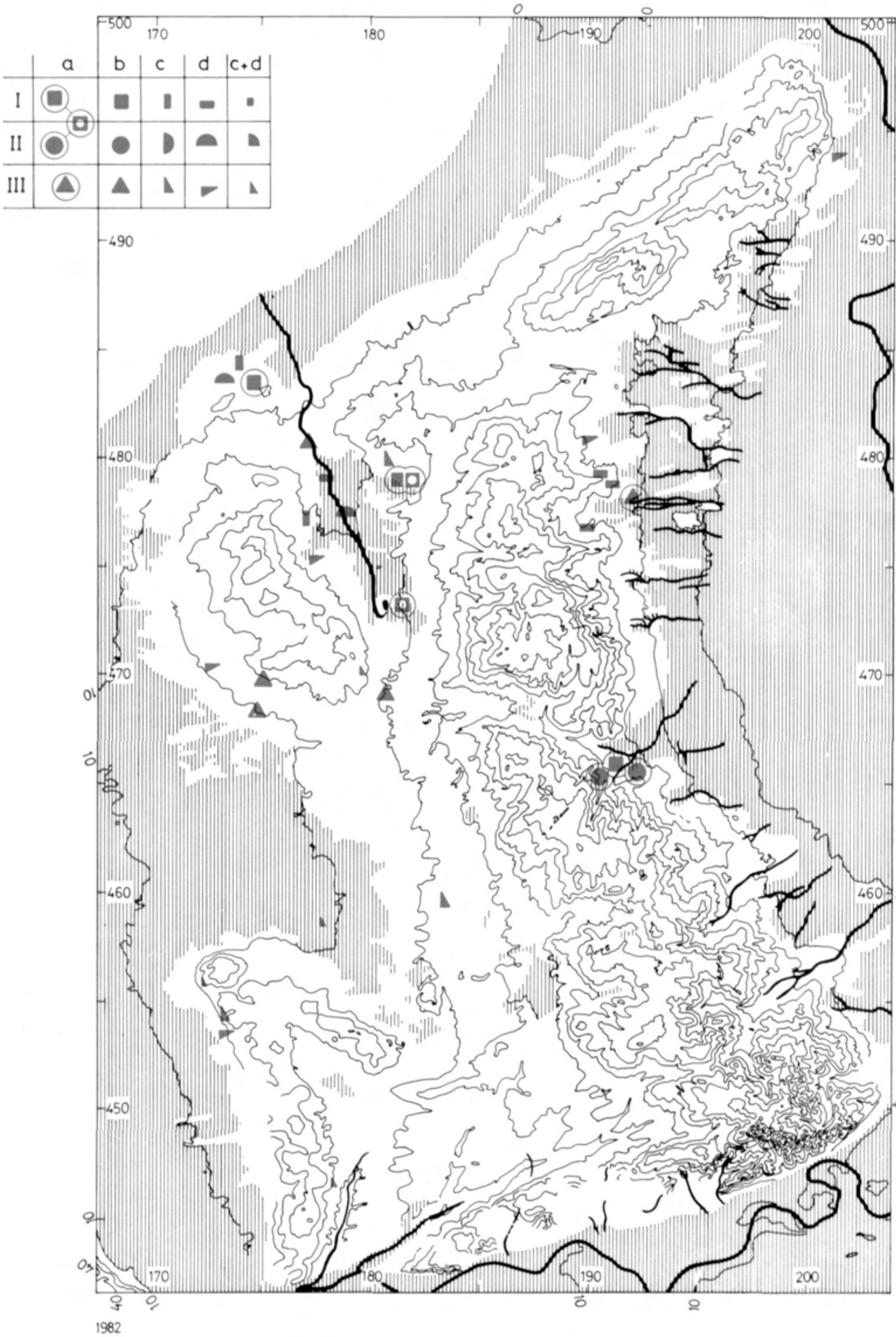
The number of known findspots (22) is too small for statistical work; only four are well localised settlements for which soil maps (sheets 28W, 34W, 34E) are available (Y23-VII, Y30-VII, two on Hd21-VII). Another settlement site was situated in a stream valley on a coversand ridge omitted on the soil map (but shown by the geomorpholocal map). That usually quite narrow dry ridges in a damp area were chosen is illustrated by a findspot of at least one TRB sherd north of Daarle (232/495) near the Linderbeek, situated upon a typical *Gordeldekzandrug* ("coversand belt ridge") along the wet foot of an ice-pushed ridge with loamy crest (fig. 11). One hunebed site (O2 at Mander, 253/497) was dicovered on an ice-pushed ridge near the border. At a short distance across the frontier two similar sites and a flat grave were found on the same ridge (Uelsen 1-3, 255/501, Schlicht 1957, 1967). One alleged hunebed site lies on one of the central ice-pushed ridges (Friezenberg, 231/476; Y23-VII near boulder clay).

Eastern Gelderland (Achterhoek) and the part of Overijssel west of the central ice-pushed ridges (Salland) are areas practically without any finds. Fig. 6 suggests that the ridges in these areas provided suitable places for TRB settlement. Presumably Enkeerd arable soils on top of the ridges and too little archaeological activity have created a blind spot on our map.

E. *The driest district: the hills of the Veluwe, Gooiland and Utrecht, and the damp valley between.* All soil map sheets are available for the Veluwe. A compilation from these and other maps at a scale of 1:100,000 (Ten Houte de Lange 1977) allows one to play the game with the overlay film once more. I applied stricter standards here (fig. 10) than in fig. 6 as regards reliability of artefact determination and localisation. Isolated finds of one sherd or a battle-axe were designated as sites of unknown character. The settlements, stray sherds and most flat graves are located on coversands (Y and Hd, usually 21, rarely 30) and on VII.

The contourmap, on which moist and wet soils are also indicated (commencing with Hn and VI) permits one to discern between two types of landscape chosen for TRB occupation. The first type comprises the sites along the feet of the high and very dry ice-pushed ridges, less than 250 to 750 m away from places where streamlets or excavated wells could provide drinking water for man and cattle. The settle-

Fig. 10. The TRB finds in the Veluwe. Original scale 1:100,000. Black symbols: I - settlement, II - flat grave, III - character of find unclear (e.g., stray battle-axe), a - very well known, b - well known, c - dubious or hearsay, d - localisation unprecise. The map shows contour lines with 10 metre intervals, rising from 0 and 10 m (in hatched area) to crest of 90 and 100 m above NAP (187/472, 192-197/450-452), but usually only 60-70 m (eastern ridge) or 40-60 m (other ridges). Hatched are moist areas (groundwater levels VI-I and Hn soils). Streams are in black. Brooks (including man-made *sprengen*) according to Ten Houten de Lange, and consequently not charted for the hatched area (e.g., Barneveldse Beek). The former Zuiderzee in the northwest is left blank. Sources: 1:100,000 maps of Ten Houten de Lange et al. (1977) and 1:50,000 Soil and Topographical Maps.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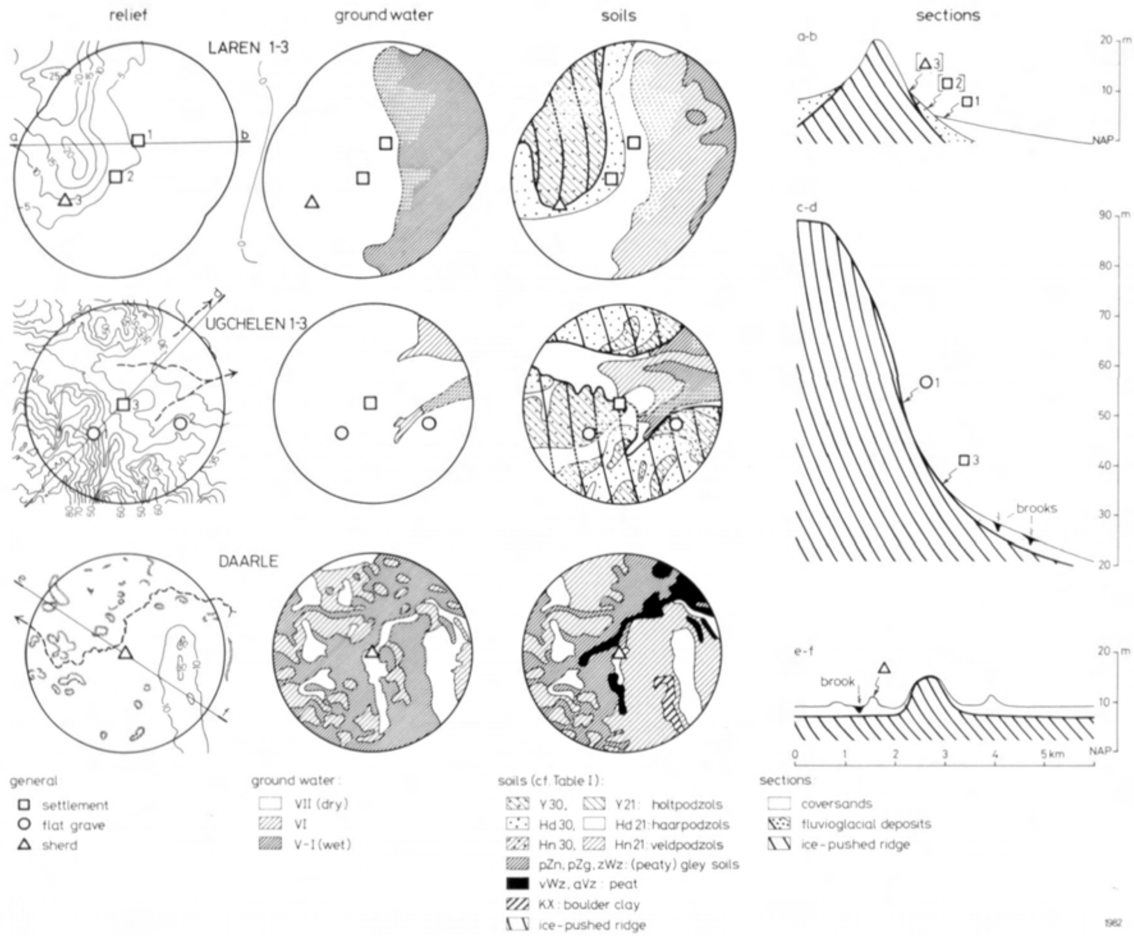

Fig. 11. Environment of the four TRB settlements of Laren-1 and -2, Ugchelen-3 and Daarle (radii of 2 km): relief, ground water, soils and geological sections (original scale 1:50,000). Contour lines (5 m intervals) and brooks according to Topographical Map; ground water and soils according to Soil Map and Geomorphological Map. The sub soil of built-up areas, enkeerd covers or recent dunes on my own estimation (broken lines). The geological sections are based on the contour lines and my estimate of the geology.

ments lie on the top of the coversand mantle, edging up against the fluvioglacial and ice-pushed sands of the hills. The same holds true for the Laren (144/473) and Remmerden (165/442) sites on the Gooi-Utrecht ridges west of the Veluwe. Fig. 11 gives details. At Ugchelen-3 in the centre-east of fig. 10 (191/466) the chosen site had a view commanding the dry Assel valley, no doubt an easy east-west thoroughfare, and the small dry valley of Het Leesten south of it. It also bordered the damp valley northward where small streams provided drinking water. It seems that the settlement site territory (as marked by two flat graves, see below) took advantage of this position. The finds in the Vaassen-Niersen enclave (189-192/476-479) north of Ugchelen may have been made in a comparable position, but unfortunately their recording is faulty.

The second type of landscape chosen for settlement were the margins of the moist valley of Uddelermeer and Leuvenumse Beek in the northwestern Veluwe (180/473 to 174/483). The sites with known location are situated on dry ground, generally coversand, near to moist soils or water.

Not represented is a third landscape type, that of low coversand ridges, or rises, often parallel and alternating with small streams and resting on a moist loamy or sandy substrate, directly west of the Veluwe. The crests of the rises, often less than 50 m wide, are covered by accumulated Enkeerd arable soils or have lain in grassland since long before 1800. Lack of effective archaeological activity has perhaps created another blind spot here, for the few systematic observations of sand pits in such rises produced artefacts of other prehistoric periods (Bellen 1931, Oosting 1936).

Along the ice-pushed ridges of Utrecht and Gooi, the Laren (fig. 11) and Remmerden settlements conform to the first landscape type, those of Lage Vuursche (143/465) partly perhaps more to the second. In the latter micro-region there may have been one hunebed (U1) as suggested in a penwash drawing of 1770-1790.

IV. *Larger map scales (from 1:25,000 to 1:10,000 and 1:40)*

The Ordnance Survey 1:25,000 maps are the maps the archaeologist usually works with in this country. They show every lane, most ditches and there is generally enough space between finds or monuments to inscribe them on uncoloured sheets. The paperwork becomes too bulky for whole-country surveys, but for subregional research they are excellent. Too little use has been made of the 1:10,000 maps. They offer no more geographical detail than the 1:25,000 maps, except for the very detailed elevation maps. Any subregional survey should start by drawing the contourlines oneself: this teaches one the lie of the land, especially the coversand relief. Ideally, one should check and improve the dicussed soil, geology and geomorphology maps by borings and then compile a selective combination (as is often done in the wetlands) on this (linearly) five times larger scale. Such work has, however, hardly begun for the environment of TRB sites, but it is clear that one should do this to bridge the gap between the plans of excavations with usual scales of 1:40 to 1:200 and the discussed smaller scale maps of the environment. The cadastral maps on scales 1:2,500 and 1:5,000 have many errors, being the result of continuous "patching" since their introduction around 1830, when their geodesy was not quite satisfactory.

Study of micro-regions of TRB settlement seems very promising (fig. 11). Harsema (this volume) and Zimmermann showed how fruitful this may be for gaining insight in the location and environment of certain better-known settlements or settlement cells *(Siedlungskammern)*.

IV. *Chronological aspects*

I will conclude by mentioning three aspects so far neglected in this article: chronological, social and biological.

TRB artefacts are quite useful for typochronological dating – even small sherds can often be identified as to form and stylistic phase. The distribution maps (Bakker 1979a, figs. 37-40) show a gradual expansion from the Drente Plateau towards the south and southwest, but the number of well localised and typochronologically significant finds appears somewhat too small to discern time trends in the choice of terrain outside Drente. Even the study of such trends on the Drente Plateau is problematical. In a review (1981) Sherratt concluded from small-scale distribution maps of phases A+B, C+D1+D2, E1+E2, and G (Bakker 1979a, figs. 37-40): "The distribution maps of these phases show an important contrast between an early, river-based pattern, a middle pattern of interfluvial expansion, and a late pattern, which is again river-based... The late pattern should be put together with an early Corded Ware distribution, which I suspect would show a complementary concentration in the interfluves, with important implications for the interpretation of these contemporary styles in social terms". However stimulating these remarks are, they do not yet quite convince me. Ik wil restrict my argument to the Dutch situation but no doubt it will, mutatis mutandis, be also valid for the adjoining parts of Germany, at least as far as the rivers Hunte and Weser.

Apart from the Veluwe, the Dutch TRB country is veined by brooks and streams, and many more of them than the Hunze, Dinkel and Vecht on my summary maps must have been canoeable (cf. figs. 6-8: there are brooks in almost all valleys). So, one can not properly speak of habitable interfluves of more than four to ten kilometres wide. Most sites on the river dunes along the Vecht and the Dinkel date from the middle phases. The available maps of TRB distribution are still dominated by the hunebed excavations, and, as we have seen above (fig. 8), most megaliths congregate on the Hondsrug and Ridge of Rolde, along the scarps of the boulder clay plateau eroded by primeval valleys. Because the excavations concentrated on the shortest and earliest hunebeds, most early pottery derives from the Hondsrug. The Hunze stream was marked on maps because it bounds the Hondsrug hunebeds to the east.

Furthermore, the recognisability of the pottery diagnostic for each phase is not consistent. Roughly stated, the A, B and G phases are, in the main, represented by larger pot fragments from the hunebeds. Small sherds of the sparsely decorated G pottery are almost indiscernable form the later urnfield ware, or even from Ruinen-Wommels *terp* pottery. A few known "peripheral" G settlements and flat graves like Bornwird, Steenendam, Oostrum, and Denekamp (265/488) and Schokland (181/517, cf. Postscript) demonstrate, however, that our distribution map must be extremely incomplete. The *tvaerstik* decoration, on the other hand, which is diagnostic for phases D1, D2 and E1, is readily identified on small sherds, and so are, to a lesser extent, the decorations of phases C and E2. The distribution map of the middle phases must therefore be much more complete than those of the early and late phases.

Still, by far the greatest amount of TRB pottery known from megalithic tombs and flat graves belongs to phases D1, D2, E1 and E2. This is often regarded as a sign of population increase, which may indeed be correct, but the alternative explanation of a longer lasting period is difficult to rule out.

The old theory of an early Corded Ware distribution complementary to the final TRB distribution was last defended by Van der Waals and Glasbergen (1955), but refuted by Van der Waals (1964, p. 22). A growing number of early Corded Ware finds in hunebeds and TRB settlements on the Hondsrug and elsewhere on the Drenthe Plateau confirm the last view. In fact, the Corded Ware immigrants - I fail to understand these events differently - appear to have associated with the local phase G TRB population, as they did with the Vlaardingen people in the wetlands.

My provisional counterobjections to Sherrat's impressions of course leave his main point standing that detailed phase maps of TRB and both Beaker cultures are needed to solve such questions, and that they may teach things which we at present do not even expect. What are we to think, for example, of the hunebeds D20-Drouwen and D26-Drouwenerveld lying 1250 m apart on the same sandy "island" in the Borger area (248/551-552)? D20 contained large quantities of G pottery, but the series of TRB pot interments in D26 broke off with phase E2. The TRB artefacts layer seemed to have been covered by a loose pavement of heavy stones upon which one and a half battle-axe of the Corded Ware must have lain. Fragments of two, half a metre wide early Corded Ware *Strichbündel* amphorae were found in an old pit cutting though the upper pavement. Because TRB Late Havelte (G) and early Corded Ware were contemporary, this is perhaps suggestive of a kind of modus vivendi of both populations at fifteen minutes' walking distance.

Diachronic research, for example from the Mesolithic to the present period, obviously would show striking time trends. Unfortunately hardly any comparable whole-country surveys have been undertaken.

Modderman's pioneer work on the prehistoric barrows and Neolithic finds of the Veluwe (1954, 1955, 1963) and that by the *Veluwe Project 2* (forthcoming) on several occupation phases between the TRB and AD 1850 shows what may be expected. Modderman (1955) concluded from a very detailed 1:25,000 soil map of the Vaassen-Niersen area (Van Liere and Steur 1955) that the 152 barrows were confined (in present terms) to gY30-VII, but avoided gHd30-VII and gHd23-VII if they were located on the ice-pushed ridge; but that those in the moister landscape along the flanks of the hills were bound to the drier coversand ridges.
He elegantly explained the strikingly disparate barrow distribution on the Veluwe hills by the presence of gY30 and the absence of Hd soils, and vice versa (1954). Unfortunately distribution maps remained unpublished at this stage. Later, Modderman (1963) researched the distribution of Corded Ware and Bell Beaker finds in barrows and (few) flat graves in the southwestern and the northwestern Veluwe on the basis of the 1:200,000 Nebo soil map. The three TRB settlements known to him (Uddelermeer (180/473), Elspeet (181/479), and Beekhuizerzand (174/483)) showed a preference for drinking water nearby, and the latter two sites were situated on very poor (viz. loamless) coversand and fluvioglacial sand (ibid., p. 13). The present study shows that this is a general trend.

There was a striking contrast in the location of Corded Ware and Bell Beaker graves. Like the prehistoric barrows - in which they were generally found - they displayed a predelection for loamier soils. Corded Ware graves were concentrated in the vicinity of moist places, but the later Veluwe Bell Beaker graves expanded to the loamy soils further away from the drinking water (Modderman 1964, p. 11-13).

A recent distribution map of the almost one thousand barrows of the Veluwe on the original scale of 1:50,000 (Klok 1978, p. 16-17) suggested a statistical comparison of the barrow locations with the 1:50,000 soil maps by the *Veluwe Project 2* J.M.A.W. Morel found here again the described relation between barrows and Y30 on the ice-pushed ridges, but stressed the fact (personal information) that this is a rough relation in which the distance between single barrows or barrow clusters and these soils may amount to several tens of metres. Furthermore hardly any TRB sites are known from areas devoid of barrows. An essential distinction should be made between the sites of settlements, barrows, fields, pastures and grazed woods (of which the latter three are very difficult to identify). The *Veluwe Project 2* also substantiated (by bar graps) subsequent shifts in the settlement history, of which the trends were detected by Blommesteijn et al. (1977).

V. *Social aspects*

I cannot yet say much about these. Dutch TRB settlement research is still in its infancy. No site hierarchy or site typology is yet applicable to the very restricted number of better-known settlements. The striking diversity of the scarce house plans known elsewhere (cf. Schirnig, ed., 1979) demonstrates once more that it is too early for generalisation. The TRB refuse concentrations of the Laren settlement where no house plans were visible were sampled on a metre square basis, but as yet no comparable maps are available for sites with house plans. What follows are "a few indigested notes".

"Neighbours assistance" in hunebed construction from inhabitants of the wide surroundings may explain the relatively uniform character of TRB artefacts over large regions.

Elsewhere I have sketched the potential of subregional stylistic research, for example the Borger area (around 249/551) on the central Hondsrug (Bakker 1980). This municipality has eleven existing hunebeds (D19-D29) of which D19 and D20 at Drouwen, D21-22 at Bronneger, D26 in Drouwenerveld and D28 at Buinen have been systematically excavated. The hundreds of fragmented pots permit one, in principle, to discern between "services" (Schlicht 1968), viz. the products made for one single occasion by the same (female) potter (on the basis of decoration organisation, used implements and technique) and pot groups of ever-lessening degrees of similarity, starting with probable products of one or two females and ending with sub-regional styles. Because clay and clay temper (granite, etc.) were normally derived from the boulder clay, petrology and clay mineralogy are useless for tracing pottery exchange, but stylistic analysis must help us here. The little that is known suggests that most pottery was locally-made, and used. Stylistic analysis may tell us in which hunebed the products from an individual potter (or at least pottery with very local decoration features) are found. Because the refuse of settlement sites also contains small amounts of decorated pottery of top quality, some residences of potters may even be traced that way. The settlement sites generally shifted to new places in the course of time, whereas the use of the megalithic tomb(s) continued. Thus it may, in principle, be possible eventually to map the "territory" belonging to the community that exclusively used one or more tombs. In that case, the stimulating Renfrew polygon model (fig. 7) could be checked, and perhaps more conclusively than in the Irish, British, Maltese, and Easter Island cases studied by him, where decorated pottery and known settlements are rare or absent (Renfrew 1973, 1974, 1976, 1980; Darvill 1979). One wonders, however, whether TRB settlers hesitated to inhabit otherwise attractive regions without boulders enough for hunebed construction. Could they share tombs elsewhere? (Cf. references and discussion of the Renfrew and Merina models in Bakker 1980)[6]. Obviously these and similar studies cannot refrain from stylistic analyses of Knöll's calibre (1952, 1959). Reference can also be made to computer-aided stylistic analyses with a cultural anthropological scope, which I shall here not anticipate (Voss, in press).

On the Veluwe, some relevant details were observed. The pottery from the Elspeet (181/479) settlement (phases B-C) is unique for its thick walls, and that from the Beekhuizerzand (174/483) settlement (phase E2, Modderman et al. 1976) and adjoining Harderwijk (173/483?) cemetery (Manssen 1980) is conspicuous for the coarse quartz tempering of the greater part of the pottery (Manssen 1980). This implies that the pottery was locally made, and that (in my opinion) quartz was more readily available at Beekhuizerzand than the usual pied rocks such as granite. While we were preparing the Beekhuizerzand publication, Professor Modderman had the impression that large zigzags were more common there than in the phase E2 site of Uddelermeer where short, one-dash zigzags prevailed. I did not emphasize this in the publication (Modderman et al. 1976, p. 53), because at least two similar pots occurred at Uddelermeer (180/473; Bakker 1979a, figs. B20:6a, 9). Afterwards Manssen found (1980, n. 5) that the most convincing parallel at Uddelermeer was the only pot from that site with coarse quartz tempering. Its findspot demonstrates its contemporaneity with other E2 pottery on the site. Thus we might have here an instance of slightly different tastes of pot decoration in two settlements 12.5 km apart, and of incidental exchange of pottery between them.

Three pots (Bakker 1979a, fig. B20) from two different localities east and west of the Ugchelen-3 settlement (191/466; fig. 11) probably represent flat graves. The asymmetrical fringe decoration on one pot from each funerary site suggests the same potter and the overall similarity with the sherds from the settlement argues that she lived there. The flat graves are situated at 1 and 1.3 km distance from the settlement, as it were on strategic positions along the fringes of the "site territory". If this were true, posts or flags may have marked the graves, because no earthen TRB barrows other than those over megalithic tombs are known from the country. The contour lines suggest that the cemeteries were visible from the settlement, slightly below the skyline, perhaps in small forest clearings on the slopes.

The little that is known about the location of the Harderwijk cemetery again suggests a distance of ca 1 km from the contemporary Beekhuizerzand settlement (Manssen 1980, fig. 1).

