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Settlement Systems of Early Agricultural Societies in East Jutland, Denmark: A Regional Study of Change

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By settlement archaeology I mean settlement history carried out by archaeological means. That is to say, the study of the development of settlements in relation to the landscape, the exploitation of the natural resources, and the location of the different settlement units in relation to soil types, to each other, and to communication lines. On all levels settlements must be seen as an expression of the social, economic, and political norms in a society, based on the technological level that made the exploitation of the natural resources possible (Thrane 1976:5, translated).

The study of settlement systems certainly is not a new development in Danish archaeology. One need only look at the works of Sophus Müller (1904, 1911) and Therkel Mathiassen (1948, 1959) to realize this. Until recently, however, there seems to have been little recognition of how important and rewarding settlement studies can be, and only during the last few years has a real interest in these arisen. This change in attitude is largely a result of influence from the New Archaeology in America—notably Binford (1964) and Struever (1968)—and from work done at Cambridge by Higgs and Vita-Finzi (1972) and Jarman (1972).

Several projects have been initiated in Denmark to study long-term trends (Thrane 1976, 1978; S. Andersen 1976) as well as specific problems of settlement systems (Albrethsen and Petersen, 1977:2). This paper introduces a project with the latter goal. That is, it investigates the development of the settlement systems of the earliest agricultural societies in Denmark within a 1600-km^2 region of east central Jutland (Fig. 1).

In this paper I will try to build a general model for the development of these settlement systems on the basis of our current knowledge of settlement and grave sites within the research areas as well as supplementary information from other parts of Denmark. The purpose of the model at this preliminary stage is to serve as a guideline for future research in the area and to elicit comments on the interpretive framework underlying the research project, not least the part concerning change in land use patterns.

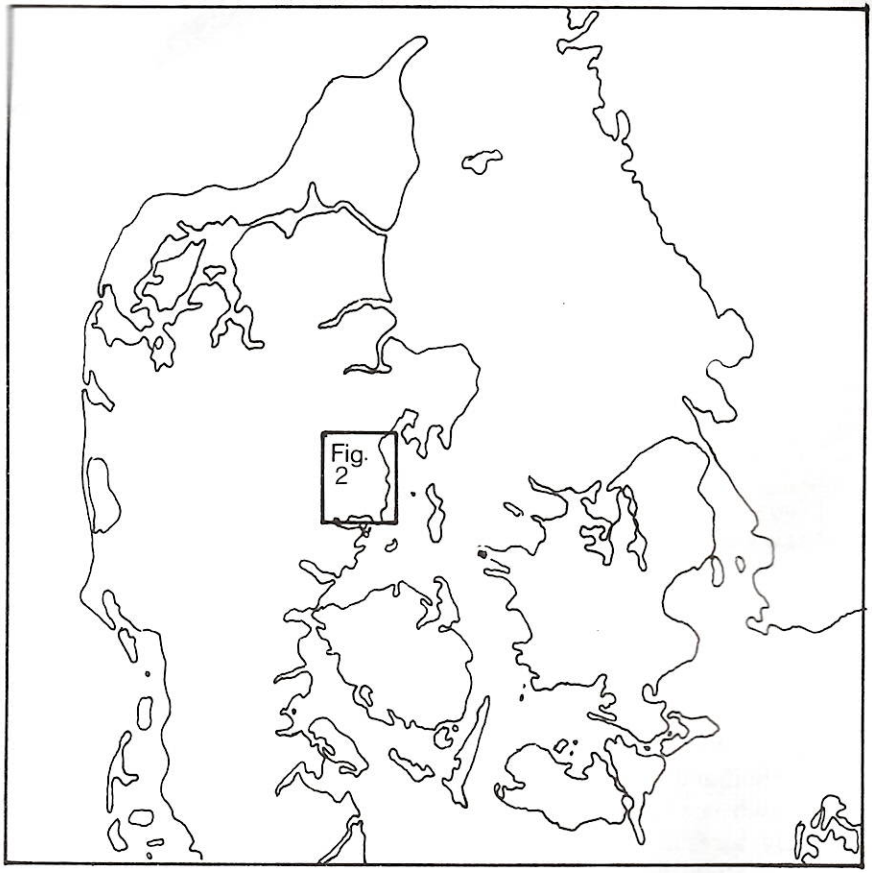

FIG. 1. Position of the research area in eastern Jutland, Denmark.

In the rest of this section I will outline the physical characteristics of the research area as well as the chronological framework used here for the cultural material. In the next two sections I will present a very abbreviated summary of the data which at present form the basis for our assessment of the settlement systems of early agricultural societies in east central Jutland. Then I will outline the locational determinants of the settlements. Finally, in the last section, I will present a model for changes in settlement patterns throughout the first millenia of agriculture as well as some hypotheses about the causes of these changes.

During the Neolithic roughly 1289 km^2 of the research area were land, 225 km^2 were covered by the Litorina Sea, and 86 km^2 by lakes (Fig. 2). The area's topography was shaped by the glacial activities of the last ice age. Generally it is a very hilly area formed of at least three terminal

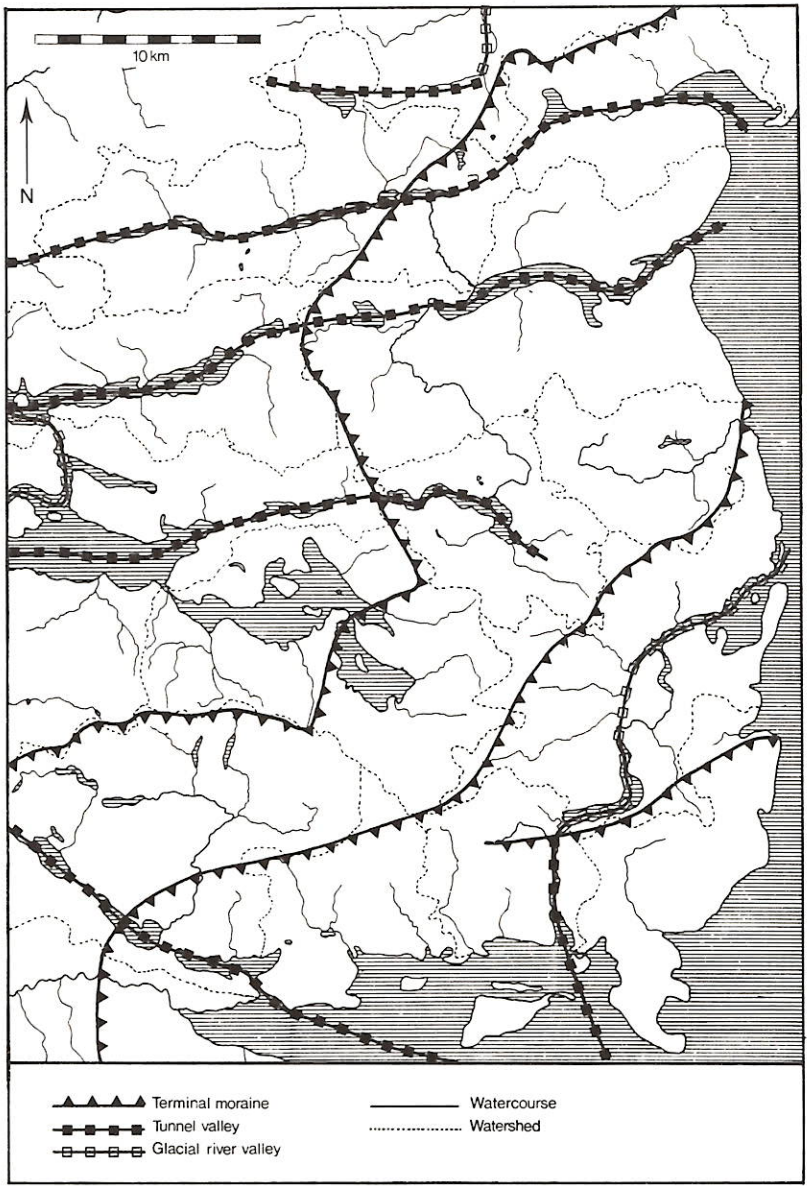

FIG. 2. Map of research area (source of glacial features, Milthers 1948).

moraines running SW–NE (Fig. 2). Furthermore it is very high country by Danish standards, including the highest point in Denmark (173 m). Several broad valleys with lakes and rivers at their bottom crosscut the country in an E–W direction. Most of these were formed as tunnel val-

leys under the ice, and a few others as glacial river valleys. In addition to these glacial valleys, there are a few relatively narrow postglacial erosion valleys carrying major watercourses.

On the average, the area is half sand and half clay, with a predominance of sand in the western parts and of clay in the eastern parts. However, it is not possible to divide the area into homogeneous zones, because the texture of the soil can shift quickly in a moraine, resulting in everything from gravel to heavy clay in the same local area. The new soil classification data sheets for Denmark provide the best available information to relate settlement location to soil types. These are maps with a scale of 1:50,000 which show seven different types of top soil (Landbrugsministeriet 1978–79). Divisions are made on the basis of grain size in the uppermost 20 cm of soil, and the seven types mapped are coarse sand, fine sand, clayey sand, sandy clay, clay, heavy clay, and humus (e.g., bog areas). With the help of these data sheets and a dot planimeter (Monkhouse and Wilkinson 1971:75), it is possible to give the percentage of soil types within a chosen distance around a given site. The only drawback to the data sheets is that forest and town areas have not yet been depicted.

Another set of basic data of importance for the understanding of the early agricultural settlement systems are the water courses, lakes, coasts, and watersheds. The major watersheds defined by the County Water Board are used in this study (Fig. 2). The longest possible stream within a watershed area is defined as a main watercourse, and used as such in the analysis.

The culture under study is known as the Funnel Necked Beaker Culture (TRB culture or, for short, TBK, as it is now conventionally termed in Denmark). The TBK is a culture complex covering a large part of Europe. However, the northern group, which covers south Scandinavia and the northernmost part of Germany, has distinctive characteristics, and its development can be viewed to a large degree on its own. When in the following pages the term TBK is used it refers only to the northern group.

