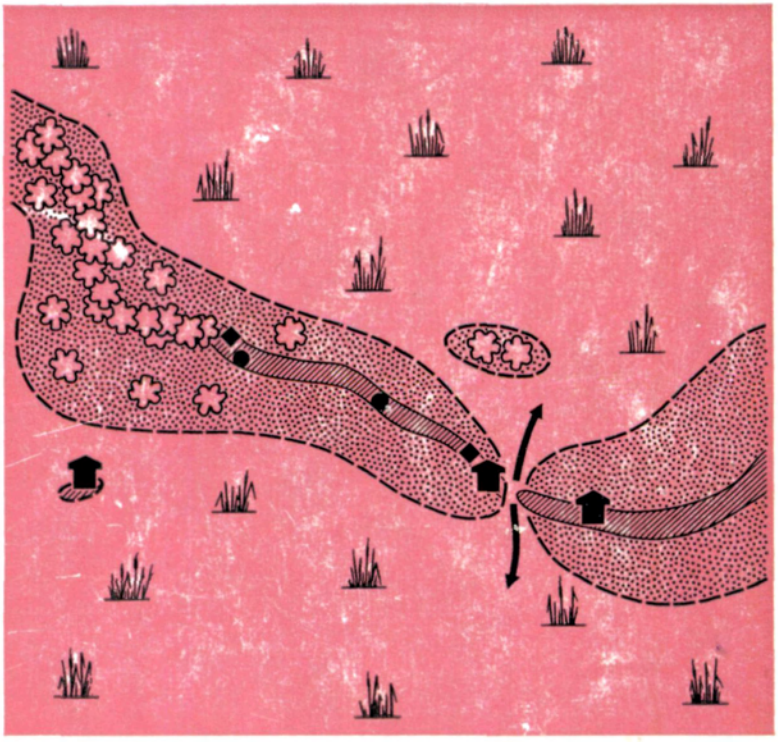
ANALECTA PRAEHISTORICA LEIDENSIA



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L. P. LOUWE KOOIJMANS

THE RHINE/MEUSE DELTA

FOUR STUDIES ON ITS PREHISTORIC OCCUPATION AND HOLOCENE GEOLOGY

WITH A CONTRIBUTION BY AGATHA S. KNIP,
LATE NEOLITHIC SKELETON FINDS FROM MOLENAARSGRAAF (Z.H.)

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FOREWORD

Before 1950 the western river area, the region between Tiel and Alblasserdam, was, from an archaeological point of view, *terra incognita*—a blank space on the distribution maps. In subsequent years a few discoveries were made, particularly during the soil surveys, but it was the foundation in 1962 of the AWN work-group, "Lek en Merwestreek", that marked the moment when systematic exploration began. Under the inspiring leadership of Mr H. A. de Kok scores of archaeological terrains, dating from the Vlaardingen Culture to the Middle Ages, were discovered. They lie on the deposits of former river courses and creek systems and on the tops of Early Holocene dunes. An intensive correspondence on the subject of these finds took place with Professor Modderman.

There are several reasons why the present writer was almost inevitably confronted with this material in 1965 and began to examine it in detail: the necessity for an inventory and evaluation of these finds, which were of such importance to our knowledge of early inhabitation of the Western Netherlands; the execution of a land re-allotment, which is meanwhile being finished; the need to accompany the work-group, and, last but not least, the author's interest in the inter-relationship of geology and archaeology, and the possibility of using the study of the region as the subject for a university thesis.

In the course of time the subject of the thesis has been extended and its accent has shifted. We soon came to the conclusion that a number of excavations would be necessary if we were to achieve the proposed results. In the Molenaarsgraaf district a preliminary investigation started on the "Hazendonk" in 1967. The "Molenaarsgraaf" terrain was almost completely excavated in 1966 and 1967. Three other excavations were carried out because of the threat of road construction works: in 1966 an Iron Age settlement near Culemborg, and in 1969 two terrains in Ottoland: the Oosteind terrain (VBB-LBA) and Kromme Elleboog (VBB/BWB). Both excavations in Molenaarsgraaf yielded so much information that its elaboration would demand a considerable amount of time. A report on the other three investigations will be given later.

At the same time it appeared to be desirable to locate the assembled information against a wider background, that of the whole of the Western Netherlands. Part I of this volume originated in this way and gives a survey of the history of inhabitation in the Western Netherlands, in particular of the period before 700 B. C. Its relationship to the geological development of the region, dominated by transgression/regression cycles, is of paramount importance here. The archaeological data contribute at the same time to the construction of a curve showing the relative rise in sea-level, in particular because the Alblasserwaard appeared to be an unusually favourable area for observations on former mean water-levels.

The original subject is discussed in Part II, in which we deal with the history of the inhabitation and the geological development of the western river area. It is not possible to comprehend the archaeology without the study of the landscape. On the other hand archaeology provides

the datings for various deposits, and especially for the stream ridges. Part II forms the first attempt for an archaeological diagram of the district.

The two last parts are reports on the two excavations at Molenaarsgraaf.

On the Hazendonk (Part III), the top of an Early Holocene dune, it has been proved that inhabitation took place there about 4100 (?), 3400, 3000, 2400 and 1700 B. C. A new group of pottery, provisionally named "Hazendonk pottery", was found and dated about 3000 B. C. The other occupation phases may be associated with "Swifterbant", the Vlaardingen Culture and the Veluwe Bell Beaker and Barbed Wire Beaker Cultures. The occupation phases coincide with the geological regression phases, and are separated by periods when there was no inhabitation.

At Molenaarsgraaf (Part IV) a small settlement from the transition period Neolithic-Bronze Age (VBB-BWB, 1800-1500 B. C.) was situated on the Schoonrewoerd stream ridge and at a break-through gully. It is one of a number of comparable occupation units on this stream ridge, which together formed a small elongated hamlet. In the settlement two subsequent house plans were documented. The infilling of the gully yielded information about the subsistence economy and the milieu (remains of slaughtered animals, pollen diagrams, wooden posts). Arable farming (grain) and cattle raising (primarily cows) were both practised. Hunting was of minor importance, in contrast to fishing. Three or four human graves and one ox grave contained well-preserved skeletons—a very unusual situation in the Netherlands. It was possible to construct a detailed chronological diagram of the settlement. The transition from Neolithic to Bronze Age seems to be marked by a great rate of cultural continuity. The cultural background of the house-plans, finds and graves are discussed in a separate paragraph.

The four parts are written in such a way that each part can be read independently. The particulars of both excavations (parts III and IV) are incorporated in the surveys (parts I and II). At the same time the conclusions in part II are used in the writing of part I. In the sequence presented here, from the general to the more specific, part II may be read as an introduction to the two excavation reports, and part I has more or less the same function for part II.

ACKNOWLEDGEMENTS

That the account of my investigations has got its present form is in large measure owing to the co-operation, interest, advice and practical help of a number of persons and institutions. I should like to express here my deep-felt gratitude to all those who have helped me.

Professor Dr P. J. R. Modderman generously made available all the data, assembled by him from the studied area, and gave moral and practical aid where necessary. Some long and intensive discussions with Professor Dr L. J. Pons led to a considerable improvement and modification of the text. Professor Dr A. Klasens gave me full liberty, within the requirements of my work, to pursue my studies.

Various experts reported on some categories of the excavated material. Miss Dr A. T. Clason (BAI) analysed the faunal remains, Miss A. S. Knip (Utrecht) described the human skeletons, Dr G. A. Mook and Professor Dr J. C. Vogel (Groningen) carried out the ^{14}C determinations, and Mr A. Voorrips (IPP) identified the wooden objects and conducted the palynological enquiry. All made available to me the essential information required. The detailed report of Miss Knip has been given as an Appendix. The expert reports on the faunal remains and the palynological enquiry will be published in specialist journals in due course.

Particular mention must be made of Mr H. A. de Kok (Hardinxveld) for the energy and enthusiasm with which he has for years carried out explorations with his work-group and for the generous way in which he made his records and material available to me. From our co-operation has grown a friendship which I value highly. I thank Mrs de Kok for the great hospitality she has always offered me.

Dr M. Geijh (Hannover), Miss Dr S. Jelgersma (Geological Survey), Mr J. N. Lanting (BAI) and Mr J. F. van Regteren Altena (ROB) read parts of the manuscript and discussed them with me. In addition they supplied me with a great deal of useful information.

Exchanges of views with my close colleagues, Mr A. Peddemors, Mr H. D. Schneider, Dr P. Stuart and Dr G. J. Verwers were a source of constant and much appreciated inspiration to me.

I received help or information from the following persons: Mr G. J. van den Beemt (ROB), Mr A. Bergkotte (Schiedam), Mr H. den Besten (Hei- en Boeicop), Dr W. H. Bierhenke (Hamburg), Mr Bliekendaal (Molenaarsgraaf), Mr J. H. F. Bloemers (ROB), Dr R. Boddeke (IJmuiden), Mr J. A. Brongers (ROB), Prof Dr A. Brouwer (Leiden), Dr J. J. Butler (BAI), Mr C. van der Esch (Papendrecht), Dr H. H. Frese (Rockanje), the late Prof Dr A. E. van Giffen (Zwolle), Mrs Dr W. Groenman - van Waateringe (IPP), Mr H. M. E. van Haaren (Esch), Mr. O. H. Harsema (BAI), Mr G. D. van der Heide (Schokland), Mr C. Hoek (Rotterdam), Mr A. T. M. Hoogeboom (Noordeloos), Prof Dr J. Huizinga (Utrecht), Mr R. S. Hulst (ROB), Mr G. Kortenbout van der Sluijs (Leiden), the late Dr R. S. Levison (Arnhem), Mr H. van der Lugt (Utrecht), Miss W. H. Metz (IPP), Mr C. J. Overweel (Leiden), Ir J. N. B. Poelman (Stiboka),

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The good co-operation with the Reallottment Comittee and the *Cultuurtechnische Dienst* (Governments Service for Land and Water Use) in the Alblasserwaard was much appreciated. The Soil Survey Institute (Stiboka) placed unpublished maps at our disposal and gave the permission to print the map, that we compiled from them. The *Nederlands Genootschap voor Anthropologie* supported this publication by paying the cost of the making of the blocks.

