PALYNOLOGICAL ANALYSIS OF DUTCH BARROWS

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CONTENTS

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1. INTRODUCTION

In the context of a renewed analysis of PFB and BB Cultures in the Netherlands (Lanting & Van der Waals, 1976), the Neolithic barrows in particular which are known from old excavations to have contained characteristic finds have been re-excavated in order a.o. to collect samples for C14 dating and pollen analysis. The old generation of excavators, such as J. H. Holwerda and F. C. Bursch, were usually content to excavate only part of a barrow, and in most cases A. E. van Giffen also left at least the sections, in using his quadrant method. Re-excavation of the old cuttings soon brings the original sections to light, from which the samples can be taken. The first author undertook the analyses of the new material for the northern provinces (Casparie, 1975), mainly the province of Drenthe[1]), including some analyses of old arable soil, and the second author did the same for the southern part of the country, mainly focused on the Veluwe, province of Gelderland (Groenman-van Waateringe, 1974; 1978), including several analyses done long before this new project by Lanting and Van der Waals started.

2. PRELIMINARY CONSIDERATIONS

The erection of a funerary monument is of all activities primarily a ritual action and one which is to a great degree culturally bound. Prehistoric burial mounds can, in many cases, be attributed to a particular culture on the basis of the construction, shape and grave gifts. These surviving material remains reflect only a limited part of the total burial ritual, although it is these same remains which have, to a great extent, shaped the archaeological division of the Neolithic and the Early Bronze Age in NW Europe. Differences in the choice of settlement terrain, settlement form, house construction and perhaps social structures are far more elusive or are even totally unknown, thus providing no adequate foundation for a cultural division.

Palynological analysis of the old surfaces beneath tumuli has led to the belief that in the Neolithic and Early Bronze Age two quite different types of *landnam* may be distinguished, the so-called Troels-Smith and the Iversen *landnam*. It was thought that these forms were culturally bound (a.o. Waterbolk, 1954, 1958a; Van Zeist, 1955, 1967b). Those cases where the pollen spectrum differed from the expected based on the cultural attribution of the barrow were classed with the "anomalies".
When a relation can be shown to exist between the (Neolithic) culture, the agricultural activities or possibly the clearance activities of the carriers of this culture and the choice of a site for the construction of a burial mound, it is by no means clear whether a particular site was deliberately selected or whether, as a result of the type of *landnam* practised, only one type of terrain was available, so that no real choice could be exercised. The situation of tumuli in rows – along prehistoric trackways – or on pronounced natural features – such as the tumuli at Swalmen with their skyline effect (Lanting & Van der Waals, 1976) – does, however, imply conscious choice amongst various siting possibilities.

In the interpretation of pollen spectra from burial mounds, where the emphasis lies on the method of land use and on cultural relations, it can by no means be assumed that such relations will in each case be clearly defined. Natural, cultural and economic factors all come into play, and we will attempt to analyze these factors further below. To a great extent our incomplete understanding of these factors exerts a considerable influence over our lines of approach.

The present analysis makes no attempt to sketch the cultural and economic activities of prehistoric man; it is our intention only to provide a framework within which may be placed those elements which are, in our opinion, of importance to our interpretation.

2.1. Natural factors

The differences in the genesis of the various landscapes in which the Netherlands tumuli occur (Drents plateau, Twente, Veluwe, ice pushed ridges of the Nijmegen complex, Utrechtse Heuvelrug etc.) and the differences in geology and pedology in these landscapes, with the addition of the interaction of the density of occupation and the Neolithic land use, together determine the vegetational development following the primary Neolithic encroachment on the landscape. We may

on no account assume *a priori* that this development progressed alike in the various landscapes or that the reaction to human interference was identical. An important aspect of the soils sought out for the Neolithic occupation is the hydrological situation, though exact information on this point is difficult to come by. It is possible that it is not so much the extent of the deforested area or the type of land use which determines the variety of species on the old surfaces beneath barrows, but rather the existing vegetation related to the specific local hydrology.

In addition to the hydrology, the (chemical) fertility of the soil is also of prime importance. It is possible that there were particular preferences as to soil type in the Neolithic, although the selection of a location will primarily be dictated by the vegetation cover – and thus only indirectly by the soil type – or by the means available to tackle it. But as Keessen (1974) put "the natural vegetation remains to the colonizer the token of the nature of the soil and its suitability for cultivation".

2.2. Cultural factors

We may assume that the choice of a site on which to construct a tumulus was also based on a number of cultural preferences. Just what these might have been is totally unknown, but elements such as the visibility of the monument (skylining), the place of the deceased in the social order (important families in the "best" places), situation as near as possible to personally tilled soil and questions of ownership may all have been factors. It is not inconceivable that factors such as these may have as result that different types of terrain might be chosen within a single culture, or even a single population.

The few cases in which we possess both the settlement and the associated graves tend to support the assumption that the dead were, in general, buried near to the settlement. Thus, the location of the settlement to a certain extent determines the location of the tumuli. As for the situation of the settlement, the availability of the desired ploughland and the availability of water are determining factors. The (visual) absence of Neolithic and Early Bronze Age settlements in those regions where there are many funerary monuments, makes it essential to first study the choice of terrain for funerary monuments if the choice of terrain for settlement and agriculture is to be pursued. It is likely that with increasing distance from the settlement the woodland was less intensively exploited and was thus less disturbed. Around the settlement there will always – also considering the area of the burial mounds themselves – have been sufficient open spaces so that no separate clearings would have to be made in the forest. Deforested, abandoned settlement sites must have been exceptionally attractive.

2.3. Economic factors

The construction of most of the (known) burial monuments was preceded by centuries of human exploitation of the forest, coupled with degeneration and complete or partial regeneration.

The exploitation of the forest consisted of gathering and cutting wood for construction and fuel, grazing which may destroy undergrowth and young shoots, lopping (elms) for fodder, bark peeling (especially lime trees); in addition fields and roads were constructed and forest fires – whether deliberate or not – broke out. All these factors influenced the composition and density of the forest. Differing usage will have resulted in various sorts of clearings, differing not only in shape and size but, also, depending on the soil type and the form of exploitation, possessing distinct herb associations. The intensity and duration of the occupation are important additional factors. Therefore, the herb values in barrow spectra inform us as to the area of the clearing, the fertility of the soil, the use of the soil prior to the construction of the barrow and further as to the extent of degeneration or the stadium reached in the regeneration of the surrounding woodland. All these various aspects are difficult to disentangle.

In this study of the spectra from Neolithic, Early (and Middle) Bronze Age funerary monuments in the Netherlands our approach has been determined by the following questions:

1. what did the landscape in the immediate vicinity of the tumulus look like
2. what sort of interference is evidenced in the pollen record
3. are there visible differences in the regions de-

fined
4. what could be the reasons for such differences
5. is there evidence for different agricultural systems from those defined by Troels-Smith and Iversen
6. are there differences within a single culture
7. can a specific type of exploitation be extrapolated from the pollen record
8. is it possible to distinguish vegetational, physical, pedological and hydrological factors?

2.4. Criteria for interpretation

In contrast to a classical pollen diagram, the analysis of spectra from tumuli does not result in a section representing the progressive vegetational development over a period of time in a particular region: each spectrum of a burial monument is not much more than a single instant of time. On the other hand, though a classic pollen diagram does portray the general development in a particular region as well as the human interference in that area, it lacks the details most interesting to the archaeologist – namely the question of how the carriers of a particular culture phase, or, to be even more explicit, the builders of a particular burial monument, disturbed the surrounding environment – since the link between the observable facts in the pollen diagram and the culture phase and/or the specific burial mound can, in most cases, never be laid.

In order to answer the questions which we posed above, we have formulated a number of criteria. These are not, however, to be seen as absolute statements. The nature of palynological analysis does not permit absolutes for a number of reasons, including 1. differences in pollen production per species, per individual, per year, per location, 2. the method of presentation of the material (in comparative figures)[2]) and 3. lack of exact information concerning the implications of the percentages obtained by analysis in phytocenological terms. The numerous studies of recent pollen rain may, to a certain extent, be of value, but information of relevance to the problems confronted here remains scarce.

Our criteria are therefore primarily based on the mutual comparison of an already considerable body of spectra from funerary monuments in the Netherlands and on general botanical experience of what may be expected on the various sites which could be chosen for the erection of a barrow.

Thus we may distinguish between recently cultivated land, long abandoned arable land, natural clearings in the forest, areas lying near to settlements or abandoned settlement sites. For each of these, a number of criteria will be set out below. However, in practice, it will also become apparent that the classification of the spectra from tumuli into these categories is not as simple or as unequivocal as it seems. Other factors need to be taken into account, such as soil types and history of settlement as well as combinations and variants of the groups 1-4.

1. Criteria for recently abandoned arable land[3])

soil profile:	thick, homogeneous grey layer under old surface layer
herb pollen:	no great variety in herb species Gramineae high Cerealia often present *Artemisia* fairly high Chenopodiaceae fairly frequent Ranunculaceae fairly high other herb values, such as *Plantago lanceolata*, not very high Ericaceae values fairly low (to 60%)
tree pollen:	*Betula* not excessively high, usually 10-20%.

2. Long abandoned arable fields (in use as pasture?)

soil profile:	as 1
herb pollen:	great number of herb species, including Caryophyllaceae several herb species with very high values Gramineae very high *Plantago lanceolata* high *Rumex* frequent *Pteridium* infrequent
tree pollen:	*Betula* and *Corylus* display a higher value than is the case in 1.

3. Natural clearings in the forest

soil profile:	thin grey line (old surface level) with underneath an undisturbed woodland (?) profile

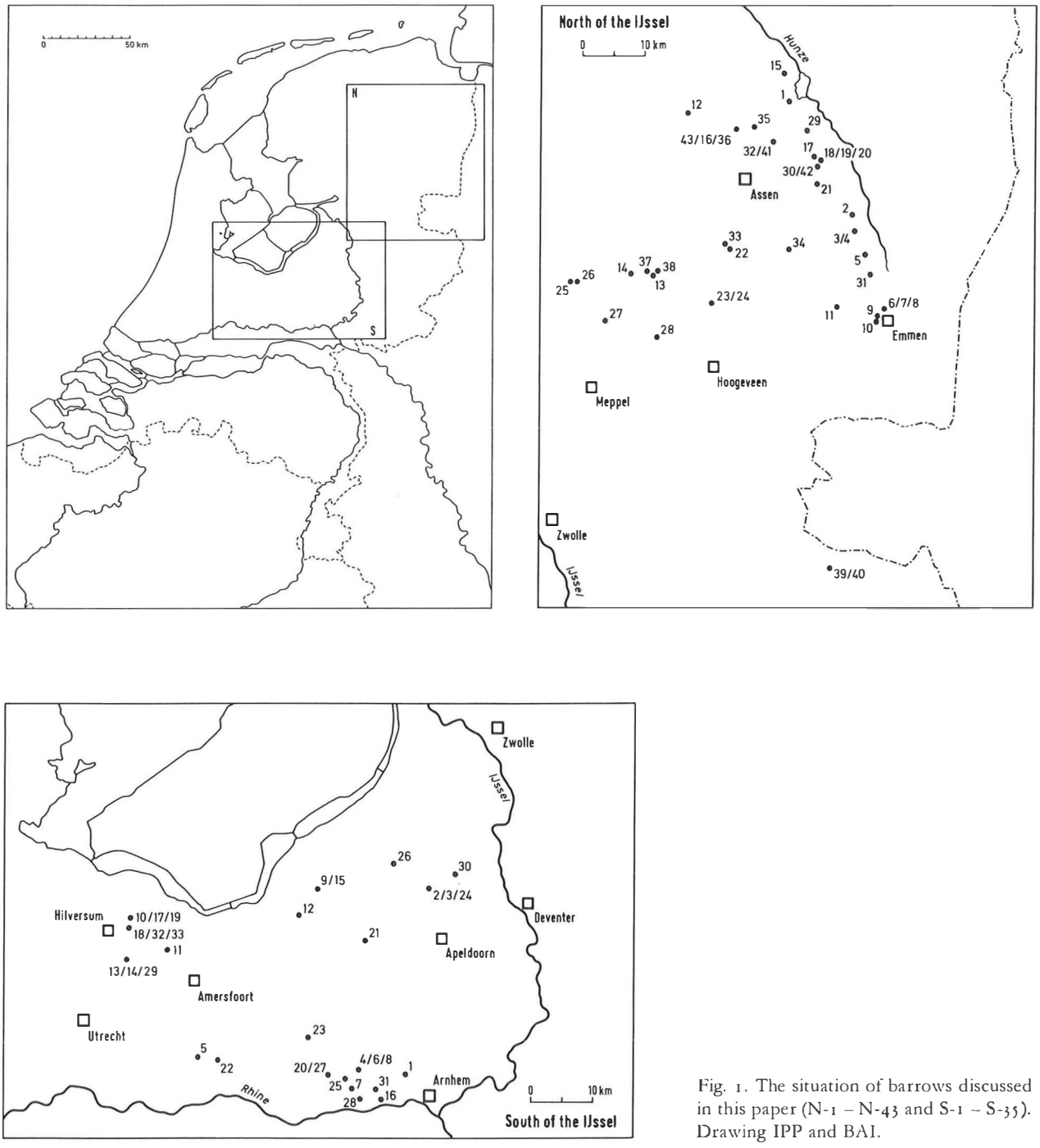


Fig. 1. The situation of barrows discussed in this paper (N-1 – N-43 and S-1 – S-35). Drawing IPP and BAI.

herb pollen: numerous herb species but represented with low values
low Gramineae values
low Ericaceae values

tree pollen: low values for *Betula*.

4. Localities near to settlements or on abandoned settlement sites

soil profile: as 3 but frequently containing particles of charcoal, sherds and flint flakes

herb pollen: numerous herb species but represented with low values. Some species occasionally display higher values
tree pollen: *Alnus* with high values.

3. THE SITES (IN CHRONOLOGICAL ORDER)

3.1. North of the IJssel (fig. 1)

Most of the analyses presented here have already been published. The description given of each barrow site includes the name of the person who analyzed the samples, together with references as to in which table or on which pages the complete pollen spectra are presented. These spectra are not reproduced here. The dates given in brackets in the descriptions refer to the year in which investigation took place and in which sampling was carried out of material that has so far remained unpublished. Pollen spectra have not yet been published for the following barrows north of the IJssel: N-2, N-18, N-19, N-20, N-26, N-29, N-30, N-34, N-39, N-40, and N-42. The results of total counts for these barrows are given in table 1.

3.1.1. *TRB Culture (fig. 2)*

N-1. Noordlaren.
"Hunebed" (megalithic tomb) G1 at Noordlaren, mun. of Haren (Gr).
Excavation by A. E. van Giffen (1957), unpublished.
Composition of mound: yellow-grey sand on hardly visible old surface.
Samples taken from old surface by H. T. Waterbolk.
Sample of old surface counted by H. T. Waterbolk, 1956, p. 42.
Notable features: the absence of *Fagus*, the high value for *Tilia*.

N-2. Bronneger.
Megalithic tomb D25 at Bronneger, mun. of Borger (D).
Unexcavated; A. E. van Giffen, 1925, 9.71 ff.
Restoration activities: A. E. van Giffen (1960).
Composition of mound: yellow sand on barely visible old surface.
Samples taken by A. E. van Giffen (F-1960-9) N of Z3.
Sample of old surface counted by the second author (1960).
Notable features: the absence of *Fagus*, the rather high *Betula* percentage the low values for Ericaceae, Gramineae and other herbs.

N-3. Buinen.
Megalithic tomb D28 at Buinen, mun. of Borger (D).
Excavation: A. E. van Giffen (1927), 1943, NDV 61, pp. 115-137.
Composition of mound: yellow sand on a grey old surface.
Samples taken by H. T. Waterbolk.
Sample of old surface counted by H. T. Waterbolk, 1954, table 2.
Notable features: the absence of *Fagus*, the high percentage for *Betula* and the low value for Gramineae.

N-4. Buinen.
Megalithic tomb D29 at Buinen, mun. of Borger (D).
Unexcavated.
Composition of mound: yellow sand on a grey old surface.
Samples taken by H. T. Waterbolk (1950).
Sample of old surface counted by H. T. Waterbolk, 1954, table 2.
Notable feature: pollen very poorly preserved; no counting possible.

N-5. Exloo.
Megalithic tomb D31 at Exloo, mun. of Odoorn (D).
Excavation: A. E. van Giffen (1918), 1925-1927.
Samples taken by W. van Zeist.
Sample of old surface counted by W. van Zeist, 1955, table VII.
Notable features: the absence of *Fagus*, the rather high percentages for *Corylus* and *Tilia* and the relatively high values for *Artemisia*, *Rumex* and Liguliflorae.

	N-2	N-18	N-19	N-20	N-26		N-29					N-30	N-34		N-39		N-40	N-42	
	o.s. TRB	o.s. PFB	o.s. per. 1 PFB	o.s. per. 1 PFB	o.s. PFB	o.s. PFB	o.s. per. 1 BB	o.s. per. 1 BB	o.s. per. 2 EBA	o.s. per. 3 MBA	o.s. per. 4 MBA	o.s. per. 1 BB	o.s. per. 1 BB	o.s. per. 2 BB	o.s. per. 1 BB	o.s. per. 2 BB	o.s. BB	o.s. per. 1 EBA	sod per. 2 MBA
Quercus	7.7	13.3	14	33	10.0	7.7	12.5	13.8	13.4	14.2	11.6	16.4	9.8	13.8	15.1	12.5	12.4	10.5	10.6
Ulmus	0.4	–	–	–	–	0.4	0.8	1.0	1.0	–	0.4	0.3	–	0.8	–	–	–	–	–
Tilia	8.1	1.4	14	–	5.4	5.7	5.1	5.4	3.9	4.7	1.5	1.0	1.7	1.0	8.8	6.9	6.2	0.5	0.7
Fraxinus	–	0.7	–	–	–	–	–	0.2	0.2	0.3	–	–	–	0.5	0.1	0.2	–	–	0.2
Fagus	–	0.5	–	–	–	–	–	–	0.2	0.5	0.4	–	0.2	0.5	–	–	0.4	–	0.2
Carpinus	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	–	–	0.2
Corylus	37.0	38.8	14	33	36.8	36.6	30.5	30.1	30.4	25.7	26.4	26.0	24.8	22.1	31.3	31.6	35.7	27.1	31.1
Taxus	–	–	–	–	–	–	0.2	–	0.2	–	–	–	–	–	–	–	–	–	–
Acer	–	–	–	–	–	–	–	–	–	0.3	0.3	–	–	–	–	–	0.2	0.2	0.2
Sorbus-type	–	–	–	–	–	–	1.2	0.6	1.0	0.3	0.6	–	–	0.2	–	0.2	–	–	–
Hedera	0.4	–	–	–	–	–	–	–	–	–	0.1	–	–	0.3	–	–	–	–	–
Ilex	0.4	–	–	–	–	–	–	–	–	–	–	–	–	–	0.1	–	–	–	–
Viscum	–	–	–	–	–	–	–	–	–	–	0.1	–	–	–	–	–	–	–	–
Alnus	43.0	44.5	57	33	47.7	49.0	44.2	44.2	46.6	52.0	56.7	56.4	63.0	59.0	44.4	48.2	44.8	61.0	56.2
Salix	1.6	0.2	–	–	–	–	–	0.2	1.2	0.6	0.1	–	–	–	–	–	–	–	–
Frangula	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	0.2	–	–	–
Humulus	–	–	–	–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–
Pinus	2.6	0.5	–	–	0.1	0.5	5.2	4.0	1.8	0.6	1.1	–	0.5	1.8	0.1	0.4	0.4	0.7	0.7
Picea	–	0.2	–	–	–	–	0.2	0.2	–	0.3	0.1	–	0.2	0.2	–	–	–	–	–
Σ AP-Betula	**236**	**439**	**7**	**6**	**708**	**557**	**489**	**497**	**506**	**662**	**713**	**284**	**657**	**607**	**967**	**536**	**545**	**407**	**452**
Betula	47.0	43.7	172	–	9.9	8.8	14.7	11.4	16.0	11.7	10.4	10.9	66.1	16.7	54.5	53.1	30.8	9.6	8.0
Calluna/Ericaceae	29.0	72.6	29	50	58.3	77.1	83.0	117.8	67.9	89.5	120.3	14.1	63.1	78.6	26.5	22.6	34.7	138.0	193.0
Gramineae	9.7	18.8	14	16	11.0	7.9	6.8	5.8	7.1	10.2	13.4	53.5	31.8	18.4	2.2	9.8	4.2	58.4	55.7
Cyperaceae	1.6	–	–	–	–	–	–	–	–	–	–	1.0	1.2	–	–	–	–	0.7	–
Cerealia	0.9	–	–	–	–	–	0.2	–	–	–	–	0.3	0.3	0.2	–	–	–	–	0.2
Plantago lanceolata	–	5.0	43	67	3.0	1.4	1.0	1.6	1.0	1.2	1.5	50.5	1.8	1.7	0.4	0.7	1.3	46.7	11.5
Plantago major	–	–	–	–	–	–	–	–	0.2	0.2	0.1	–	0.2	0.2	–	–	–	1.0	0.2
Artemisia	–	0.9	–	–	–	–	0.2	–	–	0.6	0.4	0.3	0.2	0.3	–	–	0.2	0.2	0.7
Rumex a-type	0.9	9.4	–	–	1.3	0.4	0.6	0.6	0.4	3.6	7.9	6.0	1.0	1.8	0.1	0.2	0.6	8.6	6.9
Polygonum aviculare-type	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Polygonum persicaria-type	–	–	–	17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Thalictrum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.2	–
Urtica	–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–
Spergula	–	–	–	–	0.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Lysimachia	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–
Ranunculus	0.9	–	–	50	–	–	0.4	0.8	0.4	0.3	0.3	1.4	0.5	0.2	–	–	0.6	0.2	0.4
Jasione	–	–	–	–	–	–	–	–	0.2	0.6	0.1	–	–	0.3	–	–	0.2	–	–
Succisa	0.4	0.7	–	50	0.3	0.2	0.2	–	0.2	–	0.1	2.1	2.7	0.5	1.3	0.9	0.2	2.7	5.3
Trifolium-type	–	–	–	–	–	–	–	–	0.2	–	–	–	–	0.2	–	–	–	–	–
Ulex-type	–	–	–	–	–	–	–	–	–	–	–	1.0	–	–	–	–	–	–	–
Papilionaceae indet.	–	–	–	–	–	–	0.6	0.2	0.4	0.8	0.4	–	–	0.3	–	0.4	0.2	–	–
Potentilla-type	–	–	–	–	–	–	1.8	0.2	0.6	1.7	1.0	–	–	0.3	–	–	–	–	–
Filipendula	–	–	–	–	–	–	–	–	–	–	0.1	–	–	–	–	–	–	–	–
Tubuliflorae	0.4	3.9	14	–	1.5	0.9	0.8	1.0	2.6	1.2	0.4	3.2	2.9	1.2	1.0	1.7	1.7	6.9	2.9
Liguliflorae	5.6	0.9	–	–	0.7	0.7	5.1	0.2	1.6	0.8	1.0	–	0.8	0.8	0.1	–	0.4	1.2	0.9
Chenopodiaceae	–	–	–	–	–	–	–	0.2	0.2	0.2	0.3	0.7	0.3	–	–	0.2	–	1.0	0.2
Caryophyllaceae	–	0.9	–	–	0.7	0.2	0.2	0.2	0.2	0.3	0.8	2.8	2.0	–	0.2	0.7	–	6.7	1.3
Umbelliferae	–	–	–	–	–	–	–	–	–	0.2	0.1	–	–	–	–	–	–	–	0.2
Cruciferae	–	–	–	–	–	–	–	–	–	–	0.1	–	–	–	–	–	–	0.2	–
Scrophulariaceae	–	–	–	–	–	–	–	–	–	–	0.1	–	–	–	–	–	–	–	–
Campanulaceae	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.0	–
Galium-type	–	–	–	–	–	0.2	0.4	–	–	0.2	0.4	0.3	–	0.5	–	–	0.4	0.7	0.2
Mentha-type	–	–	–	–	–	–	–	–	–	–	0.1	–	–	0.2	–	–	–	–	–
Potamogeton	–	–	–	–	–	–	–	–	–	–	–	–	–	0.2	–	–	–	–	–
Polypodium	3.0	0.2	–	50	0.6	0.4	0.2	–	0.4	–	0.1	1.0	0.2	0.2	0.2	0.2	0.6	0.7	0.2
Pteridium	0.9	–	14	17	0.1	0.4	0.2	0.2	0.4	0.3	0.3	1.4	0.2	0.5	–	0.6	0.2	0.5	8.2
Dryopteris	7.2	4.1	114	383	9.6	7.5	2.5	3.6	1.0	1.1	0.1	8.1	2.7	1.2	–	0.6	–	2.0	2.0
Selaginella	–	–	–	–	0.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sphagnum	2.1	3.7	–	–	1.3	1.1	0.2	0.2	–	0.9	0.3	2.8	3.0	2.0	0.4	0.2	1.3	2.2	3.8
Lycopodium	2.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Indet./varia	4.7	–	–	–	–	–	–	0.4	–	–	1.1	0.3	3.5	2.1	0.6	0.7	–	7.1	3.8

Table 1. Pollen spectra, not yet published, of Neolithic and Early Bronze Age barrows north of the IJssel.

N-6. Emmen.
Megalithic tomb D38 at Emmen (D).
Unexcavated.
Composition of mound: yellow sand on a clearly visible old surface.
Samples taken by H. T. Waterbolk.
Sample of old surface counted by H. T. Waterbolk, 1954, table 2.
Notable features: the absence of *Fagus*, the low percentage for Gramineae.

N-7. Emmen.
Megalithic tomb D39 at Emmen (D).
Unexcavated.
Composition of mound: yellow sand on a clearly visible old surface.
Samples taken by H. T. Waterbolk.
Sample of old surface counted by H. T. Waterbolk, 1954, table 2.
Notable features: the absence of *Fagus*, the low value for *Tilia* and for *Betula*.

N-8. Emmen.
Megalithic tomb D40 at Emmen (D).
Excavation: A. E. van Giffen (1918), 1925-1927.
Composition of mound: yellow sand on a clearly visible old surface.
Samples taken by H. T. Waterbolk.
Sample of old surface counted by H. T. Waterbolk, 1954, table 2.
Notable features: the absence of *Fagus*, the low percentage for Gramineae.

N-9. Emmen.
Megalithic tomb D41 at Emmen (D).
Unexcavated.
Composition of mound: podzolized old surface.
Samples taken by H. T. Waterbolk.
Sample of old surface counted by H. T. Waterbolk, 1954, table 2.
Notable features: the absence of *Fagus*, the relatively high percentage for *Calluna*.

N-10. Emmen.
Megalithic tomb D43 ("langgraf") at Emmen (D).
Excavation: J. H. Holwerda 1914, Prähist. Zeitschr. VI, pp. 57-67.
Re-excavation (for restoration purposes): A. E. van Giffen (1960) 1962, Helinium II, pp. 104-114.
Samples taken by A. E. van Giffen (1960).
Sample of old surface counted by the second author, 1962, Helinium II, pp. 114-115.
Notable features: the absence of *Fagus*, the relatively high values for Cerealia and *Plantago lanceolata* and some other herbs such as Compositae and Caryophyllaceae; the absence of *Betula*.

N-11. Schoonoord.
Megalithic tomb D49 "Papeloze Kerk" at Schoonoord, mun. of Sleen (D).
Excavation: A. E. van Giffen (1958-1959), 1961, NDV 79, pp. 189-197.
Composition of mound: yellow sand on a rather dark old surface.
Samples taken by A. E. van Giffen (1958).
Sample of old surface counted by the second author, 1961, NDV 79, p. 198.
Notable features: the absence of *Fagus*, the high values for *Tilia* and *Calluna*, the low percentage for Gramineae.

N-12. Steenbergen.
Megalithic tomb D1 at Steenbergen, mun. of Norg (D).
Unexcavated.
Composition of mound: yellow sand on a clearly visible, dark-grey old surface.
Samples taken by W. van Zeist.
Sample of old surface counted by W. van Zeist, 1955, table VII.
Notable features: the absence of *Fagus*, the low *Betula* percentage, the low percentage for *Calluna* and the relatively high value for Gramineae.

