

TRB SETTLEMENT PATTERNS ON THE DUTCH SANDY SOILS

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The TRB (Funnel Beaker) culture reached its westernmost extension within parts of the Netherlands between 2700 and 2150 bc.

Its boundaries, unequal distribution and site location on various sandy soils within this country are the subject of this article, along with the relations and axe trade between TRB and neighbouring cultures. The argument starts with small scale maps for the overview, while successively larger scale maps¹ allow more intricate discussion. The original map scales (not those of reproduction) are given in the text. TRB settlement was on dry sandy soils, but subsequent podzolisation has left us, until now, with no house plans, very few refuse pits, and no unburnt organic remains. Research has concentrated on megalithic tombs, flat graves, the (often partial) excavation of half a dozen settlements, palynology, and, recently, the distribution of sherd finds as related to physiographic maps. This article is mainly concerned with the last issue – an empirical detection of physiographic factors which may have determined the choice of terrain by the TRB population. In combination with palynology (which has guided thinking on the Neolithic environment since the last war) such map studies will eventually lead to a detailed understanding of the landscape in TRB times. Future research should also be directed to social and economic factors, which are merely touched upon in the present study. For most sites the kilometre co-ordinates of the Dutch grid are provided in brackets to enable location on the maps.

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

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

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

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

In the Ruhr area limits may have been set by the loess boundary, as in this border zone TRB groups restricted themselves to the sandy islands. Perhaps this was because the TRB population "possessed the formula" for subsistence on sandy soils, but not on the more loamy soils. One may suggest differences in the appropriate methods of tillage, reclamation and weed control. It seems much less certain (though it

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

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

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

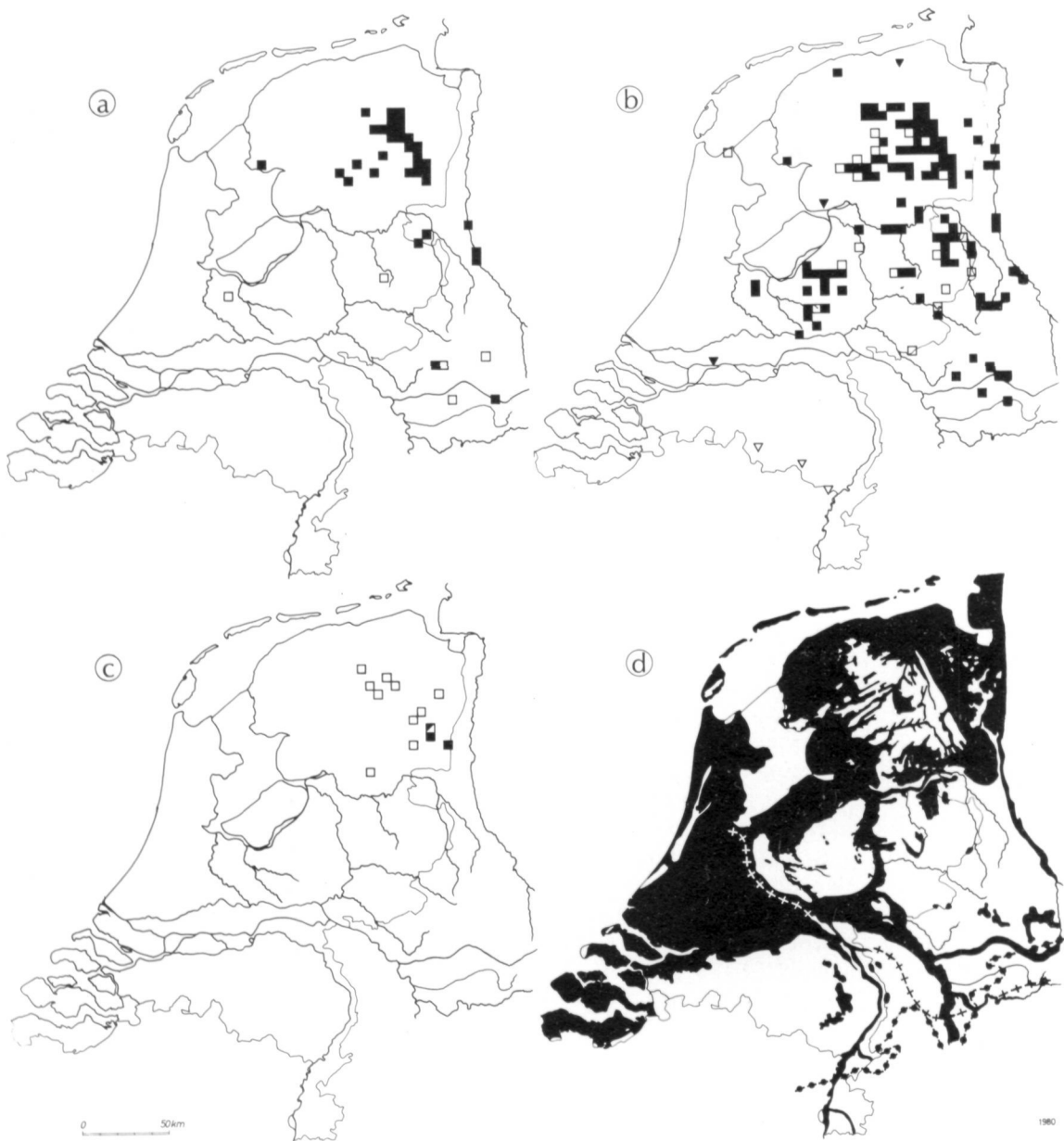


Fig. 1. TRB distribution in the Netherlands and in adjoining parts of Germany per 5 x 5 kilometre blocks of the Dutch national grid (December 1980).

(a) Hunebeds (open: uncertain).

(b) Finds of pottery (black) or battle-axes (open, but only given in blocks without pottery finds). Triangles: isolated finds outside the main TRB area.

(c) Hoards of flint axes (open) and votive deposits of pottery (black), mainly in or along peat or other wet places.

(d) Geology. Black are clays, peat bogs and other wet deposits, white the contemporary sands. The crossed line indicates the southernmost extension of the Saale/Riss glaciers, the dotline the northern limits of the loess zone.

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

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

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

archaeological research.