The TBK can be dated by conventional C-14 from roughly 3100 B.C. when it replaces the late Mesolithic Ertebølle Culture (EBK) to 2200 B.C. when it is replaced by the Single Grave Culture (EGK). The TBK thus covers 900 C-14 years or approximately 1050 calendar years (3900–2850 B.C.). The TBK is traditionally divided into two main chronological periods—the Early Neolithic or EN and the Middle Neolithic or MN. Within both of these periods a detailed sequence of phases has been proposed, based on the very rich pottery material (Becker 1947; Ebbesen 1975). However, recent investigations have shown that these phases are not only chronologically but also regionally determined, and that setting up a detailed chronology may not be so straightforward as originally thought (Davidsen 1978; Madsen 1978c; Madsen and Petersen n.d.). For

our purpose here, and with regard to what we know of the material in east central Jutland, we may safely and profitably use a division of three chronological phases.

Early Phase (3100–2650 B.C.)

This phase approximates the EN. However, in east central Jutland only material belonging to what Becker (1947) termed the non-Megalithic C group seems present (Madsen and Petersen n.d.). As its pottery is very characteristic, only a few sherds are normally needed to ensure that a site belongs to this phase.

Middle Phase (2650–2400 B.C.)

With the beginning of the Middle phase an abrupt change in the style of pottery is seen in the area, and a succession of stylistic changes follow. On the whole the pottery of the Middle phase is very characteristic, starting with what has become known as the Fuchsberg phase and ending with the MN II. The most useful stylistic element in the settlement site pottery, especially in the beginning of the phase, is a motif of vertical lines on belly sherds. Just one sherd with this motif is enough to date a site to this phase, as there is hardly any way of mistaking it with either the Early or the Late phase.

Late Phase (2400–2200 B.C.)

The last phase is comprised of material normally given as MN III–V material. Within the research area the MN V material constitutes the overwhelming majority of material from this phase, and the MN V pottery is very easily distinguishable in style and fabric from the rest of the TBK pottery. The MN IV material seems rarely to be present in the area, and only the MN III material may be difficult to separate from that of the MN II, that is, from the Middle phase. This problem seems, however, to be minor when considering the actual material within the research area. Another way of separating the Late phase from the earlier ones is through the presence of thick-butted axes as opposed to the thin-butted ones.

THE SETTLEMENT SITES

We tentatively may divide the settlement sites of the TBK into three categories, based mainly on their topographical position, but supported by other features as well. The division seems to reflect functional differences between the sites. For simplicity, then, I will refer to the three site

TABLE 1
LIST OF SITES SHOWN ON FIG. 3

Name	Date	References
1. Nørrehåb	M	
2. Årupgård	M	Sylvest and Sylvest 1960
3. Bygholm Nr.Mark	M	Davidsen 1975:13
4. Løvhøj	M,L	
5. Loddentot	E	
6. Lindskov	L	
7. Nørre Strand	E	
8. Stensballe Sund	M	
9. Blirup	M	
10. Bjerggårde	M,L	
11. Mosegården	E	Madsen and Petersen n.d.
12. Toftum	M	Madsen 1978a,b
13. Egehoved (Alrø)	E,L	Davidsen 1978:55
14. Alhale	L	
15. Amstrup Skov	L	
16. Bavnebjerg	M	
17. Ålstrup	M,L	Andersen and Madsen 1978:151
18. Lindenæs	L	
19. Marekrog	M	
20. Gylling	L	
21. Sandager gd.	L	
22. Bredkjær	E	
23. Studshoved	L	
24. Saksild Skole	M	
25. Rude Skov	E,M	
26. Kalvø	E,L	S. Andersen 1976:42, 48
27. Norsminde	E,M	S. Andersen 1976:40–44
28. Frederiksodde	E	S. Andersen 1976:44
29. Beder	M	
30. Langballe	E	
31. Hørret Skov	E	Madsen 1977:74–77
32. Moesgård Skml.	E	Madsen and Petersen n.d.
33. Langenæs	M	
34. Voldbæk	M,L	Andersen and Madsen 1978:151
35. Helenelyst	M	
36. Knudris Bakke	L	
37. Stilling	E	N. Andersen 1977:214
38. Ringkloster	E	S. Andersen 1975:20, note 6

types according to their apparent functional categories as catching sites, residential sites, and centers. In Table 1 the 38 individual sites, that reasonably can be dated to one of the three phases are given. The numbering is the same as that in Figure 3. Five sites that can be dated to the TBK but not to one of the three phases have been excluded.

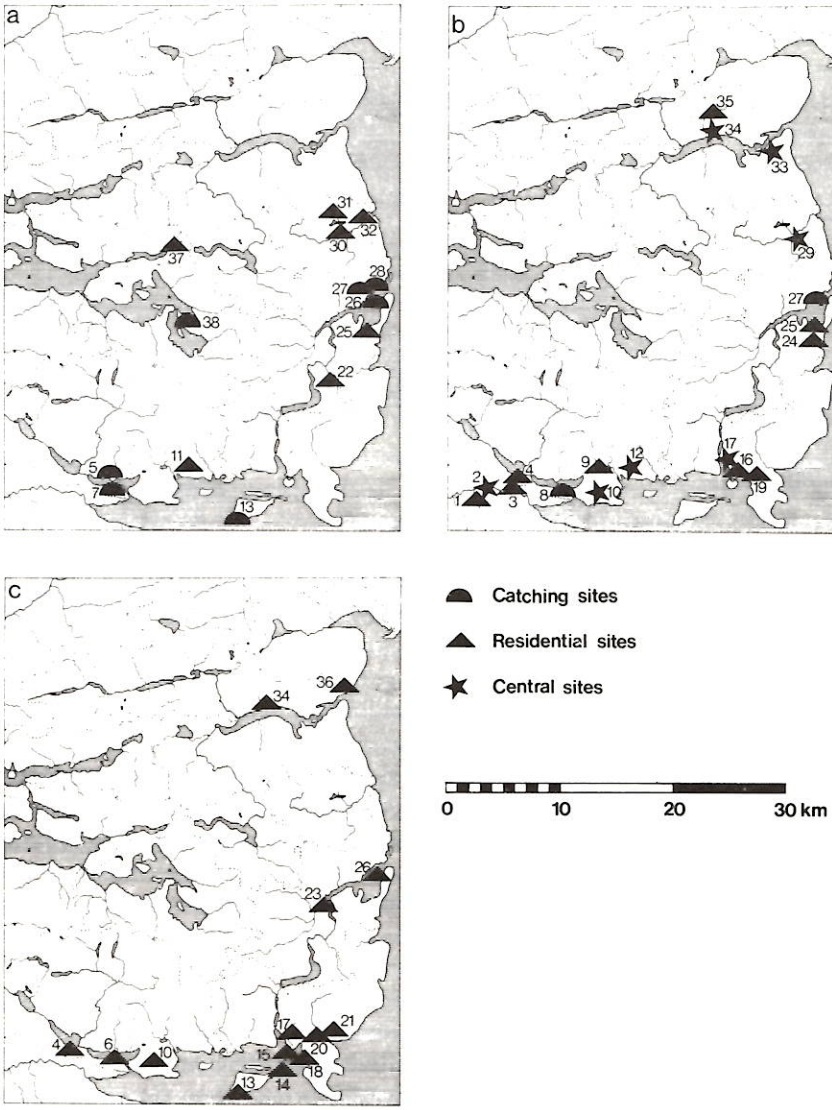

FIG. 3. Distribution of settlement sites. a, Early phase; b, Middle phase; c, Late phase.

Catching Sites

This category consists of sites which are located directly on the sea or lake coasts. They are typically placed right behind the beachline, often in connection with a low cliff face and are, when on the sea coast, accompanied by shell middens.

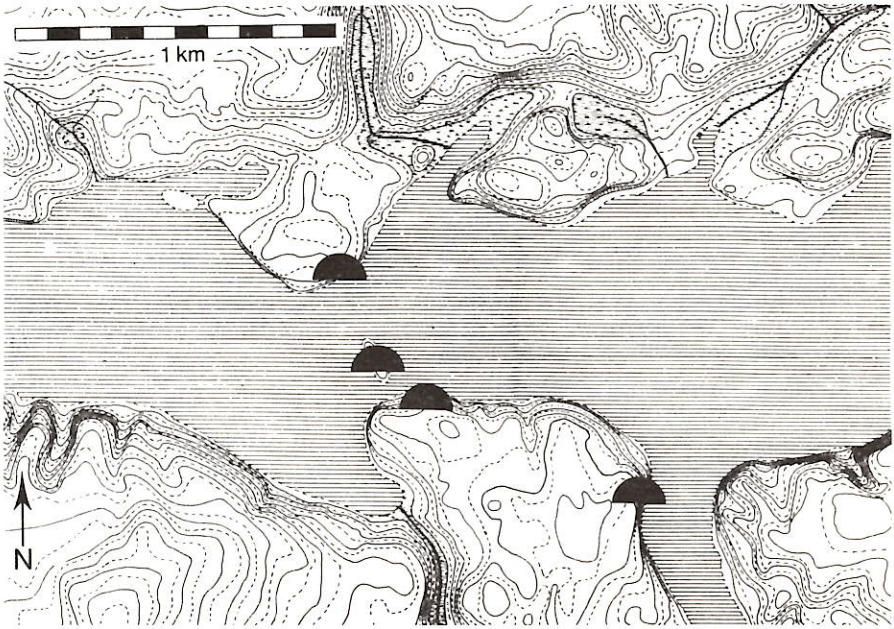

FIG. 4. The position of catching sites at narrow passages in the innermost part of Horsens Fjord (sites Nos. 5–8).

The existence of catching sites from the TBK was originally pointed out by Skaarup (1973), and they were dated by him to the EN and the early MN. This is in full accordance with the evidence from our research area, where catching sites proper belong to the Early phase and to the very beginning of the Middle phase. The sites are rather small, and so far the only well-investigated one (No. 27) seems to have been in use throughout the Early phase and into the beginning of the Middle phase.

The location of these catching sites is the same as for the late Mesolithic ones, and in many cases we find continuity within a given site, with the Neolithic layers covering the Mesolithic ones. This continuity is clearly due to the optimal location of these sites in relation to the important and geographically limited resources readily available nearby. Most of the sites were placed near narrow passages in fjords where the shifting tides gave rise to large shellbanks (Fig. 4). In the same narrow passages, stream channels also provided ideal possibilities for net fishing. In addition, a site like Egehoved (No. 13) lies directly opposite an area which until recently was a stable seal breeding ground.

In the Late phase, sites again are found to which we can ascribe a catching function due to their position on the coast as well as their con-

tents of animal bones, fish bones, and shells. However, these sites are much larger than the early ones, and most of the animal bones are from domestic animals, suggesting a rather mixed economy (Rowley-Conwy 1980; Davidsen 1978:140–142, 157). Although the position of these sites very well still may be explained by the catching component of their economy, they must be part of a rather different exploitation pattern than the earlier ones. For this reason, these sites are not separated from the residential sites in Fig. 3.

