AN ATTEMPT AT THE DEFINITION AND COMPARISON OF SETTLEMENT PATTERN. FUNNEL BEAKER CULTURE (TRB) IN THE EASTERN OF THE NIDA BASIN, SOUTHEASTERN POLAND AND IN THE EASTERN AND CENTRAL HOLLAND

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1. INTRODUCTION

The territory of present Poland in the IVth millenium BC was an area where two basic models of food-producing economies co-existed. On the one hand we are having to do with the communities of the Lengyel-Polgar complex grouped, just as the preceding Linear Band Pottery Culture, in the territories with fertile loess or swampy soils. Although certain tendencies can be observed among these communities to cross this ecological barrier, yet, basically, no mass settlement occured of the terrains with sandy soils (or at least there is no archaeological data to point to this).

The emergence of food-producing economy in these sandy territories is associated with another archaeological phenomenon viz. The Funnel Beaker Culture. Leaving out the discussion of the origins of TRB we can only claim that it emerged in the territory of Poland in all likelihood at the end of the Vth milenium BC (callibrated) (The Sarnowo phase corresponding to the continental phase AB), characterized by the presence of both elements. The fTRB was initially distributed on north-Western Poland (Pomerania, Greater Poland, Lower Silesia, Partly Masovia and Warmia). The eastern TRB group has been distinguished in these territories. This group disappeared round about 2900 BC (Callibrated). At the end of its developement it remained under the influence of the Baden and Globular Amphorae Cultures. However, the local, isolated groups were able to retain longer the traditional patterns of material culture up to the end of the IIIrd millenium BC, e.g. the Lupawa group in the Middle Pomerania.

About 3800 BC, as archaeological data so far have shown, the TRB appears in south-western Poland both on the loess soils as well as on the terrain with sandy soils. The "classical"' period of the development of the SE group of TRB falls at the period from 3000 - 3400/3300 years BC. Following this last date the influences of the style associated with the Baden Culture becomes more conspicuous in the SE part of the territory of the TRB. This process, had finally lead to the almost total disappearance of the stylistics of the TRB, about 3150 BC. In the same period in Little Poland begins to take shape the Globular Amphorae Culture. The two cultural styles co-existed most probably for about 100-150 years up to about 2900 BC.

The loess zone has a decided majority of sites representing the SE group of TRB; for this reason all investigations concentrated in this region. And because of that while we have a relatively large knowledge concerning the material culture, settlement and economy of the TRB in the loess terrains of south-eastern Poland, almost nothing is known about the remaining regions.

The objective of this paper is to offer a preliminary discussion of the SED group settlement of the TRB outside the boundaries of the loess zone, as an independent, integral episode of the evolution of this group. For our purposes we have selected the eastern part of the Nida Basin i.e. there are, outside the loess zone, so far the largest number of TRB sites has been identified. The present paper does not claim to be a comprehensive monograph which would present the whole of our knowledge of the subject, but the author focuses merely on several chosen issues which, in the author's view, may contribute to a better understanding of the character of the "sandy" settlement of the TRB.

2. NATURAL ENVIRONEMENT

The Nida Basin is a wide depression situated bewen the Silesia-Kraków Plateau and the Sandomierz-Kielce Upland. The part of the Nida Basin which is the object of our interest covers the following sub-regions : Szydlowiec Upland, the Polaniec Basin with, in its western part, the Szaniec Upland, the Pinezów Rise, the Solec Basin, and the Nida Valley (S. Gileska 1972; W.A. Nowak 1986).

The eastern part of the Nida Basin is a region built of - contrary to the ramaining parts - of primarily miocene rocks (silts, marls, limestones, hydrogenic deposits), overlain by a variety of Quarternary deposits (clays, sands, gravels, loess) (S. Gilewska 1972, p. 283). This part of Nida Basin rises to about 150 m a s l near the Lower Koprzywianka, up to 330 m a s l at the Pinczów Rise, east of Busko Zdrów, and up to 326 m on Szydlowiec Plateau, nord-east of Gnojno.

A characteristic feature of the eastern part of the Nida Basin is considerable differentiation of types of inner landscape relief. This has been determined by the lithological conditions of the older pediment and the varied degree in which the structural relief was covered by Quaternary formations. The older pediment can be seen on the surface level only in small areas. These are Upper Jurassic and Miocene rocks. The denudation structures of relief in the outcrops of the above-mentioned rocks are : faults, subsequent valleys, levelling, karst phenomena. These forms are the outstanding features of the relief of the Szaniec Upland, and the Solec Basin, and are also well-marked on the Pinczów Rise and the Szydlowiec Plateau. Among the main genetic types of the Pleistocene formations the most commonly met are sandy sediments on various substrata but with periglacial morphogenetic features. They form denudation plains and pediplains. They are the most part of the relief of the Polaniec Basin, the Szydlowiec Plateau and are well observable in the relief of the Szaniec Upland and the Solec Basin. Groups of alluvial formations are, besides the Nida Valley, present in large proportion also in the Polaniec Basin.

Suming up this brief outline of the geological structure and relief of the terrain under discussion we should draw attention to the different and unique character of the Basin in the belt of the Uplands of Southern Poland. Although the relief of the region is of an upland type yet 90% of the area has an elevation of less than 300 m a s l. The Quartenary formations take up $^{3}/4$ of the total area and reflect the basis types of morphology of the underlying older rocks. The Holocene terraces, the terraces from the Baltic glaciation, and the peat plains take up 22% of the total area. This is a very high percentage, typical of plains. At the same time this figure is the highest percentage of this type of plains in the upland regions of Southern Poland.

The eastern part of Nida Basin is covered primarily by po-sollized soils formed on weakly loamy sands and loamy sands, in smaller degree by brown soils form on analogous bedrock. There are also : rendzins, most frequently cretaceous, and hydrogenic soils. Locally there occur brown soils formed on loess-like formations.

The natural vegetational landscape of this region is made up of deciduous forest, mixed forest and oak-hornbeam forest. Terrains with poorer soils are covered with pure pine forests gradind sometimes into a mixed oad-pine forest (A. Medwecka-Kornas 1972; W.A. Nowak 1986).

3. SPATIAL STRUCTURE OF SETTLEMENT.

In the territory of the eastern part of the Nida Basin, within the above-mentionned geographical boundaries, 80 archaeological sites have been distinguished containing archaeological finds typical of the TRB. In the case of two of the sites it was not possible to mark their precise position on the maps.

The eighty sites concentrate fairly distinctly in the SW part of the region under discussion, between the river Nida and the basin of the Wschodnia river. Here the sites seem, at first sight, to group regularly (fig. 1). There are more distinct clusters of sites, possibly of the nature of microregions, in between the lower Wschondia river and the Strumien, on the middle Wschodnia, and possibly also along its upper section. Bigger concentrations, several sites each, are probably found in the area north of Busko Zdrój and south of Busko Zdrój.

In order to examine the regularities of spatial distributions of TRB settlement the method, fairly commonly used in the archaeology of settlement, of statistical evaluation of agreement between the spatial, empirical distribution of events and the random distributions (Poisson) (Z. Kobylinski 1987, p. 23-25). The method of the "nearest neighbour" was used i.e. analysis of the distance between an event and the nearest event. This method was applied in a variety of statistical tests. As each test has its merits as well as weak points therefore "in order to obtain reliable information about the nature of spatial distribution of events it is necessary to carry out a number of different tests changing parametres such as the size of investigated areas, or the number of randomevents located in this area" (Z. Kobylinski 1987, p. 26-34).