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

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

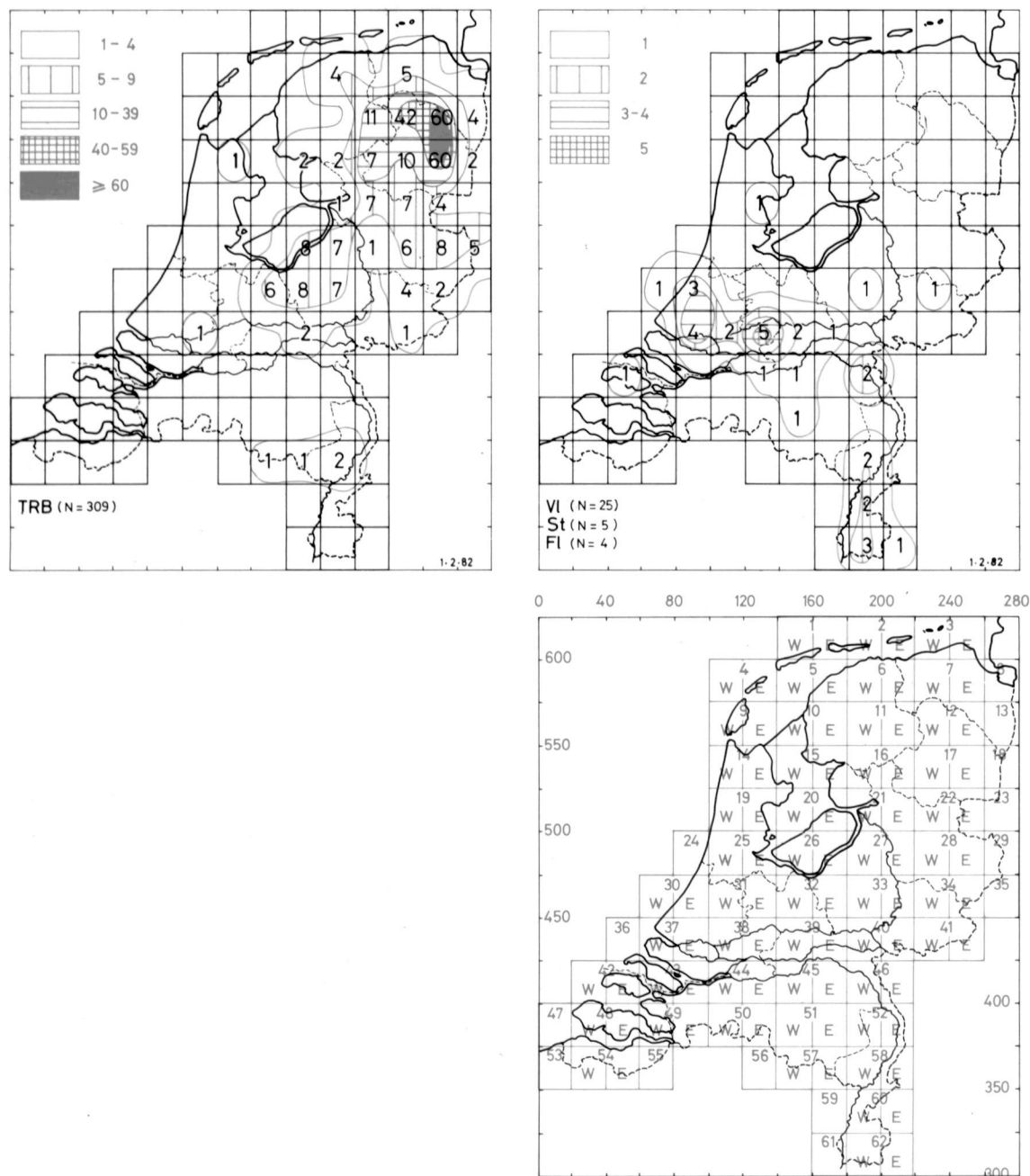


Fig. 2. *Left*: the number of known TRB sites per 1:50,000 map sheet and "lines of equal density". *Right*: the same for the sites of the Vlaardingens, Stein and SOM cultures and for flint mines, but more provisional. Finds in Germany and Belgium were omitted. *Below*: co-ordinates and sheet numbers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

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

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

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

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

Fig. 3 shows the distribution of Buren axes

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

The mountain region east of the Rhine must have hampered the spread of Buren axes towards the east, but why did this not happen beyond Duisburg into Westphalia and Lower Saxony? Perhaps "real" TRB axes gave enough counter pressure there, such as the large thin- and thick-butted flint axes with rectangular cross-section imported from N. Jutland, Schleswig-Holstein and Rügen, and the small *Flint-Rechteckbeile* ubiquitously made in the boulder clay regions west of the Elbe. Similar forms made from other erratic rocks were also involved (Brandt 1967, maps 24-27). Strikingly, the large "Nordic" flint axes are exceptionally heavily concentrated on the Drente Plateau, especially in axe hoards (fig. 1c). Nowhere west of the Elbe is a similar number of hoards found (Rech 1979, map 2; information Dr. W.H. Zimmermann), notwithstanding a tradition of

archaeological collecting in N.W. Germany quite as long and intensive as in the northern Netherlands. Harsema (1979) has sought to explain the Drente concentration as being due to direct, professional, trade between Drente and Jutland, but why does the distribution of such axes in Lower Saxony (Brandt, l.c.) show a gradual dispersion overland (via the three to four crossing places of the Elbe) until one reaches the Drente Plateau with its sudden increase in density? This suggests to me a "down the line" handing-on of axes from settlement to settlement, without professional traders (1976).

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

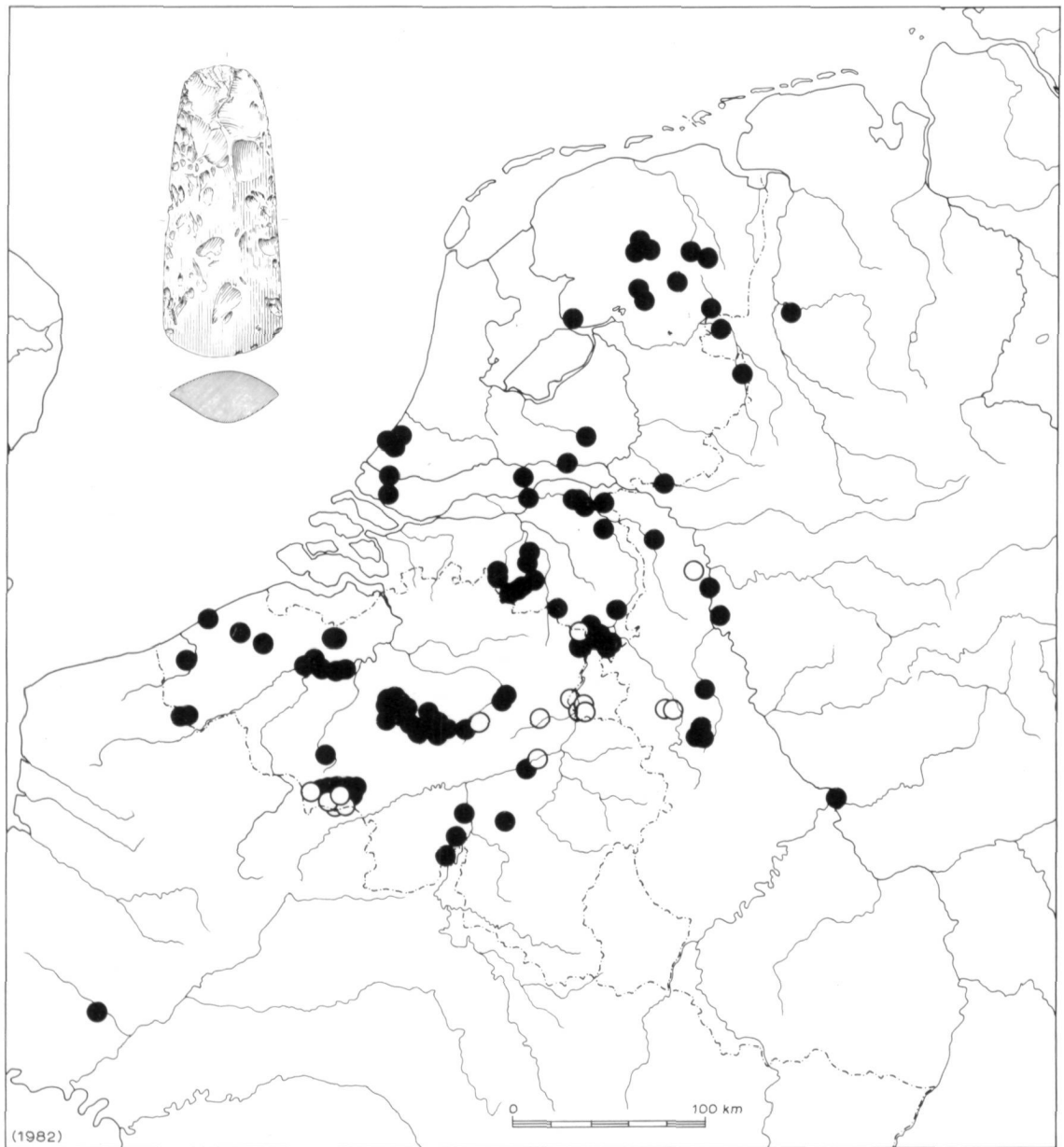
Unpolished rough-outs of Buren axes were seldom found over 60 km away from the flint mine zone, and in their distribution area they are less common than finished polished axes. This suggests that the rough-outs were polished when they were resold further and further away and that this polishing had already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

Unfortunately the origin of most flint sources

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

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

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



from the Spiennes area via the Schelde tributaries, but also by an overland route leading from the Hesbaye and Brussels towards Ostend. Or was the concentration along the present E5 highway only due to dense settlement along loess- and sand/clay boundaries? Thus the

Buren axe distribution was probably much more complex than a simple series of overlapping ovoid supply areas from each individual mine.

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

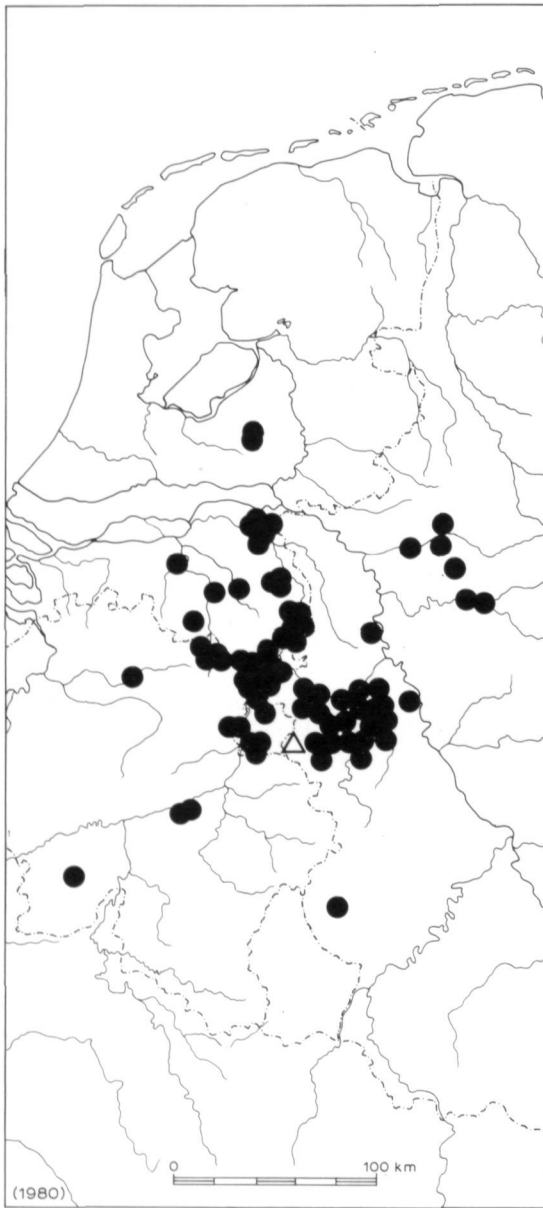


Fig. 3. (*opposite*) Distribution of Buren axes (see the text). Rough-outs are indicated by circles.