Residential Sites

The sites in this category are found on flat ground, often close to a watercourse, the sea or a lake, but not located directly on the shore, as is the case with the catching sites. There are generally no shells on these sites (exceptions may occur in the Late phase), and thus no bones are preserved due to the acid soils of the area. Examples of residential site positions can be seen in Fig. 5. Seven sites belong to the Early phase. All of them seem to be smaller than approximately 500–700 m^2 and contain very little cultural debris.

A very well-preserved site, Mosegården (No. 11), hidden beneath a long barrow, has been totally excavated. On this site a living area and a dump area could be separated (Figs. 6, 7). The dump area to the east was characterized by a black cultural layer which partly fills a natural depression. The living area is characterized by a brown cultural layer containing many pieces of burnt clay. There is a very neatly built stone fireplace with ash layers around it and several postholes to one side of it. It is not possible to reconstruct any dwellings from the postholes, but it is very probable that they are remnants from two or possibly three huts (Madsen and Petersen n.d., Jensen and Madsen n.d.).

The short-livedness of the site is indicated partly by its rather sparse cultural material and partly by the neat patterning of this material on the site. Apart from concentrations in the dump area, we note a semicircular concentration of flint debris around the fireplace on the same side as the dwellings (Fig. 6) and a fan-shaped concentration of pottery spreading from the fireplace toward the dwellings (Fig. 7). These patterns are characteristic leftovers from two different modes of social behavior (Binford, 1978, 1981). The first pattern stems from activities around the fireplace, while the participants are chatting with each other. Examples could be eating or small tool preparation. This latter very well may result in the deposition of some flint debris over time. The second pattern may be created when individuals, during space-consuming work, sit close to the fireplace because they need it for their work. An example could be food preparation, which also may account for broken pots. This patterning of

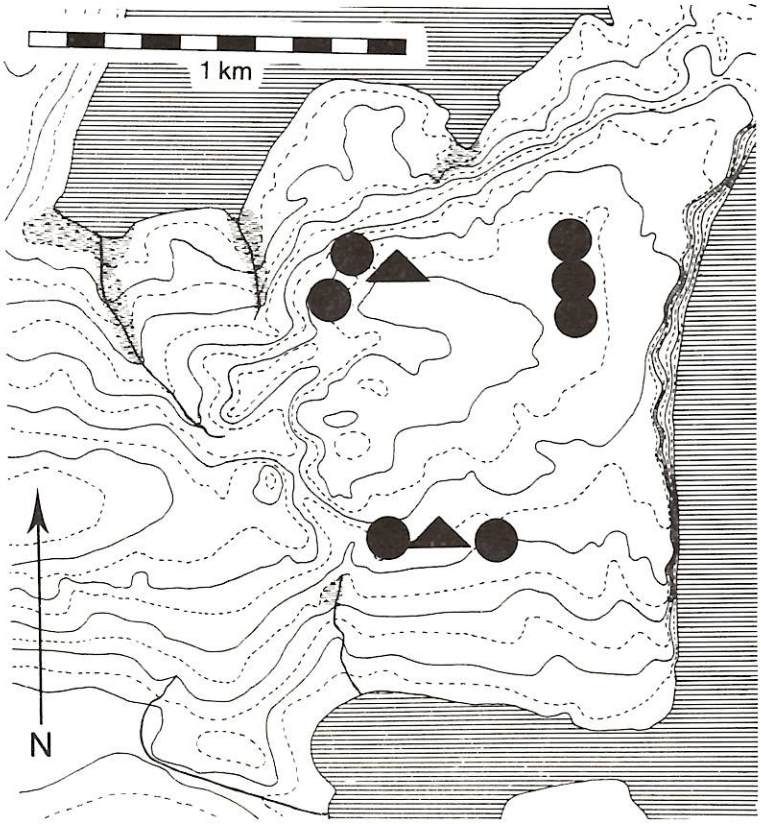

FIG. 5. The position of residential sites (triangles) and megalithic tombs in the Rude-Saksild area (sites Nos. 24–25).

cultural debris not only shows that the site has been preserved undisturbed, but it also shows that the timespan of occupation must have been relatively short. If the occupation had lasted for several decades we invariably would have expected some sort of reorganization of the site, with displacement of both dwellings and fireplace, and this effectively would have obscured the clear patterning of remains. How long the site was occupied is still an open question, but the fact that at least 105 pots could be counted from the rimsherds on the site and that a minimum number of close to 200 pots can be inferred (Jensen and Madsen n.d.) suggests that the site was occupied for some years. In fact, a closer examination of the problem suggests a minimum duration of occupancy of 2½ years (Jensen and Madsen n.d.).

In the Middle phase the residential sites are clearly larger than in the

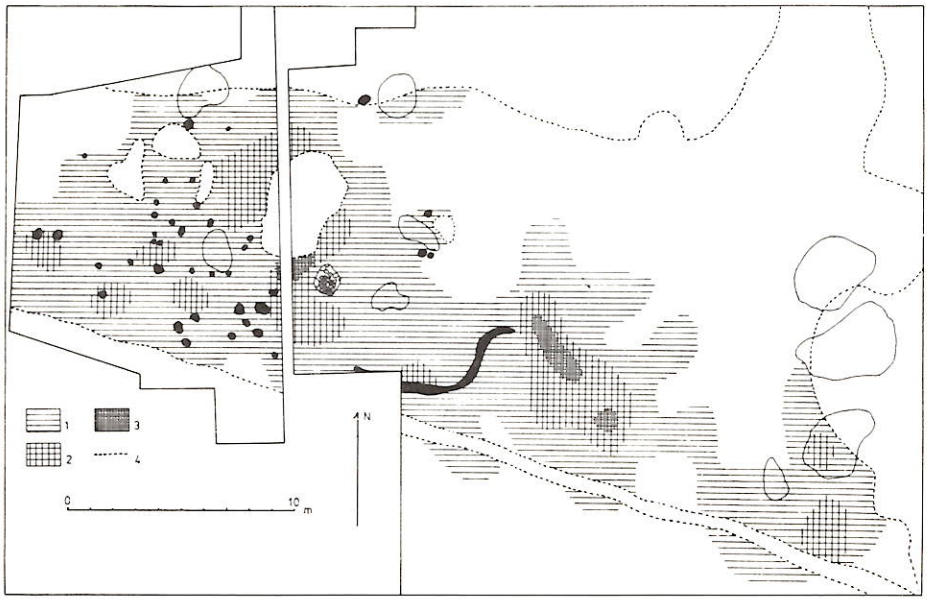

FIG. 6. A smoothed density map of flint debris at the residential site of Mosegården (No. 11), which was preserved beneath a long barrow. 1, zero to three pieces of debris/m²; 2, three to six pieces of debris/m²; 3, six to nine pieces of debris/m²; 4, limit of preserved deposits. Postholes and a post bedding trench are marked in black. After Jensen and Madsen (n.d.).

Early one, with sizes ranging up to at least 4000 m². However, judging from the surface scatters, they do not appear to have a higher density of cultural material than the Early ones. An excavation in one of them (No. 24) seems to support this. The same excavation also revealed a possible small hut.

In the Late phase the size of residential sites grew considerably, and we now have sizes in the range of 20,000–30,000 m² (Nos. 10, 20). Moreover, the surface scatter is often very heavy, indicating much more stable settlements.

The economy of the residential sites is not as clear as that of the catching sites, due to the absence of faunal material. Interestingly however, there are also no shells on these sites, even though many of them are situated only a few hundred meters from the coast. Although hunting and gathering can be expected to have taken place, it seems reasonable to assume that these sites primarily were connected with agricultural activities. Judging from the small size and the seemingly short-lived occupations of the early sites, the agricultural activities carried out lasted

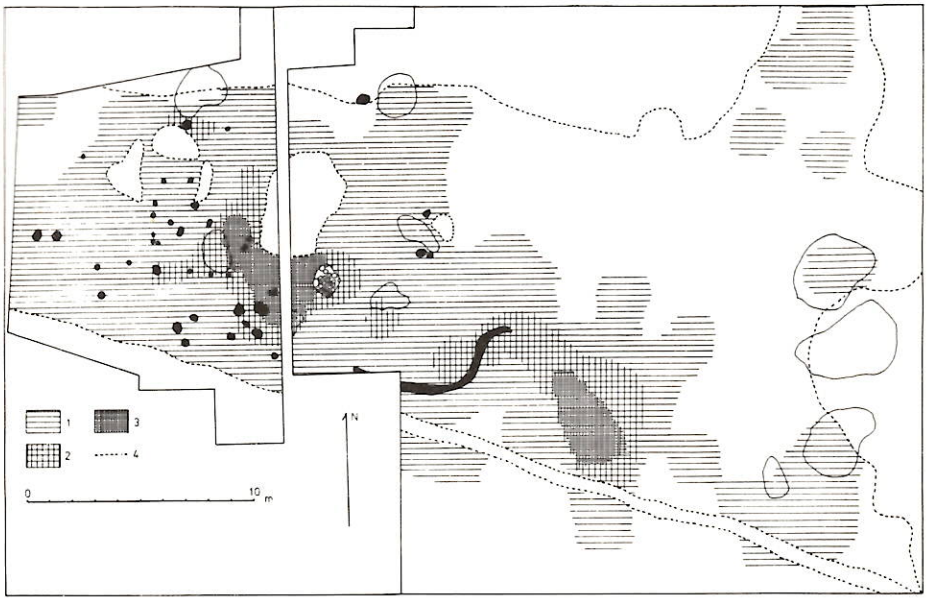

FIG. 7. A smoothed density map of pottery at the residential site of Mosegården (No. 11). 1, 0–100 g of pottery/m²; 2, 100–200 g of pottery/m²; 3, 200–400 g of pottery/m²; 4, limit of preserved deposits. After Jensen and Madsen (n.d.).

only a relatively few years. However, during the Middle phase changes began, and with the large and rich sites of the Late phase a completely new pattern had arisen. It is here also important to remember that in the Late phase catching sites were not so clearly separable from residential sites as in the Early phase. It seems somewhat more correct to say for the Late phase as a whole that we have a series of residential sites with a somewhat mixed economy, the composition of which is partly governed by the topographical position of the sites.