John Caspers made all the drawings in this book. His devotion and patience, together with his technical and artistic capacities, formed the basis of the success of our co-operation.

Mr E. T. Davies (Bunnik) translated the Dutch text into English. I recall with much pleasure his scrupulous care and our efficient co-operation.

But the author considers himself responsible for any possible inaccuracies and obscurities that may occur in the text, especially in those passages which were later inserted.

In the field, in the development of data and in preparing the manuscript for the press I have received help from Mr J. P. Boogerd and Mr W. Meuzelaar (both IPL), Mr H. Kok and Mr M. van Meerkerk (both Geological Survey), Miss I. M. Ebbinge, Miss H. A. Hasselbach, Miss C. M. M. Pieterse, Mrs S. D. R. Versteeg-Middendorp, Mr F. G. van Veen, Mr M. T. Vinkesteyn and Mr B. H. van Winkel (all RMO).

During my research I was frequently conscious of the value of the education as a physical geographer and prehistorian I received from the late Professor Dr H. P. Berlage, the late Professor Dr W. Bleeker, Professor Dr P. Buringh, Professor Dr Ir C. Koeman, Professor Dr G. H. R. van Koenigswald, the late Professor Dr M. Minnaert, Professor Dr P. J. R. Modderman, the late Professor Dr M. G. Rutten, and Professor Dr J. I. S. Zonneveld. Further, the instruction I received in the field, especially from the late Mr M. W. Beyerinck, Mr K. H. Hoeksema and the late Mr C. H. J. van Rossum, who led my first visits to the peat region, was of great value to me.

I can imagine that the writing of this book was not always enjoyed by my wife and children, since I had to withdraw from my obligations as a father too often. Nevertheless Anneke showed the interest and patience, which were essential for me to accomplish the work. I owe my parents a great debt of gratitude for all stimuli and opportunities they offered to me during my education and study. I tried to express my feelings in dedicating this book to them.

ABBREVIATIONS

(those in brackets are only used in Appendix I)

Aarbøger	Aarbøger for Nordisk Oldkyndighed og Historie
A.D.	Anno Domini
AN	Archeologisch Nieuws: Nieuwsbulletin, maandelijkse bijlage van het Bulletin van de Koninklijke Nederlandse Oudheidkundige Bond
AOC	All Over Cord
APL	Analecta Praehistorica Leidensia
AWN	Archeologische Werkgemeenschap voor Nederland
BAI	Biologisch-Archaeologisch Instituut, Groningen
B.C.	Before Christ
Ber. RGK	Bericht der Römisch-Germanischen Kommission
Ber. ROB (BROB)	Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek
BJ	Bonner Jahrbücher
BSPF	Bulletin de la Société Préhistorique Française
Bull. KNOB	Bulletin van de Koninklijke Nederlandse Oudheidkundige Bond
BW	Barbed Wire
BWB	Barbed Wire Beaker
C I-IV^{b}	Calais I-IV^{b}
D 0-III	Dunkirk 0-III
DKS	Drakenstein
EBA	Early Bronze Age
et al.	*et alii* (and others)
HaB	Hallstatt B
(Hel)	Helinium
HVS	Hilversum
IPL	Instituut voor Prehistorie, Leiden
IPP	Instituut voor Prae- en Protohistorie, Amsterdam
Jahrbuch RGZM	Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz
Jschr. mitteldt. Vorgesch.	Jahresschrift für Mitteldeutsche Vorgeschichte
LBA	Late Bronze Age
MBA	Middle Bronze Age
MBB	Maritime Bell Beaker
Med. Geol. Sticht.	Mededelingen van de Geologische Stichting
Med. Rijks Geol. Dienst	Mededelingen van de Rijks Geologische Dienst
MHW	Mean High Water
MSL	Mean Sea-Level
mun.	Municipality
NAP	Normaal Amsterdams Peil (Dutch Datum Level)
NN	Normal Nul (German Datum Level)
NNU	Nachrichten aus Niedersachsens Urgeschichte
OD	Ordnance Datum
Oudh. Med. (OML)	Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden

PCAS	Proceedings of the Cambridge Antiquarian Society
PFB	Protruding Foot Beaker
PPS	Proceedings of the Prehistoric Society
PZ	Prähistorische Zeitschrift
RMO	Rijksmuseum van Oudheden, Leiden
ROB	Rijksdienst voor het Oudheidkundig Bodemonderzoek, Amersfoort
R-W	Ruinen-Wommels
Stiboka	Stichting voor Bodemkartering, (Soil Survey Institute), Wageningen
TAG	Tijdschrift van het Koninklijk Nederlands Aardrijkskundig Genootschap
t.a.q.	*terminus ante quem*
t.p.q.	*terminus post quem*
TRB	Trechterbeker (= Funnel Beaker)
VBB	Veluwe Bell Beaker
Versl. Landb. Ond.	Verslagen van Landbouwkundige Onderzoekingen
VL	Vlaardingen
Voetspoor	In het voetspoor van A.E. van Giffen, 10 jaar I.P.P., Groningen, 1966 (2nd impression).
WF Oudh. (WFO)	Westfriese Oudheden
(Wh)	Westerheem

POSTSCRIPT

It is one of the disadvantages of a publication of this plan and diversity that it cannot be fully up-to-date in most respects. After the enquiries were ended and the manuscript was closed (in the beginning of 1973) new finds have been made, new data have come available and a number of papers have appeared, that have reference to various aspects of this work.

The following applies to Part I. The continued investigations at Swifterbant, especially the undertaken full excavation of a third site, provide more detailed data on the living situation of the Early Neolithic communities, than used in this paper. The occupation on the dunes appeared to be partly of Mesolithic age (^{14}C dates). New VL Culture sites have been discovered at Loosduinen (near The Hague), Ewijk (Betuwe) and Kootwijk (Veluwe) which means a further extension eastward and a firmer link to the sand regions. The study of the distribution and sequence of the occupation around the Meuse estuary, undertaken by Mr J. F. van Regteren Altena and Mr D. P. Hallewas on behalf of sheet 37 of the new geological map, will provide a more detailed picture than used by us. Of special importance is the Middle Bronze Age date of human influences on the vegetation, established by Mr J. de Jong (Geological Survey), in a pollen diagram near Vlaardingen. It helps to bridge the gap in the MBA occupation pattern between Molenaarsgraaf and the coastal barriers.

Anne V. Akeroyd recently published a very critical and well-documented review of all observations that are of relevance to the establishment of former water levels along the British coast between Wight and the Humber. (Philos. Transact. Royal Soc. London, Series A, Vol. 272, 151-169). Although the "translation" of the field observations into former sea-level heights might sometimes be open to some criticism, while compaction could not be taken into account, it appears that the general tendency of the rise in sea-level in East England agrees very well with that in the Netherlands. The transgression-regression cycles are, however, still rather obscure.

In Quarternaria XIV (1971) we find the contributions to the 8th INQUA congress in Paris. The papers provide information on the Holocene sea-level changes all over the world. We mention here only the curve of Hawkins for S.W.-Britain, which is very similar to that of Akeroyd and to our curve for the North Sea (Louwe Kooijmans 1970/'71, fig. 3).

New evidence for Part II is provided by the excavation led by Mr Sarfatij and the borings of the Geological Survey at the site Alblasserdam 3[a] (App. III, no. 7). A small residual channel of the creek followed there the extreme southern side of the ridge and was contemporaneous with the Roman occupation, the level of which had later undergone considerable compaction where it was situated on the soft high water deposits of the creek.

With respect to Part III the discovery of a second site with Hazendonk pottery at Het Vormer near Wijchen is very important, the more since it occurs there together with sherds of

bowls with round bottoms of Belgian Michelsberg and perhaps Windmill Hill affinities. Only a short reference (p. 166 note 77) could be made to this material. In Analecta Praehistorica Leidensia VI the report on Koningsbosch (*cf.* p. 159, 165) appeared. It seems that the relationships to the Hazendonk pottery are small and that this group is probably a few centuries later, dating from the same phase as Stein.

Three publications have appeared in the end of 1973 which are of great importance for the matters dealt with in Part IV, especially section 4.9. First, J.N. Lanting gave a full discussion of the typology and dating of the BWB pottery and the burial ritual of this phase in Palaeohistoria XV. With regard to our more sketchy review this article contains much detailed background material together with unpublished or re-interpreted data of old BAI excavations and information on recent work, among other things additional ^{14}C dates. It appears that the phase before the BW Beakers in the Northern Netherlands is characterized by E-W graves with battle axes of the newly defined Zuidvelde and Emmen types and flint knifes of the type as our fig. 97e. Lanting stresses the continuity of the pottery traditions (workmanship, forms, decoration) and grave ritual, while we stressed (p. 339) the more or less contemporaneous and sudden changes in these culture-elements. The frequent references to the data of Molenaarsgraaf in Lanting's paper underline the contribution given by this site to our knowledge of this period.

In Helinium XII, 3 (1972) the report of the excavation of barrow III at Anner Tol adds a new well-dated (relatively late) BWB grave to the list. The next number of Helinium (XIII, 1) contains a publication by Lanting, Mook and Van der Waals on the ^{14}C chronology of the various beaker groups. The survey of the impressive number of ^{14}C dates for Dutch (and a few German) Beakers is the basis for a discussion about the possible local origin of the Bell Beaker and the Bell Beaker find-association (BB Culture). But many questions appear still to remain unanswered.

