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

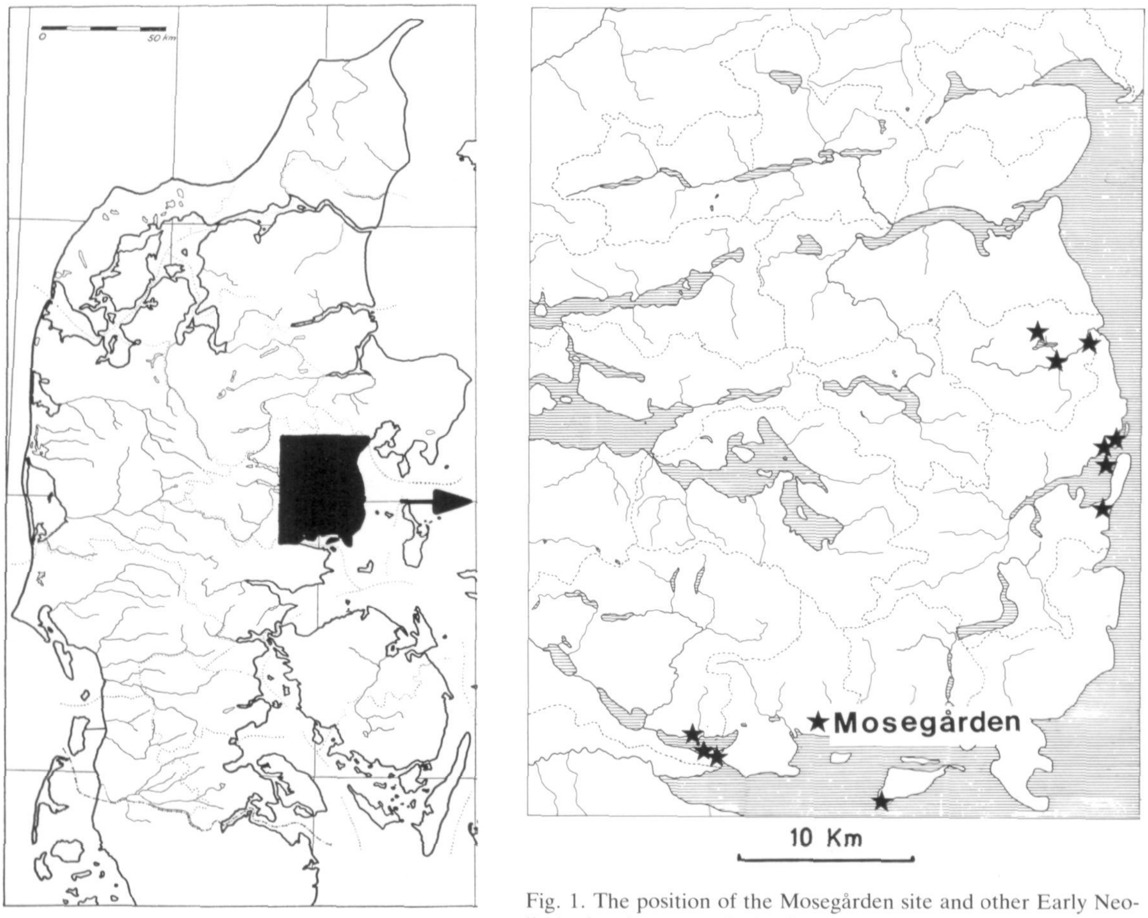

Fig. 1. The position of the Mosegården site and other Early Neolithic sites in eastern Jutland.