Centers

The sites in this third category are very different from the others. First, they have a very distinctive and prominent topographical placement. All but one of them are found on promontories stretching out into narrow fjords, lakes, and bog areas, or between two confluent watercourses (Figs. 8–10). The one exception is situated on the top of a hill with steep slopes and a magnificent view over the plateau it governs. Second, these centers are very large sites, ranging between 10,000 and 50,000 m². Third, almost all of them appear to be very rich in cultural material. Fourth, all of

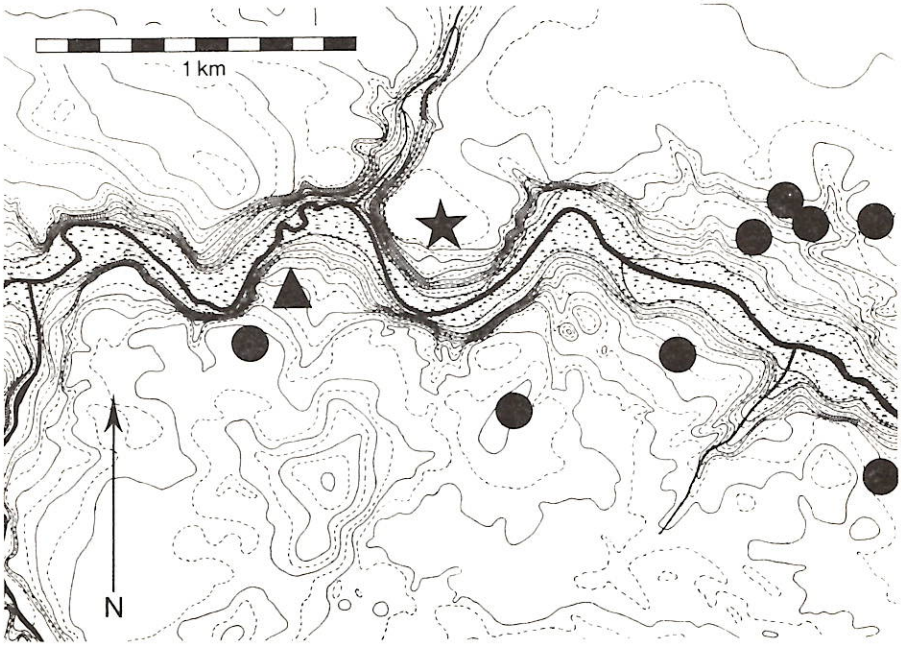

FIG. 8. The center site of Årupgård (star) with nearby megalithic tombs (circles) and a residential site (sites Nos. 1–2).

them are datable to the Middle phase, and they seem to have been constructed at the very beginning of this phase.

The causewayed camp (that is, a site surrounded by interrupted ditches and sometimes palisades) at Toftum (No. 12; Fig. 10) is the site which has been the most thoroughly investigated, with 115 m of its double ditch system having been uncovered. In the ditches large amounts of cultural material were found deposited in distinct layers. As many as three layers were found in one ditch, and all layers in the ditches held contemporary material, datable to the very beginning of the Middle phase. There is good evidence to argue that the layers containing cultural material had been deposited in the ditches very shortly after these had been dug and then deliberately covered. Furthermore, there is evidence that complete pots had been thrown into the ditches and that huge fires had burned in them.

Causewayed camps are now well known in Denmark although they have been recognized only recently (Madsen 1979). In large parts of Europe they have, however, been known for quite some time, and have been found in association with many different cultures covering a considerable span of time. For as long as they have been known the question of their function has puzzled scholars throughout Europe. Suggestions have

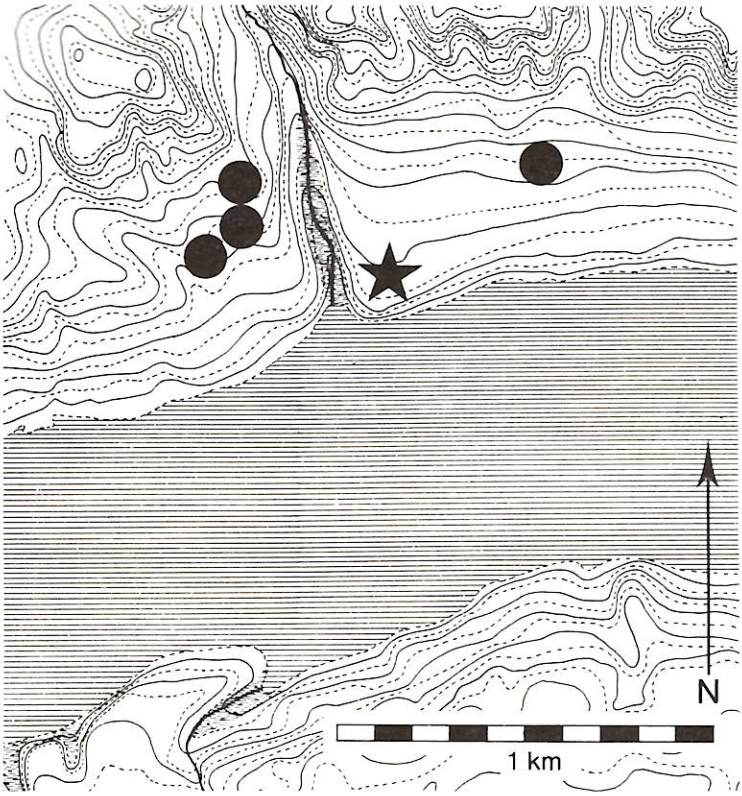

FIG. 9. The center site of Voldbaek (Star) with nearby megalithic tombs (site No. 34).

included defensive sites, with or without permanent habitation, cattle folds, and centers with a social, economic and/or funeral purpose (Boelicke 1978:114 ff.). In more recent years the latter interpretation has met with growing sympathy especially among British scholars (Renfrew 1973:541; Mercer 1980:58 ff.). In Denmark the evidence has also pointed clearly to the latter interpretation (Madsen 1978a, b). This is especially evident at Sarup, a fully excavated causewayed camp on South Funen, where both offerings of pottery and beautifully shaped stone battle axes, as well as the presence of probable funeral remains (i.e., human bones) were found (N. Andersen 1981). Furthermore, the evidence from the surrounding ditch systems both at Sarup and especially at Toftum (Madsen 1978a, b) suggest that large communal feasts were held in a strongly ritualized fashion along the edges of the ditches, with huge fires burning, intentional breaking of pottery, consumption of masses of foodstuffs, and

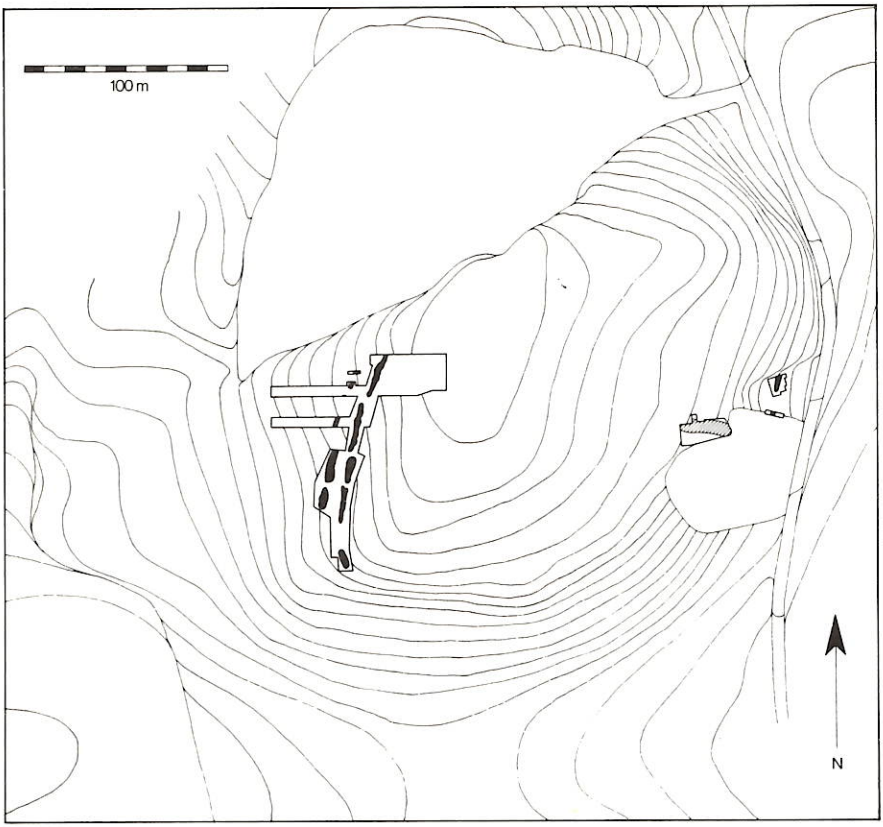

FIG. 10. The center site of Toftum (No. 12) with its partly excavated double ditch system.

deliberate filling in of ditches immediately afterward (for comparable evidence from British structures see Mercer 1980:30, 64). There may also have been some settlement in the causewayed camps, but to judge from the evidence at Sarup it has been relatively sparse. As a conclusion we should accept the causewayed camps as centers with possible socio-economic, ritual, and funeral functions for groups of people gathering from a large area.

Two of the other sites marked here as centers (Fig. 3) have been shown to be causewayed camps (Nos. 10, 34), and one other (No. 2) almost certainly was, as some of its features are comparable to those of the Sarup site. The placement, size, richness, and dating of the other three sites suggests that they too are causewayed camps. This still remains to be proven, but it seems to be a reasonable working hypothesis that they indeed are.

THE GRAVES

Two hundred and four graves are known from the study area (Fig. 11). A few of these are excavated earth graves from the Early phase, but most of them are megalithic tombs. Apart from excavated and preserved monuments, all likely megalithic tombs recorded through the national survey at the end of the preceding and the beginning of this century are included. This means that there may be a few erroneous finds, but experience has shown that the national survey is reliable with respect to the identification of megalithic tombs. However, detailed surveys of smaller areas show that many more tomb sites than recorded are present.

Of 21 excavated tombs, both dolmens and passage graves, there is sufficient material from 10 to date them to the beginning of the Middle phase. A couple of other dolmens may belong to late in the Early phase, but this is uncertain. If we look at the evidence from other parts of Denmark, we find that all passage graves seem to have been built in the Middle phase (Kjærum 1967:329; Kaelas 1967:268). The evidence for the dolmens is less clearcut. Only those of the rectangular type without passages, which are rarely found in the study area, show consistent evidence of belonging to the Early phase (Aner 1963:23–26) whereas there is a growing body of information dating most other types to the earlier part of the Middle phase. The greater part of the megalithic graves in the study area thus were built within the 200 to 300 years of the Middle phase, with only a few possibly belonging to the Early phase. Their distribution pattern as shown in Fig. 11 therefore can be seen as the result of a relatively short phase of activity, principally during the Middle phase. Excavations in the study area and elsewhere show that most of the megalithic graves were reused in the Late phase, indicating different mortuary activities centered upon reuse rather than building of graves.