1. PREHISTORIC INHABITATION AND SEA-LEVEL CHANGES IN THE WESTERN NETHERLANDS [1]

Seldom do natural circumstances influence the settlement patterns and inhabitation sequence so thouroughly as in the sea-level-governed Holocene sedimentation area at the Rhine/Meuse estuary. In a general survey of the archaeological remains and data the influence of the transgression-regression cyclicity on the occupation history is worked out. Finally the archaeological data are used to construct a new, detailed curve for the relative rise of the Mean High Water level in the Rhine mouth district.

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[1] By "Western Netherlands" in this paper is meant the Holocene sedimentation area at the lower courses of the rivers Rhine, Meuse and Scheldt, as indicated in fig. 1. So the IJsselmeer district and the river clay area (Betuwe) are included too.

1.1. THE HISTORY OF THE ARCHAEOLOGICAL ENQUIRY

1.1.1. Before 1940

As early as the 16th century remains of Roman settlements were discovered in the Western Netherlands and recognized as such. In 1520, 1552 and 1562 finds were made on the beach at Katwijk, where the Brittenburg must have been situated, and on the terrain of the Roman *castellum* near Leiden, the Roomburg [2]. In 1647 the Nehalennia temple near Domburg was exposed by the sea [3]. The first systematic excavation in this country concerned the Roman town of Arentsburg near Voorburg, where Roman finds had been made as early as about 1500. It was Reuvens who conducted large-scale excavations there between 1827 and 1833 [4].

On the other hand prehistoric finds in the low-lying western parts of the Netherlands were not yet recognized as such. Pleyte [5] was the first to make drawings of a few: two stone axes from Hoorn, a flint sickle from Venhuizen, an arrow-head from Katwijk, the Late Bronze Age hoard from the Veenenburg estate (Hillegom/Lisse), a socketed axe and a flint sickle from Herveld. More finds were known to Holwerda [6], namely more of the finds from Veenenburg, the hoard from Voorhout and the high-flanged axe from Wassenaar. He regards these finds in the Western Netherlands, however, as having been lost by chance travellers and not as a proof of prehistoric occupation. The discovery of the Late Neolithic settlement site at Zandwerven in 1928 by Butter was therefore a sensation of the first order: the proof of a real settlement in the Western Netherlands in the Neolithic! The year before Oppenheim had already stressed the importance of the prehistoric finds in the Older Dunes and the consequences for the age of the coastal barriers [7].

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[2] We will not discuss here the interesting problem as to what finds, said to be made at Katwijk beach, were in reality found there, and what finds at Roomburg, nor the question whether the foundations traditionally called "Brittenburg" really were observed at the beach or not. See Dijkstra and Ketelaar 1965, esp. 10 f.; Byvanck 1943, 430 f.

[3] As to Domburg, see Hondius-Crone 1955. As result of the discovery of the remains of a second Nehalennia sanctuary at the bottom of the sea-arm Eastern Scheldt near Colijnsplaat, the Domburg finds are again in the focus of interest. See Stuart 1971, 1972, Louwe Kooijmans 1971.

[4] Recently Bogaers (1971) gave a summary of the various interpretations and argued that Arentsburg might be *Forum Hadriani*, the capital of the *Cananefates*.

[5] Pleyte 1877-1903. As the first in Dutch archaeology Pleyte made archaeological distribution maps with a geological background.

[6] Holwerda 1924, 1925, 72. The maps by Holwerda also have the geology as background.

[7] Butter 1935, Oppenheim 1927/'28, Van Giffen 1927/'28.

1.1.2. After 1940

For a long time inhabitation seemed to have been limited to the coastal barriers ("the Older Dune Landscape"), separated from the high Pleistocene sands of Utrecht and Brabant by an extensive uninhabited and uninhabitable peat swamp. A sharp increase in finds and archaeological sites and consequently in our understanding of prehistoric settlement in the Western Netherlands occurred only after the second world war. This is due chiefly to the activities of two new organisations: the systematic soil survey led by Edelman since 1943 [8], later by the Soil Survey Institute (Stiboka), and the foundation of the Association of Amateur Archaeologists in the Western Netherlands (the AWWN, now AWN) in 1951.

Through the physiographic character of the surveys and through the interest of the pedologists the soil surveys, which were made primarily in the alluvial regions, were at the same time a kind of systematic archaeological exploration. In a large number of regions, the history of human occupation especially in relation to the transgression and regression phases, and particularly in the period during and after Roman times, could be described consecutively [9]. These studies increased our understanding of the occupation of alluvial landscapes unprotected by dikes: of the living places of the inhabitants, where we may expect prehistoric settlements, possibly at some depth under younger sediments, and where they will lack.

Due to the work of amateur archaeologists, together with the extensive digging and building activities of the last twenty years, numerous sites and finds were discovered which otherwise would have remained unnoticed. Witness of this is given in the journal *Westerheem*. Obvious objects such as stone axes and bronze implements would in many instances have come to the attention of archaeologists as they had done previously, but settlement sites, which are only identifiable by means of sherds (not easily recognized as such by a lay person) would certainly have remained undiscovered or might have been destroyed.

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[8] Hoeksema 1948.

[9] The most important comprehensive studies listed by district, are:

general	— Van Giffen 1954, J. P. Bakker 1958
Betuwe	— Modderman 1949[b]
Bommelerwaard	— Modderman 1947, 1949[c]
Heusden en Altena	— Modderman 1953[b], Voogd 1955
Maas en Waal	— Modderman 1951[b], Pons 1957
Maaskant	— Modderman 1950
Vijfheerenlanden	— Modderman 1951[a], Pons 1961
river area as a whole	— Modderman 1955[d], Pons 1957
Westland	— Modderman 1949[a], Van Liere 1947
Zeeland	— Van der Feen 1952, Van der Feen in Bennema & Van der Meer 1952, Trimpe Burger 1958, 1960, 1960/'61
West Frisia	— Wiese 1956
IJsselmeer district	— Braat 1932, Modderman 1945, Van der Heide 1955[a], [b], [c], 1962, 1965/'66
Older Dunes	— Van Regteren Altena in : Jelgersma *et al.* 1970

further a series of internal reports and find lists at the RMO, Leiden.

Since the discovery of the Neolithic settlements at Hekelingen [10] and Vlaardingen [11], and the Bronze Age barrows at Zwaagdijk [12], it was clear that occupation was also possible in the region behind the coast, along creeks and on deposits that were silted up to a high level, at least since the Late Neolithic. The peat area, however, seems to have been an uninhabited wilderness through which the courses of rivers and creeks formed the only communication with the high sand areas. It was only an occasional find which indicated that prehistoric man actually also lived along these rivers and on the sandy deposits of silted-up older systems [13]. In the river area the first Bronze Age settlement was discovered in 1954 at Kesteren, after a number of Iron Age sites had already been found during the soil surveys [14]. Thanks to the investigations of Havinga in recent years the number of Bronze Age sites has increased to some dozens [15], for the greater part in the surroundings of Opheusden and Dodewaard.

With increasing knowledge of the geological history of the Western Netherlands and recognition of the problems connected with this area, interest also increased in its prehistoric (and historic) inhabitation history, which is closely linked with them. In the modern geological surveys, conducted by the Netherlands Geological Survey, the superficial deposits as well as the whole deeper lying Holocene complex, are involved. They also contribute to a better understanding of the possibilities for inhabitation. The prehistorian is aware of the possibilities for research, while on the other hand the results of excavations are of importance for an accurate picture of the geological situation and for a correct dating system.

1.2. THE HOLOCENE OF THE WESTERN NETHERLANDS

1.2.1. A SHORT OUTLINE OF ITS STRUCTURE (fig. 1)

A knowledge of the geomorphological development of the area is essential to full comprehension of the inhabitation history in the Western Netherlands. Thanks to the numerous soil surveys and the investigations of the Netherlands Geological Survey the structure of the Holocene deposits is well known at this moment. Numerous comprehensive studies have been published [16]. Here only a short summary is necessary for our purpose.

As a consequence of the rapid rise in sea-level there occurred in what are now known as the Western Netherlands at about the end of the Boreal, marshy conditions which resulted in the formation of the "Basal Peat", an eastward extension of the earlier peat formation in what is now the North Sea (the *moorlog*) [17].

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[10] Modderman 1953[a].

[11] Van Regteren Altena *et al.* 1962/'63.

[12] Van Giffen 1944[a].

[13] See p. 98, note 62.

[14] Modderman 1955[d], 31.

[15] Pers. comm. Mr R. S. Hulst, Amersfoort; Havinga 1969.

[16] Edelman 1960, Pannekoek (ed.) 1956, J. D. de Jong 1960, Pons *et al.* 1963, Stichting voor Bodemkartering 1965, Brand *et al.* 1966, J. D. de Jong 1967, Hageman 1969, J. D. de Jong 1971.

[17] *Cf.* Florschütz 1944, Van Straaten 1954. In the Late Glacial Rhine/Meuse valley the peat formation started earlier (Preboreal). There, however, not the rise of sea-level but the changes in *regime* of the rivers determined the conditions.