The data obtained from the dendrites of smallest distances was used in several, easily calculated tests such as : R. Clark-Evans´ test, test R with the correlation of D. Pinder, T. Shimada, and D. Gregory, and TNND test. Basically, the tests are applicable to areas with straight boundaries, approximating a square. After the dendrites of closest proximities had been obtained, the boundaries of the study area were delineated in such a way as to diminish distortion of test results caused by the so called boundary effect : the cutting by the boundary across the linking zone between points inside the bounded area and their "nearest neighbours" this phenomenon and only one site has not been taken into account in the estimates. The boundaries of the study area delineated a rectangle. For this reason the western-most sites had to be left out, while several sites were added, situated outside the geographical boundaries of the investigated region on the Upper Nida an Lower Vistula. The same estimates were obtained for the whole territory (A) and several sub-regions. We hope to obtain more detailed information as to the nature of spatial distribution of sites. The results are presented in Table 1.

TABLE 1

Results of the analysis of points representing the TRB in the eastern part of the Nida Basin, SE Poland.

TEST OBSZAR	R	R KOREL	TNND
A	0,6355	0,6058	- 7,1716
B	0,6456	0,6126	- 6,5089
C	0,7955	0,7514	- 3,8750
D	0,8054	0,7450	- 3,0501
E	0,8507	0,7800	- 2,4100
F	0,8205	0,6991	- 1,9043
G	0,6332	0,5442	- 2,9841

As we can see, with only few exceptions, the obtained values all showed the presence of spatial distribution of events of the cluster type. Area A and area B show almost identical values. The tendency towards clustering is observable also in area C comprising the majority of TRB sites in the eastern part of the Nida Basin, although the values are slightly more shifted towards random distribution. The areas D and E show the same tendency too, but their values are even more distinctly shifted towards randomness (aea E more conspicuously so). The situation in the selected grouping (area F) at the western boundary of the investigated area is similar. The value of the TNND test does not allow to decidedly reject even the null hypothesis about the randomness of distribution. The fact is worthy of attention in view of the importance of this statistics (Z. Kobylinski 1987, p. 33). In another peripheral area G, on the other hand, test values show clearly a tendecy towards grouping, stronger than in the previously mentioned areas.

Before we make an attempt at the interpretation of the data we should signalize two essential limitations to the method of "the nearest neighbour". Firstly all archaeological sites are treated in the same way, regardless their functional variability. An attempt to remove this weakness by combining sites into dendrites in accordance with functional groups is unsatisfactory since after such an operation there are still no links between assemblages of different functions, while particular sub-assemblages become poorer, which is of importance when small assemblages are concerned (S. Golachowski, B. Kostrubiec, A. Zagozdzon 1974, p. 142). Fortunately, in the case of TRB sites in the eastern part of the Nida Basin, the differentiation of sites is relatively small. Most of them can be ascribed to the category of so-called camp-sites. The sites are seen on the surface as group of ceramics, most frequently a dozen or so sherds of clay pottery, sometimes up to the several tens, and a dozen or so flint artefacts. The concentrations measure as a rule several tens of metres in diametre. Obviously, the definition of these concentrations as camps is partly stipulated but first of all hypothetical since only 3 sites of this type have been excavated. Yet, such an interpretation of this particular surface appearance seems most plausible as it was confirmed by the 3 sites mentioned above (U. Maj., W. Morawski 1985; J. Gurba 1954), or in other settlement mezoregions of the SE group of the TRB. Settlement points are in minority among sites (17); these are single finds of axes, or sherds of clay pots. In the case of two settlements the large quantity of ceramic surface finds pointed to their considerable size. One of the sites is probably a TRB grave.

Another negative aspect to the application of the "nearest neighbour" method in archaeology is the a-chronological treatment of sites. Especially in the case of the area under discussion this is of importance considering that the SE group of TRB existed for 800-900 years. Thus, the revealed tendencies may only be apparent, resulting from the accumulation in one area of traces of long-term occupation. It is difficult to resolve the problem in the situation when chronological stratification is not possible and one can only rely on cautions conclusions and common sense. Further in this study I shall try to show that notwithstanding this difficulty the TRB settlement area under disscusion lends itself to analysis (As a matter of fact, these two, above mentioned, limitations are cause by the weakness of the archaeologist who cannot precisely define the function of site and date it, and not by the weakness of the method itself).

It is known that when a process leading to the formation of clustered patterns in relation to the distribution of archaeological sites in a region has been estabilished, this may suggest the expansion of settlement as a generating process (Z. Kobylinski 1987, p. 24), although - unfortunately - this is not quite unequivocal. In view of the fact that decided majority of TRB sites in this area are small camps, and taking into account the above statement, test results can be interpreted in two ways. The first hypothesis (Fig. 3A) assumes the existence of the population with funnel beakers occupying the camps which for economic reasons were subsequently shifted to the nearest neighbourhood, within the same microregion. In the same period a larger number of microregions may have functioned simultaneously.

The second model we propose (Fig. 3B) is similar to the first, but in addition it assumes that after a series of shifts within one microregion, for economic reasons a given population group moved to more distant and unutilized territories where again took place shifts on the scale of microregion. This process could continue and ramify. Such a pattern could occur not as one, specifie dendrite, but several for the whole of the discussed area.

A possibility that in a microregion several camps functioned simultaneously (both models) is less faesible as the values of tests for the smallest areas F and G show a tendency towards concentration. As we have already said this may confirm the presence of the generating process in settlement. In reference to area F this remark obtains to less extent.

4. POSITION OF SITES IN RELATION TO THE SOIL COVER

In order to determine the position of TRB sites in relation to the soil cover we have used maps of soils on the scale of 1 : 300 000. Because it was not possible to properly define the type of soil cover directly on a site types of soils were examined in the vicinity of sites within the radius of 3 km. In the case of farming economy this may be even more importance than the position of the site itself among soils. The distance of 3 km has been arbitrarily adopted although there are some theoretical grounds to warrant it (Z. Kobylinski 1986). The size of the territory utilized by a settlement was diverse and dependent upon a large number of local natural conditions as well as the human factor. We shall not attempt here to offer any conjectures on this issue as the reconstruction of the size of a settlement is a huge and at the same time controversial task (see above). In the immediate vicinity of a site there occur as a rule several types of soils. When a given soil type takes up more than 50% of the area within the radius of 3 km, only this one type has been taken into consideration. In the situation when none of soil types covers more than 50% of the area, the soil type is taken into account which covers the biggest area, followed by two co-occuring types, next in respect of the occupied area (hence double values in the table when two soil types co-occur).

TABLE 2

Position of TRB sites in the eastern part of the Nida Basin in relation to the soil cover.

Soll type	1	2	3	11	12	20	21	22	24	28	29
B		2	1						2		2
C	3	5	1	3	3	2	13	2	15	3	3
D	21-3	24-4	11-1	5-2	21-3	2-1	24-9	24-2	21-12	21-2	21-3
	2-1	1-1	24-1	35-2	34-2	21-1	36-4	3-1	34-4	24-2	28-2
	20-1	11-1		24-1	36-1	24-1	3-3	21-1	11-3	29-1	2-1
	24-1	22-1		34-1		36-1	44-3		13-2	34-1	
		29-1					1-1		33-2		
		34-1					11-1		44-2		
		36-1					12-1		1-1		
							13-1		2-1		
							15-1		3-1		
							28-1		28-1		
							34-1		38-1		

	32	34	36	44
B				2
C	1	2	1	6
D	29-1 44-1	11-1 12-1 24-1 36-1	2-1 44-1	24-4 12-2 22-2 36-2 2-1 32-3

B - Number of sites surrounded by soil type taking up more than 50% of the surface.

C - Number of sites surrounded by soil type taking up less than 50% of the surface.