Another type of flat grave cemetery must have been those immediately next to the settlement, as at Uddelermeer (Holwerda 1912, fig. 1-n indicating flat graves, and k, l, m refuse pits and palisades). A possible flat grave as Elspeet, at a similar short distance from the settlement, may also be assumed (Bakker 1979a, p. 189).

VI. *Vegetation*

Ideally a reconstruction of the vegetation of a landscape and human influence thereon should hinge on:

a. pollen analysis of peat sections - divisible into (a1) long sections providing master diagrams depicting the general vegetational history, and (a2) sections as close to the settlements as possible, often incomplete, but showing pollen like *Cerealia* that hardly ever occur at any distance from the arable fields,

b. analysis of pollen spectra preserved in old ground surfaces or turves of ancient barrows etc., indicating the vegetation in the immediate surroundings of the barrow or the place of sod cutting at the moment of mound construction (Waterbolk 1954),

c. seeds collected by wet sieving or flotation from refuse pits,

d. seed imprints on pottery, and other plant remains like charcoal,

e. analysis of the soil maps.

Dutch research relevant to TRB questions has thus far successfully concentrated on (a1) and (b). A comprehensive study by Casparie and Groenman-van Waateringe (1980) summarizes and reinterprets the work done on (b) and (a1) by Waterbolk, Van Zeist and the authors themselves on the Drente Plateau and the Veluwe and the Gooi-Utrecht hills. Reference can also be made to an excellent introduction to the general problems involved (Groenman-van Waateringe 1978).

Fourteen spectra from hunebed mounds in east and central Drente are available; further, numerous Corded Ware and later spectra from barrows in Drente and in the central Netherlands, in addition to the master peat diagrams indicate the later course of landscape development. Unfortunately the thousands of pingos and other small lakes riddling the coversand landscape of the Drente Plateau have usually lost their Sub-Boreal peat due to turf exploitation. There are, however, exceptions (e.g. Ploeger and Groenman-van Waateringe 1964). Further study of seeds (Van Zeist 1968) and soil maps would be rewarding.

On the very dry Veluwe and the Gooi-Utrecht hills (where Corded Ware barrow spectra and a few 'master diagrams provide the information, as TRB mounds are lacking) Groenman-van Waateringe reconstructs "an open woodland with chiefly oak, lime, birch, and hazel, and a compartively well developed undergrowth, providing sufficient fodder for livestock". This was the predecessor of the present *Fago-Quercetum* with lime instead of beech. As a result of grazing, the woodland became increasingly open but this was a very gradual process, in contrast with Drente, and there are no signs of wholesale forest burning. The TRB population supposedly made small clearances in this landscape, as the data from Drente suggest (Groenman-van Waateringe in Casparie and Groenman 1980).

According to Casparie (ibid.) the hunebed spectra in Drente show that these graves were constructed in small open areas in the *Quercetum mixtum* oak forest. These were arable fields, sometimes still under cultivation or grazing, but often abandoned. Some showed forest regeneration, but heath expansion took place here and there (eventually it would lead to large heathlands in the Bronze and Iron Ages). The hunebed spectra show no regional or chronological trends. It would, however, be relatively easy to increase their number.

Casparie discusses three types of forest between 3000 and 2200 bc in Van Zeist's many peat diagrams directly east of the south-eastern tip of the Hondsrug (l.c., p. 57-60). From the northwest to the southeast the locations are

Emmen, Bargeroosterveld and Nieuw-Dordrecht, 1.5 and 2.5 km apart. In the direct vicinity of the location of the master diagrams between Emmen and Bargeroosterveld Neolithic man did not affect a wood rich in *Fraxinus* (ash), but near Emmen a wood rich in elm *(Ulmus)* was greatly reduced by Neolithic clearings, as was a wood with many lime trees *(Tilia)* near Bargeroosterveld and Nieuw-Dordrecht. Casparie tried to locate these forest types in an interpretation of the 1:200,000 Nebo soil map (Atlas 1, pl. IV-I) by J. Wieringa (1958, cited in Bakker 1976, fig. 10). It is difficult, however, to translate Casparie's conclusions in terms of the present 1:50,000 soil map. The damp to wet *Fraxinus*-rich woods which remained intact must then have grown on present Hn 21x-VII in a side-valley of the Hunze between Emmen-Angelslo and Bargeroosterveld. Casparie's surmise that *Tilia* flourished on Wieringa's symbols 6 and especially 4 (which border the peat bog there) would imply Hn23x-V and perhaps KX-V on the larger scale soil map. Further checking here and at other places by hunebed spectra and peat remnants in pingos or bogs is necessary, but it is clear that we have here a first step towards a reconstruction of a map of the forest cover and other vegetation in the TRB period.

An additional problem is that TRB is known archaeologically only from 2700/2600 bc onwards, while the *Ulmus* decline starts 300 years earlier. Van der Waals (1972) assigned *Rössener Breitkeile* to this pre-TRB (?) period. They are found on wet sandy soils along stream, valleys, etc. Harsema (1975) reminds us that *Walzenbeile* (quartzitic axes with circular or oval cross-section) should also belong to this period. They have not been studied systematically in the Netherlands since Åberg (1916, 1918), but are common in the sandy regions. Do we have here an agrarian Swifterbant (?) culture, or is the elm decline mainly due to natural causes, as several authors assume?

K.E. Behre works in N.W. Germany on the same problems on the Flögeln sandy "island" (personal information Behre; Zimmermann this symposium). He was able to locate TRB clearings of small *Tilia* groves for arable plots through the analysis of peat sections from small pingo-like pools next to them (a2), which showed such data much better than the master diagrams (a1) from the large peat bogs along the "island". The TRB people "cut especially the lime forests on the somewhat better and drier soils. This is marked by a sharp decrease in the *Tilia* pollen curve. At the same time the wood was thinned out *(gelichtet)* by grazing and felling, which resulted in the expansion of herbs (especially grasses) and locally heather" (Behre et al. 1982). A comparison with the TRB finds distribution (Zimmermann, loc. cit.) and soil maps (e) is now being undertaken and it will be of great interest to see what pollen spectra the old ground surfaces (b) of the local megalithic tomb mounds will show when compared with Drente.

VII. *Final remarks*

That an integration of "earth" and "biological" sciences and archaeology is necessary, is, of course, the opinion of Dutch archaeology since World War I or before. The new 1:50,000 "earth science" maps give new impetus to such research in the sandy regions. One hopes that the compilation of gazetteers of "all" remains of one or more archaeological cultures or horizons for the whole of the country will now become a matter for urgent consideration.

"Settlement patterns" may be random because originally random distributions are involved, or because the distribution was subsequently randomised by later filtering processes. In the TRB case, the Dutch distribution maps display, however, direct influences from the environment. Future research may disclose whether (besides more basic needs like dry feet and drinking water) TRB settlement patterns were more guided by the presence of open woodland than by the lightness or the fertility of the soils. The former seems more probable than the latter, but the conflicting provisional conclusions mentioned above concerning the soils chosen for settlement in Drente and the Veluwe, and for the wood clearings in Drente and Flögeln show that it is still too early for an explanatory synthesis.

Human settlements attract and repel each other because of social, economic and psychological factors which are partly determined by culture and technological level. Little is known yet about such patterns of TRB settlement in the West Group, whether influenced by the environment or not. Future research should also be directed to the strictly contemporary occupation areas (like the Borger or the Emmen region) with a high site density, and to those (such as the Veluwe) with a low density.[7]

VIII. *Postscript*

Shortly before 14 July 1982 the BAI discovered a hunebed below the intact peat and clay layers upon which the *terp* of Heveskesklooster (260/591), near Delfzijl was resting. The hunebed ("G5") stood on a tabular coversand ridge (top 1.90 to 2.10 m below NAP). Before the peat growth on top of the monument (1500 - 500 bc?) some sidestones have been dislocated. Three pairs of sidestones, two endstones and an interior chamber size of 3.6 by 1 m could be recognised. The capstones were missing and the top of the tomb mound (1.25 m below NAP) did not reach as high as the top of the orthostats (0.80 to 0.75 m below NAP).

Further research has been planned. My thanks are due to drs. J.W. Boersma and Professor H.T. Waterbolk for their permission to publish these provisional data. Zimmermann mentioned (this symposium) comparable peat-covered hunebeds near Flögeln. The tomb mounds of several of these are "incomplete" as well. Excavation of such "incomplete hunebeds" without any post-Neolithic disturbance may clarify several unsolved questions about more complete items elsewhere.

Once more this find demonstrates, dramatically, that enormous parts of the Pleistocene sands which are now covered by peat and clay must have provided excellent settlement areas in TRB times. Marginal ridges must have been favourable because they were well drained and suitable for agriculture, but also gave access to the hunting, fishing and grazing grounds of the surrounding wetlands. The mean sea level then lay about 3.5 to 3 m below NAP and TRB sites are known from a maximum depth of about 2.5 to 2 m below NAP. The contour line of 3.5 m below NAP of the Pleistocene surface is rendered in fig. 6 as a rough indication of the maximum extent of outcropping Pleistocene in TRB times (Roeleveld 1971; Griede 1978; sheets 10W-E of the Geological Map 1:50,000; Pons et al. 1963). Beyond that line minerotrophic peat growth and coastal sedimentation took place; within it were large areas covered by ombrotrophic peat.[8]

The TRB finds at Heveskesklooster, Siddeburen and Hellum came to light after the compilation of fig. 2. The same is true for a first indication of Vlaardingen occupation in the former Zuiderzee area. Quartz tempered Vlaardingen sherds were recognised among those from Schokland-P14, a Pleistocene outcrop in the wetlands immediately southwest of the most important stream of the Noordoostpolder (181/517; cf. note 8; personal information J.W.H. Hogestijn). The TRB sherds from this site now comprise an E1, a G and a belly-fringed funnel beaker sherd (phase D2 or earlier). Permanent or seasonal TRB occupation of this site during a long period of time is thus suggested. Excavation would seem rewarding, also because TRB-Vlaardingen contacts may have occurred here, as on the Hazendonk.

This new find suggests a Vlaardingen occupation along the lower rivercourses, lagoons and estuaries of the Zuiderzee area. This basin reached as far inland as the "Vlaardingen area" downstream of Nijmegen. The scarcity of finds and the geology may perhaps argue for a sparser settlement of the Zuiderzee area, but later sedimentation and erosion may have been a disturbing factor here.

Due to similar conditions, there is no real proof that Vlaardingen never penetrated the coastlands northeast of Texel where sand barriers are presumed to have been present roughly following the line of the present Frisian Islands in the Netherlands and Germany. The absence of Vlaardingen pottery in the Corded Ware settlement sites of Aartswoud and Kolhorn (126/528 and 122/534; Van Iterson Scholten and De Vries-Metz (1981) and personal information from Professor J.D. van der Waals) and in the prehistoric collections from the Ems, Weser-Hunte, and Elbe estuaries argues in favour of the nonresidence of Vlaardingen beyond the (now mainly eroded) sandridges of Friesland-Wieringen-Texel (cf. fig. 6, contour line of 3.5 m below NAP).

Thus the Vlaardingen culture seems to have occupied three wetland basins: the Rhine-Meuse area west of Nijmegen, the Zuiderzee basin, and the Schelde basin where Vlaardingen is only summarily known.

Dedication. I found it a great privilege and pleasure to contribute to this Symposum in honour of Professor Modderman, who taught me how to excavate just 30 years ago (Elspeet 1952, Sittard 1953, Spanjaardsberg 1955) and in whose footsteps I often followed while studying the Neolithic finds of the sandy soils and the wetlands of this country. I hope that he, who has himself devoted so much time and energy during his impressive carreer to the compilation of archaeological distribution maps and their comparison to soil maps (Noordoostpolder, river area, Veluwe, Atlas 1, pls. VIII/1-2, etc.) may appreciate the preceding study.

Acknowledgements. My thanks are due to quite a number of amateurs, colleagues and institutions for the information on which my site gazetteer is based, or for other invaluable information; to the Director of the Soil Survey Institute Wageningen for providing the available concept sheets of the Soil Map 1:50,000 and for permission to use one of them for fig. 11; to Professor E.A. Koster, Physical-Geographical Laboratory of the University of Amsterdam, for providing the contour map base for fig. 10; to Mr R. Reinders, Rijksdienst IJsselmeerpolders, for creating the possibility of a new study of Schokland-P14; to Dr. W.H. Zagwijn, Rijks Geologische Dienst Haarlem, to Dr. P. Buurman, Soils and Geology Dept. Landbouwhogeschool Wageningen, to Dr. O. van de Plassche, Instituut voor Aardwetenschappen Vrije Universiteit Amsterdam, and to Professor W. Groenman-van Waateringe, IPP, for their advice; to Mr J. Knight, Mrs C. van Driel-Murray, IPP, and especially to Dr. F. Pryor, Peterborough, for correcting my English text; finally to Mr A. Visser and Mr B. Donker, IPP, for drawing the illustrations. None of them of course may be held responsible for the errors of this article.

NOTES

1. A large-scale map shows a smaller area in greater detail than a small-scale map. This long-established usage of the term "large scale" in geography and scale-model construction is contrary to the current usage of its figurative derivative as in "scale enlargement". "Large-scale archaeological enterprises" will tend to use smaller-scale maps as they expand in area.
2. K. Jazdzewski and G. Kossinna subdivided the "TRB culture" or "TRB *Kulturkreis*" ("culture cycle") into "Groups", in which "Subgroups" may be discerned. This is current usage in Continental Europe. David Clarke used a different hierarchical terminology: "Technocomplex", "Culture Group", "Culture", "Subculture", "Site" (1968, fig. 61), so that the "TRB culture" would have been named the "TRB Technocomplex" the "TRB West Group" would have been named the "TRB Technocomplex", the "TRB West Group" would have remained unchanged, and its "subgroups" would have been named "cultures".
3. This area with its sluggish brooks must have been an ideal habitat for beavers. Their clogging of such drainage systems is, for instance, visible in the watershed valleys of the Canadian Rocky Mountains. The detrimental effect of the introduction in 1956 of Canadian beavers into Tierra del Fuego to the passability of valley trails is described by Chatwin (1981, p. 132).
4. In borderline cases the "best" possibility was chosen. Covers of arable Enkeerd soil or of recent dune forma-

tions were "omitted" and the probable original soil type was reconstructed. Such cases are a minority in the higher parts of Drente, but render the scarcer data from other, less densely occupied regions more problematical because such covers are there more common on TRB sites.

5. It is as sobering as satisfactory to read that Krause and Schoetensack (1893) were already aware of similar principles of hunebed location when they studied the distribution of the megalithic graves in the Altmark, in the present southwestern DDR: "The megalithic graves were often constructed on sandy, sterile soils, no doubt because this material was lighter to handle while the barrow was being made. Their present preservation is often due to this circumstance. The geological map demonstrates that such sandy areas often only form islands in a larger boulder clay plateau, or that they frequently border on larger boulder clay areas" (free and abbreviated translation from p. 111, cf. also p. 112-14).
6. My sentence (1980, p. 55): "Renfrew (1976) explained the construction of megalithic graves as a brilliant invention to reduce stress in Neolithic societies which were hemmed in their expansion by the Atlantic Ocean" is insofar misleading as it presupposes a far-sighted inventor who intended to reduce land-hunger frustrations in this way. Instead stress reduction may have been an unexpected side-effect of what started as a series of decisions for "normal" funerary reasons - induced, perhaps, by a surplus of labor force. But according to Renfrew's line of thoughts it is precisely this benificent side-effect which may have ensured its age-long incorporation in the Neolithic cultural systems into the "Atlantic Façade".
7. If I had seen Trigger's clear introduction to the research of settlement patterns (1968) before this article was written, its composition might have been slightly different. Trigger pleaded in favour of what are increasingly presenting themselves as two totally different and separate approaches of settlement pattern studies. The first, "a sort of ecological determinism" "appears to be based on the assumption that the settlement pattern is a product of the simple interaction of two variables - environment and technology". The second approach is confined to "the strictly social aspects of settlement patterning", while making inferences about the social, political, and religious organisation of cultures. Professor Diderik van der Waals regretted in his summing up an almost total neglect of the second approach at this otherwise so stimulating Symposium. This must, in my opinion, be due to the preferences and education of the organisers and several of the invited speakers.

   There is an analogous cleavage between sociographic and physiographic geography in this country. Like Dutch ethnologists, sociographers often glance at sociological approaches, whereas physiographers incline towards geology. A mainstream of fruitful prehistoric research has in this country for several decades been determined by Trigger's first type of approach, no doubt due to the biological and physiographical basic training of most prehistorians, and the rapid adaptation to it by the minority educated in sociography, ethnology, or other fields. There are now some signs of a turning wind, however.
8. The maximum depth observations for low TRB sites on Pleistocene sands are 0.80 to over 1.60 m below NAP for the Bornwird ploughmarks, whereas Oostrum and Steenendam lay higher than 1.50 m below NAP (Fokkens 1980). The Siddeburen TRB settlement (255/584) on the fringe of the Slochteren-Hevesklooster sandridge lies at 1.7 to 2.0 below NAP (personal information J.N. Lanting, March 1982). The base of the Heveskesklooster hunebed lies at 1.90 m below NAP, but the maximum depth of occupation and ploughing - both of which may be expected there - has not yet been ascertained. A peat-covered ploughland with three TRB sherds and Vlaardingen, Veluwe Bell Beaker, Pot Beaker and Barbed Wire sherds on the coversand-covered boulderclay ridge of Schokland-P14 (181/518) lay at 2.50 m below NAP (excavation 1957), personal information G.D. van der Heide and J.W.H. Hogestijn). TRB sherds and flints lay on coversand below peaty material at 2.5 m below NAP (=NN) at Nortmoor-Heimschloot, east of Leer, Ostfriesland, Germany (Schmid 1965). It is not known whether refuse dumps in a depression or the true level of occupation are concerned here.

   Van de Plassche (1982, fig. 67) reconstructs a Mean Sea Level of about 3.3 to 3 m below NAP for the TRB period and a Mean High Water sea level of just 1 m above that, but stresses the fact that the groundwater level of localities like our TRB sites was much influenced by local factors such as the topography of the sandy surface, rain and river water from the hinterland, distance from the open beach, and the local tidal amplitude in sea inlets (cf. also Louwe Kooijmans 1976b).

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A cheap reproduction of all Dutch 1:50,000 Ordnance Survey Map sheets on a scale of 1:80,000, without colours and contour lines. It is useful for the compilation of find gazetteers. The findspots should be numbered by 1:50,000 map sheet number and sequential number ("17W-27"). For a precise location the Dutch grid co-ordinates should be used, not the green numbers added to the Atlas for biological documentation systems.

PROBLEMS OF SURVIVAL: LATER PREHISTORIC SETTLEMENT IN THE SOUTHERN EAST ANGLIAN FENLANDS

FRANCIS PRYOR

Recent years have seen a renewal of interest in the archaeology of the Fenlands of East England. This paper attempts to provide a succint overview of Fenland research prior to 1970 and this is followed by a more detailed account of work along the western Fen edge in the Peterborough area, in the lower valleys of the rivers Nene and Welland. A principal aim of the paper is to provide the reader with a thorough list of published papers on recent work, but the main problems still outstanding in the Neolithic, Bronze and Iron Age periods are also reviewed. Much attention is given to the problems of post-depositional distortion which are particularly severe in an area subject to peat wastage ("shrinkage") and annual alluviation. The problems these processes pose to the undertaking of regional survey are also considered in some depth. The paper concludes that team-based projects organised on a regional basis offer the best means of approaching these difficulties. Despite these problems, the extraordinary preservation of archaeological deposits offers a unique opportunity for research.

Introduction

This paper summarises recent work in the wetlands that surround the Wash inlet. We will concentrate on the Neolithic and Bronze Age periods (for the Iron Age see Cunliffe, this volume), as seen in a comparatively narrow band of land around the western and southern Fen margins. Nearer the North Sea we encounter the marine clays and silts of the Silt Fens; these deposits have their origin in Iron Age times and contain evidence for Roman, but no earlier occupation (Phillips 1970). Thereafter their development is of indirect relevance to prehistory (Hall 1982). Indeed, the adaptation of Medieval Fen communities to the vicissitudes of their changing environment could well echo processes that took place many centuries earlier (Ravensdale 1974; for further refs., Pryor 1980, 186).

The paper is in six sections (I-VI). The first briefly considers previous work in the area, and is intended more as a guide to the literature than a comprehensive synthesis. Part II is a short description of more recent work mainly carried out by the author and his team; there then follows (Parts III-V) a chronologically-based discussion of the principal developments in the region's prehistory. The paper concludes (Part VI) with some thoughts on the role of regional studies in archaeology.

I: *Fenland: its Ancient Past and Uncertain Future*

The title of this section is that of Sir Harry Godwin's recent synthesis of work in the Fenlands, prior to ca. 1962 (Godwin 1978). That volume includes an excellent discussion of Fenland research both before and after the last War; inevitably it reflects the author's own interest in palaeobotany. More archaeologically-orientated syntheses have been published by Sir Cyril Fox, Professor Grahame Clark and their collaborators (Clark et al. 1960; Clark and Godwin 1962; Fox 1923; Fox et al. 1926). These papers contain full references to the many Cambridge-based projects undertaken prior to 1960, mainly in the southern Fens. After 1960 archaeological interest in the region lapsed and this, in many respects, was most unfortunate, as the 'sixties

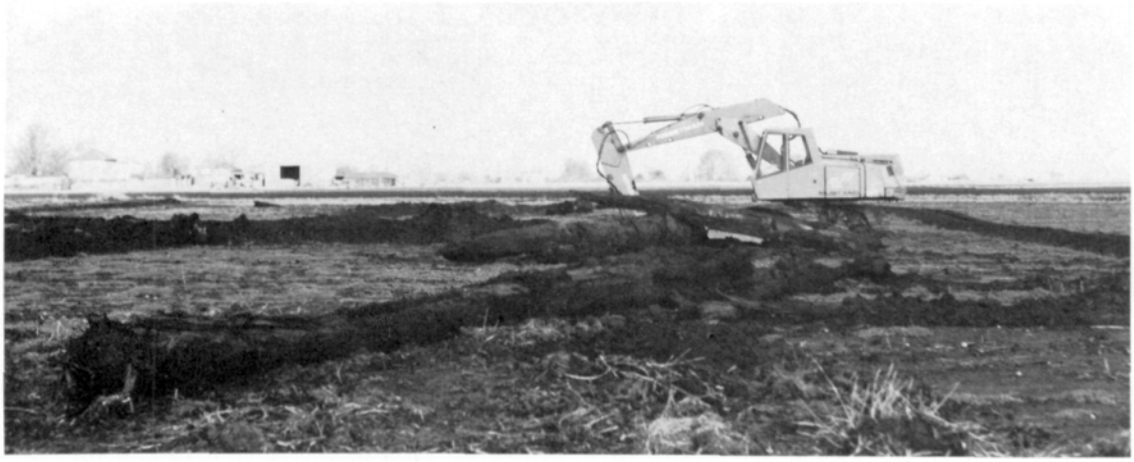

Fig. 1. "Bog oaks" being removed mechanically from the basal peat at Ramsey Heights, Peterborough, Cambridgeshire.

and 'seventies were periods of massive agricultural intensification and its consequences: land drainage, peat wastage and plough-damage. The extraordinary annual "harvest" of so-called "bog oaks" - many of which were inundated at the time inland fens began to form on level ground, from ca. 4000bc (Godwin 1978, 33-42) - bears sad witness to the fact that this is a continuing process (fig. 1).

The Fenlands cover an enormous area; estimates of their size vary (depending on criteria of definition), but substantially waterlogged deposits may be found over an area of some 1,070,000 acres (445,833 hectares). This landscape represents an archaeological resource of unique importance.

Recent, large-scale work on the southern Fen-edge began in 1969 with the publication of sites threatened by the imminent expansion of Peterborough New Town (RCHM 1969). The principal threatened prehistoric Fen-edge site was Fengate, on the eastern fringes of the city. This large (ca. 200 ha) cropmark site was excavated from 1971 to 1978 (Pryor 1974a; 1978; 1980a; in press). The Fengate project was followed by the Welland Valley Project, the report of which is in preparation, and this, in turn, will be followed by excavation and survey at Etton and Borough Fen, immediately north of Peterborough (fig. 2). We will discuss these projects further below.

Most work in the Fenland before 1960 took place under the auspices of the Fenland Research Committee which disbanded (Phillips 1970), but was reformed, in the mid-1970s, under the Chairmanship of Professor J.M. Coles. The Committee was concerned about the agricultural damage that was taking place in the Fens and accordingly appointed a full-time Fenland Field Officer, David Hall, to carry out a comprehensive, but rapid assessment of the situation in Cambridgeshire, a county which includes slightly less than half the total Fen landscape (Hall 1981). Working at the rate of some 10,000 ha a year, Hall has covered much of the county and is now also turning his attention to the fenlands of the other counties concerned (Lincolnshire, Norfolk and Suffolk). His discoveries have influenced our appreciation of the ancient Fen landscape fundamentally; in this paper, for example we will mainly be concerned with the buried barrowfields and landscapes he discovered at Borough Fen and Haddenham (Hall and Pryor forthcoming).