The tombs are far more numerous than known settlement sites, thus it would be an advantage if they could be used as a general indication of settlement location. Before this can be done, however, two problems must be considered. First, we must be sure that the distributional pattern we see today is identical with the original one, and that some areas have not been partly or entirely cleared of tombs earlier than could be remembered by the informants in the national survey. Second, we must determine if graves always are placed close to settlement sites, and if there are not a number of settlement sites that have no Megalithic tombs in their vicinity.

Until the relevant data are collected, these questions cannot be answered completely. We can, however, stress some important points. In the first case, it should be noted that the destruction of the Megalithic graves was not something that happened over the centuries as a result of

FIG. 11. The distribution of TBK graves in the research area.

continuous agriculture. The monuments were very well preserved by the strong superstition connected with them. Only in the 19th century when agriculture became more efficient, when there was a marked increase in the need for stone for construction, and when superstition began to disappear with the enlightenment, did a wave of destruction hit the Megalithic tombs.

Much of the destruction occurred during the last half of the 19th century

so that when the national survey was carried out, the greater part of the Megalithic graves had already vanished. However, they had been so conspicuous that they were generally well remembered by older people. The survey in the study area was carried out between 1890 and 1920. This means that in some parts of the area informants could remember the period around the beginning of heavy destruction, whereas in other areas they could not. In addition, many different surveyors were involved in the survey, and they clearly were not all equally good at their job. Consequently, the intensity of the survey may have differed greatly from parish to parish. We can conclude from all this that the distribution of graves today is not necessarily representative of the original distribution. However, we should realize also that this probably will not affect our ability to understand the determinants of the location of the graves. As far as I can see, there was no selective destruction of graves in particular types of landscapes, creating a distortion in the pattern of location. There could, however, be other factors that we have not yet thought of, and it is therefore necessary that surveys of the distribution of destroyed tombs be made in different areas before tombs are finally accepted as indicators of settlements.

The second case is much more problematic. Whether settlement sites and graves are always close to one another has been a major topic of discussion in Danish archaeology (Müller 1904:56; Mathiassen 1948:100). It is, however, my opinion that the tombs of the TBK are closely connected with two types of settlement sites, namely the residential sites and the centers. This point is supported by the distribution of these two site types and tombs as can be seen by comparing Figs. 3 and 11. In several cases the graves even were placed directly, and presumably deliberately, on older settlement sites. This co-occurrence does not, however, necessarily prove anything, and again it is the representativeness of our data that is at question.

The settlement sites are, in contrast to the Megalithic graves, very unimpressive even to the professional eye, and only gradually has their number grown. It is very easy to imagine a serious distortion of their distribution pattern if too many sites have been found directly or indirectly in connection with an interest in Megalithic graves. Actually, only 8 out of a total of 43 settlement sites have been found under such circumstances, leaving 35 that have been found independently of graves. These still show a close correlation with the distribution of the graves, but comprise only a small sample. Whether the co-occurrence of residential and central sites with Megalithic tombs is meaningful and predictable as Clark (1977) and Chapman (1981) have suggested (see also below), or whether it is the result of unrepresentative data can only be determined through further investigations. However, for the development of hypoth-

eses here, I shall assume that there is a correlation between settlement and grave distribution.

ANALYSIS OF LOCATIONAL DETERMINANTS

It is immediately apparent from the distribution maps (Figs. 3 and 11) that graves and settlement sites are not randomly distributed. There are marked clusters in the coastal areas and large empty spaces inland. Furthermore, there seems to be a tendency for the sites to be located close to the major watercourses and away from the watersheds.

To quantify these relationships three "contour" maps were drawn where each "contour line" marks a given distance from the determinant in question (Hodder and Orton 1976:226). One map was drawn with lines at 1-km intervals starting from the coast, another with lines at .5-km intervals starting from the coast and the major watercourses, and a third with lines at .5-km intervals starting from the watersheds.

For each map, the areas between consecutive lines were computed, and the densities of sites in the different zones calculated. These figures were then compared with a theoretical distribution of uniform density. The results are seen in Figs. 12–14, and in all three cases χ^2 tests show that the differences between predicted and observed values are highly significant (Table 2).

Figure 12 shows that areas within a radius of 0–4 km from the coast have a much higher density of graves than areas further inland, which have a generally low density with small concentrations in some areas. However, the graph does not give any information on the more detailed location of the graves in the landscape. This information can be obtained from Fig. 13, where the shortest distance from the graves to the coast or main watercourses is given. Here, there is a concentration of graves within a distance of up to 1.5 km from the source, after which the curve falls off abruptly. The density of graves is constant or even slightly increases for the first 1.5 km showing that the graves do not lie directly upon the coastline or main watercourses, but rather occupy an area in the vicinity of these. This is in accordance with field observations that graves generally occupy terraces, which are not directly on the coast or watercourses, but often overlook them.

That it is actually the coastline and watercourses that drew the graves, and that the distribution pattern is not the result of a systematic avoidance of the watersheds, can be seen on Fig. 14, where there are graves at all distances from the watersheds, although a marked peak occurs around 2–3 km from the watersheds.

To examine the relationship between graves and settlement sites on one hand and soil types on the other, it was necessary to obtain the theoretical

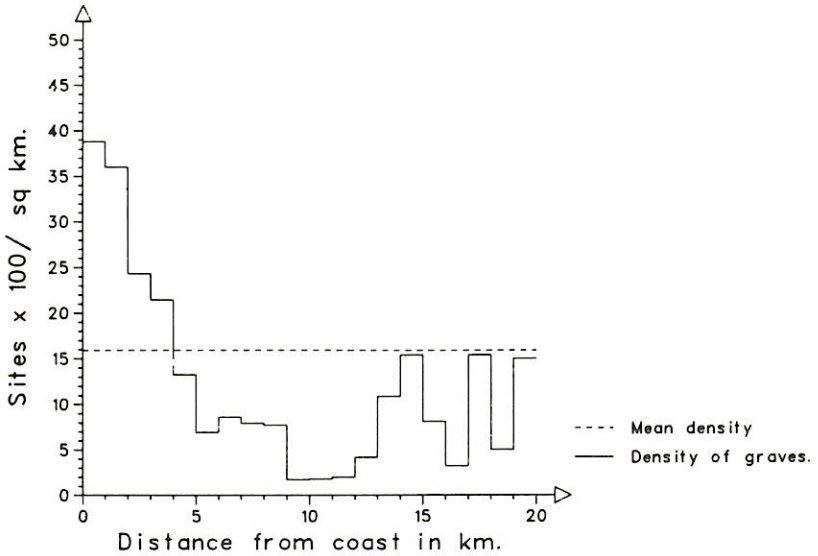

FIG. 12. Density of graves at different distances from the coast.

distribution of a randomly drawn sample of soil types in the study area to compare with the soil types surrounding the actual sites. To do this, a set of coordinates was randomly generated and used to plot 205 "sites" on the national grid system. The distribution of soil types around these randomly chosen control sites was then compared with that around the actual sites. Many detailed analyses could be made on this basis. However, only two are relevant at this preliminary stage.

Figure 15 gives sites by soil types. There is a slight tendency for the

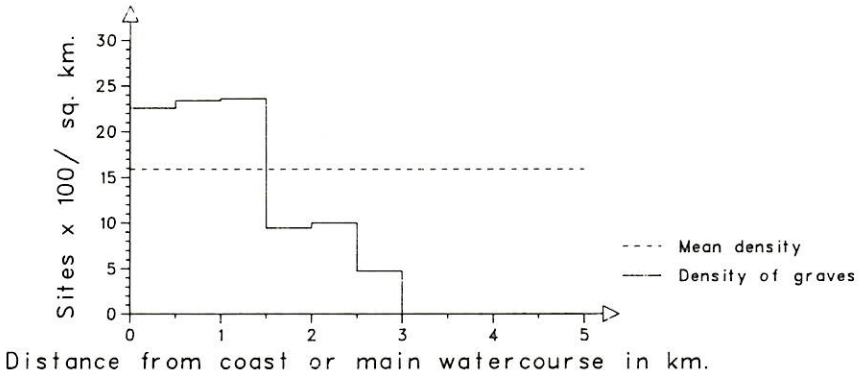

FIG. 13. Density of graves at different distances from the coast or the main watercourses.

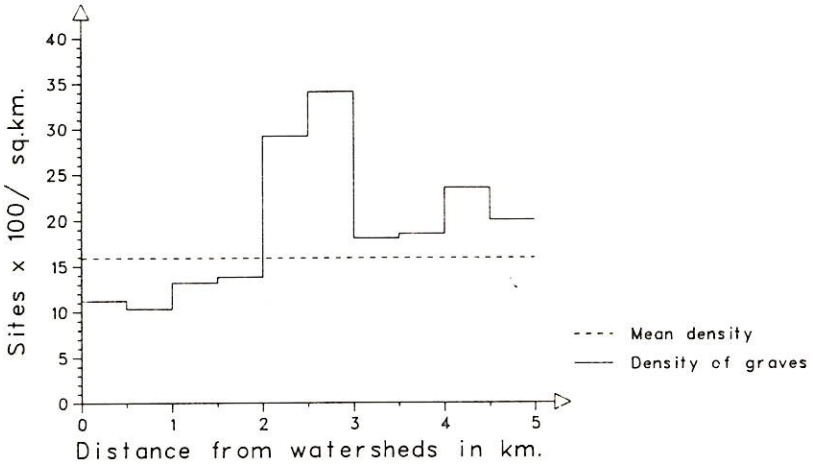

FIG. 14. Density of graves at different distances from the watersheds.

graves and settlement sites to be on more sandy soil than the average. This tendency is significant (.01 level, χ^2 test) for the graves, but significant at only the .10 level for the settlement sites, due to their small number.

The second analysis is aimed at showing the degree of heterogeneity in the surroundings of the graves and settlement sites. In Fig. 16 the number of different soil types within a radius of 1 km from the sites is shown. Both the graves and the settlements are clearly placed in areas where there are more soil types in their vicinity and thus greater than average diversity in the environment. χ^2 tests show that these differences are highly significant for both graves and settlements.