D - Soil types in the vicinity of sites listed under C, next as to occupied area after soil type S enumerated under C. Two types have been taken into account hence double values in comparison to position C. The first figure denotes soil type, the second, after the hyphen, the number of sites.
Soil types and number denoting them used in Table 2 (acc. to A. Musierowicz)

Carbonate rendzins
- 1 - Tertiary rendzins
- 2 - Cretaceous rendzins
- 3 - Jurrasic rendzins
- 5 - Gypsum rendzins

Brown soils, developed from boulder loams and sand formed on loams and clays.
- 11 - Light and medium
- 12 - Heavy
- 13 - Developed from various loams of alluvial origin, and from weathered loams
- 15 - Developed from silty formations of alluvial origin

Podsols developed form sands.
- 20 - Loose
- 21 - Weakly loamy, developed from boulder loams and sands formed on loams and clays
- 24 - Light and medium
- 28 - Developed from silty formations of alluvial origin
- 29 - Developed from loess and loess-like formations

Chernozems
- 32 - Developed from loess Black earth soils
- 33 - Developed from loams and clays of various origin
- 35 - Developed from silty formations Bog soils
- 36 - Slime-bog
- 38 - Peat soil developed from peat of lowmoor (valley)

Alluvial soils
44 - (River) alluvial soils, light, medium, and heavy

As we may have excepted of greatest importance among 75 analysed sites are podsol soils. In four cases they take up more than 50% of the area in the vicinity of the site, and in 38 cases they constitue a large proportion of soils around the sites (5 + 51%). Podsols occur, besides, in highest frequency as a co-occuring soil in smaller proportions. Two types of these soils are conspicuously of biggest significance : light and medium podsol developed from boulder loams and sands on clays and loams (n°24), and podsol soils weakly loamy developed from sands (n°21). Other soils accopanying podsols play a minor role. In slightly bigger proportions occur : slime-bog soils (n°36), black soils developed from clays and loams (n°34), also rendzins, brown soils developed from boulder loams and sands formed on clay and loams, and alluvial soils (n°44).

Next in importance are rendzins. They take up more than 50% of the surrounding surface in the case of three sites, and play a major role in the vicinity of 12 sites (4 + 16%). In biggest proportions seem to occur cretaceous rendzins (n°2), but the differences in rations are small. The most frequent co-occuring soil types are podsols (n°21 and 24 mainly).

Two of the sites are surrounded mainly by alluvial soils, taking up more than 50% of the surface (n° 44), while in the case of 6 sites these soils are of major importance (2,7 + 8%). The most frequent co-occuring soils are also podsols.

Brown soils take up most of the surface round 6 sites. These are soils developed from boulder loams and sands developed on clays and loams, light or medium (n°11) and heavy (n°12).

In the case of two sites an important part among soils in the surrounding area belongs to black soils developed from clays and loams (n°34). One site is surrounded mostly by slime-bog soils (36).

Also in the vicinity of one site a major role belongs to chernozems developed from loess (n°32).

Figure 4 shows a distinct territorial differentiation. The eastern part of the region under consideration contains almost exclusively sites with podsolized soils in the surrounding area. These are : the basin of the Czarna river, and of the rivers Wschodnia i Strumien. The western part on the other hand is characterized by a larger number of sites in the vicinity of which predominate soils other than podsols such as : rendzins or brown soils.

5. POSITION OF SITES IN RELATION TO THE VEGETATION

Of assistance in the reconstruction of the vegetational cover surrounding the sites are charts of potential natural vegetation. The state of investigations into this area is very good as for the area of the whole Poland we have now maps on the scale of 1 : 50 000. However, there two disadvantages to these application of such charts. Firstly, one should be aware that the conception potential natural vegetation is not identical with palaeo-vegetation. This is a theoretical state of vegetation which would emerge in a given territory after all human activity ceased. But in view of far reaching changes of a number of environmental elements in the consequence of man's interference, it is not possible to re-create the original state of vegetational cover, prior to the invasion of man with the food-producing economy. For this reason a settlement network of a given praehistorical culture cannot ba referred to charts of potential vegetation without reservations. Secondly, comparisons like this serve no purpose especially in the case of an area which had been interfered with by man's economic activity inducing changes in the vegetation prior to the emergence of the TRB (J. Kruk, L. Przywara 1983). In the period which is the object of our interest it is likely that the potential vegetation approximates most closely the palaeo-vegetation in the "sandy" territories. Possibly, it was the activity of the population with funnel beakers in these areas that initiated more intensive transformations of vegetation starting from the transition between the Atlantic and the Sub-Boreal period.

The methodological procedure is the same as for the analysis of the soil cover except that two variants of the dimensions of the area surrounding a site have been taken into consideration : an area with radius of 1 km, and the second variant with the radius of 3 km. A total of 80 sites have been analysed (Table n°3).

In the surrounding area within a radius of 1 km the dominant role belongs to subcontinental oak-hornbeam forest (Tilio-Carpinetum), Little Poland type, poor series (26 sites, including 12 with this forest covering more than 50% of the surface), and rich series forest (16 sites, with 5 of them more than 50% of the surface is taken up by this forest). Altogether on more than 53% of examined sites oak-hornbeam forest are of major importance. When a surrounding surface within the radius of 3 km was considered the above tendency is even more conspicious, with the poor series being distinctly predominant (40 sites, including 6 with more than 50% of surface covered by this forest). The rich series appears on 11 sites (including one site with more than 50% covered by this series). Altogether, in the case of the radius of 3 km, oadk-hornbeam forest cover about 64% of all sites. Alongside oak-hornbeam forest of poor series, co-occur most frequently continental oak-pine mixed forest (Pino-Quercetum), marshes of alder and ash-alder groves (Circaeo-Alnetum) and - as we have said- oak-hornbeam forest of rich series. In the case of oak-hornbeam forest of rich series the tendency is similar although less conspicious.

Next in importance is the continental oak-pine mixed forest (Pino-Quercetum) which takes up 19 sites (including 9 sites with more than 50% of the surrounding surface covered by this forest) within the radius of 1 km, and 13 sites (more than 50% of the surface in the case of 2 sites) within the radius of 3 km. As far as types of co-occuring vegetation are concerned the tendencies are less marked. A slight prevalence of oak-hornbeam, mainly poor series forest is observed, also marshes of alder and alder-poplar.

The remaining community of potential vegetation which have been distinguished play a less important role. To these belong, first of all, marshes of alder and ash-alder (Circaeo-Alnetum). They appear on 10 sites within the radius of 1 km, and on 8 sites within the radius of 3 km. The most frequent co-occuring vegetation groups are oak-hornbeam, poor series, forest, mixed oak-pine forest and stenothermal oak forest. Besides, there are high, rich, stenothermal oak forest of upland type (in the case of both the smaller and the larger distance on 7 sites) accompagnied by oak-hornbeam forest, marshes, and mixed oak-pine forest. In insignificant proportions occur xerothermic oakwood (Potentillo albae-Quercetum), wet alderwood (Carici elongatae-Alnetum) and eutrophic fir forest (Galio-Abietion).

Comparison fo charts (fig. 5) did not reveal microregional differentiation.

6. CONCLUSIONS

In the foregoing considerations we have analysed the spatial distribution of the TRB settlement in the eastern part of the Nida Basin as well as the distribution of sites of this culture against the background of two, chosen, elements of natural environment viz. Soil and vegetation. The latter two analyses have been carried out in reference to the present natural environment which is all likelihood differs from the environment during the period of occupation of the population with funnel beakers. There are no detailled palaeographical studies which would enable us to perform analogous analyses for the second half of the Atlantic period or the initial stages of the Boreal. We can merely offer a few remarks general concerning vegetation.

The reconstruction of vegetation has been done for the Staszów Karst in the eastern part of the region under disscusion (K. Szczepanek 1968; 1971) and for the Holy Cross Mountains (K. Szczepanek 1961). These studies give us some idea of the vegetational cover in the Atlantic and the Sub-Boreal. In the Atlantic period forests predominated which are characteristic for the Holocene climatic optimum viz. : multi-species, mixed forest with elm, lime, oak, ash, alder, spruce, and hazel. The proportion of birch and pine on the investigated peat land does not exceed 20%. Pollen of willow, maple, beech, fir and hornbeam occur sporadically (they do not form continuous curves). Wet habitats were occupied by alderwood, and marsh forests. Worthy of attention are pollen of synantropic plants and cereals.