The northen part of the Fenland (occupying the southern part of the county of Lincolnshire)

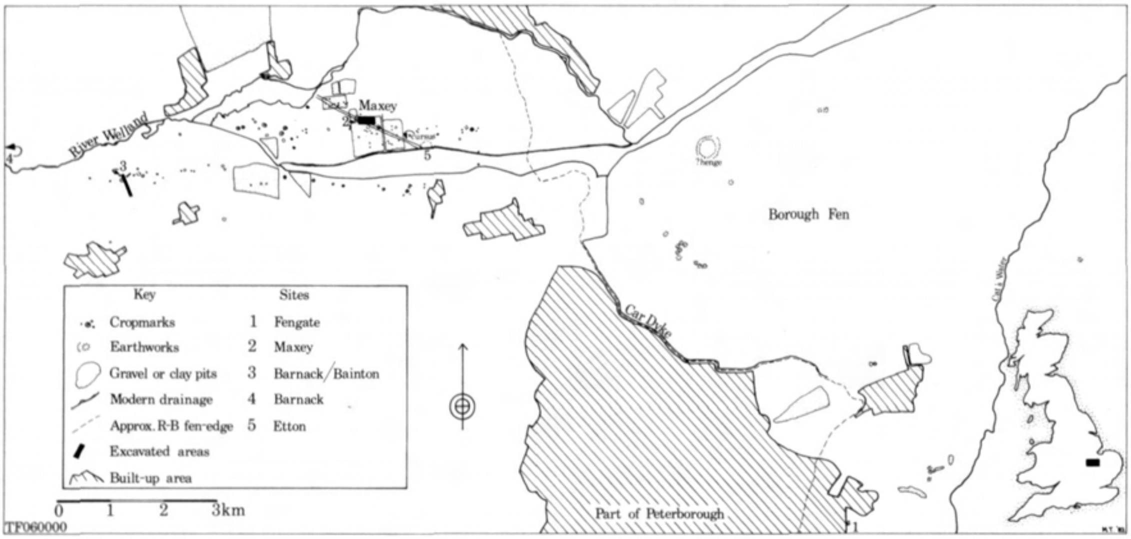

Fig. 2. Location plan, showing principal sites mentioned in the text (Drawing by Maisie Taylor).

has received less attention from archaeologists. In general, this prehistoric landscape is less readily accessible, being buried under substantial accumulations of marine deposits. The potentially severe erosive effects of these processes should also be borne in mind. It has recently been suggested that the Lincolnshire Fens were largely inundated by sea water during the Iron Age (Simmons 1980). This interpretation of events seems to the present author, and others, rather extreme and disregards the complexities of the situation (Shennan 1982). Certainly the varied collection of fish and wildfowl bones recovered from Middle Iron Age contexts at Fengate, just south of the Lincolnshire border, are entirely indicative of a freshwater, or very slighly brackish, environment (Biddick, in Pryor in press). Apart from a small excavation at Washingborough Fen, in the Witham valley near Lincoln (Coles et al. 1979), no recent prehistoric research in the Lincolnshire Fenland has yet been published in final form. Peter Chowne's important work at Billingborough, on the Fen-edge some 30 km north of Peterborough is, however, available in interim form (Chowne 1978; 1980).

We can conclude this brief account of the first steps of modern Fenland research with the good news that the English state archaeological service (currently the Department of the Environment) now recognises the importance of the Fens. Funds have been provided, via a small, central controlling committee, for three additional full-time Field Officers. Funds have also been allocated for projects at Borough and Haddenham Fens. It is understood that this represents the start of a long-term commitment.

II: *The S-W Fen-edge Project*

This project arose out of the Fengate project, which immediately preceded it. Its general aims and objectives have already been considered in some detail and need only a brief outline here (Pryor 1980b).

The Welland Valley project (WVP) was originally intended to augment information provided by Fengate which stood, to a considerable extent, in a contextual vacuum. The site's isolation was brought about by the rapid 19th Century expansion of Peterborough, modern agri-

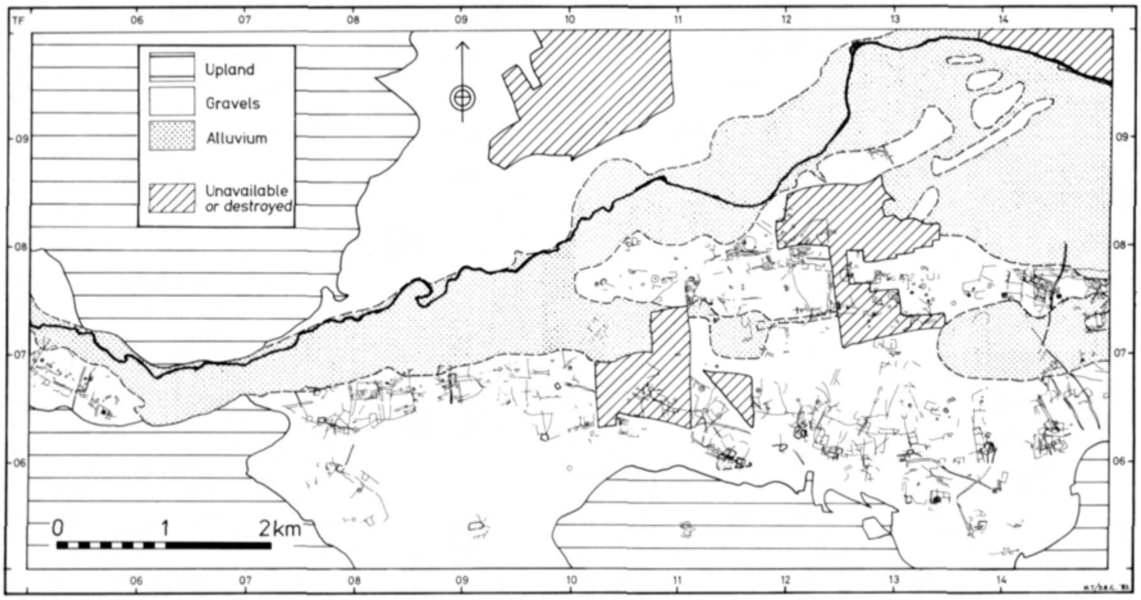

Fig. 3. Map showing distribution of cropmarks in the lower Welland valley, plotted against soil types. Plans of cropmarks on the gravel soils north of the Welland were not available at the time of publication (Drawing by Maisie Taylor, with D.R. Crowther).

culture and recent large-scale gravel quarrying. The Welland valley lies immeditaly north of Peterborough and provides a low-lying river valley and Fen-edge environment closely comparable with that of the lower river Nene in which Fengate is located. The Welland region is also rich in ceremonial and funerary sites which are less frequently encountered in the lower Nene. The two areas are thus comparable and complimentary.

Most of Fengate was covered by clay alluvium, laid down in Roman and post-Roman times. This deposit tended to obscure air photos and completely prevented pre-Roman material from reaching the surface. Geochemical (phosphate) survey, using boreholes, was possible but conventional field-walking techniques could not be employed successfully. These constraints were not so severe in the Welland valley where alluviation was restricted to the immediate surrounding of existing or relict river courses. The geology at Fengate, too, was remarkably uniform and did not provide opportunities for a comparison of settlement pattern with different soil types. The Welland valley displays a variety of soil types and physiographic regions of which the upland (limestone), valley side (limestone and gravel), valley bottom (gravel and alluvium) and Fen (peat and alluvium) are the most important (figs. 3, 4).

It was decided to survey the lower Welland valley using a sample strategy based on transects, 20 m wide. These transects were aligned N-S at approximate intervals of 1 km; the location of each transect within the appropriate kilometre "corridor" was determined by reference to random numbers. This pilot survey was intended to investigate the distribution of material between known sites and to investigate post-depositional phenomena that might distort the data. Analysis is still in progress, but preliminary results indicate that distortion is critically important: limestone soils of the uplands and valley sides are very thin indeed and plough-damage is severe; colluvium (hill-wash) has accumulated at the foot of the valley slope,

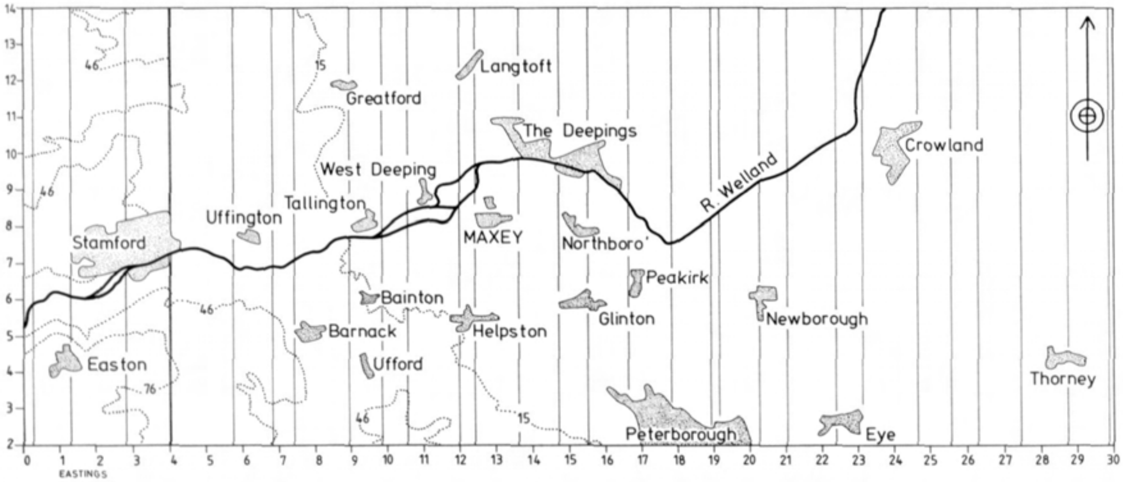

Fig. 4. Map showing study area of Welland Valley Project, with survey transect locations. (Drawing by R. Powell, after J.R. Bourne).

effectively masking cropmarks, while the gravel soils of the valley bottom show uneven preservation. Medieval plough headlands, for example, effectively preserve ancient soils in linear strips many kilometres long. The alluvium of the valley floor and Fen skirtland conceals an extraordinary wealth of waterlogged and semi-waterlogged sites. The distortions caused by these factors are very significant and when better understood might well cause us to modify current views of the prehistoric settlement pattern.

The academic aims of the WVP are mainly middle range, as will be apparant, below. These aims, however, can only be attained once suitable techniques, both of survey and of excavation, have been developed. Here we lean heavily on the advice and experience of our colleagues in the IPP, Amsterdam, who have recently carried out extensive survey and excavation at Assendelft. Our data recovery and sampling procedures are designed to be comparable with those used at Assendelft and elsewhere. Our broad aim is to develope techniques that may eventually be employed in the deep Fen; but for present purposes we do not attempt to carry out survey in areas where alluvium or surface peat accumulations are more than ca. 2.5 m thick. Again, our appreciation of settlement patterns is constrained, and therefore distorted, by such purely practical problems.

The transect survey aside, work in the Welland valley was principally concentrated at two threatened sites, Maxey and Barnack/Bainton. The former is a well-known site located at the centre of perhaps the most extensive cropmark scatter in Britain, which also happens to be the site of a large gravel pit (RCHM 1960; Simpson 1966; 1967). The latter was excavated ahead of a gas pipeline and is located in an extension of the same cropmark complex, in an area of known prehistoric importance some 5 km west of Maxey (Donaldson et al. 1977; Pryor and Palmer 1981).

The second phase of the project will see attention focus on the Fen-edge at Etton, immediately east of Maxey, and at Borough Fen, some 5 km further east. In many ways it is misleading to diferentiate between these sites which form part of the same prehistoric landscape, for the apparent separation, usually indicated by gaps in cropmark plans, is entirely caused by post-depositional effects of alluviation and peat-growth.

III: *Third and Fourth Millennia bc*

Until recently the Neolithic of the Cambridgeshire Fens had received little systematic attention since the pioneering research of Professors Clark and Godwin (1962). It was the period when large areas of Fen were still forming and the evidence, such as it is, indicates that settlement was dispersed, based on single family units, who practised mixed agriculture or horticulture amidst clearings in the woods of Fen-edge and island. Doubtless the Fen itself was exploited for fish, fuel, wildfowl and (seasonal?) hay and grazing. The available evidence suggests that the economy of these dispersed settlements was based on Boserup's (1965) long fallow system.

Only one house, dating to the latter part of this period, has so far been recovered, from Fengate; charcoal from the foundations of this small rectangular building (ca. 7 x 7.5 m) gave a C-14 date of 2445 ± 50bc (GaK 4197) (Pryor 1974a, fig. 4). Houses of approximately half this size, but post-built and sub-rectangular have recently been excavated at Tattershall Thorpe, a Fenedge site further north, in Lincolnshire (P. Chowne, pers. comm.). Some of the buildings included pottery in the insular (British and Irish) Late Neolithic Grooved Ware (formerly Rinyo-Clacton) tradition, so a date somewhat later than Fengate is anticipated. The Fengate house foundations contained a blade-based flint industry, some exotic items, and pottery in the plain earlier Neolithic bowl tradition of Eastern England. Pottery of this tradition finds close contemporary parallels in the Hazendonk-2 wares of the Netherlands. Dr. Louwe Kooijmans (1976) has pointed out that this material derives from Wetland sites on either side on the North Sea; but it is, perhaps, significant that nobody has yet attempted to explain the implied connection between Middle Neolithic communities of the lower Rhine and their insular earlier Neolithic contemporaries, in England.

The dispersed settlement pattern of earlier Neolithic times has been augmented recently by the discovery at two sites, Etton and Haddenham, of Fen-edge causewayed enclosures. Both sites appear to have been used for settlement and are protected from the plough by thick accumulations of alluvium; ditch deposits are waterlogged and preservation is accordingly excellent. The Haddenham site is currently being investigated by a team from Cambridge University, under the direction of Dr. Ian Hodder, but the project is still at a very early stage.

The Etton site is located alongside an extension of the Maxey cursus monument which is also buried beneath alluvium at this point (Pryor and Kinnes 1982). Preliminary investigations of the causewayed ditch have revealed quantities of pottery in the Mildenhall style, closely comparable with material excavated by Professor Clark at Hurst Fen (Clark et al. 1960). Primary and secondary ditch fillings are waterlogged and it is clear that the area was wet when occupied, for peat was growing at the base of the enclosure ditch and wood is almost entirely from Fen species: willow, alder, poplar (fig. 5). A thin clay deposit beneath the turf-revetted gravel bank that ran around the inside of the ditch suggests that the area was wet before occupation began. This picture is further confirmed by the accumulation of ca. 1.3 m of clay above the prehistoric land surface. It is still not certain when the alluviation began, but a date at least as early as the Iron Age would accord with local evidence; deposition finally ceased in 1953.

This is not the place to attempt a discussion of the role of causewayed encloses within the English Neolithic, but Haddenham and Etton, on the present slender evidence, seem to be occupation sites. In the latter case occupation was probably seasonal. There is, as yet, no evidence to suggest a primary ceremonial or funerary function for either monument. Perhaps it would be best to regard the causewayed layout of the enclosing ditch(es), as a constructional technique in common use in the earlier Neolithic period. On the other hand, it cannot be denied that the construction of these monuments involved communal effort and expense of energy. They must, therefore, have played a signifi-

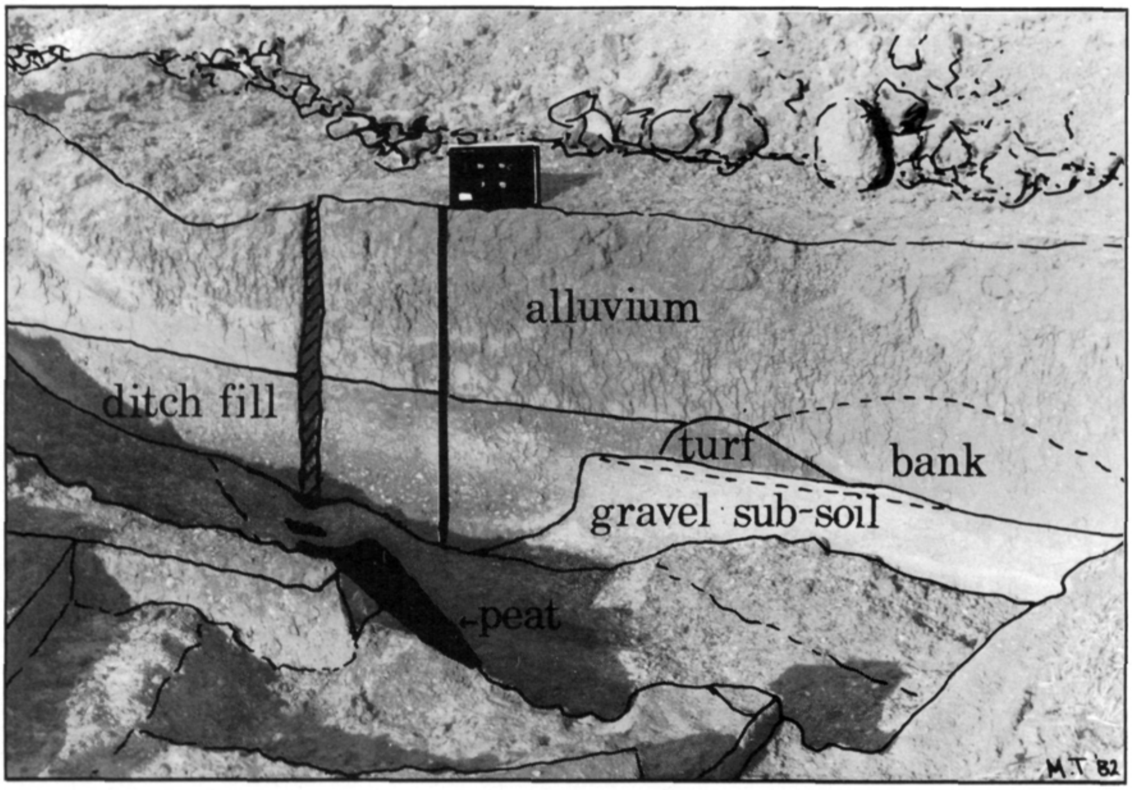

Fig. 5. Neolithic causewayed enclosure ditch buried beneath 1.3 m of alluvium, at Etton, near Maxey, Cambridgeshire. Note the internal turf-revetted bank and peat growing on the ditch bottom. Scale in half metres. (Explanatory drawing by Maisie Taylor).

cant role in contemporary society. We have seen that Etton was probably occupied seasonally and this hypothesis may provide some clue to its original significance, perhaps as a home-base in a transhumant circuit; for it is surely significant that both sites are located over five metres above the contemporary Fen wetland. The sites could have provided important foci for dispersed communities of the two regions and would have played an important role in the maintenance (and development?) of social cohesion. It is, moreover, tempting to suggest that these sites, or sites like them on higher land (for example, Great Wilbraham, Cambs), would have played an especially significant role in the years immediately following the widespread semi-marine Fen floods which deposited the so-called Buttery or Fen Clay ca. 2500 bc (Calais IV in the Dutch sequence). The presence of these sites illustrates well how important it is to study a wetland landscape in its dryland context (or *vice versa*).

IV: *Second Millennium bc*

We have already seen that large parts of the Fen were affected by the floods of the Fen Clay transgressions. Recent evidence has suggested that many apparently low-lying areas that escaped flooding did so because of the presence of large tracts of raised bog. Most of these oligotrophic peats have been eroded away, but a few pockets still survive (Godwin and Vishnu-Mittre

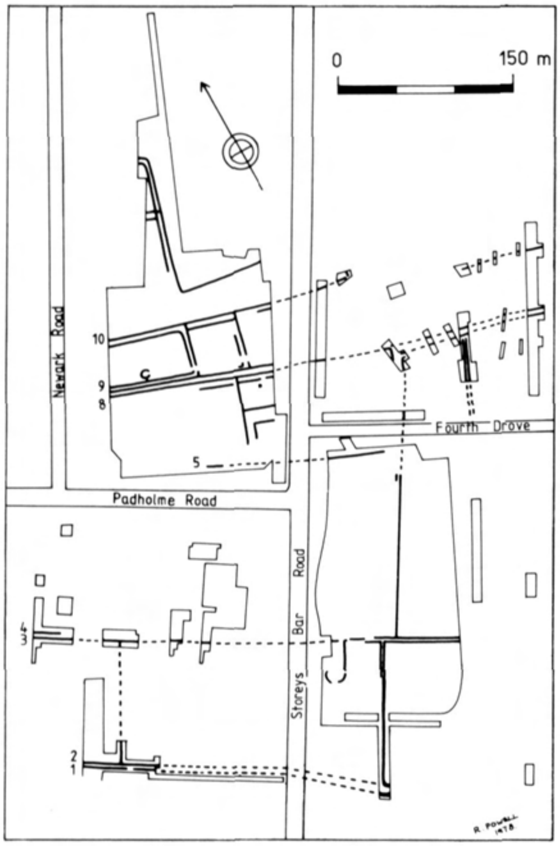

Fig. 6. Plan of excavated second millennium bc ditches, Fengate, Peterborough (from Pryor 1980a).

1975). The best evidence for the original widespread distribution of these peats is provided today by the spread of acid soils (Hall and Switsur 1982). This new information provides yet another example of the subtle, yet potentially very significant effects of some post-depositional distortions. In the present case the effects are hard to assess, as we shall see below, but the relatively homogenous reed and sedge fen peats that were once thought to fill most of the Fen Basin not directly affected by marine influence are now seen as just one component in a more complex picture. Reed and sedge would have grown along the floodplains of the base-rich rivers that drained into the Fen; similarly, surface run-off in Fen margin areas near limestone, chalk or limestone gravel uplands would have encouraged the development of eutrophic peats, fen carr and fen wood. These regions, whether cleared of woodland or not, would have provided excellent grass for pasture or hay. Beyond would have stretched the raised bogs of the deep Fen, where the state of pasture would depend on local growing conditions, but more information is required before any further speculation is attempted.

The intricately varied environment of the wetland may find archaeological expression in the varied morphology of Fen-edge sites and features. Due to a combination of factors it would appear that the peat Fen was relatively dry throughout much of the second millennium bc (Godwin 1941). Nowhere is this better demonstrated than in the early distribution map of Fox (1923, map II) which shows a thin, but even, spread of Bronze Age material over "islands" within the deeper wetlands. Numerous sites are now known amongst these Fen islands and margins, but very few have been adequately excavated (Clark 1933; 1936; Martin 1977).

It would appear that we have a similarly varied picture along the gravels of the Fen-edge. At Fengate (fig. 6) the gravel lands were parcelled into a series of ditched rectilinear fields or paddocks, the principal elements of which were probably laid out in the centuries prior to 2000bc (Pryor 1978; 1980a). Scattered amongst the enclosures were small settlements suitable for single families, while outbuildings housed livestock (fig. 7). Simplifying greatly, it has been suggested that these Fen-edge communities made primary use of their flood-free ditched and hedged paddocks during winter months when the vast pastures of the Fen were unavailable. Although land-use was intensive, the settlement pattern was extensive, suggesting perhaps a society, or, more probably, a part of a larger grouping, in which social stratification was not pronounced; the burial evidence, such as it is, tends to support this view (Pryor 1980a, 169-89). The Fengate ditched fields or paddocks are no longer seen as an isolated phenomenon: Billingborough and other ditched sites along the

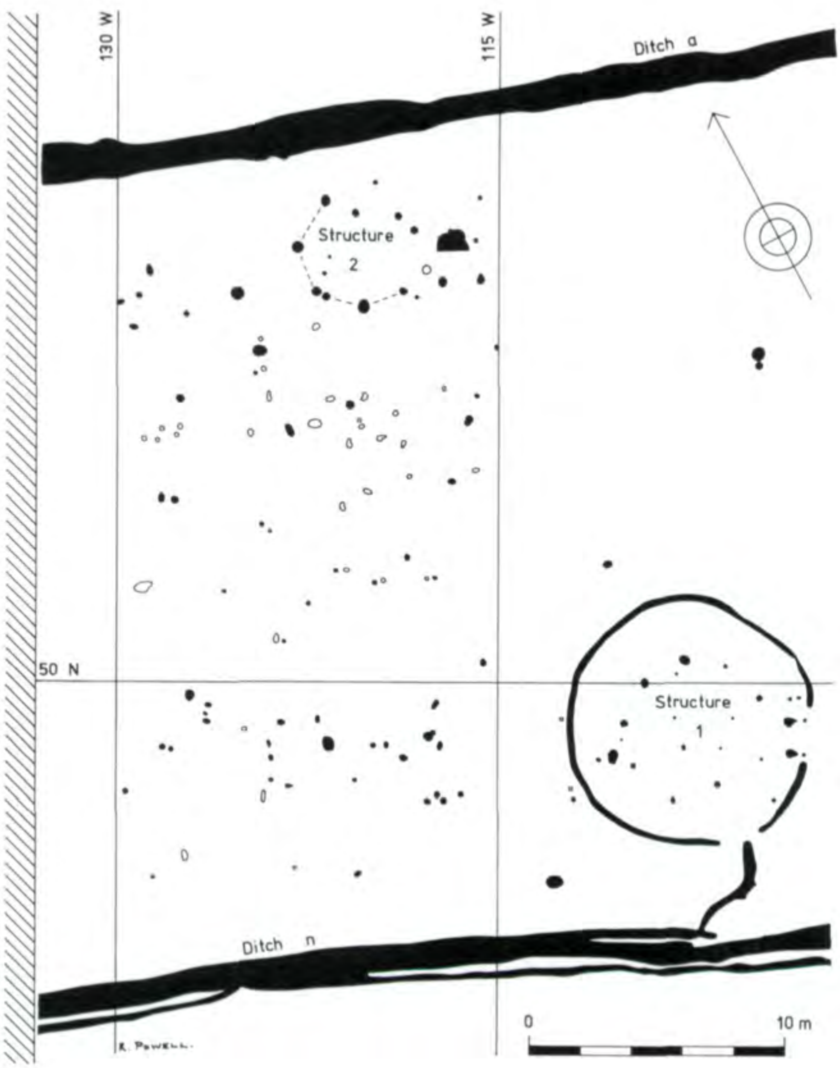

Fig. 7. Second millennium bc settlement within the ditched enclosure system, Fengate, Peterborough (after Pryor 1980a).