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

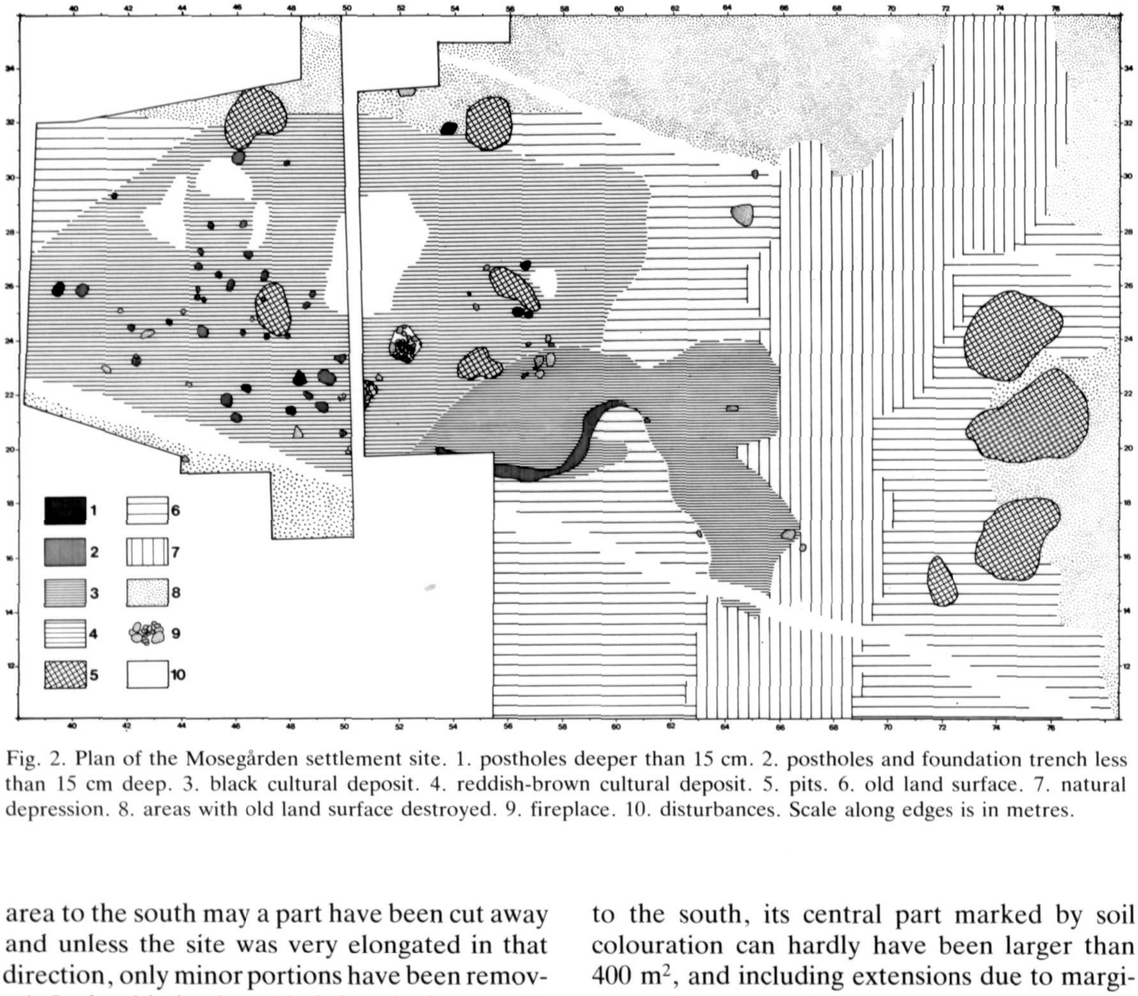

Fig. 2. Plan of the Mosegården settlement site. 1. postholes deeper than 15 cm. 2. postholes and foundation trench less than 15 cm deep. 3. black cultural deposit. 4. reddish-brown cultural deposit. 5. pits. 6. old land surface. 7. natural depression. 8. areas with old land surface destroyed. 9. fireplace.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

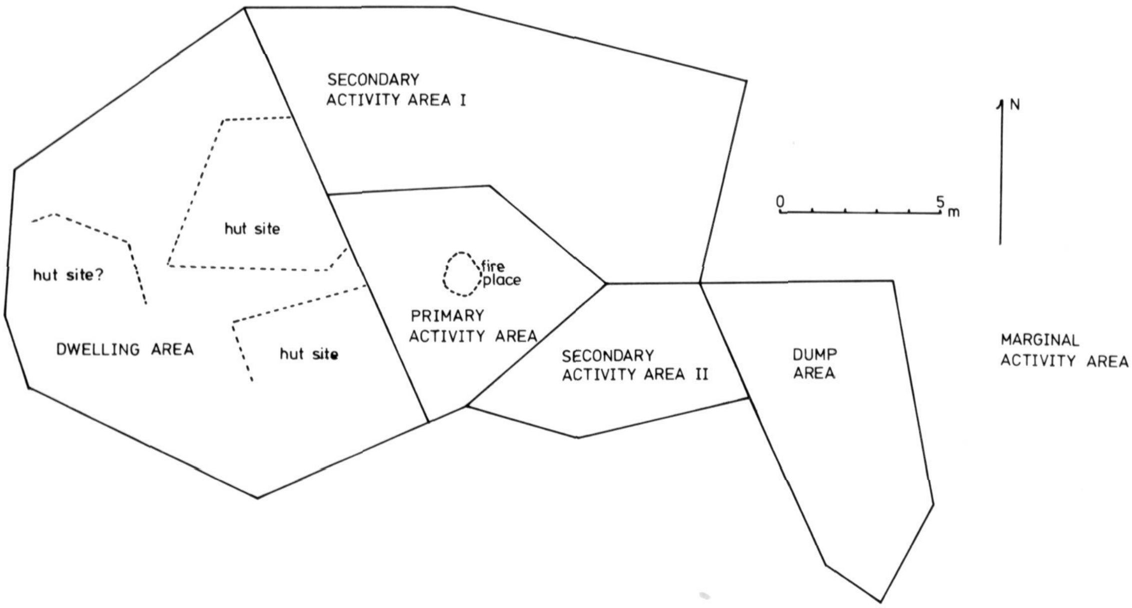

Fig. 3. Suggestion for a division of the Mosegården site into activity areas.

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 north-eastern 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 wind-break 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 test-pits 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-