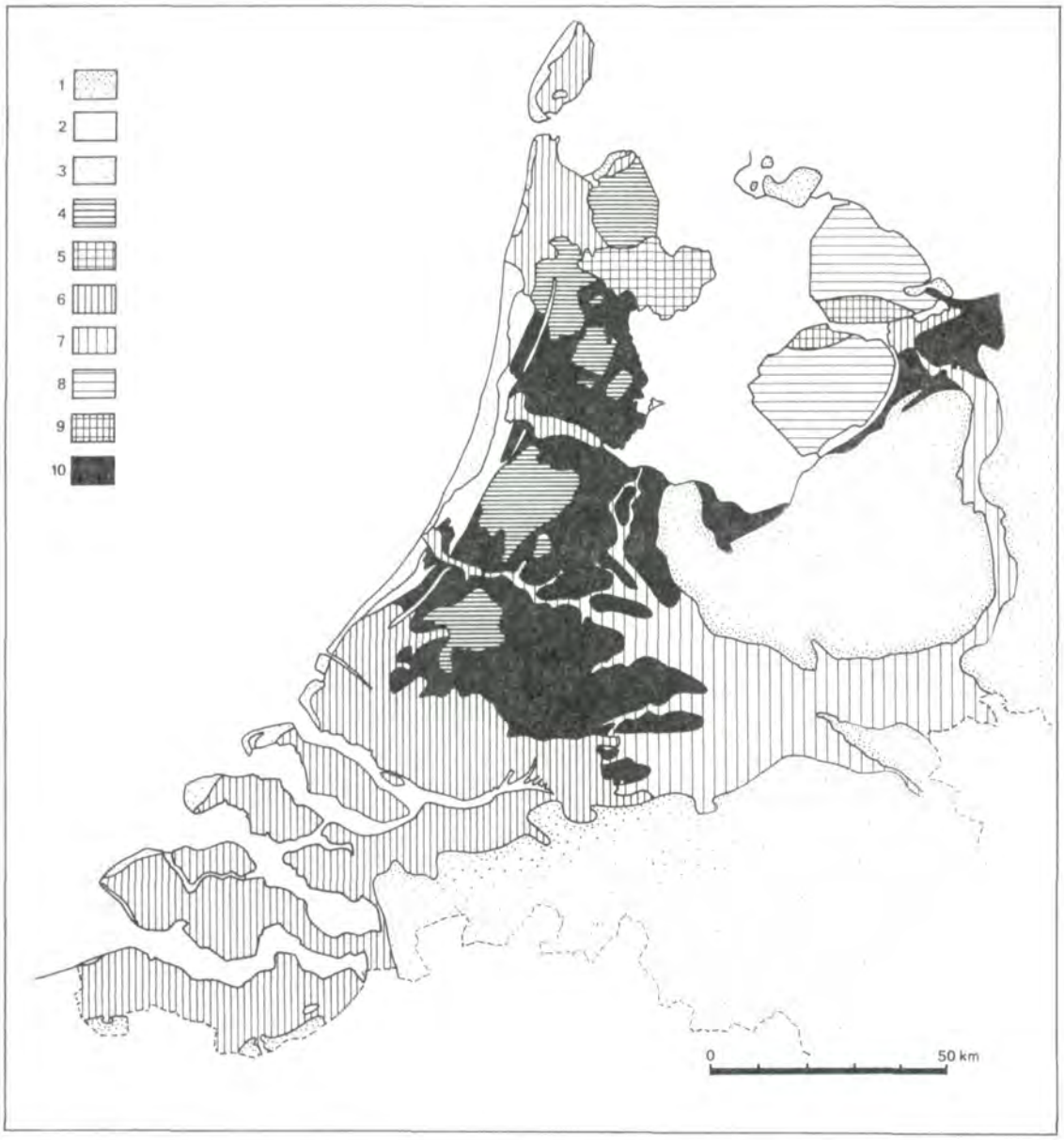

Fig. 1. Generalized map of the Holocene surface deposits in the Western Netherlands, used as background in the distribution maps figs. 2, 5, 7 and 8. A cover of recent or subrecent clay, if less than half a meter is left out of consideration. For the greater part after the generalized soil map scale 1:600,000 in the "Atlas van Nederland".

Legend :

1. Pleistocene (mainly ice-pushed hills and cover-sands, the "high sand area", well above NAP.
2. Coastal Barriers and Older Dunes.
3. Younger Dunes.
4. Calais deposits (5 and 9 excluded).
5. Westfrisian deposits (Calaix IV^b and Dunkirk 0).
6. Dunkirk deposits (5 and 8 excluded).
7. Tiel deposits.
8. IJsselmeer deposits (Dunkirk III).
9. Dunkirk deposits underlain by Calais deposits and Early Holocene dunes in the IJsselmeer Polder district.
10. Holland Peat, in the southern part with Gorkum river deposits (stream ridges) and outcropping Early Holocene dunes.

After the continuous rise in sea-level the sea passed the present day coast line in the beginning of the Atlantic. The Western Netherlands changed into a landscape of tidal flats, its inland boundaries formed by reed swamps and separated from the open sea by a coastal barrier which was broken by a number of tidal inlets [18]. These zones shifted more landward as the sea continued to rise, but as the rate of the rise in sea-level decreased the landward move of the coastal barrier became slower and slower, until in the beginning of the Subboreal a balance was achieved between erosion and the coastal sedimentation. From then on new coastal barriers were subsequently formed seaward of the old ones. So the oldest preserved coastal barriers [19], formed in the beginning of the Subboreal (3000-2700 B. C.), are the innermost of the present coastal barrier complex. Mainly after the formation of the second belt of coastal barriers which were covered soon after their formation with low dunes (the Older Dunes), the tidal flat area was more or less cut off from the sea.

The marine sediments were changing markedly from tidal flat deposits into salt marsh deposits at that time [20]. On the other hand already in Atlantic times there must have been short periods of non-deposition, during which the thin peat layers originated that separate the different Atlantic Tidal Flat Deposits. Especially by means of these peat layers it was possible to establish the subdivision into the various Calais phases.

Under the influence of the eutrophic river water flowing into the central salt marsh area from the east, it quickly became an extensive fresh water swamp. A swamp forest developed on the former tidal flats and salt marshes.

From the beginning of the Holocene the area of sedimentation of the main rivers was already situated in its present position. In the course of time the deposits were laid down there in various superimposed systems. In this process parts of the older sediments were eroded each time and replaced by new deposits.

Since the oldest preserved coastal barrier was formed the tidal inlets through the coastal barrier system (which were at the same time the estuaries of the main rivers) had little changed their places. We distinguish: the estuary of the Scheldt in the place of the present Eastern Scheldt, the estuary of the Meuse near Rotterdam, the estuary of the Rhine near Katwijk and an extensive inlet near Egmond. This was the estuary of a river, of which at least in the older stage of development the Utrecht-Vecht and probably also the river IJssel with the Oude IJssel and the Overijssel-Vecht formed the upper courses [21]. The most western courses of

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[18] For the Older Dunes and the coastal barriers see: Van Straaten 1965, Zagwijn 1965, Jelgersma & Van Regteren Altena 1969, Jelgersma *et al.* 1970.

[19] By "coastal barrier belt" we mean in this paper the units of several single coastal barriers, formed close together and separated from each other by small discontinuous shore flats or (mostly) not at all. The coastal barrier belts are separated from comparable units by broad, well recognizable shore flats, with which they form the units into which the coastal deposits below the Older Dunes can be divided in the first instance. See fig. 9. The small and older (Calais II ?) coastal barrier remains at Nootdorp (Schans & van der Knaap 1956) and near the IJpolders are left out of discussion here. We follow the conception of Jelgersma *et al.* 1970.

[20] Riezebos & du Saar 1969.

[21] The part of the river IJssel between Arnhem and Doesburg must be of very recent date, as appears from the absence of natural levee deposits in this reach. So the present IJssel was not yet one of the lower courses of the river Rhine, but the lower course of the many brooks of the Achterhoek, Twente and Salland, including the Overijssel-Vecht. *Cf.* Poelman & Harbers 1966, Zagwijn 1971, Pons 1957, fig. 38. Since the discovery of the remains of the Roman

the main rivers therefore appear to have been much more conservative, that is to say much less liable to deviations, than was thought until recently.

1.2.2. Transgression and Regression Phases (table 1)

Periods marked by a relatively strong marine influence can be distinguished as transgressions, or rather "transgression phases", which left their marks chiefly behind the tidal inlets. The transgression phases are followed by periods of rest, which are called the "regression phases". We can recognize a sequence or a cyclicity which can be described as follows: the transgression phase begins with erosion of the older sedimentation and/or peat areas and the forming of a network of creek systems. The next phase is that of marine sedimentation, followed by the gradually silting-up of the creeks. One of the results of the vanishing of the creeks is the blocking of the drainage of the sedimentation area. Finally in the regression phase peat growing spreads again over the whole area [22]. In this cycle the advanced state of the sedimentation phase and the beginning of the phase with general peat formation form the period in which the possibilities for occupation by men are most favourable. On the one hand drainage is still sufficient, and on the other hand the fully developed sediments provide terrains of sufficient height for permanent occupation.

The first (Atlantic) transgressions, occurring during a rapid rise in sea-level and an eastward shift of the narrow (*i.e.* much broken) coastal barrier, resulted in the formation of a coherent marine sedimentation area covering an extensive part of the Western Netherlands. In the Subboreal and Subatlantic when the sea-level rose slower and the coastal barrier system was well developed transgressions were limited regionally and more or less restricted to the regions behind the inlets; yet they generally appeared clearly in various places more or less simultaneously, and may therefore be grouped in well-defined periods of transgression activity.

Present-day Holland has always been well-protected by a broad and nearly continuous series of coastal barriers covered with low "Older Dunes". It was only through the abovementioned inlets that the sea could invade the peat area. In Zeeland and the Northern Netherlands, on the other hand, the old peat landscape suffered considerable flooding. In the north it disappeared almost entirely and was replaced by young tidal flat and salt marsh deposits. In the region of the Zeeland and South Holland islands the peat was cut up by numerous young creeks. The remaining areas between these young deposits were preserved and now form a number of geological (and archaeological) "windows" [23].

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temple at Colijnsplaat (*cf.* note 3) the course of the Roman Scheldt is in the centre of interest. In addition to the old reconstruction through South Beveland (Steur & Ovaa 1960), a course through the Eastern Scheldt seems to be another possibility (pers. comm. Mr F.F.E. van Rummelen). In both models the mouth is situated north of Domburg.

[22] Pons in: Van Regteren Altena *et al.* 1962/'63, esp. 1962, 235 f.