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

axes could not compete in popularity with the splendid tall Buren axes.

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

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

The fact that the cultural boundary is formed by a definite landscape boundary makes me less averse to the concept of "environmental determinism" of "environmentalism" than some social geographers seem to be. On a microscale, "determinism" is sometimes translated as "pos-

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

sibilism", specifically the aptitude of some populations to exploit their habitat as flexibly as possible (Taylor and Tatham, in Taylor 1952). The diversity of the wet Vlaardingen environment is sufficiently known, but we have only begun to discern the heterogeneity of the "dry sands" landscape occupied by the TRB culture.

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

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

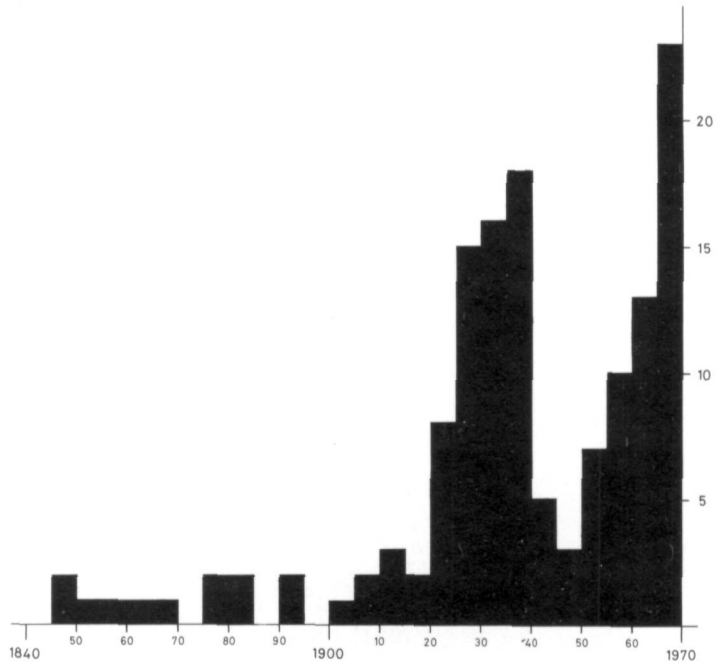
Initial cautionary remarks. The procedure outlined above depends on at least three assumptions. (1) That the TRB distribution is suitable to generalisations of this kind. In my opinion such generalisations are acceptable for any human behaviour. Individual deviations – which some societies find more permissible than others – may reveal themselves as incidental anomalies in our records; if they found no subsequent acceptance. Another matter that concerns us is at what remove within the TRB *Kulturkreis*² the "normal" or collective behaviour is similar in similar cases. The fact that the German peaty Dümmer basin was settled by the TRB West Group while the Dutch peat bogs were not, can best be explained by the different habitat poten-

tial of these landscapes. Perhaps a different case is presented by the flourishing of the TRB South and Southeast Groups on loess soils while the TRB West Group was more averse to loess. As long as no proof of essential environmental differences is given, we may have here an instance of poor information exchange between different "Groups" belonging to the same TRB "culture". Such cases may be expected where similar landscapes occur very far apart within a "culture" and are absent from the contact zone of the "Groups" concerned.

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

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

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



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

One possibility for gathering negative evidence for the TRB distribution has not yet been explored. The total surface of Dutch archaeological excavations on sandy soils amounts to several hundreds of hectares. Although one has not always been prepared for observing Neolithic features while excavating much later (and sharper) soil discolourations, TRB flat graves with pottery can hardly have been missed; in addition, scrapers, querns and decorated sherds were quite often found on such occasions. When

the B horizon is largely intact the lack of TRB finds seems sound evidence for inferring the absence of TRB settlement. For instance, it seems meaningful that the 4 ha Kootwijk excavations of medieval settlements (182/466) have only produced one Vlaardingen pot, some scrapers, one transverse arrowhead, one large Beaker "with short-wave moulding", one Veluwe Bell Beaker, and one Pot Beaker, but no TRB ware (personal information H.A. Heidinga).

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

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

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

The TRB area further defined. While playing with overlay and maps in Atlas 1 it became clear that TRB sites are found on contiguous sandy soils, but with the following restrictions (fig. 6):

1. North of the rivers Emscher and Rhine, the Amsterdam-Rijn kanaal and the line Amsterdam-Alkmaar-Bergen aan Zee (symbol 1).
2. Not on the present coastal dunes (which did not exist at the time) or on then existing coastal barriers.
3. Not on peat, "mucky brook-soils" or clays, symbol 2 (Atlas 1, Pl. IV-12).
4. Not on "non-mucky brook-soils and gley soils" (*ibid.*), symbol 3.
5. Not on loess soils (*ibid.*), symbol 4.
6. In the Veluwe not on dry sands above 55 m above NAP (Dutch Ordnance Datum, identical to German NN, about at sea level), symbol 5.
7. Not on damp sandy soils, symbol 6 (Atlas 1, Pl. VII-6, winter ground water table below 70 cm).

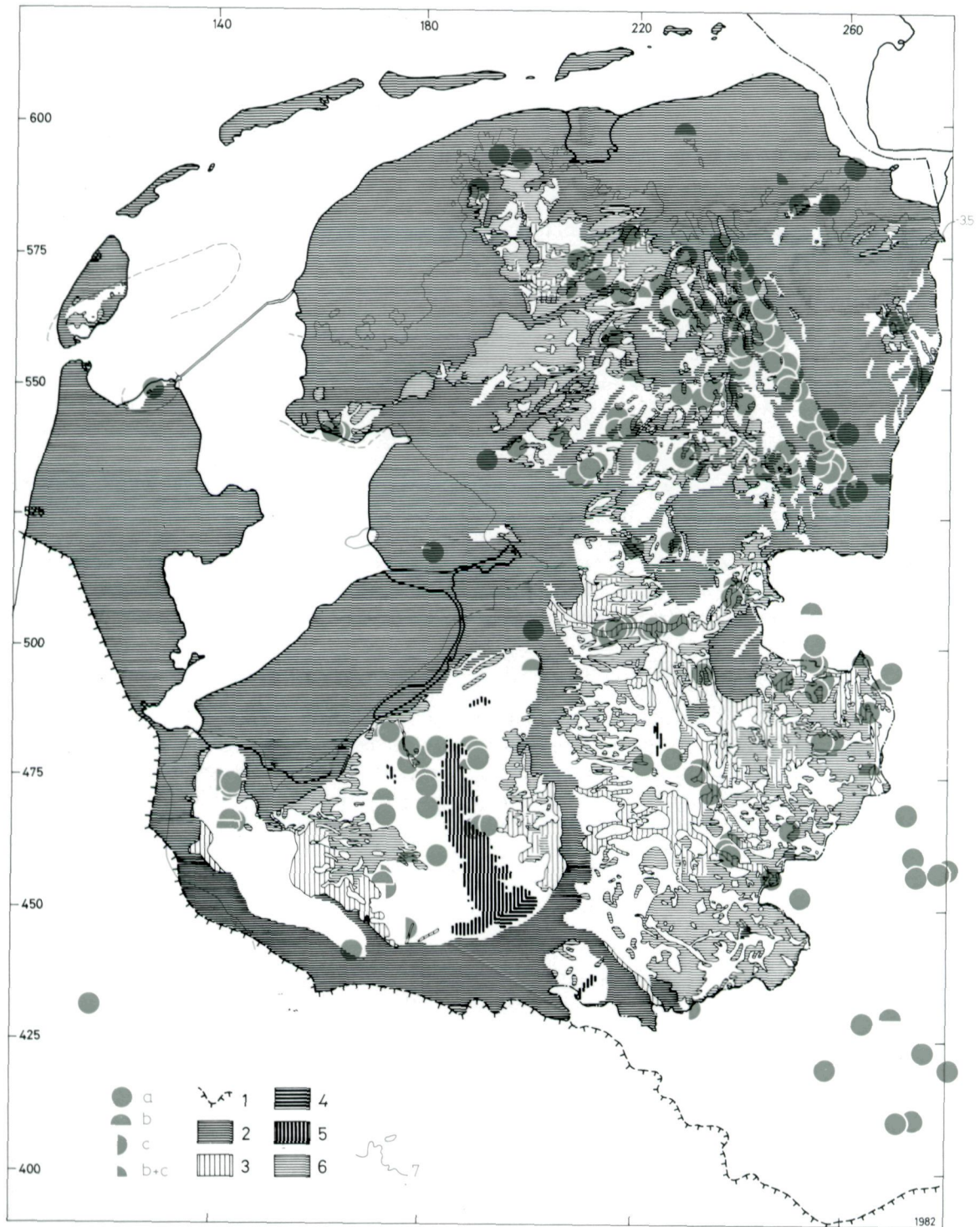
There are some real and *quasi* exceptions to this: (a) the above-mentioned four battle-axes found along the Belgian border, on sandy soils. Another was found at Ste. Cécile in the Semois valley, on the Franco-Belgian border. (b) the TRB votive deposits on the Drente Plateau, which were frequently placed along wet places, which were later overgrown by peat. Several battle-axes also derive from wet places. (c) the above-mentioned TRB pottery from the Vlaardingen settlement on the small dune of Hazen-