Lincolnshire Fen-edge possibly have origins in this period, while the sandy margins of the Vale of Pickering fenland in eastern Yorkshire have also recently produced linear ditches of pre-Iron Age date (Dominic Powlesland, pers. comm.; for other sites see Pryor 1980a, 182-4).

The picture in the Welland valley, just a few kilometres away from Fengate, appears to be quite different. Admittedly the area of study is far larger and the land actually cleared and excavated is concomitantly small (the combined excavations at Maxey and Barnack/Bainton cleared slightly less than the ca. 12 ha of Fengate). None the less, soils in the Welland valley are very favourable to cropmarks and there are no indications of a neatly parcelled landscape in the second millennium bc. It is certainly possible that the form of land division employed need not have left any archaeological trace (hedges, hurdles, banks etc.), for it is most improb-

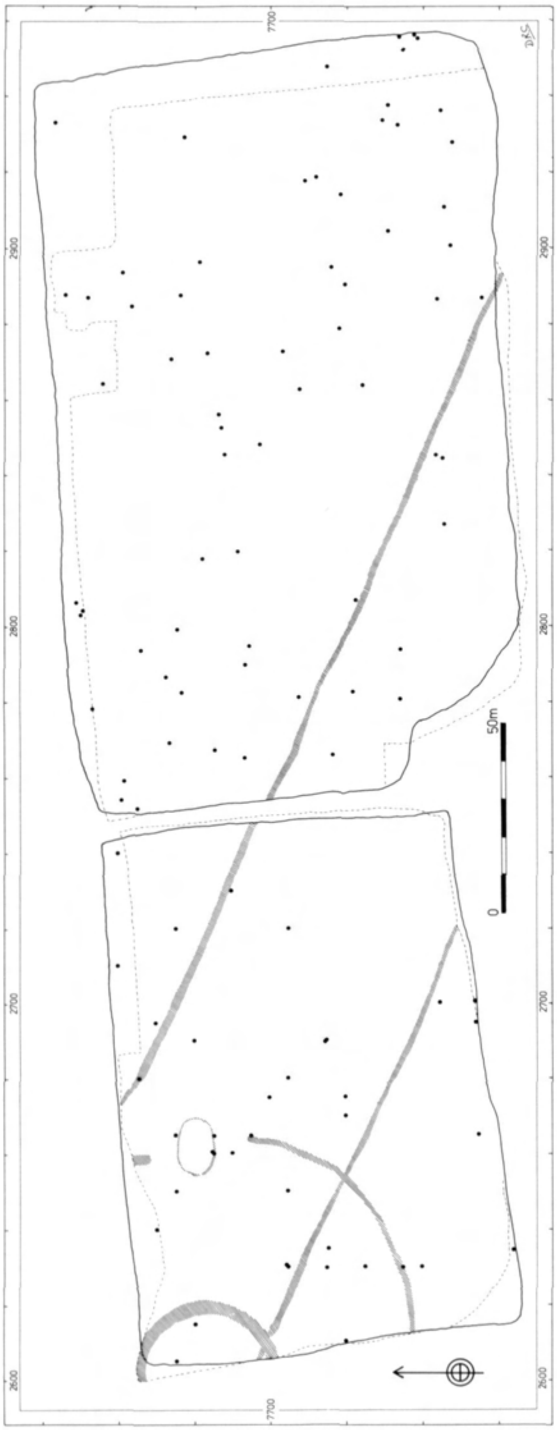

Fig. 8. Distribution of flints on the ploughsoil surface, Maxey, Cambridgeshire. Each dot represents a single find; pre-Iron Age archaeological features are indicated by shading. (Drawing by D. R. Crowther).

able that the lower Welland valley was not exploited at this time. Positive evidence for Bronze Age land-use is, however, provided by intensive surface survey which reveals a thin, but even, scatter of typologically Bronze Age flint implements and by-products over large areas of the valley floor. At the two sites excavated (fig. 8, 9, 10) the distribution of surface flints bore little relation to underlying archaeological features, and it is therefore improbable that they had been brought to the surface by the plough. On the contrary, the available evidence suggests that these flints represent discard of spent implements, rather than casual loss. The flints are indistinguishable in source material (gravel pebbles), typology and technique from those found in the Fengate enclosure ditch fillings. Collections from both areas also exhibit a very high implement to by-product ratio. It is suggested that this dispersed industry which is not based on the preparation of formal flake or blade cores, like its Neolithic and Mesolithic antecedents (Pitts 1978), is ideally suited to the exploitation of gravel flint with its numerous internal plains of weakness. There is much evidence, too, that flint tools of earlier periods were collected, used and were often modified. The scale of this re-use even suggests deliberate exploitation of known earlier settlements, and introduces an important, cultural, post-depositional distortion of the data.

The new pebble-based Bronze Age flint technology has wider implications (Pryor, forthcoming). In general, unmodified pre-Bronze Age flintwork does not occur in this widespread surface scatter. Locally, Neolithic and earlier flint tends to occur at clearly defined foci (sites). Bronze Age sites are, however, known in the region, but have not produced the enormous quantities of flint found, for example, at Hurst Fen and other Neolithic settlements. The various Fengate Bronze Age settlements, for

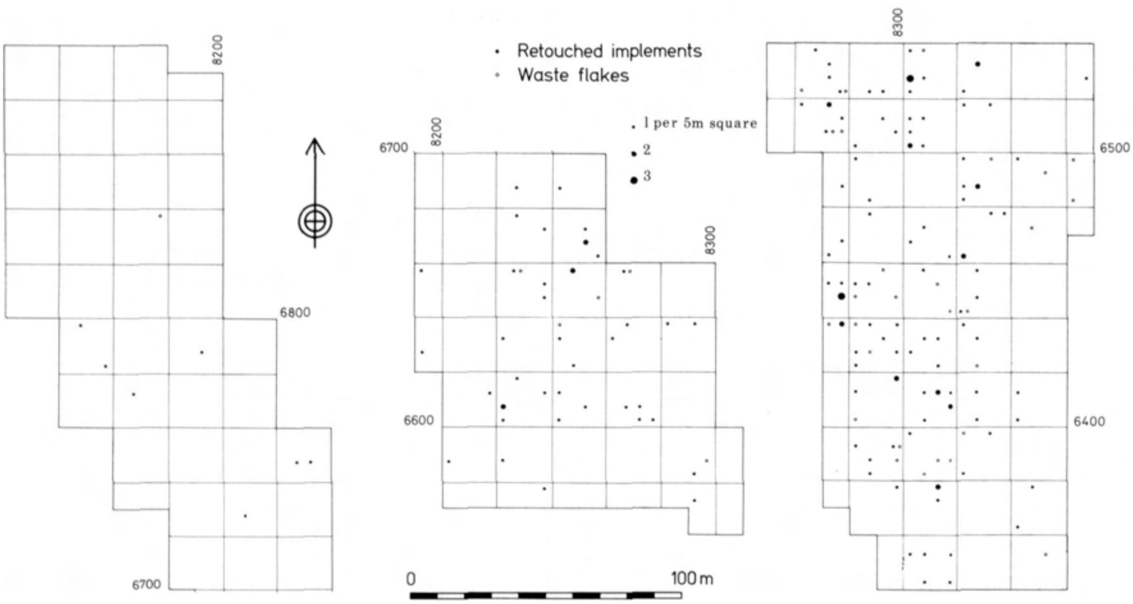

Fig. 9. Distribution of flints on the ploughsoil surface at Barnack/Bainton. The survey transect runs from north (left) to south (right); the absence of material from the northernmost area is due to post-depositional alluviation (no contemporary features were found in the underlying subsoil). (Drawing by Maisie Taylor).

instance, were almost flint-free. It has often been suggested that the Bronze Age sees an apparent decline in standards of flint-working. This, however, is an over-simplification that disregards the limitations of the source material involved: flakes made from British flint, for example, would seem crude when compared with the fine blades that can be produced from obsidian. Similarly, the "new" Bronze Age technique is an efficient means of producing piercing, scoring and strong edge-tools from a readily available source, with the minimum of debitage (hence the high implement to by-product ratio).

It has recently been suggested that innovation will only succeed when society is ready to accept it (Spratt 1982). In the present case, the widespread adoption of the pebble-based flint-working technique, by communities occupying the gravel lands of valley bottom and Fen-edge, seems also to have involved other, social or economic, phenomena, as illustrated by the off-site, diffuse, distribution of artifacts. It is doubtful whether the new technique modified settlement or day-to-day working patterns of itself; it is also doubtful whether the adoption of the technique necessarily reflects the exhaustion of mined flint sources (Pitts and Jacobi 1979). It is suggested instead that the new technique was accepted because it suited the practical and social requirements of at least a part of Bronze Age society in the region: small, mobile, economically self-sufficient communities would have appreciated availability of the implements and its practical utility outside the "core" settlement area. Perhaps the denticulate, scraper and piercer forms, so often combined on one modified implement, are specially suited to an economy where livestock figure prominently.

The hypothesis, for it is still only that, raises some fascinating problems. There are many indications, for example, that the pebble-based flint industry was not the norm in the British Bronze Age. Barrow sites, for example, have

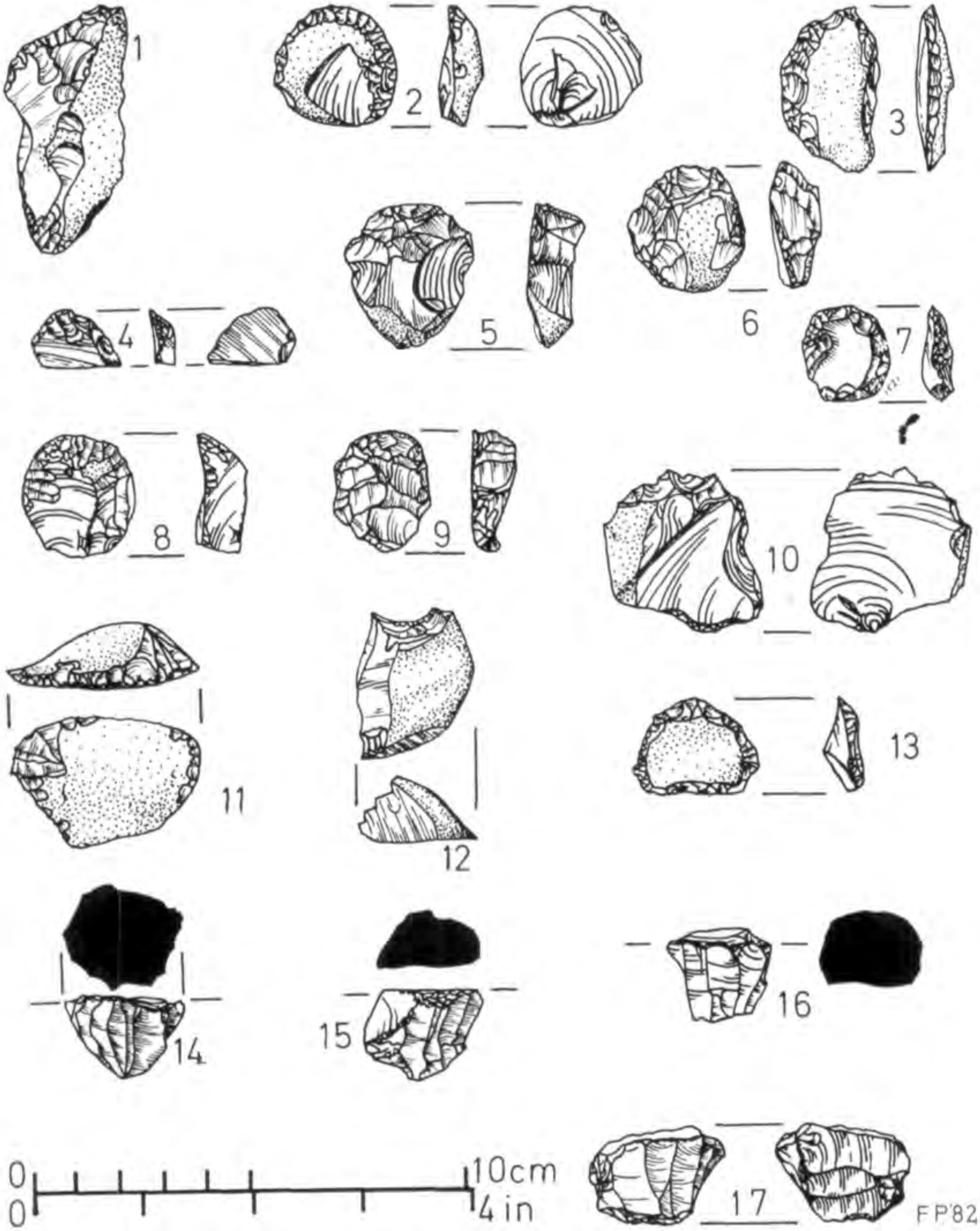

Fig. 10. A selection of flints from the ploughsoil surface, Barnack/Bainton. (Drawing by Francis Pryor).

produced true Bronze Age flint industries based on a core/flake technique (Horsey and Shackley 1980, fig. 5). Some high status implement types, such as plano-convex, or blade knives make use of techniques that recall classic Neolithic practice (for local examples, Pryor 1974b). It is possible that these differences in flint-working technique indicate social differentiation; but we must first prove beyond doubt that the differences exist at the regional level. We must then examine the nature of the difference(s). In the meantime we must resist speculation.

Before we leave the topic of flintwork, we may note that flints should not be studied *in vacuo,* removed from their regional contexts. Comparatively small changes of technique assume greater importance when set against a properly collected distribution pattern. Furthermore, re-use of flint tools may be more common in later prehistory than suspected hitherto, and this could seriously distort conclusions drawn from metrical data alone. Finally, we should cease to study pebble-based flintwork using terminology (and standards for assessing workmanship) which are based on a scheme intended for (and admirably suited to) a blade-based Middle Neolithic assemblage (Clark in Clark et al, 1960).

We have seen that the Neolithic settlement pattern showed a two-fold division: long-fallow agriculture and an as yet poorly understood "nucleated" element represented by causewayed enclosures. The situation in the second millennium also shows a two-fold split between, on the one hand, the extensive settlement pattern discussed above, and on the other, a significant collection of ceremonial and funerary sites. Bronze Age barrowfiels, for example, are very much a feature of the Fen-edge (for refs. see Lawson et al., 1981, but note that the ring-ditches indicated on the Silt Fens (fig. 44) are Medieval). It is still not clear whether this later two-fold pattern of sites and monuments evolved from an earlier system, but something of the sort seems probable: Neolithic round barrows are now widely recognised (Kinnes 1979) and other classes of monument such as cursuses and henges span the later Neolithic and Bronze Age periods.

The available evidence from the Fenland suggests that this two-fold division also finds expression in the disposal of the dead. Many individuals were disposed in ready-dug features, such as field ditches, without (non-perishable) grave-goods or grave markers (Pryor 1980, 174-5). The graves of these people can usually only be detected by excavation, provided, that is, they have survived ditch recutting etc.; they may well represent the majority of the population. Other individuals were buried in the more familiar Bronze Age pattern, within barrows and with grave-goods in pottery, metal and stone, not to mention perishable materials. In certain cases these burials are of important individuals, as at Barnack (Donaldson et al. 1977). Taken at face value we have here evidence for a stratified society, although at present we do not have the regional data to discuss the nature of the class system involved. The latter is clearly a matter of the greatest importance which will have implications that reach far beyond the Fens. For once, however, we can say with some confidence that we wil soon have opportunities to investigate these problems, since David Hall's recent survey has revealed extensive barrow-fields sealed beneath peat and alluvium and thus protected from plough-damage and the attention of antiquarians. The sites are also largely waterlogged. One barrow in the Haddenham/Over field has so far been investigated (fig. 11, Hd 3). It was cut, off centre, by a modern drainage dyke (ditch), whose sides were cleaned and examined. These revealed two cremations, one of which produced objects which establish a Beaker period terminus ante quem for any primary burial (Hall and Pryor, forthcoming). David Hall estimates that the peat of Haddenham Fen is shrinking, in places, at the rate of several inches a year.

The Borough Fen and its associated Cat's Water barrowfield is slightly less waterlogged than Haddenham, but is potentially larger and contains the earthworks of a possible partially-waterlogged henge monument (fig. 1). It also

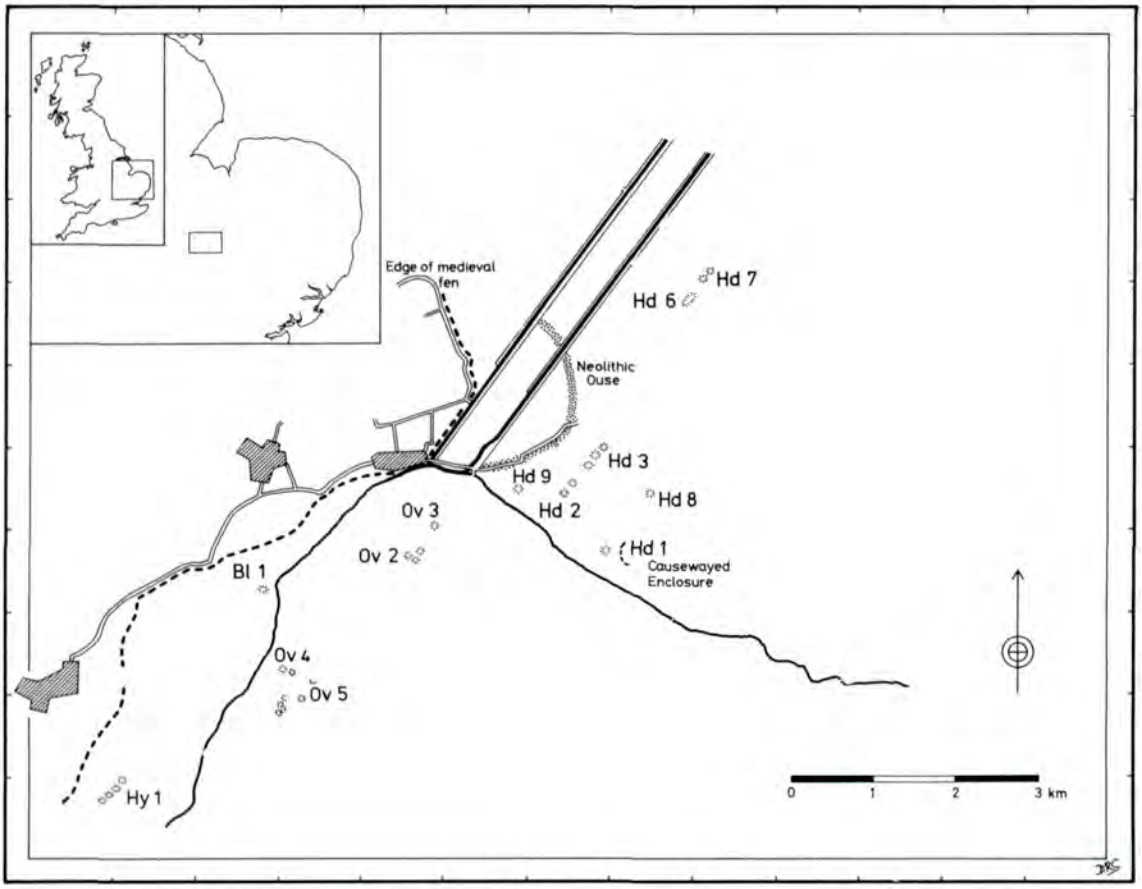

Fig. 11. Plan of the buried barrow field at Haddenham and Over, Cambridgeshire (courtesy D. N. Hall; drawing by D. R. Crowther).

forms, as we have seen, part of an extensive, and generally better understood landscape. The S.W. Fen project will attempt to monitor peat wastage and monument preservation and will employ phosphate analysis and other techniques to locate, hopefully, the settlements associated with the funerary monuments. It will by interesting to see whether land management practices involve ditched enclosures, as at Fengate, or apparently unenclosed land, as further west in the Welland valley.

Turning briefly to Maxey, recent work has been focussed on the cursus, which traverses the site from NW to SE; we also investigated the larger henge with its inner ring-ditch which sits slightly off-centre, partly within the cursus, immediately SE of the point where it changes direction. These features were excavated extensively, but together produced a mere handful of artifacts and bones. Such apparent cleanliness would be most unusual if the monuments had remained in use for any length of time. There is also sedimentary evidence to suggest that these ceremonial features were short-lived. The few surface finds, moreover, show no indication for settlement activity (fig. 8); perhaps the conventional picture of henges and cursuses, based on the Wessex model, may prove inappropriate for sites such as Maxey. Returning to non-settlement monuments in general, the lower Wel-

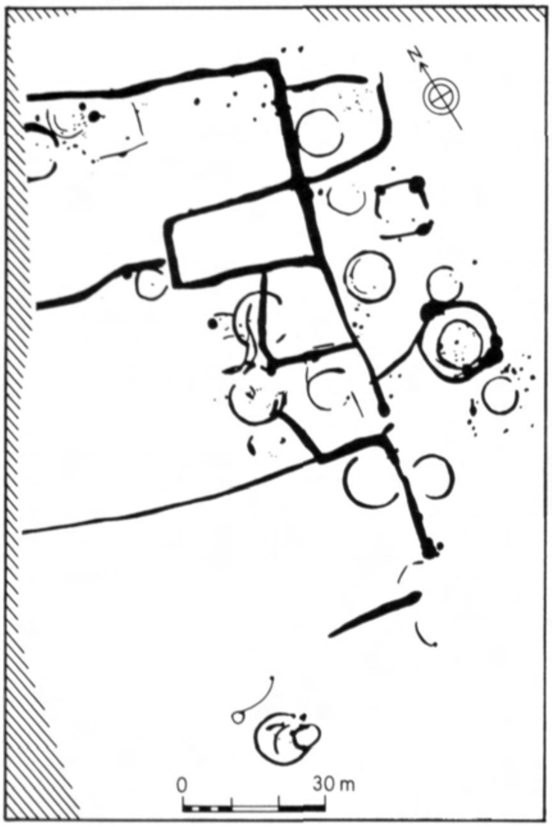

Fig. 12. Outline plan of Middle Iron Age settlement at Cat's Water, Fengate, Peterborough (ca. 3/400-100 B.C.). (After Pryor 1982).

land and its contiguous Fen contains an enormous number of round barrows and ring-ditches, whilst henges (?4) and cursus (?2) monuments are rare.

If the problem is viewed in its wider (British) contexts, the disparity in numbers is often explained qualitatively: barrows are somehow less important than the rarer monuments; their principal role involves the maintenance of ties of kinship and, perhaps, associated territorial rights (Renfrew 1979 etc.). The ceremonial monuments, on the other hand, being rarer and often located in territories subsequently marked by major hillforts, are seen to have wider, perhaps tribal, significance (e.g. Wainwright 1979). The evidence available suggests that this "Wessex" model cannot be applied to our region, and indeed it is doubtful wether it necessarily applies to lowland regions, other than the southern chalklands. The tendency to see henges as a uniform class of monuments is as valid as the unitary view of causewayed enclosures, discussed above. The various monuments must be studied and compared within their regional contexts, before attempts are made at a wider explanation. Efforts to force them to fit an inappropriate model, such as the belief that henges should align along "sight lines", may sometimes produce questionable results (Harding 1981).

The social role of the Maxey ceremonial monuments is not clear, but they seem to have been short-lived, transient, and thus, by definition, ill-suited to be major social or territorial features. Perhaps the principal social focus lay in the richer barrows such as Barnack. Again we lack the evidence to suggest any concrete proposals. It is, however, probably fair to say that a coherent explanation of these sites may lie outside the monuments themselves, within their social, environmental economic and demographic contexts.

V: *First Millennium bc*

There is good evidence that the years around 1000 bc saw widespread economic and social change in the region. The ditched enclosures went out of use at Fengate, where there is also evidence for freshwater flooding in the later Bronze Age. The system of Fen grazing was not abandoned, but there does seem to have been an economic re-alignment based on mixed farming; indeed, the Fen-edge location of at least three major Iron Age settlements argues strongly that Fen grazing still played on important role, but within a broader-based economy (Pryor in press; 1982 chapter 5; Pryor and Cranstone 1978). Only one settlement, Cat's Water, Fengate, has been totally excavated and that revealed a superficially amorphous distribution of round buildings and drainage ditches (fig.