[23] In the Dutch sedimentation areas we can name those districts "windows" where an older landscape is at or near the present-day surface, in an otherwise completely covered or destroyed region. So the "window" is surrounded by younger sediments or water. There a glance at the former situation is made possible, so that the landscape on a wider scale may sometimes be reconstructed. It must be borne it mind that this is a relative question: one can have

TABLE I

Transgression phases in the Netherlands. Comparison of the different names used

Pollen zones	Transgression phases				Remarks
	Calais- and Dunkirk phases	Older names	"Tidal flat deposits"	Conventional ^{14}C dates after Hageman 1969	
Subatlantic	D III^c	recent			
	D III^b	Late Mediaeval		800-recent	Younger Dunes
	D III^a	Ottonian post Carolingian			
	D II	post Roman Early Mediaeval		A.D. 250-600	beginning of coastal erosion
	D I^b	pre Roman (II)	Early subatlantic	600-100 B.C.	
	D I^a	pre Roman (I)			
Subboreal	D O	Cardium Westfrisian II	Late subboreal	1500-1000	widespread peat formation
	C IV^b	Unio Westfrisian I	Early subboreal	2600-1800	
	C IV^a	Wieringermeer Hellevoeter zand			
Atlantic	C III	Hoofddorp Beemster	Late atlantic	3300-2800	oldest preserved coastal barrier
	C II	Watergraafsmeer	Early atlantic	4300-3400	
	C I	Starnmeer		6000-4500	lower peat
	C I^a	layer of Velsen Hydrobia layer			
Boreal					*donken*

"Younger sea clay"

"Older sea clay"

We meet a comparable situation in the river area, where the prehistoric deposits have been eroded in the meander belt windings of later river courses. They are only preserved at places of exclusively back swamp clay sedimentation in later times [24]. Between the river clay area and the "younger sea clay" a great part of the South Holland peat area has been preserved. It can be conceived of as the largest of the geological or archaeological "windows". Besides former river courses a large number of Early Holocene dunes have been spared, the so-called *donken*, of which the tops have frequently not become overgrown with peat.

We need only refer to the problem of the causes of transgression and regression cycles, as it falls outside the scope of this study [25]. Of especial importance in this connection are the correlations of the marine transgression phenomena themselves with the information about cyclicity outside the marine sedimentation area. Thus, it seems possible to correlate a number of periods with marine sedimentation with sedimentation phases in the river clay area [26]. Moreover, a succession of aeolic sedimentation phases and phases in which humic or peaty layers were formed in the coastal dunes appears to run parallel with the regression and transgression phases respectively in the marine sedimentation area. It is suggested that the blocking of the tidal inlets by wind-blown sands during the periods with a low ground water table in the Older Dunes, might be one of the causes of the origin of the regression phases [27]. Later we shall deal further with these matters (p. 100).

For the present classification and nomenclature of the most important deposits and transgression phases in the Dutch Holocene we refer to table 1 and to the listed literature [28].

1.3. THE DETERMINATION OF INHABITATION AND ITS PERIODICITY

1.3.1. Introduction

The determination of the presence of inhabitation and forming of ideas about the (relative) density of inhabitation is a matter of relationships between the distribution patterns of the finds and the original pattern of inhabitation. In which way and to what extent does a map showing the distribution of finds reflect inhabitation during a given period?

In an enquiry into the occupation of the Western Netherlands the same questions must be asked as in any similar enquiry elsewhere: when (if at all), where and how was the region used for inhabitation? What is exceptional in the Western Netherlands is that the whole problem of inhabitation is governed by the drainage conditions: the average height of floods,

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a Roman window within a Mediaeval sedimentation area, or a Neolithic window within a region with pre-Roman sediments and Roman occupation. The lake bottom reclamations (*droogmakerijen*) may for instance be regarded as windows too.

[24] Havinga 1969.

[25] See lit. mentioned in note 16.

[26] Pons & Modderman 1951, Pons 1957, Hageman 1969, Havinga 1969, Verbraeck 1970.

[27] Jelgersma *et al.* 1970.

[28] *Cf.* note 16, also S. van der Heide & Zagwijn 1967.

extreme water-levels, the general rise of sea-level or of the groundwater table and its fluctuations, the availability of well-drained terrains (that is, relatively sandy and high) their size and accessibility. An ultimate purpose of this part of the enquiry is the determination of periods of more or less intensive inhabitation as opposed to periods without or with only slight inhabitation and the relationship of such inhabitation periodicity to the changes in the environment. These last data may be represented by the geologically established transgression and regression phases.

The history of inhabitation will not be the same for the different physiographic regions of the Western Netherlands. The distribution of inhabitation, the concentrations in special parts of these regions and the choice of the settlement sites in these regions reflect the suitability for inhabitation and so give a picture of its circumstances.

1.3.2. Some critical Remarks on the Interpretation of the Finds

Certainly in the Western Netherlands we must make a sharp distinction in the different levels of our knowledge of inhabitation, as we could also conclude from the history of the enquiry. We must distinguish between establishing:

— human presence

— actual inhabitation

— the density of occupation.

In the ideal case these questions must be answered for each landscape unit (physiographic region) and for each culture or phase within these units.

Human presence is proved already by one reliable and well-documented find. Actual inhabitation appears from at least one settlement site, from grave finds or from clear indications of human activity in a pollen diagram. The character of the settlements reflects the nature of the inhabitation. This knowledge can only be acquired by excavation. Especially in the wet Western Netherlands it is possible to make a detailed picture of a prehistoric society because organic material often has been preserved at the settlement sites.

It is much more difficult to determine the intensity of the inhabitation, or its absence. As is the case also outside the Western Netherlands a number of factors play a role in this, which we can summarize as the "chance of discovery". This includes, for example:

— The absolute rarity of the relevant material. This can be the result of, for example, the short duration of its use; one thinks in this connection of the Maritime Bell Beakers, which in the higher parts of the Netherlands, moreover, are mainly grave finds from barrows.

— The nature of the relevant material can be such that it is only identified by laymen with difficulty; for example, tanged and barbed arrow-heads are much easier to identify than transverse arrow-heads, Roman pottery easier than that of the Bronze Age, and bronze axes easier again than those of stone.

— The way the material is found. Of certain groups, particularly the beaker cultures, the finds occur predominantly in barrows. As these hardly ever appear in the Western Nether-

lands, the distribution picture is determined by settlement finds, which have never attracted much attention outside the Western Netherlands. The same applies to the Late Bronze Age, although it must be remembered that until a few years ago no well-defined domestic assemblages were known at all either in the west or in the south. The dimensions of the settlement terrains are also of importance: a Roman site is easier to find than a Beaker settlement.

— The intensity of the enquiry. Also in the Western Netherlands this is of importance. In the districts of active AWN groups the number of known find spots can increase rapidly in a short time, as was the case, for example, in the Alblasserwaard. The extra attention which has been given to those relief units on which experience teaches that finds are to be expected, can also lead to an incorrect picture. With our present knowledge of the possibilities of inhabitation it seems to us, however, that this factor is not of much significance.

An entirely different aspect is the variable degree of typological differentiation and the possibility of dating in that way. Such datings of the Beaker Cultures for example, can be established fairly closely; in the Bronze Age and often also in the Iron Age settlements can only be dated roughly. Bronze axes can be closely dated, but dating of stone axes is often almost impossible. Naturally all this plays a part in the determination of possible periodicity of inhabitation. Thanks to the ^{14}C-dates these difficulties can now be partly surmounted.

Peculiar to the Western Netherlands finally, besides the above-mentioned generally valid factors, is the influence of geological conditions. Old landscapes are often covered with later deposits, so that the opportunity of discovering archaeological terrains is reduced with increasing thickness of the deposits. This applies particularly to former creek systems and the river courses. In large parts of the Western Netherlands old deposits have been considerably affected by later erosion, or have even completely disappeared and replaced by younger sediments. Good examples of this are Zeeland and the present IJsselmeer district, and also the Atlantic coastal barriers. All information for a given period of time has thus disappeared from such an area, sometimes with the exception of a few small districts, which for this reason we called "archaeological windows". In establishing inhabitation and its periodicity these are important factors.

1.4. THE SEQUENCE OF INHABITATION IN THE WESTERN NETHERLANDS BEFORE THE IRON AGE

1.4.1. The Maps

Prehistoric finds in the Western Netherlands have not yet been the object of a comprehensive publication. There are some regional surveys [29] and summaries for a few cultures [30]. Recent finds have been listed in the "Chronicles" of the journal *Helinium*. In view of our invest-

[29] *Cf.* note 9.

[30] Van Regteren Altena *et al.* 1962/'63 (VL-Culture), Verwers 1968 (BB-Culture).

igations in the river clay/wood peat area we were most interested in the period before the Iron Age. So this period will be discussed here in detail, while the later times will be dealt with more comprehensively in the next paragraph.

In a list (appendix I) and a number of maps the finds dating from before the Iron Age are here brought together. Included have been only the finds which are in some degree datable: all settlement terrains, pottery finds, shaft-hole axes, flint axes, bronze implements and a number of "other artifacts". Excluded are all stone axes and the majority of antler implements, since these generally can be dated only very roughly. Further we have not included unreliable finds, such as all finds dredged up from the main rivers (especially those "near Nijmegen") which have mostly reached the museums via the art-dealers. The list of finds (appendix I) now consists of 261 items, namely 198 find-spots and 63 references.

The material is divided over four distribution maps. The time limits of the periods covered by the maps coincide as far as possible with divisions in the archaeological material, but they are primarily moments when large parts of the region appear to be relatively thinly inhabited.

Considerations of classification have led us in each case to show groups of similar isolated finds on one map. The flint axes and battle axes have thus been shown on map II, the flint arrow-heads on map III and the hammer axes on map IV. A number of late battle axes certainly falls, however, in the period of map III; flint axes were certainly in use as late as 1700 B.C. The Sögel arrow-heads fall in the beginning of the period of map IV and the dating of the hammer axes is still a considerable problem. As long as the above points are borne in mind, all this — certainly since we are concerned with isolated finds — has little influence on the interpretations and the conclusions. Stone axes of round or oval cross-section form a special problem, which will be discussed in its appropriate context.