N-13. Diever.
Megalithic tomb D52 at Diever (D).
Excavation: Large-scale restoration by A. E. van Giffen (1953-1954), unpublished.
Composition of mound: rather clean sand; old surface hardly visible.
Samples taken by W. van Zeist.
Sample of a "sod" (a somewhat humous, dark spot in the rather clean sand of the mound) counted by W. van Zeist, 1955, p. 43.
Notable feature: very poor in pollen; no counting possible.

N-14. Wapse.
Destroyed "hunebed" D52a, "Pottiesbarchien" near Wapse, mun. of Diever (D).
Excavation: A. E. van Giffen (1929), 1946, NDV 64, pp. 61-71.
Composition of mound: yellow sand with a clearly outlined dark-coloured sod; dark old surface.
Samples taken by W. van Zeist.
Samples of old surface and of dark-coloured sod counted by W. van Zeist, 1955, table VI.
Notable features: old surface without pollen; sod: the presence of *Fagus* and *Carpinus*, very high percentage for *Calluna*, relatively high percentage for Cerealia. The sod probably represents younger material.

3.1.2. *PFB Culture (fig. 3)*

N-15. Onnen.
Flat grave near Onnen, mun. of Haren (Gr).
Grave goods: small undecorated beaker and PFB type Id.
Composition of grave: concentric humous bands in filling of grave pit.
Excavation: A. E. van Giffen (1927), 1930, Taf. 90.
Samples taken by A. E. van Giffen.
Sample of humous band of pit-filling counted by H. T. Waterbolk, 1954, table 2.
Notable features: the absence of *Fagus*, the low value for *Betula* and for Gramineae.

N-16. Zeyen.
Two-period tumulus I at Zeyen, mun. of Vries (D).
Grave goods: greenstone axe and small flint knife.
Composition of mound: primary and secondary mound of yellow sand on a grey old surface.
Original excavation: A. E. van Giffen (1924), 1930, Taf. 88.
Re-excavation: A. E. van Giffen (1949): H. T. Waterbolk, 1977, NDV 94, pp. 177-203, esp. 193-7.
Samples taken by H. T. Waterbolk (1949).
Samples of old surface under period 1 (PFB) and of old surface period 2 (Late Bronze Age) counted by H. T. Waterbolk, 1954, table 3.
Notable features: the absence of *Fagus* and the high percentage for *Tilia* and the low percentage for *Quercus* in the older sample; the presence of *Fagus*, the low *Betula* percentage and the high value for *Calluna* in the younger sample.

N-17. Eext.
Single-period barrow C at the Schaapdijksweg, N. of Eext, mun. of Anlo (D).
Grave goods: PFB type Ic.
Composition of mound: low mound of yellow-grey sand on a grey old surface.
Excavation: H. T. Waterbolk, 1957, NDV 74, pp. 23-34, esp. 32-33.
Samples taken by H. T. Waterbolk.
Sample of old surface counted by W. van Zeist, cf. H. T. Waterbolk, 1956, p. 43.
Notable features: the presence of *Fagus*, the high value for *Calluna*, the relatively high values for Cerealia and *Plantago lanceolata*.

N-18. Eext.
Single-period tumulus Galgwandenveen I near Eext, mun. of Anlo (D).
Grave goods: PFB type Ic and flint knife.
Composition of mound: dirty-yellow sand.
C14 dating: GrN-8254: 3930 ± 45 BP, from charcoal from pit next to grave.
Excavation: J. D. van der Waals and J. N. Lanting (1970).
Samples taken by J. D. van der Waals and J. N. Lanting (1970).
Sample old surface counted by first author (1973).
Notable features: the presence of *Fagus*, the high value for *Corylus*, the not very high percentages for herbs.

N-19. Eext.
Two-period tumulus with ZZ beaker near Eext, mun. of Anlo (D).
Grave goods: ZZ beaker, GP dagger, battle axe type P1 and a small flint axe.
Composition of mound: dirty yellow sand, capping of sods.
C14 dating: GrN-6727: 4145 ± 30 BP (charred post in foundation trench).
Original excavation (after robbing of grave): A. E. van Giffen (1937), 1939, NDV 57.
Samples taken by J. D. van der Waals and J. N. Lanting (1970).
Sample of old surface counted by the first author (1973).
Notable feature: very poor in pollen, sample contained much carbonized material; no counting possible.

N-20. Eext.
Two-period tumulus Galgwandenveen III near Eext, mun. of Anlo (D).
Grave goods: PFB Id, battle axe type H, GP dagger, flint axe.
Composition of mound: dirty yellow sand.
C14 dating: GrN-6368: 3935 ± 35 BP, GrN-6635: 3940 ± 40 BP; average: 3940 ± 30 BP.
Excavation: J. D. van der Waals and J. N. Lanting (1970); finds published by J. N. Lanting and J. D. van der Waals, 1976, Glockenbechersymposion.
Samples taken by J. D. van der Waals and J. N. Lanting.
Sample of old surface under period 1 (PFB) counted by the first author (1973).
Notable features: very poor in pollen, sample contained much charcoal; no counting possible.

N-21. Eext.
Two-period tumulus "Ketenberg" at Eext, mun. of Anlo (D).
Grave goods: PFB type Ia, battle axe type B, flint axe, small flint knife.
Composition of mound: primary mound of yellow sand, secondary mound of dark sods.
C14 dating: GrN-1676: 3775 ± 55 BP from period 2.
Excavation: A. E. van Giffen (1927), 1930, Bauart.
Re-excavation: A. E. van Giffen (1949).
Samples taken by H. T. Waterbolk (1949).
Samples of old surface under period 1 (PFB) and of sod of period 2 (BB) counted by H. T. Waterbolk, 1954, table 2.
Notable features: the presence of *Fagus*, the high value for *Plantago lanceolata* and the somewhat higher value for Gramineae in the older sample and the lower values for the herbs in the younger sample.

N-22. Hijken.
Two-period tumulus 8 at Hijken, mun. of Beilen (D).
Grave goods: PFB type Ib.
Composition of mound: primary barrow of dirty yellow sand on a humous old surface, covering mound sod-build.
Excavation: A. E. van Giffen (1953), unpublished.
Samples taken by W. van Zeist.
Sample of old surface under period 1 (PFB) and two samples of sods of covering mound (period 2, Early Bronze Age) counted by W. van Zeist, 1955, table II.
Notable features: the presence of *Fagus*, the rather high value for *Alnus* and low values for *Quercus* and *Betula* in period 1, and the rather low value for *Alnus* and the higher values for *Quercus*, Gramineae and Cerealia in period 2.

N-23. Spier.
Single-period tumulus 5 at Spier, mun. of Beilen (D).
Grave goods: none.
Composition of mound: yellow sand on a barely visible old surface.
Excavation: A. E. van Giffen (1949), unpublished; only a short note in L'Antiquité Classique 19, 1950, Archaeologie pp. 427-437.
Samples taken by H. T. Waterbolk.
Sample of old surface counted by H. T. Waterbolk, 1954, table 5.
Notable features: the absence of *Fagus*, the low value for *Calluna*, the high percentage for *Plantago lanceolata*.

N-24. Spier.
Three-period tumulus 1 at Spier, mun. of Beilen (D).
Grave goods: none.
Composition of mound: primary mound of yellow sand on yellow-grey old surface; secondary and tertiary periods with sods visible.
Excavation: A. E. van Giffen (1949), unpublished.
Samples taken by H. T. Waterbolk (1949).
Samples of sods of period 1 (PFB), of period 2 (Early/Middle Bronze Age), and old surface of period 3 (Middle Bronze Age) counted by H. T. Waterbolk, 1954, table 5.
Notable features: *Fagus* present in periods 1 and 3 and the increase in *Calluna* from period 1 to period 3.

N-25. De Eese.
Two-period tumulus at De Eese, mun. of Vledder (D).
Grave goods: grave was robbed before excavation.
Probable grave gifts: flint axe (found in 1934/1935), battle axe type H (found by excavation in 1956) and flint knife, see J. N. Lanting, 1973,

Palaeohistoria XV, pp. 300-301.
Composition of mound: secondarily leached sand.
Excavation: H. T. Waterbolk (1956), 1957, NDV 74, p. 46, nr. 17, and 1964, Palaeohistoria X, pp. 71-86.
Samples taken by H. T. Waterbolk.
Samples of sod-like filling of temporary foundation trench of primary mound (period 2) and of old surface of period 2 (both PFB) counted by W. van Zeist (1955), see H. T. Waterbolk, 1964, Palaeohistoria X, p. 85.
Notable features: the absence of *Fagus*, the relatively high values for *Calluna* and *Plantago lanceolata*.

N-26. De Eese.
Single-period tumulus no. 8 at De Eese, mun. of Steenwijkerwold (O).
Grave goods: PFB type Id, battle axe type H, GP dagger and flint axe.
Composition of mound: yellow sand on grey old surface.
Excavation: A. E. van Giffen (1918), 1930, Bauart, Taf. 4.
Re-excavation: J. N. Lanting and J. D. van der Waals (1972).
Samples taken by J. N. Lanting and J. D. van der Waals (1972).
Two samples of the old surface counted by the first author (1974).
Notable features: the absence of *Fagus*, the relatively high values for *Tilia* and *Corylus* and the low values for *Betula* and for herbs.

N-27. Havelte.
Two-period tumulus 4 in the "Holtingerzand" near Havelte (D).
Grave goods: PFB type Ib and a small flint axe.
Composition of mound: primary mound of yellow sand, secondary capping of yellow sand with clearly visible sods.
Excavation: A. E. van Giffen (1943), 1951, NDV 69, esp. pp. 105-108.
Samples taken by H. T. Waterbolk.
Samples of old surface of period 1 (PFB) and of sod of period 2 (Early/Middle Bronze Age) counted by H. T. Waterbolk, 1954, table 6.
Notable features: the presence of *Fagus* in period 2, the high value for *Plantago lanceolata* in period 1 and the high value for *Corylus* in period 2.

N-28. Ruinen.
Three-period tumulus "Galgenberg" near Ruinen (D).
Grave goods: PFB type Ie and a small amphora.
Composition of mound: primary mound of brownish-grey sand on a hardly perceptible old surface; second and third period also of sand, without sods.
Excavation: W. Glasbergen (1954), cf. J. D. van der Waals, 1964, NDV 81.
Samples taken by W. van Zeist.
Samples of old surface of period 1 (PFB), of period 2 (Middle Bronze Age), and of period 3 (Middle/Late Bronze Age to Iron Age) counted by W. van Zeist, 1955, table VII.
Notable features: *Fagus* present in periods 2 and 3, *Carpinus* present in period 3, the high values for *Corylus*, *Quercus* and Cerealia in period 3, the not very high values for most of the herbs.

3.1.3. *BB Culture (fig. 4)*

N-29. Annertol.
Four-period tumulus Annertol III at Schuilingsoord, mun. of Zuidlaren (D).
Grave goods: BB bowl type 2Ib, two BB's, one undecorated, the other of type 2Ia; BW pot and bronze dagger (period 2).
Composition of mound: primary mound of relatively homogeneous grey sand, cappings of periods 2 and 3 with clearly visible dark sods, final capping (period 4) of yellow sand with dark sods.
C14 dating: period 1, GrN-6643: 3870 ± 35 BP, charcoal fragments between sherds in base of barrow; period 2, GrN-6753: 3450 ± 35 BP, charcoal fragments charred cist; period 3, GrN-6412: 3375 ± 35 BP, charcoal from grave pit; period 4, GrN-6411: 3335 ± 35 BP, charcoal on top of capping period 3.
Excavation: A. E. van Giffen, 1923, NDV 41, pp. 156-205, esp. 202-205 (only a small test pit). J. J. Butler, J. N. Lanting and J. D. van der Waals (1970), 1972, Helinium XII, pp. 225-241.
Samples taken by S. Bottema (1970).
Samples of the old surface of period 1 (BB), of period 2 (BW = EBA), of period 3 (MBA) and of period 4 (MBA) counted by the first author.
Notable features: the presence of *Fagus* in periods 2, 3 and 4, the presence of *Carpinus* in period 4, the relatively high value for *Calluna* in period 1, the

low values for Gramineae and for other herbs, including Cerealia and *Plantago lanceolata*, indicating the absence of arable land in the immediate surrounding of the tumulus.

N-30. Eext.
Two-period tumulus Kerkweg 3 near Eext, mun. of Anlo (D).
Grave goods: battle axe of Emmen type, and an unfinished atypical battle axe (period 1).
Composition of mound: grey sand on clearly developed soil profile.
C14 dating: GrN-6340: 3760 ± 35 BP, period 1.
Excavation: J. N. Lanting and J. D. van der Waals (1970), J. N. Lanting, 1973, Palaeohistoria XV, pp. 270-271.
Samples taken by J. N. Lanting and J. D. van der Waals.
Sample of the old surface of period 1 counted by the first author (1973).
Notable features: the absence of *Fagus*, the low value for *Calluna*, the high percentage for *Plantago lanceolata* and the relatively high percentage for Gramineae, indicating that the mound was constructed on abandoned arable land.

N-31. Odoorn.
Two-period BB tumulus at Odoorn (D).
Grave goods: BB type 2Ib, copper tanged dagger, copper awl, copper spiral bracelet, gold and amber beads.
Composition of mound: greyish sand with a dark-filled foundation-trench, capping of greyish sand, with ring-ditch.
Excavation: A. E. van Giffen (1929), 1930, Die Bauart; 1947, NDV 64.
Samples taken by A. E. van Giffen (1929).
Samples of old surface and of foundation-trench counted by H. T. Waterbolk, 1954, table 2.
Notable features: the presence of *Fagus* in one sample, the relatively low values for *Calluna*.

N-32. Oudemolen.
Three-period tumulus 13 near Oudemolen, mun. of Vries (D).
Grave goods: two primary graves, one with undecorated and with heavily decorated beaker (no type), the other with BB type 2Ic.
Composition of mound: primary mound of dirty yellow sand, second period of rather distinct, long sods; of the third period only a few sods visible.
C14 dating: GrN-6146: 3725 ± 35 BP (period 1 with BB), GrN-6255: 3705 ± 35 BP (period 2, BB grave without finds).
Excavation: A. E. van Giffen (1954).
Samples taken by W. van Zeist.
Samples of old surface of period 1 (BB), of sod of period 2 (BB) and of sod of period 3 (Middle Bronze Age) counted by W. van Zeist, 1955, table VII.
Notable features: the presence of *Fagus*, the presence of *Carpinus* in period 3, the rather high to very high percentages for *Calluna*.

N-33. Hijken.
Three-period tumulus 1 "De Utrecht" at Hijken, mun. of Beilen (D).
Grave goods: none.
Composition of mound: primary mound of greyish sand, covering mound of light coloured sand, in which a few distinct sods can be distinguished; third period without capping, but with bronze palstave (MBA).
C14 dating: GrN-6261: 3665 ± 35 BP, period 1, GrN-6262: 3455 ± 35 BP, period 2.
Excavation: A. E. van Giffen (1953).
Samples taken by W. van Zeist.
Samples of old surface (BB) and of sod (period 2 = MBA) counted by W. van Zeist, 1955, table II.
Notable features: the absence of *Fagus*, the low value for *Corylus*, the high value for *Quercus* in the sod sample; the low *Calluna* percentages in both samples; the high values for *Alnus*, *Plantago lanceolata* and a number of other herbs in the old surface sample.

N-34. Elp.
Two-period tumulus 1 near Elp, mun. of Westerbork (D).
Grave goods: BB type 2Ib.
Composition of mound: both periods of yellow sand.
Excavation: A. E. van Giffen (1932), 1934, NDV 52, pp. 100-110.
Re-excavation: J. N. Lanting and J. D. van der Waals (1970).
Samples taken by J. N. Lanting and J. D. van der Waals (1970).

Samples of old surface of period 1 and of period 2 counted by the first author (1974).
Notable features: the presence of *Fagus*, the relatively high value for *Betula* in period 1, the not very high percentages for herbs.

N-35. Vries.
Two-period tumulus with stone cist, no. 3 at Vries (D).
Grave goods: sherds of pot beaker in body of mound; a stone cist as primary grave.
Composition of mound: mound of first period of yellow sand; mound of secondary period of clearly visible sods.
Excavation: A. E. van Giffen (1939), 1941, NDV 59, pp. 116-120.
Re-excavation: A. E. van Giffen (1949), unpublished.
Re-interpretation: J. N. Lanting, 1973, Palaeohistoria XV, pp. 307-308.
Samples taken by H. T. Waterbolk.
Samples of old surface of first period (BB) and of second period (MBA) counted by H. T. Waterbolk, 1954, table 2.
Notable features: the presence of *Fagus* only in the second period, the relatively high values for *Calluna*, the rather low percentages for Gramineae and the relatively high percentage for *Plantago lanceolata* in period 1; the low values for the other herbs.

N-36. Zeyen.
Two-period tumulus at the "Noordse Veld" near Zeyen, mun. of Vries (D).
Grave goods: none.
Composition of mound: yellow brown sand with humous sods visible on yellow-grey old surface with ring-ditch; capping of yellow-brown sand.
Excavation: A. E. van Giffen, 1949a, NDV 67, pp. 102-104.
Samples taken by H. T. Waterbolk.
Sample of old surface counted by H. T. Waterbolk, 1949, NDV 67, pp. 126-129; see also A. E. van Giffen, 1949a, NDV 67, pp. 102-104.
Notable features: the absence of *Fagus*, the low value for *Tilia*, the not very high percentage for Ericaceae and the low values for *Betula* and Gramineae.

N-37. Diever.
Single-period sod-built tumulus II with a wooden cist as primary grave, near Diever (D).
Grave goods: small oval flint knife with marginal retouch.
Composition of mound: light coloured sods on a subsoil of incipient podzolation, i.e.a. leached layer, about 10 cm thick, but not a hard pan.
Excavation: A. E. van Giffen (1931), published by J. N. Lanting, 1973, Palaeohistoria XV, pp. 269-270.
Samples taken by W. van Zeist.
Sample of sod counted by W. van Zeist, 1955, table VI.
Notable features: the presence of *Fagus*, the high *Calluna* percentage, the relatively low values for Gramineae and other herbs.

N-38. Diever.
Single-period tumulus I, with stone cist, constructed over TRB stone cist, near Diever (D).
Grave goods: BB (no specific type).
Composition of mound: dirty yellow sand with a number of clearly visible sods on a subsoil with incipient podzolation.
Excavation: A. E. van Giffen (1929), 1930, Die Bauart.
Re-interpretation: J. N. Lanting, 1973, Palaeohistoria XV, pp. 241-242.
Samples taken by W. van Zeist (1953).
Sample of primary grave counted by H. T. Waterbolk, 1954, table 2; samples of old surface and of sod counted by W. van Zeist, 1955, table VI.
Notable features: the presence of *Fagus* and of *Carpinus* (in the sod sample), the relatively high *Calluna* percentages; the low values for Gramineae, *Rumex*, *Plantago lanceolata* and Compositae.

N-39. Mander.
Two-period tumulus I (1971) near Mander, mun. of Tubbergen (O).
Composition of mound: dirty yellow sand.
C14 dating: GrN-6856: 3835 ± 55 BP.
Excavation: C. C. W. J. Hijszeler (1971).
Samples taken by the first author (1971).
Samples of old surface underneath period 1 (BB) and of period 2 (BB) counted by the first author (1973).
Notable features: the absence of *Fagus*, the relative-

ly high percentage for *Tilia*, the low values for Gramineae, *Plantago lanceolata* and for the other herbs.

N-40. Mander.
Single-period tumulus III (1971) near Mander, mun. of Tubbergen (O), situated between tumulus I and tumulus II (with the corpse silhouette of the "Man van Mander").
Composition of mound: sod-built.
Excavation: C. C. W. J. Hijszeler (1971).
Samples taken by the first author (1971).
Sample of old surface counted by the first author (1973).
Notable features: the presence of *Fagus*, the relatively high value for *Tilia*, the low values for Gramineae and for other herbs.

3.1.4. *Early Bronze Age (fig. 5)*

N-41. Oudemolen.
Four-period tumulus 12 north of Oudemolen, mun. of Vries (D).
Grave goods: as grave gift a small flint knife; in base of period 1 sherds of large BW pot were found.
Composition of mound: primary mound of yellow sand with long sods visible; second period consists of a small capping of yellow grey sand; third and fourth periods consist of circular ditches without capping.
Excavation: A. E. van Giffen (1950).
Published by J. N. Lanting, 1973, Palaeohistoria XV, esp. pp. 263-264.
Samples taken by H. T. Waterbolk (1950).
Samples of old surface and of sod of period 1 (EBA), of period 2 (MBA) and of ditch and trench of periods 3 and 4 (LBA) counted by H. T. Waterbolk, 1954, table 4.
Notable features: the presence of *Fagus* in periods 1 and 2, the increasing values for *Calluna*, the relatively low percentages for *Plantago lanceolata* except in the old surface of period 2.

N-42. Eext.
Two-period tumulus Eext-1939 near Eext, mun. of Anlo (D).
Grave goods: none.
Composition of mound: yellowish-grey sand, capping of sods.
Excavation: A. E. van Giffen (1939), 1941, NDV 59, pp. 27-31.
Samples taken by J. N. Lanting (1970).
Samples of old surface (BW) and of sod (MBA) counted by the first author (1974).
Notable features: the presence of *Fagus* and *Carpinus* in the sod sample, the high value for *Plantago lanceolata*, especially in the old surface; the relatively high values for the herbs.

N-43. Zeyen.
Single-period tumulus 114 at the "Noordse Veld" near Zeyen, mun. of Vries (D).
Grave goods: bronze riveted dagger and whetstone.
Composition of mound: mound of long, inverted dark-coloured sods on a subsoil with a well developed podzol profile.
Excavation: A. E. van Giffen (1918), 1920, NDV 38, pp. 121-146 and 1930, Die Bauart.
Samples taken by W. van Zeist (1953).
Samples of old surface and of sod (EBA to MBA) counted by W. van Zeist, 1955, table III.
Notable features: the presence of *Fagus*, the absence of *Carpinus*, the not very high values for *Calluna* and the relatively low values for the other herbs.

►

Fig. 2. Frequencies of several pollen types for TRB grave monuments N-1 – N-14. Drawing BAI.

►

Fig. 3. Frequencies of several pollen types for PFB barrows N-15 – N-28. N-17, N-18, N-23 and N-26 are single-period barrows. Drawing BAI.

►

Fig. 4. Frequencies of several pollen types for BB barrows N-29 – N-40. N-37, N-38 and N-40 are single-period barrows. Drawing BAI.

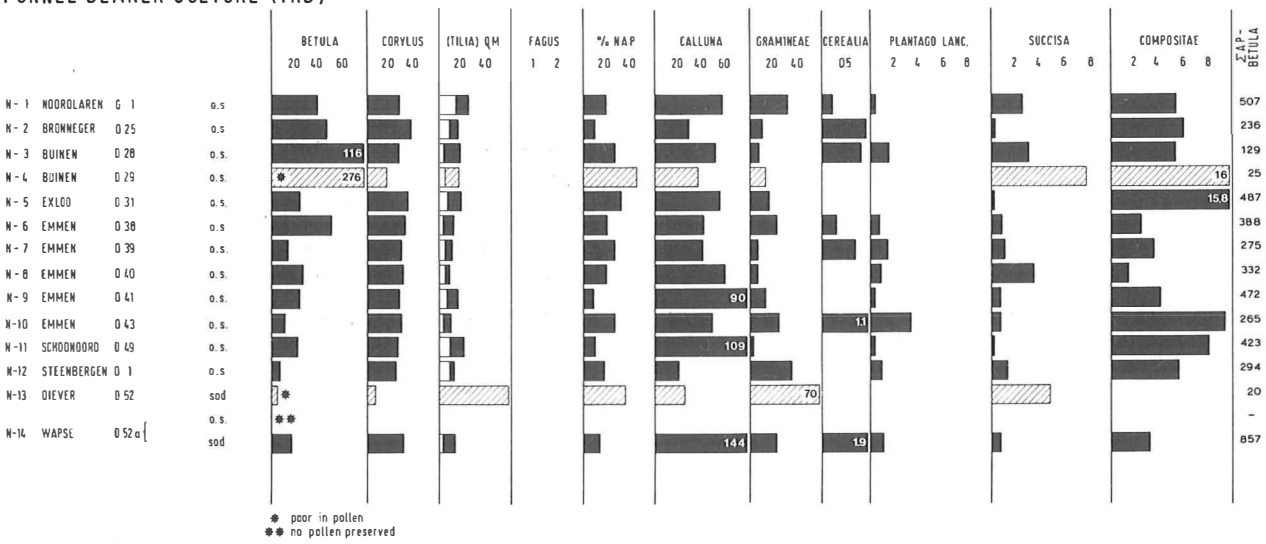
►►

Fig. 5. Frequencies of several pollen types for EBA barrows N-41 – N-43. N-43 is a single period-barrow. Drawing BAI.

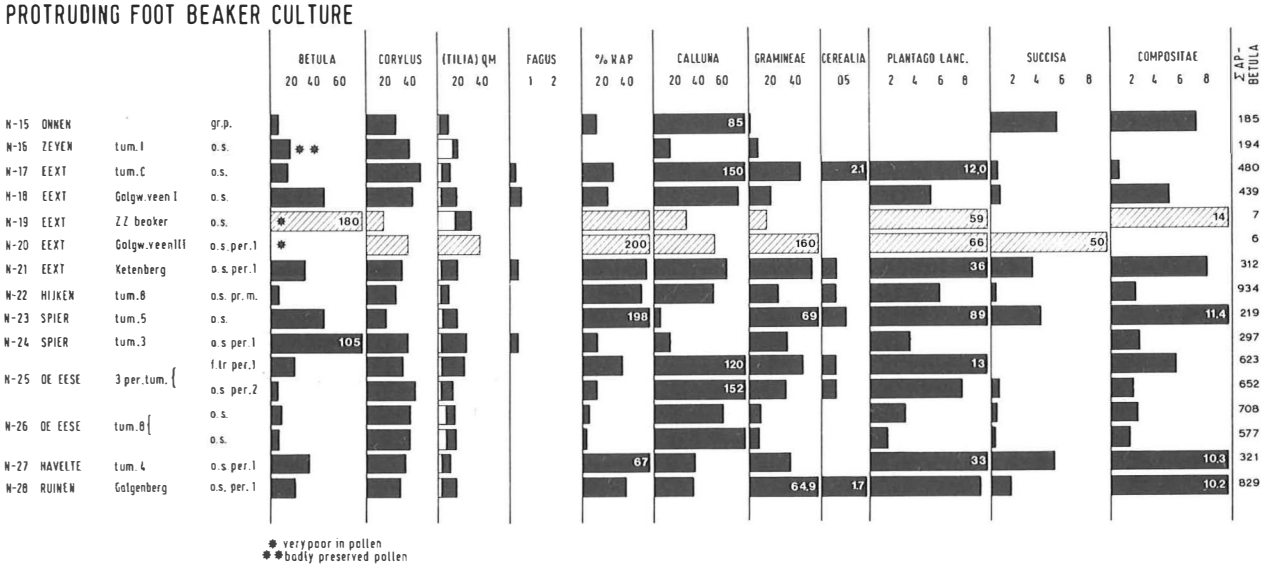
►►

Fig. 6. Frequencies of several pollen types for multi-period barrows north of the IJssel. Drawing BAI.