A fairly distinct change took place in the Sub-Boreal period. Forest with a different composition dominate. The proportion of pollen of elm, hazel, lime, ash and to a lesser extent oak grows smaller, while spruce reaches its maximum values in the spectra from these areas. Also pine gains in importance. "New" trees appear such as : hornbeam, beech, and fir. But initially their proportion was not large (larger in the Staszów Karst than in the Holt Cross Mountains). It seems that at first these changes did not embrace communities with alder. Analogous changes in plant cover are shown by isopollen maps of a mumber of species of trees and bushes (M. Ralska-Jasiewiezowa 1983). On the other hand, pollen data are spatially limited hence the conclusions must be approached with caution.

In respect of soils the situation is worse. Data are poorer and does not described all soil types. Our main interest are podsols. At the moment it would seem that these soils developed throughout the whole of the Holocene (K. Konecka-Betley 1982). From the beginning of the Atlantic, or the terminal Boreal, a markedly more intensive process of podsolization can be observed which persisted also in the Sub-Boreal period. The question of these soils is as follows : soil with the indeterminate profile weakly developed soil brow soil proper leached brown soil lessive soil (podsolized soil). The oretically the formation of lessive soils should have taken place in the cooler and wetter conditions of the Sub-Atlantic period with coniferous forests. Theoretically, in the IVth and IIIrd millenium BC the range of brown soils should be broader and more concentrated at the cost of podsolized and buff soils. The situation is complicated by the fact that nowadays the process of soil regradation can also take place (Cz. Swiecicki 1981, p. 387).

Generally, the primary reason why it is difficult to draw correct conclusions about the nature of the TRB settlement in the region under disscusion is the poor state of investigations in comparison to the loess zone. The eastern part of the Nida Basin is from the point of view of environment very much different from the loess uplands, somewhat resembling the Lowland environment. In this region a certain number of sites are found containing typical TRB inventories. Naturally, their number is small in comparison to the zone, but sufficient especially in relation to other non-loess area of Little Poland, to deserve separate attention.

The basic issue is a correct choice between two hypotheses about TRB settlement in the region :

- The TRB settlement in the "sandy" zone constitutes the earliest phase of this settlement in Little Poland, emergent in the consequence of the influx of population (from the territories of the easter group ?) in the period corresponding to the Pikukowo phase of the eastern group, or possibly even earlier, or on the local mesolithic base. Subsequently, the whole part of the population may have "moved" to the loess territories. In the latter case an autonomus, in relation to the loess zone, evolution of the TRB continued in the "sandy" regions.

- The TRB in the "sandy" zone is the effect of a more or less periodical penetration of the population of this culture from the loess zone. This, the "sandy" zone would constitute an area used only sporadically.

The TRB settlement displays here an essentially different form than it does in the loess zone. Typically occur camps with a certain number of single finds. As the analysis of spatial structure has proved they show a tendency towards forming aggregates. This, as we have shown, can have two explanations but of greater importance seems to be the assumption about the gradual, generating development of settlement network. In the neighbouring, i.e. western loess uplands (west of the Nida river) analysis of spatial distribution of the TRB has provided different results (J. Kruk 1980, p. 74-85), which indicated a tendency towards regular settlement netword. According to J. Bruk (as above) this tendency is an apparent phenomenon resulting from the superimosition of traces of strong and long-lasting settlement in one region. On this basis we can infer that the TRB settlement in the eastern part of the Nida Basin was relatively short-lived with, simultaneously, its autonomous and integral development. The spatial tendencies we have established allow us, in my opinion, to reject the thesis about the penetration of population groups from the loess zone.

On the scale of microregion the spatial organization of settlement is different too. According to S. Milisauskas and J. Kruk (1984) around 3600-3150 BC we can speak in the loess zone of the hierarchical structure of the TRB settlement. In terms of a whole number of parametres one settlement is distinct, most probably the centre of the settlement microregion. The next category are medium-size settlement (7), finally the third category are small settlements (46). Medium size settlements constitued local centres, situated at a certain distances from the main settlement in Bronocice. Other settlements functioned as small hamlets dominated by the main settlement or local centres. They did not play any independent role in the whole system (S. Milisauskas, J. Kruk 1984, p. 22).

The balance in favour of certain soils we have established in eastern part of the Nida Basin, is sufficient to result in a basic difference in the type of economy, which in all like-lihood had a mixed character : both farming-breeding and hunting-gathering. It is of interest that there is no association with the local layer of loess soils in the region of Stopnica. No concentration of sites have been established, just the opposite the TRB settlement seemed to have avoided this area. Also worthy of attention is the frequent occurrence of rendzins in the vicinity of sites in the western part of the region as these are relatively fertile soils although very difficult to cultivate. They could not be properly utilized in the Neolithic. This would suggest that the choice of soils surrounding the sites was not overly important.

Of great importance for the explanation of the nature of TRB settlement in the region are the recent results of excavations of two camps : at Kawczyce, community of Busko Zdrój and at Umia-nowice, community Kije (U.Maj, W.

Morawski 1985). The results have shown that in respect of material culture these sites display very distinct, specific character while at the same time, the generals markers of the TRB are retained. For this reason it is difficult to synchronize the chronology of these sites with other areas. Certain features, notably technology of some of the ceramic groups (soft ceramics, smooth surfaces, matt, a large number of weakly fired specimens) are similar to Phase I of the TRB settlement at Bronocice dated to about 3800-3600 BC/J. Kruk, S. Milisauskas 1981).

Suming up we may be tempted to put forward a hypothesis that the TRB settlement in the eastern part of the Nida Basin represents its early phase within the SE group, contemporaneous at least with the beginnings of this settlement in the loess zone where too it was limited to small settlements. After a fairly short period of development (200-250 years ?) based on a mixed farming-breeding and hunting-gathering economy within micro-regions and in the environment of mixed forests of the Terminal Atlantic, the main body of the population moved to the loess territories. I would like to stress that, hopefully, my hypothesis will be confirmed in the course of further investigations. It is likely that the reported, dramatic change in the vegetation at the transition of the Atlantic and Sub-Boreal, observable in pollen diagrams from the Staszów Karst, was the cause of the described phenomenon. The loess zone retained longer the plant composition typical of the Atlantic period (J. Kruk 1984).

7. TRB IN THE EASTERN PART OF THE NIDA BASIN AGAINST THE WESTERN GROUP OF TRB, IN HOLLAND.

The next part of the present paper is a comparison between the hypothetical model fo the TRB settlement in the eastern part of the Nida Basin and the models of the neolithic settlement in the western part of the Central European Plain i.e. : in the regions settled by the western group of the TRB. The first step is, similarly, the analysis of regularities of spatial distribution of the settlement of this group by means of the "nearest neighbour" technique. Basing on the available literature of the subject, we have chosen for our purposes, two regions or rather mezoregions within the range of the western TRB. These are : The Drente Plateau in eastern Holland (Fig. 6,7), and the second : the area of the Veluve Hills in central Hollandf (Fig. 8, J.A. Bakker 1982, p. 100-101). As to their size they correspond more or less to the area of the eastern part of the Nida Basin. The basic information concerning the TRB in the above-mentioned areas in Holland is to be found in the work by Bakker (1982). Results of statistical analyses are presented in Table 4.

TABLE 4.

Results of the analysis of points representing the TRB in the Drente Plateau and the Veluve Hills).

AREA / TEST		R	R Correl.	TNND
Drente	All sites	0,4715	0,4538	-12,1248
	A area	0,5989	0,5616	-6,0329
	Settlement sites, graves	0,5219	0,495	-8,4404
	A area	0,4133	0,3808	-6,9385
	Settlement sites	0,3573	0,331	-8,7265
	A ara	0,4697	0,4297	-5,7309
	Hunebeds	0,4046	0,3814	-9,4034
	A area	0,7111	0,5021	-3,2137
Veluve		0,4652	0,4288	-6,5287

For the Drente Plateau "the nearest neighbour" dendrites were made both for all the mapped sites (J.A. Bakker 1982, p. 101, Fig. 7) (The comparison of Fig. 7 and Fig. 2 on page 91 in the work by Bakker shows the former displays only about 70% of all TRB sites from the whole area), as well as for particular functional groups of sites. Besides, a smaller area A has been distinguished characterized by the biggest density of the distribution of TRB sites on the Drente Plateau, in its north-east part. This area has been analysed separately using similar techniques.