12). Analysis of finds distributions and soil phosphates, however, show that livestock were kept near the centre of the settlement, while houses were largely confined around the exterior. This organisation is "organic" in pattern, and typical of many apparently disorganised lowland settlements. The hillfort model of carefully-arranged roads demarcating areas reserved for different types of building (eg Danebury - see Cunliffe this, volume for refs.) is quite inappropriate for the lowland situation, where purely local factors, such as ground water drainage and soil permeability may play an important part in the determination of settlement shape. Social constraints will exert a powerful influence on the internal organisation of such settlement (Clarke 1972), but the effects will not necessarily mirror the military regularity seen on some hillforts.

Although not imposing by upland standards, Cat's Water and numerous settlements like it around the Fen-edge (see Pryor in press, chapter 8 for refs.), are truly nucleated. This surely represents an important change from earlier practice. The mechanisms of the change are no doubt complex and are conditioned by a variety of factors, including the trajectory of Bronze Age social change, discussed above. However other factors in so deterministic an environment must also be borne in mind, and of these ground water, in turn the result of many factors (surface run-off conditions, climate, the state of river outfalls, local drainage etc.), is surely significant. More broadly-based changes in European society must also be considered (Rowlands 1980), but their effects cannot be distinguised from purely indiginous processes, at the regional level, until truly comparable studies have been undertaken in other areas.

Despite advances made recently in the study of the Bronze/Iron Age transition in Britain, the period is still poorly understood from the settlement and social point of view. This is especially true of the lowlands of eastern England and it is most unfortunate that these few centuries see the emergence of the nucleated settlement pattern that was to be so influential in the formation of the Romano-British and subsequent landscapes. It is a period that still requires close study, but in a tightly controlled regional setting.

VI: *Conclusion*

In conclusion, it is hoped that this paper has shown the potential of intensive regional study. Such a study may be limited in its powers to explain certain monuments on a national, or broader, canvas. On the other hand, it may focus attention on quite different issues such as the desirability (or otherwise) of attempting such explanation, given the state of current knowledge. Above all, a regional study allows us to appreciate better the constraints and opportunities inherent in our distorted data. With this improved understanding of our subject matter we might pose questions which offer some chance of being answered successfully. Put simply, the study of a parish need not be parochial.

A proper, comparative, integration of the various (environmental, artifactual distributional and cultural) strands of information at our disposal is still only feasible at the regional level. Although of course other approaches are possible, experience on numerous projects has shown that teamwork is essential to the successful outcome of a regional study; hopefully this is a lesson that graduate departments in British universities will soon heed. The multi-facetted, or conjunctive (Taylor 1948) approach to the study of the past was an accepted procedure for Professor Modderman and his contemporaries. We have recently tended to stray from that path, not, it must be admitted, without profit to our discipline, but it is now time we returned to earth.

Acknowledgements

I would first like to thank my colleagues in Leiden for giving me the opportunity to read this paper in such congenial surroundings. I also wish to thank the British Academy for the travel grant that allowed me to visit Leiden. Above all, I must thank David Hall, and the members of the Welland Valley Project, David Crowther, Charles Franch, David Gurney and Maisie Taylor, who gave me something to say. Alas, the errors are mine.

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SETTLEMENT SITE SELECTION IN DRENTHE IN LATER PREHISTORIC TIMES: CRITERIA AND CONSIDERATIONS

O.H. HARSEMA

Nowadays more and more research is applied to trying to understand the criteria which played their several roles in prehistoric times in the selection of sites for settlement. After a short summary of some of the more recent ideas and hypotheses, three settlement sites in the north of the Netherlands are discussed. None of the theories summarized explains the choice of each single site completely, and no one model is shown to have dominant validity. Nevertheless elements of several theories and models appear to be helpful in gaining insight. Especially in the later period (from the Iron Age onwards) there are indications that, apart from agricultural needs, the relationship of the location in question to the system of communications (mainly the road system) would certainly have been taken into consideration, and to some extent also the presence of signs of former habitation (burial monuments).

Interest in settlements and settlement patterns has increased considerably since the 1960s. Chang's "*Settlement Archaeology*"[1], containing Trigger's contribution on "*The Determinants of Settlement Patterns*"[2], appeared in 1968. A meeting held at the Institute of Archaeology in London in 1970 resulted in the publication of an extensive volume entitled "*Man, Settlement and Urbanism*"[3]. No longer do we mainly have books with titles like "The prehistory or archaeology of this or that country" or that or such as "Man's Early History" or "Prehistoric Man and Culture", but now also quite a number whose titles indicate that settlement structure and settlement patterns are the main interest. To name just a couple: "*Lowland Iron Age Communities in Europe*"[4] and "*Das Dorf der Eisenzeit und des frühen Mittelalters*"[5], while a long article like "*Agrarian Development, Settlement History and Social Organisation in Southwest Norway in the Iron Age*"[6] is also relevant. Often specific attention is paid to the ecological relations or the effects of the agrarian economy on the landscape as in: "*Man-Land Relations in Prehistoric Britain*"[7] and "*Untersuchungen zur eisenzeitlichen und frühmittelalterlichen Flur in Mitteleuropa und ihrer Nützung*"[8].

The questions which are now being asked concern organizational aspects of settlement and housing but also relate to more fundamental questions: Why did that group select just this specific site? Which environmental or other qualities were people looking for?

Is it possible to answer these questions in a generalized way? And if it is and if there was any preference in a certain period, when and why did changes occur? Let us see if there is a kind of common strategy in the tackling of these problems and any similarities in the existing ideas or the hypotheses which are generated.

First we have to explain what is meant by the term settlement pattern. According to Trigger (1968, p. 55) we can conceive of settlement patterns in terms of three levels: individual buildings (which I will not discuss), the arrangement of these buildings (the layout) within single communities and the manner in which communities were distributed over the landscape.

We will reserve the term settlement pattern for the distribution of sites (the areal pattern). The term settlement structure wil be used for the arrangement of buildings (the site pattern).

One of the contributors to "*Man, Settlement and Urbanism*", Irving Rouse (1972, p. 96), leaning heavily on Trigger's analysis, states that "by a settlement pattern is meant the manner

in which a people's cultural activities and social institutions are distributed over het landscape". Such a pattern to him "embodies all three kinds of systems, cultural, social and ecological, and provides a record of the relationship among them".
Peter Gathercole, (1972, p. 56), referring to the situation in Polynesia, says that most archaeologists working in that area would regard settlement patterns as an interpretative aspect of what Kennedy - an archaeologist from New Zealand - has termed "the spatial organisation of a human group, which is held to reflect economy, social organisation and the resources of the physical environment".

Before I continue and try to state precisely the question we want to answer, I will give you the opinion of a "non-believer", namely Taylor (1972) of the Royal Commission on Historical Monuments in England. He believes that "the recovery of the pattern of settlement of pre-Saxon society in Britain is something that archaeologists cannot achieve". First there is the incompleteness of the recorded pattern, due to large-scale destruction which has been specifically apparent in recent years. The destruction had started already in late Roman times, however slowly. Second it is unknown what the percentage of the recovered remains is compared to the total original pattern. Third there is the uneven distribution of the evidence, dependent on the interest and activities of local archaeologists and on discoveries made by pure chance. Even greater problems, according to Taylor, arise when an attempt is made to assess the size, function and relationship of the component parts of the pattern of settlement. It is hardly ever possible to excavate a specific site completely. Also it is now clear that there was much variety in size, form and organisation even within a limited time span.

More enthusiasm and optimism is apparent in the American southwest, where a group called SARG (Southwestern Anthropological Research Group), was conceived in 1971. This large group of southwestern archaeologists decided to devote a part of their research towards the testing of hypotheses of general interest to the group. To be of such interest the question had to be of a general and fundamental nature. Such a question was: "Why do people live where they do?" An announcement of their program is in the June 1974 issue of *World Archaeology*[9].
More precisely formulated the major question was: "Why are population aggregates located where they are? Ancillary themes being: why do population aggregates differ in size, why do locations differ through time, and why does a single population aggregate (or individual site) grow or decrease in size?" (SARG, 1974).

As to the major question, emphasis was laid on explaining the variability in the spatial distributions of prehistoric human settlement sites i.e. on the description and explanation of the distribution in space. That is to say that the emphasis was on synchronic variability, although the long term goal included explaining change in locational patterning as well.

Within settlement systems several types of sites can be distinguished: besides real habitation sites there is a wide variety of so-called "special purpose" or "limited activity" sites. However the description of the site type in space was not the chief research object. Of basic importance to the SARG members is "the relationship of sites and settlement systems to significant natural and social regional variability. Sites may be located with respect to various natural resources, for example; or they may be located with respect to each other [but] sites are components of settlement systems, and ultimately cannot be explained... without reference to the entire system...". The thrust of our current effort, SARG says, is "to test specific propositions regarding the determinants of site location within settlement systems". It is an attempt to discover which variables are critical.

"Three propositions currently form the core of the research design...:
A. Sites were located with respect to critical on-site resources;
B. Sites were located so as to minimize the effort expended in acquiring required quantities

of critical resources;
C. Sites were located so as to minimize the cost of resources and information flow among sites occupied by interacting populations".

Proposition A suggests that sites will tend to be located at resource locations;
B. that sites be rather located in intermediate positions with regard to resource locations;
C. introduces the importance of the social environment and of positions which have advantages from the point of view of communication and communicating.
In the first stage the three propositions will be tested by the SARG members with respect to the following three variables or determinants: plant community, landform and water resources.

In the February 1978 issue of *"World Archaeology"* there is an article by Geoffrey Conrad (1978) based on research carried out in South America, more precisely in the Viru Valley of Coastal Peru. Its title includes "Models of compromise in settlement pattern studies...". It can be related to the discussion of the determinants of prehistoric settlement pattern, activated in the southwestern United States by Plog and Hill, which also resulted there in the SARG-program mentioned above.

Conrad concludes that at least in the case of complex societies the opinion that individuals and populations act either to maximize certain resources or to minimize the effort needed to obtain these resouces is incorrect. As he says "behaviour that maximizes gain or minimizes effort for some resources may tend to minimize gain or maximize effort for others. Complex societies, which must balance a variety of resources against numerous and diverse needs, cannot confine their attention to several of these factors and ignore the rest. Accordingly, the settlement patterns of such societies are not intended to optimize exploitation of a few resources; instead, they represent attempts to arrive at a workable compromise among many determinants".

Three of these factors or determinants have been identified by Conrad and tested:
a. maximization of arable land;
b. minimization of agricultural effort;
c. maintenance of socio-political control.
As to a. it is to be expected that "if agricultural land is to be maximized, sites should not occupy arable tracts and settlements should be restricted to zones outside the limits of cultivation".
As to b: "a settlement pattern can optimize agricultural effort for instance by minimizing the amount of time a farmer must spend travelling from home to field", so the fields are located adjacent to the settlement or vice versa.
And as to c: "the optimal settlement pattern for maintaining social and political control is a hexagonal central place hierarchy", of the type Cunliffe (this volume) showes us. As a result of the testing the rank order in this case, in order of increasing importance, proved to be a-b-c.

Conrad's general conclusion is that it is impossible to predict the specific compromise that has been made in a certain area at a certain time.

A further element in the discussion on the study of settlement patterning is introduced by the Canadian archaeologist Philip Smit (1972).
As traditionally accepted determinants of settlement patterning he lists:
- the environmental factors such as soil, water, terrain;
- religion and relationship to larger political units;
- thirdly, but of primary importance, the mode of subsistence and the way it is exercised, involving the quantity of cultivable land and the ease of working it.
However Smith diverges from the traditional point of view which as he says sees "the cultivation systems in use, and particularly the degree of intensification of cultivation as largely determined by the variations in soil and climatic characteristics and by the technological capacities of the cultivators". It is his opinion that "the various levels of exploitation have usually been considered as relatively static adaptations to local environmental conditions combined with the available techniques, and the agricultural systems themselves as rather stable and fixed

in the absence of external cultural influences or environmental changes". The point he wants to make is that it "is too frequently overlooked... that each agricultural system often reveals subsystems with much diversity and that the pattern of land use is normally highly flexible and adaptable in the face of stresses". As he says "the different types of agricultural land-use are in fact not primarily adaptations to local geographical conditions but, within certain limits, reflections of decisions by the cultivators regarding food-production and labour input;... resilient in the face of demographic pressures, caused by high man-to-land ratios".

So the different types of agricultural land-use and the differences in the levels of intensification are now considered to have as an important determinant the demographic circumstances.

Philip Smith is, as he admits, clearly inspired by Boserup's model of land–use types, which sees land–use as flexible and fluctuating in response to factors other than soil quality, technological level or cultural preference, but first and foremost responding to demographic changes. In Boserup's classification 5 levels of intensity of cultivation are recognised: forest fallow, bush fallow, short or grass fallow, annual cropping and multicropping[10].

"Where the ratio of cultivated land to fallow land is high and population pressure exerts itself on the available land there is a tendency not only for the fallow periods to be shortened in response but also for the villages and compounds to become almost or completely permanent sites" (Smith, 1972, p. 145).

To conclude this first part, I will mention two other remarks of Smith which may also be of interest. Repeated occurrence of warfare or hostile actions may result in larger and more nucleated settlements which may have the similar effect as demographic pressure and result in shorter fallow periods.
Longer residential occupation tends to lead to closer identification of people with a particular locality. Fixed cultivation as a result of this longer occupation can lead to the assertion of individual control over the land.

Before we are able to draft even the concept of a model of the settlement patterns in Drenthe, a province in the Northeastern part of the Netherlands (fig. 1), in the different periods of prehistory, we should have the basic information on the main determinants of settlement location in this area. Which factors determined the selection of the settlement site? Acquiring a picture of the natural landscape in our area is seriously hampered by the extremely poor properties of the sandy soils with regard to the conservation of organic material.

Something that may be of help here is the concept, formulated by Hawke-Smith, in a book entitled *"Man-Land relations in Prehistoric Britan"*[10], and borrowed from the palaeo-economic school, "that human economies ... habitually depend on a combination of complimentary resources drawn from two or more ecological communities which together constitute an economic 'niche' " (Hawke-Smith, 1979, p. 3).

As soon as agriculture becomes the main means of subsistence of prehistoric man, these ecological communities gradually lose their original characteristics and the success of human exploitation to a large degree seems to be determined by the abiotic qualities of the environment, climatic and edaphic. Climatic differences can be neglected within the restricted area which we will consider now (that is the province of Drenthe).

In the habitable part of this area, roughly 60 x 60 km, differences in elevation are of a magnitude of up to about 25 m.

Of more importance are the edaphic factors, the geomorphology, the texture and structure of the soil, the hydrological properties and the translation of these in agricultural terms: natural fertility, workability and drainage qualities. Information regarding these properties could be directly useful in gaining insight into prehistoric man's behaviour, in this case an insight into the question as to which qualities he preferred in the process of settlement site selection.

Detailed soil maps are now available for a large part of our area. The main natural ele-

Fig. 1. Province of Drenthe, the Netherlands, with the main sites mentioned in the text (the inhabitable parts are hatched). Inset: the Netherlands and the surrounding area.
1 = Drenthe; 2 = 1 m + N.A.P. contour-line.

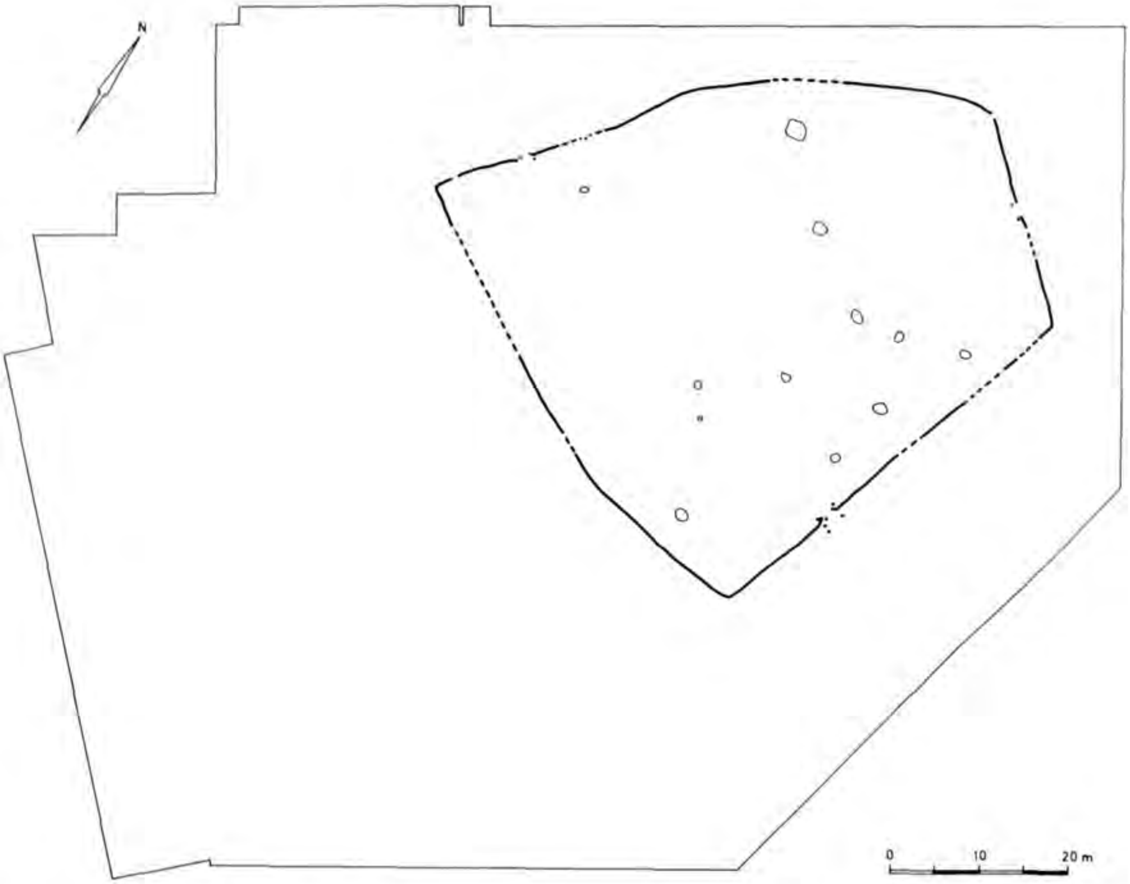

Fig. 2. Anloo, TRB settlement (Middle TRB) with the fence of the first period and pits filled with settlement refuse material (cf. Waterbolk, 1960).

ments in the province of Drenthe are of Pleistocene age: glacial deposits, namely sands and boulder-clays from the Saalian glaciation, covered by wind blown sands (cover-sands) from the (end of) the Weichselian period. The surface topography and the properties of the soil for agricultural usage are mainly determined by the depth of the boulder-clay and the thickness of the cover-sand deposit.

In the detailed system of soil classification elements are incorporated resulting from intensive human influence in rather recent times, e.g. intensive cultivation, reclamation or anthropogenic vegetation. As a result a large number of podsolic soils have been distinguished, several of which fitted prehistoric man's requirements quite, if not equally, well.

Let us see now which elements can be distinguished at the location of habitation sites from three different periods in Drenthe: the Neolithic, the Bronze Age and the Iron Age.

The Neolithic site is near Anloo in the middle of the eastern part of Drenthe, in an area with a dense concentration of megalithic monu-

Fig. 3. Anloo. TRB settlement with double fence of the second period (first period shaded).

ments. It is the structure which has been known as the cattle-kraal since its excavation in 1957/1958 (Waterbolk, 1960). In my opinion it is a two-period settlement of the TRB culture with a single and a double fence, dating from the earlier and later period respectively (fig. 2 and 3). The site is in the middle of an area with a relatively low groundwater table notwithstanding the presence of boulder-clay beginning at a depth between 0.40 and 1.20 m. The contour map (fig. 4) of an area of 2 x 3 km surrounding the site shows considerable difference in elevation and explains the hydrological situation. The site itself is a little above the 17+ contour-line, on an eastward facing slope that starts at +19 m, 500 m west of the site, to +10 m, about 1 km east of the site. As a result of the difference in elevation there is little or no stagnation of ground-water even where the boulder-clay is not far below the surface.

Near the site soils with the best agricultural qualities, especially a higher loam content, are located in the western part of the boulder-clay area. There is an area with brown podsolic soils surrounded approximately by the 18 m contour-line (fig. 4). The settlement site is at some dis-

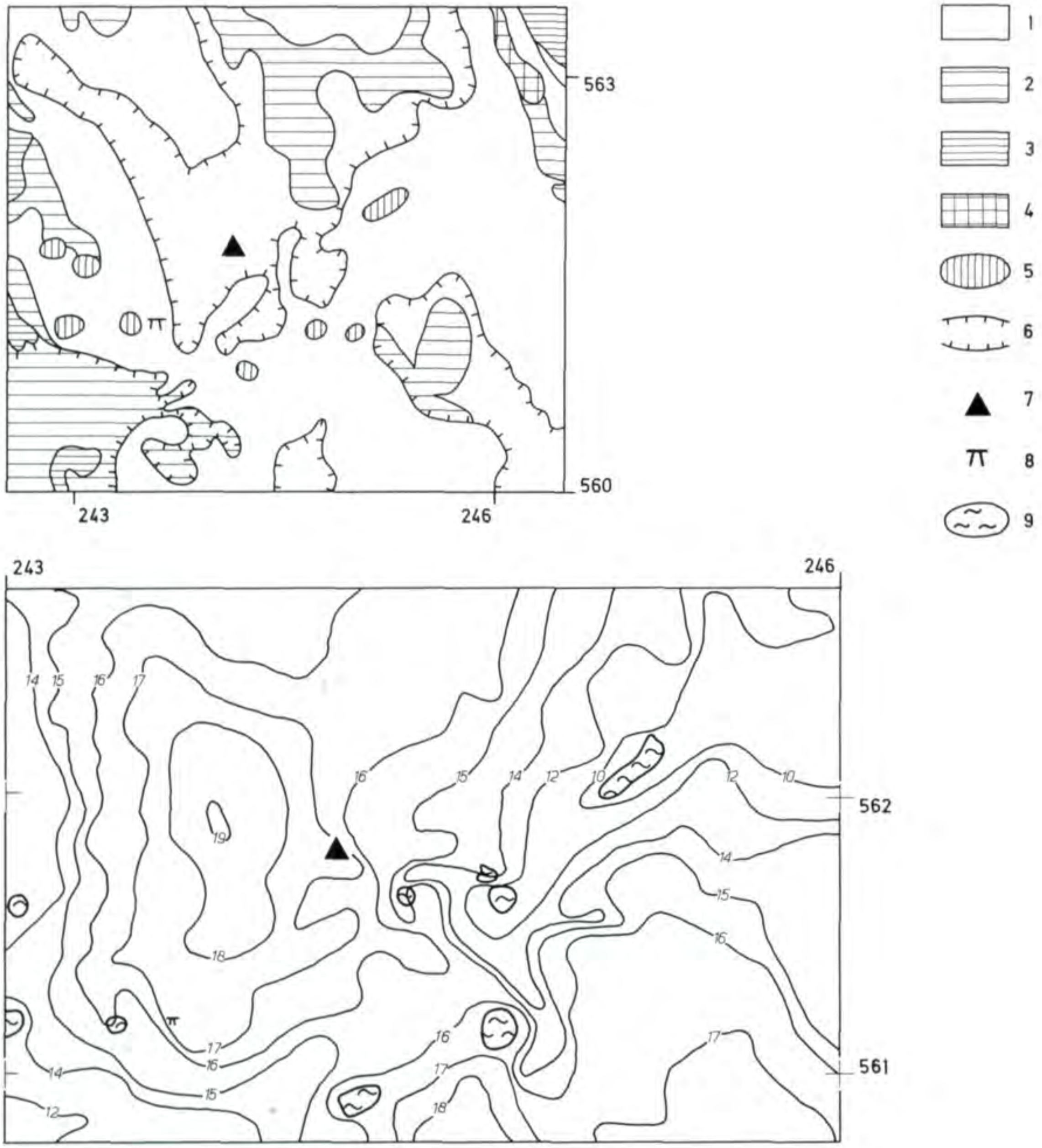

Fig. 4. Anloo, soil map (top) and contour map of the area around the TBR settlement site; scale 1 : 50.000 and 1 : 25.000 resp. (distance between successive coördinates 1 km).
1 = dry sandy soils; 2 = moderately dry sandy soils; 3 = wet sandy soils; 4 = peaty sidements; 5 = waterlogged depressions; 6 = boulder-clay beginning between −0.40 m and −1.20 m; 7 = site of TRB settlement; 8 = megalith; 9 = 5.