1.4.2. Palaeolithic-Middle Neolithic (fig. 2)

1.4.2.1. *The Palaeolithic*

A few finds originating from the Middle Palaeolithic were made in the area of the river Scheldt, apparently washed out of deeper deposits, in the subsoil. We must, however, be on our guard against objects, thrown overboard from modern ships on their way to the harbour of Antwerp, such as tropical shells and a tooth of an African elephant, recently dredged up, does show.

Moreover, only two Late Palaeolithic implements from the subsoil of the Western Netherlands are known. Both have been described as Lyngby axes, which appears to us to be a somewhat daring interpretation. We prefer to call them worked reindeer antlers. Together with the finds of Late Palaeolithic implements in the coastal regions of the Western Netherlands, at Aardenburg and Axel in Zeeland Flanders, near Schokland in the North-east Polder and on the island of Texel for example, they do in fact show that the cover-sand landscape and the Late Glacial river system in the subsoil of the Western Netherlands were inhabited. Cultural similarities between the finds in Great Britain and the Netherlands, especially in the Allerød period, point indeed indirectly to inhabitation of the intermediate part of the North Sea basin. But the chance of finding direct proof of this in the form of flint implements is very small.

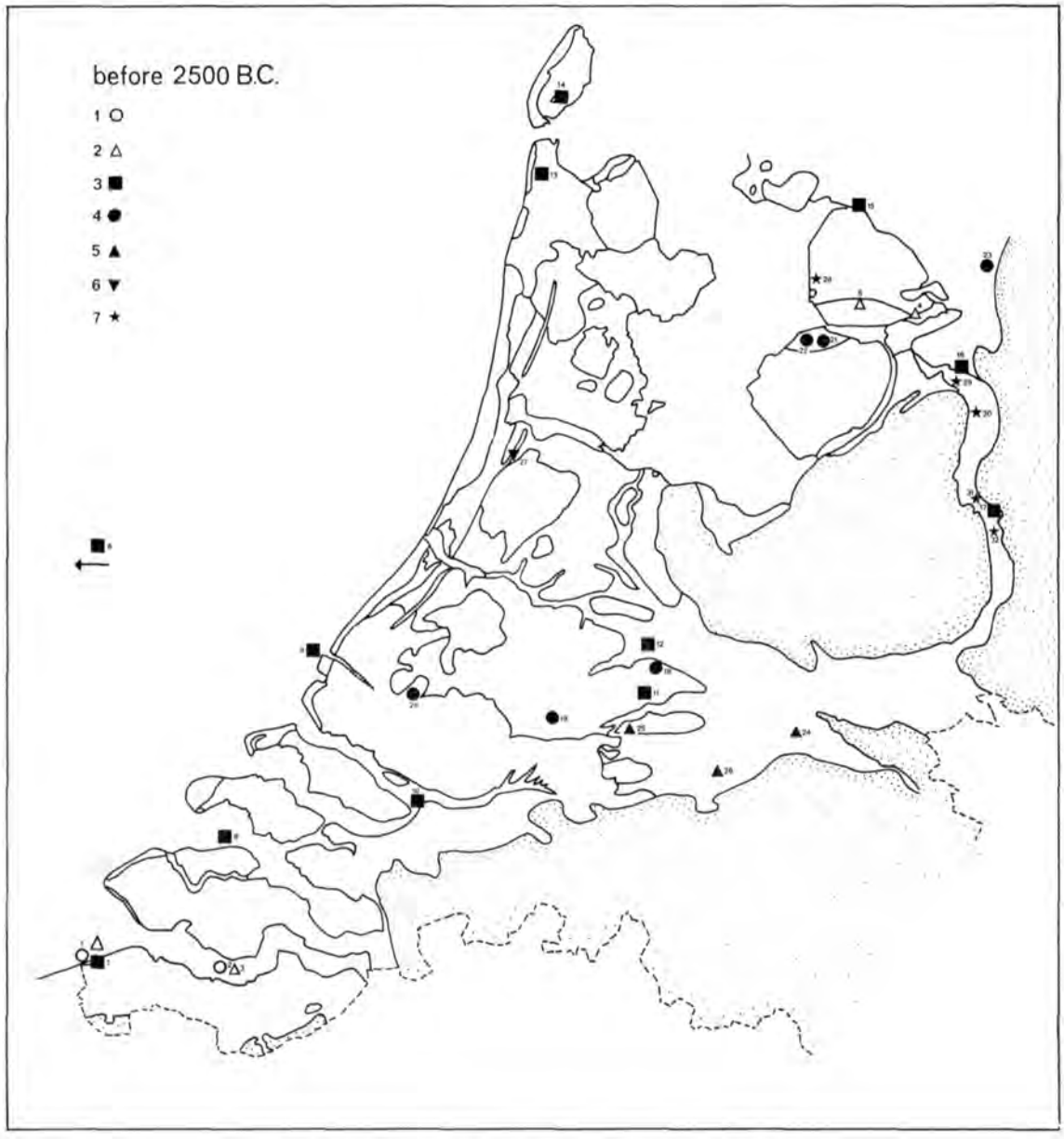

Fig. 2. Prehistoric finds in the Western Netherlands, dated :

— before 2500 B.C.
— before the VL Culture
— before the transgression phase Calais IV

The numbers refer to the documentation of the mapped sites in Appendix I, section I.

Legend :

1. Middle Palaeolithic.
2. Late Palaeolithic.
3. Mesolithic.
4. Early and Middle Neolithic.
5. shaft-hole axes of *Breitkeil* type.
6. stone axes.
7. antler T-shaped axes.

1.4.2.2. *The Early Mesolithic.*

The similarity of the Early Mesolithic cultures on both sides of the North Sea is proof of inhabitation of the North Sea basin at that time [31]. A marshy zone with peat (the *moorlog*) will have been attractive, as is shown by the finds and as can be accepted by extrapolation of the Danish finds to the comparable landscape in the North Sea region.

In this peat was found the Maglemose barbed point of Leman and Ower Banks [32]. Some years ago, moreover, among the numerous bones of a Pleniglacial fauna which were fished up from the surroundings of the Brown Bank (half way between Lowestoft and Katwijk) some implements were found [33]. These are, however, not of Pleniglacial age, but must be dated for typological reasons to the Early Mesolithic, especially the Late Preboreal and Early Boreal. All of the implements are made from aurochs bones. The most characteristic pieces are a shaft-hole pick and a socketed axe. They were dredged up from depths between 35 and 45 m. and they originate very probably from the *moorlog* deposit, which is dated there in the very beginning of the Boreal [34]. The finds offer worthy additional data for the construction of the Early Holocene part of the curve of the relative rise of sea-level.

The Brown Bank finds made it very likely that the marshy Basal Peat landscape in the subsoil of the Western Netherlands was also inhabited by small groups of hunter-fishers during Boreal times. Another argument supporting this assumption is the distribution of (Early) Mesolithic bone implements, and especially the barbed points, all around the southern North Sea. In a recent paper we mapped these finds [35].

In the end of 1972 the above supposition was confirmed by some extraordinary finds on the artificial sand plain called "Maasvlakte", the most westerly part of the Europoort harbour of Rotterdam. The finds comprise until now four barbed points, one of them fragmentary, an antler sleeve, a bone needle, a wild boar's tusk chisel and some worked pieces of bone and antler (fig. 3) [36]. The implements must have been derived from the thin peaty clay (part of the Basal Peat) that overlies there the sandy and gravelly Late Glacial river beds at a depth of -26 to -22 m. NAP. We must imagine that the chance of making finds from this depth is extremely small. The deep and extensive sand dredging works in Europoort offered such a possibility.

1.4.2.3. *The Late Mesolithic*

We can name three possibly Late Mesolithic finds from the Western Netherlands.

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[31] Clark 1936, Schwabedissen 1951, Louwe Kooijmans 1970/'71, 64.

[32] Clark & Godwin 1956, esp. fig. 5 and Pl. I, 6; Clark 1932, Appendix VII, Louwe Kooijmans 1970/'71, 32.

[33] Louwe Kooijmans 1968[a], 1969[a] (preliminary notes), 1970/'71.

[34] *Cf.* Jelgersma 1961, 70-72. The centre of the localized finds is near "Location B". It is rumoured that also on the Dogger Bank Mesolithic worked bones have been fished up. According our information this seems, however, not to be the case.

[35] Louwe Kooijmans 1970/'71. In addition to the finds listed there we must mention the three barbed points found at Dinslaken, Stampfuss & Schütrumpf, 1970. I discovered this publication too late, to include its information. To our opinion the dating of these barbed points to the Allerød period is not very sound and is still open to discussion. A later date, more in agreement with all other evidence (Preboreal-Early Boreal) cannot be excluded.

[36] Louwe Kooijmans 1970/'71, 50-53.