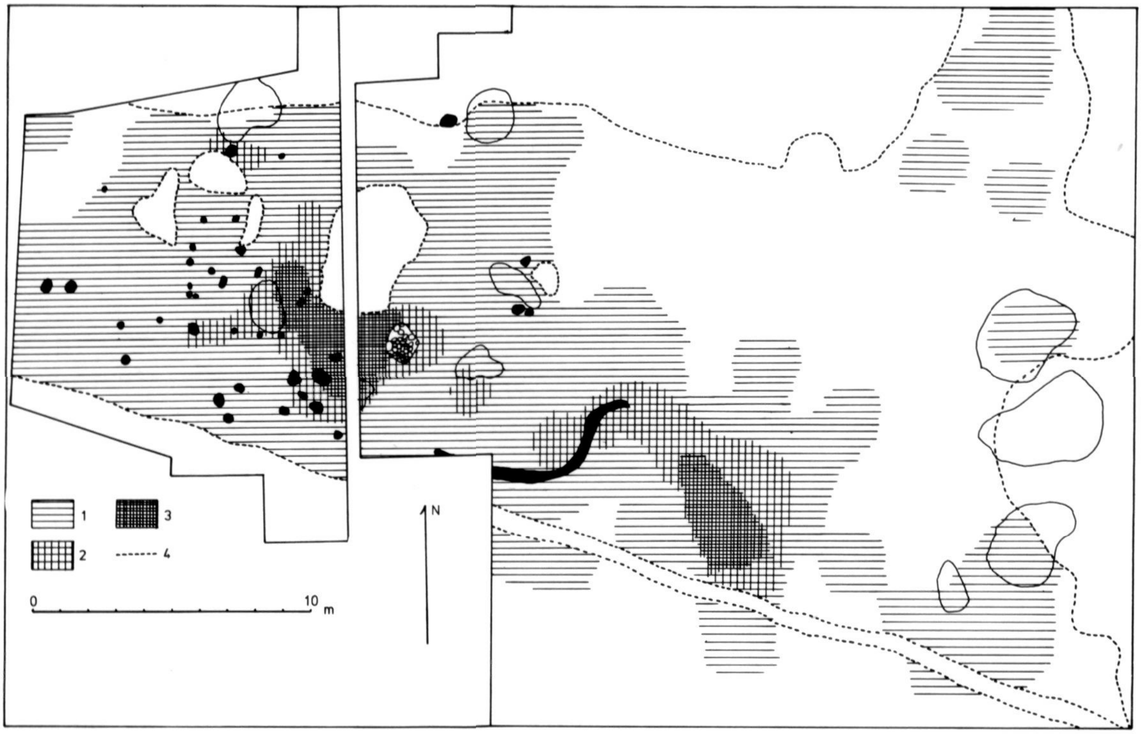

Fig. 4. A smoothed density map of pottery on the Mosegården site. 1. 0-100 g pr. m^2. 2. 100-200 g pr. m^2. 3. 200-400 g pr m^2. 4. Limit of preserved deposits.

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

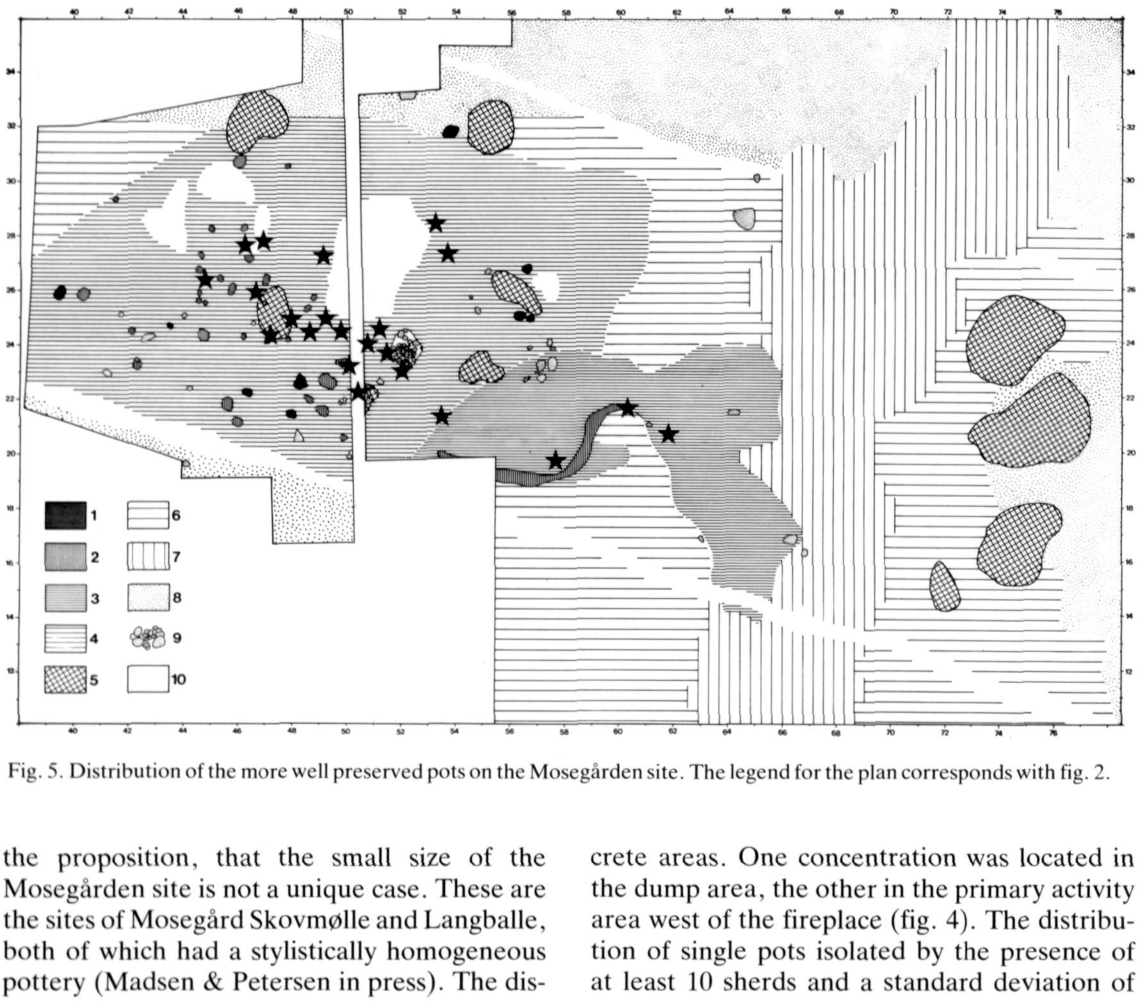

Fig. 5. Distribution of the more well preserved pots on the Mosegården site. The legend for the plan corresponds with fig. 2.

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 m^2.

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 m^2, 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

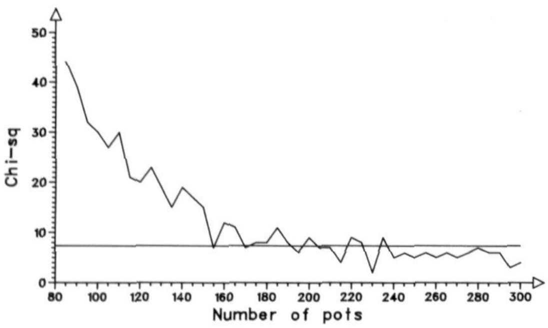

Fig. 6. Plotting of χ^2 values against number of pots from the comparisons between simulated and actual numbers of rim sherds pr. pot.