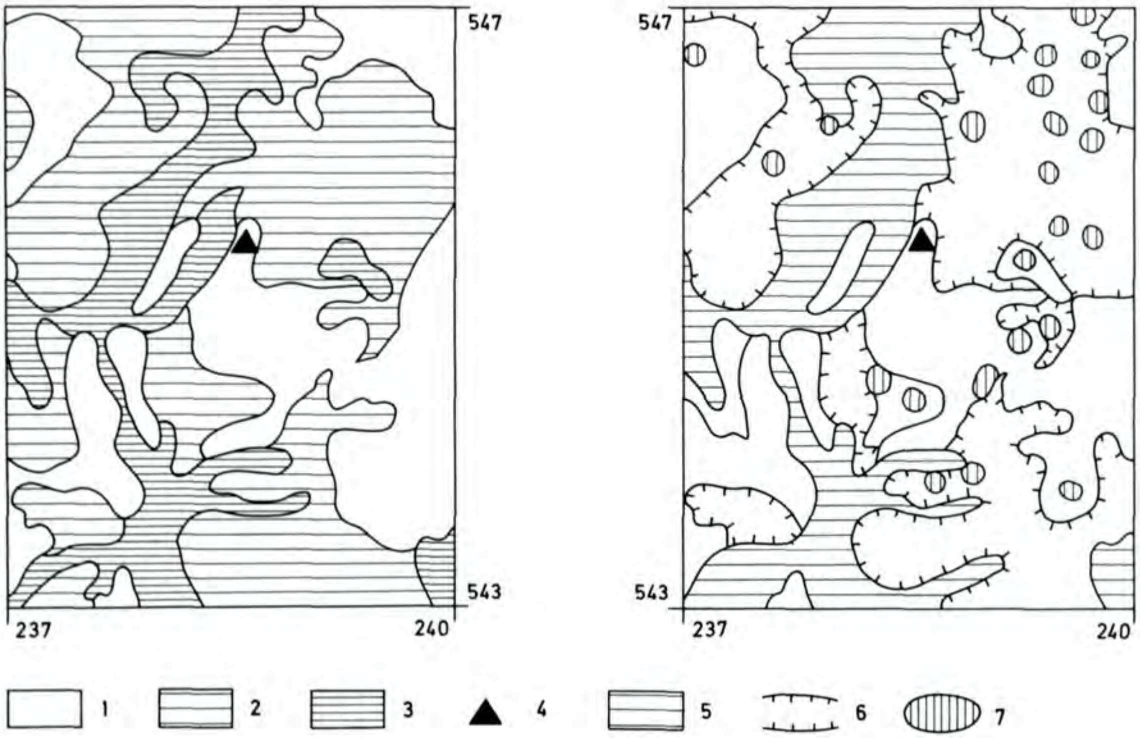

Fig. 5. Elp, soil maps of the area around the Middle Bronze Age settlement; scale 1 : 50.000.
1 = dry sandy soils; 2 = moderately dry sandy soils; 3 = wet sandy soils; 4 = site of Middle Bronze Age settlement; 5 = peaty valley sediments; 6 = boulder-clay beginning between −0,40 m and 1.20 m; 7 = waterlogged depressions.

tance from the best arable land. Its position can be seen as intermediate between the area with the best agricultural qualities, a few hundred metres to the west, and some small depressions to the east, one of which, at a distance of about 600 m, would have contained water permanently.

The location of the Middle Bronze Age settlement of Elp (Waterbolk, 1964), seems easier to understand. According to the soil map and the groundwatertable map there are dry sandy soils immediately to the south, somewhat less dry soils with boulder-clay beginning at a depth between 0.40 m and 1.20 m to the east and north-east and wet soils with peaty valley sediments to the west and north-west (fig. 5). This situation completely answers the general description of Hawke Smith, an economic "niche" being composed of several ecological communities.

In agricultural terms we have sandy soils to the south that are rather poor but dry and easy to work, and soils that to the east are richer and loamy but wetter and with agricultural possibilities probably restricted to the highest part, on and closely around the area enclosed by the 17.5 m contour-line (fig. 6). The area to the west will have supplied water and probably firewood. Alder woods would have been present here until well after medieval times.

Near Hijken, in the middle of Drenthe, we meet one of the largest Celtic fields in this province,

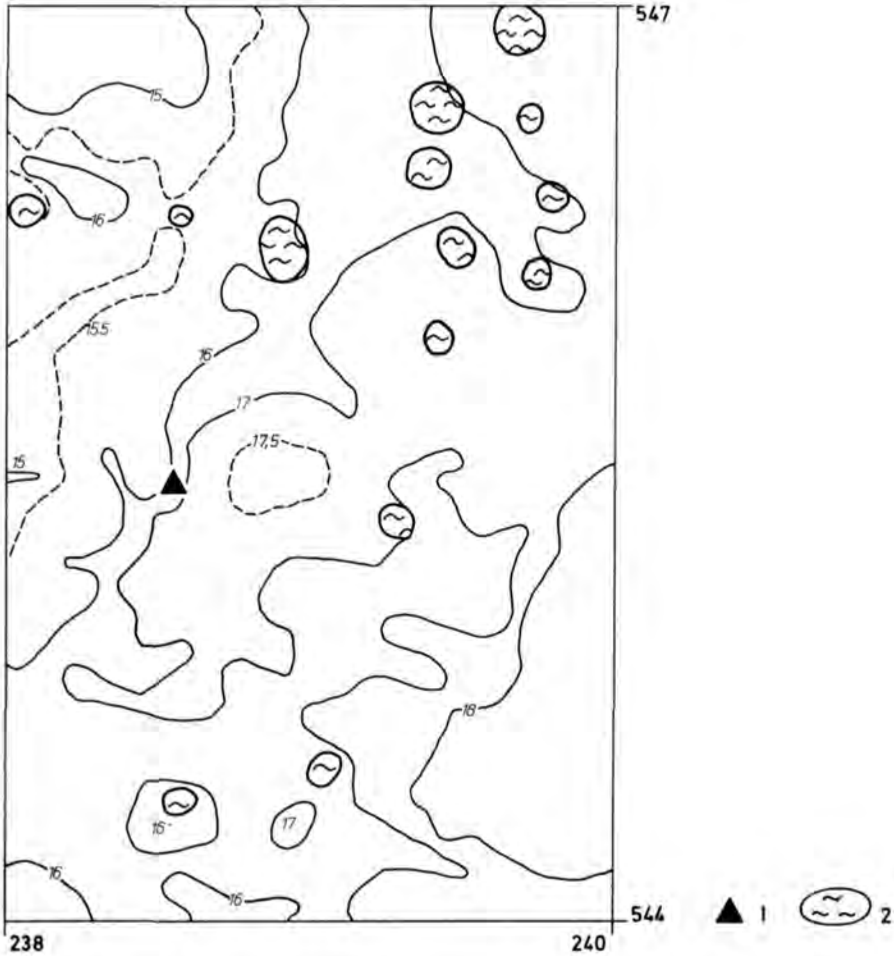

Fig. 6. Elp, contour map; scale 1 : 25,000.
1 = site of Middle Bronze Age settlement; 2 = waterlogged depressions.

ca. 90 ha or a little less than 1 km². It extends in a roughly southwest-northeast direction for about 1850 m, with a maximum width of 750 m (fig. 7). In the southwestern part contemporary Iron Age farm-buildings have been excavated, each one inside a single Celtic field plot, which constitutes the homestead (fig. 9) (Harsema, 1980a, b).

There is reason to believe that Brongers' opinion as to the Celtic field structure in Vaassen (Brongers, 1976) also applies to the Hijken field. The NW-SE field banks are the principal ones. They divide the system into long strips, and all the plots in a single strip were probably used by one and the same farmer. This farmer could subdivide his strip and select his house site within it according to his own preference. Neighbouring strips had different users/occupants. However the 10 plots that could be found at most in a single strip were insufficient to meet the demands of a normal family. At least one strip but probably two in another part of the

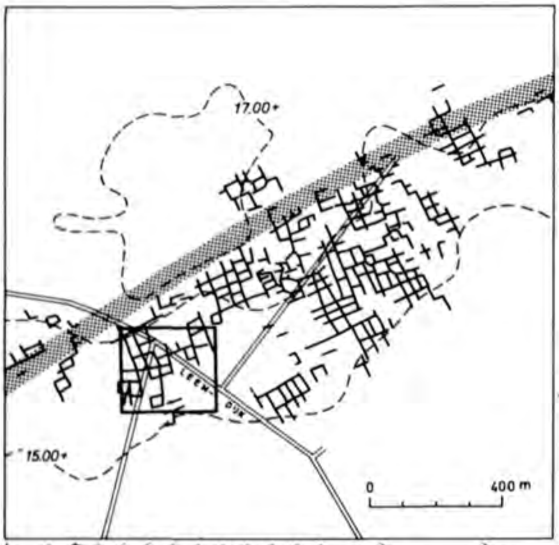

Fig. 7. Hijken, Celtic field plan based on air-photographs and terrestrial survey (cf. Brongers, 1976). Shaded is an important road that ran along the northwestern border until the 19th century. Within the large square considerable parts of settlements from the Middle Bronze Age and the pre-Roman Iron Age have been excavated (cf. fig. 8).

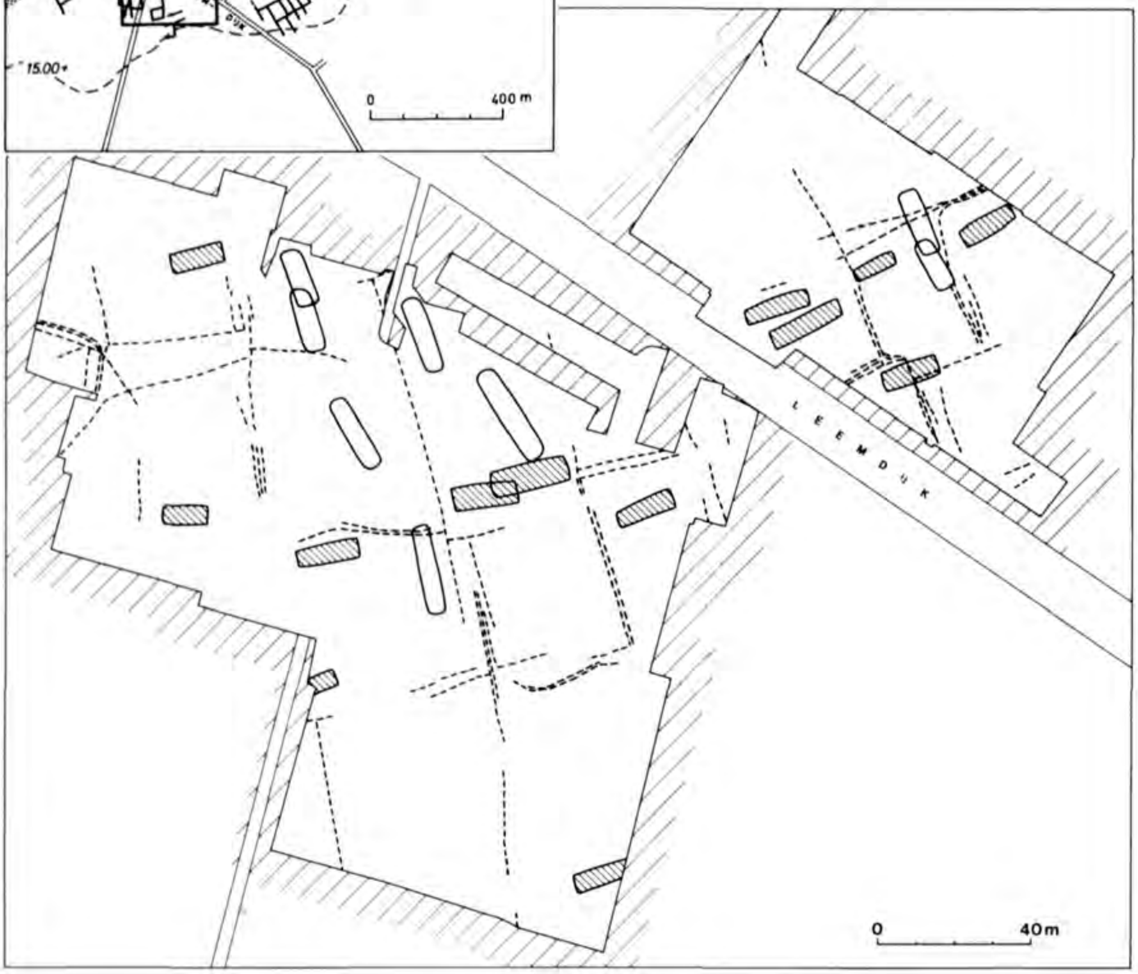

Fig. 8. Hijken, plan of the excavated area within the Celtic field (for location cf. fig. 7).
Indicated are Middle Bronze Age houses (open), Iron Age houses (hatched) and fences (broken lines) surrounding the Iron Age fields resp. homesteads.

Celtic field system also had to be farmed by the family. In the way in which habitation and agricultural use was combined in the Celtic field system at Hijken a compromise has been found between minimization of agricultural effort on the one hand (demonstrated by the fact that some of the plots even border on the homestead) and a rather compressed settlement plan on the other (responding to social needs, such as the maintenance of social ties, and security). It seems that factors which are operative within the entire settlement pattern can also be applied in the explanation of the layout of the individual settlement site.

To discover which criteria played a role in the actual site choice we will look again at the soil map and the contour map. The Celtic field system at Hijken occupies an area where the boulder-clay comes relatively close to the surface. Dry sandy soils are found only in a small strip in the western part of the system. This strip borders to the southeast on slightly wetter soils (fig. 9). The division between the soil types is formed approximately by the 16 m contour-line. The entire system is on a southeast facing slope between the 17 and 15 m contour-lines (fig. 7, 9).

Waterlogged depressions are few and are not present within 500 m of the excavated part of the settlement. Neither major variations in soil type nor ecological variations resulting from considerable differences in elevation can have prompted the choice of this site. Could it just be that uniform conditions over a large area were especially valued in the Iron Age? Or are other factors to be taken into consideration?

In historical times an important road, connecting the southwestern part of Drenthe with the north ran along the western border of the field system (fig. 7). In the beginning of the nineteenth century the digging of two canals - running east-west, just south of the Hijken area - changed the traditional traffic system. There are indications that this old road had a very long history and probably even went back to the Later Neolithic. Almost certainly it was in use in the Middle Bronze Age. This road may very well have influenced the preference for this place as a site for settlement. In the Iron Age it even seems to have influenced the layout of the fields in terms of the direction of the strips, in such a way that all the farmers had equal access to the road.

If we now look closer at the main Celtic field system in northern Drenthe, at Balloo and Zeijen, we see that also in these two cases one of the two directions of the dividing field-bank system is perpendicular to the direction of the road, while the other one runs parallel to it.
Roads may be among the determining factors in the choice of habition sites and of some importance at least from the Iron Age onwards. Nevertheless the reasons for the selection of precisely the chosen area along the road are not self-evident, neither is the selection always sufficiently explained by the soil conditions.

So we will finish with a last consideration. It is remarkable how often burial monuments from quite different periods are concentrated in certain areas. It is theoretically possible to explain this situation by continuity of habitation, but it is quite certain, in Hijken at least, that there was no habitation between the end of the 10th century (after the Middle Bronze Age) and the beginning of the sixth century B.C. Certainly every occupation would have had an effect on the landscape, but I wonder if change in the vegetational cover (a more open landscape as the result of earlier occupation) is the only determining factor here. Certainly in Hijken such changes would have been largely obliterated after 3 if not 4 centuries. Nevertheless after this long break in habitation the Iron Age group settled at exactly the same site as the former Bronze Age inhabitants. The only possible visible remains and reminders of this Bronze Age habitation would have been the barrows, one to two hundred metres to the north.

I think that, in prehistory, if there was a choice to be made between several more or less equally suitable sites, preference often would have been given to the site which had its suitability for human occupation demonstrated by the presence of older burial monuments.

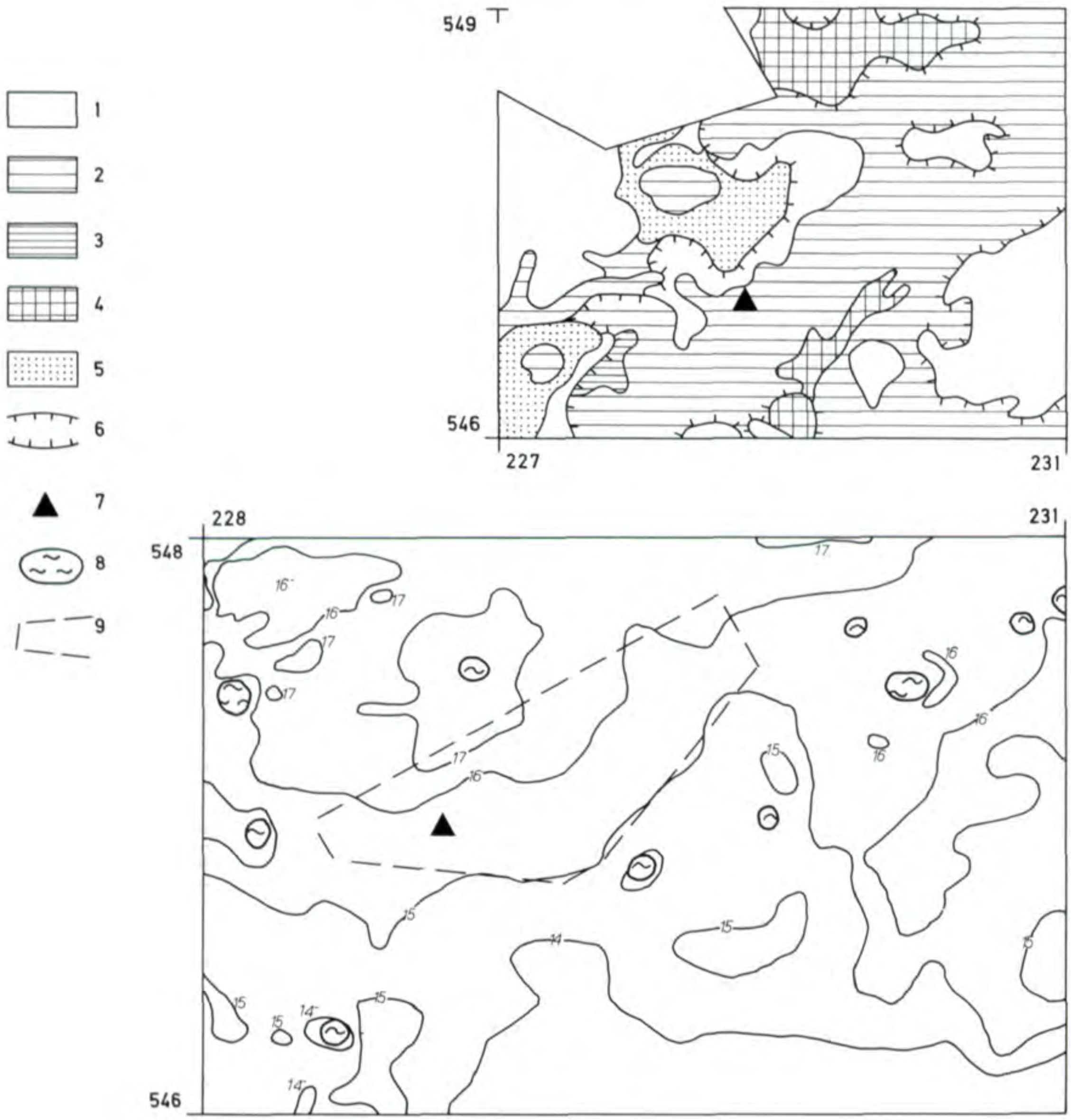

Fig. 9. Hijken, soil map (top) and contour map of the area around the Celtic field and the settlement; scale 1 : 50.000 and 1 : 25.000 resp.
1 = dry sandy soils; 2 = moderately dry sandy soils; 3 = wet sandy soils; 4 = peaty sediments; 5 = recently (?) blown sand; 6 = boulder-clay between −0.40 m and −1.20 m; 7 = site of Middle Bronze Age and Iron Age settlements; 8 = waterlogged depressions; 9 = approximate limit of Celtic field (cf. fig. 7).

NOTES

1. Chang, K.C. (ed.) (1968)
2. Trigger, Bruce G. (1968)
3. Ucko, Peter J., Ruth Tringham and G.W. Dimbleby (eds.) (1972)
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SETTLEMENT HIERARCHY AND SOCIAL CHANGE IN SOUTHERN BRITAIN IN THE IRON AGE

BARRY CUNLIFFE

The paper explores aspects of the social and economic development of southern Britain in the pre-Roman Iron Age. A distinct territoriality can be recognized in some areas extending over many centuries. A major distinction can be made between the Central Southern area, dominated by strongly defended hillforts, and the Eastern area where hillforts are rare. It is argued that these contrasts, which reflect differences in socio-economic structure, may have been caused by population pressures in the centre south. Contrasts with north western Europe are noted and reference is made to further changes caused by the advance of Rome.

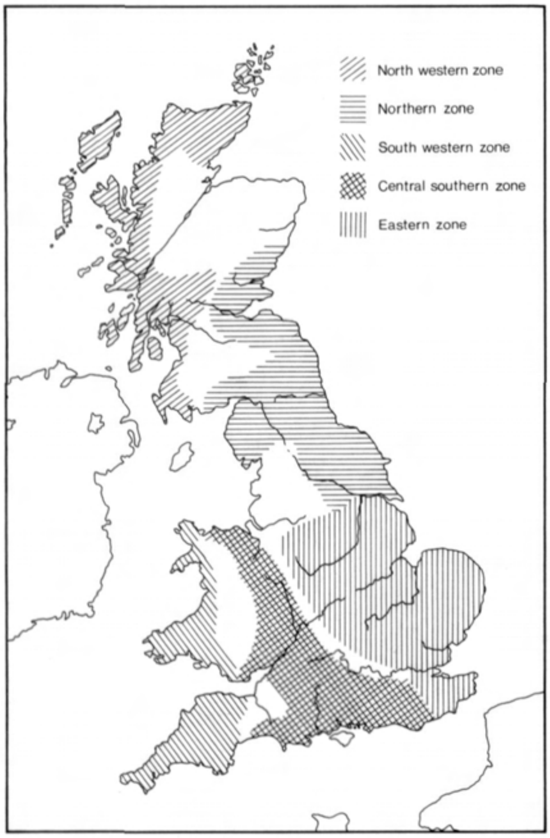

Fig. 1. The principal socio-economic zones of Britain by the second century BC.

Introduction

The last two decades has seen an intensification in the study of the Iron Age in southern Britain. Until the early 1960s most excavation effort had been focussed on the chalklands of Wessex, but recent programmes of field-work and excavation in the South Midlands (in particular Oxfordshire and Northamptonshire) and in East Anglia (the Fen margin and Essex) have begun to redress the Wessex-centred balance of our discussions while at the same time emphasizing the social and economic difference between eastern England (broadly the territory dependent upon the rivers flowing into the southern part of the North Sea) and the central southern arc which surrounds it (i.e. Wessex, the Cotswolds and the Welsh Borderland. It is upon these two broad regions that our discussions below will be centred.

Beyond the two south eastern zones three further regions can be broadly defined (fig. 1): a south western zone, including western Wales, Cornwall, Devon and western parts of Somerset; a large northern zone, in which there is a considerable range of variation, and a north western zone, including the extreme north and west of Scotland, the Western Isles and Orkney and Shetland. In each, the settlement evidence suggests different systems of socio-economic organization and different rates and directions of development. While these areas are of considerable interest in their own right it is the south and east of the country which are of immediate concern to the theme of this volume.

Chronology and change: 1000-400 BC

It the period from before 1000 BC to about 400 BC (Ha B - La T I) the British Isles was in close contact with continental Europe. The range of metal types found widely distributed in the island (weapons, metal vessels and horse trappings) show that continental types were being brought in in some quantity, presumably by a complex of social exchange mechanisms, and ingeniously copied and improved by British craftsmen (for a summary see Cunliffe 1978a, 137-157). Meanwhile hillforts were being widely constructed in most parts of the country in a variety of styles incorporating vertical walling of timber, stone or a combination of the two, in a manner closely similar to continental forts of the Ha B and C (*ibid,* 243-255). The impression given by a survey of the surviving evidence is of a degree of uniformity over much of the country heightened by extensive exchange networks across the North Sea. By Ha D - La T I, however, the volume of imports had declined.

In the seventh and sixth centuries significant divergent developments can be detected in Wessex, in particular in Wiltshire and western Hampshire. Simply stated there appears to be a rapid increase in the number of hillforts constructed, and highly distinctive decorated pottery styles appear, first the All Cannings Cross styles with haematite-coated furrowed bowls and deeply stamped and incised decoration and later the Meon Hill style typified by haematite-coated scratched-cordoned bowls. On present evidence they date to the seventh and sixth centuries respectively but the All Cannings Cross styles may begin a little earlier. One possible implication of these innovations is that social pressures may have led to a greater emphasis on territoriality which manifested itself in the need to build substantial defensive structures and to express ethnicity through distinctive decorative styles, of which pottery is archaeologically the most evident. The reasons for these supposed "social pressures" are at present difficult to define but one line of argument which commends itself is to suppose that the Wessex population was reaching the holding capacity of the land through a combination of factors such as population growth and decrease in soil fertility due to environmental constraints or overcropping. In support of such an explanation it can be shown that active arable exploitation of stable plots of land had already been underway in Wessex for at least half a millennium before the sixth century and it is highly likely that the thin, poort-textured, chalkland soils were by now showing signs of exhaustion. A further relevant observation is that there appears to be a notable increase in the number of sites found dating to after the seventh century (Cunliffe 1978b). Thus, while positive statements are ill-advised at present, it is fair to say that there is a growing body of evidence which points to stress among the Wessex population as early as the seventh/sixth centuries. As we shall show these trends became intensified.