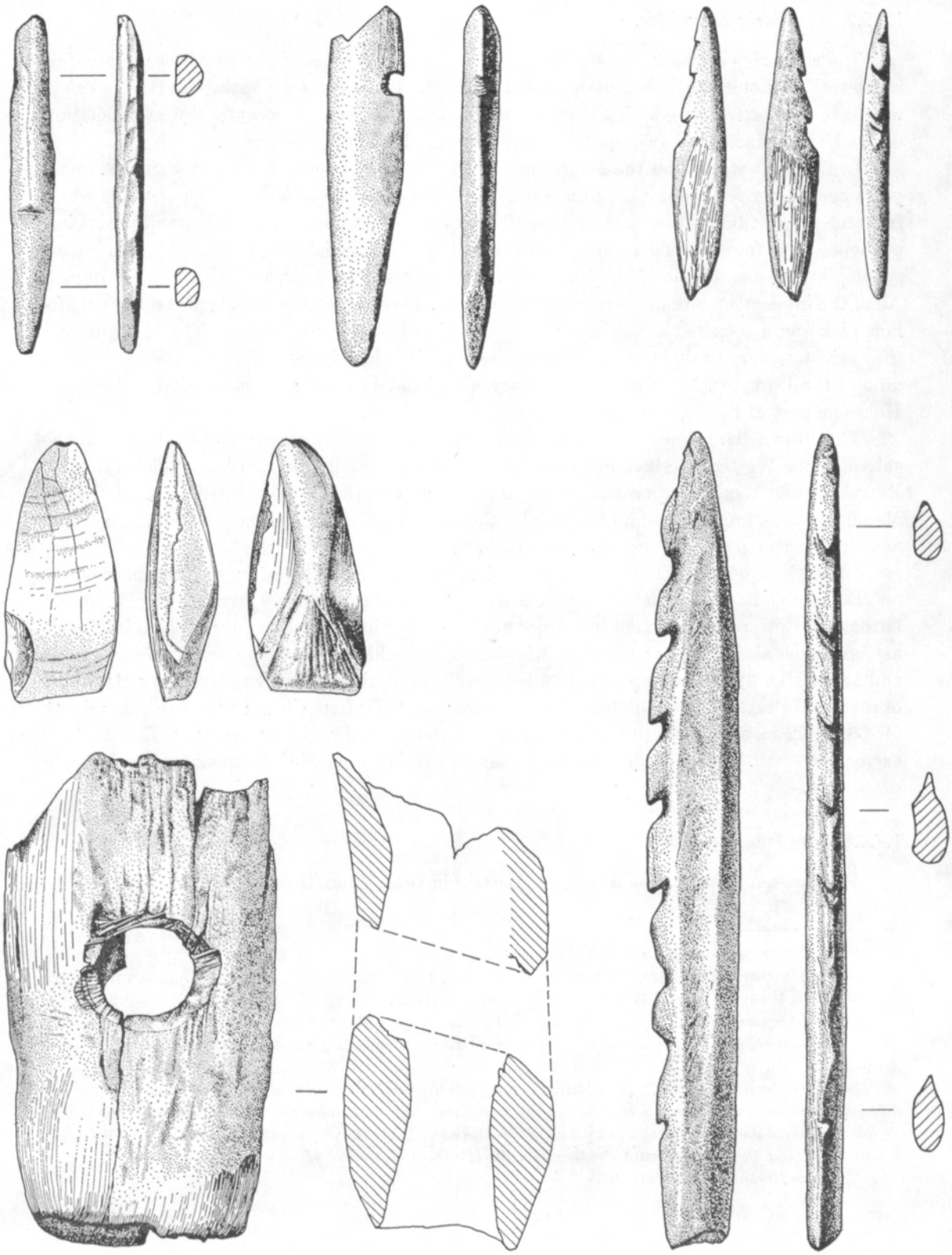

Fig. 3. Early Mesolithic implements, found in 1971-'72 on the Maasvlakte of Europoort, Rotterdam. Dredged up from a depth of —26 to —22 m. NAP. Scale 1:1.

First, the small wooden figure which was found in 1966 during the building of a lock in the Volkerak [37]. It was lying in a thin layer of peat at about — 8 m. NAP, between the roots of a tree stump directly above a gradual rise in the cover-sand. A ^{14}C dating gave an age of *c.* 4450 B.C.

At Koegras in 1950 a few flint flakes were found, also on the top of a sizeable rise (up to —4.25 m. NAP) of the cover-sand landscape. The base of the overlying peat is dated at about 3000 B.C., which is the latest possible date for the finds [38].

The third find is a human skull of apparently Mesolithic age, which was dredged up near Vianen [39].

The *donken* seem to offer the best chances of making more finds from the Late Mesolithic. Up to the present time, however, only a few flint implements have been found there. One piece, a trapeze, found on a *donk* near Leerdam, is perhaps Mesolithic [40]. In the pollen diagram of the Hazendonk, mun. Molenaarsgraaf, it appears that there are some traces of human activity at about 4100 B.C. [41]. In an identical situation Mesolithic finds were made in the English Fen district in 1935 [42].

Late Mesolithic finds are thus only known from the former peat regions. No inhabitation and so no finds are to be expected in the tidal flat landscape further to the west, with the exception perhaps of the short phases, during which a thin peat layer was formed there.

1.4.2.4. *The Early and Middle Neolithic* [43]

It is also valid to the Early and Middle Neolithic that the level of inhabitation is so deep that finds can only be of an incidental character. Moreover, at that time the largest part of the Western Netherlands consisted still of a tidal flat landscape of which the possible coastal barriers, with the exception of the latest series had disappeared.

Of the greatest importance is the discovery in 1963 of some Early Neolithic settlements with a number of graves near Swifterbant in the East Flevoland Polder, situated on outcrops of the Pleistocene/Early Holocene sandy subsoil and on the natural levees of Early Holocene water courses in a former peat area, which has since completely disappeared by marine erosion[44]. These sites and the finds made there are discussed in some detail at p. 163 in our comment on the Hazendonk pottery and we will mention here only some special characteristics. The depth of the inhabited surface is —5 to —5.75 m. NAP. Three ^{14}C dates give a date in the middle

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[37] Van Es & Casparie 1969, Van Es 1968.

[38] Du Burck 1959, Jelgersma 1961, 29.

[39] Huizinga 1959, 52 and figs. 12, 13. The skull is very similar to those from Téviec, Brittany. The skulls from Swifterbant seem to be of the same type. A skull, recently dredged up at Avezaath near Tiel, is perhaps a second specimen from the river area. See also Constandse-Westermann 1968, Louwe Kooijmans 1970/'71 and lit. cited there.

[40] De Kok 1965. "Chronicles" in "Helinium" for district B: 1964, 136, no. 13; 1969, 75, no. 1; since similar trapezes occur at Swifterbant, the artifact might be Early Neolithic as well.

[41] In Part III of this paper our investigations at this site are discussed in full detail.

[42] See p. 73 f.

[43] Most of the finds mentioned here will be discussed in more detail in Part III of this paper, where we deal with the cultural relations of the "Hazendonk pottery".

[44] Ente 1971.

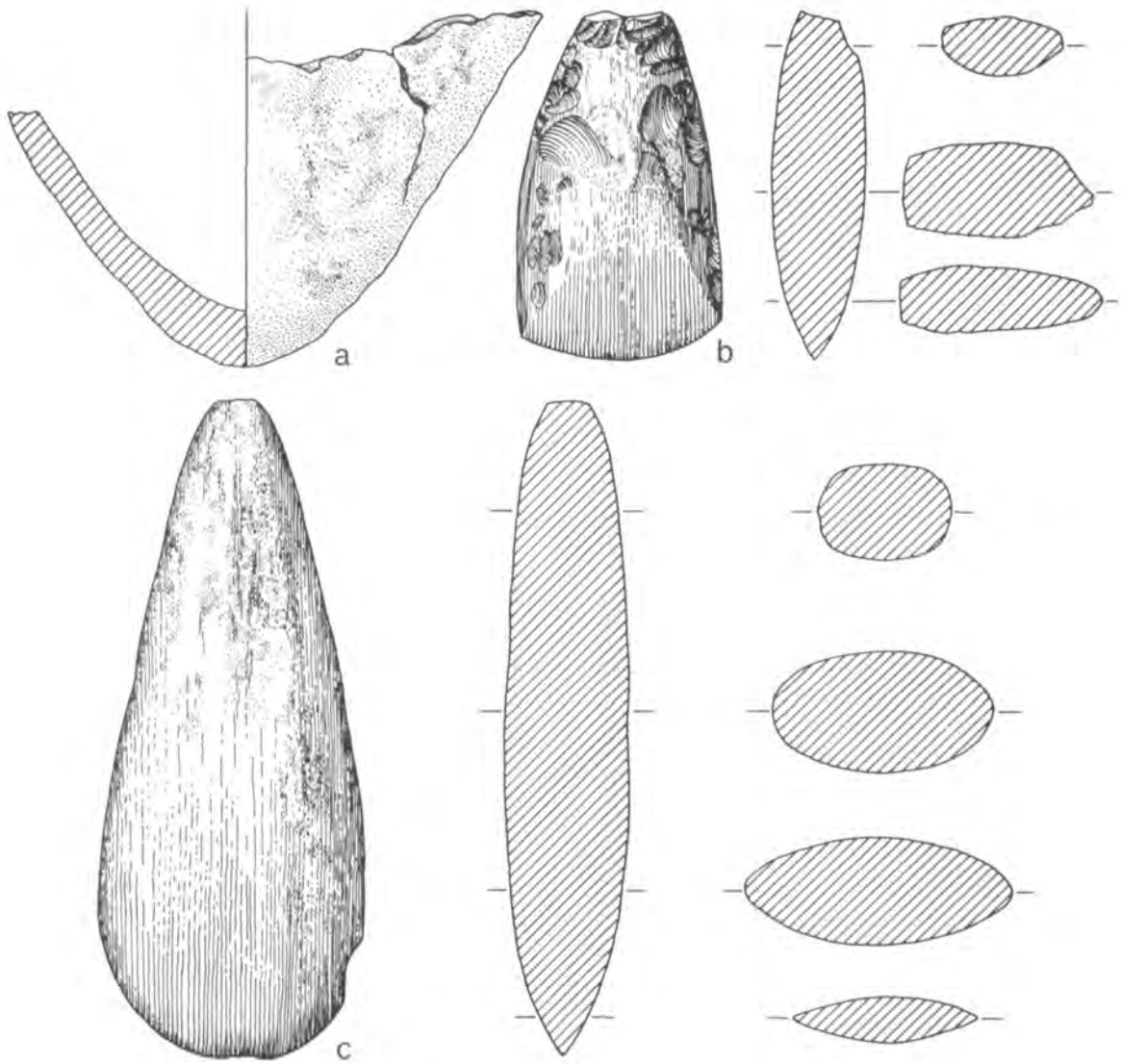

Fig. 4. Some recent Early/Middle Neolithic finds from the Western Netherlands. Scale 1:2

a) round pot base, Schiedam (fig. 2, no. 15)
b) flint axe, Abbenes (fig. 5, no. 43[a])
c) stone axe, Schalkwijk-Heemstede (fig. 2, no. 24)

of the fourth millennium. The recent excavations by the BAI, Groningen revealed that the organic material is preserved very well on the settlement sites. These investigations will give us a very complete picture of the communities (and their way of life), which inhabited the low lying regions in the Early Neolithic [45].