THE SETTLEMENT SYSTEMS OF THE TBK—THE MODELS

It has been held generally that an invasion of new peoples took place at the beginning of Neolithic times, and that these were peoples who, in contrast to the Mesolithic population,

> would not slavishly subject themselves to nature but on the contrary, would fight it in order to impose their own terms on life (Brøndsted 1957:143, translated).

Or, as Becker stated,

> The change from nature-bound hunter's existence to the completely different life of the farmer, which today may seem as natural as, for instance, the shift from stone to metal tools, is in reality so profound, even revolutionary, that it is unconceivable on our northern latitude where every natural condition for such a process is missing (1947:259, translated).

TABLE 2

PREDICTED AND OBSERVED NUMBER (sum = 204) OF GRAVES AT DIFFERENT DISTANCES FROM WATERSHEDS, WATERCOURSES, AND COAST LINE[a]

Distance from watersheds in km	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Predicted number	48	42	35	27	22	13	8	4	3	2
Observed number	34	27	29	24	42	28	9	5	4	2
Distance from water-courses in km	.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Predicted number	43	38	33	28	24	17	11	6	3	1
Observed number	62	58	49	16	14	5	0	0	0	0
Distance from coast in km	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Predicted number	22	18	17	16	15	14	13	12	10	9
Observed number	54	41	26	21	12	6	7	6	4	1
Dist. (continued)	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
Pred. (continued)	9	8	8	7	6	6	5	4	3	2
Obs. (continued)	1	1	2	5	6	3	1	4	1	2

[a] The predicted values were calculated under the assumption of a uniform density (compare with Figs. 12–14).

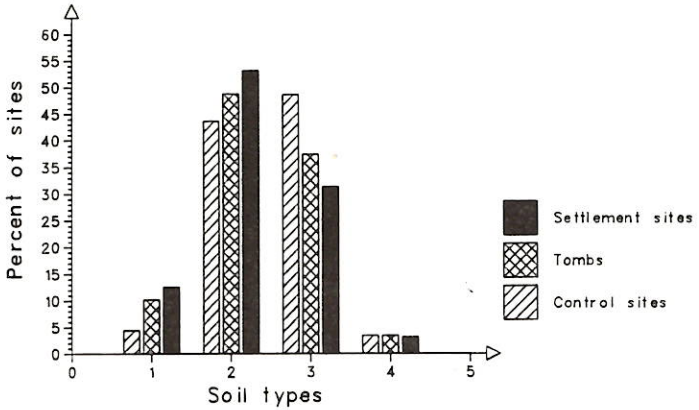

FIG. 15. Sites by soil types. 1, Sand; 2, clayey sand; 3, sandy clay; 4, clay.

Today only few would openly accept such categorical statements. Nevertheless, little has appeared in the Scandinavian literature to correct this view, and through discussions with colleagues I have found that most even in the younger generation, still feel that agriculture, almost by definition, must be something entirely different than hunting and gathering. The argument is inevitably that agriculture had had millennia to develop on its way from the Near East before it was introduced in Scandinavia, and thus it must have represented a complete break with the existing economic patterns. However, new ideas to the contrary have been appearing, for instance in the works of Clark (1977), Jensen (1979), Johansson (1979) and Welinder (1975). Neither should it be forgotten that

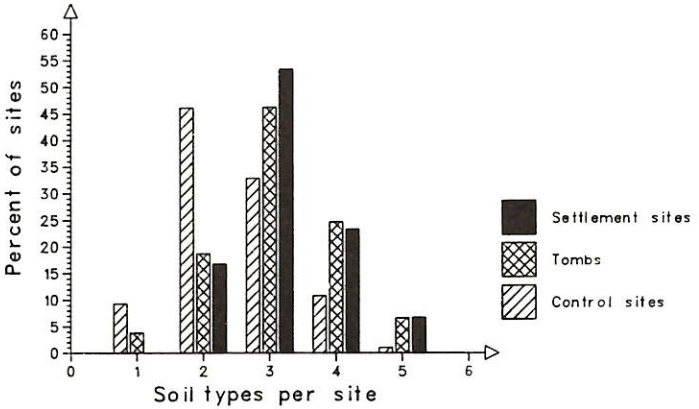

FIG. 16. Number of soil types within a radius of 1 km from the sites. In addition to the soil types given in Fig. 15, humus and water areas are included.

Troels-Smith (1953, 1960) at a very early stage presented ideas that in many respects are still acceptable today.

The basic argument which I will present here is that man never willingly fights nature, but rather utilizes it as economically as possible. That is to say, he chooses the option which will give him the highest possible returns for the least work under the given circumstances. This view is also expressed by Boserup (1965) in her excellent discussion of the problem of land use in relation to population, technology, and energy. She points out, using examples from tropical areas, that the development of agriculture can be viewed as a series of stages ranging from forest fallow cultivation, through bush fallow and grass fallow cultivation, to annual cropping and, if possible, multicropping. Each stage means an intensification of agriculture, that is to say, a higher output per year per square kilometer. However, it also means that production per unit of labor declines with intensification. Man, therefore, in each new situation, always will seek the lowest possible intensity of cultivation, and several types of fallowing may be used side by side. Regular devolutions may also occur if the demographic situation, for one reason or another, allows for a return to a lower level of intensity. In the long run, however, man will end up on the higher levels of cultivation made necessary, in Boserup's opinion, by population pressure, acting as an independent variable. Boserup's scheme specifies certain important relationships. First, following the Law of Least Effort, a group of people given a choice within their land use system will choose a solution that safely assures the survival and reproduction of the group. Second, following the Law of Diminishing Returns, intensification means, on the average, a lower output per unit labor invested. Third, the two first points lead to the conclusion that a group of people will avoid intensification and only allow it to take place if, for some reason, it has obvious advantages, or when they have no other choice. Fourth, the factor most likely to make intensification the only possible choice for a society is population growth, although in more complex societies political factors also are a likely possibility. I feel that the Boserup scheme is very useful for the understanding of developmental tendencies in land use patterns. Only when it comes to the question of the active force behind intensification, is there reason for disagreement. Her stressing of the importance of population growth clearly stems from her own experiences with the population explosion in the developing countries after the Second World War, where the impact of medical aid brought population growth completely out of control (1965:11). However, the medical aid was an "outside" factor, beyond the control of the societies themselves, and the situation must be characterized as completely atypical. It seems doubtful that societies generally should exist under constant population pressure (Cowgill 1975), and although popula-

tion pressure may play a part in the change of land use patterns, it certainly is not the only factor, and it may not be the most important one. In the following I try to focus on others.

Binford (1968) avoided the problem of unconditional population pressure by using the notions of optimal core areas and marginal areas. He suggested that an expansion from the core areas to adjust population levels could, if it hit the marginal area, create disastrous changes in the population level of that area and force a change in the economy. However, as a general hypothesis for change and intensification of land use in the Danish situation Binford's idea is not applicable. First of all, it demands geographically distinct core and marginal areas, and such areas can hardly be separated in Denmark. Second, Binford's model only explains how change is brought about in marginal areas, not how it is introduced and accepted in the core area. Even if Binford's model cannot be used for general explanation of change in land use patterns everywhere, it nevertheless introduces and makes use of a very important notion, namely that of differential access to resources, an essential factor for inducing change.

By differential access to resources, however, I do not mean solely access determined by geographical, ecological, or other natural factors, but also, and perhaps more important, access as determined by sociocultural factors. In a rather homogenous area like Denmark there will be, for any given land use pattern, microareas or microenvironments that are better suited for that type of land use than others. They will, however, occur regularly dispersed over the country, so that reference to natural factors will not be enough to account for patterns of access. We should, therefore, in this case look at access to resources exclusively from a sociocultural point of view, and primarily with the problem of regulatory mechanisms in mind.

It should be noted that, although there may be no actual population pressure, there nonetheless may be heavy demand on resources. That is to say, some people will be utilizing the better land for which their less fortunate neighbors would envy them, and strife over land would be an open possibility. Even where there is no actual lack of land, mechanisms for the regulation of access to land could quickly become a necessity. We may take it for granted then that, from the beginning of any land use system, mechanisms were in effect which regulated access to resources. The nature of these mechanisms and our ability to recognize them, however, are quite different matters.

In a case, as will be shown in the following, where each group needs a large territory to make a living, symbolic expressions of rights to that territory might be expected. Elaborate social organization and ritual also may develop to control patterns of access over large areas. Following

Chapman (1981), I will argue that the monumental tombs, especially with their outward display of pottery, in the Middle phase served as symbolic expression of land rights. Furthermore, I will argue that the huge centers of the Middle phase made up the frame for social interaction and rituals designed to regulate the patterns of access to resources and the interrelationship of groups over a wider area. Finally, I will argue that the total regulatory system became so over-expanded and "expensive" in the long run that it can be held at least partly responsible for the intensification and subsequent change of the land use patterns that followed.

The Early Phase

If we apply Boserup's ideas to the situation in Denmark at the beginning of the Neolithic, we cannot expect, with only a slightly changed technology, to have hunting and gathering in a forest environment in one century and then, in the immediately following century, an economy which relied completely on grain growing and cattle husbandry in permanent forest clearances. We would expect that the first agricultural system in a forested land would make every possible use of the natural environment instead of reshaping it, simply because that would be the most efficient way to keep down energy expenditure. The system to be expected is thus of the generalized type described by Harris (1969). This expectation is valid whether the people involved, as I assume, were solely of a local Mesolithic stock or included immigrants from outside. Furthermore it makes no difference whether they were aware or not of the existence of more specialized systems of agriculture to the south of them.

What kind of subsistence activities and land use should we then expect at the beginning of the Neolithic? According to Boserup, agriculture would be of a slash-and-burn type, as this forest-fallow cultivation is the type of agriculture demanding the lowest energy expenditure. However, the importance of agriculture should not be overemphasized. It should be expected to be one among many subsistence activities, and probably only very restricted plots were opened up for growing grain in the beginning. Another, and perhaps much more important, component of subsistence activities would be animal husbandry. Three kinds of domestic animals were present in the Early phase of the Neolithic, but in the forest environment we would expect them to have differed in importance. Both cattle and sheep/goats would have been able to browse in the forest and graze on newly abandoned plots, and, for the winter, leaf fodder could have been gathered. However, their number must have been restricted in terms of individuals per square kilometer, as the forest environment in general is prohibitive for these animals. The pig, on the other hand, is a typical forest animal, able to feed on its own all year round. Furthermore,

a relatively large pig population would be able to feed in certain parts of the forest. This implies that, if the Neolithic farmers settled in the right areas, they would be able to keep large herds of pigs with virtually no work at all.