The characteristic settlements in Wessex at this time are hillforts and homesteads. Of the hillforts, Danebury provides an extensively excavated example. In its early phase (sixth-fifth century) the defences consisted of a massive timber-revetted rampart, fronted by a ditch, enclosing an area of *c.* 5 ha, pierced by two entrances set in opposite sides of the enclosure. The occupation inside appears to have been dense, with groups of circular houses set between areas reserved for grain storage pits (Cunliffe 1982b). Other extensively explored examples include the first phases of Maiden Castle, Dorset and Winklebury, Hants. A number of other forts have been sampled but usually only by sections through ramparts and gates (e.g. Torberry, Sussex, Yarnbury, Wilts and Blewburton, Berks). In general these forts are of similar sizes (4-6 ha), univallate and often have two entrances.

The contemporary settlement sites, as best exemplified by the early phases of Little Woodbury, Wilts., Meon Hill, Hants., Old Down Farm, Hants. and Gussage All Saints, Dorset, are all of similar type, consisting of a fenced or ditched enclosure containing circular houses, granaries and storage pits appropriate to a unit of extended family size. The possibility of larger settlements and of unenclosed homesteads is hinted at by scraps of evidence but the picture is still very incomplete.

Whether or not similar developments were experienced in other parts of southern Britain it is not yet possible to say. Hillforts were certainly being built and occupied in other areas, e.g. Wandlebury and Wilbury on the Chilterns, Crickley Hill, Leckhampton and Shenbarrow on the Cotswolds and Hunsbury further to the north along the Jurassic ridge, while many of the Welsh borderland hillforts are likely to have been in use at this time. But the impression given by the available evidence, inadequate though it is, is that Wessex differed from the rest of Britain in the density of its early hillforts and settlements and in the highly distinctive nature of its decorated pottery styles. We might therefore tentatively conclude that the social stresses inherent in southern British society at this time had become intensified in Wessex giving rise to a number of chiefdoms focussed on fortified hilltops, the tribal unity of the core area being reflected in distinctive pottery traditions shared by a number of communities.

The centre south: 400-1000 BC

The social processes briefly outlined above became further intensified in the centre south in the period 400-100 BC. A survey of the Wessex and Sussex data shows quite clearly that after about 400 BC the number of hillforts maintained in use dramatically declines while, in parallel, a few sites not only continue but become more strongly defended and are sometimes enlarged. This process is well illustrated by the Sussex Downs where on each block of downland, naturally defined by river valleys, one hillfort seems to rise to dominance at the expense of all others. The same process is evident on the block of chalkland between the rivers Test and Bourne, on the Hampshire/Wiltshire border. Here, of four evenly spaced early forts, only Danebury emerges dominant, the other are abandoned. (For further discussion and references see Cunliffe 1978a, 268-278.) Clearly until every fort has been adequately sampled it will be impossible to produce an accurate picture of this process but fig. 2 attempts to contrast the overall distribution of hillforts with those forts which, on a variety of topographical and cultural evidence, can be shown to belong to the period 400-100 BC. While it must be stressed that the data used for the lower map is very uneven and open to reinterpretation (and some sites which should be shown may have been omitted simply for lack of evidence) the overall impression is of a striking evenness of spacing. We are looking here at a landscape divided into a number of distinct territories each dominated by a single hillfort.

These developed hillforts (a term used to distinguish them from early hillforts) share a number of superficial characteristics in common:

a. Their defences were built, or rebuilt, in a glacis style, i.e. the rampart was given a sloping front continuous with that of the inner face of the ditch. Vertical walls or fences may have been set on the rampart crests (for summary Cunliffe 1978a, 249).

b. Rebuilding on previously occupied sites might significantly extend the defended area (e.g. Maiden Castle, Hambledon Hill, Yarnbury).

c. The entrances show signs of elaboration. The gates were often inturned, while outworks were frequently constructed. Several cases were known in which an earlier second gate was blocked.

d. Multiple lines of defence were sometimes built to increase the depth of protection.

Fig. 2a. Hillforts in Southern Britain: all hillforts.

A number of developed hillforts, which have been adequately examined, show that the intensity of internal occupation was considerable. In some cases, in the Welsh borderland forts of Credenhill, Croft Ambrey and Midsummer Hill, and the Hampshire fort of Danebury, there is clear evidence that the interiors were now arranged in functional zones divided by roads and that buildings were erected in rows with a degree of regularity, maintained through many phases of rebuilding, which must imply the exercise of control over considerable periods of time. All these structuralcharacteristics conform to what might be expected of a social structure in which coercive power was centralized in one location forming the focus of a well-delimited territory. A further reasonable inference is that the developed hillforts may well have served as redistribution centres for their territories (Cunliffe 1978a, 273). Such evidence as there is tends to support this contention.

Clearly, in such a socio-political system there

Fig. 2b. Hillforts in Southern Britain: forts for which there is evidence suggesting occupation in the period 400-100 BC.

will have been a considerable degree of variation. It would be wrong to suppose that all developed hillforts were of equal status or that a status, once achieved, remained unchanged over several centuries. A fort serving as the seat of a paramount chieftain would have had the balance and intensity of its functions altered if the status of its leader became that of a vassal: similarly an increase in status might also be expected to affect the archaeological record. We must assume a situation of flux, but unfortunately the present state of the archaeological research does not allow us to test the assumption.

There are hints of differences in status (or intensity of occupation) between sites. Some forts (like Maiden Castle, Dorset, Hambledon Hill, Dorset, Yarnbury, Wilts. and Danebury, Hants.) are well defended with complex entrances; others (like St. Catharine's Hill, Hants., Winklebury, Hants. and The Trundle, Sussex) have less substantial defences and comparatively simple entrance earthworks. Whether these differences are the result of status, duration of use, or local stylistic factors it is difficult to say - differences of this kind are likely to reflect a complex of variables.

Some general patterning does emerge from the wealth of disparate data. It is, for example, possible to suggest that the developed forts of the North Downs and the North Weald (Surrey and Kent) did not grow out of existing hillforts but were built in the fourth century or later on virgin sites - an observation which would suggest that the socio-political system, represented by the developed forts spread late to this region (Cunliffe 1982c, for details of individual sites). Less substantial indications hint that a similar late extension from the Wessex area may have led to the construction of many of the forts of Devon east of the river Exe. The evidence is however sparse.

The situation in the Cotswolds is even less clear, in spite of the large number of surviving sites, but given that there were many forts in the area in the period before 400 BC and that some (*e.g.* Bredon Hill, Worcestershire and Rainsborough, Northants.) continued to be used and refurbished after *c.* 400 BC, it is fair to assume that the Cotswolds, like Wessex, were part of the core area within which hillfort development was continuous over a long period. Moreover, a number of Cotswold forts, mostly unexcavated, exhibit physical characteristics closely similar to the developed hillforts of Wessex. The same generalization appears also to be true for the Welsh borderland but while complex sequences have been demonstrated (e.g. at Midsummer Hill and Croft Ambrey), dating evidence is at present imprecise.

In summary we are suggesting that hillfort development can be divided into three broad phases (fig. 3):

a. 1000-600: Early hillforts widespread but not densely packed.

b. 600-400: Hillfort occupation and building continues sporadically but in Wessex hillfort building intensifies and forts become densely packed.

c. 400-100: The emergence of developed hillforts serving as central places in well defined territories, covering a broad arc form Sussex through Wessex and the Cotswolds to the Welsh borderland. In Wessex continuous development from earlier sites can be demonstrated but to the east in the North Downs region, and, less certainly, to the west in East Devon, there is some probability that most developed forts were newly founded. The nature of continuity in the Cotswolds and Welsh borderland is less easy to define. If we can regard developed hillforts as representing a socio-political system, it is reasonable to suggest that by the third century BC the whole of the centre south from the Channel Coast to North Wales was part of a single zone.

We have suggested above that the situation in Wessex before *c.* 400 BC was one in which increasing stress led to the development of a number of strongly defended chiefdoms bound together within a broad tribal configuration. What then, in social and economic terms, does the new pattern of larger territories dominated by single strongly defended hillforts imply? At one level it must mean a coalescence under more powerful leaders but it could also, in part, reflect a greater degree of economic centralization, the forts now providing both a means for articulating exchange and a source of manufactured goods. It is certainly true that the range and number of tools, weapons and ornaments dramatically increases after the fourth/third century and it is tempting to see in the great rise in the number of sheep, and the large quantity of artefacts relating to the manufacture of woollen fabrics, some suggestion that in Wessex, at least, there may have been the specialized production of woollen fabric, presumably for the purpose of exchange.

Another factor which cannot be ignored is the considerable military strength of the developed forts. Complex entrance fortifications and the presence of quantities of sling stones (e.g.

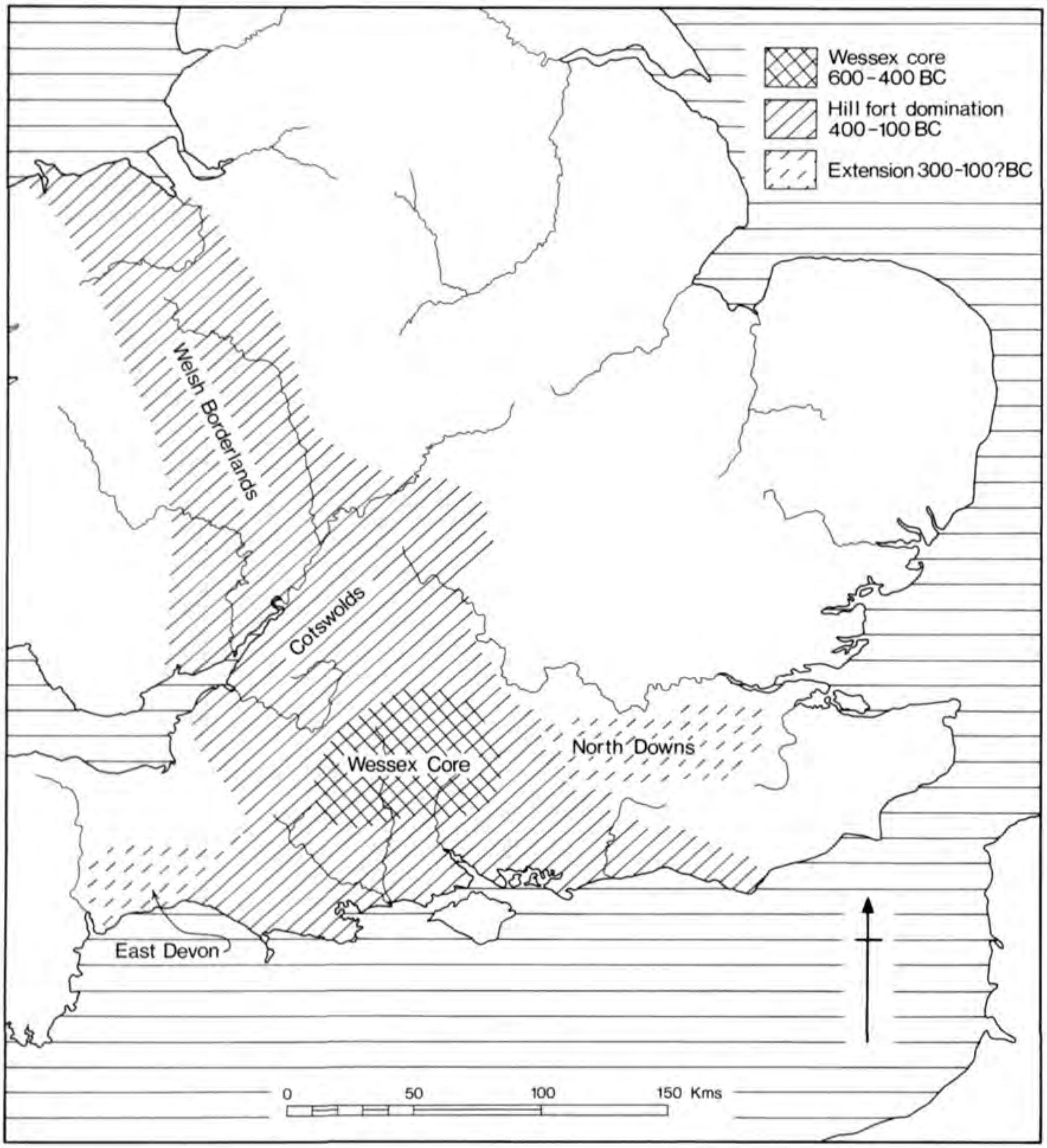

Fig. 3. The development of the hillfort-dominated zone.

at Maiden Castle and Danebury) are a reminder of the need for defence, while evidence of periodic burnings, together with mutilated human remains from a number of forts, leaves little doubt that attacks were not infrequent. The developed hillforts must, then, reflect the increasing stress under which society was now coming. That warfare was endemic is a strong probability.

One notable feature of the hillfort-dominated zone is the broad similarity throughout of styles of construction, material culture and economy. But certain regional variations are apparent. In the form of hillfort entrances, for example, it is possible to distinguish two localized methods of constructing entrance hornworks, one centred on Hampshire, the other on Dorset, while recessed guard chambers are a recurring feature in the Welsh borderland and the Jurassic ridge. But even more noticeable are different regional styles of pottery decoration. The principal divisions are shown on fig. 4. Space does not permit a detailed discussion of them (but see Cunliffe 1978a, 45-8). Suffice it to say that the pottery styles of the hillfort-dominated zone differed significantly from those of the east of England. Within the zone four broad categories can be recognized, each of which seems to have originated in the fourth century BC and had, by the second century, developed highly distinctive decorative motifs. Moreover the firmness of the boundaries between the styles suggests that they may represent distinct tribal groupings, the decoration being a conscious demonstration of the ethnicity of each group. The validity of this assertion is considerably strengthened when the style zones of the third/second century BC are compared with the known tribal boundaries early in the first century AD immediately prior to the Roman invasion of AD 43: the saucepan pot styles (group 5 on fig. 5) correspond precisely with the territory of the Atrebates, the Dorset styles (group 2) marking the territory of the Durotriges. The decorated "Glastonbury wares" of group 1 correspond with the easternmost part of the Dumnonii while the decorated "Glastonbury wares" of group 3 represent exactly the territory of the southern Dobunni who are, in the first century AD, numismatically distinct from the northern part of the tribe. The distribution of West Midlands styles (group 4) is a close fit to the northern Dobunni. Thus, the tribal groupings, known historically and numismatically in the first century AD, are already recognizable as ethnic entities in ceramic styles going back to the third century BC or even earlier. We may therefore argue that the ceramic differences of this early period are likely to reflect ethnic groups, who recognized themselves to be different from their neighbours and demonstrated these differences in various ways, one of which, pottery decoration, is readily recognizable in our very defective archaeological record.

The saucepan pot assemblage of group 5 offers the possibility of a further refinement. Within the overall zone it is possible to define certain style preferences which have distinctive distributions. Three of these, Groups 5B, C and D, have overlapping distributions which suggest that no strict social boundaries existed but the fourth, group 5A, appears to form a tight pattern having sharp boundaries with all its neighbours. The implication would seem to be that here lay a distinct sept of the larger tribe. The suggestion is, of course, highly speculative but the fact that it is precisely this region that formed the core of a territory, defined by its own pottery traditions and the rapid growth in the number of hillforts in the preceding period (sixth-fifth centuries), adds support to the view that the nuclear Wessex territory may have retained its identity from the sixth century. Significantly, perhaps, this same area remains a distinct numismatic anomaly even into the early first century AD.

In summary we may say that the picture which is beginning to emerge of this period suggests that a number of distinct chiefdoms existed, represented by developed hillforts. These were evenly spread throughout central southern Britain but can be grouped in larger entities, representing tribal divisions, which continued to be maintained up to the time of the Roman inva-

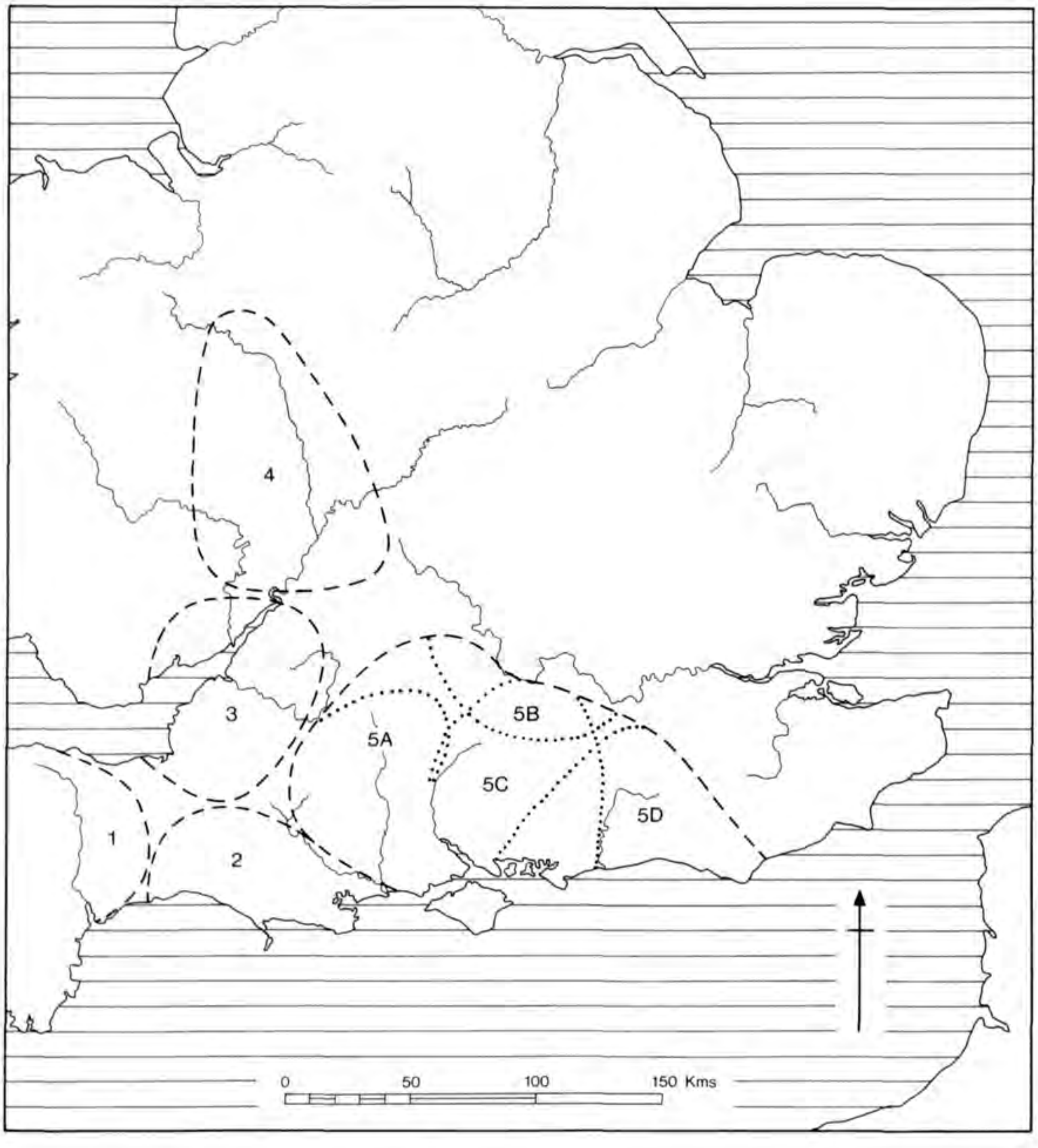

Fig. 4. Regional pottery styles within the hillfort-dominated zone:

1. Glastonbury wares of East Devon;
2. Maiden Castle-Marnhull styles of Dorset;
3. Glastonbury wares of Somerset;
4. Malvernian pottery of the West Midlands;
5. Saucepan pot styles.

sion. Some of these tribes or septs may well have originated as socially distinct groups in a much earlier period.

Finally, something must be said of settlements lower in the hierarchy than hillforts. In Wessex many are known and some have been excavated. A recurring feature is that they often occupy sites which had already been settled and, in effect, are merely a continuation of the existing settlement pattern (e.g. Little Woodbury, Gussage All Saints and Old Down Farm) representing units of extended family size. A new type of settlement also appears in the third or second century. Known as banjo enclosures, these are smaller settlements (*c.* 1 ha) defined by ditches which also delimit a long entrance approach. It is possible that they were occupied by smaller family units of inferior status but until several have been adequately excavated further speculation is unwise. Settlements were particularly densely packed in Wessex and in some areas seem to have been as close as 1 km one from another.

Elsewhere in the centre south very little is known of settlement form and location but detailed field-work in the Upper Severn valley (Spurgeon 1972) suggests that, here too, small enclosed homesteads were densely packed into the congenial parts of the landscape, while the recent excavations at Beckford, Worcs. will undoubtedly add significantly to our knowledge of the settlement of the Lower Severn valley.

The eastern zone: 400-100 BC

The eastern zone of Britain can best be defined as the area drained by rivers flowing into the southern part of the North Sea (fig. 5). Its cultural integrity can be gauged from pottery distributions. The earliest well-defined type, the scored wares of the Bredon-Ancaster style dating roughly to the fifth to second centuries, lies wholly within the area north of the Thames (Cunliffe 1978a, fig. 3.5) while the later decorated bowl and jar styles cover the same regions but extend the western and southern limits (*ibid,* fig. 3.8). The entire ceramic tradition of this eastern zone, from the fifth century, is in marked contrast to that of the centre south. The further significance of the decorated groups will be returned to below.

The eastern zone had little geomorphological uniformity but is divided into a number of micro-regions, the principal being (from south to north) the North Downs, the Lower Thames valley, the Chilterns, the Upper Thames valley and Ouse valley, the Northamptonshire Uplands, and the Trent-Witham zone. Strictly, then, we are dealing with three ridges of hills, each with major ancient trackways running along them, separated by major complexes of river valleys.

The most striking aspect of the settlement archaeology of this zone is the paucity of hillforts in comparison with the centre south. Fig. 2 shows that there are some but recent work suggests that a number of those in East Anglia should now be deleted since they are likely to post-date the Iron Age, while the majority of those remaining very probably pre-date *c.* 400 BC. In other words in the period from 400-100, when the centre south was developing into a hillfort-dominated landscape, the eastern zone was almost devoid of forts. The generalization must however be qualified. We have already suggested above that there was an extension of developed hillforts along the North Downs as far as the river Medway in an area where previously there were few forts. This region is therefore best considered to be one that passed from the eastern zone to the hillfort-dominated zone sometime in or about the third century.