donk, in the middle of the fluviatile Vlaardingen district. (d) sites which afterwards became covered by peat and sometimes subsequently by clay, but which lay originally at the well drained brink of the sandy Drente Plateau (Bornwird (192/594) and Steenendam (189/588) in Friesland: Fokkens 1980). (*See the Postscript*). (e) sites on isolated sandy outcrops which formed part of the large sandy districts at the time (Oostrum (199/594) in Friesland). (f) doubtful exceptions are the unbroken funnel beaker said to have been found in marsh clay at Lutjesaaksum (228/597), north of Groningen (Van Giffen 1957; Roeleveld 1974b) and a reused battle-axe at Woltersum (244/588), also found in clay of the same region, but which may have been a medieval import (Lanting 1977).

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

Fig. 6. The TRB area further defined (see the text). Original scale 1:600,000 (Atlas 1). Date of compilation June 1982. The coordinates of the national grid (in kilometres) are given.

- a - TRB artefact(s), findspot certain
- b - idem, findspot not exactly known
- c - uncertain TRB artefact(s), findspot certain
- 1 - line of the Emscher, Rhine, Amsterdam-Rijn kanaal, Amsterdam, Alkmaar, Bergen aan Zee
- 2 - peat, "mucky brook-valley soils" and clays
- 3 - "non-mucky brook soils and gley soils"
- 4 - loess
- 5 - area above 50 m above NAP in the Veluwe
- 6 - sandy soils with a winter ground water table below 70 cm
- 7 - contour line of 3.5 m below NAP for the top of the Pleistocene (see Postscript)



(Harck 1980, 1973; Harck et al. 1974; Müller-Wille 1981). Megalithic graves and other TRB finds are known there from Pleistocene sands. TRB axes, however, also stem from coastal barriers which must have carried TRB habitation. Some finds stem from contemporary peat bogs, but none are known from the little that is left of contemporary clays (*unterste Sedimentdecke*: Hoffmann 1980; Harck 1980). So the dubious Dutch finds on clay are without parallels elsewhere.

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

The Dutch data provide no good evidence by themselves for TRB avoidance of loess soils, because the only relevant area (fig. 6, symbol 4) borders on a very dry sandy region of the southeastern Veluwe which is also without finds. Strictly speaking the "non-mucky brook-valley soils and gley soils" (fig. 6, symbol 3) again occur in areas with too few TRB finds to be certain that they were avoided. Larger map-scale research clearly shows, however, that settlements occurred on the banks of small streams, where the refuse was dumped into the water (Modderman et al. 1976).

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

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

must have been a prime necessity (Groenman-van Waateringe 1978, figs. 6-7).

None the less, these hydrographic maps give only a very distorted image of the relative situation in TRB times. First, the modern use of drinking water, the digging of peat, the canalisation of streams and the making of ditches has rendered the country much drier than it was a few centuries ago. Second, the rise of the sea level since TRB times and the enormous spread of peat bogs in the Bronze and Iron Age and afterwards have clogged the Neolithic drainage systems considerably, especially in low places³. Some settlement sites have even been covered by peat. The Sub-Boreal climate was somewhat drier in the Neolithic period than in the Bronze Age, and certainly drier than in the Sub-Atlantic period and today. Dr. Zagwijn reminds me, in addition, of the fact that a primeval deciduous forest transpires much more water than heathlands, fields, or meadows. Consequently, dry regions were less dry and the wet regions were often less wet in the TRB period than now. Furthermore, conformities between TRB settlement and hydrographical maps in one landscape will not be completely applicable to others.

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

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

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

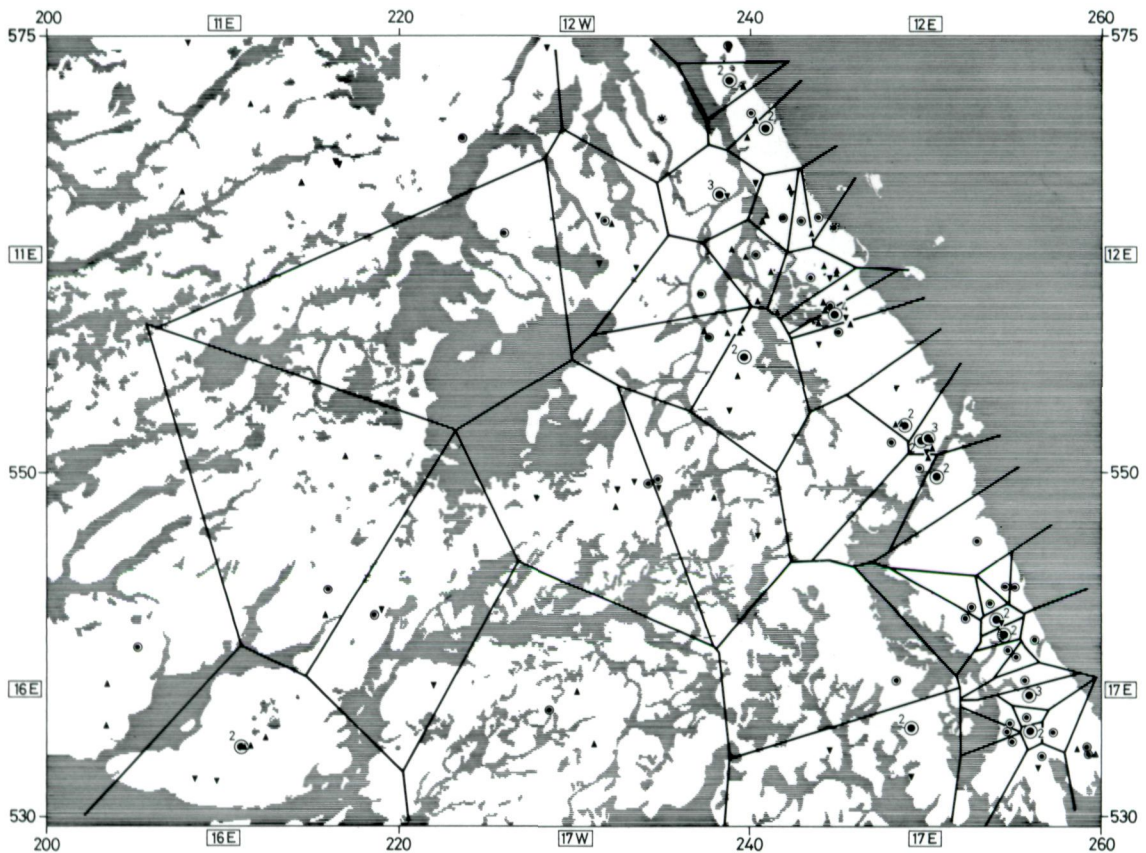


Fig. 7. Sand/peat division on part of the Drente Plateau. Standing triangles indicate stray sherds or settlement sites, hanging triangles flat graves and one stone cist, circled dots hunebeds. Because these passage graves were all in use during pottery phase D, Thiessen polygons around them should indicate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

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

published sheets because the latter were often simplified for the sake of clarity.

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

A. *The Drente Plateau.* The Drente Plateau again is not evenly covered by known TRB sites (fig. 7). Whereas the distribution of settlements, flat graves and findspots of one or more sherds

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

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

The soil maps demonstrate that hunebeds are found in immediate proximity of the erosion "escarpment" of the boulder clay cover, but that they were constructed upon well-drained coversands, or similarly textured preglacial sands, while the ill-drained till subsoils were avoided (Wieringa 1968). On the Hondsrug and the Ridge of Rolde the periglacial erosion of the formerly uninterrupted boulder clay layer has left a landscape of straight wet till ridges and of later often coversand-filled dry valleys between them (fig. 8). The straightness of the border zones between till and the dry sands

which were preferred for hunebed building sufficiently explains the alignment of the hunebeds here. Their situation along roads has thus become superfluous as an explanation, but long distance roads may in fact have chosen such courses, demanding the least "relief energy" and a dry soil.