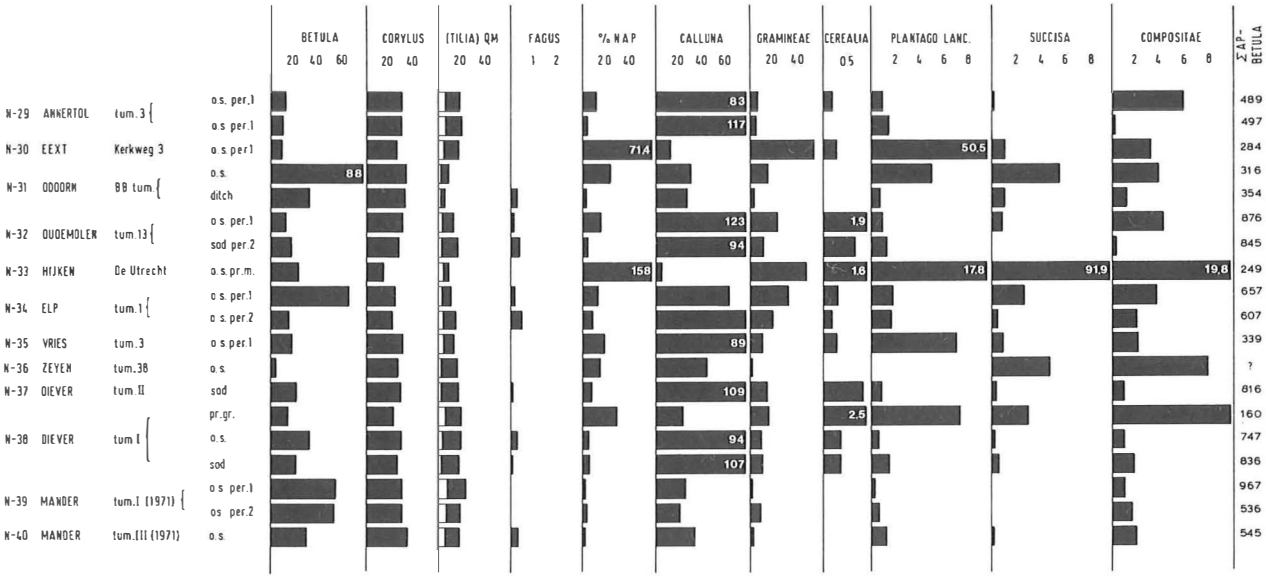
FUNNEL BEAKER CULTURE (TRB)



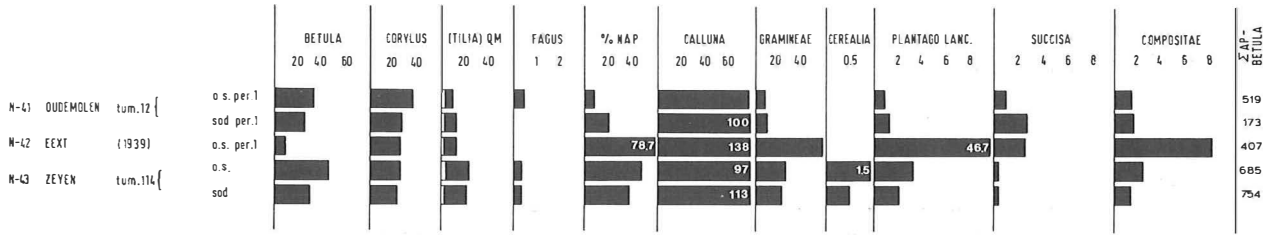
PROTRUDING FOOT BEAKER CULTURE



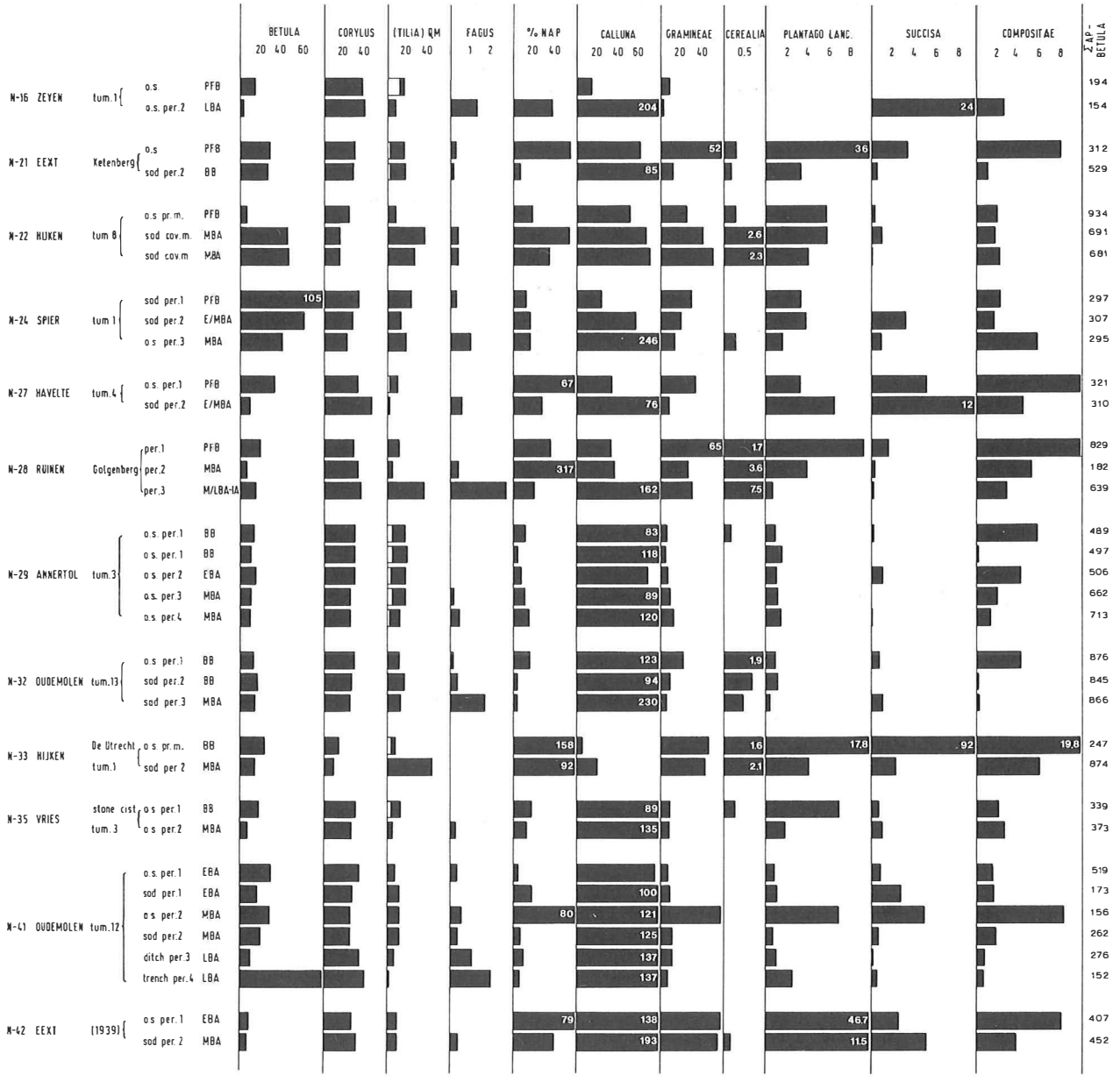
BELL BEAKER CULTURE



EARLY BRONZE AGE



MULTI-PERIOD BARROWS



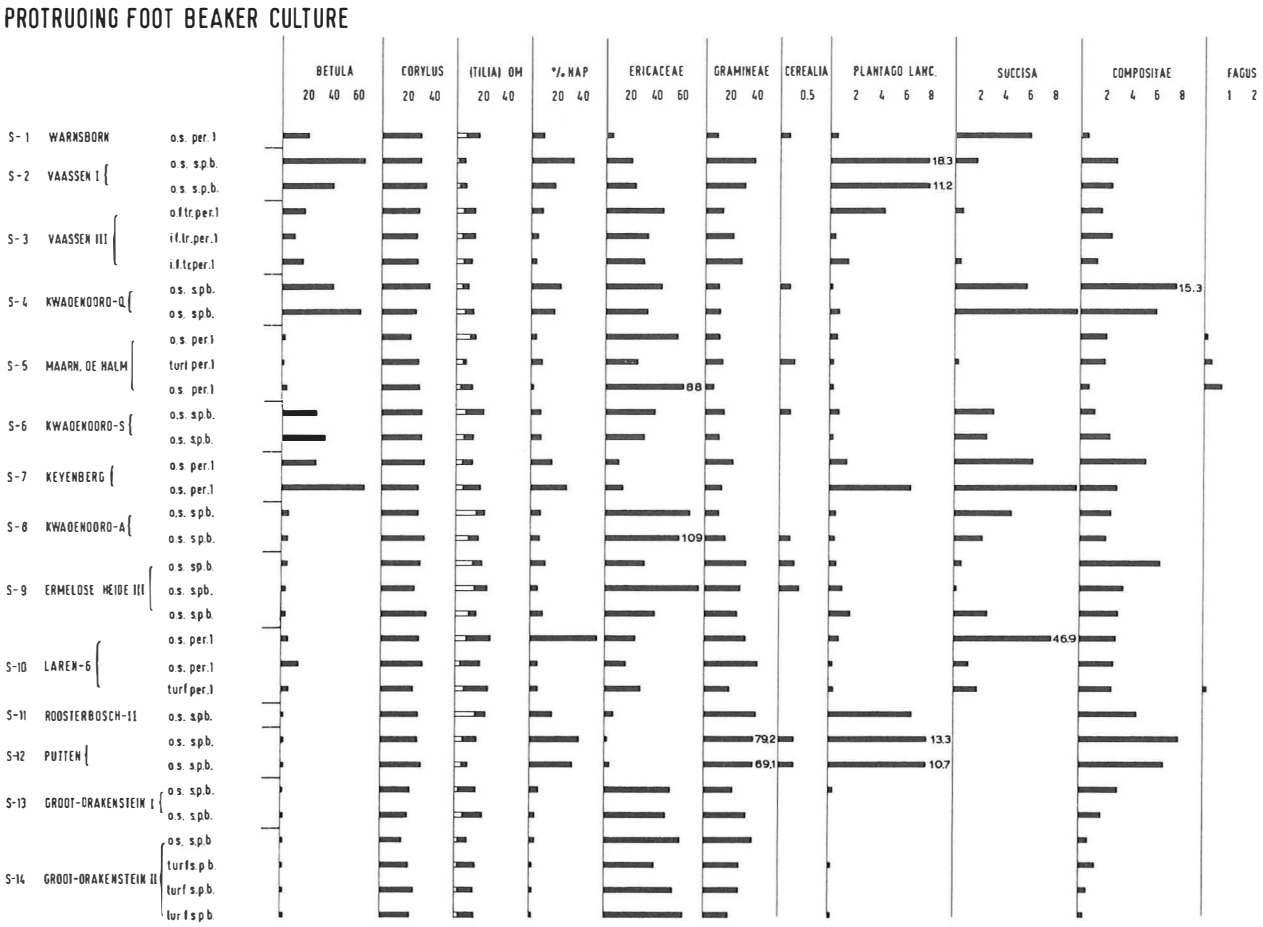


Fig. 7. Frequencies of several pollen types for PFB barrows S-1 – S-14. Drawing IPP.

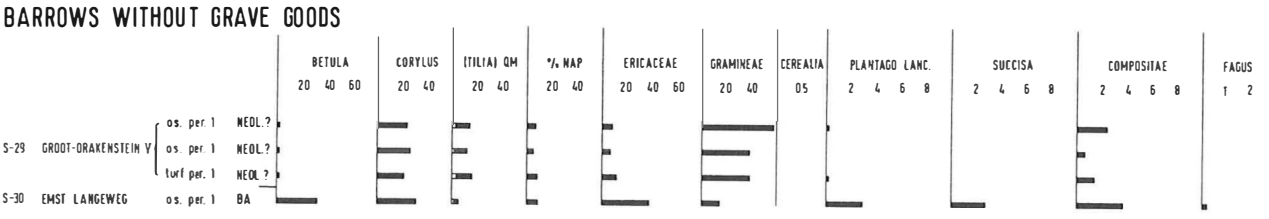


Fig. 9. Frequencies of several pollen types for archaeologically undated barrows S-29 and S-30. Drawing IPP.

3.2. South of the IJssel (fig. 1)

3.2.1. *PFB Culture (fig. 7, table 2)*

S-1. Single-period barrow at Warnsborn near Schaarsbergen, mun. of Arnhem (G).

Grave goods: PFB type 1a, flint axe, flint blade.
Composition of mound: yellow sand on barely visible old surface.
C14 dating: charcoal from primary grave 4435 ± 320 BP (GrN-318) (Lanting & Mook, 1977, p. 84).
Original excavation: W. Glasbergen and H. T.

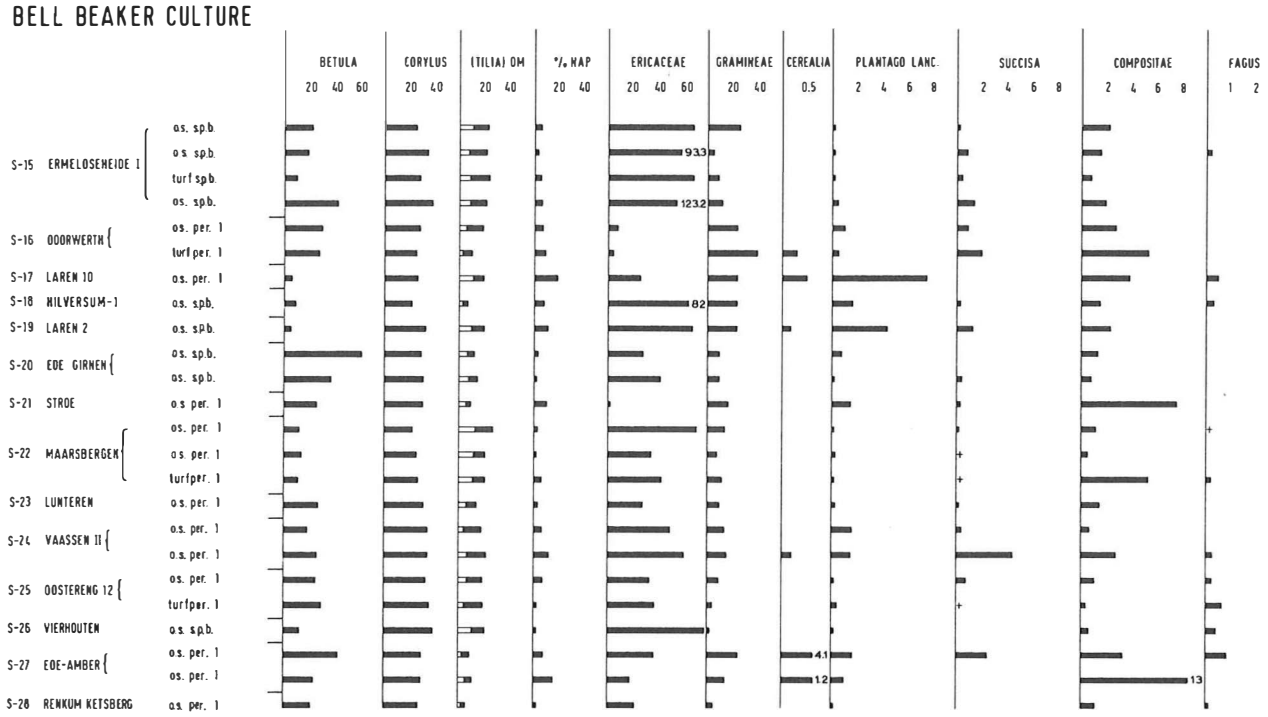


Fig. 8. Frequencies of several pollen types for BB barrows S-15 – S-28. Drawing IPP.

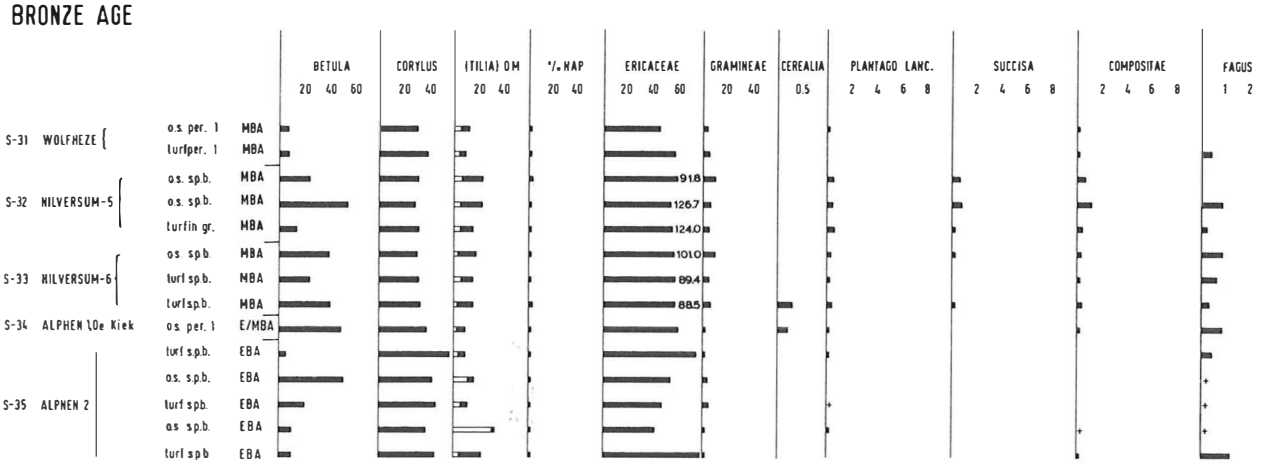


Fig. 10. Frequencies of several pollen types for Bronze Age barrows S-31 – S-35. Drawing IPP.

Waterblok, 1947 (Glazema, 1951, p. 96; Waterbolk, 1954, pp. 95-98).
Re-excavation: J. N. Lanting and J. D. van der Waals, 1972 (Lanting & Van der Waals, 1972d, p. 132).
Samples taken by second author from the old surface (P1972-75-78, 80) and from a Bronze Age interment (P1972-79).
Samples P1972-75, 79 counted by the same, 1972.
Notable features: in the old surface sample, the low values for all the herbs, including Ericaceae and Gramineae and the absence of *Fagus*; in the youn-

	S-1		S-2		S-3			S-4		S-5					S-6	
	P1971-75	P1971-79	P1971-7	P1971-8	P1971-13	P1971-138	P1971-140	P1972-252 1	P1972-252 3	P1976-1	P1976-2	P1976-4	P1976-3	P1976-6	P1972-253 1	P1972-253 2
Alnus	41.0	41.9	60.6	56.5	53.9	56.7	57.2	50.0	57.2	54.7	60.0	49.8	58.2	67.4	60.2	50.2
Corylus	36.0	34.0	31.6	35.6	30.7	28.8	29.3	39.3	27.8	23.9	30.1	31.2	29.9	20.6	33.3	32.8
Fraxinus	–	–	–	–	–	–	–	0.2	0.2	–	0.6	0.7	0.8	0.9	0.3	0.2
Quercus	12.3	16.7	5.6	10.5	10.5	7.6	5.6	7.1	4.5	3.2	8.0	6.5	6.9	14.0	14.0	8.0
Tilia	6.7	6.0	1.4	2.2	4.5	3.6	4.4	3.9	5.9	10.4	4.5	3.7	1.6	0.5	6.8	5.6
Ulmus	–	–	0.4	–	0.3	0.2	0.5	0.4	0.4	0.7	–	1.7	–	0.9	0.8	0.7
Fagus	–	0.6	–	–	–	–	–	–	–	0.1	0.3	0.7	–	1.4	–	–
Carpinus	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–
Salix	–	–	–	–	–	–	–	0.4	0.8	–	0.6	–	0.3	0.5	0.7	2.0
Pinus	3.5	0.6	0.4	–	0.2	0.2	0.2	0.2	0.6	2.2	0.6	4.0	2.5	0.9	0.5	0.7
Acer	0.2	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Picea	–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–
Hedera	–	–	–	–	–	–	–	–	–	–	–	0.3	0.3	–	–	–
Σ AP-Betula	**479**	**485**	**284**	**278**	**685**	**534**	**409**	**486**	**509**	**713**	**312**	**301**	**368**	**218**	**600**	**610**
Betula	21.4	26.8	66.9	41.7	19.3	9.7	17.1	41.0	62.7	2.5	1.9	2.7	2.2	9.2	28.3	35.4
Ericaceae	5.2	9.9	20.8	24.5	45.5	34.1	31.3	44.9	33.8	57.6	25.6	88.0	92.4	5.1	39.8	30.8
Gramineae	9.4	12.6	39.8	31.7	13.9	22.8	29.1	11.3	12.2	11.8	13.5	7.0	9.2	32.6	15.0	11.0
Cerealia	0.2	–	–	–	–	–	–	0.2	–	–	0.3	–	–	–	0.2	–
Plantago lanceolata	0.6	0.2	18.3	11.2	4.4	0.4	1.5	0.2	0.8	0.6	0.3	0.3	0.8	4.1	0.8	0.3
Rumex a-type	–	–	0.7	0.4	–	–	–	–	–	0.6	0.3	0.3	0.8	3.2	–	–
Succisa	6.1	3.7	1.8	–	0.6	–	0.5	5.8	10.0	–	0.3	–	–	–	3.2	2.6
Compositae liguliflorae	–	–	1.1	1.1	0.4	0.8	0.7	6.2	3.0	1.1	1.0	0.7	0.3	–	–	0.3
Compositae tubuliflorae	0.6	0.6	1.8	1.4	1.3	1.7	0.7	9.1	3.1	0.1	1.0	–	–	0.5	1.2	2.1
Artemisia	0.2	–	–	–	–	–	–	0.4	–	–	0.3	–	–	–	0.2	–
Campanula-type	–	–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	0.3
Caryophyllaceae	0.4	0.8	5.6	4.3	1.5	0.2	0.5	0.2	–	–	1.0	–	–	–	0.8	0.3
Chenopodiaceae	–	–	0.4	–	–	–	0.2	–	–	–	–	–	–	–	–	0.2
Cruciferae	–	–	–	–	–	–	–	0.6	0.2	0.1	2.2	–	0.3	2.3	0.2	0.2
Cyperaceae	0.4	0.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Drosera	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–
Filipendula	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Galium-type	–	–	–	–	–	–	–	–	–	–	–	–	–	0.5	–	–
Geraniaceae	–	0.2	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–
Humulus-type	–	–	–	–	–	–	–	–	–	–	–	0.3	0.3	0.5	–	–
Labiatae	–	–	–	–	–	–	–	–	0.2	–	0.3	–	–	–	–	–
Lonicera	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–
Papilionaceae	–	–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	0.3
Plantago major/media	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Polygonum persicaria	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.2	–
Ranunculaceae	0.6	0.2	0.7	0.4	0.3	0.2	0.2	–	0.2	0.3	1.0	0.3	0.5	0.9	0.2	0.3
Ranunculus arvensis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.2	–
Rosaceae	–	–	–	–	–	–	–	–	0.2	–	–	–	0.3	–	0.2	–
Scrophulariaceae	–	–	–	–	–	–	–	–	0.2	0.1	–	–	0.3	–	–	–
Thalictrum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.2
Typha angustifolia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Umbelliferae	–	–	–	–	–	–	–	0.6	–	–	0.3	–	–	–	–	–
Urtica sp.	–	–	–	–	–	0.6	–	–	0.2	0.1	–	–	–	–	–	–
Pteridium	–	–	1.1	0.7	–	0.9	–	0.2	0.6	0.6	0.3	–	0.3	0.5	0.5	0.3
Dryopteris	11.9	5.4	18.3	18.0	9.8	7.5	6.1	0.6	1.6	1.7	1.6	2.0	0.3	0.5	2.8	2.6
Polypodium	7.1	3.3	0.7	1.4	1.0	0.8	1.0	0.2	0.2	0.1	1.0	1.0	0.3	–	0.7	0.8
Sphagnum	1.4	0.8	10.2	8.6	3.7	2.3	1.2	0.8	0.2	0.1	1.0	–	0.3	–	1.2	0.8
Lycopodium	0.4	–	0.4	–	0.2	–	–	–	–	–	–	–	–	–	–	–

Table 2. Pollen spectra, not yet published, of PFB barrows south of the IJssel.

S-7			S-8		S-9			S-10				S-11	S-12		S-13		S-14			
P1975-81	P1975-76	P1975-82	P1972-251 1	P1972-251 2	P1971-61	P1971-62	P1971-64	P1970-130	P1970-133	P1970-134	P1970-136	P1970-52	P1971-4	P1971-5	L1965-24	L1965-25	L1965-26	L1965-27	L1965-28	L1965-29
50.2	49.4	45.0	44.5	44.9	46.5	47.9	45.4	42.3	46.1	45.8	53.3	45.0	53.7	57.4	59.0	55.6	71.2	59.2	57.8	–
35.1	29.4	32.3	29.5	34.7	31.6	26.8	36.6	30.7	33.8	25.6	31.0	30.5	29.4	32.6	24.1	22.0	17.7	22.6	27.2	–
0.7	0.4	0.4	0.3	0.4	–	–	–	–	0.3	+	–	–	–	–	–	–	–	–	–	–
9.1	14.3	9.2	6.2	5.7	7.3	10.2	6.9	19.5	17.2	19.9	10.9	7.9	10.8	5.0	14.4	15.6	8.3	15.8	12.9	–
4.6	5.2	8.4	16.2	10.1	12.8	14.2	10.0	7.5	2.7	6.1	2.1	15.2	5.0	5.0	1.9	6.2	2.1	1.5	1.8	–
–	–	0.4	0.3	2.1	0.6	0.4	+	0.4	–	+	0.8	0.7	1.1	–	0.2	0.3	–	0.4	–	–
–	–	1.2	–	–	–	–	–	–	–	0.2	0.1	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	1.3	2.0	0.3	0.5	–	–	0.2	–	–	+	–	–	–	–	–	–	–	–	–	–
0.4	–	0.8	2.3	1.7	0.6	0.4	0.8	–	–	0.2	0.4	0.7	–	–	0.4	0.3	0.7	0.4	0.3	1.1
–	–	0.4	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
285	**231**	**251**	**616**	**577**	**329**	**459**	**478**	**241**	**373**	**472**	**752**	**151**	**361**	**319**	**474**	**723**	**278**	**682**	**706**	**546**
28.1	83.6	39.0	6.0	5.4	5.2	3.1	2.9	5.4	13.7	5.7	4.0	1.3	2.2	2.2	0.8	2.2	2.5	0.4	1.8	2.9
10.9	15.2	56.6	68.5	109.9	32.3	75.4	40.5	23.7	16.6	39.2	54.0	6.6	1.7	4.4	53.0	48.6	61.2	40.5	55.2	62.8
21.8	13.9	10.8	11.0	16.1	33.4	28.5	25.5	33.2	42.9	20.3	17.2	41.1	79.2	67.1	22.8	34.6	38.9	27.6	28.2	20.5
–	–	0.8	–	0.2*	0.3*	0.4***	–	–	–	–	–	–	0.3**	0.3*	–	–	–	–	–	–
1.4	6.5	0.8	0.5	0.4	0.6	1.1	1.7	0.8	0.3	0.4	0.4	6.6	13.3	10.7	0.4	–	–	0.1	–	0.2
0.4	–	0.4	–	–	–	–	–	–	–	–	–	–	1.7	–	–	–	–	–	–	–
6.3	10.0	5.6	4.6	2.3	0.6	0.2	2.7	46.9	1.2	1.9	1.1	–	0.3	–	–	–	–	–	–	–
1.8	0.4	4.8	0.2	0.4	2.8	0.7	0.8	2.1	1.6	1.5	0.5	–	3.6	3.1	1.0	0.9	–	0.6	0.3	0.2
3.5	2.6	1.2	2.3	1.7	3.7	2.8	2.3	0.8	1.1	1.1	1.1	4.6	4.4	3.7	2.1	0.8	0.7	0.7	0.3	0.4
–	–	0.4	0.2	–	–	–	–	–	–	–	0.1	–	0.3	–	–	–	–	–	–	–
–	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	2.2	–	0.3	0.5	1.8	–	0.8	2.5	1.1	0.2	0.4	–	7.5	8.5	1.3	0.7	0.7	–	0.7	0.7
–	–	0.4	–	–	–	0.4	–	–	–	–	0.1	–	0.3	0.3	–	–	–	–	–	–
0.7	–	1.6	–	0.2	–	–	–	–	–	–	–	0.7	0.3	0.3	–	–	0.4	–	–	–
–	0.9	–	–	–	–	–	–	–	–	–	–	–	–	–	1.0	0.3	0.4	0.4	0.7	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	0.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	0.4	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	–	–
1.1	0.4	0.4	–	0.2	0.6	–	0.2	–	–	–	–	4.0	2.8	0.9	0.4	0.8	1.1	–	0.1	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	1.2	–	–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–
0.4	–	–	–	0.2	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	0.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	0.3	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	0.6	0.4	0.1	0.3	0.2
1.1	4.8	1.2	–	0.2	0.9	0.2	1.1	0.8	0.8	0.2	0.4	–	4.2	5.6	–	–	–	–	–	–
1.8	14.3	1.6	1.8	1.0	7.6	1.7	33.7	17.8	17.2	11.9	5.1	148.3	94.2	86.5	13.1	6.1	19.4	2.9	6.8	2.4
0.4	7.0	0.8	1.0	0.2	0.6	0.4	3.1	1.7	0.8	0.2	0.4	7.9	5.5	6.3	0.2	0.7	2.1	0.1	0.3	0.4
1.1	7.8	0.8	0.7	0.7	8.5	0.4	11.3	3.7	2.7	1.9	2.3	13.2	19.9	20.1	3.0	1.4	2.1	0.7	1.7	1.4
–	0.4	0.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

* = Hordeum-type
** = Triticum-type
*** = 0.2% Hordeum-type
0.2% Triticum-type

ger sample, the presence of *Fagus* and the still low values for the herbs.