Isolated hillforts are also found along the Chiltern ridge but dating evidence is inadequate. Ravensburgh Castle, Herts. and Wilbury, Herts., which may be typical of the region, seem to have been occupied in the fifth-fourth century but there is little evidence of later use until the first century BC-first century AD. Only at Wandlebury, Cambs. is evidence of active occupation in the period 400-100 reasonably convincing. The overall impression given is that the majority of the Chiltern hillforts were out of

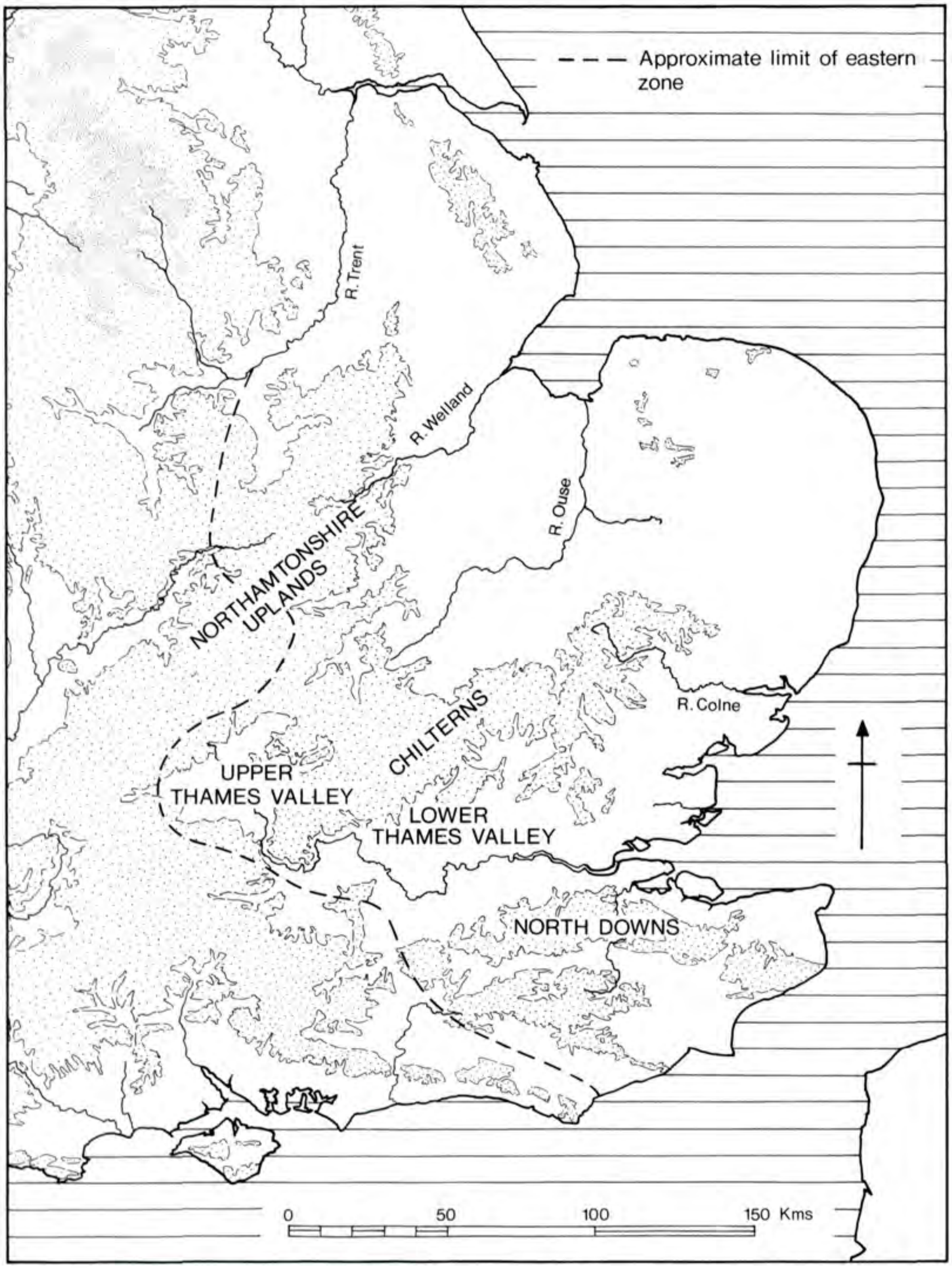

Fig. 5. The Eastern zone.

use by *c.* 400 and, with rare exceptions, were not reoccupied until the century or so before the Roman conquest. The situation is closely similar to that in Northern France, Belgium and Luxembourg (p. 176).

The Northamptonshire Uplands are notably devoid of hillforts but Hunsbury was refurbished and continued to be occupied into the second or first century BC. It is best regarded as an eastern outlier of the Cotswold hillfort-dominated zone.

If, then, we accept that the hillfort-dominated zone of the centre south represents a distinctive socio-political organization we must suppose that the social, economic and political systems of the eastern zone were of a very different kind. Unfortunately evidence which may allow us to examine these problems further is difficult to find. The impression given by the Ordnance Survey map of Iron Age Britain (published 1962), that much of the eastern area was sparsely settled, is quite wrong as recent surveys in Northamptonshire, Bedfordshire and Essex have shown. Indeed in some areas of Northamptonshire settlements were as densely packed as in Wessex and while such densities cannot be expected to extend over all the varied soil types we must now accept that the region supported a substantial population.

A number of settlements have recently been extensively excavated in Northamptonshire (e.g. Twywell, Wakeley, Aldwinkle, Blackthorn, Moulton Park and Fengate) to add to the two previously excavated sites of Draughton, Northants., and Colsterworth, Lincolnshire. In Essex the sites of Little Waltham and Mucking are broadening our understanding of a hitherto little-known region, while in the Upper Thames the work of the Oxford Archaeological Unit has concentrated on the problems of Iron Age rural settlement of which two important excavations at Farmoor and Ashville, are now fully published, while others, at Hardwick and Claydon Pike (Glos.) are described in interim reports. This brief, and very incomplete list, gives some idea of the range of data which has become available in the last ten years.

Two generalizations may be made: the basic settlement form seems to represent the single family or extended family unit, the boundaries frequently being enclosed by a ditch and presumably a bank with a fence or hedge on it, but much larger groupings of houses and other domestic structures are found (e.g. Twywell, Ashville, Claydon Pike and Little Waltham), suggesting larger agglomerations of population of village size. Since no site of this kind has yet been fully excavated it is impossible to speculate on population size or even on duration of occupation but the apparent contrast to the situation in the centre south is significant. It may be that these larger agglomerations represent settlements which carried out some of the functions of the hillfort communities but until we know more of them, of their variety and of their spatial relationships to the homesteads it would be unwise to speculate further.

We have already referred to the pottery of the eastern zone as differing from that of the centre south. One point of particular note is that, with certain exceptions, most of the assemblages lack distinctive decoration. If one accepts the view that highly decorated and distinctive pottery groups are a reflection of the desire of the community to express their ethnicity, then that desire would appear to be little felt among much of the population of the eastern region. The exceptions are, however, of some interest. Four highly decorated groups can be recognised (Cunliffe 1978, fig. 3.8) (fig. 6), all of which lie close to the border between the eastern and centre south zones. Such a pattern might well be anticipated on a border zone where communities would wish to offer a statement of their internal unity and their difference from their neighbours. While the evidence fits well with the model, other explanations should not be overlooked. The Hunsbury-Draughton style for example is distributed in the territory of the Hunsbury fort which could be regarded as an outlier of the centre south zone, while Stanton Harcourt-Cassington style occupies an economically important region where Cotswolds, Chilterns and Wessex chalkland converge on the Upper Thames valley. Such a favoured area may

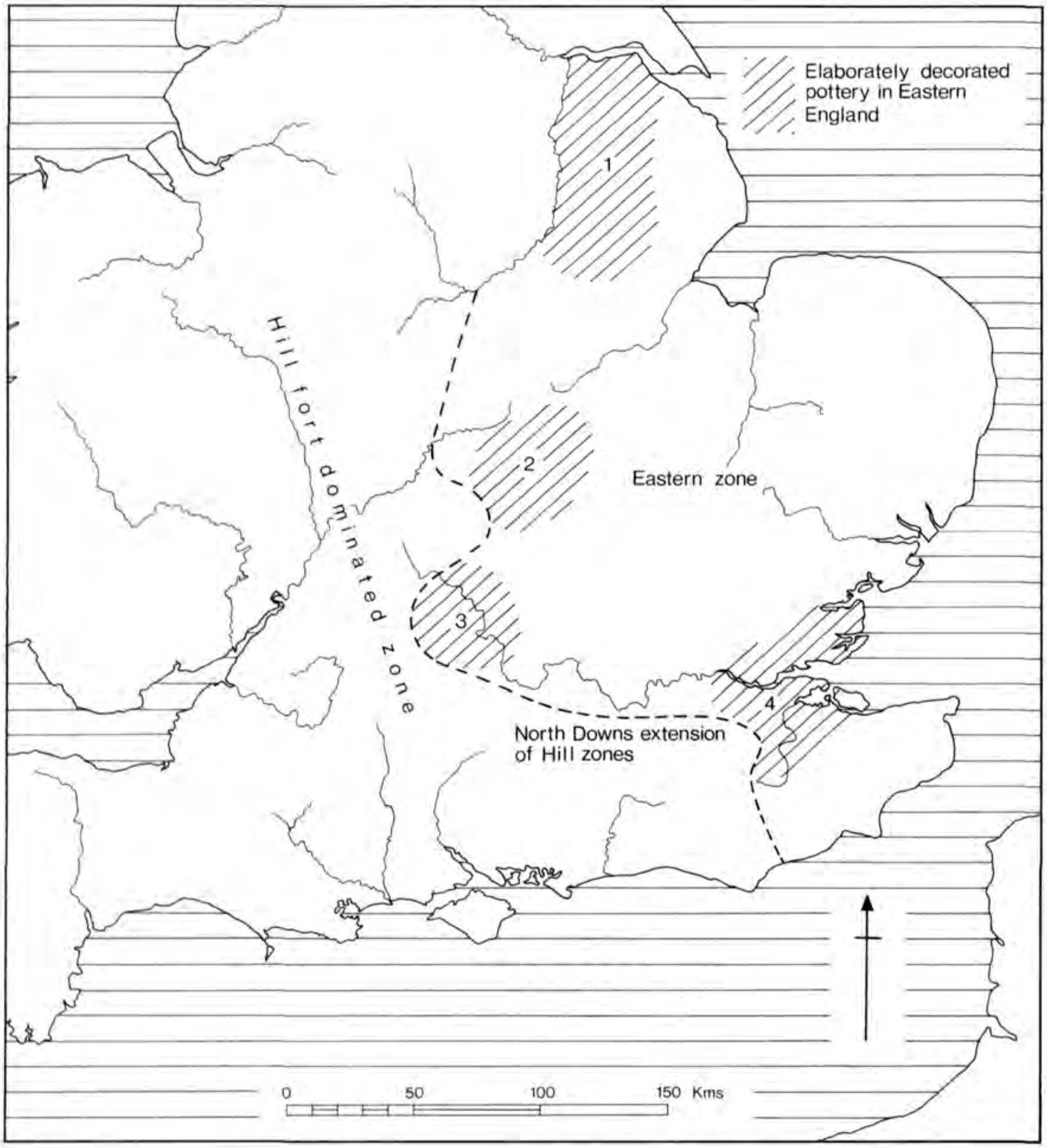

Fig. 6. Regional pottery styles of the Eastern zone:
1. Sleaford-Dragonby style;
2. Hunsbury-Draughton style;
3. Stanton Harcourt-Cassington style;
4. Mucking-Crayford style.
(For details see Cunliffe 1978a, fig. 3.8).

well have developed a centralized political structure of its own. At best the examples show the potential complexities of a border region and the difficulty of drawing hard boundaries on archaeological distribution maps.

The broader implications of the eastern and central south zones

We have seen that in the period *c.* 400-100 BC it is possible to define two areas in the south of Britain which have markedly different settlement patterns, the one dominated by hillforts, the other mostly without hillforts. We have also shown that in the hillfort-dominated zone, and along its border, highly distinctive styles of pottery decoration can be recognized which may be thought to demonstrate a strong ethnic identity in these areas, in contrast to most of eastern England where pottery appears to be largely undifferentiated stylistically. These two disparate types of evidence lead to the same broad conclusion - that the social systems of the two zones must have been markedly different. From the evidence briefly outlined we may characterize them thus:

Centre south - strong chiefdoms based on hillforts, organized into larger confederacies (septs or tribes) using distinctive pottery styles as insignia. The hillforts perform central place functions. Society is in a state of stress and warfare is endemic.

Eastern - lack of centralization in production and authority except at isolated points and on the interface with the centre south zone. No evidence of stress or warfare.

The differences are striking and call for explanation, but such is the nature of the archaeological evidence that no firm conclusions can yet be reached. One line of approach worth exploring, however, is that stress caused by population growth may have continued to be a factor. We have already suggested this as a reason for the development of the hillfort-dominated society of the centre south and the argument might be extended to suggest that the converse, i.e. lack of population pressure, may have allowed the more open settlements of the east to have developed in comparative peace. Beyond this point the argument becomes even more speculative, but controlled speculation leading to the formation of testable hypotheses is justifiable.

If population pressure, caused by the population level and holding capacity of the land converging, is a formative influence in the centre south, in contrast to the east, then it must be assumed that one or more of the following factors was in operation:

a. the rate of increase of population in the two zones differed;
b. new land for surplus population was available in the east but not in the centre south;
c. technological innovation in the east led to greater productivity;
d. the greater diversity and quality of soil type in the east allowed productivity to be maintained or increased;
e. changes in microclimate adversely affected the centre south but not the east.

In practice any or all of these factors may have had a causative effect leading to the social differences noted. Simply listing them suggests directions for further detailed research.

One observation of potential relevance can be made on present evidence. In the Wessex area the number of sheep increased dramatically throughout the Iron Age. The usual explanation is that flocks were developed to provide food as the woodland environment suitable for cattle and pigs was progressively cut down (Clark 1947). But another explanation may be that the vast flocks of sheep were required to provide manure to maintain the fertility of arable fields. To add a dynamic to the equation, as the natural fertility of the thin chalk soils declined and more of the high down was broken to extend the arable so sheep would have been required in increasing numbers. A byproduct of this develop-

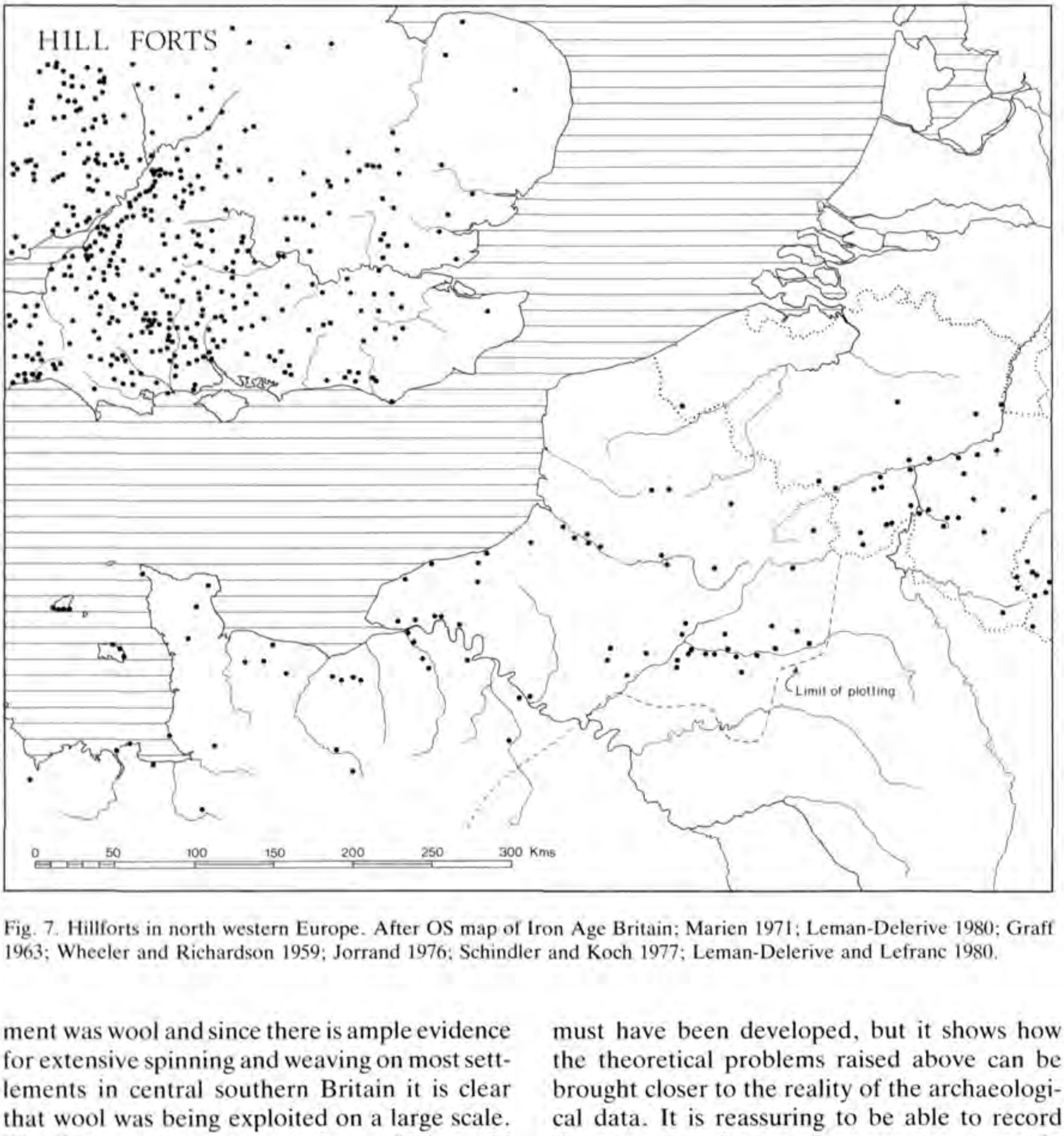

Fig. 7. Hillforts in north western Europe. After OS map of Iron Age Britain; Marien 1971; Leman-Delerive 1980; Graff 1963; Wheeler and Richardson 1959; Jorrand 1976; Schindler and Koch 1977; Leman-Delerive and Lefranc 1980.

ment was wool and since there is ample evidence for extensive spinning and weaving on most settlements in central southern Britain it is clear that wool was being exploited on a large scale. Woollen garments were an item which could easily be exchanged. This simple chain of observation, borne out by archaeological evidence, links increasing need for grain to the rise in number of sheep and the potential use of the byproduct, wool, as an item of exchange. No doubt it belies the true complexity of the situation and of the different regional strategies that must have been developed, but it shows how the theoretical problems raised above can be brought closer to the reality of the archaeological data. It is reassuring to be able to record that a series of research programmes now in operation will have much to contribute to these questions.

Britain and the Continent

It is not the purpose of the present paper to explore the evidence from the adjacent parts of continental Europe in any detail but certain generalizations can be made. Fig. 7 presents a gross plan of all hillforts in Britain, Belgium and parts of northern France and Luxembourg, structures which we know can span the whole of the first millennium. Clearly one cannot base detailed arguments on such disparate data but assuming the surveys in each country to be of approximately equivalent thoroughness then it is clear that the hillfort-dominated zone of central Southern Britain is quite exceptional in the density of forts recorded. It is equally clear that an arc of hillforts extends through Normandy to the Marne and the Ardenne, leaving a substantial part of Nord and Pas de Calais, Belgium and Holland without defensive structures of this kind.

Little modern excavation has been undertaken in the forts of this part of north western Europe and that which has been done consists, almost without exception, of trial trenching through the ramparts and ditches. Work of this kind, while undoubtedly useful has limitations when considering duration and intensity of occupation. However the general picture to emerge has a degree of consistency. Many of the sites can be shown to have been occupied in the period approximately 1000-400 BC (e.g. Saint Pierre-en-Chastres, and Fort Harrouard, in France and Etalle, Salm-Chateau, Tavigny-Alhoumont, Buzenol, Kemmelberg, and Hastedon, in Belgium), some (*e.g.* Saint Pierre-en-Chastres, Fort Harrouard, Tavigny-Alhoumont and possibly Hastedon) were reoccupied again in the middle of the first century BC at which time a number of other forts were built on virgin sites (e.g. Duclair, Gros Cron (Bellefontaine) and Cherain-Brisy). The site lists are far from complete but contain the forts for which sound data is available. The implication would seem to be that evidence for hillfort occupation between 400 and 100 BC is lacking, or at least rare, in this region.

There are, of course, dangers in basing too much on the evidence of a few rampart sections (and futher east in Luxembourg at both Otzenhausen and Altburg occupation continued into or began in this middle period) but as a broad generalization it is fair to say that the east of England, northern France and Belgium seem to have shared a similar settlement pattern history which saw hillforts in use in the first half of the first millennium BC, up to the beginning of the early La Tène period, followed by a period of abandonment, with a spate of fort building again in the troubled times of the first century BC. The contrast of this pattern to that of central southern Britain is dramatic and serves further to emphasize the aberrant nature of the socio-political system of this hillfort-dominated zone.

The first century BC: an epilogue

Some time about 100 BC Britain's contacts with continental Europe were invigorated. A western trade axis developed, linking the centre south of Britain with Atlantic sea routes and ultimately, via the Garonne and the Carcasonne Gap, to the Romanized Mediterranean (Cunliffe 1982a), while links between the Belgae of the Somme valley and the communities of the Thames valley developed an intensity which supports Caesar's assertion that Belgic settlers migrated to Britain, an event which led to the parallel cultural development of the two areas both before and after Caesar's invasion. A decade of turmoil, created by Caesar's presence in Gaul, soon gave way to a period of ninety years during which the new Roman province traded extensively with the east of Britain culminating in the creation of a regular trade network extending along the Rhine frontier zone to reach the tribes occupying the regions of Essex and Hertfordshire (Partridge 1981, 351-352).

The events and implications of this period of economic revolution cannot be considered here in any detail but since they serve to bring to an end the old order which we have been discussing, the immediate effects should be mentioned by way of an epilogue.

Two major changes can be recognized in the settlement pattern of southern Britain. First, there developed in the eastern zone, extending to adjacent parts of the centre south, large fortified enclosures or *enclosed oppida* located at significant route nodes especially where major land routes cross rivers. Some may be associated with or replaced by large open settlements. These oppida must reflect a reorganization of existing economic systems to facilitate intensified long distance trade (Cunliffe 1976a). Their appearance accords well with what might be expected of the effects of the proximity of the Roman economic system. Second, the majority of the strongly defended hillforts of the centre south seem to have been abandoned at about the same time. Some may have continued as religious centres (*e.g.* Danebury), or as farms or may have been refortified later (*e.g.* South Cadbury and Hod Hill), but the intense and densely packed occupation of the second century BC came rapidly to an end. On present evidence only at Maiden Castle does occupation seem to have been continuous but by this time the fort may have begun to assume the functions of the eastern oppida. Although dating evidence is necessarily imprecise, the end of the developed hillforts seems to have occurred within the period 100-50 BC in Wessex and probably also in the Cotswolds, but how long afterwards forts continued in use in the Welsh borderland cannot yet be assessed.

The rapid end of hillforts in the south must mark the collapse of the social system which supported them. The simplest way to explain this is to suppose that the economic reorganization, which came about gradually as the result of the increasing proximity of the Roman world between *c.* 100 BC and AD 43, dislocated the British socio-political systems to such an extent that those that were unstable simply collapsed. If we are correct in arguing that the hillfort-dominated landscape represented society that was under increasing stress, then its disintegration at this time is only to be expected.

How communities readjusted economically to the changed conditions and what kind of political systems evolved are questions currently under investigation but the data base is of reasonable quality and holds out hope that significant advances in knowledge may be attainable.

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CONCLUDING REMARKS

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Walking arround the streets of Leiden during this conference, it is not surprising that the image which sticks in the mind is that of the bridge. Much of this meeting has been concerned with bridgebuilding, not only between different periods but also - more fundamentally - between the raw data of archaeology on the one hand and the stimulating but elusive idea of "settlement pattern" on the other.

It is no accident that the question of settlement patterns should be of prime concern to a group of archaeologists working in north-west Europe. It is a contribution of this area to European archaeology as a whole to have pioneered the extensive and often total excavation of settlement sites, to reveal the connections between houses, byres, granaries, boundaries, graves and fields. Undistracted by an excess of painted pottery, marble statues, or even Bandkeramik figurines, it has been possible to concentrate on revealing the structure of prehistoric occupation. The techniques pioneered by Professor Modderman and others have been profitably exported to areas where otherwise art-history would have first claim on the attention of archaeologists.

Even within our own area, however, there is an enormous diversity of landscapes. Some of the first bridges to build, therefore, are between our different traditions of field archaeology, based on the particular opportunities of local conditions. Questions posed in one area may be answered in another. Lack of one kind of evidence may intensify research on alternative ways of gaining this information, and lead to new advances of general value. Our differing emphases on phosphate analysis, coring, microwear, pollen studies, mapping techniques, etc. have been usefully compared and exchanged, as well as their results, at the "Information Market" during the meeting.

So too with ideas and interpretations. Danish colleagues (Brinch-Petersen, Madsen) have stressed the importance of seasonal rhythms in Mesolithic and Neolithic contexts. German contributors (Brandt, Zimmermann) have emphasised the specific functions of individual sites in the Iron Age - pasturing, cultivation, manufacturing. English and Dutch speakers (Cunliffe, Bakker) have looked at the regularities with which hillforts and megalithic tombs are spread across the landscape. There is tremendous scope here for crossfertilisation, in looking for these patterns in material that has not so far been approached from these points of view. Simple techniques like site catchment analysis have already become a common way of looking at very different types of archaeological site, and some well-known settlements have been illuminated by putting them in an immediate geographical context (Harsema).

One common thread among geographically diverse contributions has been the emphasis on landscapes rather than individual sites (Lüning, Pryor, van Regteren Altena). Here we meet problems that are specific to the *archaeological* study of settlements patterns: problems not encountered by geographers working with more recent material. One is the question of sampling - how we may most efficiently retrieve information on a scale large enough to make sense of it. This was much discussed over refreshments at the meeting, but deserves more explicit debate at future gatherings. Another problem is that of differential preservation. Archaeological visibility may simply reflect the process of site-destruction, and the most rewarding sites may still be covered by protective alluvium. We need to publish much more "control information" about the site-preservation and the circumstances of discovery, in order to understand our distribution maps. Blank areas may represent either "lack of information" or a genuine "negative observation", and we need to be able to distinguish the two. Thirdly, our comparisons would be helped if we had a common convention for describing settlement grouping between the levels of the site and the *Siedlungskammer*. Our discussions of Bandkeramik sites (Bakels, Constantin, Lüning) showed the importance of groups of sites, lying close to one another and perhaps forming a community for certain purposes. We need to describe and compare these structures, and perhaps invent specific terms for forms of settlement which have no analogies in later (eg Medieval) settlement morphology.

Finally, one conclusion arose without debate from our meeting. These questions are best pursued in comfortable surroundings and congenial company. Whatever conclusions we may have reached about prehistoric settlement, we were unanimous in our agreement over the clear evidence of planning and forethought which was manifested in this tribute to Professor Modderman.