Because the number of sites in the region of the Veluve Hills is distinctly smaller the drawing of "the nearest neighbour" dendrites for particular site categories seemed to serve little purpose.

Just as in the case of the eastern part of the Nida Basin, the test values received for the Drente Plateau and the Veluve Hills indicate the occurence of spatial distribution of events of aggregated type. Here this tendency is even more conspicious than in the Nida Basin. All values received from particular tests approximate in a general way those obtained for the Nida Basin. The only values that stand apart are those for the megalithic tombs (hunebeds) in the north-eastern part of the Drente Plateau (area A) where the tendencies towards aggregating are less apparent than in other instances.

We may conclude that the settlement of the western group of the TRB in the selected areas concentrates in microregions too. This tendency is slightly more conspicious than that observed in the case of the eastern part of the Nida Basin. There fore, the settlement models proposed earlier in this paper can be also referred to the Drente Plateau and the Veluve region.

Thanks to the system of ceramics chronology it is possible to obtain more precise chronological determinations of the sites in these two mezoregions. We know (J.A. Bakker 1979, pp. 63-75) that the TRB sites are distributed on the Drente Plateau in relatively large numbers, practically in every developmental phase viz. From phase A (Early Drouven) to phase G (Late Havelte) that is throughout a period of 500-600 radiocarbon years. On the basis of the materials at the author's disposal it was not possible to chart particular chronological phases of the TRB on the Drente Plateau. It is then difficult to decide with all certainty whether the proposed settlement models can be applied to the whole period of the local development of the TRB. The fact that the megalithic tombs show aggregated distribution, that predominantly they come from phase D, makes it plausible that the aggregated model occured in all the phases of the existence of the TRB on the Drente Plateau.

A short review of the spatial distribution of particular ceramic phases of the western TRB group (J.A. Bakker 1979, pp. 63-75) reveals that in the Veluve region majority of sites should be ascribed to phase E. Only three or four sites have been ascribed to other phases (B and C). Archaeological materials from phases A,D,F and G have not been recorded at all. Obviously this picture cannot reflect reality with all certainty, primarily because of the difficulties in unambiguous classification of materials. This concerns particularly phases A,B an G, hence the maps of the distribution of these phases are most probably incomplete (J.A. Bakker 1982, p. 112). We are entitled, however, to assume that the settlement picture obtained for the Veluve region is more or less - reliable for one phase viz. Phase E. This means that the tendency towards aggregation of settlement in micro-regions is observable in shorter time blocks (about a hundred years). Indirectly, this may also be an argument in favor of the existence of the aggregated settlement model in each of the settlement phases in the areas such as Drente that is the areas with multiple-phase settlement. Test results obtained for the latter area seem to suggest that throughout all the phases of its development the same microregions were occupied by local communities of the western group of the TRB.

We have also used the above-mentioned work by J.A. Bakker (1982, pp. 102-107) for the comparison of the results received from our analysis of the location of TRB sites in the eastern part of the Nida Basin in relation to the soil mantle. J.A. Bakker performed very precise analyses of this kind in the south-east corner of the Drente Plateau. The results are presented in Fig. 9. Certain problems have been caused by the fact that the soil classifications used by Bakker and in Polish works are not quite identical. For this reason the conclusions which have been drawn are somewhat too general. Firstly, it is striking that both in te south-east corner of the Drente Plateau as well as in the eastern part of the Nida Basin the TRB settlement concentrated primarily on podzols. In the former area this dependence is as much as 92%, in the eastern part of the Nida Basin on the other hand it reaches 58%. The fact also attract attention that a much greater variety of soils occurs around the sites under discussion in Little Poland , both in respects of podzols as well as other soils. On the Drente Plateau the TRB is associated with humus-podzols (nearly 70%) and gley-podzols (about 22%). The remaining 8% represents typical podzol brown earth. In the eastern part of the Nida Basin, on the other hand, besides podzols (6 types) the TRB sites are surrounded by rendzins (ca 17% - 4 types), alluvial soils (ca 11%) and brown soils (ca 8%) - 4 types).

The above comparison tells us that majority of Dutch sites discussed in this paper is located on the soil whose parent rock is constituted by fine sand with little or no loam (about 90%). The remaining sites are situated on fine, loamy sands. As far as we are able to tell, the situation in the eastern part of the Nida Basin is different. In the immediate vicinity of 24% of sites there are loose sands or weakly loamy sands, forming the top part of the parent rock.

The dregree of dampness of the soil mantle on the TRB sites cannot be compared as we have no such data for the eastern part of the Nida Basin.

Reconstructions of the original vegetation made on the basis of pollen profiles are available both for the Veluve and the Drente regions (J.A. Bakker 1982, p. 115). The reconstruction for the Veluve area showed : forest with mainly oak, lime tree, birch, hazel, and a relatively rich brushwood which ensured sufficient fodder for live-stock. Because the forests were used as a pasture, they became more and more open. But this was a gradual process. There are no indications of large-scale buring of the forest.

Profiles from the megalithic tombs in the Drente area indicate that they were probably built on small clearings within Quercetum Mixtum forest. In all likelihood clearings like this were used for cultivation or stock breeding. However, traces of forest regeneration have been recorded as well as of the expansion of heath.

A general conclusion can be drawn that neither in the Drente Plateau nor in the Veluve region there had be any basic change in the vegetational cover between the period of the existence of the TRB i.e. the early phases of the Subboreal period, and the Atlantic period. On the other hand, we can claim that certain changes in the appearance of the vegetational cover did occur in the eastern part of the Nida Basin in the transition between the Atlantic and the Subboreal period. Providing then, that the assumption is correct about the early, most probably Atlantic, dating of the TRB in the eastern part of the Nida Basin, we can suggest with caution that centres of this culture which are found on non-loess soils are associated with the "Atlantic" plant formations in Central Europe.

Summing up our considerations let us look at the basic similarities and dissimilarities between the agglomerations under discussion. Firstly, considerable similarities have been found in respect of spatial organization of the Drente and Veluve areas and the eastern part which result, in all likelihood, from similar environmental conditions. On the example of the two Dutch regions we could observe the tendency towards aggregation both in the case of multi-phase settlement which spread over a larger time-span as well as the relatively short, single-phase settlement.

A striking difference, on the other hand, is the fact that settlement of the western TRB is almost totally absent in the areas with soils developed on the loess parent rock despite their nearness. This is seen in border regions such as e.g. Münsterland (J.A. Bakker 1982, p. 122). The loess areas closest to the western TRB were, in turn, used by the Michelsberg Culture almost exclusively. This culture was distinctly earlier than the western TRB group. For this reason we can assume that the loess soils continued to be settled by groups which have not been throughly described yet (the Wartberg group ?, the gallery graves ?), or they remind unoccupied until the population with the All-Over Ornamented Beakers appeared. In the latter case we would have to infer that the western TRB communities did not chose to take advantage of the opportunity to change or partially extend their ecumen.

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"FQ" - Folia Quaternaria, Kraków
"SprArch" - Sprawozdania Archeologiczne, Kraków

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TABLE 3.

The distribution of the TRB sites in the eastern part of the Nida Basin against the background of potential natural vegetation.