S-2. Single-period barrow I at Vaassen, mun. of Epe (G).
Grave goods: large thick-butted flint axe (early phase of PFB Culture); flint blade and fragment of another (possibly belonging to the settlement material?). In the old surface beneath the mound sherds with short-wave moulding indicating a PFB settlement.
Composition of mound: pale orange sand on slightly podzolized soil.
Original excavation: F. C. Bursch and A. L. Tromp, 1941.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971a, pp. 53-54; 1971b, pp. 94-104; 1976, p. 60).
Samples taken by the above from the old surface (P1971-6-8).
Samples P1971-7-8 counted by Mrs. C. Niessen-Boomgaard (analyst IPP), 1971.
Notable features: the absence of *Fagus*, the rather high values for *Betula*, the low values for Ericaceae, the rather high values for Gramineae and the high values for *Plantago lanceolata* and Caryophyllaceae.

S-3. Two period barrow III at Vaassen, mun. of Epe (G).
Grave goods: first period, battle axe type P2 (Addink-Samplonius, 1968, p. 230, 232), small flint blade, probably a small axe of greenstone and sherds of a PF Beaker type 1a; second period, Veluvian Bell Beaker type 2Id, copper knife, V-bored amber button and lunula-shaped amber pendant (Butler & Van der Waals, 1967, p. 51, 125).
Composition of mound: non-existing at re-excavation, samples taken from humic patches in sandy ditch fillings.
C14 dating: first period, 4165 ± 40 BP (GrN-6369) (Lanting, Mook & Van der Waals, 1973, p. 52).
Original excavation: F. C. Bursch and A. L. Tromp, 1941.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971a, p. 54; 1971b, pp. 108-117; 1976, p. 39, 60).
Samples taken by the above from the intermediate foundation trench (P1971-138-141) and from the outermost foundation trench (P1971-13), all belonging to the first period.
Samples P1971-13, 138, 140 counted by Mrs. C. Niessen-Boomgaard, 1971.
Notable features: the low *Betula* percentages, the absence of *Fagus*, the rather modest values for Ericaceae, Gramineae and, with the exception of P 1971-13, also for *Plantago lanceolata*, Caryophyllaceae and the other herbs.

S-4. Single-period barrow Q at Kwadenoord, mun. of Renkum (G).
Grave goods: PF Beaker type 1a, flint blade?
Composition of mound: dark yellow sand on a light grey old surface band.
Original excavation: H. J. Bellen, 1929.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1972 (Lanting & Van der Waals, 1972b, pp. 131-132).
Samples taken by the above from the old surface (P1972-252, 1-4).
Samples P 1972-252, 1, 3 counted by second author, 1974.
Notable features: the absence of *Fagus*, the high percentages for *Betula*, Ericaceae, *Succisa* and Compositae, in contrast to the low values for Gramineae, *Plantago lanceolata* and other herbs.

S-5. Three-period barrow at De Halm, mun. of Maarn (U).
Grave goods: PF Beaker type 1a, battle axe type D or E, flint axe and flint blade.
Composition of mound: yellow-grey sand on grey, slightly humic soil.
C14 dating: first period, 4140 ± 50 BP (GrN-7802) (Lanting & Mook, 1977, p. 85).
Excavation: J. N. Lanting and J. D. van der Waals, 1976.
Samples taken by second author from the old surface underneath the primary mound (P1976-1, 4), from turfs in the primary mound (P1976-2, 5), from the old surface of the second period (P1976-3, 6) and from the old surface of the third period (P1976-7).
Samples counted by the same, 1978.
Notable features: the difference between samples 3 and 6 and the likeness between samples 3 and 4, indicating that sample 3 belongs to the primary mound; the presence of *Fagus* in three samples of the primary mound and the high *Fagus* value in the

old surface of the secondary mound, indicating a date in the advanced Bronze Age; the rather low *Betula* percentages in all the samples and the rather high Ericaceae values in the primary mound, in contrast to the very low percentage in the secondary mound; the low values for all the other herbs, with the exception of the Gramineae in sample 6 and *Plantago lanceolata*. Samples 5 and 7 contained too little pollen for a reliable result.

S-6. Single-period barrow S at Kwadenoord, mun. of Renkum (G).
Grave goods: PF Beaker type 1b.
Composition of mound: dark yellow sand on a light grey old surface band.
Original excavation: H. J. Bellen, 1929.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1972 (Lanting & Van der Waals, 1972b, p. 132).
Samples taken by the above from the old surface (P1972-253, 1-2) and from the barrow mound (P1972-253, 3-4).
Samples P1972-253, 1-2 counted by second author, 1974.
Notable features: the absence of *Fagus*, the moderate values for both *Betula* and Ericaceae and the low values for all the other herbs.

S-7. Two-period barrow at De Keyenberg, mun. of Renkum (G) (Modderman, 1964, p. 19; Elzinga, 1966, p. 13: tumulus 3).
Grave goods: period 1, PF Beaker type 1b; period 2, small bronze ring?
Composition of mound: yellow-orange coloured sand on slightly humic (light grey) thin soil layer with charcoal patches.
Excavation: J. A. Bakker and second author, 1975/77 (Bakker & Groenman-van Waateringe, in prep.).
Samples taken by second author from the old surface of the primary mound (P1975-76-81), from turfs in the primary mound (P1975-74-75), from the old surface of the secondary mound (P1975-82-83) and from turfs in the secondary mound (P1975-84-88).
Samples P1975-76, 81-82 counted by second author; the other samples did not contain enough pollen.
Notable features: the difference between the samples from the two periods, i.e. no *Fagus* in samples 76 and 81 and the high *Fagus* percentage in sample 82, indicating a dating in the advanced Bronze Age; the difference between the two samples from the primary mound, with a high *Betula* percentage a high value for *Plantago lanceolata* in sample 76 and low values for both in sample 81. Considering its origin in the centre of the mound, sample 81 seems the most reliable, whereas sample 76 lies somewhat eccentrically (see Bakker & Groenman-van Waateringe, in prep.). Furthermore, in sample 81 the moderately high values for Gramineae and *Succisa* are noteworthy.

S-8. Single-period barrow A at Kwadenoord, mun. of Renkum (G).
Grave goods: PF Beaker type 1d, battle axe Glob type D, flint axe and flint blade.
Composition of mound: brown-yellow sand on barely visible old surface.
C14 dating: 4065 ± 55 BP (GrN-6712C), being a *terminus post quem* for the interment (Lanting, Mook & Van der Waals, 1973, p. 52; corrected in Lanting & Van der Waals, 1976, p. 39).
Original excavation: H. J. Bellen, 1929.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1972 (Lanting & Van der Waals, 1972b, p. 131; 1976, p. 39).
Samples taken by the above from the old surface (P1972-251, 1-4).
Samples P1972-251, 1-2 counted by second author, 1974.
Notable features: the absence of *Fagus*, the low values for *Betula*, the high values for Ericaceae and *Succisa* and the low values for all the other herbs, included the Gramineae.

S-9. Single-period barrow III at De Ermelose Heide, mun. of Ermelo (G).
Grave goods: PF Beaker type 1d, late PF Beaker, flint blade.
Composition of the mound: yellow-grey sand on a barely recognisable old surface.
Original excavation: P. J. R. Modderman, 1952 (Modderman, 1954, pp. 12-14, 24-25; 1964, p. 14).
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971d, p. 126).
Samples taken by second author from the old sur-

face (P1971-60-64).
Samples P1971-61, 64 counted by Mrs. C. Niessen-Boomgaard, 1971; P1971-62 by second author, 1974.
Notable features: the absence of *Fagus*, the very low values for the birch, the rather high values for Gramineae and low values for other herbs and the very high Ericaceae percentage in sample 62.

S-10. Two-period barrow 6 at Laren, mun. of Laren (NH)
Grave goods: PF Beaker type 1d, battle axe Glob type C.
Composition of mound: grey-yellow sand with rather well marked old surface layer.
C14 dating: 4385 ± 75 BP (GrN-6683C) (Lanting, Mook & Van der Waals, 1973, p. 52; corrected in Lanting & Van der Waals, 1976, p. 39), being a *terminus post quem* for the grave.
Original excavation: A. E. Remouchamps, 1925/26 (Remouchamps, 1928, pp. 68-69).
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971g, p. 129).
Samples taken by second author from the old surface under the primary mound (P1971-130-133), from turfs in the primary mound (P1971-134-135) and from the old surface of the secondary mound (P1971-136-137).
Samples P1971-130, 133-134, 136 counted by Mrs. C. Niessen-Boomgaard, 1971.
Notable features: the presence of *Fagus* in both periods, the low percentages for *Betula*, the rather low percentages for Ericaceae and other herbs, with the exception of *Succisa* in sample 130 and Gramineae in sample 133, in the first period; the slight increase in the Ericaceae percentage in the second period, but apart from that the close resemblance between the two periods.

S-11. Single-period barrow II in Het Roosterbosch near Soestdijk, mun. of Baarn (U).
Grave goods: PF Beaker type 1d, flint scraper.
Composition of mound: brown-yellow sand with barely recognisable old surface.
Original excavation: A. E. van Giffen, 1926 (Van Giffen, 1930, p. 128).
Re-excavation (only for pollen sampling): J. A. Bakker, A. Boomert, W. Glasbergen, second author, 1970.
Samples taken by last mentioned from the old surface (P1970-41-45, 52, 1-3) and from turf in the mound structure (P1970-47).
Samples P1970-52, 1-3 counted by Mrs. C. Niessen-Boomgaard, 1970. The other samples contained too little pollen.
Notable features: the absence of *Fagus*, the low value for *Betula* and Ericaceae, the high values for Gramineae, *Plantago lanceolata*, Ranunculaceae; the extremely high value for *Dryopteris*, indicating poor preservation conditions and selective corrosion?

S-12. Single(?)-period barrow with secondary interments, on an old surface layer with settlement ceramics of the PFB Culture (fragments of at least three pots with short-wave moulding) at Putten, mun. of Putten (G).
Grave goods: PF Beaker of zigzag type, faceted battle axe Brandt type 2b, GP dagger, flint axe, four flint flakes; later interments, Bell Beakers type 2Ic and 2Id.
Composition of mound: patchy grey-brown sand on a c. 12 cm thick grey old surface layer.
Original excavation: A. E. van Giffen, 1947/48 (Waterbolk, 1954, p. 93; Van Giffen, Addink-Samplonius & Glasbergen, 1971; Lanting & Van der Waals, 1976, p. 46).
Re-excavation (only for pollen sampling): A. E. van Giffen, W. Glasbergen and second author, 1971.
Samples taken by the last mentioned from the old surface (P1971-1-5).
Samples P1971-4-5 counted by Mrs. C. Niessen-Boomgaard, 1971.
Notable features: the absence of *Fagus*, the low values for *Betula* and Ericaceae, the high values for Gramineae, *Plantago lanceolata* and other herbs.

S-13. Single-period barrow I at Groot-Drakenstein, Lage Vuursche, mun. of Baarn (U).
Grave goods: axe of greenstone, flint blade.
Composition of mound: dark yellow-grey sand with sods on a grey old surface band.
Original excavation: A. E. van Giffen, 1927 (Van Giffen, 1930, pp. 60-61).
Re-excavation: M. Addink-Samplonius & W. Glasbergen, 1965.

Samples taken by second author from the old surface (L1965-24-25).
Samples counted by Mrs. C. Niessen-Boomgaard, 1966.
Notable features: the absence of *Fagus*, the extremely low values for *Betula*, the rather high percentages for Ericaceae and Gramineae and the very low values for all other herbs.

S-14. Single-period barrow II at Groot-Drakenstein, Lage Vuursche, mun. of Baarn (U).
Grave goods: battle axe type S (Addink-Samplonius, 1968, p. 234), flint blade.
Composition of mound: dark yellow-grey sand with clearly recognisable sods on a grey old surface band.
Original excavation: A. E. van Giffen, 1927 (Van Giffen, 1930, pp. 61-62).
Re-excavation: M. Addink-Samplonius & W. Glasbergen, 1965.
Samples taken by second author from old surface (L1965-26) and from turfs in mound structure (L1965-27-29).
Samples counted by Mrs. C. Niessen-Boomgaard, 1966/67.
Notable features: the absence of *Fagus*, the low values for *Betula*, the rather high values for Ericaceae and Gramineae and the low values for the other herbs.

3.2.2. *BB Culture (fig. 8, table 3)*

S-15. Single-period barrow I at De Ermelose Heide, mun. of Ermelo (G).
Grave goods: AOO Beaker type 2IIb.
Composition of mound: dark yellow sand on barely visible light grey old surface band.
C14 dating: 4005 ± 30 BP (GrN-6351) (Lanting, Mook & Van der Waals, 1973, p. 53).
Original excavation: P. J. R. Modderman, 1952 (Modderman, 1954, pp. 21-22; 1964, p. 15).
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971d, p. 126; 1976, p. 40, 47, 57).
Samples taken by second author from the old surface in (P1971-53-54) and outside the encircling trench (P1971-55-56), from turfs in the trench (P1971-57-58) and from the old surface in the trench (P1971-59).
Samples P1971-53-57 counted by Mrs. C. Niessen-Boomgaard, 1971; P1971-55, 59 by second author, 1974.
Notable features: the presence of *Fagus* in one sample, the rather high values for the Ericaceae, the low values for all the other herbs, with the exception of Gramineae in sample P1971-53.

S-16. Two- or multi-period barrow at Doorwerth, mun. of Renkum (G).
Grave goods: first period, AOO Beaker type 2IId, proto-Potbeaker, dagger of GP flint, small flint axe.
Composition of mound: orange-yellow sand with humic patches (turfs?) on soil with "holt"podzol[4]).
Excavation: R. S. Hulst, ROB, 1972 (Hulst, Lanting & Van der Waals, 1975, pp. 77–101; Lanting & Van der Waals, 1976, p. 58).
Samples taken by R. S. Hulst from the old surface (P1973-71) and from a turf in the primary mound (P1973-72).
Samples counted by second author, 1974.
Notable features: the absence of *Fagus*, the moderate values for *Betula*, the very low values for Ericaceae and other herbs, with the exception of the Gramineae.

S-17. Two(?)-period barrow with later interment no. 10 of De Zeven Bergjes, Laren, mun. of Laren (NH).
Grave goods: copper tanged dagger, three flint arrowheads.
Composition of mound: yellow-brown sand with darker patches on barely visible old surface.
Original excavation: A. E. Remouchamps, 1925/26 (Remouchamps, 1928, pp. 71-72).
Re-excavation: P. J. R. Modderman, 1952 (Modderman, 1954, p. 7, 41); only for pollen sampling by J. A. Bakker, W. Glasbergen, C. R. Hooijer, J. D. van der Waals, 1958 (Lanting & Van der Waals, 1976, p. 59).
Samples taken by the above from the old surface of the primary mound (A1959-24).
Sample counted by second author, 1959/62.
Notable features: the presence of *Fagus*, the low value for *Betula*, the rather low values for Ericaceae and Gramineae and the low values for other herbs.

S-18. Single(?)-period barrow with later interments no. 1 at De Erfgooiersstraat, Hilversum, mun. of

	S-15				S-16		S-17	S-18	S-19	S-20		S-21		
	P1971-53	P1971-55	P1971-57	P1971-59	P1973-71	P1973-72	A1959-24	A1959-22	B1959-48	P1971-81	P1971-83	P1971-46	P1971-49	P1971-50
Alnus	46.8	41.3	44.4	38.1	52.0	64.4	50.0	68.5	46.9	56.7	52.7	59.2	60.7	52.8
Corylus	24.7	35.0	28.9	39.2	28.9	25.7	27.2	22.2	33.0	30.4	31.9	31.3	25.4	26.1
Fraxinus	-	0.4	+	-	-	-	0.9	0.6	0.2	-	-	-	-	+
Quercus	11.9	14.6	15.5	12.5	13.9	7.4	10.0	3.9	9.9	6.1	8.6	4.3	5.8	10.7
Tilia	10.3	6.6	6.8	8.4	4.5	2.5	10.4	2.1	9.1	6.1	6.4	5.2	8.1	9.8
Ulmus	1.4	0.4	2.0	0.5	0.6	-	-	0.3	0.2	0.2	0.2	-	-	+
Fagus	-	0.2	-	-	-	-	0.5	0.3	-	-	-	-	-	-
Carpinus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salix	-	0.2	-	-	0.1	-	0.5	-	0.2	-	-	-	-	0.3
Pinus	5.7	1.5	2.3	1.2	0.1	0.3	0.5	2.1	0.7	0.5	0.2	-	-	-
Acer	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Picea	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Viscum	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ilex	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hedera	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Σ AP-Betula	**683**	**1186**	**686**	**594**	**693**	**405**	**220**	**333**	**606**	**612**	**499**	**326**	**346**	**337**
Betula	22.0	18.7	10.1	32.7	30.3	28.4	5.9	8.7	4.5	62.4	37.5	26.4	23.4	20.5
Ericaceae	68.6	93.3	68.6	123.2	8.1	3.5	25.9	81.7	67.8	28.3	42.3	2.5	2.3	1.8
Gramineae	25.7	4.4	9.4	11.8	24.2	40.2	24.1	24.0	23.9	9.8	9.2	16.9	8.7	13.4
Cerealia	-	-	-	-	-	0.3	0.5	-	0.2*	-	-	-	-	-
Plantago lanceolata	0.2	0.2	0.2	0.5	1.0	0.5	7.6	1.7	4.5	0.8	0.2	1.5	1.5	0.3
Rumex a-type	-	0.2	0.1	-	-	-	-	0.3	1.0	0.2	-	-	-	-
Succisa	0.2	0.8	0.4	1.4	0.9	2.0	-	0.3	1.3	-	0.4	0.3	0.6	0.9
Compositae liguliflorae	0.7	-	0.3	0.2	0.6	2.0	2.5	+	0.8	-	-	0.6	+	+
Compositae tubuliflorae	1.5	1.6	0.8	2.0	2.2	3.4	1.4	1.5	1.5	1.3	0.8	7.1	1.7	2.6
Artemisia	-	-	-	-	-	-	0.5	0.9	0.3	-	-	-	-	+
Campanula-type	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-
Caryophyllaceae	0.2	-	0.1	0.8	0.7	0.7	4.1	-	0.8	-	-	+	-	0.3
Chenopodiaceae	0.2	-	-	0.4	0.1	-	0.5	0.3	-	-	0.2	-	-	-
Cruciferae	0.2	-	-	-	0.3	-	-	-	0.2	0.2	-	-	-	-
Cyperaceae	-	-	-	-	-	-	4.1	0.9	0.2	-	-	-	-	-
Equisetum	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-
Filipendula	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-
Galium-type	-	-	-	-	-	-	-	0.3	0.3	-	-	0.3	-	-
Geraniaceae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Humulus-type	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Labiatae	0.2	-	2.1	0.4	-	-	0.5	0.6	-	-	-	-	-	-
Lonicera	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lythrum	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Papilionaceae	0.2	-	-	-	-	-	-	0.3	-	-	-	-	-	-
Plantago major/media	-	-	-	-	0.1	-	-	-	-	-	0.2	-	-	-
Ranunculaceae	0.2	-	0.1	-	0.3	-	-	-	0.3	0.3	0.2	+	+	0.6
Rosaceae	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
Scrophulariaceae	0.2	-	0.3	-	-	-	-	-	0.2	-	-	-	-	-
cf. Solanum nigrum	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
Spergula	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Typha angustifolia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Umbelliferae	-	-	-	-	-	-	-	0.3	0.2	-	-	+	-	-
Urtica sp.	-	-	-	-	-	-	-	0.3	0.2	-	-	-	-	-
Pteridium	2.3	-	0.7	0.2	0.6	-	1.4	0.6	-	0.2	0.2	0.3	1.5	0.6
Dryopteris	15.0	1.9	4.0	2.5	2.7	2.0	12.3	2.1	13.0	10.6	2.8	5.5	17.1	17.8
Polypodium	1.2	0.3	0.2	0.7	0.4	1.2	6.9	1.7	2.0	1.1	0.4	0.6	3.5	3.9
Sphagnum	2.5	0.3	0.7	0.4	0.9	-	4.1	2.1	1.8	1.8	1.4	0.3	+	1.1
Lycopodium	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-

Table 3. Pollen spectra, not yet published, of BB barrows south of the IJssel.

S-22						S-23	S-24				S-25				S-26	S-27		S-28
P1971-74	P1971-76	P1971-77	P1971-79	P1971-90	P1971-92	P1971-249	P1971-9	P1971-10	P1971-11	P1971-12	P1972-255	P1972-257	P1972-259	P1972-261	P1972-254	P1971-87	P1971-89	D1959-21
48.1	53.2	51.2	54.5	41.2	45.2	53.9	46.9	54.2	56.0	61.8	63.7	52.8	51.4	55.5	39.1	59.2	58.2	66.0
23.4	25.8	26.7	28.5	37.0	38.9	32.4	35.3	35.0	30.1	27.9	33.1	36.4	31.6	31.2	39.3	30.8	30.5	28.0
0.1	–	–	–	0.4	–	–	–	–	+	0.1	–	0.2	0.6	0.3	–	–	–	0.4
14.3	8.6	9.6	7.2	14.8	10.3	8.1	14.6	15.2	5.9	6.7	12.6	5.5	8.2	7.6	10.7	6.5	6.2	3.9
11.9	11.3	10.3	8.4	4.8	4.2	5.5	2.6	5.6	7.3	2.5	6.1	3.6	5.2	3.1	9.9	2.5	5.1	1.7
1.0	0.8	1.3	0.6	0.2	–	–	0.3	0.6	0.1	0.4	0.2	0.2	0.6	0.5	+	–	–	0.4
+	–	0.2	–	0.6	0.7	–	–	0.2	0.1	0.3	0.2	0.6	0.5	0.5	0.4	0.8	–	0.1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
+	–	–	–	0.6	0.5	–	–	–	0.1	–	0.3	0.2	0.6	–	–	–	–	–
0.8	0.4	0.8	0.8	0.6	0.2	0.2	0.3	0.6	0.3	0.4	0.2	0.6	1.1	1.1	2.4	–	–	0.4
–	–	–	–	–	–	–	–	–	0.1	–	0.2	–	–	–	–	–	–	–
–	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	0.2	–	–	–
–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–
1886	**1281**	**1270**	**657**	**541**	**427**	**618**	**685**	**466**	**1132**	**1140**	**604**	**549**	**632**	**638**	**535**	**120**	**177**	**721**
12.3	13.7	11.4	7.9	16.1	18.7	26.7	18.5	26.4	23.0	24.5	24.8	30.4	19.0	19.3	12.6	44.2	22.6	22.1
71.6	35.3	43.2	28.2	41.1	49.2	28.3	49.9	60.9	34.4	56.6	33.1	37.3	57.4	51.3	79.2	37.5	18.1	22.2
13.6	7.6	12.3	29.2	6.6	6.1	9.6	13.4	15.5	9.1	9.2	9.2	3.8	7.4	11.1	2.3	25.0	15.3	4.9
–	–	–	–	–	–	–	–	0.2**	0.2**	–	–	–	1.1***	0.2*	–	3.3**	1.2****	–
0.1	0.3	0.2	–	0.2	1.2	0.3	1.6	1.5	1.9	0.6	0.2	0.4	0.2	0.3	0.2	1.7	1.1	0.1
–	–	0.2	–	–	–	–	0.2	+	–	–	–	–	0.6	–	–	–	1.1	–
0.1	+	+	–	0.4	1.4	0.2	0.4	4.5	0.3	0.1	0.7	+	0.2	0.2	–	2.5	–	–
0.9	0.2	0.3	2.3	0.2	0.5	–	0.7	1.3	–	0.2	0.3	–	+	–	–	1.7	1.1	–
0.3	0.3	5.1	2.3	1.5	2.1	1.5	–	1.5	0.5	0.2	0.7	0.4	0.5	0.8	0.6	1.7	11.9	1.2
0.1	–	–	–	0.6	0.5	–	–	–	0.1	0.1	0.2	0.2	–	0.3	–	–	–	–
0.1	0.2	0.1	–	0.2	–	–	–	–	–	–	–	–	–	0.2	–	–	–	–
0.2	0.2	–	0.2	–	0.9	0.2	0.4	0.2	0.4	–	0.5	–	0.3	–	–	–	–	–
0.1	–	–	0.2	–	–	–	–	–	–	0.1	–	–	0.2	–	–	–	–	–
0.1	–	–	–	0.4	–	–	0.2	+	0.1	–	0.2	–	0.2	0.2	–	–	–	0.1
–	–	–	–	0.9	0.2	–	–	–	–	–	0.2	–	–	–	–	–	–	0.1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	0.2	–	–	–	–	–	–	0.1
–	–	–	–	–	0.5	–	–	–	–	–	–	–	–	–	–	–	–	–
0.1	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–
0.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.1	–	–	–	0.6	0.2	0.3	–	–	–	–	–	–	0.2	–	–	–	–	–
–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.1
–	–	–	–	0.2	0.2	–	–	–	0.2	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	0.2	–	–	–	–	–	0.1
0.1	–	0.2	–	0.2	+	0.2	0.4	1.1	0.5	0.3	0.5	–	+	0.2	0.2	–	–	0.7
–	–	–	–	–	0.2	–	–	–	–	–	0.2	0.2	0.3	0.3	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.2	–	0.6	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	0.1	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	0.1	–	–	–	–	–	–	–	–	–
0.1	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	0.1	–	–	0.2	–	–	–	0.1	–	–	–	–	–	–	–	–	–
0.1	0.2	–	1.1	–	0.5	0.2	1.6	1.1	0.3	1.0	–	–	–	0.3	–	–	0.6	0.4
1.3	0.9	2.4	3.5	1.3	0.7	10.2	10.5	10.3	4.1	2.2	0.8	0.6	1.3	0.9	2.4	1.7	2.3	1.5
0.2	0.3	0.2	0.5	0.2	0.2	1.8	1.6	0.2	0.5	0.3	0.3	0.6	+	0.5	0.6	–	2.3	0.4
0.4	0.2	0.2	1.4	0.6	–	2.3	4.5	3.7	1.0	1.1	0.8	0.2	0.5	0.5	3.9	2.5	1.1	1.2
–	–	–	–	0.2	–	–	+	–	–	–	–	–	–	–	–	–	–	–

* = Triticum-type
** = Hordeum-type
*** = 0.8% Hordeum-type 0.3% Triticum-type
**** = 0.6% Hordeum-type 0.6% Triticum-type

Hilversum (NH).
Grave goods: copper tanged dagger.
Composition of mound: yellow-grey sand on barely visible old surface with charcoal patches.
Original excavation: F. C. Bursch, 1934 (Bursch, 1935, pp. 47-50).
Re-excavation (only for pollen sampling): J. A. Bakker, W. Glasbergen, C. R. Hooijer, J. D. van der Waals, 1958 (Lanting & Van der Waals, 1976, p. 59).
Samples taken by the above from the old surface (A1959-22).
Samples counted by second author, 1959/74.
Notable features: the presence of *Fagus*, the low value for *Betula*, the high value for Ericaceae, and the low values for all the other herbs with the exception of the Gramineae value, which is moderately high, the rather high total amount of herb species.