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-

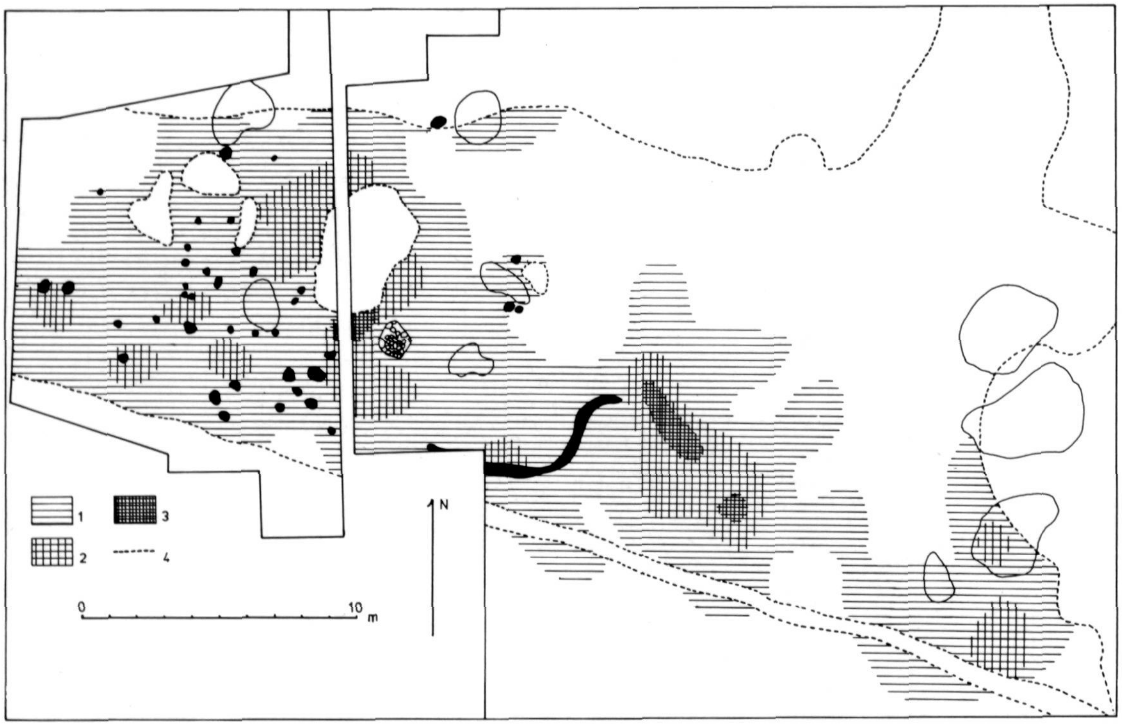

Fig. 7. A smoothed density map of flint debris on the Mosegården site. 1, 0-3 pieces pr. m². 2. 3-6 pieces pr. m². 3. 6-9 pieces pr. m². 4. Limit of preserved deposits.