Zbiorowisko Rosline	012		41		78	
	1 km	3 km	1 km	3 km	1 km	3 km
B						
C	2		10	7	1	
D	104-2 631a-2		012-1 82-4 84-1 104-4 211-1 221-1 631a-7	82-3 103-1 104-2 631a-5 631b-3	631a-2	

	81		82		104	
	1 km	3 km	1 km	3 km	1 km	3 km
B				1		
C	2		10	7	1	
D	104-2 631a-2		012-1 82-4 84-1 104-4 211-1 221-1 631a-7	82-3 103-1 104-2 631a-5 631b-3	631a-2	

	631		631 b	
	1 km	3 km	1 km	3 km
B	12	6	5	1
C	14	34	11	11
D	41-8 82-4 103-1 104-8 631b-7	12-1 41-16 52-1 81-2 82-7 104-24 631b-17	41-4 51-1 78-1 81-4 82-6 104-5 631a-3	41-7 52-1 81-1 82-3 104-5 631a-5

Symbols B, C and D as in Table 2

Figures dennotating plant communities used in Table 3 (acc.) to W. Matuszkiewicz).

12 - Wet alderwood (Carici elongatae-Alnetum), central European species.
103 - Central European acidophylic oakwood (Luzulo Quercetum).
12 - Grasses and tall herbs (Caricetea curvulae and others).
16 - devastated terrain with unknown vegetational sequence ("industrio klimax").
21 - Sub-oceanic pine forest (Leucobryo-Pinetum).
221 - Continental pine forest (Feucedano-Pinetum), subboreal species.
3 - Willow-poplar riverside forest (Salici-Populetum).
41 - Marshes of alder and ash-alder groves (Circaeo-Alnetum).
51 - Marshes with elm forest (Ficario-Ulmetum chysoplenietosump.
52 - Marshes of ash-elm (Ficario-Ulmetum typicum).
631a - Oadk-hornbeam, subcontinental forest (Tilio-Carpinetum), Little Poland species, poor series.
631b - Oadk-hornbeam, subcontinental forest (Tilio-Carpinetum), Little Poland species, rich series.
78 - Eutrophie fir forest (Gallio-Abietion).
81 - Xerothermic oakwood (Potentillo albae-Quercetum).
82 - High, rich, stenothermal oak forest, upland type.
84 - High, xerothermal pine-oak forest.
95 - Upland, fir forest (Abietetum polonieum).