S-19. Single-period barrow no. 2 of De Zeven Bergjes, Laren, mun. of Laren (NH).
Grave goods: four V-perforated amber buttons.
Composition of mound: yellow-grey sand on thin grey layer.
Original excavation: A. E. Remouchamps, 1925/26 (Remouchamps, 1928, pp. 66-67).
Re-excavation (only for pollen sampling): J. A. Bakker and second author, 1959 (Lanting & Van der Waals, 1976, p. 59).
Samples taken by second author from the old surface (B1959-48) and a humic patch in the barrow structure (turf?) (B1959-49).
Sample B1959-48 counted by second author, 1959/74.
Notable features: the absence of *Fagus*, the low value for *Betula*, the high value for Ericaceae, the rather high values for Gramineae and *Plantago lanceolata* and the rather high amount of total herb species.

S-20. Single-period barrow Girhen, on De Ginkelse Heide, mun. of Ede (G). (Butler & Van der Waals, 1967, pp. 48-49, 122-123).
Grave goods: Bell Beaker type 2Ib, copper tanged dagger, wristguard, seven flint arrowheads, two strike-a-lights, flint flakes.
Composition of mound: yellow sand on barely visible old surface.
C14 dating: 4155 ± 60 BP (GrN-6688C) (Lanting, Mook & Van der Waals, 1973, p. 54; corrected in Lanting & Van der Waals, 1976, p. 41).
Date is *terminus post quem* for the grave.
Original excavation: H. J. Bellen, 1927.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1976, p. 53, 58).
Samples taken by the above from the old surface (P1971-81-86).
Samples P1971-81, 83 counted by second author, 1972/74.
Notable features: the absence of *Fagus*, the high values for *Betula*, the moderate values for Ericaceae and the low values for Gramineae and other herbs.

S-21. Two(?)-period barrow near De Konijnenkolken at Stroe, mun. of Barneveld (G) (Butler & Van der Waals, 1967, p. 124).
Grave goods: first period (?), copper tanged dagger, Veluvian Bell Beaker type 2Ie. Below the primary mound late PFB settlement material was found.
C14 dating: 3955 ± 55 BP (GrN-6350) (Lanting & Van der Waals, 1974, p. 41).
Composition of mound: yellow-grey sand on barely visible old surface, second period idem on humic band on top of primary mound.
Original excavations: W. Pleyte and C. A. Nairac, 1877; Westendorp, 1926-29.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971e, p. 126; 1976, p. 41).
Samples taken by second author from old surface of primary mound (P1971-46-48) and from old surface of secondary mound (P1971-49-52).
Samples P1971-46, 49-50 counted by second author, 1974.
Notable features: the close resemblance of both periods, the absence of *Fagus*, the moderately high values for *Betula*, the extremely low values for Ericaceae, the somewhat higher values for Gramineae and again the very low values for the other herbs.

S-22. Three- or four-period barrow at Maarsbergen, mun. of Maarn (U).
Grave goods: first period, Veluvian Bell Beaker type 2Id, wristguard; later finds, Laren urn, fragments of Harpstedt urns, dish and sheet bronze; an

urnfield was situated over the barrow.
Composition of mound: grey humic sand, with dark humic sods (?) in the centre.
Original excavation: F. C. Bursch and A. L. Tromp, 1941.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971b, pp. 93-98, 118-123; 1971f, p. 127; 1976, p. 60).
Samples taken from the old surface of the primary mound (P1971-74-76), from turfs in the primary mound (P1971-77-78) and from the old surface of the second period (P1971-79-80) by second author; samples P1971-90-91 from the old surface of the second period and P1971-92 from the old surface of the third period taken by J. N. Lanting and J. D. van der Waals.
Samples P1971-74, 76-77, 79 counted by Mrs. C. Niessen-Boomgaard, 1971; sample P1971-90-91 counted by second author, 1974.
Notable features: the presence of *Fagus* already in the old surface of the primary mound, the low values for *Betula*, the lack in increase for Ericaceae towards the younger periods, the decrease in *Tilia* and the low values for all the herbs, including Gramineae.

S-23. Two-period barrow at De Lunterse Berg, mun. of Lunteren (G).
Grave goods: Veluvian Bell Beaker type 2Id, copper dagger, wristguard, seven flint arrowheads, strike-a-light.
Composition of mound: centre dark coloured sand with humic patches (sods), surrounded by yellow sand on soil with "moder"podzol.
C14 dating: 3790 ± 35 BP (GrN-6332) (Lanting, Mook & Van der Waals, 1973, p. 54).
Excavation: R. S. Hulst (ROB, Amersfoort), 1970 (Hulst, 1972b; Lanting & Van der Waals, 1976, p. 41, 60).
Samples taken by the above from the old surface of the primary mound (P1972-249-250).
Sample P1972-249 counted by second author, 1974.
Notable features: the absence of *Fagus*, the moderate value for *Betula*, the low values for all the herbs, including Ericaceae and Gramineae.

S-24. Two-period barrow no. II at Vaassen, mun. of Epe (G).
Grave goods: first period, Veluvian Bell Beaker type 2Id, lunula-shaped amber pendant, fragment of same, V-bored amber button; second period, Bronze Age pottery.
Composition of mound: orange coloured sand with vague humic patches on a barely visible old surface with humic patches.
Original excavation: F. C. Bursch and A. L. Tromp, 1941.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971a, pp. 53-54; 1971b, pp. 106-107).
Samples taken by the above from the old surface of the primary mound (P1971-9-10) and from turfs belonging to the second period (P1971-11-12).
Samples counted by Mrs. C. Niessen-Boomgaard, 1971.
Notable features: the presence of *Fagus* in three samples and the close resemblance of the spectra of the two periods; the moderate values for *Betula*, Ericaceae, Gramineae and all other herbs, with the exception of *Succisa* in sample P1971-10.

S-25. Three-period barrow no. 12 at De Oostereng, Bennekom, mun. of Renkum (G).
Grave goods: first period, Veluvian Bell Beaker type 2Ie, wristguard, two small flint knives, two small flint flakes, seven flint arrowheads.
Composition of mound: central mound made from sods with well developed "humus"podzol on top of moderately developed soil profile.
Original excavation: F. C. Bursch, 1929 (Bursch, 1933a, pp. 26-38; 1933b, pp. 15-16, 53-55).
Re-excavation: J. N. Lanting and J. D. van der Waals, 1972 (Lanting & Van der Waals, 1972a, p. 129).
Samples taken by the above from the old surface of the primary mound (P1972-255-256), from turfs in that mound (P1972-257-258), from the old surface of the second period (P1972-259-260) and from the old surface of the third period (P1972-261-262).
Samples P1972-255, 257, 259, 261 counted by second author, 1974.
Notable features: the presence of *Fagus*, the moderate values for *Betula*, the likeness of all four samples in every respect, indicating that the periods do not differ much in time; the slight increase in the Ericaceae percentages, although they remain rather low, just as all the herb percentages.

S-26. Single-period barrow at Vierhouten, mun. of Epe (G).
Grave goods: two Veluvian Bell Beakers types 2Ie, wristguard.
Composition of mound: dark yellow sand with humic patches on clearly visible grey old surface band.
Original excavation: A. E. van Giffen, 1939.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1972 (Lanting & Van der Waals, 1972c, p. 60).
Samples taken by the above from the old surface (P1972-254, 1-3).
Sample P1972-254, 1 counted by second author, 1974.
Notable features: the presence of *Fagus*, the low percentage of *Betula*, the rather high Ericaceae percentage in contrast to the extremely low percentage for the other herbs, including Gramineae.

S-27. Single-period barrow no. 5 Ede-Amber, mun. of Ede (G).
Grave goods: Veluvian Bell Beaker type 2Ie, twelve amber beads.
Composition of mound: dark yellow sand on barely visible grey old surface band.
Original excavation: H. J. Bellen, 1927.
Re-excavation: J. N. Lanting and J. D. van der Waals, 1971 (Lanting & Van der Waals, 1971c, pp. 125-126).
Samples taken by the above from the old surface (P1971-87-89).
Samples P1971-87, 89 counted by second author, 1974.
Notable features: the presence of *Fagus* in one sample, the rather high values for *Betula* and Gramineae, at least in the first sample, together with the high values for Cerealia (4.1 and 1.2% resp.); the low values for Ericaceae.

S-28. Two-period barrow "De Ketsberg" at De Lindenlaan, Renkum, mun. of Renkum (G).
Grave goods: first period, Veluvian Bell Beaker type 2If in central grave, small Bell Beaker type 2Ie-f in base of mound.
Composition of mound: grey sand with clearly marked old surface layer, humic patches, indicating the presence of sods?
Excavation: A. E. van Giffen, 1958.
Sample taken by the above from the old surface (D1959-21) of the primary mound.
Sample counted by second author, 1959/74.
Notable features: the presence of *Fagus* and the low values for *Betula* and all the herbs, included Ericaceae.

3.2.3. *Barrows without grave goods (fig. 9, table 4)*

S-29. Two-period barrow V, Groot-Drakenstein, Lage Vuursche, mun. of Baarn (U)[5]).
Grave goods: unknown.
Composition of mound: yellow-grey sand with rather clearly recognisable sods on a grey old surface.
Trial excavation: A. E. van Giffen, 1927.
Excavation (only for pollen sampling): M. Addink-Samplonius, W. Glasbergen, 1965.
Samples taken by second author from the old surface (L1965-38), from a turf in the mound (L1965-39) and from a later interment (L1965-37); by W. Glasbergen from the old surface (L1965-39C).
Samples counted by Mrs. C. Niessen-Boomgaard, 1966/67.
Notable features: the lack of *Fagus* pollen in the samples belonging to the first period and the low values for Ericaceae, indicating a date in the Neolithic (?); the low values for all the herbs – with the exception of the Gramineae; the very high values for Ericaceae, *Fagus* and *Carpinus* in sample L1965-37 and the occurrence of *Secale*, suggesting a date in the advanced Iron Age or even in early historical times.

S-30. Four-period barrow at De Langeweg, Emst, mun. of Epe (G).
Grave goods: none.
Composition of mound: orange-brown to light red-grey sand with orange-brown infiltrates on barely visible light grey old surface band.
Original excavation: J. Butter, 1932.
Re-excavation: R. S. Hulst, 1972 (Hulst, 1972a).
Samples taken by the above from the old surface of the first period (P1972-82), second period (P1972-83), third period (P1972-84), fourth period (P1972-85) and from the surface of the mound of the fourth period (P1972-86).
Samples P1972-82-86 counted by second author, 1974.

Notable features: the small differences in the percentages of the tree pollen and the presence of *Fagus* – be it with low values – in all the samples; the gradual increase of the Ericaceae and the low values for the herbs, including Gramineae.

3.2.4. *Bronze Age (fig. 10, table 4)*

S-31. Two-period barrow at Wolfheze, mun. of Renkum (G).
Grave goods: first period, Drakenstein urn.
Composition of mound: heather sods on clearly visible "haar"podzol.
Excavation: R. S. Hulst, 1971 (Hulst, 1971, pp. 114-115).
Samples taken by first author from the old surface of the primary mound (P1972-237-242), from a turf in this mound (P1972-243-244), from the old surface of the second period (P1972-245-246) and from the surface of the secondary mound (P1972-247-248).
Samples P1972-237, 243, 245, 248 counted by second author, 1974.
Notable features: the similarity between the two periods as far as the main pollen types are concerned. This indicates that the periods were not much different in time; the marked increase in *Fagus* and Ericaceae points to a considerable time lapse between the building of the secondary mound and the final covering. This may well have happened late in the Bronze Age or in the Early Iron Age, although *Carpinus* is still missing. The percentages for *Betula* and all the herbs – save for Ericaceae – are low, only the total amount of herb species in sample P1972-248 is somewhat higher.

S-32. Single-period barrow no. 5 at De Erfgooiersstraat, Hilversum, mun. of Hilversum (NH).
Grave goods: none.
Composition of mound: dirty grey sand without visible sod structure.
Original excavation: F. C. Bursch, 1934 (Bursch, 1935, p. 54).
Re-excavation: J. A. Bakker and A. E. van Giffen, 1965 (Van Giffen & Bakker, 1965).
Samples taken by second author from the old surface (L1965-40-42), from a humic layer around the central grave (L1965-43) and from a turf in the grave itself (L1965-44-45).
Samples L1965-40-41, 44 counted by second author, 1975. Sample L1965-42 contained too little pollen.
Notable features: the still rather high values for *Tilia*, the presence of *Fagus* in only two of the samples, the high values for Ericaceae and the low ones for all other herbs.

S-33. Single period barrow no. 6 at De Erfgooiersstraat, hilversum, mun. of Hilversum (NH).
Grave goods: none.
Composition of mound: black and grey sods on primary surface, changed into a "haar"podzol by secondary infiltration.
C14 dating of burnt log in primary grave: 3240 ± 35 BP (GrN-4885) (Vogel & Waterbolk, 1967, pp. 133-134).
Original excavation: F. C. Bursch, 1934 (Bursch, 1935, pp. 54-56).
Re-excavation: J. A. Bakker and A. E. van Giffen, 1965 (Van Giffen & Bakker, 1965).
Samples taken by second author from the old surface (L1965-22, 47) and from turfs in the mound structure (L1965-23, 46, 48).
Samples L1965-22-23, 46 counted by the same, 1965/75.
Notable features: the presence of *Fagus* – be it with low values – in all samples; the still rather high values for *Tilia*, the high Ericaceae percentages and the low values for all the other herbs, including the Gramineae.

S-34. Two-period barrow at De Kiek, mun. of Alphen (NB).
Grave goods: none, but dating according to construction in Early Middle Bronze Age.
Composition of mound: clearly recognisable heather sods on podzolized old surface.
Excavation: P. J. R. Modderman, then ROB, 1953 (Modderman, 1955, pp. 50-53).
Samples taken by the above from the old surface underneath the primary mound (A1959-8), outside the primary mound (A1959-11), from the ringditch (A1959-9) and from the old surface of the secondary mound (A1959-10).
Samples counted by second author, 1957.

	S-29				S-30					S-31			
	L1965-38	L1965-39C	L1965-39	L1965-37	P1972-82	P1972-83	P1972-84	P1972-85	P1972-86	P1972-237	P1972-243	P1972-245	P1972-248
Alnus	61.3	60.3	62.2	58.2	61.9	52.3	58.1	53.1	55.7	56.0	50.1	47.2	61.3
Corylus	24.0	27.4	21.5	17.3	32.3	41.7	33.7	37.8	34.5	31.5	39.1	31.6	23.6
Fraxinus	0.3	–	–	0.2	0.2	–	–	–	–	+	–	0.3	0.4
Quercus	11.9	11.4	13.6	14.5	4.0	3.8	3.7	4.0	6.2	6.3	5.3	13.3	7.0
Tilia	2.1	0.6	2.7	–	1.1	1.7	2.9	2.6	2.2	4.7	4.2	3.8	2.3
Ulmus	–	–	–	0.2	0.2	–	0.2	0.4	0.2	0.5	–	0.3	–
Fagus	–	–	–	6.8	0.2	–	+	0.2	0.3	–	0.4	0.3	2.8
Carpinus	–	–	–	1.5	–	–	–	–	–	–	0.4	–	–
Salix	–	–	–	–	–	0.2	–	0.2	0.3	0.2	–	0.2	0.2
Pinus	0.3	0.2	–	1.3	0.2	–	1.5	1.7	0.5	0.8	0.6	1.4	2.5
Picea	–	–	–	–	–	–	–	–	–	–	–	–	–
Abies	–	–	–	–	–	0.2	–	–	–	+	–	–	–
Hedera	–	–	–	–	0.2	–	–	–	–	–	–	–	–
Ilex	–	–	–	–	–	–	–	–	–	–	–	0.2	–
Σ AP-Betula	**653**	**464**	**368**	**469**	**620**	**417**	**594**	**529**	**580**	**634**	**511**	**633**	**653**
Betula	1.1	0.9	0.5	7.2	32.3	21.8	15.7	29.8	21.4	7.3	8.0	11.2	6.4
Ericaceae	8.6	7.1	12.0	190.4	37.4	61.6	57.7	92.4	146.0	45.3	57.5	62.9	126.6
Gramineae	58.5	38.0	37.8	37.3	13.9	4.6	6.4	4.9	8.0	3.6	4.7	12.0	19.1
Cerealia	–	–	–	0.2**	–	–	–	–	0.2*	–	–	0.2*	–
Plantago lanceolata	0.2	–	0.5	0.4	2.9	0.5	0.2	0.4	0.3	0.2	–	0.2	0.5
Rumex a-type	–	–	0.3	0.4	–	–	–	–	0.2	–	–	0.3	0.2
Succisa	–	–	–	–	2.7	1.7	–	–	0.3	–	0.2	–	0.2
Compositae liguliflorae	1.1	0.2	0.5	0.2	–	0.2	0.3	0.2	0.7	–	–	–	0.2
Compositae tubuliflorae	1.2	0.4	0.8	0.2	1.0	0.5	1.0	–	0.7	0.2	0.2	0.5	1.4
Artemisia	–	–	–	0.4	–	0.2	–	–	0.2	0.2	0.2	+	0.2
Caryophyllaceae	1.0	1.1	1.6	–	0.5	0.2	0.2	–	0.2	–	–	–	–
Chenopodiaceae	–	–	–	0.6	–	–	–	–	–	–	–	–	0.2
Cruciferae	–	–	0.3	–	–	–	+	0.2	–	0.2	–	–	–
Cyperaceae	2.1	2.2	3.0	1.9	–	–	–	–	–	–	–	–	–
Filipendula	–	–	–	0.4	–	–	0.3	–	0.2	–	–	–	–
Galium-type	–	–	–	–	–	–	0.2	–	–	–	–	0.2	–
Geraniaceae	–	–	–	–	–	–	–	–	–	–	–	–	0.5
Labiatae	–	–	–	–	–	0.2	0.5	0.2	0.2	–	0.2	0.5	0.4
Papaveraceae	–	–	–	–	–	–	–	0.2	–	–	–	–	–
Papilionaceae	–	–	–	–	–	–	–	–	–	–	–	–	0.2
Plantago major/media	0.2	–	0.3	0.2	–	–	–	–	–	–	–	–	0.2
Ranunculaceae	–	–	0.5	0.4	0.2	0.2	–	–	0.3	–	0.2	–	–
Rosaceae	–	–	–	–	–	–	–	–	0.2	–	–	–	0.4
Rosaceae Potentilla-type	–	–	–	0.2	–	–	–	–	–	–	–	–	–
Scrophulariaceae	–	–	–	–	–	–	0.3	0.2	1.4	–	–	0.3	0.8
Thalictrum	–	–	–	–	–	–	0.2	–	–	–	–	0.2	–
Typhaceae	–	–	–	–	–	–	–	–	–	–	–	–	–
Urtica sp.	0.6	0.4	–	0.6	–	–	–	–	–	–	–	–	–
Pteridium	–	–	–	–	0.2	0.5	–	–	0.2	–	0.2	–	0.2
Dryopteris	21.0	14.0	22.9	1.1	5.0	1.2	0.5	1.7	1.9	1.1	0.4	0.6	1.7
Polypodium	1.1	0.4	0.5	0.2	0.2	–	–	–	0.5	–	0.4	0.2	0.4
Sphagnum	7.0	5.0	6.0	2.1	0.6	–	1.2	0.2	0.2	0.2	0.2	0.2	–

Table 4. Pollen spectra, not yet published, of archaeologically undated barrows (nos. S-29 – S-30) and of barrows of the Middle Bronze Age south of the IJssel.

S-32			S-33			S-34				S-35				
L1965-40	L1965-41	L1965-44	L1965-22	L1965-23	L1965-46	A1959-8	A1959-9	A1959-10	A1959-11	G1962-1	G1962-2	G1962-3	G1962-4	Gron 1962-3
41.6	44.2	49.2	47.3	50.4	46.4	49	56	43.7	42	31.6	39.7	38.6	27.1	38.0
32.1	28.7	32.4	30.6	32.2	34.2	39	32	33	48	57.1	43.2	46.5	38.3	45.1
0.8	–	0.2	0.5	0.2	0.3	–	0.3	+	0.2	0.2	–	0.2	+	0.2
16.9	17.7	10.3	14.9	9.0	13.6	5.2	2.7	2.3	2.7	5.6	5.1	6.6	2.8	8.2
5.9	5.3	5.2	2.4	5.3	1.8	2.9	6.8	16	3.5	3.6	10.4	4.6	30.2	3.8
1.1	0.4	0.4	0.3	0.4	0.7	0.4	0.3	0.4	0.8	0.2	0.2	0.4	0.2	0.4
–	0.8	0.2	0.8	0.6	0.3	0.8	–	0.4	0.2	0.4	+	+	+	1.1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	0.2	–	+	0.2	–	–
1.5	3.0	2.1	3.0	2.0	2.2	1.9	1.7	2.8	2.7	1.2	1.4	4.1	1.5	3.2
–	–	–	–	–	–	0.2	0.2	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.2	–	–	–	–	0.4	–	–	–	–	–	+	–	–	0.2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
657	**265**	**484**	**594**	**510**	**683**	**519**	**587**	**697**	**515**	**567**	**507**	**518**	**616**	**526**
23.6	55.1	13.8	40.1	24.5	40.7	50	45	37	29	5.6	51.5	21.2	10.4	9.5
91.8	126.7	124.0	101.0	89.4	88.5	60	56	72	98	75.4	53.6	47.3	40.9	79.7
9.5	6.0	4.5	9.9	4.5	6.2	2.5	4.6	4.1	3.3	1.4	4.1	4.6	1.9	0.4
–	–	–	–	–	0.3	0.2	0.3	0.6	–	–	–	–	–	–
0.5	0.4	0.6	0.3	0.2	0.4	0.2	–	–	–	0.2	–	+	0.6	–
0.5	–	–	0.2	–	–	–	–	–	–	–	–	–	–	–
0.6	0.8	0.2	0.2	–	0.2	–	0.2	0.1	–	–	–	–	–	–
–	–	–	+	–	–	–	–	0.1	–	–	–	–	–	–
0.6	1.1	0.4	0.3	0.2	0.4	0.2	0.7	0.4	0.6	–	–	–	+	0.2
–	–	0.2	0.3	–	0.4	0.2	–	–	–	–	0.6	–	–	–
0.2	–	–	0.2	–	0.3	–	–	–	–	–	–	–	+	–
–	–	–	+	–	–	–	–	–	–	–	–	–	+	–
–	–	–	–	–	0.2	–	–	–	–	–	–	–	–	–
–	–	0.2	+	–	–	–	0.2	–	–	0.2	–	+	–	0.2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	0.2	+	–
–	–	–	–	0.4	–	–	–	–	–	–	–	–	–	–
–	–	–	0.2	–	–	–	–	–	–	–	–	–	+	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	0.2	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	0.4	–	–	0.2	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	0.2	0.3	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	+	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	0.2	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	0.2	0.2
0.2	–	–	0.3	+	0,3	0,4	0,7	–	–	0.2	–	–	–	–
2.7	1.5	2.3	1.7	0.4	1.5	–	0.2	0.6	–	0.5	0.8	0.2	0.2	0.4
0.3	0.4	0.4	–	0.2	0.3	1.2	–	0.1	0.6	0.2	+	0.2	+	0.4
0.6	0.8	0.6	0.3	0.4	0.9	1.0	0.7	0.3	0.6	0.4	–	–	+	–

* = Hordeum-type
** = Secale-type

Notable features: the small differences between the four samples of which A1959-8 must be the oldest, followed by A1959-9, 11, while A1959-10 must be the youngest; the rather high values for *Betula* and *Calluna* and the extremely low values for all the herbs.

S-35. Single-period barrow, with bank and ditch at Alphen, mun. of Alphen (NB).
Grave goods: bronze flanged axe, 15th century BC (Butler, 1966, pp. 66-68).
Composition of mound: clearly recognisable heather sods upside down on rather heavily podzolized old surface (secondary podzolization, cf. Waterbolk, 1964).
Excavation: G. Beex, ROB, 1961/62 (Beex, 1966, pp. 53-65).
Samples taken by second author from the old surface (G1962-2, 4), from a turf in the mound structure (G1962-3), from a turf in the ringditch (G1962-1) and from a turf in the bank, the last one taken by W. van Zeist, BAI (Gron. 1962-3).
Samples counted by second author, 1963.
Notable features: the rather large differences between the samples, for example the high percentage for *Betula* in G1962-2, and for *Tilia* in G1962-4. There seems to be a division between the old surface samples and the turf in the mound on the one hand, and the two turf samples of ditch and bank on the other hand, indicating that the turf in the ditch fell from the bank itself? Remarkable too are the very low values for all the herbs, save for Ericaceae.

4. EVALUATION OF THE RESULTS IN THE LIGHT OF FORMER DATA

4.1. General

With the aid of figs. 11-15 analyses were made of the combinations of pollen types and plant species/families represented by high values, to ascertain which of these were the most frequent and which combinations were mutually exclusive or less frequent[6]). Such comparisons may lead to useful conclusions concerning the types of vegetation.

For sites north of the IJssel both published and unpublished spectra of TRB, PFB and BB barrows have been used, and for sites south of the IJssel only unpublished data of PFB and BB barrows and of five barrows dating from the Middle Bronze Age. In the northern region spectra are only taken of those barrows for which the age of the oldest phase is well established archaeologically. In the southern region too the spectra taken are of barrows that can confidently be dated palynologically.

Fifteen pollen types were selected, which in our opinion are good indicators of an open landscape, forest regeneration, arable land, pasture-land, extension of heath-land etc. One might assume that the barrows of corresponding cultures on both sides of the IJssel would be characterized by more or less corresponding frequencies of plant combinations. Comparing the two PFB-figures (figs. 12 and 14) and the two BB-figures (figs. 13 and 15), it is clear that this is not the case. Although it is not impossible that this is a result of the methods we have used, we are nevertheless inclined to think that we are concerned here partly with essential differences in vegetation, soil and economy. There is a drawback to the approach presented here in that especially for the barrows north of the IJssel rather many pollen analyses were carried out a relatively long time ago, when fewer pollen types were recognized and often a smaller pollen sum was counted.

North of the IJssel

In the TRB spectra combinations regularly or frequently occur of high values for *Calluna* (or Ericaceae), with the presence of Cerealia, Compositae and *Rumex*, indicative of abandoned fields, where it was possible for heath to expand. The frequently high value for *Betula* too indicates incipient regeneration of forest. The combination of high values for Gramineae and the presence of *Rumex* could be indicative of pasture-land. High values for Gramineae in connection with the occurrence of Cerealia could be indicative of the use of abandoned fields as pasture-land.

In the PFB spectra combinations frequently occur of Gramineae, *Plantago lanceolata*, *Artemisia* and *Rumex*, indicating the grazing of land including abandoned fields, as is evident from the combination of Cerealia with high values for Gramineae. High values for *Betula* occur i.a. in combination

with higher values for Gramineae and Compositae, but far less frequently in combination with Ericaceae. This could mean that the regeneration of forest took place especially in places where heath had not yet been able to expand.

In comparison with the TRB spectra the *Tilia* values in most of the PFB spectra are lower, which could indicate that serious degradation had occurred already during the TRB period, while in the regenerating forest the expansion of *Tilia* lagged behind (fig. 3).

The BB spectra show combinations of *Rumex*, high values for Ericaceae and Cerealia and *Artemisia*, indicating that heath came to extend over abandoned fields. It is possible that this process took place in a relatively short time. Combinations of high values for *Plantago lanceolata* and *Succisa*, both indicators of i.a. abandoned arable land, with for example large numbers of herb types occur rather infrequently. The combination of *Succisa* with high values for heath occurs only once. Evidently *Succisa* was not a component of the (especially dry) heath vegetation, but grew especially on more moist soils. High values for Gramineae occur only a few times in combination with high values for *Betula*, Ericaceae and large numbers of herb types. In areas of pasture where grass was abundant there was probably a low species diversity; forest regeneration would possibly not have occurred in the first instance in these areas.