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

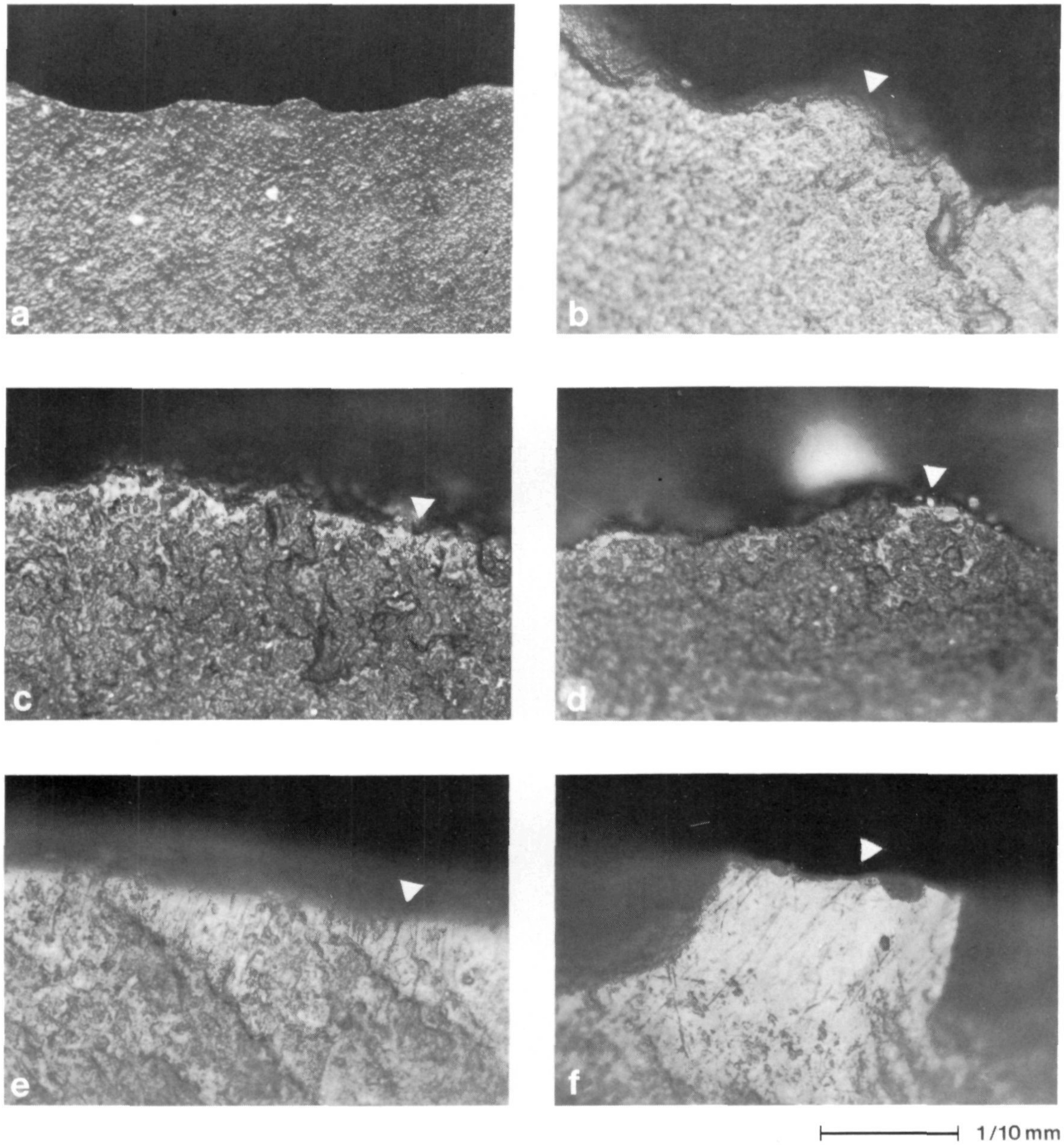

Fig. 8. Micrographs of flint tools.
a. Fresh tool edge, showing the dark, uneven surface typical of unused flint.
b. Edge of a scraper from Mosegården (2052 KH). Note the matte polish and the rounding of the very edge (arrow), caused by the working of hide.
c. Edge of an experimental scraper used on 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

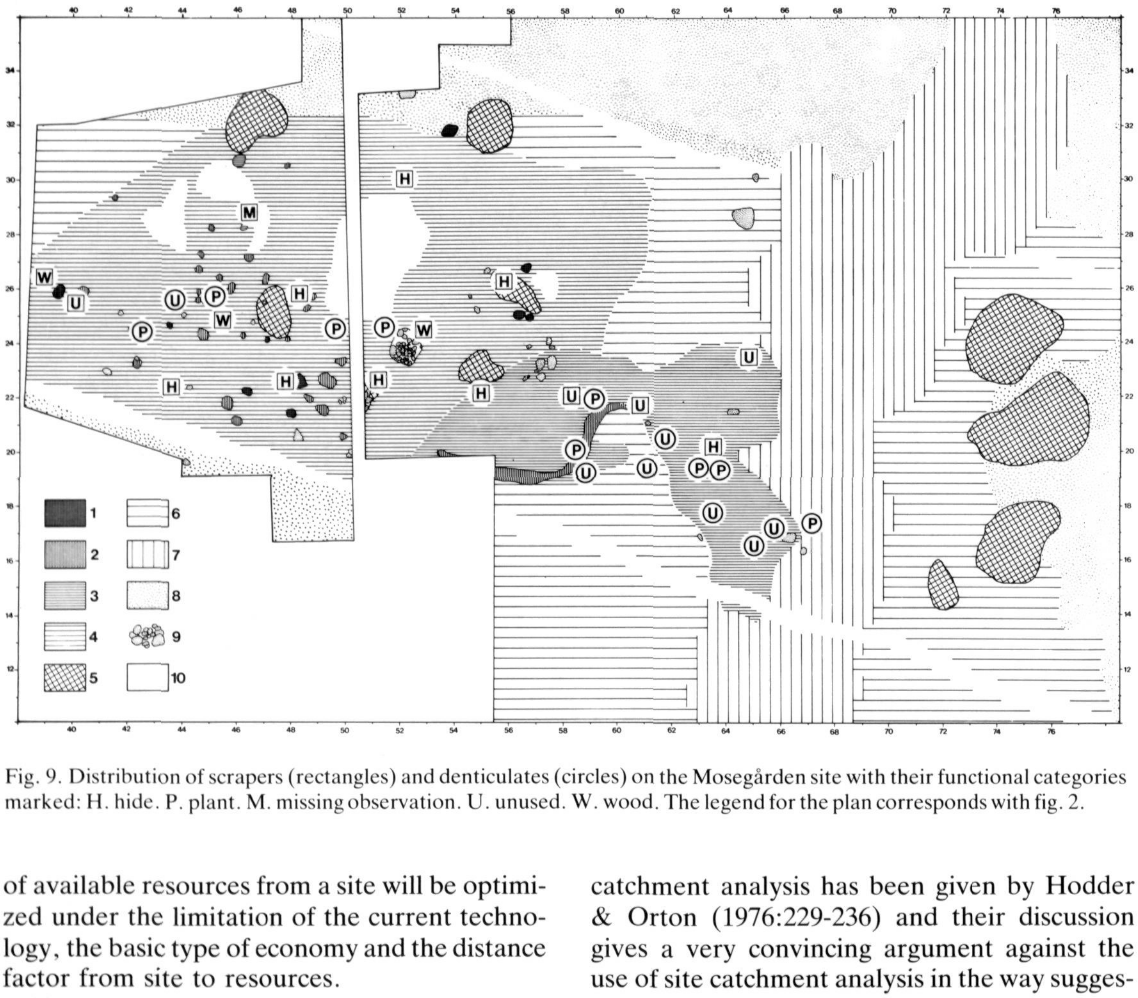

Fig. 9. Distribution of scrapers (rectangles) and denticulates (circles) on the Mosegården site with their functional categories marked: H. hide. P. plant. M. missing observation. U. unused. W. wood. The legend for the plan corresponds with fig. 2.

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

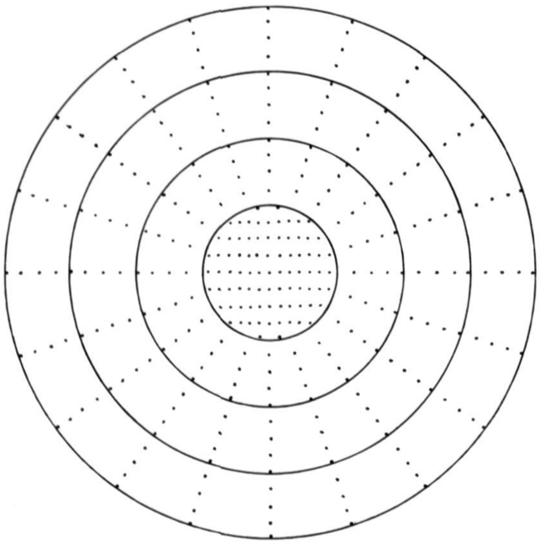

Fig. 10. Dot planimeter as used in the area analysis.