The most important forest tree for pigs is the oak. One of its natural habitats is on low ground close to bogs and lakes, where it competes with elm and to a lesser degree with alder and ash (Iversen 1967:398). As elm provides the best leaf fodder for cattle, and as it is also on the low ground in the light oak forest in general, and in the zone between the forest edge and open water in particular, that we also find the best natural feeding grounds (Bay-Petersen 1978:128), this low ground area would be the place to settle for general husbandry in the forest environment.

A third major component in the economy would naturally be hunting and gathering, similar to that which was carried out in the late Mesolithic. A wide variety of wild plant foods could be gathered. Well documented from the Neolithic are apples, strawberries, raspberries, blackberries, hazelnuts, and acorns. The latter can be treated with hot water, transforming them into a flavorless "flour" with which bread can be baked. The nutritional value is not very different from that of grain (Jørgensen 1978). The game animals can be expected to have been even more plentiful than in the Mesolithic, because of the advantageous effects of the regenerating forest clearances. For the purpose of hunting and gathering, we again would expect the settlements to be placed near lake, river, and coastal areas, where the best resources for hunting and gathering are found (Bay-Petersen 1978; Paludan-Müller 1978).

How do these expectations then fit with our actual knowledge of the Early phase within the research area as well as in other parts of Denmark? If we first turn to site type and site location, we previously noted that during the Early phase two very different types of sites could be distinguished. One type was catching sites which were placed on the same strategic locations as those from the late Mesolithic, for an optimal exploitation of aquatic resources. The continuous utilization of these sites throughout the Early phase reflects the importance that these traditional resources still had. However, according to measurements of C-13 contents in human bones, it is clear that their level of importance was not anywhere near that of the late Mesolithic, during which it seems that the coastal populations may have relied almost completely on aquatic resources (Tauber 1981). The other type of site was termed residential. All the known examples from the research area are small sites, placed in areas with greater than average diversity in the environment and close to low-lying areas, as was shown in the analysis of locational determinants. These two characteristics probably relate to the use of the areas around these sites for animal husbandry, for gathering, and for hunting terrestrial

animals. Unfortunately, no site within Denmark has so far yielded sufficient organic remains to directly indicate the exploitation patterns at these sites. Not even the relative importance of domestic animals can be determined. However, we may predict that pigs will turn out to be the most abundant species on the basis of the facts that hunting of wild boar was of prime importance in late Mesolithic inland sites like Ringkloster (S. Andersen 1975:85), and that in the beginning of the Middle phase the domestic pig was the most frequent animal (see below). The possible importance of cattle should, however, not be overlooked, as the weight of the meat from one of these animals is equal to that of approximately 10 pigs.

Probably the most important source of information for a general evaluation of the land use patterns in the Early phase are pollen diagrams. The first thing we may note from these concerning the farmers at that time is that, whatever they did in the forested areas of Denmark, a general clearing of land was not involved. The forest as such was relatively unaffected by the presence of farmers. However, there are significant changes which can be seen in the diagrams. First of all, pollen grains from cereals as well as from plantain are present, although they are extremely few in number (Troels-Smith 1953:14). Second, elm declines together with ivy and mistletoe at the very beginning of the Early phase. It has been suggested (Troels-Smith 1953, 1960) that this decline should be seen as the result of the farmers using these plants for fodder. By cutting away a ring of bark around the elms, the younger trees would shoot from the roots, creating an easily obtainable source of fodder for cattle. The elms thus would not be destroyed but would be prevented from flowering. This would create the elm decline in the diagrams as seen. If the idea holds, it certainly can be regarded as a very specific form of adaption of husbandry to forest environment. There are, however, several problems connected with the elm decline. One of them is the elm's general decline all over northern and central Europe, even in regions that already had been used for agriculture for a considerable time (Tauber 1965:54, 59). Many other reasonable suggestions to explain the elm decline have been put forward (Iversen 1967:413). One of them is a general attack of elm disease. It is not easy at present to decide if the elm decline should be accepted as a result of man's interference. However, it should be recognized that oak is a competitor with elm in lower-lying areas and would flourish with the elm's decline, creating better possibilities for pig husbandry. So whether the elm decline was natural or due to man, it meant an improvement of the conditions for pigs.

Another interference with the forest environment seen in the pollen diagrams, and this time certainly created by man, is the *landnam* (land

occupation). It was Iversen who showed its existence and first described it (1941). We may use his own words:

> The *landnam* can in all detailed pollen diagrams be split in 3 stages, which are particularly distinct in diagrams from smaller lakes. The first stage consists of a sudden advance of herbaceous plants, especially grasses, and composits, while the trees of the tall forest, except alder, show some regression. This stage in the diagram represents the forest clearing phase itself which resulted in a short-term rise in herbaceous plants: a few pollen specimens from plantain and cereals are also already found. In the second stage two things happen. First willow and European aspen reach their maximum followed by that for birch which is much larger. This succession, especially the maxima of the birch, is characteristic of the *landnam* and constitutes a strong argument that the clearing of forest was connected with burning. Only with burning does birch stand a chance on ordinary forest floor to be an indicator of regeneration. The pollen curve for lime and elm at the same time drops to very low values. Furthermore the herbaceous vegetation undergoes characteristic changes, when guide plants for pastures are spreading, especially plantain (lanceolata) is becoming frequent. The third stage is characterized by hazel, which already became more frequent in the second stage, and now reaches its maximum. At the same time the tall forest regenerates little by little, and the pasture plants, cereals and weeds almost disappear. (Iversen 1967:415, translated).

The *landnam* seems to be present in most diagrams and often very markedly so. In general it always seems to follow shortly after the elm decline, and current C-14 dates suggest that the general *landnam* is synchronous with the Middle phase (Christensen 1980). Small, local, and very short-termed *landnam* are, however, known from the Early phase in a few diagrams, including one dating to the very beginning of the phase (Troels-Smith, personal communication).

Iversen's interpretation of the *landnam* as evidence of slash-and-burn agriculture recently has been challenged by Rowley-Conwy (1980) who suggests that, on the contrary, it is evidence for permanent field systems in forest clearances, and that these fields probably would have been fertilized by cow manure. I feel that this view is highly questionable. For the Early phase the very short and local *landnam* surely cannot be attributed to this explanation, and the small, short-lived settlement sites of this phase in the research area (e.g., Mosegården) even more clearly stress the existence of a movable slash-and-burn system and not a system with permanent fields.

Yet another set of evidence points away from permanent fields and toward a slash-and-burn system. It has been remarked that samples of cereal grains preserved to the present day are amazingly free from weeds (Jørgensen 1977). This is true also for the Bronze Age (Rowley-Conwy 1979) but not for the Iron Age (Helbæk 1954). It has been suggested that this purity is due to a combination of careful selective harvesting and sieving, as the fields "must have been extremely rich in weeds" (Jørgensen 1977).

A much more likely explanation, however, is that weeds are really only a natural component of permanent fields, whereas they never reach any marked level on slash-and-burn fields, because these are moved all the time into new weed-free areas of forest (Groenman-van Waateringe 1979). The oldest archaeologically demonstrated permanent fields in Denmark are still the so-called Celtic fields from the Iron Age, and there may be a very close connection between the appearance of these field systems and the change from pure to weed-contaminated grain samples.

A last item of information to be touched upon is the presence of the ard. Through a series of plow furrows found beneath barrows, the appearance of the ard in Denmark is dated to the Early phase (Thrane n.d.). This has been taken for granted as evidence for permanent field systems (Rowley-Conwy 1980). However we may note Groenman-van Waateringe's words that the ard may have been equally useful in slash-and-burn agriculture:

> It is true that the first Neolithic farmers were confronted with thick woodland on the higher sandy soils, but the undergrowth of shrubs and herbs was composed of plants shallowly rooted in the loose woodland soil. This latter could, after the removal of trees and shrubs by felling and burning, be easily broken up with an ard: the eradication of weeds presented no particular problems. (1979:363).

Anybody who has excavated in forested areas will know how tight the web of smaller roots can be. I think that many an experienced excavator will nod approvingly at Groenman-van Waateringe's suggestion. It is actually easier to tear up the roots with the help of a large pick than it is to dig one's way through them with a spade, shovel, or the like.

With these background comments, I now will try to gather the threads to form a coherent model for the land use pattern of the Early phase. The earliest farmers lived together in small units, probably not much larger than an extended family. They preferred to place their settlements in areas with varied resources, close to low ground with a high water table and open water (sea, lakes, major watercourses). They exploited their surroundings in an economical way. To one side of them, on the high ground, they had small clearances for growing cereals. New clearances would be made each year, and the old ones would be abandoned after only one, or very few, years' use. In the beginning, the old clearances would have served as pasture for cattle, but soon the forest would have regenerated, and the hazel then could have been utilized for the gathering of nuts. To the other side of the settlement, on the low ground, ideal conditions for pig husbandry were present, without much need for interfering with the forest. Ringing of elm trees, however, may have occurred, both to encourage the growth of oak and to provide winter fodder for the cattle. The low ground in its natural state also provided suitable grazing for limited

numbers of cattle, and it would be generally the best area for hunting and gathering.

The opening of new plots in the forest each year, as well as the utilization of the forest itself for pig and to a lesser degree cattle husbandry, meant that the territory of each group had to be rather larger, and that the population had to be located in a dispersed pattern with regular shifts of living sites. On certain occasions, perhaps at certain times of the year, groups would move to selected places on the coast, or, for the inland population, on the larger lakes, where hunting, fishing, and gathering were particularly favorable. At these places several groups would gather within a limited area and possibly even stay at the same site. The high yield from the natural resources in some parts of the coastal area would have been of great importance to the early farmers, as evidenced by the high density of population in the coastal zone.

The Middle Phase

With a virtual explosion in the building rate of megalithic tombs, with the introduction and building of numerous centers, and with a rate of pottery consumption unsurpassed in Danish prehistory (tied to the use of Megalithic tombs and centers), the Middle phase really stands out as something unique. It is usually claimed that we here have a "blooming" culture with a high production potential. The situation may, however, not be that simple. Let us take a closer look at the problem. The first thing we may note is that the level of population density has expanded somewhat from the Early phase. This can be seen from the size and number of settlement sites relative to phase length, as well as inferred from the general expansion of the *landnam* at this time. We may assume that population density had grown and that expansion of the settled area had taken place.