Three soil map sheets for the southeast corner of Drente (fig. 9e, cf. fig. 7 for their location) were used for a more detailed analysis of TRB site location. I refer to former studies (Wieringa 1968; Bakker 1980) and Table 1. The soil map 1:50,000 presents, simultaneously, a division according to three features: (1) soil type *sensu stricto*. The most important sandy soils are coded Y = *Holtpodzol*, "typical (non-humic) brown podzolic earth"; Hd = *Haarpodzol*, "humuspodzol", Hn = *Veldpodzol*, "typical (humic) gley-podzol"; and pZg or pZn = *Beekeerd*, *Broekeerd*, or *Gooreerd*, "typical humic-sandy gley soil". KX indicates a boulder clay or "pot clay" near the surface and "x" a depth of these between 40 and 120 cm. (2) The texture of the upper layer of parent material is coded: 30 = coarse sand, 23 = loamy fine sand, 21 = fine sand with little or no loam. "Loam" is the fraction smaller than 50 μ ; symbol 23 has over 17.5% of it, and symbol 21 less. (3) The main ground water level is indicated by the ciphers VII (very dry) to I (very wet). The foreign user of the Dutch soil map is referred to the well illustrated *Major soils and soil regions in the Netherlands* (De Bakker 1979) which provides the multilanguage glossary from which Table 1 was compiled.

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

Table 1

Glossary of the relevant Dutch sandy soil types

Dutch soil map 1:50,000 ^a	<i>Holtpodzol</i> soil code Y	<i>Haarpodzol</i> soil code Hd	<i>Veldpodzol</i> soil code Hn	<i>Beekeerd</i> soil* code pZg	<i>Enkeerd</i> soil* code zEZ	<i>Duinvaaggrond</i> * code Zd
Germany ^b	Rostbraunerde	Eisenhumus-podzol	Gley Podzol	Typischer Gley	Grauer Podsol-Plaggenesch	Podsol-Regosol
England and Wales ^c	Typical (non-humic) podzol brown earth	Humuspodzol	Typical (humic) gley-podzol	Typical humic-sandy gley soil	Sandy man-made humus soil	Podzolic sand-ranker
France ^d	Sol ocre podzoli-que modal	Podzol humo-ferrugineux	Podzol humique à gley	Sol humique à gley	Sol d'apport anthropique	Sol mineral brut d'apport éolien
U.S.A. ^e		Typic Haplohumod	Typic Haplaquod	Typic Humaquept	Plaggept	Typic Udipsamment

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

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

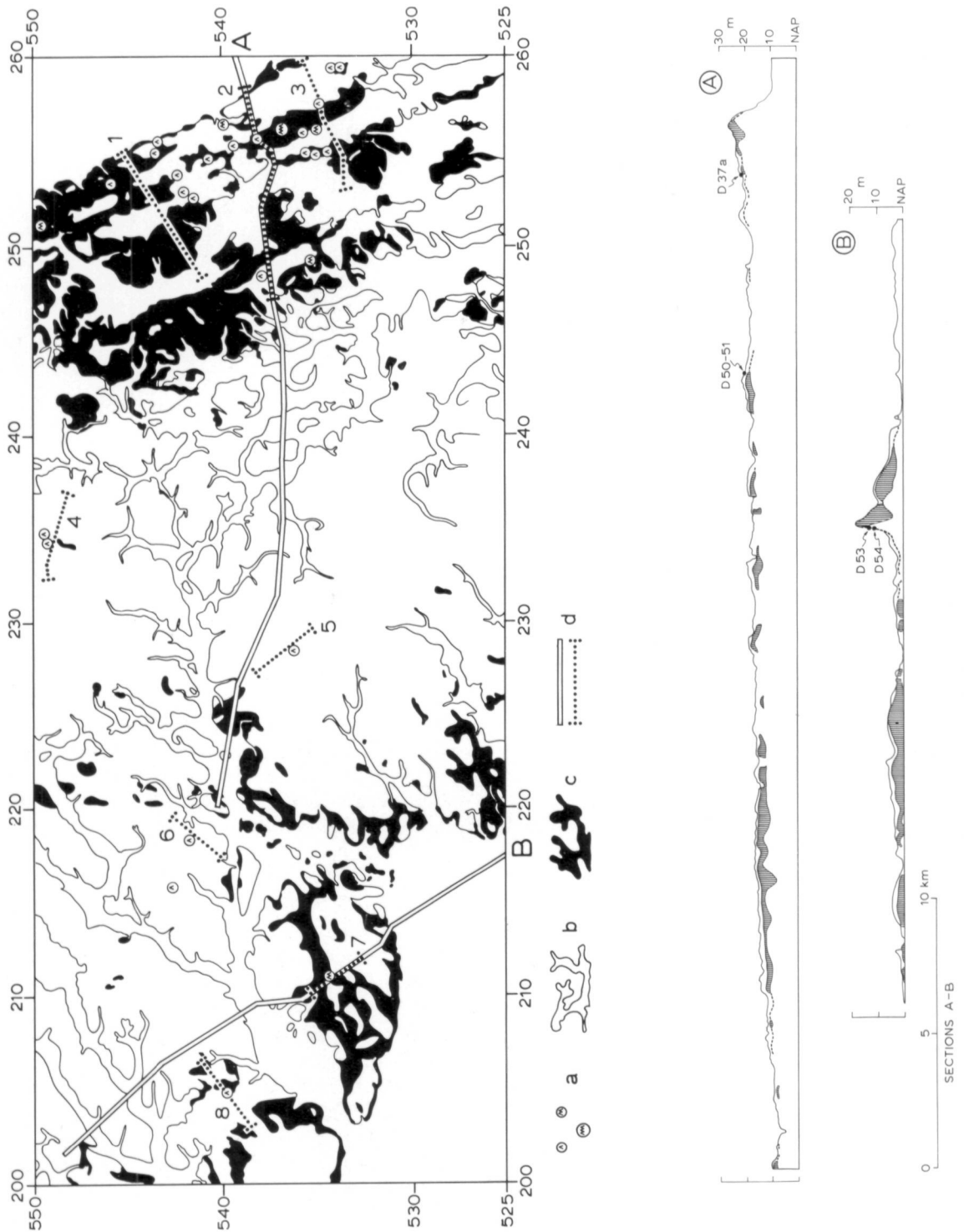
Emmen (260/530) and the stream valley at Borger-Buinen (250/550). *Beekeerd*, *Broekeerd*, *Gooreerd* and *KX* soils were omitted because they were avoided by TRB settlement, as were peatbogs⁴. The results are presented in fig 9d in bar graphs per map sheet for the soils on which (a) hunebeds, (b) flat graves, and (c) settlement or find spots of stray sherds were situated. There is a clear preference for Hd, 21, and VII. It is also plain that known graves and settlement sites are quite unevenly distributed. Because the plateau dips towards the north and the west, Y, Hd and VII gradually give way to Hn, VI and V into these directions.

The preference for 21 instead of 23 suggests a preference for Younger Coversands which are loamless, instead of the slightly loamier Older Coversands. This may partly be a quasi-relationship, however. If the tops of coversand ridges were chosen, they usually consisted of Younger Coversand, which in turn usually overlaid Older Coversand⁵.

The tabulations thus only refer to the site on which a settlement was situated. While it must have been convenient to locate houses on dry non-sticky sand, it is quite possible that the