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

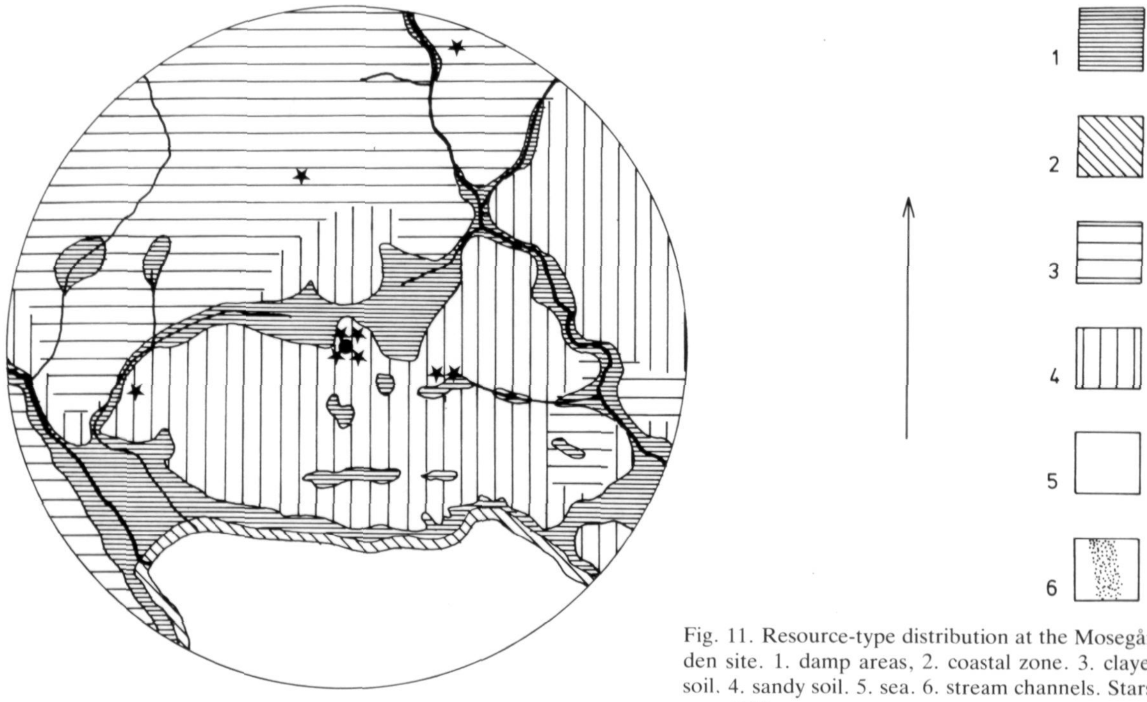

Fig. 11. Resource-type distribution at the Mosegården site. 1. damp areas, 2. coastal zone. 3. clayey soil. 4. sandy soil. 5. sea. 6. stream channels. Stars, megalithic graves.

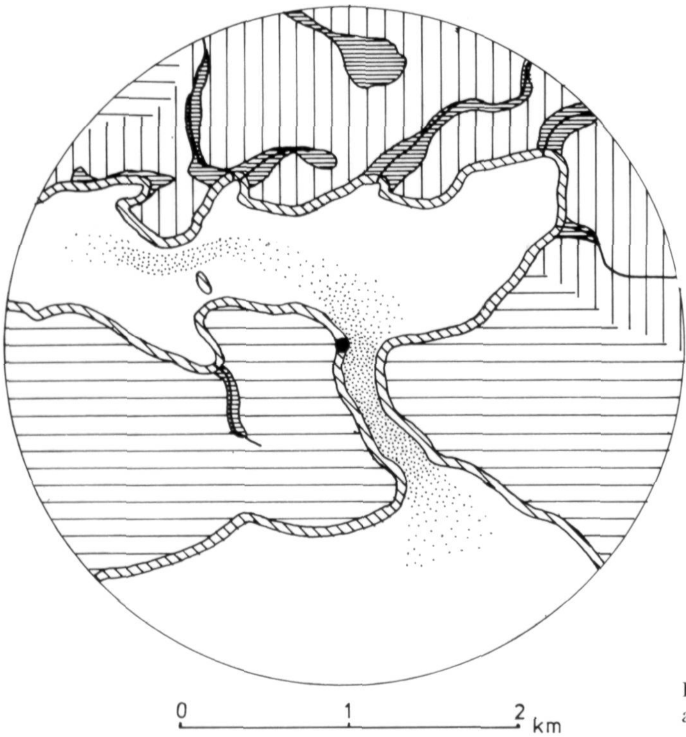

Fig. 12. Resource-type distribution at a catching site at Stensballe Sund. Legend as in Fig. 11.