South of the IJssel

Plants frequently occurring together with high values are, for example, Gramineae, Caryophyllaceae, *Plantago lanceolata*, Compositae and Chenopodiaceae, all of which point to pasture-land. An alternative combination is a large number of herb species, Cerealia, *Artemisia* and – curiously – *Succisa*, indicating abandoned fields and/or moist conditions. Incompatible seem to be *Betula* and Ericaceae, *Betula* and Ranunculaceae, Ericaceae and Compositae, Ericaceae and *Plantago lanceolata*, Ericaceae and Cerealia, and Ericaceae and *Succisa*.

High percentages of Gramineae and Ericaceae are accompanied by a low diversity of herb species, suggesting patches of pasture or heath which were either exceptionally small in size or rather monotonous in thier vegetation cover. *Succisa* and Caryophyllaceae do not appear to have formed part of the heath vegetation.

On the basis of the data and arguments given above we arrive at the indication of a number of types of vegetation that owe their origin or expansion above all to prehistoric human interference with the natural forest.

North of the IJssel

a. (abandoned) fields: Cerealia, fairly high to high values for Ericaceae, Compositae, *Rumex acetosa*-type, *Plantago lanceolata*.
b. pasture-land: high Gramineae values, *Plantago lanceolata*, *Rumex*, relatively low *Betula* values, no high Ericaceae values; in the case of abandoned fields used as pasture: Cerealia.
c. open (regenerating) forest: high *Betula* values, usually not very high Ericaceae and Gramineae values, sometimes many herb types; regeneration of forest on abandones fields: Cerealia, *Succisa*.
d. heath: Ericaceae with high values, few herb types, sometimes high *Rumex* values. Where heath was able to expand rapidly over abandoned arable land: fairly high Cerealia values.

South of the IJssel

a. (abandoned) arable fields: Cerealia, many herb species, *Artemisia*, Cruciferae, Labiatae and *Succisa*.
b. pasture-land: Gramineae, few herb species, *Plantago lanceolata*, Caryophyllaceae, Compositae, Chenopodiaceae, Ranunculaceae and *Rumex*-a type.
c. open (regenerating) woodland: *Betula*, Chenopodiaceae, *Succisa*.
d. heath: Ericaceae, few herb species.

We see that inconsistencies appear in the results from barrows north and south of the IJssel e.g. the combination of high values for Ericaceae and *Rumex* in PFB barrows and Cerealia and high values for Ericaceae in the BB barrows north of the IJssel, but also if we now compare these results with the criteria presented in 2.4. for recently abandoned fields, long abandoned fields, natural clearings in the forest and deserted settlement sites. There is, for example, evidence for a greater diversity in herb species in the vegetation of arable land

than in pastures. Therefore, the criteria for the number of herb species in 2.4., points 1 and 2, must be transposed, at least as far as the Central Netherlands is concerned. Furthermore a higher value for *Betula* is correlated with neither arable land nor pasture, but is in fact paired with low Gramineae values and also low Ericaceae values, with exception of the TRB barrows, where high values for *Betula* are quite well correlated with high values for Ericaceae.

Deserted settlement sites cannot be identified solely by means of pollen analysis – we require more criteria, such as sherds of household pottery, flint chippings and charcoal of the ancient surface.

4.2. North of the IJssel

4.2.1. *The vegetation at the spot chosen for a burial monument*

4.2.1.1. TRB barrows (nos. N-1 – N-14, figs. 2 and 11)

On the basis of the pollen spectra and any supplementary data available, such as the soil profile, the following characteristic features of each site have been ascertained with regard to the choice of a spot for erecting a hunebed.

No. N-1. Not long abandoned arable land of limited extent, where little or no grazing occurred and where regeneration of forest had not started or had scarcely begun.

No. N-2. Already regenerating forest on fairly recently abandoned arable land of limited extent, on the basis of the fairly large number of herb types, the relatively high values for *Betula* and *Corylus* and the low value for Gramineae.

Nos. N-3 and N-4. Rather advanced regeneration of forest (evident from the high *Betula* values) on a field already abandoned for some time, that may also have been used as pasture-land.

No. N-5. Field already abandoned for some time, that may subsequently have been grazed, after which forest regeneration was able to begin and the heath was able to expand slightly.

No. N-7. A fairly small area brought under cultivation a relatively short time before the erection of the hunebed, where the heath was not yet able to expand, but where forest regeneration did not yet

TRB: North of the IJssel. Maximum score: 14.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-
4	1	1	4	-	-	-	-	-	-	-	-	-	-	-	-
5	4	1	7	5	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	4	-	3	2	2	-	-	-	-	-	-	-	-	-	-
8	7	-	6	3	4	-	3	-	-	-	-	-	-	-	-
9	3	-	4	1	1	-	2	3	-	-	-	-	-	-	-
10	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-
11	4	1	6	2	4	-	1	2	3	-	-	-	-	-	-
12	7	1	10	6	7	-	3	7	4	-	6	-	-	-	-
13	-	-	1	1	-	-	-	1	1	-	-	1	-	-	-
14	-	-	1	1	-	-	-	1	1	-	-	1	1	-	-
15	4	1	6	4	5	-	3	2	2	-	4	6	-	-	-

Fig. 11. TRB culture north of the IJssel. Correlation diagram of fifteen pollen types as possible indicators of human influence on the vegetation cover.

Fig. 12. PFB culture north of the IJssel. Correlation diagram of the same pollen types as in fig. 11.

PFB: North of the IJssel. Maximum score: 15.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	6	3	5	-	-	-	-	-	-	-	-	-	-	-	-
5	3	3	4	6	-	-	-	-	-	-	-	-	-	-	-
6	5	2	4	7	4	-	-	-	-	-	-	-	-	-	-
7	3	-	3	3	2	4	-	-	-	-	-	-	-	-	-
8	6	1	4	5	4	5	4	-	-	-	-	-	-	-	-
9	4	2	3	5	5	6	3	5	-	-	-	-	-	-	-
10	2	-	1	2	1	3	2	2	2	-	-	-	-	-	-
11	5	3	5	7	6	6	3	6	5	2	-	-	-	-	-
12	5	3	7	7	6	6	3	6	6	2	8	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
14	1	2	2	2	2	2	-	2	2	-	1	1	-	-	-
15	1	1	1	3	3	3	1	2	3	-	3	3	-	1	-

BB: North of the IJssel. Maximum score: 18.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
5	5	5	9	4	-	-	-	-	-	-	-	-	-	-	-
6	1	1	1	2	3	-	-	-	-	-	-	-	-	-	-
7	3	2	1	3	4	3	-	-	-	-	-	-	-	-	-
8	1	1	2	2	4	2	2	-	-	-	-	-	-	-	-
9	3	1	2	3	4	3	4	1	-	-	-	-	-	-	-
10	1	1	-	1	2	2	3	1	2	-	-	-	-	-	-
11	5	4	9	3	10	3	3	3	3	2	-	-	-	-	-
12	9	4	11	3	10	2	3	2	4	2	10	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	1	1	-	-	1	-	1	-	1	1	1	2	-	-	-
15	3	2	5	4	6	3	3	2	4	2	4	7	-	1	-

Fig. 13. BB culture north of the IJssel. Correlation diagram of the same pollen types as in fig. 11.

BB: South of the IJssel.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	5	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
5	3	2	1	4	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
7	3	1	1	1	2	-	-	-	-	-	-	-	-	-	-
8	3	1	-	3	3	1	1	-	-	-	-	-	-	-	-
9	-	-	-	1	1	1	-	1	-	-	-	-	-	-	-
10	1	1	1	-	1	-	1	-	-	-	-	-	-	-	-
11	1	4	3	3	2	1	-	2	1	-	-	-	-	-	-
12	4	5	5	3	3	-	2	4	1	1	3	-	-	-	-
13	6	6	4	2	3	-	1	4	-	1	3	5	-	-	-
14	2	3	3	2	1	1	-	2	1	-	3	3	2	-	-
15	3	4	3	3	2	1	-	3	1	-	3	4	4	4	-

Fig. 15. BB culture south of the IJssel. Correlation diagram of the same pollen types as in fig. 11.

Fig. 14. PFB culture south of the IJssel. Correlation diagram of the same pollen types as in fig. 11.

PFB: South of the IJssel.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-
5	3	5	3	2	-	-	-	-	-	-	-	-	-	-	-
6	3	4	-	4	1	-	-	-	-	-	-	-	-	-	-
7	4	4	2	2	5	1	-	-	-	-	-	-	-	-	-
8	2	3	1	3	3	3	3	-	-	-	-	-	-	-	-
9	3	2	2	7	2	5	3	4	-	-	-	-	-	-	-
10	1	3	2	3	2	3	1	3	3	-	-	-	-	-	-
11	3	5	2	1	6	1	4	2	1	2	-	-	-	-	-
12	3	3	1	2	2	3	1	2	3	3	3	-	-	-	-
13	3	6	3	3	5	3	4	4	3	5	5	3	-	-	-
14	2	4	2	-	3	1	3	2	1	2	3	2	4	-	-
15	4	3	1	4	3	4	3	3	5	2	2	3	3	1	-

1 = Betula > 20%
2 = number of weed types > 18
3 = Ericaceae > 40%
3 = Gramineae > 20%
5 = Cerealia present
6 = Plantago lanceolata > 6%
7 = Succisa > 2%
8 = Compositae > 4%
9 = Caryophyllaceae > 1%
10 = Ranunculaceae > 1%
11 = Artemisia present
12 = Rumex a-type present
13 = Cruciferae present
14 = Labiatae present
15 = Chenopodiaceae present

occur either. No clear indications of grazing.
No. N-8. An open spot, abandoned already for some time, that had been under cultivation and where the heath was able to expand; still no regeneration of the forest.
No. N-9. A small area with expanding heath cover, that had previously been under cultivation.
No. N-10. A relatively small open spot, that had been under cultivation or near cultivated land and where grazing may also have taken place.
No. N-11. A small abandoned field, where heath was able to expand.
No. N-12. A grazed open spot, where forest was not (yet) able to regenerate.
No. N-13. No informative data available, but the possibility of a grazed area cannot be excluded.
No. N-14. If material from the TRB period is indeed concerned here, then this is a spot overgrown by heath, where cultivation had taken place, without any distinct influence of grazing.

General remarks.
For the most part open areas still of limited extent, but where in a number of cases the heath was already able to expand. There was presumably still no large-scale degradation of the forest, as the numbers and amounts of herbs present are not very high, and *Tilia* values are on average distinctly higher than in later spectra.

4.2.1.2. PFB barrows (nos. N-15 – N-28, figs. 3 and 12)

On the basis of the pollen spectra and any supplementary data available, such as the soil profile, the following characteristic features of each site have been ascertained with regard to the choice of a spot for constructing a burial mound of the PFB culture.

No. N-15. Fairly pronounced expansion of heath on abandoned arable land, possibly after grazing had taken place. Little or no forest regeneration detectable.
No. N-16. Probably a very small open spot, but the pollen content can provide no further details as to how the soil had been used previously. It does appear however that the heath was not (yet) able to expand to any considerable degree and that forest regeneration had not yet taken place.
No. N-17. Presumably forest already severely degraded locally, in which *Corylus* was able to expand. On the open spots, that owe their origin to cultivation, the heath was able to expand locally to a considerable degree. Grazing may also have taken place here, before the barrow was constructed, but only for a relatively short time.
No. N-18. Expansion of *Betula* and to a lesser degree of *Calluna* on abandoned arable land; little or no grazing.
Nos. N-19 and N-20. Shortly before these barrows were constructed the vegetation was destroyed by fire, possibly for the purpose of clearing the spot before using it for burial. It is not known how the soil was used previously.
No. N-21. Not very long abandoned arable land, used subsequently for grazing; the latter occurring perhaps until the time when the barrow was constructed.
No. N-22. Presumably already severely degraded forest or advanced deforestation (*Alnus* 64.8%), where cultivation and (intensive?) grazing took place, as a result of which *Betula*, *Calluna* and Gramineae could not expand to any considerable degree.
No. N-23. Rather severely degraded forest or advanced deforestation (*Alnus* 66%), but where relatively little regeneration took place, Grazing on abandoned fields, as a result of which *Calluna* could not expand; presumable also fallow areas, including precisely the spot where the barrow was constructed.
No. N-24. Fairly pronounced expansion of *Betula*; possibly after grazing. It is not clear whether this was old arable land.
No. N-25. Already fairly pronounced expansion of the heath on abandoned arable land, possibly also partly pasture-land, in the vicinity of the barrow. The somewhat higher *Corylus* value in the old surface spectrum may indicate that the forest was being cleared until shortly before the construction of the second phase of the barrow.
No. N-26. In the forest, that was probably only very locally degraded, *Corylus* was able to expand. There is no question of the presence of any large open spaces as a result of cultivation, so the heath was not able to expand either; probably only extensive grazing took place.
No. N-27. Abandoned field, where *Plantago lan-*

ceolata and various other herbs were able to expand; if grazing took place, this was very extensive. The low value for *Calluna* possibly indicates fairly fertile, as yet unleached soil.
No. N-28. Grazed, abandoned arable land, where neither *Betula* nor *Calluna* was able to expand.

General remarks.
From the *Tilia* values being on average lower in comparison with the TRB spectra, we can perhaps deduce a fairly intensive exploitation of the forest. In many cases *Betula* attains no high values; there was therefore no question of forest regeneration by means of the expansion of *Betula*. The high values for Ericaceae in combination with high values for *Plantago lanceolata* are (presumably) an indication that the soil was leached as a result of cultivation, so that here the heath could expand, rather than that the forest regenerated. High *Plantago* values (nos. N-21, N-23, N-25, N-27) may also be connected with the drying-out of fallow fields. The higher herb values compared with the TRB spectra indicate that the soil was used more intensively and possibly on a larger scale too. This applies especially for *Calluna* and Gramineae. The absence of high *Corylus* values means that no newly-cleared areas of forest were used for the construction of barrows.

4.2.1.3. BB barrows (nos. N-29 – N-40, figs. 4 and 13)

On the basis of the pollen spectra and any supplementary data available, such as the soil profile, the following characteristic features of each site have been ascertained with regard to the choice of a spot for constructing a burial mound of the BB culture.

No. N-29. Distinct expansion of the heath in an open area, where the forest was not able to regenerate. Grazing took place but the ground was not used intensively immediately prior to the construction of the barrow.
No. N-30. Presumably abandoned arable land, that was used for grazing, where the heath was not (yet) able to expand and where as a result of grazing the forest was not able to regenerate.
No. N-31. Pronounced expansion of *Betula* on old arable land; no indications of grazing.
No. N-32. Abandoned arable land, overgrown by heath. No forest regeneration (leached soil?).
No. N-33. Grazed area of not very great extent (very low *Calluna*), previously under cultivation. Site not long abandoned, possibly in use until the barrow was constructed.
No. N-34. Open spot with local expansion of *Betula*. Expanding heath vegetation and perhaps also some grazing on abandoned arable land.
No. N-35. Expanding heath on abandoned field, where grazing possibly took place too; no regeneration of forest.
No. N-36. There is insufficient information available (this was one of the oldest pollen analyses), but it is not impossible that this was a fairly recently abandoned field.
No. N-37. Pronounced expansion of the heath on abandoned arable land. Possibly no grazing.
No. N-38. The grave-filling possibly of cultivated soil only just abandoned and not yet overgrown by heath; the old surface and the sod come from a spot that was overgrown by heath and not in use, though previously cultivated.
Nos. N-39 and N-40. Presumably a very small open space in hardly degraded forest. Relatively high *Tilia* values can perhaps be attributed to the fertile soil. There was no cultivation on the spot, though some grazing may have taken place, as a result of which *Betula* declined, but *Calluna* was able to expand slightly (no. N-40 is slightly younger than N-39).

General remarks.
The high values for Ericaceae indicate the rapid spread of heath on the abandoned arable land. This indicates further exhaustion/leaching of the soil. It is not always possible to show that the land was previously under cultivation (e.g. no. N-29); the expansion of heath erases, as it were, the traces of cultivation and at the same times has a limiting effect on the number of herb types and the percentage of NAP. The Gramineae attain high values only seldom (nos. N-30 and N-33); this also applies to *Betula*. This goes together especially with low values for Ericaceae. It was only when *Calluna* did not expand immediately, or in the case of less exhausted soils, that especially *Betula*, Gramineae and also *Plantago lanceolata* were able to expand.

The values for *Corylus* being on average slightly

lower compared with the PFB spectra fits in with the picture presented by the pollen diagrams.

4.2.1.4. EBA barrows (nos. N-41 – N-43, fig. 5)
On the basis of the pollen spectra and the soil profile the following characteristic features of each site have been ascertained with regard to the choice of a spot for constructing a burial mound of the EBA.

No. N-41. Open space with heath vegetation predominantly, with no clear indications as to whether cultivation or grazing took place previously. The relatively low values for *Quercus*, *Tilia* and *Fraxinus* (*Ulmus* is not present) could indicate that the open space was relatively large in extent, and that *Betula* could establish itself here and there.
No. N-42. Open space covered predominantly by heath and also by grasses here and there, where grazing took place, but where the land was presumably under cultivation previously. Here too the open space may have been of fairly large extent.
No. N-43. Open space predominantly covered by heath, where grazing took place and where the land was previously under cultivation.

General remarks.
Only three barrows are concerned here; for these spectra it has not been ascertained which combinations of pollen types occur with certain frequencies.

Low values for Ericaceae no longer occur; the process of increasing spread of heath, that was already detectable with the BB barrows, here continues. No barrows were constructed on arable land that had only just been abandoned. The fact that Cerealia occur only twice, and only in low values, does not necessarily mean that the areas in question were not old arable land, but is also the result of erasing, by the spreading of heath, of any traces of agricultural activities. The overall picture fits in well as a sequel to that of the BB spectra. The *Tilia* values are, however, slightly lower, *Fagus* is not markedly higher and higher values for NAP occur slightly more frequently.

4.2.1.5. Multi-period barrows (nos. N-16, N-21, N-22, N-24, N-25, N-27, N-28, N-29, N-32, N-33, N-35, N-41, N-42, fig. 6)
The difference in time between the various periods is sometimes considerable, as in the case of no. N-16 (PFB/LBA), but more usually the difference in time is less or even only slight, e.g. as in the case of no. N-21 (PFB/BB), no. N-41 (EBA/MBA/LBA) and no. N-24, periods 2 and 3 (EBA/MBA).

The first phase of Neolithic activities in Drenthe is not concerned here; the TRB spectra come exclusively from single-period monuments. For each spectrum the archaeological dating is indicated. The information given here below is mainly supplementary to what has already been said with regard to the oldest phase in each case.

No. N-16. After the construction of the PFB barrow the heath expanded considerably; there was also severe degradation of the forest and deforestation. Grazing may have taken place, possibly on abandoned arable land.
No. N-21. The lower values for NAP and Gramineae and the higher Ericaceae values are indicative of decreasing activity after the construction of the PFB barrow, perhaps as a result of leaching of the soil due to (intensive) use (cultivation/grazing). The time interval between periods 1 and 2 was too short to allow any considerable expansion of the heath.
No. N-22. The area remained in use mainly as arable land and also as pasture (though perhaps less intensively), as a result of which the forest was hardly or not able to regenerate, while the heath was able to expand only slightly. Possibly also fallow areas, where *Betula* was able to expand; no leaching of the soil can be concluded from the pollen record.
No. N-24. A considerable part of the extended *Betula* vegetation gives way to heath. Whether the subsequent leaching/degradation of the soil is the result of (intensive) cultivation or grazing, or of both, cannot be said.
No. N-27. Intensive use of the soil, as a result of which the values for QM, *Betula* and NAP decrease. Ericaceae increase though not very much; no marked leaching of the soil. Perhaps also clearance of the forest on a considerable scale. Possibly grazing for the most part (*Betula* values are low, for example) but also cultivated land in the vicinity.
No. N-28. Near the primary barrow clearance of the forest took place, and subsequently the forest soil was used for building up the barrow (2nd

period, *Pteridium* 300%). Increasing cultivation activities in the vicinity and finally a rapid expansion of the heath on the cultivated land, possibly without any intervening phase of grazing on the abandoned fields. Some regeneration of the forest after period 2.
No. N-29. Initially no or hardly any further expansion of the heath, on which the primary mound was built. Further degradation of the forest and also further leaching of the soil (an increase in *Rumex* in period 4). No cultivated land at this spot, no settlement nearby, possibly some grazing.
No. N-32. Pronounced further expansion of the heath; no cultivated land at this spot, no indications of grazing, no settlement nearby.
No. N-33. The soil of period 2 comes from relatively recently cleared forest, where the heath had not been able to become established. In the immediate surroundings there may still have been some (small) fields in use.
No. N-35. Further expansion of the heath and further degradation of the forest, possibly accompanied by decreasing use of the soil for cultivation/pasture in the immediate surroundings.
No. N-41. Some grazing in period 2, possibly after cultivation activities in the vicinity. Subsequently further expansion of the heath, accompanied by or subsequent to decreased use of the soil. The high *Betula* value for period 4 may be related to the local situation: the trench. No regeneration of the forest.
No. N-42. The area immediately surrounding the barrow seems to have been left alone, as a result of which the heath was able to expand on the leached soil. Yet presumable there was (extensive) grazing at this spot and fields were present not too far away in the MBA.

General remarks.
In a number of cases further deforestation occurs; regeneration of the forest took place in only a few cases. The expansion of the heath, present at all tumuli, indicates fairly advanced leaching of the soil. Not all barrows were built at a spot where the heath was already an important constituent of the vegetation, but in almost all cases the heath was able to expand on the spot, sometimes to a considerable extent (nos. N-16, N-28, N-29, N-32, N-42). It seems as though this stage had already been reached in the MBA (e.g. nos. N-16, N-24, N-32, N-42), but in one case the heath was an important component of the local vegetation already before the construction of a much older barrow (no. N-25).

There are certainly differences regarding the initial situation of the spot at which each of these multi-period barrows were constructed. Large open spaces seem to predominate, but occasionally a small clearing is concerned (e.g. no. N-33, possibly also no. N-16). The vegetation may be predominantly heath (e.g. nos. N-25, N-29, N-32, N-35, N-42), but high values for e.g. *Plantago lanceolata* (nos. N-21, N-27, N-33, N-42), Compositae (nos. N-21, N-26, N-33) often accompanied by low values for Ericaceae, indicate completely different vegetations on which barrows were built. In all cases the soil concerned had already been utilized for purposes of cultivation and/or pasture for livestock.

4.2.2. *The general pattern of vegetation development as influenced by human activity in Drenthe*

Almost all spectra are indicative of reclamation or cultivation activities. From this we conclude that in most cases by far the barrows were constructed in the intensively exploited forest, i.e. close to the settlement. Even if (abandoned) arable land was not used, there would usually have been some arable land present not too far away.

4.2.2.1. Period of the TRB culture
The amount of pollen-analytical information available is greatest for the eastern part of the Drents Plateau, although this is not an accurate reflection of the distribution of this culture.

Noteworthy is the already rather early expansion of the heath and in several cases of grasses too; very often no forest regeneration took place, even though we can assume that the clearings made were not of great extent. This we regard as an indication of an already rapidly occurring exhaustion of the soil, which was however by no means general, in view of the relatively great abundance of herbs in various spectra. The high *Tilia* values, compared with most of the spectra of younger cultures, indicate that degradation of the forest had not yet occurred on a wide scale. The high *Betula* values in several spectra may have something to do with a

slash-and-burn culture; perhaps the heath was able to expand also after such burning had taken place, as high *Betula* values correlate fairly often with high values for Ericaceae.

The open spaces served as arable land and pasture; most of them had not been used any longer for cultivation for quite some time when the hunebed was built.

4.2.2.2. Period of the PFB culture

The absence of palynological information on barrows of this culture in Southeast Drenthe does not mean that this part of the Drents Plateau was uninhabited at that time; the grave with the A-hammer in Odoorn, the wooden trackway in the raised bog near Nieuw-Dordrecht and the oaken disc-wheels found in the peat bog (Van der Waals, 1964) indicate the presence of i.a. PFB people in this region. Also the late-Havelte phase of the TRB – contemporaneous with early PFB – is present here. The values for *Tilia*, that are lower on average, indicate, as previously stated, distinct degradation of the forest. It is not possible, however, to say anything about the extent of this. The somewhat more frequent occurrence of a large number of herb types, in comparison with the TRB, but also with the BB and the EBA spectra, indicates nevertheless forest clearance on a wider scale. The values for *Corylus*, that are on average slightly higher, may also be related to this further degradation. Both the heath and the grasses were able to expand further. Any forest regeneration, e.g. the initial expansion of *Betula*, is almost out of the question. The exhaustion of the soil evidently continues. *Rumex* occurs mainly in the heath, in view of its frequence occurrence in combination with i.a. Ericaceae.

Plantago could probably only expand on abandoned fields that were drier and *Succisa* on those that were somewhat wetter, when the heath had still not (yet) taken possession of the ground, e.g. when the land was still used for grazing.

Fagus occurs very scantily; we may assume that this tree was able to become established mainly in regenerating forest.

4.2.2.3. Period of the BB culture

The lower *Corylus* values are familiar to us from the pollen diagrams; a direct relation to human activity is not necessarily present here.

The herb values, that are generally somewhat lower, are not an indication of any decrease in human activity, as stated previously, but show a connection with a marked expansion of the heath. The exhaustion of the soil becomes more extreme. Higher values for Gramineae, often accompanied by higher NAP-values, such as *Plantago*, *Succisa* and Compositae, occur to a lesser extent than in the case of the PFB spectra. Abandoned fields evidently become fairly rapidly overgrown by heath.

Fagus expands only relatively little in comparison with the PFB spectra. This may be connected with the fact that forest regeneration was able to take place to only a very limited degree. The *Betula* values do not differ much from those in the PFB spectra. This can be regarded as an indication that agricultural practices, in particular the clearance and/or burning of forest, had not changed very much.

4.2.2.4. Early Bronze Age

These spectra show a distinct continuation of the development outlined above. The values for Ericaceae are somewhat higher, in one case even considerably higher. The process of "heathification" continues, as a result of soil exhaustion, but possibly also as a result of further hydrological developments that ultimately led to i.a. peat growth.

4.2.2.5. Various subregions

All the burial monuments discussed here, apart from nos. N-39 and N-40, are situated on the Drents Plateau, where there is a glacial boulder-clay formation, overlain by a layer of cover-sand of variable thickness. The entire plateau has an extremely ramified drainage system, as the boulder-clay is impervious to water (see also W. Groenman-van Waateringe 1978, especially fig. 7). This means that in this markedly dissected landscape prehistoric man met with different situations as regards soil conditions, hydrology, fertility and thus the vegetation that he cleared in the process of reclamation. We must assume that the various types of landscape reacted in different ways to interference by prehistoric man. To ascertain in more detail whether this is visible in the barrow spectra we have divided the Drenthe spectra into six groups, namely:

– group 1, in the SW of Drenthe, where drainage occurs in a SW direction i.a. via the Meppeler Diep and the Vledder Diep: nos. N-25, N-26, N-27, N-28, N-37, N-38.
– group 2, N-Drenthe, where drainage occurs in a N direction, via the Eelder Diep and the Peizer Diep, west of the Drentse A: N-12, N-16, N-32, N-35, N-36, N-41, N-43.

Three groups on the E side of the Drents Plateau:
– group 3, NE Drenthe: nos. N-1, N-15, N-17, N-18, N-19, N-20, N-21, N-29, N-30, N-42.
– group 4, E Drenthe: nos. N-2, N-3, N-5, N-31.
– group 5, SE Drenthe: nos. N-6, N-7, N-8, N-9, N-10; and
– group 6, Central Drenthe: nos. N-11, N-22, N-23, N-24, N-33, N-34.

Nos. N-4, N-13, N-14, N-19 and N-20 are disregarded because they contain no or too little pollen. For each burial monument only the oldest spectrum, of the first phase, is used.

We have ascertained any differences that there may have been concerning forest regeneration (high/low *Betula* values), the expansion of the heath (Ericaceae), of grasses (Gramineae) and soil use (arable land/pasture).

In all subregions *Betula* is present in both low and high percentages in all four periods that we have distinguished (TRB/PFB/BB/EBA). There is no link between the marked expansion of *Betula* and either time, culture or locality. Instances of the expansion of *Betula* are generally of a strictly local nature and also of short duration, to be regarded as reactions to interference or precisely the absence of interference.