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

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



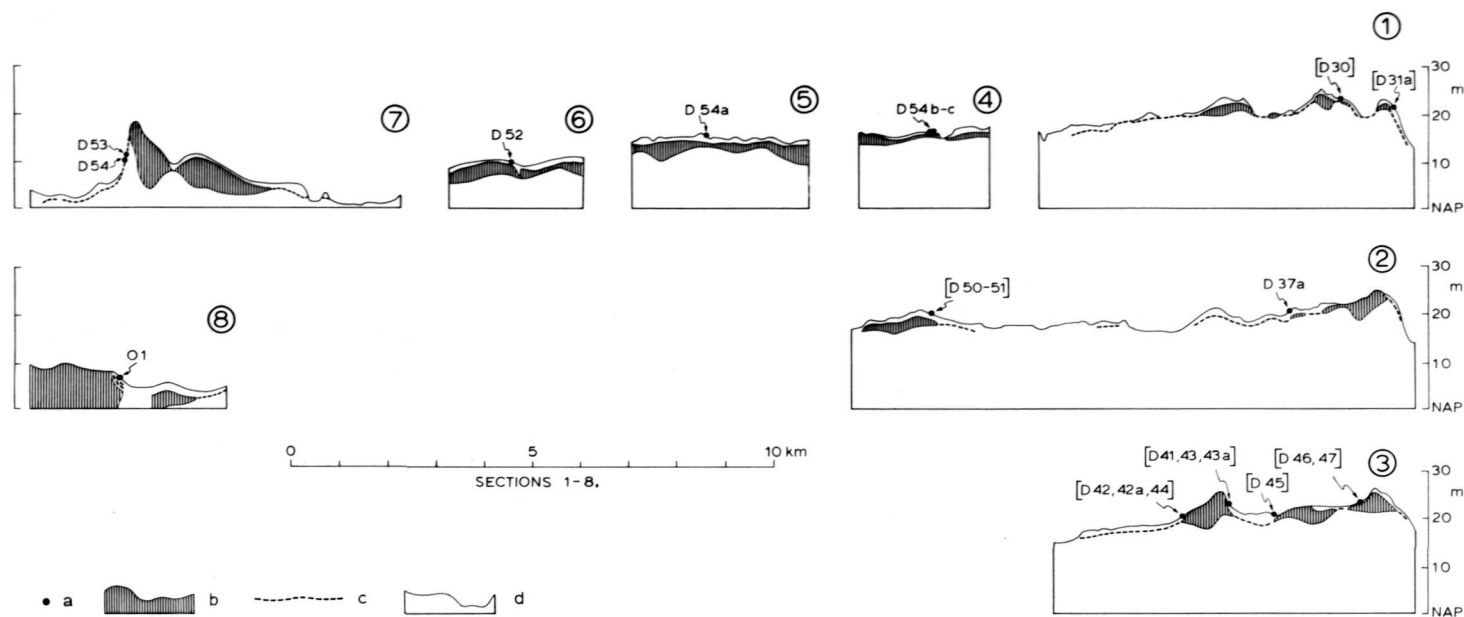


Fig. 8. Hunebeds were built where erosion had uncovered boulders from the till or "boulder clay" layer, and where later coversand deposition had not hidden them again.

Upper: map of the southern Drente Plateau (sheets 16E, 17W, 17E, cf. fig. 7). a - one, two, or three hunebeds, b - boulder clay, not (much) eroded, c - completely eroded boulder clay, d - position of the sections (below).

Lower: sections A-B and, enlarged, 1-8. The base line is on the NAP level. The plateau slopes towards the northwest. a - hunebed with registration number (in brackets those projected from some distance into the section), b - boulder clay, c - layer of boulders and smaller stones remaining from eroded till layer, d - other sediments, usually sandy (coversands are on top of boulder clay remnants). Peat, recent inland dunes and manmade enkeerd/plaggen soils are omitted. Source: M.W. ter Wee's geological map sheets 16E, 17W, 17E.

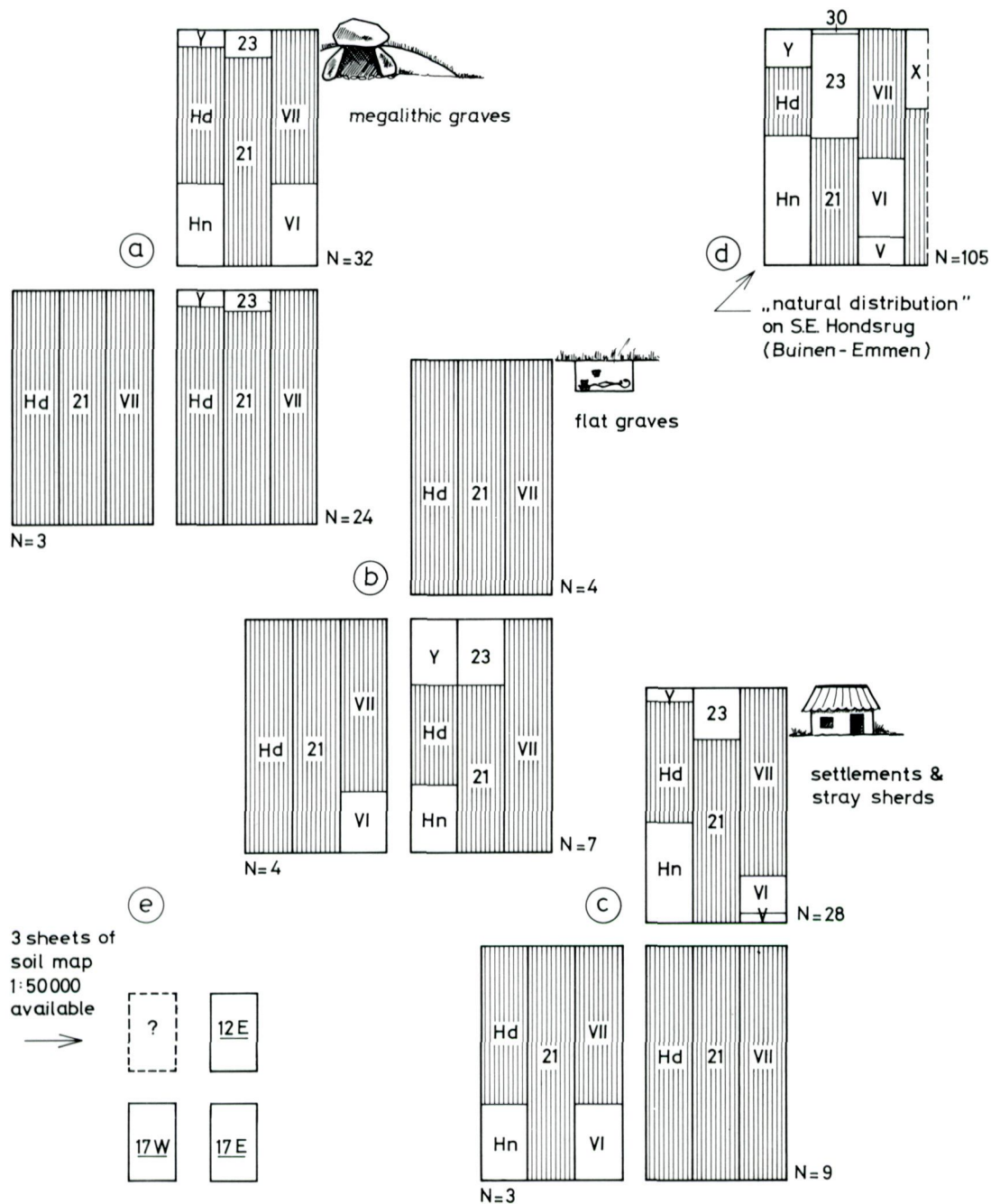


Fig. 9. Bar graphs of site characteristics of (a) hunebeds, (b) flat graves, and (c) settlements or stray sherds on the Drente Plateau, according to the sheets 12E, 17W and 17E of the 1:50,000 soil map (e). The present "natural distribution" of these features on the relatively dry sandy island in the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

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

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

The third landscape is the former fringe of the plateau, where two settlement sites near Dokkum (sheet 6W) are now overgrown by peat (Bornwird (192/594) and Steenendam (189/588); Fokkens 1980). Both represent TRB phases F-G which may have been precisely contemporary with the Corded Ware refuse found at the same places. At Bornwird fine ard-marks were observed belonging to one or both cultures. The sandy surface lay in the excavation pits at 0.8 to 1.6 m below NAP, but the lower margins of the ard scratches were not reached. Naked barley was grown here (Van Zeist 1970). Curiously the ard grooves appeared scratched into the leached layer of an Hd podzol in the higher parts and an Hn podzol in the lower parts of the excavation. Perhaps we have here an instance of secondary podzol formation (Waterbolk 1964) after the Neolithic occupation, but before peat growth started on top of the arable soil (1980 $\pm$ 50 bc, GrN-5295). Podzolisation must mainly have taken place since Bell Beaker times, according to the sections through hunebed barrows and through later barrows resting upon TRB flat graves. But this barrow evidence is restricted to the higher parts of the Drente Plateau and may have less relevance for its moister fringes. Further excavation of this peat-covered site may be advantageous, not only for

the finding of seeds and for ascertaining the extent of the arable plots, but also for revealing postholes, because the house sites must have been situated in the immediate vicinity of the 1966 excavation considering the pot sherd frequency (I am grateful to Mr. H. Fokkens for this information). The Oostrum flat grave(s) of phase G east of Dokkum were discovered at the base of a removed and much later *terp* lying on a coversand outcrop (199/594).

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

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

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

C. *The riverdunes along the river Vecht.* Much amateur activity since the 1960s has brought a fine series of findspots to the light (Van Beek 1970, and later finds), especially along the north side of the river (between 213/503 and 239/512). They are located on late Glacial coversand dunes along the important primeval valley of the Vecht south of the Drente Plateau. The soil

map (22W) indicates that these soils have 21 and VII, but that the Hd podzol was generally covered by dune sand or Enkeerd arable soil in medieval and later times. The direct riverside was often chosen.