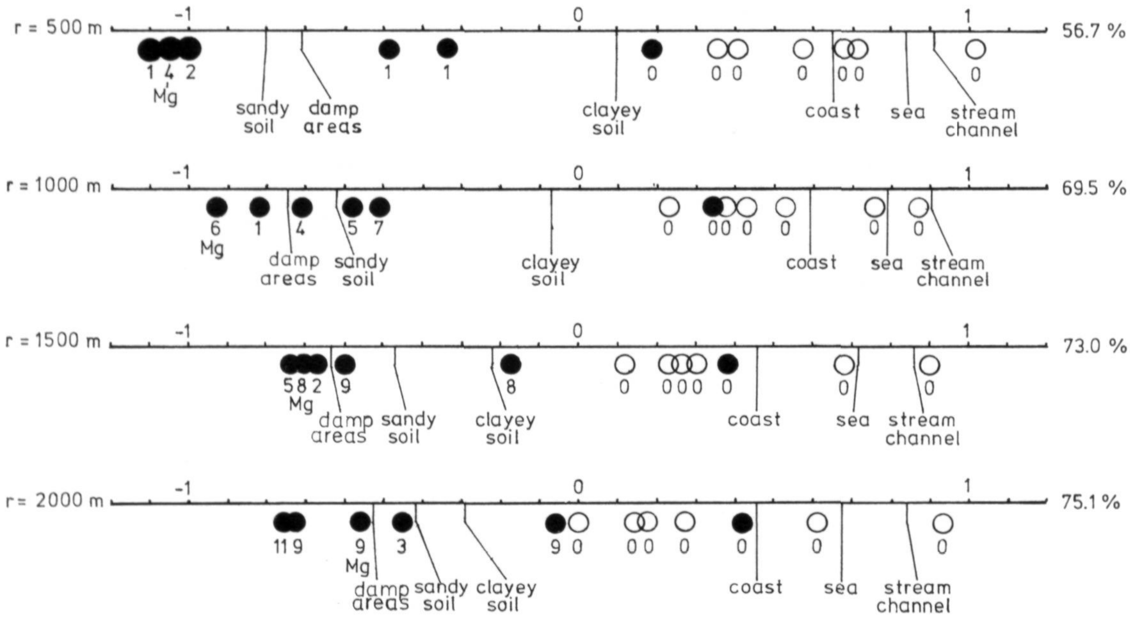

Fig. 13. A plot of each of the first principal axes from the four correspondence analyses. For further explanation see the text.

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

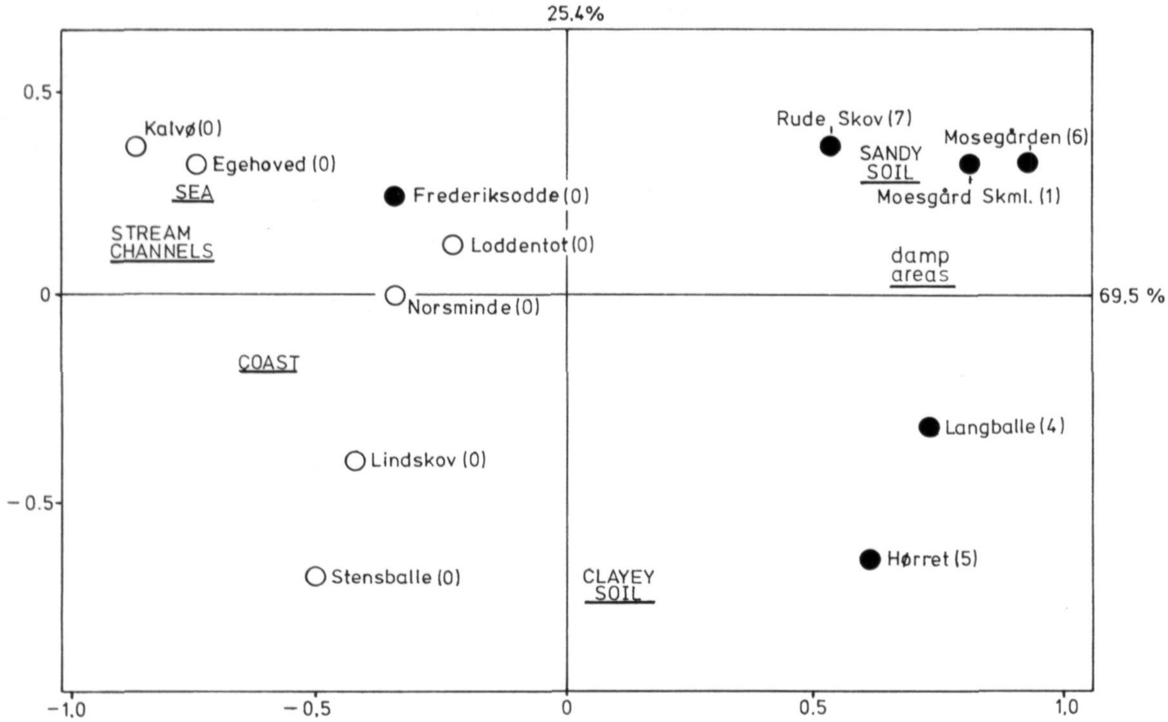

Fig. 14. A plot of the first two principal axes from the correspondence analysis of the 1000 m area. For further explanation see the text.

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.

BIBLIOGRAPHY

Andersen, Niels, H. (1981), Sarup: befæstede neolitiske anlæg og deres baggrund. *Kuml 1980*, p. 63-103.

Becker, C.J. (1953), Ørnekul på Nekselø: En sjællandsk Stenalderboplads med Hustomter. *Aarbøger for nordisk Oldkyndighed og Historie 1952*, p. 60-108.

Broholm, H.C. & J.P.Rasmussen (1931), Ein steinzeitlicher Hausgrund bei Strandegaard, Ostseeland. *Acta Archaeologica 2*, p. 265-278.

Bølviken, E. et. al. (1981), *Preliminary Lecture Notes for the Nordic Research Course in Multivariate Analysis in Archaeology*. Institutet for Matematiske Realfag. University of Tromsø.

Bølviken, E. et. al. (in press), A final and enlarged version of the above publication.

Casselberry, E. (1975), Further refinement of formulae for determining population from floor area. *World Archaeology 6*, p. 117-122.

Chapman, Robert. (1981), The emergence of formal disposal areas and the "problem" of megalithic tombs in prehistoric Europe, in: Robert Chapman, Ian Kinnes & Klaus Randsborg (ed.), *The Archaeology of Death*, p. 71-82, Cambridge.

Cook, S.F. (1972), *Prehistoric demography*, Addison-Wesley Modular Publications, Module 16.

David, Nicholas (1972), On the life span of pottery, type frequencies, and archaeological inference, *American Antiquity 37,1*, p. 141-142.