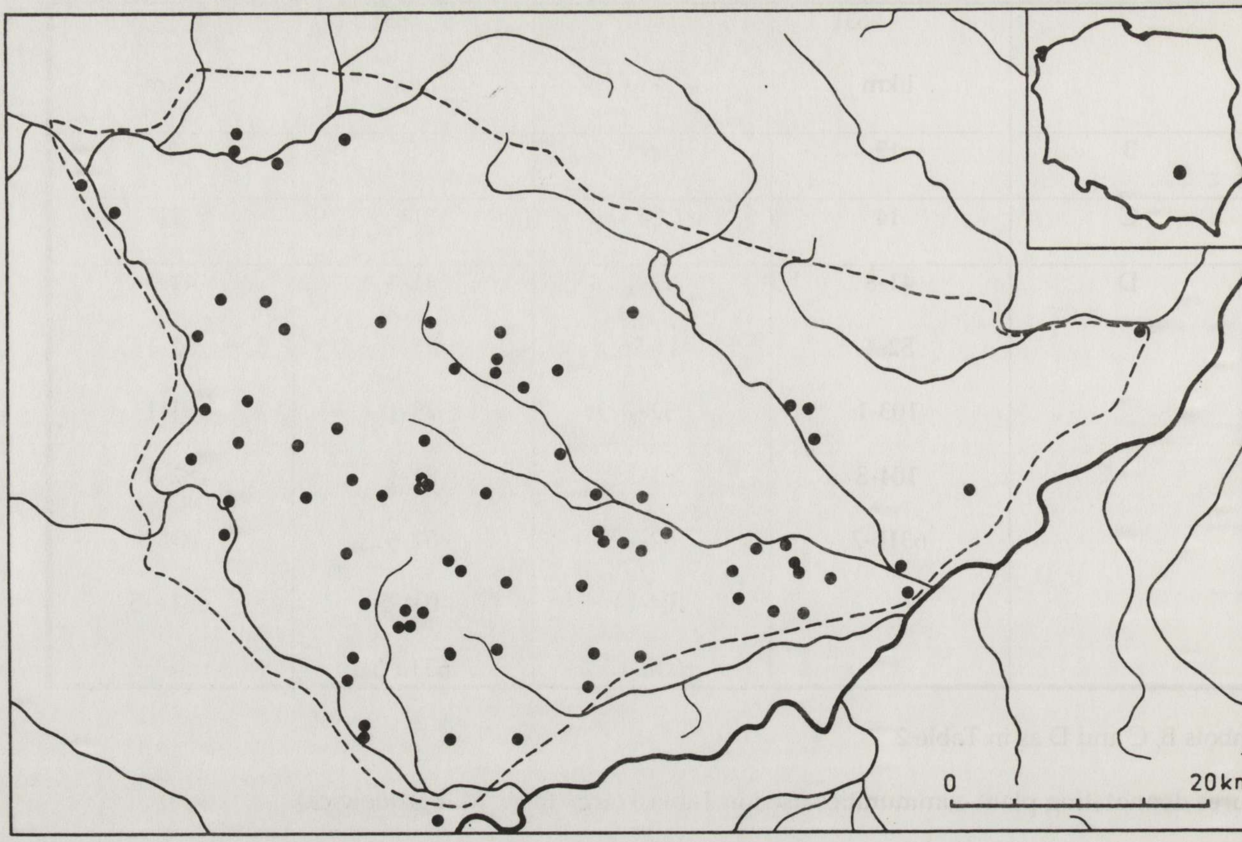


Fig. : 1

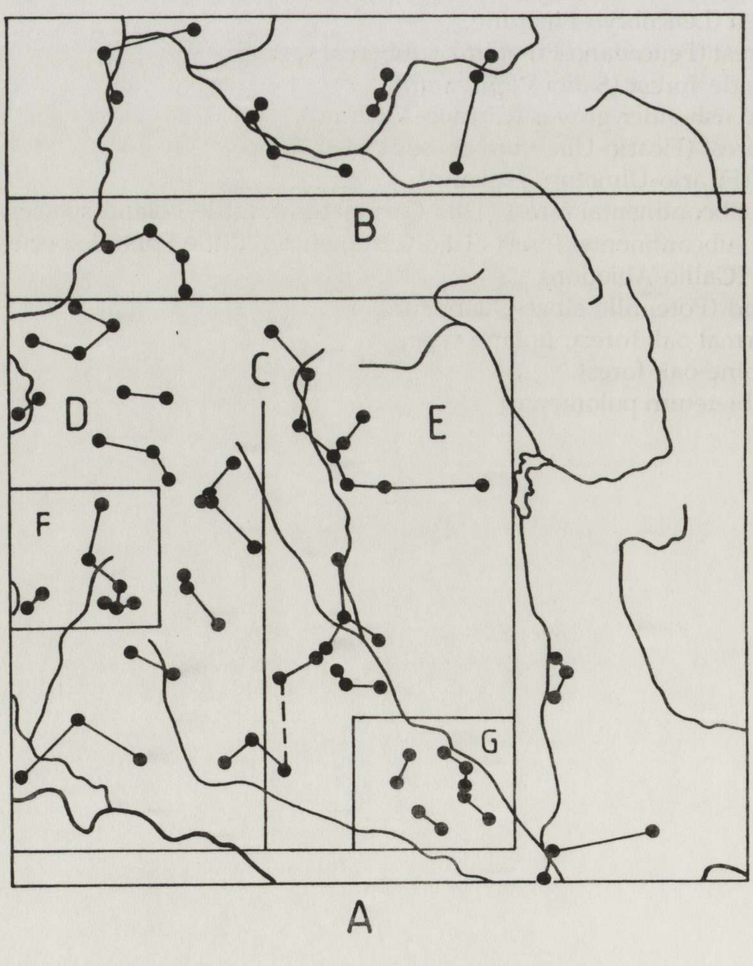


Fig. : 2

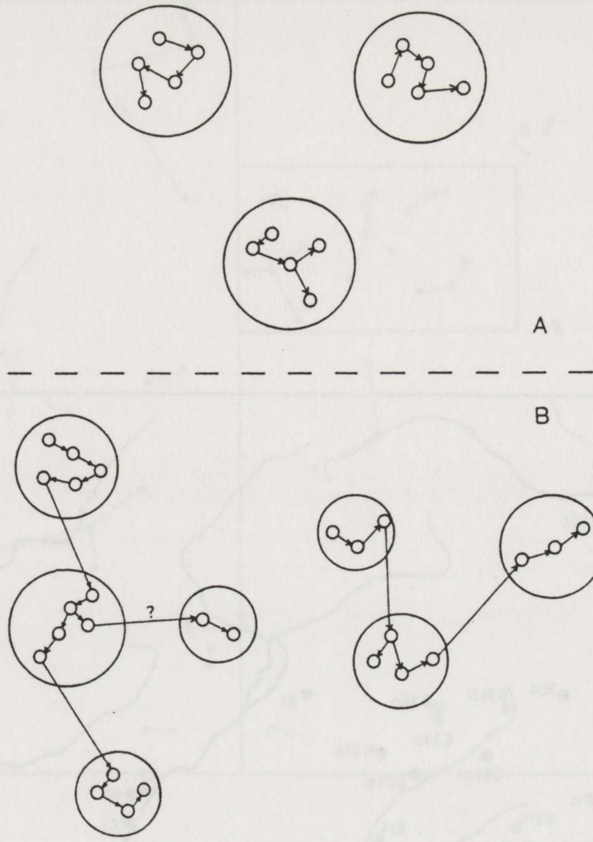
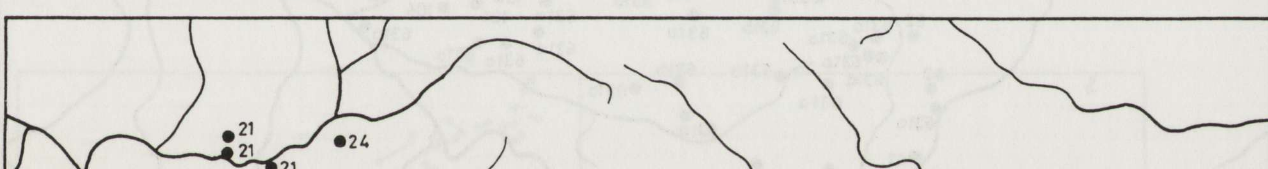


Fig. : 3



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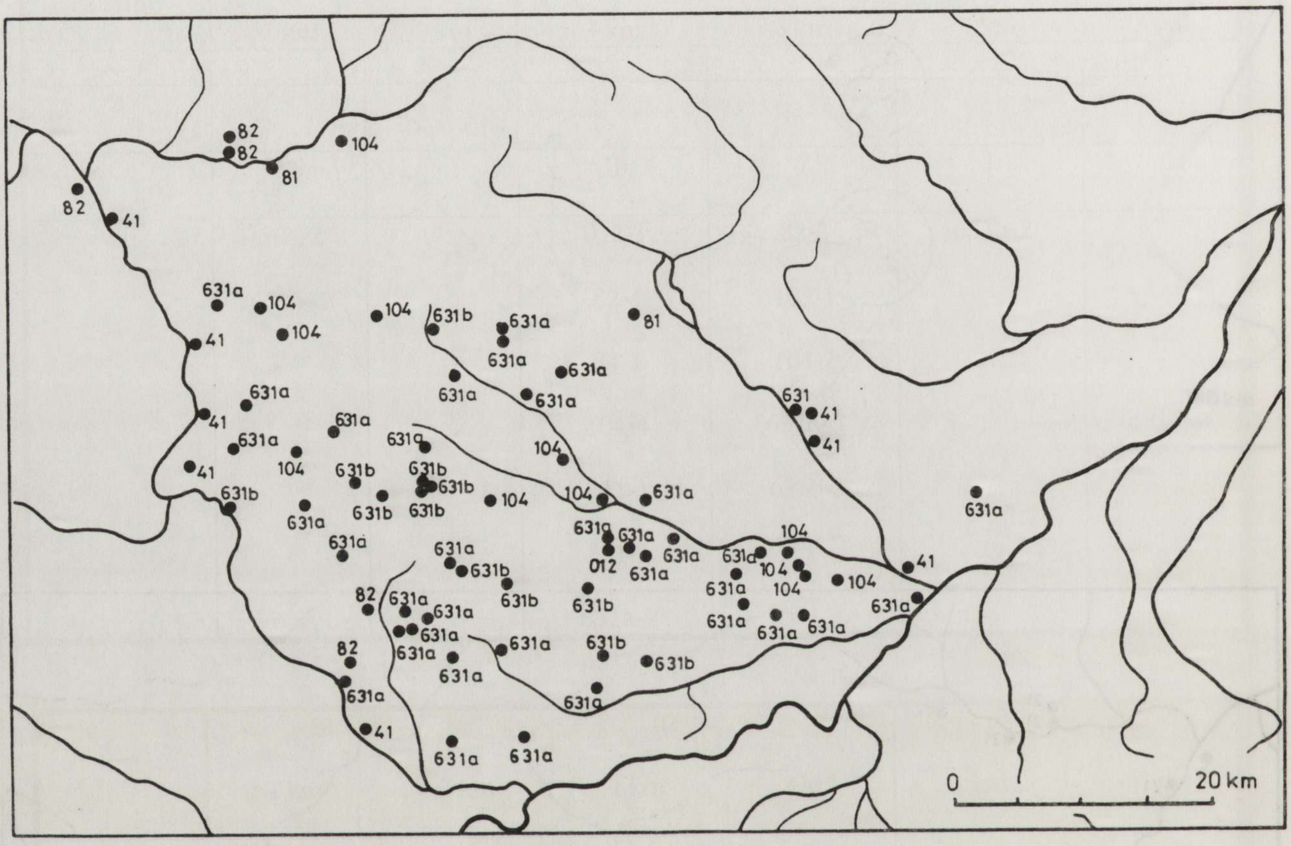

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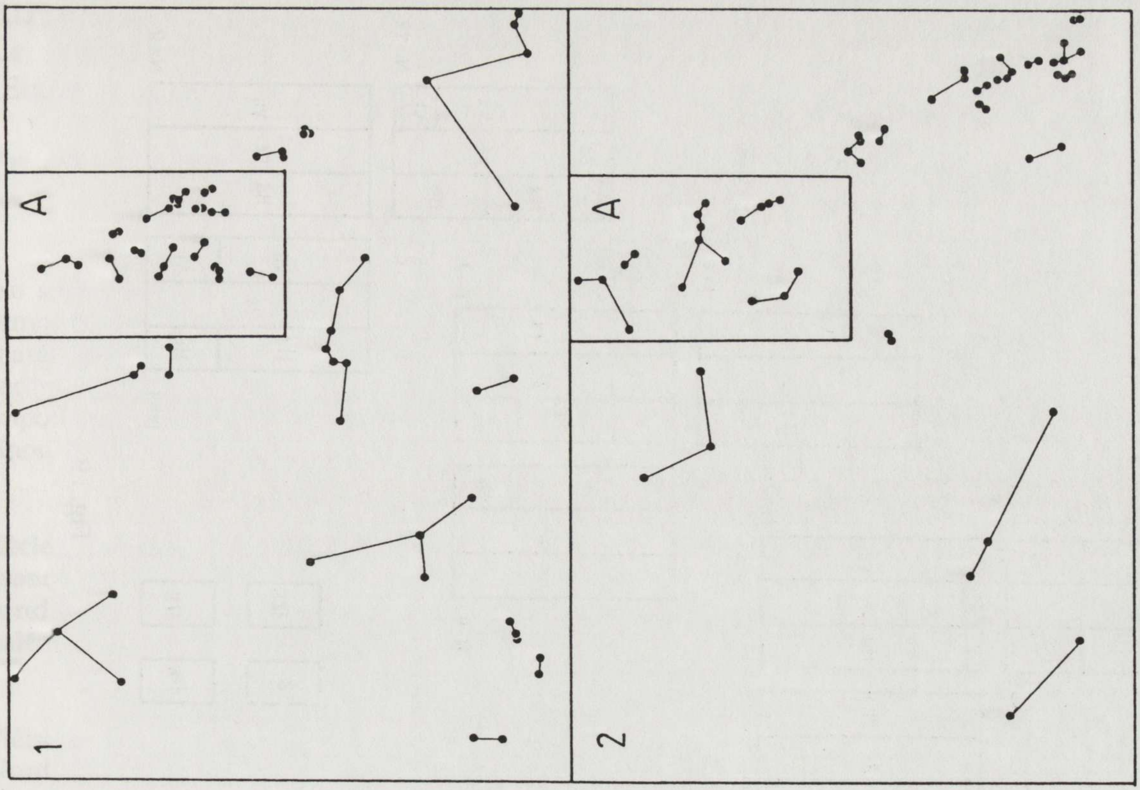