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

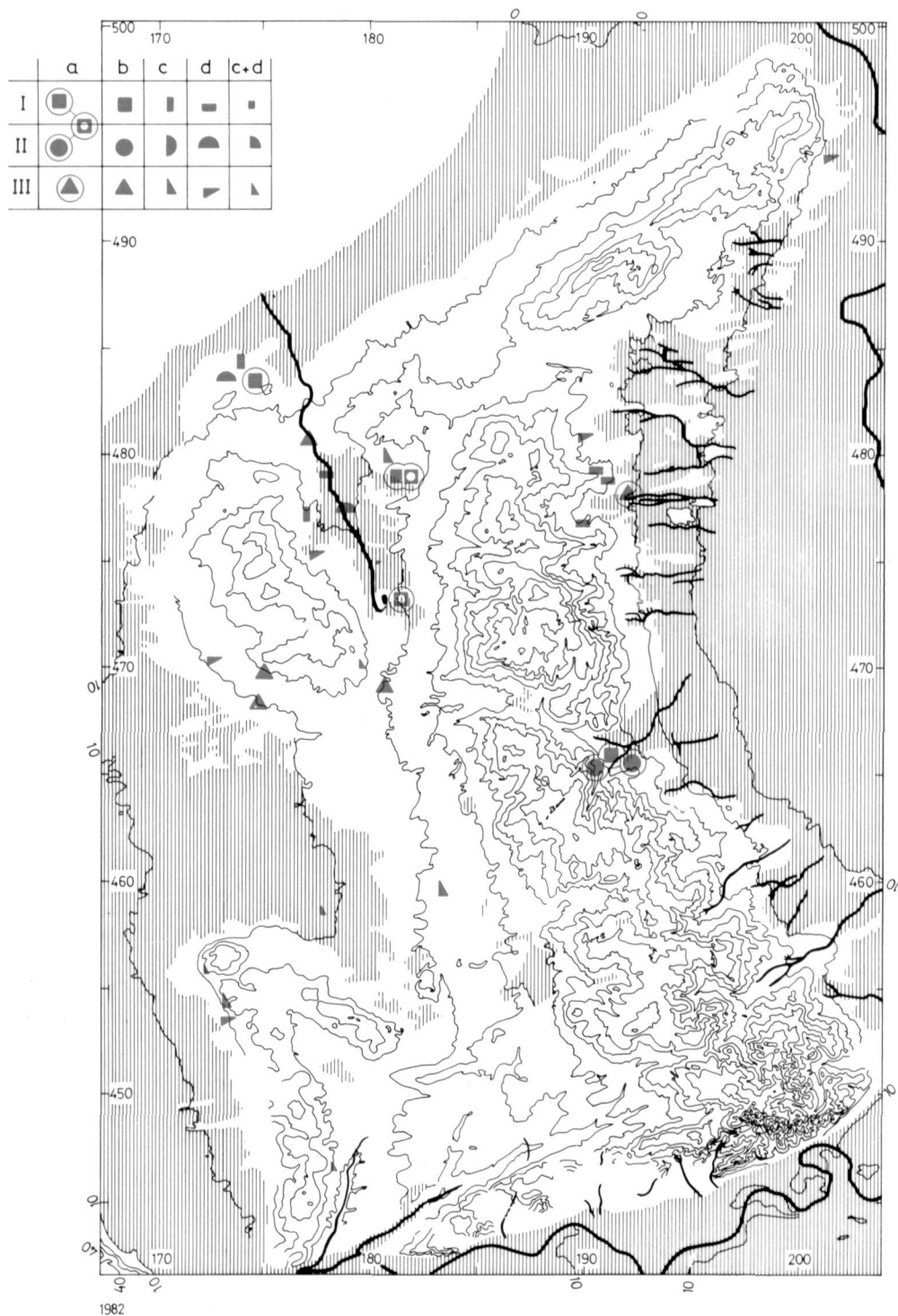
The number of known findspots (22) is too small for statistical work; only four are well localised settlements for which soil maps (sheets 28W, 34W, 34E) are available (Y23-VII, Y30-VII, two on Hd21-VII). Another settlement site was situated in a stream valley on a coversand ridge omitted on the soil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

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

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

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

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



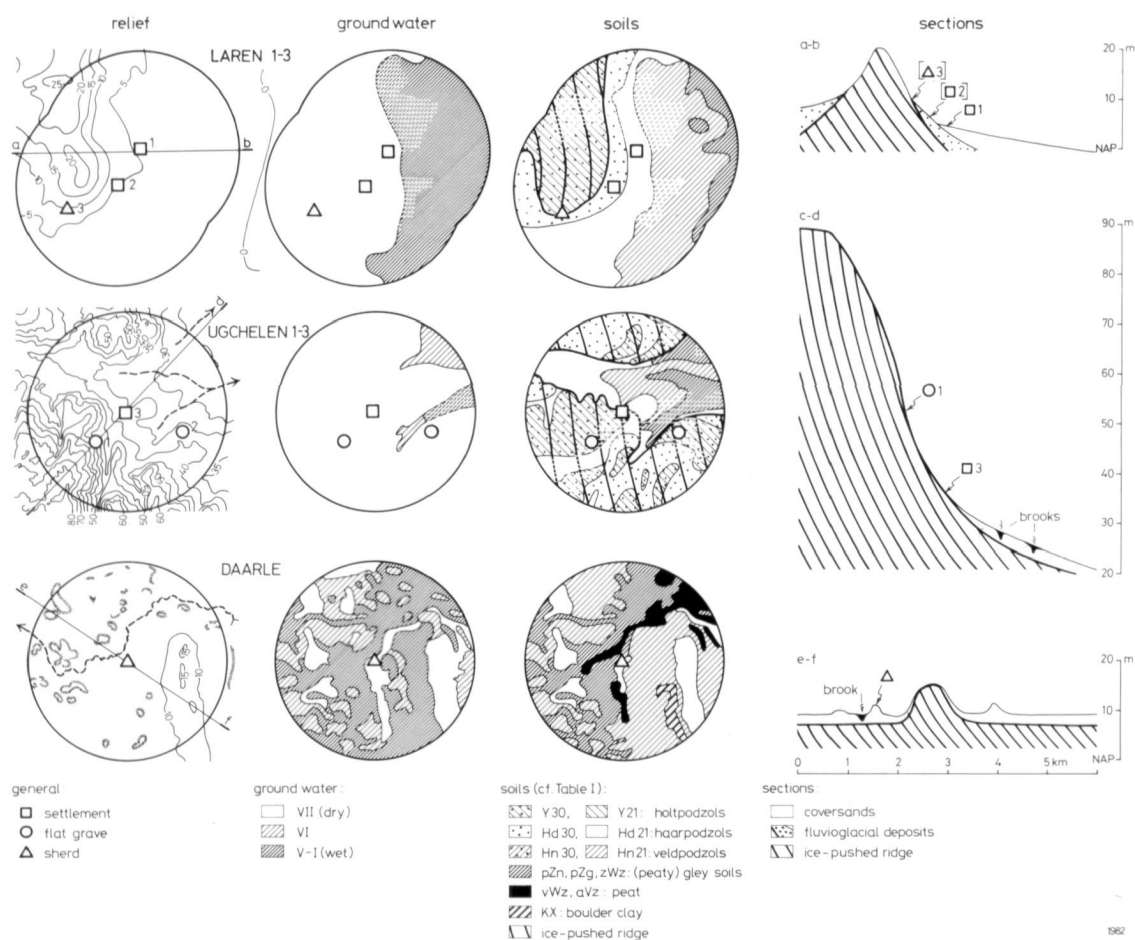


Fig. 11. Environment of the four TRB settlements of Laren-1 and -2, Ugchelen-3 and Daarle (radii of 2 km): relief, ground water, soils and geological sections (original scale 1:50,000). Contour lines (5 m intervals) and brooks according to Topographical Map; ground water and soils according to Soil Map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

ments lie on the top of the coversand mantle, edging up against the fluvioglacial and ice-pushed sands of the hills. The same holds true for the Laren (144/473) and Remmerden (165/442) sites on the Gooi-Utrecht ridges west of the Veluwe. Fig. 11 gives details. At Ugchelen-3 in the centre-east of fig. 10 (191/466) the chosen site had a view commanding the dry Assel valley, no doubt an easy east-west thoroughfare, and the small dry valley of Het Leesten south

of it. It also bordered the damp valley northward where small streams provided drinking water. It seems that the settlement site territory (as marked by two flat graves, see below) took advantage of this position. The finds in the Vaassen-Niersen enclave (189-192/476-479) north of Ugchelen may have been made in a comparable position, but unfortunately their recording is faulty.