The expansion of heath, on the basis of (fairly) high values for Ericaceae, is a general trend that manifests itself already in the Neolithic. There is no clear link with any one culture. The average values for the three Neolithic cultures are fairly close (between 60 and 70%); the EBA values are on average distinctly higher (around 100%). In the Central, E and SE subregions TRB spectra already have fairly high values for Ericaceae. The PFB spectra of the SW and NE subregions already have high values to some extent, while in the N subregion this is the case with the BB spectra. *Calluna* was undoubtedly already present everywhere or at least in many places, but the data mentioned above concerning the expansion are nevertheless insufficient in our opinion to permit the conclusion that we have demonstrated an earlier expansion of the heath in the higher areas of Drenthe. What we can say is that the exhaustion of the soil, and perhaps also the specific hydrological situation of the Drents Plateau had a very favourable effect on the heath.

The grasses occur with values that are higher on average especially in the PFB spectra, but (relatively) high values are not restricted to this culture. None of the six subregions however has values for Gramineae that are remarkable different to those for the other subregions. The expansion of grasses is especially a local phenomenon as a reaction to interference with the vegetation. Vegetations of this kind could possibly maintain itself for a fairly long time under the subsequent conditions of soil use. Grazing and a high fertility of the soil probably had a favourable effect on the expansion of grasses, especially where competition with *Calluna* is concerned.

There are no apparent differences in soil use in the subregions distinguished. If we assume that all of the cultures under discussion practised agriculture as well as keeping cattle, then it will be possible to ascertain at most only slightly accentuated differences – indications of either more agriculture or more grazing. This is not possible with regard to the six subregions. The fact that the subregions differ considerably with regard to the number of different types of barrows investigated palynologically together with the fact that usually no arable land still in use or essentially pasture-land was used for the construction of a barrow, may have contributed here to a great extent. Summarizing we can say that any geographical pattern of the vegetation development on the Drents Plateau on the basis of our information is out of the question. The development of the initially mostly dense, only slightly degraded natural forest, that was exploited in the Neolithic for food production, into the subsequently largely deforested landscape extensively covered by heath is above all a development in the course of time. Factors such as over-cultivation, over-grazing, exhaustion and leaching of the soil played a much more important role in this respect than the cultural pattern as determined by the prehistoric inhabitants who utilized the soil.

4.3. South of the IJssel

4.3.1. *The vegetation at the spot chosen for a burial monument*

4.3.1.1. PFB barrows (nos. S-1 – S-14, figs. 7 and 14)
The following account of the choice excercised by the PFB people in the location of their barrows is based on soil profiles, pollen spectra and evidence from additional sources.
Tumulus S-1. Small clearing with regenerating forest on old arable land, which was not used as pasture in view of the fact that *Betula* is above 20%, Ericaceae and Gramineae are low, there are few herb species, *Succisa* is high and Cerealia are present. Because of the weakly developed soil profile, the agricultural phase cannot have lasted long or been intensive.
Tumulus S-2. Abandoned settlement site used as pasture, with regenerating woodland, following the criteria noted in chapter 2.4. and in this chapter 4.a., South of the IJssel, sub b and c.
Tumulus S-3. As tumulus S-2.
Tumulus S-4. As tumulus S-1, but a greater variety in herbs and higher *Betula* and Ericaceae percentages. Therefore, the clearing was perhaps larger, or the regeneration of the forest was less advanced.
Tumulus S-5. Former arable land with encroaching heath in an otherwise dense forest, based on the fairly high percentages of Ericaceae, low *Betula* percentages, Cerealia and numerous herb species, coming from the former field.
Tumulus S-6. As tumulus S-4.
Tumulus S-7. As tumulus S-2, possibly extensive grazing in the forest, considering the high *Succisa* values (Groenman-van Waateringe, 1978, p. 142).
Tumulus S-8. As tumuli S-4 and S-6, but with much higher Ericaceae values and lower *Betula* percentages, pointing to soil exhaustion as a result of a fairly long occupation phase?
Tumulus S-9. As tumulus S-5 but much smaller number of herb species.
Tumulus S-10. Small, natural clearing in the forest.
Tumulus S-11. Fairly open terrain with grazing.
Tumulus S-12. As tumuli S-2 and S-7, considering the archaeological finds, but with much lower *Betula*, obviously open pasture land.
Tumulus S-13. Small, open, heathy space.
Tumulus S-14. As tumulus S-13.

4.3.1.2. BB barrows (nos. S-15 – S-28, figs. 8 and 15)
A correlation diagram similar to that for tumuli S-1 – S-14 (fig. 14) was constructed for tumuli S-15 – S-28 (fig. 15), but as a consequence of extremely low herb values in a number of the samples, no clear correlations emerged.

The *Betula* values correspond to those from the tumuli S-1 – S-7; but clearly exceed those from tumuli S-8 – S-14; the values of the Ericaceae remain more or less comparable, with the exception of tumuli S-15, S-18, S-19, S-24 and S-26, these again perhaps the result of a fairly long occupation phase in the area, resulting in soil exhaustion? The Gramineae values are in all cases low – only once in 40% attained – and the other pasture herbs are also in general low, with the exception of the tumuli in the Gooi nos. S-17 – S-19, where *Plantago lanceolata* is higher, and tumuli S-16, S-17, S-21, S-22, S-24 and S-27, where the Compositae were higher. In all cases, the clearings in which the tumuli were raised must still have been small. Tumuli S-16 – S-19, S-21, S-24 and S-27 were probably built on fallow or pasture land.

Natural clearings will have been chosen, or clearings were perhaps made for the remaining barrows.

The diversity on herb species in roughly the same for the tumuli S-16 – S-19, S-22, S-24 and S-25 as it is for the PFB tumuli S-4 – S-8 and S-12.

By now *Fagus* is represented with low values in virtually all the samples, this in contrast to the barrows of the PFB Culture, where *Fagus* only occurred on the Utrechtse Heuvelrug (tumulus S-5, PFB 1a) and in the Gooi (tumulus S-10, PFB 1d).

4.3.1.3. Tumuli without grave goods (nos. S-29 – S-30, fig. 9)
Tumulus S-29 is in every respect comparable to the two PFB tumuli at Groot-Drakenstein. Tumulus S-30 is, likewise, comparable to the Veluvian BB barrows on the Veluwe; the same holds true on account of the situation of the corpse-silhouettes (oral communication J. N. Lanting, BAI).

4.3.1.4. Bronze Age (nos. S-31 – S-35, fig. 10)
The five Bronze Age barrows are situated in three different areas, the Veluwe (S-31), the Gooi (S-32, S-33) and the Brabantse Kempen (S-34, S-35); three of them belong to the Hilversum/Drakenstein Culture, as defined by

Glasbergen (1954). These three are mutually comparable in every respect, those from the Gooi displaying higher Ericaceae values, but, considering the C14 date of tumulus S-33, these should also be dated somewhat later. The barrows continue to be raised in small clearings in the forest (Ericaceae percentages of ca. 50%, the other herb values, including Gramineae, remain low).

4.3.1.5. Multi-period barrows (nos. S-1, S-5, S-7, S-10, S-21, S-22, S-24, S-25, S-29 – S-31, fig. 16)

Especially diagnostic for the lapse of time between the various periods within a single tumulus is the

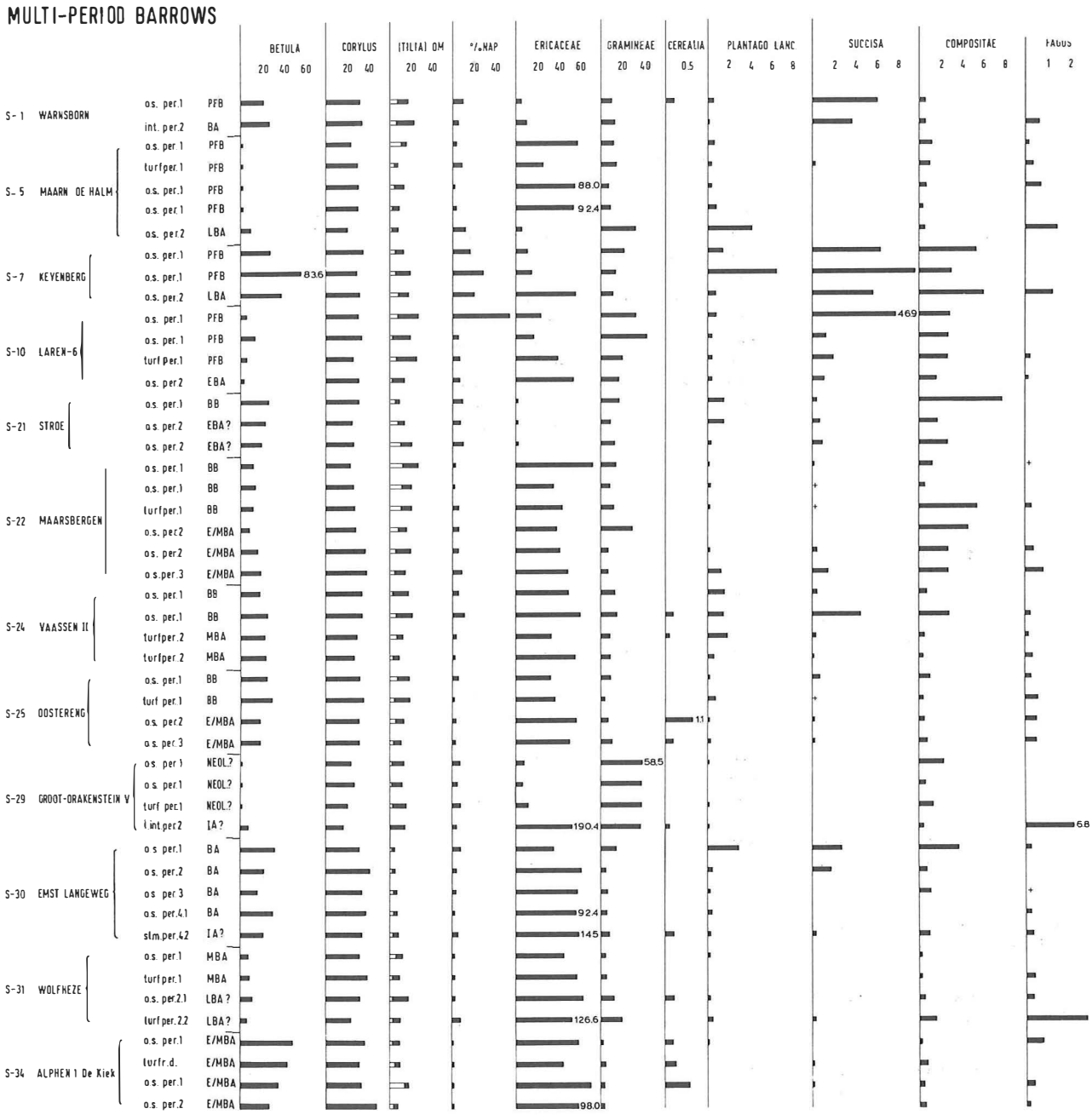


Fig. 16. Frequencies of several pollen types for multi-period barrows south of the IJssel. Drawing IPP.

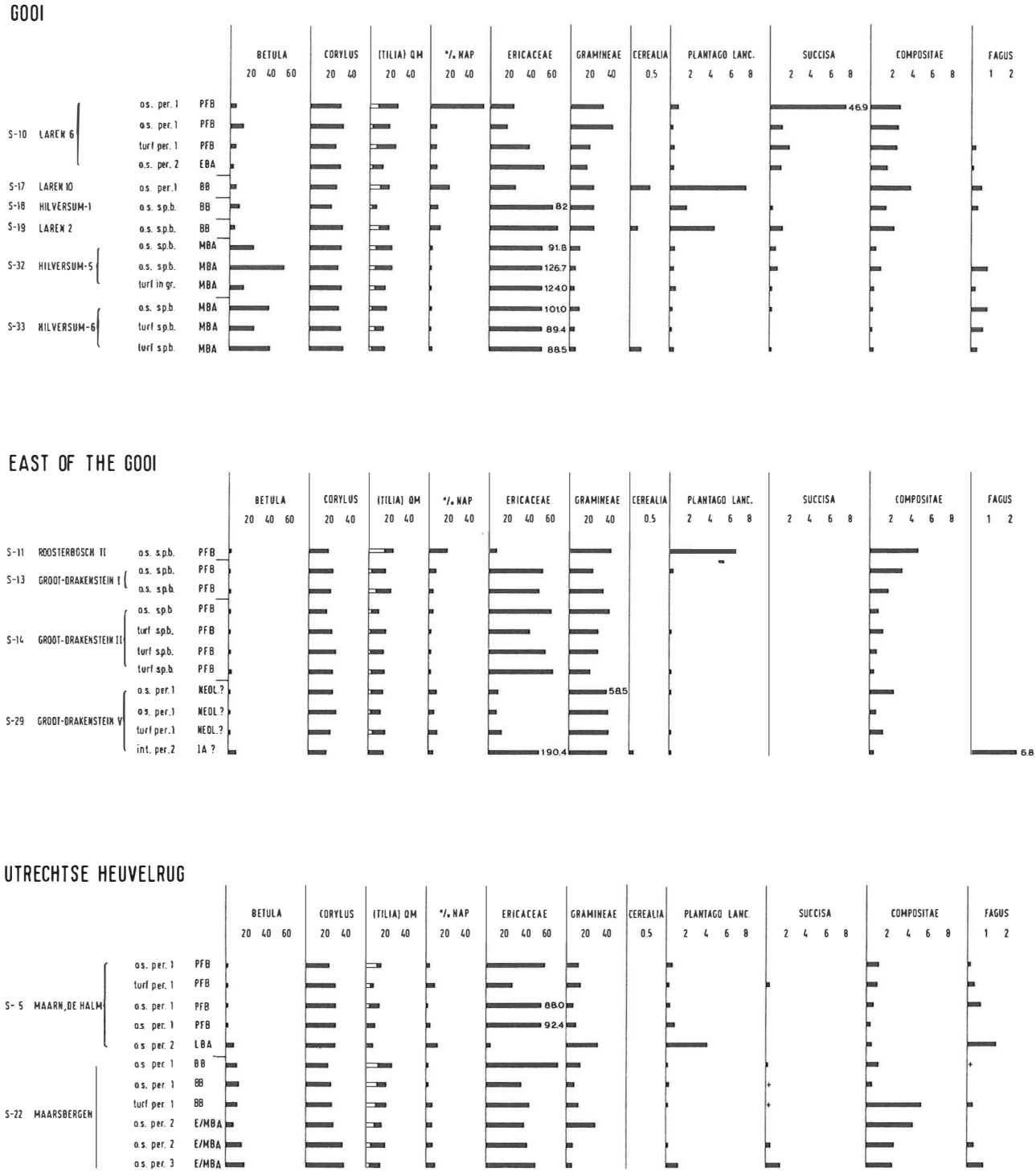


Fig. 17. Frequencies of several pollen types for barrows in the Gooi. Drawing IPP.

Fig. 18. Frequencies of several pollen types for barrows east of the Gooi. Drawing IPP.

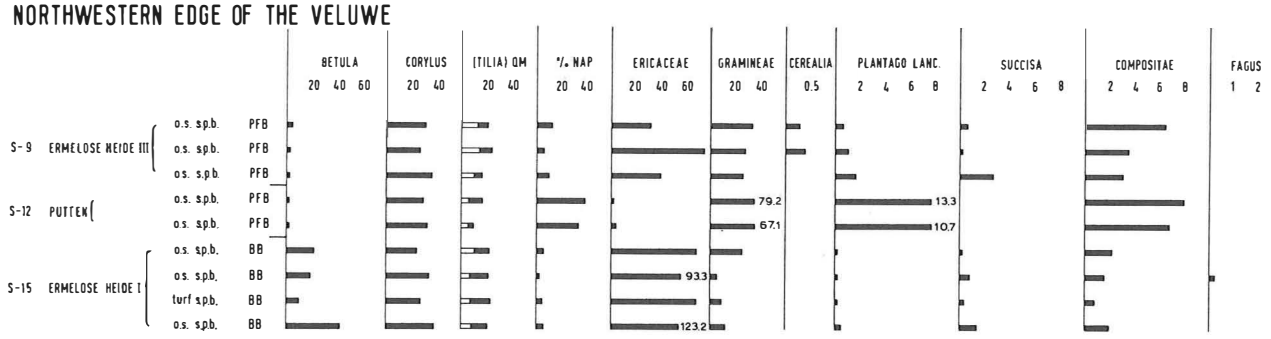
Fig. 19. Frequencies of several pollen types for barrows of the Utrechtse Heuvelrug. Drawing IPP.

Fig. 20. Frequencies of several pollen types for barrows on the northwestern edge of the Veluwe. Drawing IPP. ►

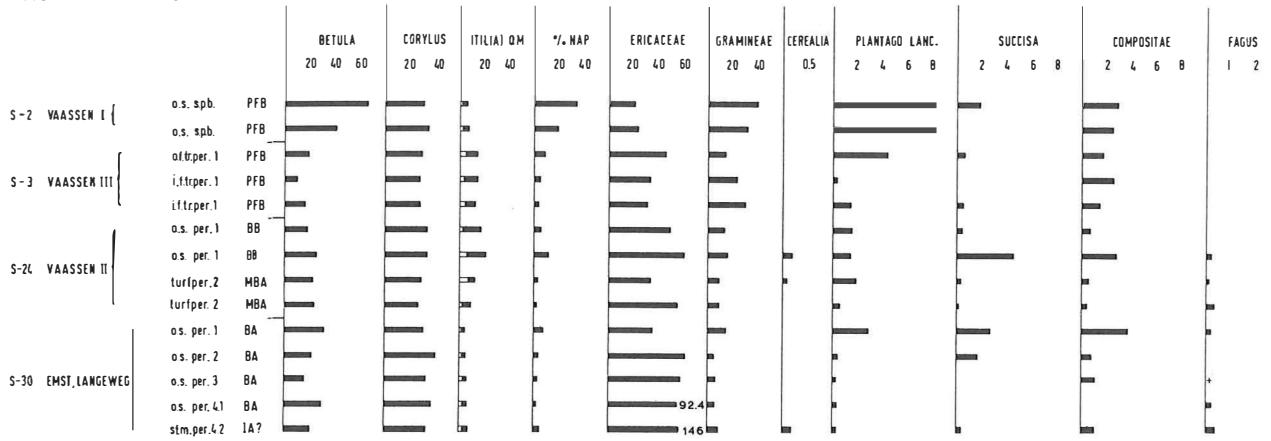
Fig. 21. Frequencies of several pollen types for barrows on the eastern edge of the Veluwe. Drawing IPP. ►

Fig. 22. Frequencies of several pollen types for barrows on the southern Veluwe. Drawing IPP. ►

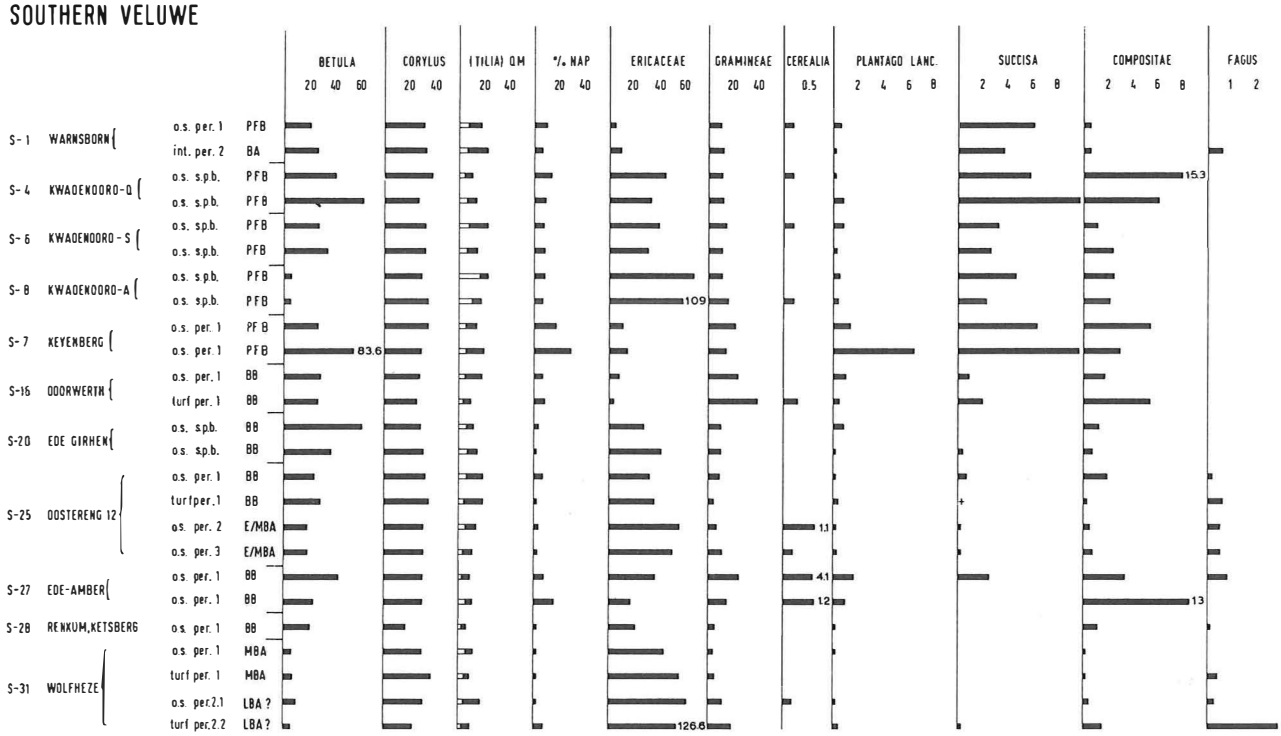
NORTHWESTERN EDGE OF THE VELUWE



EASTERN EDGE OF THE VELUWE



SOUTHERN VELUWE



Fagus percentage (cf. tumulus S-5) and to a lesser extent, proportional changes in the remaining pollen (both of trees and of herbs). Indeed, the development in tumulus S-5 is just the reverse of what would be expected here, namely, a marked decline in the Ericaceae percentage from the first to the second period, while Gramineae and *Plantago lanceolata* increase: perhaps evidence for the reclamation of the heath (by fire, for example), upon which the locality was given over to pasture? In view of the values for *Fagus* (above 1%), the second period of tumuli S-5 and S-7 should be dated to the advanced Bronze Age. Period 3 of tumulus S-31 and the secondary interment of tumulus S-29 should, with reference to the high percentage of *Fagus* and the presence of *Carpinus* and *Secale* in barrow S-29, be dated well into the Subatlantic, i.e. the Iron Age. In the tumulus at Emst (S-30), we see extremely high values for Ericaceae, though not paired with higher *Fagus* values. Should, therefore, this increase in the Ericaceae be regarded as a purely local phenomenon?

4.3.2. *The general pattern of vegetation development as influenced by human activity in the Central Netherlands*

4.3.2.1. Sequence of vegetation in the Gooi (nos. S-10, S-17 – S-19, S-32, S-33, fig. 17)

Remarkable are the relatively high percentages for *Succisa* in PFB tumulus S-10, the relatively high values for *Plantago lanceolata* in the BB barrows S-17 – S-19, the low values for all the herbs in the Bronze Age barrows S-32 and S-33, with the exception of the Ericaceae, which occur with values of 90% and more. Taking into account the regularity of low herb percentages in all Neolithic samples (both of the PFB and the BB) and the low values for *Betula*, we may tentatively visualize the tumuli as standing in clearings in rather dense forest, with tumulus S-10 raised on disused arable land (?), despite the absence of Cerealia but with regard to the high *Succisa* values, while tumuli S-17 – S-19 were located on grazed-over former arable land. At the time of the construction of tumuli S-32 and S-33 (Middle Bronze Age) the area of heathland must have been expanding rapidly on soils exhausted by continuous occupation.

4.3.2.2. Tumuli east of the Gooi (nos. S-11, S-13, S-14 S-29, fig. 18)

Since three of the four tumuli are assigned to the PFB Culture while the fourth, no. S-29, is likely to belong to the same period, these analyses are of no value in establishing the sequence of vegetation[7]).

Remarkable are the extremely low values for *Betula* in all samples and, indeed, with the exception of tumulus S-11, for all herbs. Here too, the tumuli must have been raised on small clearings in the forest, where, except around tumulus S-11, grazing was rare.

In contrast to the barrows in the Gooi area, *Fagus* does not appear in any of the samples here, although it is already present in the PFB tumulus S-10.

4.3.2.3. Sequence of vegetation on the Utrechtse Heuvelrug (nos. S-5 and S-22, fig. 19)

Since both of the PFB tumulus S-5 and the BB tumulus S-22 are multi-period barrows it is justifiable to speak of a vegetational development. The *Fagus* of tumulus S-22 would seem to place its construction between the two periods of tumulus S-5.

Once more, the low *Betula* percentages are noteworthy, here coupled to low values for all herbs, even in the PFB barrow. The spot where tumulus S-5 was raised was perhaps somewhat more open, with a growth of heath, but indications for abandoned arable land or pasture are absent. Here, *Fagus* occurs already in the earliest periods (PFB 1a).

4.3.2.4. Tumuli on the northwestern edge of the Veluwe (nos. S-9, S-12, S-25, fig. 20)

Here again there is no question of a sequence since the grave goods in the barrows (PFB 1d, PF Beaker of zigzag type and an AOO Beaker type 2IIb) date them too close together.

Both barrows at Ermelo are comparable, even though tumulus S-15 has a somewhat higher *Betula* percentage and also, on average, higher values for Ericaceae. Tumulus S-9 seems to have been raised on abandoned arable land: evidence for pasture is scanty. Tumulus S-12, in contrast, presents a totally different picture, but here we know for certain that the barrow was built over a former settlement. There is clear evidence for grazing.

4.3.2.5. Sequence of vegetation on the eastern edge of the Veluwe (nos. S-2, S-3, S-24 and S-30, fig. 21)

Tumuli S-2 and S-3 are both of the early PFB phase, tumuli S-24 and S-30 are Veluvian BB phase, both with secondary interments, which, however, considering the *Fagus* percentages, cannot be dated so very much later than the primary mounds, although in the case of tumulus S-30 the latest period does show a marked increase in Ericaceae. With the exception of tumulus S-2, once more situated on a former settlement site (comparable to barrow S-9) the barrows are mutually comparable on all points. They must have been raised on small open spaces in the woodland, with possibly some arable and pasture land in the vicinity. There is no question of large open spaces prior to the latest phase of tumulus S-30.

4.3.2.6. Sequence of vegetation on the southern Veluwe (nos. S-1, S-4, S-6 – S-8, S-16, S-20, S-25, S-27, S-28 and S-31, fig. 22)

Notable are the high values for *Succisa* in PFB barrows along the valley of the Renkum brook. The *Succisa* is correlated with the Cerealia and would, therefore, appear to be an arable weed here, or at least, a weed growing on fallow land. Evidence for pasture is scanty in these mounds.

Tumulus S-7 forms an exception and seems to be comparable to tumuli S-2 and S-9, both of which were raised on old settlement sites. The numerous charcoal particles in the old surface of tumulus S-7 could be an indication that this barrow, too, was built over an abandoned settlement site[8]).

The remaining tumuli, with the exception of no. S-27, with its high Cerealia and Compositae values, present a picture not at variance to that from the BB barrows elsewhere on the Veluwe.

Published analyses from the Gooi and the Utrechtse Heuvelrug are non-existent, from the Veluwe they were until now rather scarce. The latter comprise the following barrows:

1. the Neolithic tumulus at Putten (see above no. S-12)
2. a Neolithic (?) tumulus without any grave finds at Ugchelen (Waterbolk, 1954, p. 95)
3. a Neolithic barrow no. 1 at Schaarsbergen, see above our no. S-1; a Neolithic (?) barrow no. 2 without grave finds (Waterbolk, 1954, p. 95-9)
4. an Early Bronze Age barrow from Boeschoten (Waterbolk, 1954, pp. 93-95)
5. four Early Bronze Age barrows from Schaarsbergen (Waterbolk, 1954, loc. cit.)
6. a Late Bronze Age barrow from Ugchelen (Waterbolk, 1954, p. 95)
7. a four-period barrow at the Oostereng near Bennekom (primary mound with Veluvian BB type 2I (Van Zeist, 1954))
8. a Neolithic barrow belonging to the Veluvian BB phase at Renkum (= de Ketsberg) (Van Zeist, 1967b, fig. 5), see above our S-28
9. a three-period barrow (cf. Waterbolk, 1964b, p. 101, note 14) no. II at Ermelo (Van Zeist, 1967b, fig. 6).