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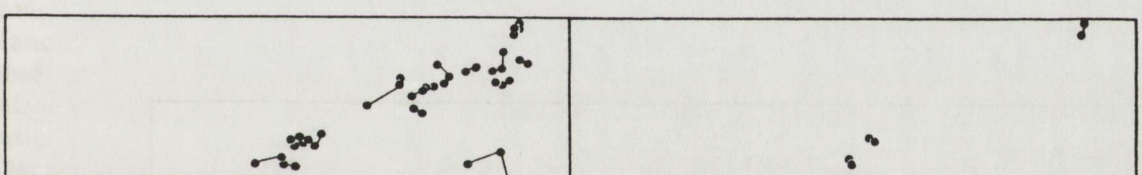

Fig. : 6

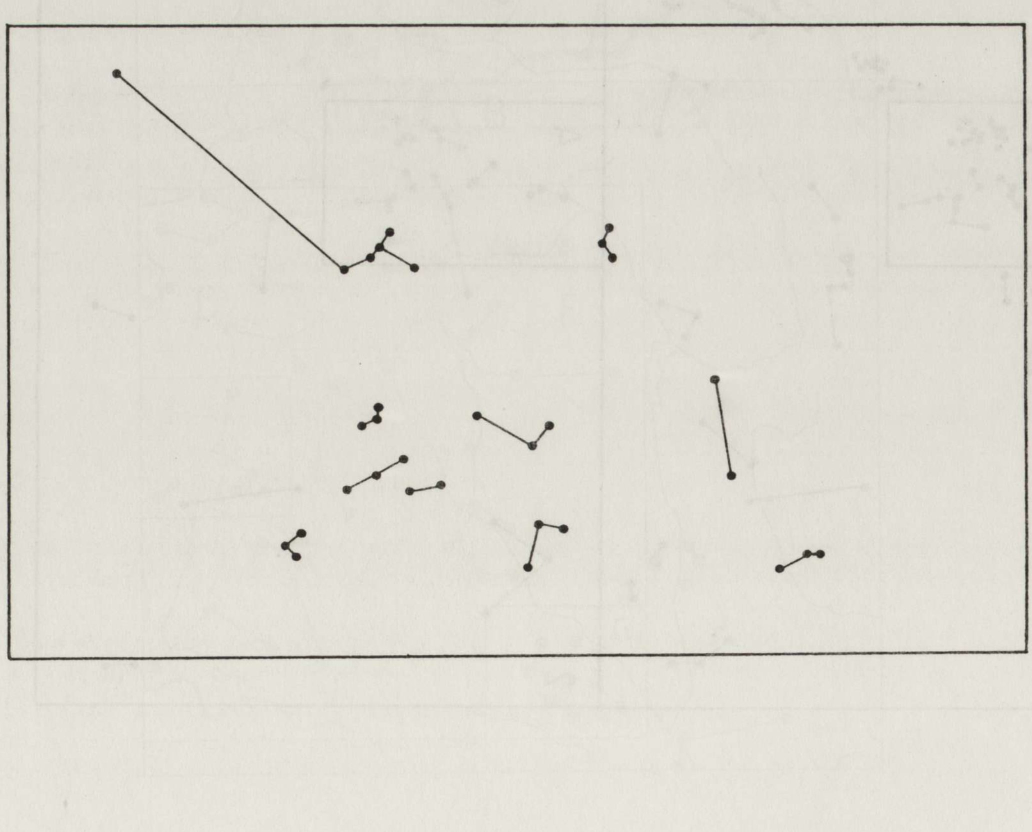

Fig. : 8

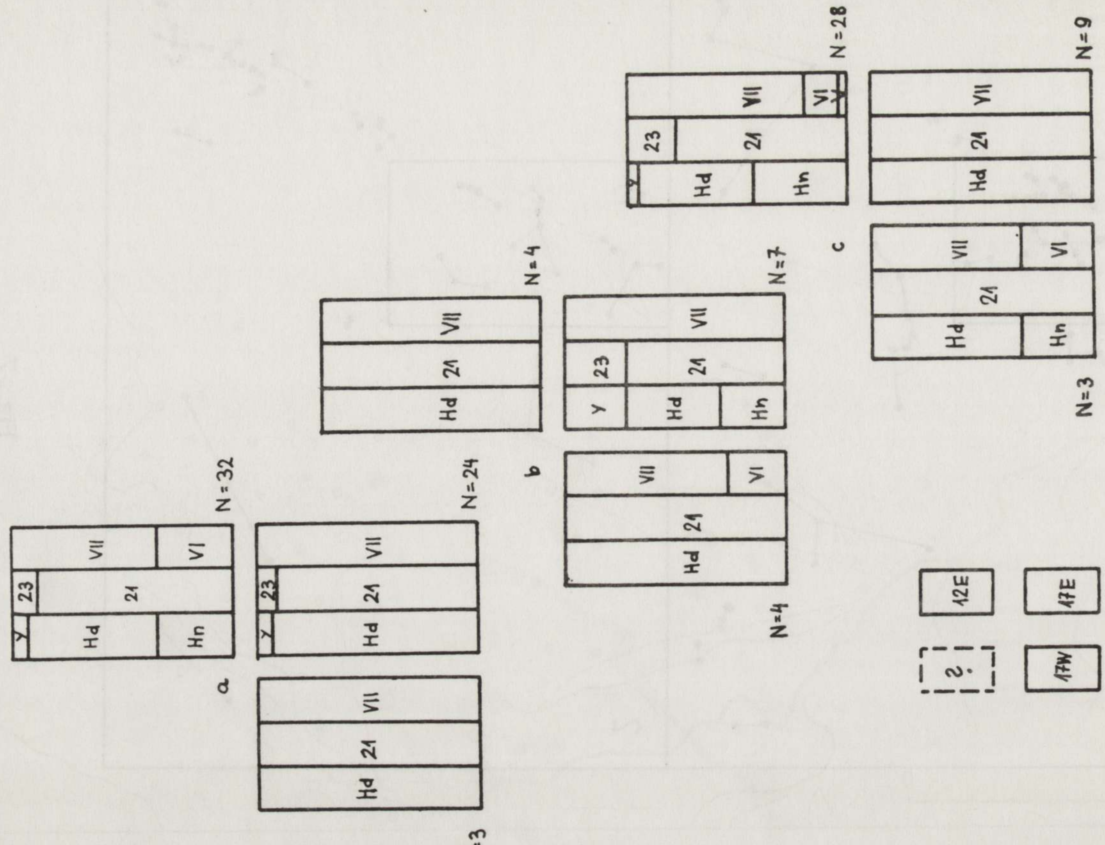

Fig. : 9