David, Nicholas & Hennig, Hilke (1972), *The Ethnography of Pottery: a Fulani Case seen in Archaeological Perspective*, Addison-Wesley Modular Publications, Module 21.

DeBoer, Warren R. & Donald W. Lathrap (1979), The Making and Breaking of Shipibo-Conibo Ceramics, in: C. Kramer (ed.) *Ethnoarchaeology. Implications of Ethnography for Archaeologists*, p. 102-138.

Doran, J.E. & Hodson, F.R. (1975), *Mathematics and Computers in Archaeology*, Edinburgh.

Foster, Georg M. (1960), Life-expectancy of utilitarian pottery in Tzintzuntzan, Michoacan, Mexico, *American Antiquity 25,4*, p. 606-609.

Glob, P.V. (1949), Barkær: Danmarks ældste Landsby. *Fra Nationalmuseets Arbejdsmark* 1949.

Glob, P.V. (1975), De dødes lange huse. *Skalk 1975 no 6*, p. 10-15.

Higgs, E.S. & Vita-Finzi, C. (1972). Prehistoric economies: a territorial approach, in: E.S. Higgs (ed.). *Papers in Economic Prehistory*, Cambridge, p. 27-36.

Hill, M.O. (1974), Correspondence Analysis: A Neglected Multivariate Method, *Appl. Statist. 23,3* p. 340-354.

Hodder, Ian & Orton, Clive (1976) *Spatial analysis in archaeology*, Cambridge.

Jeppesen, J. (in press), Funktionsbestemmelser af flintredskraber: Slidsporanalyse af skrabere fra Sarup, *Kuml*.

Juel Jensen, H. (1981), A preliminary analysis of blade scrapers from Ringkloster, a Danish late mesolithic site, paper presented at *"Recent Progress in Microwear studies"*, seminar at Tervuren, Belgium. April 14th-16th, 1981.

Juel Jensen, H. (1982 a), Analysis of wear on flint tools, *Second Nordic Conference on the Application of Scientific Methods in Archaeology. PACT 7 Parts I/II.*

Juel Jensen, H. (1982 b), En slidsporsanalyse af skrabere fra Ulkestrup hytterne, in: K.N. Andersen, *Maglemosehytterne ved Ulkestrup Lyng*. Nordiske Fortidsminder, Serie B, Bind 7.

Keeley, L.H. (1980), *Experimental Determination of Stone Tool Uses*, Chicago.

Kuper, Rudolph & Lüning, Jens (1975), Untersuchungen zur neolithischen Besiedlung der Aldenhovener Platte, in: *Ausgrabungen in Deutschland, Teil I*, Mainz, p. 85-97.

Landbrugsministeriet (1978-79), *Soil Classification Sheets*, Department of Soil Classification,

Ministry of Agriculture, Enghavevej 2, DK 7100 Vejle.
Larsen, Knud A. (1958), Stenalderhuse på Knardrup Galgebakke. *Kuml* 1957, p. 24-43.
Liversage, D. (1981), Neolithic monuments at Lindebjerg, Northwest Zealand. *Acta Archaeologica* vol 51, 1980, p. 85-151.
Lüning, Jens (1980), So bauten die Zimmerleute der Steinzeit: Die Bauerkulturen der "Bandkeramiker". *Bild der Wissenschaft* 8, p. 44-59.
Madsen, Torsten (1978), Toftum ved Horsens: Et "befæstet" anlæg tilhørende tragtbægerkulturen. *Kuml 1977,* p. 161-184.
Madsen, Torsten (1979), Earthen Long Borrows and Timber Structures: Aspects of the Early Neolithic Mortuary Practice in Denmark, *Proceedings of the Prehistoric Society 45,* p. 301-320.
Madsen, Torsten (in press), Settlement Systems of Early Agricultural Societies in East Jutland, Denmark. A Regional Study of Change, *Journal of Anthropological Archaeology* 1 (1982), p. 197-236.
Madsen, Torsten & Petersen, Jens Erik (in press), Tidligneolitiske anlæg ved Mosegården i Østjylland. Regionale og Kronologiske forskelle i dansk tidligneolitikum. *Kuml.*
Modderman, P.J.R. (1970), *Linearbandkeramik aus Elsloo und Stein,* Analecta Praehistorica Leidensia 3, also Nederlandse Oudheden 3, 's-Gravenhage.
Monkhouse, F.J. & Wilkinson, H.R. (1971), *Maps and Diagrams,* 3rd ed., London.
Narroll, R. (1962), Floor area and settlement population, *American Antiquity 27,* p. 587-589.
Rasmussen, R. (1981), *Unpublished Thesis,* Inst. of Prehist. Archaeology. Univ. of Aarhus, Moesgård.
Sahlins, Marshall (1972), *Stone Age Economics,* Chicago/New York.
Skaarup, Jørgen (1973), *Hesselø-Sølager. Jagdstationen der südskandinavischen Trichterbecherkultur,* Arkaeologische Studier I, København.
Skaarup, Jørgen (1975), *Stengade. Ein langeländischer Wohnplatz mit Hausreste aus der frühneolithischen Zeit,* Meddedelser fra Langelands Museum, Rudkøbing.
Soudsky, Bohumil (1966), *Bylany,* Praha.
Soudsky, Bohumil & Pavlu, I. (1972), The Linear Pottery Culture settlement patterns of central Europe, in: Peter J. Ucko, Ruth Tringham & G.W. Dimbleby (eds.) *Man, settlement and urbanism,* London, p. 317-328.
Troels-Smith, J. (1960), The Muldbjerg Dwelling Place: An Early Neolithic Archaeological Site in the Aamosen Bog, West-Zealand, Denmark. *Annual Report of the Board of Regents of the Smithonian Institution,* 1959.
Vita-Finzi, C. & Higgs, E.S. (1970), Prehistoric Economy in the Mount Carmel Area of Palestine. Site Catchment Analysis, *Proceedings of the Prehistoric Society vol. 36* p. 1-37.