As each group of people needed a rather large area for their extensive land use, the best land would be exhausted quickly, and mechanisms to regulate access to land could be expected. Chapman has suggested that the monumental tombs of the Early and the Middle phase can be understood as symbolic expressions of land rights (1981:79–80). He develops an idea introduced by Renfrew (1976) and backs it with ethnographic observations (Chapman 1981:72–74) compiled by Goldstein (1981:59–61), among others.

Two important predictions can be made from this hypothesis. First, that the tombs will mark out the critical resources and the most desirable land by being placed directly on or very close to them. This indicates that we may use the locational analysis (see above) to point to specific types of

areas and predict that these were areas of prime importance to the economy. Second, a growing population with an increasing demand for optimal land would cause an increase in the number and monumentality of tombs built. This is actually what we see happen. During the Early phase there is a moderate but slightly increasing construction activity. In the Middle phase, however, the building of monumental tombs develops into a regular boom, and at the same time the stones used in the constructions increase in size. We also may see the vast amount of beautifully ornamented pottery placed in front of the tombs as marking group identity (Plog 1980:117–119, 137–138), and a display of this identity in connection with a specific tomb.

Whereas the tombs then had mainly a divisive function, i.e., marking rights of individual groups, the large centers may well have had an integrative function. The centers clearly were used by many people at the same time. The ritual and the feasts that are indicated to have taken place in these centers would have been part of a system which ensured that symbolic expression of rights were recognized and respected.

The society of the Middle phase, which organized the building of monumental tombs and huge centers has been held by some authors to be of an at least partly ranked type (Randsborg 1975:113; 1979:317; Jensen 1979:112) but by others to be of an egalitarian type (Ebbesen 1979:47). The suggestions, however, have been only of a speculative kind, and have always been cautiously put. In England, in a very similar situation, Renfrew (1973) has inferred the existence of a ranked society. In Germany just south of the Danish border, and with closely comparable material, even the existence of kingdoms has been suggested (Körner and Laux 1980), while discussing the same material, others speak of basically egalitarian societies with perhaps a slight ranking (Schirnig 1979:23).

It is difficult to decide whether TBK society was ranked or not. Detailed investigations need to be undertaken before a more definite answer can be given. At present it is my opinion that some degree of ranking developed in the Middle phase. I am here relying on the arguments brought forward by Randsborg (1975, 1979) and Renfew (1973), but it should be noted also that there is a growing amount of information which suggests that the monumental tombs of the Middle phase with all their evidence of elaborate ceremonial activities were intended for only one or a very few persons (Madsen 1981; Thorsen 1981). Their function as communal graves seems exclusively to date from the Late phase, when the whole idea of building monumental tombs had been abandoned.

Regardless of whether the society was ranked or not, some need for surplus production was clearly part of the system. If this was not so, the large construction works probably could not have taken place. If we accept the idea that tombs and centers had a function in regulating access to land, and especially to those parts that included the more valued and

scarce resources, then we have a very ironic situation. On one hand, elaborate mechanisms were operating to keep a status quo utilization of those resources that were traditional to the cultural system. On the other hand, these mechanisms demanded a high surplus production, which made an intensification of resource utilization necessary. This was clearly a situation that could not last for long.

The Late Phase

From the Middle to the Late phase an abrupt change occurred. Monumental tombs ceased to be built. Centers went out of use, and the vast consumption of pottery ceased, while at the same time the pottery changes from some of the finest to some of the worst ever made in Denmark. At first glance, one would be tempted to view this change as cultural disintegration, and in reference to sociopolitical phenomena this may be true. But if we turn to the evidence from the settlement sites, we do not get the same impression. On the contrary, we see very much larger and richer settlement sites, suggesting a population explosion in the Late phase, relative to earlier periods, with people now living a sedentary life in large units. It follows that the land use system cannot have been the same as earlier. It must have been a much more intensive one or else such large settlements would not have been able to be sustained. We should expect that distinct changes in the economy had taken place. Two things could have happened. The first is an increase in reliance on grain growing. The other is a switch from pig to cattle husbandry, with cattle being raised on more permanent clearances in the forest. Of these two possibilities, we know nothing definite about the first, except that the quality of the grain was improving during the Middle phase (N. Andersen 1981). With regard to the second we know that there was a shift toward a cattle-dominated husbandry. Several large samples of faunal remains are available from Middle and Late phase settlement sites in Denmark. Seven are shown in Fig. 17, which demonstrates a general shift during the two phases toward a complete dependence on cattle husbandry.[1]

[1] The sites and data presented in Fig. 17 are: (1) Material from Toftum dated to approximately 2650 B.C. on the basis of 11 C-14 dates and associated with pottery of the Fuchsberg style (Madsen 1978a). (2) Material from troldebjerg associated with pottery of MN Ia style (no C-14 dates) (Higham 1968, 1970). (3) Part of the material from Sarup dated to 2450 ± 90 B.C. and associated with pottery of early MN II style (N. Andersen 1981:88). (4) Material from Fannerup I associated with pottery of MN II style (no C-14 dates) (Eriksen 1980, Rowley-Conwy 1980). (5) Part of the material from Sarup dated to 2390 ± 90 B.C. and associated with pottery of later MN II style (N. Andersen 1981:92). (6) Material from Lindø, site 2 associated with pottery of MN IV style (no C-14 dates) (Higham 1968, 1970). (7) Material from Lidsø dated to approximately 2340 B.C. by averaging four C-14 dates and associated with pottery of MN V style (Davidsen 1978:170; Hatting 1978). The well-known Bundsø site is not included as the presence of several pottery styles on the site indicates a possible mixing of material from different phases (Ebbesen, 1975:14).

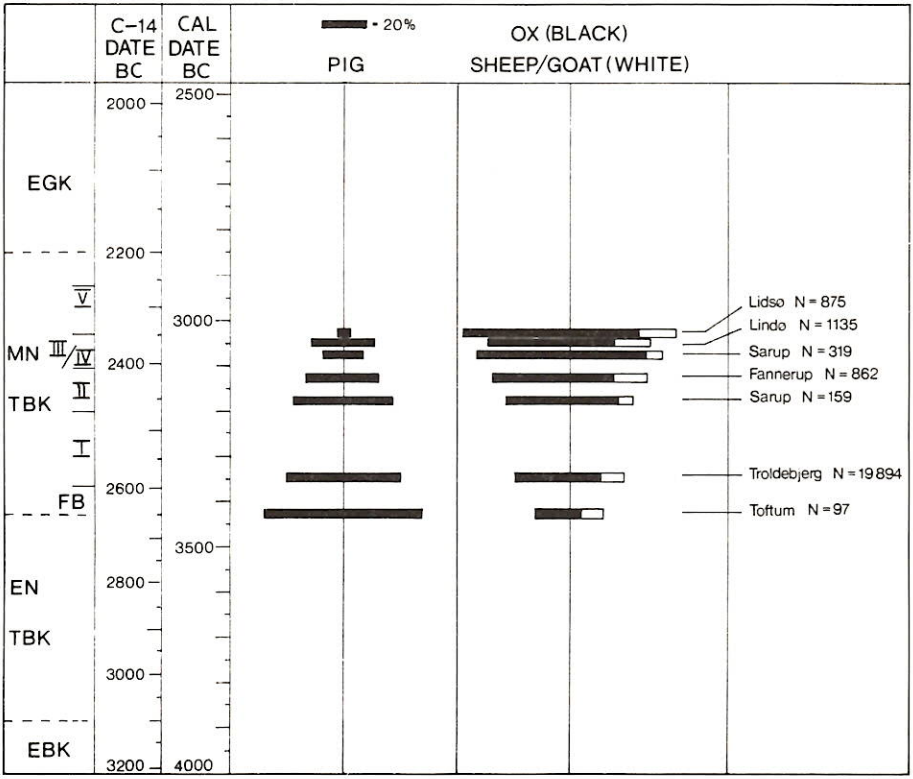

FIG. 17. The relative frequencies of pig, ox, and sheep/goat in Danish MN TBK settlement sites.

It is necessary to be very cautious in the use of relative frequencies in bone samples. Nevertheless, the general tendency which can be seen in Fig. 17 seems clear, and what is more, it makes sense. A general shift in husbandry toward large herds of cattle kept in permanent clearances can be seen as the outcome of the need to intensify production in the Middle phase. At the same time, it would open up new and less scarce resource areas not appreciated earlier. It also would allow people to settle in larger and more permanent units. The price paid, however, would be one of higher labor input into gathering of winter fodder for cattle. A new land use pattern in which there suddenly were enough optimal areas for everybody could effectively undermine the established sociopolitical system, with its labor consuming "show-off" construction works, and eventually the entire structure would crumble. Of course problems of territoriality still would exist but probably could be handled with much less outward display, and, as settlement units grew in size and became

more permanent, violence possibly may have also played a regulating role. Thus, from one viewpoint the change from the Middle to the Late phase may be termed cultural disintegration, but essentially it was a case of change and intensification of land use patterns.

CONCLUDING REMARKS

The aim of this paper was to present a model of change in land use patterns during the first millennia of agriculture in Denmark with reference to a specific research area. In doing so it has also touched upon some more general principles of change. Although I will not reject the importance of population pressure as an agent of change in land use patterns, I have tried to show that other factors also may have played an important role in such changes. Thus the sociopolitical system, trying to maintain the status quo in resource utilization patterns, may very well, unknowingly and unintentionally, have worked to intensify and subsequently change the system of land use. Hopefully, then, this paper will not only be of specific interest for those concerned with the TBK but also to those interested in the more general aspects of change.

In concluding, I would like to take the opportunity to discuss one more general aspect of the model. It has for a very long time been clear to archaeologists that cultures often follow cyclic movements which are described as birth, life, and death; spring, summer, autumn, and winter; or in more specialized terms like archaic, florescent, classic climax, and postclassic. Many works have described with cultural "ontogeny" both in specific cases and in more general terms (Clarke 1978:272 ff.). The traditional view of this "ontogeny" is that the "ups" and "downs" that we observe in the material remains are directly representative of the "ups" and "downs" in the prehistoric societies. This is, I feel, an incorrect generalization. As has emerged here, vitality in the material remains may very well be a disguise for profound stress in the society. Conversely, sparse and coarse material remains may be indicators of a vital culture. Moreover, there may be a causal relation of a general nature involved in these oppositions. I think it would be worth while to investigate the question of whether an apparent degeneration of material culture is indeed indicative of the decline of a given culture or whether it often represents important changes in the basic economy.

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