From the Brabantse Kempen ca. 30 Bronze Age (Early and Middle Bronze Age) barrows have been analysed (Waterbolk, 1954, pp. 101-111; 1957b; Van Zeist, 1967a).

In these previously published spectra, both from the Veluwe and the Brabantse Kempen, the same tendencies are recognisable as in our samples (cf. Groenman-van Waateringe, 1974):
the percentages of Gramineae and Ericaceae are contrary, the values for *Tilia* are rather high and all herbs occur in low quantities.

The overall picture again is that of an open wood cover with enough open space and light for grazing and tillage, but without large clearings.

Other previously published pollen analyses of PFB and BB barrows from the region south of the IJssel are to be found in Waterbolk (1964b), Groenman-van Waateringe (1961b, 1974) and Van Zeist (1963).

5. DISCUSSION

5.1. General

The views that are included in the following conclusions are mainly derived from the data obtained from research on barrows of the Veluwe. These data provide evidence that clearly deviate from views that have been accepted already for some years concerning the culturally linked *landnam*. In retrospect, it is understandable how these earlier views became formulated on the basis of the material then available, namely above all PFB spectra

from Drenthe and BB spectra from the Veluwe.

5.2. South of the IJssel

An unpublished geological study by Keessen (1974) showed that the Neolithic occupation was especially concentrated in the region of the valleys of the Renkum, Heelsum and Leuvenum brooks. Here, between the pushed moraines of Putten-Garderen in the north, Wageningen-Lunteren in the south and the major Veluwe moraine, is a region of gradients, the transition from high, dry sands to lower, damper ones. The only significant difference in the selection of soil type excercised by the various Beaker groups which Keessen was able to detect was in the degree of coarseness or fineness of the sands. PF Beakers and AOO Beakers occurred chiefly on the coarse sands, Bell Beakers predominantly on the fine sands and mildly loamy sands, while of the Veluvian BB, 38% was found on the fine sands, 42% on coarse sands and 20% on other soils. Keessen considered that these differences in soil types might reflect the application of different *landnam* methods (the Iversen type, with large-scale forest clearance for pasture, on the coarse sands, the Troels-Smith variant with small fields on the better soils and the livestock not ranging freely).

From the foregoing palynological analysis, it will be evident that such a distinction cannot be made. There is no discrimination between the economic patterns of the PFB and the AOO on the one hand and the early BB on the other, with a reversion within the Veluvian BB group (practising in part Iversen's *landnam*, in part Troels-Smith's) as assumed by Keessen, neither is there an economic distinction between Early PFB and Later PFB, as suggested by Lanting and Van der Waals (1976, p. 71).

The most remarkable aspect of the pollen analysis of barrows in the Central Netherlands is the uniformity of the picture obtained from the Early and the Late PFB, AOO and Early and Late BB barrows. Those differences detected are all to be explained by the site selected for the construction of the barrow. Here, too, there was seemingly no consistency. A culturally linked economic pattern cannot be inferred from the evidence presented here. Neolithic people were far more capable of adapting their economy to the potentialities of the landscape than hitherto recognized. There was no question of a rigid pattern which was to be followed under all circumstances. Within rather wide margins, people were able to make a living for themselves wherever they went (cf. the settlements of Zandwerven and Aartswoud, where, besides agriculture, fishing and gathering shelfish were highly important).

With the exception of certain PFB tumuli, which were clearly raised over abandoned settlement sites, the evidence for arable and stock farming is scanty. Large open areas, cleared by man do not yet occur during the Neolithic in the Central Netherlands. Only when high Ericaceae percentages are correlated with relatively high *Pinus* values is it possible to speak of large open heathland (cf. the tumuli S-32 and S-33 in the Gooi).

Neither is such evidence forthcoming from the available master-diagrams from the Uddelermeer (Polak, 1959) and from the peat deposits along the Leuvenum brook (id. 1967) for the northwestern part of the Veluwe and the recently published diagram of Valkenhuizen II for the southern part of the Veluwe (Maarleveld & De Lange 1977, p. 25). Considering the density of occupation (Keessen, 1974) an Iversen *landnam* on the Veluwe ought to have been recognisable in these diagrams had it been practised (Groenman-van Waateringe, 1978, pp. 142-143, figs. 4-5).

The Veluwe consists of pushed moraines, cover sands and fluvio-glacial material of porous nature. Rainwater seeps down to the water table some 20-30 m and more below, and reappears as springs along the lower edges of the Veluwe. The resulting river valleys were the most attractive for settlement, but make up only a fraction of the total area, which consists mainly of dry sandy soils. This suggests an open woodland with chiefly oak, lime, birch, and hazel, and a comparatively well developed undergrowth, providing sufficient fodder for livestock. In the pollen diagrams and spectra this will result in an under-representation of the herbs, because most of the herb pollen will be caught in the trunk space (Tauber, 1965). As a result of grazing, the woodland will have become increasingly open, allowing grass and heather to encroach. But this was a far more gradual process than the wholesale burning of the forest. In the Uddelermeer,

Leuvenum brook and Valkenhuizen diagrams we do not see a sudden depression in the curves for oak and lime, and in the spectra from the barrows, too, lime continues to be represented by high values. This is yet a further indication of the openness of the forest, because *Tilia* is, especially under favourable light conditions, a great pollen producer. When lime grows in dense forest, however, flowering is greatly reduced (Iversen, 1960, note 11).

In Denmark a similar process can be observed. In two diagrams from Central Jutland (Bølling Sø and Hostrup Sø) Iversen (1941, pp. 52-53) found no indications of clearance fires, the fall in the curve of the oak mixed forest is not pronounced and the birch shows no distinct peak (Groenman-van Waateringe, 1978, p. 143, fig. 5). Iversen remarks: "Unless the characteristic land occupation phase is underdeveloped in the diagrams owing to slow sedimentation, we must assume that the relatively slight density of the forest and its wealth of grass made a clearance fire unnecessary."[9])

The gradual degradation of the forest cover can be understood as follows (see Van de Brink & Van der Werf, 1977). The original wood consisting of lime and oak (cf. the present-day Fago-Quercetum with lime instead of beech), was already rather open on account of activities in these woods for several thousand years. Because of this openness the undergrowth was rather well developed and a variety of shrubs and weeds occurred in these woods (barrow S-16). The increasing pressure on the woods by Neolithic man led in the long run to impoverishment of the soil and henceforward to an impoverishment of the vegetation, resulting in a restriction in the variety of weed species and an expansion of certain types strong enough to resist continuous human interference, e.g. certain grasses (barrows S-11, S-29) and Ericaceae (barrows S-3, S-13, S-14, S-18, S-26, S-31, S-32).

Another result of the impoverishment of the soil can be the development of a Betulo-Quercetum. This means a regeneration of the wood cover, but with a different composition to the original one (barrows S-1, S-20, S-21, S-27, S-33, S-34). One can think of several transitional stages between the above-mentioned main types, e.g. a phase in which grasses and Ericaceae both occurred with rather high values (barrows S-9, S-10, S-17), and a phase with a lot of Ericaceae, but in which the birch is already penetrating (barrows S-23, S-25, S-28, S-30).

Barrows S-2, S-7 and S-12 are situated on old settlement sites, i.e. open spaces in the wood with a lot of weeds and in the case of barrows S-2 and S-7 with high *Betula* values, indicating a beginning regeneration of the wood. Barrows S-4 – S-6, S-8, S-15, S-19, S-22 and S-24 show a large variety of weeds, but also rather high values for Ericaceae. This could indicate a development from a deserted settlement site in the direction of an expansion of the Ericaceae vegetation, instead of a regeneration into a Betulo-Quercetum.

So it seems that we can at least discern between two different trends, i.e. 1. the gradual vegetation development from a wood rich in nutrients into a wood poor in nutrients, and 2. the vegetation development on a former settlement site, ending up either in a wood poor in nutrients and/or with rather high Ericaceae values, developing in the long run into a heath vegetation.

5.3. North of the IJssel

The barrows north of the IJssel, with the exception of nos. N-39 and N-40, are all situated on the Drents Plateau. The Neolithic period and the Early Bronze Age (as well as younger periods too) are usually well represented in many pollen diagrams for the region of Drenthe. Meanwhile, the amount of information available on the way in which the peat built up in SE Drenthe has increased considerably (Casparie, 1972). The information with regard to human influence on the vegetation in this region is so detailed that the pollen diagrams for SE Drenthe are just as informative as the true '*landnam*-diagrams' from small peat bogs.

In his pollen diagram for Bargeroosterveld Van Zeist (1967) distinguishes three instances of Neolithic intervention. The changes occurring in the pollen picture, that can be dated to between ca. 3000 and 2200 BC, such as the decline of *Ulmus*, the marked decrease of *Tilia* (from ca. 20 to ca. 10%), but especially the presence of *Plantago lanceolata* in very low values, is ascribed to reclamation activities of the TRB people[10]). It is the Troels-Smith

type of *landnam* that is concerned here: small clearances and the livestock kept in byres or inside an enclosure. On the basis of the course of the curves for *Tilia* and *Ulmus* a further division into two phases is possible: the first from ca. 3000 to 2500-2400 BC and a second from 2500-2400 to 2200 BC. This second phase is considered in more detail below.

The two other instances of Neolithic intervention affecting the vegetation are manifested not only by a renewed sharp decline of *Tilia* but especially by relatively high values for *Plantago lanceolata*. They can be dated to between ca. 2200 and 1900 BC, and to between 1900 and 1800-1700 BC, respectively. The older of these two is ascribed by Van Zeist to the PFB people; whether the younger also belongs to the PFB or to the BB is not immediately clear. In both cases the so-called Iversen *landnam* is concerned: fairly large-scale reclamation of forest by use of the axe and fire, with most of the land reclaimed subsequently being used for grazing.

The pollen diagram for Bargeroosterveld is not without parallels. In the diagrams for Emmen I, Emmen V and Nieuw-Dordrecht Van Zeist (1959) found a similar picture, albeit with several notable differences, especially in the values for *Ulmus*, *Tilia* and *Fraxinus*, but also for *Plantago lanceolata*.

In the diagrams for Emmen I and V (1.5 km north of Bargeroosterveld) the period 3000-2200 BC shows especially a sharp decline in *Ulmus* (from ± 15 to 5% and from 20 to 8%, respectively). In Bargeroosterveld in this same period there is above all a decline in *Tilia* (from ± 20 to 10%), as is also the case in the diagram for Nieuw-Dordrecht (from ± 18 to 8%), situated some 2.5 km further south. Around 3000 BC the *Fraxinus* values change hardly or not at all; they are (from north to south) 9 to 10% (Emmen I and V), 4 to 5% (Bargeroosterveld), ± 2% (Nieuw-Dordrecht). This places *Fraxinus*-rich forests in a side-valley of the Hunze, that opens out between Emmen I and V and Bargeroosterveld into the wide, peat-filled Hunze valley. These damp to wet forests were not reclaimed by the TRB people.

The TRB people reclaimed the *Ulmus*-rich forest and the more southerly *Tilia*-rich forest. The considerable decline in *Ulmus* and *Tilia* – starting from the level of ca. 3000 BC – suggests that this instance of Neolithic intervention was of fairly great extent, which is not what one would expect with the Troels-Smith type of *landnam*. We find it hard to imagine that intervention on such an extensive scale was primarily a matter of cutting foliage to feed livestock. In the open spaces, which in our opinion were not extremely small, cultivation was practised in any case. Where clearings were abandoned, the forest was able to regenerate gradually without any great expansion of *Plantago lanceolata*. Even in the case of small clearings where occupation lasted some 5 to 8 centuries one wonders whether *Plantago* would expand to a great extent, unless the soil was suitable. In our opinion, in regenerating forest and in the open spaces lying fallow *Plantago lanceolata* was not able to expand to any great extent because the soil conditions were not favourable (see below).

The diagrams for Emmen I and V and Bargeroosterveld I (Van Zeist, 1959) indicate that from ca. 2200 BC onwards forest was cleared on a soil where *Plantago lanceolata* was able to expand considerably. This marked expansion, well represented in the diagrams mentioned above, is not accompanied by any corresponding expansion of other light-demanding herbs of open vegetations (Van Zeist, 1959). In both reclamation phases (from 2200 to 1900 BC and from 1900 to 1800-1700 BC, respectively) the relatively high values for *Plantago* were attained in a relatively short time, within ± 50 years. This indicates the development of suitable conditions for the establishment and rapid spread of this agriculturally-linked species from ca. 2200 BC onwards. In addition parts of forests rich in *Ulmus* and *Tilia* were also cleared.

The first expansion on a relatively big scale of *Plantago lanceolata* is in our opinion not merely the result of intervention by PFB people, although there is indeed evidence for the activities of these people near the sampling site of Bargeroosterveld, both in the peat-bog (Neolithic disc-wheels, Van der Waals 1964) and in the forest that they cleared along the border of the bog (Neolithic wooden trackway in the raised bog near Nieuw-Dordrecht[11]), Van Zeist, 1957). The clearings, where *Plantago lanceolata* was able to expand considerably, must have had a different soil to the forests rich in *Ulmus* and *Tilia* that the TRB people preferred above all. The forest cleared by the TRB people

would have been present especially on the weathered boulder-clay ridge (Van Zeist, 1959, fig. 1). Bakker (1976, fig. 10) points out that here "loamy, moist sandy soils" and "very loamy, moist to wet sandy soils" occur. As the *Fraxinus*-rich forests were not cleared by the TRB people, it can be assumed that the wet soils were probably still being avoided.

From ca. 2200 BC forest was also cleared that had developed on cover-sand, that was generally considerably poorer in nutrients, far less loamy and also far more susceptible to drought. Which of the three interconnected factors (availability of nutrients, loaminess and water supply) is of primary importance in determining the differences ascertained in the expansion of *Plantago lanceolata*? In his investigations on the germination of several *Plantago* species in soils varying in compactness and in the supply of water available, Blom (1974) was able to show that precisely in compacted soils *Plantago* germinated poorly and with difficulty. A poorer supply of water to the soil had no negative effect. Blom made no investigations as to any relation with the availability of nutrient in the soil.

It is conceivable that the loamy to very loamy soils of the boulder-clay ridge became compacted very readily, a process that checked considerably the establishement of *Plantago lanceolata*; this situation would have prevailed to a far lesser extent or not at all in the much more drought-susceptible cover-sand.

The characteristic features of Neolithic activity in the pollen diagrams have in the past been ascribed above all to differences between the TRB and the PFB in economy and associated methods of reclamation. In our opinion, however, these features are much more indicative of the type of forest cleared and the condition of the soil occupied (rich and poor in nutrients respectively, more and less loamy respectively, better or worse water-supply respectively) than of cultural or economic differences between these two cultures.

The Neolithic intervention dated to between ca. 1900 and 1700 BC, that especially in the pollen diagrams for Emmen I and V and for Bargeroosterveld I (Van Zeist 1959) shows a definitive decline of *Tilia* to low values, must be regarded as a rather severe instance of intervention that affected forest already degraded to a considerably extent. This is indicated by the increase in *Corylus*, *Pteridium* and Gramineae coincident with the pronounced expansion of *Plantago lanceolata* (Van Zeist, 1959). This can be ascribed to the BB people.

Also some of the changes in vegetation dated to between ca. 2200 and 1900 BC, that are evident from the pollen diagrams, can perhaps be ascribed to the BB Culture, seeing that this culture was present in this region already by ca. 2200 BC.

It is not clear from the pollen diagrams whether in the cleared *Ulmus*-rich and *Tilia*-rich forests there was a profuse undergrowth, that would have made it unnecessary for the TRB people to convent specific areas of land into pasture. The pollen diagrams show that the forest cleared ca. 2200 BC on poorer soil had undergrowth that was not profuse. It did not expand considerably after reclamation. Perhaps the forest was in many places so light that even in the absence of any wide-scale systematic reclamation the Neolithic exploitation led to the development of open spaces that were subsequently suitable for cultivation, grazing and the construction of barrows. A *landnam* of the Iversen type – with the aid of fire – would in our opinion have had a more pronounced effect on the herb composition than is shown by the pollen diagrams.

Although the first relatively high values for *Plantago lanceolata* in the pollen diagrams for Emmen I and V and Bargeroosterveld I can be dated to ca. 2200 BC, in Nieuw-Dordrecht this expansion clearly predated the level of the wooden peat-bog trackway: a dating of ca. 2400 BC is plausible. This first expansion is accompanied i.a. by a marked increase in *Trifolium repens* and Caryophyllaceae, and is approximately contemporaneous with or perhaps slightly later than the second of the two phases distinguished previously in the first instance of Neolithic intervention in the pollen diagram for Bargeroosterveld (Van Zeist, 1967). With regard to Nieuw-Dordrecht the pollen analytical changes of ca. 2400 BC cannot be ascribed categorically to the PFB as an Iversen *landnam*. It is true that people of the PFB culture were active in the surroundings of Nieuw-Dordrecht, but the dating of ca. 2400 BC is somewhat on the early side; the TRB culture cannot be excluded completely. The same applies equally for the second phase, datable to ca. 2500-2400 BC, with low *Plantago* values for the Emmen and Bargeroos-

terveld diagrams. These low values therefore do not indicate a Troels-Smith *landnam* here, but the clearance of forest on a soil where *Plantago lanceolata* was unable to expand to any great extent, in contrast to the situation at Nieuw-Dordrecht, where *Plantago* was able to expand considerably. As we have already remarked, the pollen picture is determined primarily by the type of soil present and consequently the way in which the vegetation regenerates, rather than by the culturally linked or economic use of the soil.

Whether or not the situation in Southeast Drenthe applies generally, the following is nevertheless noteworthy. The phenomenon, already long familiar, that TRB and BB barrow spectra have on average lower herb values than PFB spectra (this applies especially for *Plantago lanceolata*, *Rumex* and Gramineae, see also Van Zeist, 1967) cannot be ascribed merely to different methods of reclamation. Moreover the information presented here indicates differences that are less great, in particular between PFB and BB spectra. The original view can perhaps be partly attributed to the limited amount of information formerly available.

Only to a limited extent is it possible to compare barrow spectra with pollen diagrams. For example, the TRB spectra N-6 – N-10, situated 5-6 km west of the Bargeroosterveld profile (Van Zeist, 1967), do not indicate that these burial monuments were constructed in open spaces in forest rich in *Tilia* or *Ulmus*. This shows that the TRB people reclaimed or at least exploited different types of forest. This is not immediately obvious from the pollen diagrams. Nor are the hunebeds concerned situated on the weathered boulder-clay ridge (Van Zeist, 1959) mentioned previously.

If we look at the barrow spectra per culture/period, then in addition to the above-mentioned general trend towards lower herb values for TRB and BB spectra compared to PFB spectra we still see quite considerable differences within each culture. In our opinion already during the TRB period different types of open spaces are evidently present that could be chosen for burial of the dead. Comparing with spectra for "real" old arable land (e.g. Celtic fields, and arable land covered by windblown sand), it seems probable that arable land in use during the Neolithic and Early Bronze Age was not actually used for the construction of barrows. From this we conclude that the land that was most valuable economically was as a general rule not used for burial and that there was sufficient space available elsewhere. In the Neolithic we see evidence of arable land abandoned for varying lengths of time, of grazing, of expansion of the heath and – to a far lesser extent – of regeneration of the forest. For the Early Bronze Age there is too little information available to permit the same conclusion; in this period the expansion of the heath appears to be predominant. The general picture seems to be that the degradation of the natural vegetation becomes increasingly more clearly visible in the pollen picture.

A number of barrow samples consist almost exclusively of particles of charcoal. Here the local vegetation was destroyed by fire shortly before the barrow was constructed. This may indicate that the area was cleared intentionally before a barrow was constructed; it may represent a certain phase in the *landnam*, but it may also represent some kind of ritual activity.

An important difference between the pollen spectra of barrows north of the IJssel and those of barrows south of the IJssel is the earlier and especially more pronounced expansion of the heath in the northern barrows. Where the TRB is present in the two regions, we are inclined to regard the different hydrological situation as the most important factor accounting for this difference (Groenman-van Waateringe, 1978).

In contrast to the situation in large parts of the Veluwe, on the Drents Plateau the precipitation cannot sink in very far due to the presence of impervious boulder-clay, often at no great depth below the surface. In Drenthe soils therefore existed that were generally much wetter and far more acid, as is also apparent from the presence of many peat-bogs, that developed precisely in the Subboreal. It was therefore precisely here, that disturbance of the vegetation cover and agricultural activities resulted in rapid exhaustion of the soil and a very drought-sensitive topsoil, that in many places facilitated rapid expansion of the heath.

As we have assumed for the Veluwe, regeneration of the forest in the form of a transition from a Fago-Quercetum with *Ulmus* and *Tilia* instead of

Fagus to a Betulo-Quercetum would have occurred in suitable places in Drenthe too. Here however the impoverishment of the soil led to expansion of the heath much earlier and to a greater extent, as we have already demonstrated above. In our opinion this process is not necessarily closely connected with the presence of large open spaces in the forest that had been cleared of trees and that were subsequently exploited. The process of soil impoverishment as A result of increasing human pressure on the vegetation, that began in the Neolithic, and the subsequent limited abundance of herbs together with precisely an increase in i.a. heath and grasses, that are hardy enough to resist human intervention, was by no means fully completed in the EBA.

We can assume that those places where the heath had become established were very unattractive for the agricultural economy practised in the Neolithic and the EBA. This made it necessary to reclaim more and more forest.

The lower values for *Tilia* in the PFB, BB and EBA spectra compared with many TRB spectra indicate not only the exploitation of this tree on a relatively wide scale already in the TRB period, but also the deterioration of conditions necessary for the regeneration of lime already early in the Neolithic.

6. FINAL CONSIDERATIONS

Of the many factors that play a role where the construction of burial monuments is concerned (see section 2), in our opinion only a few have had a demonstrable influence on the composition of the barrow spectra.

The palynological research above all provides information concerning the natural factors and especially the reaction of the vegetation to the clearance of the forest and the expansion of or changes in the herb vegetations, under the influence of human activity, that was followed in some cases by regeneration of the forest.

For the palynologist any ritual or cultural factors have so far remained elusive, unless the occurrence of samples consisting exclusively of charcoal is interpreted as evidence of the practice of burning vegetation to clear a spot for burial of the dead. Economic factors, such as different methods of reclamation, the use of open spaces and the production of food and animal fodder, are hardly perceptible. There is really no evidence at all for activities such as the cutting of plants, the peeling of bark, the gathering of fruits and other plants, or the conversion of land into pasture. The cultivation of grain or the use of land as pasture – both undoubtedly important reasons for clearing forest – is in many cases difficult to establish with certainty. It appears that barrows were constructed only seldom on arable land then in use or in the immediate vicinity of such arable land. In a number of cases it is clear – but then especially from the presence of artefacts – that a barrow was constructed on an abandoned settlement site. Following up the questions that we posed in section 2.4., we arrive at the following concluding remarks. The environment in the immediate vicinity of a barrow varied from only slightly degraded forest to estremely degraded, heath-rich vegetations, with all possible intermediate stages. The pressure of man on the environment continually increases on average from the TRB period, throughout the PFB and BB periods, into the EBA (and thereafter too), with as a result continually more advanced degradation of the natural forest.

The barrow spectra of the Drents Plateau have somewhat fewer herb types as a rule, and often with somewhat lower values than the Veluwe pollen spectra, with the exception of the values for *Calluna*/Ericaceae that are actually considerably higher in many Drenthe spectra. It is not always possible to explain the differences in pollen composition that are sometimes considerable between closely adjacent barrows in terms of differences in vegetation or soil or human intervention. The very local aspect of the vegetation recorded will undoubtedly play a role here.

The differences that have been ascertained between the Drents Plateau and the Veluwe can be explained on the one hand by differences in fertility and composition of the soil, and on the other hand by differences concerning the hydrological situation.

In making a distinction between two different agricultural systems (Troels-Smith *landnam*, Iversen *landnam*) we are indicating two extreme possibilities rather than taking into account for the majority of reclamation activities. It seems more likely

that prehistoric man adapted his methods of reclamation to a great extent to the possibilities available, and in such a way that no culturally-linked pattern is evident.

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The authors wish to dedicate this article to Professor H. T. Waterbolk, the scholar who was the first to carry out palynological analysis of barrows in the Netherlands systematically.

This article was intended originally for the volume of PALAEOHISTORIA XXI in honour of Professor Waterbolk's 25 years as Professor in the University of Groningen.

8. ABBREVIATIONS

TRB = *Trichterbecher* = Funnel Beaker (culture)
PFB = Protruding Foot Beaker (culture)
BB = Bell Beaker (culture)
EBA = Early Bronze Age
MBA = Middle Bronze Age
LBA = Late Bronze Age
E/MBA = Early-Middle Bronze Age
M/LBA = Middle-Late Bronze Age
BA = Bronze Age
IA = Iron Age
ZZ = Zig-Zag Beaker
BW = Barbed-Wire Beaker
GP = Le Grand Pressigny; dagger of flint from Le Grand Pressigny
AOO = All-Over-Ornamented Beaker
AP = Arboreal Pollen (without *Betula*)
NAP = Non-Arboreal Pollen (without Ericaceae amd Gramineae)
Gr = province of Groningen
D = province of Drenthe
O = province of Overijssel
G = province of Gelderland
U = province of Utrecht
NH = province of North Holland
NB = province of North Brabant
IPP = Albert Egges van Giffen Instituut voor Prae- en Protohistorie
BAI = Biologisch-Archaeologisch Instituut
ROB = Rijksdienst voor het Oudheidkundig Bodemonderzoek
NDV = Nieuwe Drentse Volksalmanak
OMROL = Oudheidkundige Mededelingen van het Rijksmuseum van Oudheden, Leiden
KNOB = Koninklijke Nederlandse Oudheidkundige Bond
Ber. ROB = Berichten ROB
QM = Quercetum Mixtum
tum. = tumulus
s.p.b. = single-period barrow
pr.m. = primary mound
sec.m. = secondary mound
cov.m. = covering mound
pr.gr. = primary grave
gr.p. = grave pit
gr. = grave
o.s. = old surface
sf.m. = surface of mound
per. = period
f.tr. = foundation trench
o.f.tr. = outermost foundation trench
i.f.tr. = intermediate foundation trench
int. = interment
l.int. = later interment
r.d. = ring ditch
ditch = filling of ditch
outs. = outside

9. NOTES

1 The analysis of the hunebed D25, province of Drenthe, was done by the second author (see 3.1.1.).
2 Absolute values are of no help because all the factors mentioned under 1 continue to play a role.
3 Specifically for Neolithic tumuli.
4 For the meaning of the term "holt"podzol, "haar"podzol etc. see De Bakker & Schelling, 1966.
5 The barrows IV (grave goods unknown) and VI (with bronze dagger with three rivets) were also sampled, but the barrows appeared to be seriously disturbed and the result of the pollen analysis gave high values for rye (*Secale*) pollen and buckwheat (*Fagopyrum*) besides high values for *Fagus* and *Carpinus* thus indicating a medieval or even later date of the samples.
6 This can only be done for independent variables, not for the dependent variables included in the pollen sum.
7 The secondary interment in tumulus S-29 is so much later (very high Ericaceae percentages and the appearance of *Carpinus* and *Secale*), that this should be regarded as two individual instances, widely separated in time, rather than evidence for a local development.
8 For another possible interpretation of the numerous charcoal particles on the ancient surface, see Groenman-van Waateringe & Bakker, in prep.
9 Waterbolk already indicated this possibility for some of the Dutch samples in his thesis in 1954.
10 In the Netherlands there is no archaeological evidence for TBR older than ± 2700 BC. From pollen analyses there is clear evidence of Neolithic activity in the period 3000-2700 BC; finds for this period are very scarce however. Until more information is available, we here take the line that these earliest Neolithic indications can be attributed to the TRB. Where we speak of TRB people, PFB people etc. we are referring only to cultural differences. No ethnical implications are intended whatsoever.
11 The wood used for the construction of this peat-bog trackway included *Tilia*.

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