The second type of landscape chosen for set-

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

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

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

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

The Ordnance Survey 1:25,000 maps are the maps the archaeologist usually works with in this country. They show every lane, most ditches and there is generally enough space between finds or monuments to inscribe them on uncoloured sheets. The paperwork becomes too bulky for whole-country surveys, but for subregional research they are excellent. Too little use has been made of the 1:10,000 maps. They offer no more geographical detail than the 1:25,000 maps, except for the very detailed elevation maps. Any subregional survey should start by drawing the contourlines oneself: this teaches one the lie of the land, especially the coversand relief. Ideally, one should check and improve the discussed soil, geology and geomorphology

maps by borings and then compile a selective combination (as is often done in the wetlands) on this (linearly) five times larger scale. Such work has, however, hardly begun for the environment of TRB sites, but it is clear that one should do this to bridge the gap between the plans of excavations with usual scales of 1:40 to 1:200 and the discussed smaller scale maps of the environment. The cadastral maps on scales 1:2,500 and 1:5,000 have many errors, being the result of continuous "patching" since their introduction around 1830, when their geodesy was not quite satisfactory.

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

IV. *Chronological aspects*

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

TRB artefacts are quite useful for typochronological dating – even small sherds can often be identified as to form and stylistic phase. The distribution maps (Bakker 1979a, figs. 37-40) show a gradual expansion from the Drente Plateau towards the south and southwest, but the number of well localised and typochronologically significant finds appears somewhat too small to discern time trends in the choice of terrain outside Drente. Even the study of such trends on the Drente Plateau is problematical. In a review (1981) Sherratt concluded from small-scale distribution maps of phases A+B, C+D1+D2, E1+E2, and G (Bakker 1979a, figs. 37-40): "The distribution maps of these phases show an important contrast between an early, river-based pattern, a middle pattern of interfluvial expansion, and a late pattern, which is again river-based... The late pattern should be put together with an early Corded Ware distribution, which I suspect would show a comple-

mentary concentration in the interfluves, with important implications for the interpretation of these contemporary styles in social terms". However stimulating these remarks are, they do not yet quite convince me. Ik wil restrict my argument to the Dutch situation but no doubt it will, *mutatis mutandis*, be also valid for the adjoining parts of Germany, at least as far as the rivers Hunte and Weser.

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

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

phases must therefore be much more complete than those of the early and late phases.

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

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

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

Diachronic research, for example from the Mesolithic to the present period, obviously

would show striking time trends. Unfortunately hardly any comparable whole-country surveys have been undertaken.

Modderman's pioneer work on the prehistoric barrows and Neolithic finds of the Veluwe (1954, 1955, 1963) and that by the *Veluwe Project 2* (forthcoming) on several occupation phases between the TRB and AD 1850 shows what may be expected. Modderman (1955) concluded from a very detailed 1:25,000 soil map of the Vaassen-Niersen area (Van Liere and Steur 1955) that the 152 barrows were confined (in present terms) to gY30-VII, but avoided gHd30-VII and gHd23-VII if they were located on the ice-pushed ridge; but that those in the moister landscape along the flanks of the hills were bound to the drier coversand ridges.

He elegantly explained the strikingly disparate barrow distribution on the Veluwe hills by the presence of gY30 and the absence of Hd soils, and vice versa (1954). Unfortunately distribution maps remained unpublished at this stage. Later, Modderman (1963) researched the distribution of Corded Ware and Bell Beaker finds in barrows and (few) flat graves in the southwestern and the northwestern Veluwe on the basis of the 1:200,000 Nebo soil map. The three TRB settlements known to him (Uddelermeer (180/473), Elspeet (181/479), and Beekhuizen (174/483)) showed a preference for drinking water nearby, and the latter two sites were situated on very poor (viz. loamless) coversand and fluvioglacial sand (*ibid.*, p. 13). The present study shows that this is a general trend.

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

A recent distribution map of the almost one thousand barrows of the Veluwe on the original scale of 1:50,000 (Klok 1978, p. 16-17) suggested a statistical comparison of the barrow locations

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

V. Social aspects

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

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

Elsewhere I have sketched the potential of subregional stylistic research, for example the Borger area (around 249/551) on the central Hondsrug (Bakker 1980). This municipality has eleven existing hunebeds (D19-D29) of which D19 and D20 at Drouwen, D21-22 at Bronneger, D26 in Drouwenerveld and D28 at Buinen have been systematically excavated. The hundreds of fragmented pots permit one, in princ-

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

On the Veluwe, some relevant details were observed. The pottery from the Elspeet (181/

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

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

The little that is known about the location of

the Harderwijk cemetery again suggests a distance of ca 1 km from the contemporary Beekhuizen settlement (Manssen 1980, fig. 1).

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

VI. Vegetation

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

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

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

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

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

- e. analysis of the soil maps.

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

Fourteen spectra from hunebed mounds in

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

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

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

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

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

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

K.E. Behre works in N.W. Germany on the same problems on the Flögel sandy "island" (personal information Behre; Zimmermann this symposium). He was able to locate TRB clear-

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

VII. Final remarks

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

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

soils chosen for settlement in Drente and the Veluwe, and for the wood clearings in Drente and Flögeln show that it is still too early for an explanatory synthesis.

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

VIII. *Postscript*

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

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

Once more this find demonstrates, dramatically, that enormous parts of the Pleistocene sands which are now covered by peat and clay

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

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

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

Due to similar conditions, there is no real proof that Vlaardingen never penetrated the coastlands northeast of Texel where sand bar-

riers are presumed to have been present roughly following the line of the present Frisian Islands in the Netherlands and Germany. The absence of Vlaardingen pottery in the Corded Ware settlement sites of Aartswoud and Kolhorn (126/528 and 122/534; Van Itersen Scholten and De Vries-Metz (1981) and personal information from Professor J.D. van der Waals) and in the prehistoric collections from the Ems, Weser-Hunte, and Elbe estuaries argues in favour of the nonresidence of Vlaardingen beyond the (now mainly eroded) sandridges of Friesland-Wieringen-Texel (cf. fig. 6, contour line of 3.5 m below NAP).

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

Dedication. I found it a great privilege and pleasure to contribute to this Symposium in honour of Professor Modderman, who taught me how to excavate just 30 years ago (Elspeet 1952, Sittard 1953, Spanjaardsberg 1955) and in whose footsteps I often followed while studying the Neolithic finds of the sandy soils and the wetlands of this country. I hope that he, who has himself devoted so much time and energy during his impressive career to the compilation of archaeological distribution maps and

their comparison to soil maps (Noordoostpolder, river area, Veluwe, Atlas 1, pls. VIII/1-2, etc.) may appreciate the preceding study.

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NOTES

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

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

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

neglect of the second approach at this otherwise so stimulating Symposium. This must, in my opinion, be due to the preferences and education of the organisers and several of the invited speakers.

There is an analogous cleavage between sociographic and physiographic geography in this country. Like Dutch ethnologists, sociographers often glance at sociological approaches, whereas physiographers incline towards geology. A mainstream of fruitful prehistoric research has in this country for several decades been determined by Trigger's first type of approach, no doubt due to the biological and physiographical basic training of most prehistorians, and the rapid adaptation to it by the minority educated in sociology, ethnology, or other fields. There are now some signs of a turning wind, however.

8. The maximum depth observations for low TRB sites on Pleistocene sands are 0.80 to over 1.60 m below NAP for the Bornwird ploughmarks, whereas Oostrum and Steenendam lay higher than 1.50 m below NAP (Fokkens 1980). The Siddeburen TRB settlement (255/584) on the fringe of the Slochteren-Hevesklooster sandridge lies at 1.7 to 2.0 below NAP (personal information J.N. Lanting, March 1982). The base of the Hevesklooster hunebed lies at 1.90 m below NAP, but the maximum depth of occupation and ploughing - both of which may be expected there - has not yet been ascertained. A peat-covered ploughland with three TRB sherds and Vlaardingen, Veluwe Bell Beaker, Pot Beaker and Barbed Wire sherds on the coversand-covered boulderclay ridge of Schokland-P14 (181/518) lay at 2.50 m below NAP (excavation 1957), personal information G.D. van der Heide and J.W.H. Hogestijn). TRB sherds and flints lay on coversand below peaty material at 2.5 m below NAP (=NN) at Nortmoor-Heimschloot, east of Leer, Ostfriesland, Germany (Schmid 1965). It is not known whether refuse dumps in a depression or the true level of occupation are concerned here.

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

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Atlases

Atlas 1 - *Atlas van Nederland* (1963-1977), The Hague.

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Atlas 5 - *Inventarisatieatlas voor flora en fauna van Nederland, samengesteld en geproduceerd door de Topografische Dienst te Delft in opdracht van het Staatsbosbeheer, Inspectie Natuurbeschoud en Natuurwetenschappelijk Archief, Utrecht (Staatsbosbeheer) 1981.*

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