A second important site is the Hazendonk, mun. Molenaarsgraaf, also on an Early Holocene outcrop, but situated in the river clay/wood peat area of South Holland. In the pollen diagram at this site, human influences (esp. *Cerealia* pollen) are present at levels which are ^{14}C dated about 3400 B.C. and 3000 B.C. The levels correspond with former peat surfaces at —4.30 m. and —3.70 m. NAP respectively. The older dated level corresponds very well with the date of Swifterbant, the younger date can be brought in connection with the "Hazendonk pottery", found on the top of the *donk*. This pottery is a new group for this country [46]. We refer the reader to Part III for full details on this site.

Other finds supplement the inhabitation pattern. First the recently rediscovered round pot base from Schiedam, which is clearly related to the pottery found at Swifterbant [47]. Next we mention the indications of inhabitation since about 3000 B.C. which were found in the pollen diagram of the infilling of the stream channel at Zijderveld [48]. The "Zijderveld stream ridge", a Late Atlantic/Early Boreal river course, must therefore have been inhabited as early as in the Middle Neolithic. At the boundaries of the area are the Michelsberg Culture finds, made near Antwerp [49] and the occupation remains found at De Gaste near Meppel [50].

Some of the isolated finds can be dated to this period. First, three shaft-hole axes of *Breitkeil* type, of which two were found at the perimeter of the area, apparently below the Holocene deposits and on the cover-sand surface. Only one (no. 25) comes from the Holocene deposits themselves. Second, some T-shaped antler axes. Both types of implements are studied by Van der Waals [51].

Although Brandt placed all his *felsrund* and *felsoval* axes in the Early Neolithic (pre-TRB), we did not follow him here. The find circumstances of most of these axes, the locations and the over-all picture on the map make it likely that these axes, or at least some of them, are later [52].

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[45] Preliminary reports on the sites: Van der Heide 1964, 1965, 1965/'66 and esp. Van der Waals 1972.

[46] Renewed study of the finds from the *donk* at Waardhuizen, mun. Almkerk (fig. 5 no. 41; predominantly VL Culture, *cf.* fig. 6) yielded one sherd with deep reed impressions, very probably "Swifterbant" ware, and one rim sherd that might be "Hazendonk" ware. Both finds are not indicated on the map at fig. 2.

[47] Van Regteren Altena *et al.* 1962/'63, esp. 1962, 19-20. This paper: p. 164.

[48] Pers. comm. Mr R. S. Hulst, Amersfoort; J. de Jong 1970/'71.

[49] De Laet 1966, 1958, 31 and fig. 22; Lüning 1967, *Taf.* 1-4.

[50] Pers. comm. Mr O. H. Harsema, Groningen.

[51] We thank Prof. Dr. J. D. van der Waals, who gave us the manuscript of his article on these artifacts (Van der Waals, 1972) to read. The *Tüllengeweih-äxte* are in the collections of the RMO, Leiden and the Museum voor de IJsselmeerpolders, Schokland. The elk antler axe has its parallels among the finds from the Dümmer See (Deichmüller 1963, 80 and *Taf.* 1, 2), and at Star Carr (Clark 1954). Mr G. Elzinga, Leeuwarden, kindly informed us of the T-shaped axes found in the Holocene sedimentation area.

[52] Brandt 1967. Axes with oval or round cross-sections were found on the coastal barriers, in West Frisia, the Wieringermeer Polder and the southern part of the North-east Polder, *i.e.* in the blank regions of the Early/Middle Neolithic map (fig. 2). We think that not only the form, but also the stone used, the working technique and minor details in the form are determinative characteristics.

A dating before the VL Culture for the axe from Heemstede (fig. 4 c), seems, however, very probable on geological grounds. The axe was found on one of the oldest coastal barriers, that of Spaarnewoude, and must come from below the covering peat [53].

To summarize it appears clear that the Western Netherlands were inhabited in the Early and Middle Neolithic. Settlements were made in any case on the tops of sandy outcrops and on the stream ridges in the peat zone between the coast and the relatively high hinterland. Almost all the coastal barriers of these periods have, however, disappeared or are reworked by dune formation, so that it is a pure guess whether dwelling places also existed there of the kitchen-midden type such as are met with in the Danish Ertebølle Culture and in Brittany. To us it seems probable. From the region between the coastal barriers and the peat area the Schiedam pot base is the only find. It is dated now in a regression phase (CII/III), when in this predominantly estuarine region relatively quiet circumstances prevailed and peat formation took place so far to the west. In our view, occupation of the tidal flats themselves may have been as improbable as in the foregoing Mesolithic.

1.4.3. The Vlaardingen Culture (fig. 5)

1.4.3.1. *Dating, distribution, cultural relations*

It is not until the Late Neolithic that information becomes so detailed that we can form a picture of inhabitation which is more than a summary of incidental observations.

The Vlaardingen Culture (VL Culture)[54] is one of the best known cultures in the Netherlands, for which a fairly large number of ^{14}C dates is available (table 2). The dates of Leidschendam seem to be a few centuries too late, like that of the lowest layers of Voorschoten. On the basis of all dates we may place the VL Culture in the Western Netherlands between 2450 and 2000 B.C.

The distribution map of the archaeological remains of the VL Culture has undergone a number of changes in the course of time. The site which was first discovered (Zandwerven) occupies an exceptional position. The discoveries of Hekelingen and Vlaardingen increased the significance of the estuarine area, and Voorburg, Leidschendam and Voorschoten then made it clear that the coastal barrier area between the river Meuse and the mouth of the Rhine had been intensively inhabited.

As a result of the investigations in the river clay/wood peat area, the map has undergone a new and fairly drastic change. One findspot is known there on a stream ridge (Zijderveld)

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[53] It concerns a drop-shaped axe with oval cross-section, made from a compact sandstone with a beating technique. Only the cutting-edge has been ground. The axe probably originates from a southern Neolithic group. A few comparable pieces belong to the Michelsberg Culture (Lüning 1967, *Beilage* 9: *Beile Typ* 3). Of the other axes only those from Hoorn and Monster, made with the same technique, are axes of the true *Walzenbeil* type.

[54] Van Regteren Altena *et al.* 1962/'63, 101-103 for the definition of the VL Culture. For the natural circumstances in relation to the inhabitation see esp. Pons in the same paper, 97-111.

TABLE 2

Vlaardingen Culture. Radiocarbon dates

		Coastal barriers			
Zandwerven	GrN 2221	2050 ± 65	charcoal	Vogel & Waterbolk	1972, 85
Voorschoten	GrN 4908	2030 ± 60	charcoal	—	1967, 125
	GrN 4907	2130 ± 70	charcoal	—	1967, 125
	GrN 5031	2080 ± 40	charcoal	—	1972, 85
	GrN 4906	2140 ± 50	charcoal	—	1967, 125
Leidschendam	GrN 5027	1710 ± 60	charcoal	—	1972, 86
	GrN 5028	1860 ± 60	charcoal	—	1972, 86
	GrN 5029	1710 ± 80	charcoal	—	1972, 86
Haamstede	GrN 1577	2460 ± 60	charcoal	—	1963, 179
		Estuarine area			
Hekelingen	GrN 254	2250 ± 120	charcoal	De Vries *et al.*	1958, 135
	GrN 684	2120 ± 85	bone	De Vries & Waterbolk	1958, 1553
Vlaardingen	GrN 2480	2240 ± 70	charcoal	Vogel & Waterbolk	1963, 178
	GrN 2304	2300 ± 75	wood	—	1963, 178
	GrN 2303	2380 ± 60	charcoal	—	1963, 178
	GrN 2487	2330 ± 100	wood	—	1963, 178
	GrN 2306	2460 ± 100	wood	—	1963, 178
	GrN 4114	2470 ± 120	wood	—	1972, 84
	GrN 4948	2180 ± 40	bone	—	1972, 85
		River clay/wood peat area			
Hazendonk	GrN 5175	2340 ± 40	peat	Vogel & Waterbolk	1972, 85
	GrN 6213	2520 ± 40	peat	unpublished.	

and at least five, very probably seven, settlements have been identified on the *donken* (fig. 6). We must assume that still many more VL settlements lie buried in the subsoil on the levee deposits of former rivers at a depth of about 1.50 m. under the surface.

Characteristic finds of the VL Culture were recently made in the river clay area proper and on the sand hills of Wijchen, S. W. of Nijmegen. First, at the *donk* called Bommelse Loo, west of Zaltbommel a few (early) VL sherds were found during building works. Second, a few sherds found near Geldermalsen in washed position might belong to the VL Culture. At a site named Homberg near Wijchen amateur archaeologists recently discovered a small find group. The finds comprise two big rim-fragments of S-profiled pots, built-up in strips, like the Almkerk pot (fig. 6) and two clay-disc fragments. The original distribution of the VL Culture, limited to the coastal districts, has been extended to the east by the new finds. It is now the more clear that the VL Culture had in the first place its links with the Southern Netherlands [55].

[55] These sites are not indicated on the map (fig. 5). We thank Mr R. S. Hulst, Amersfoort, and Mr W. N. Tuyn, Nijmegen, for the information on these sites. The author is preparing a more detailed report on these finds and on the site Het Vormer, where Hazendonk pottery was discovered.

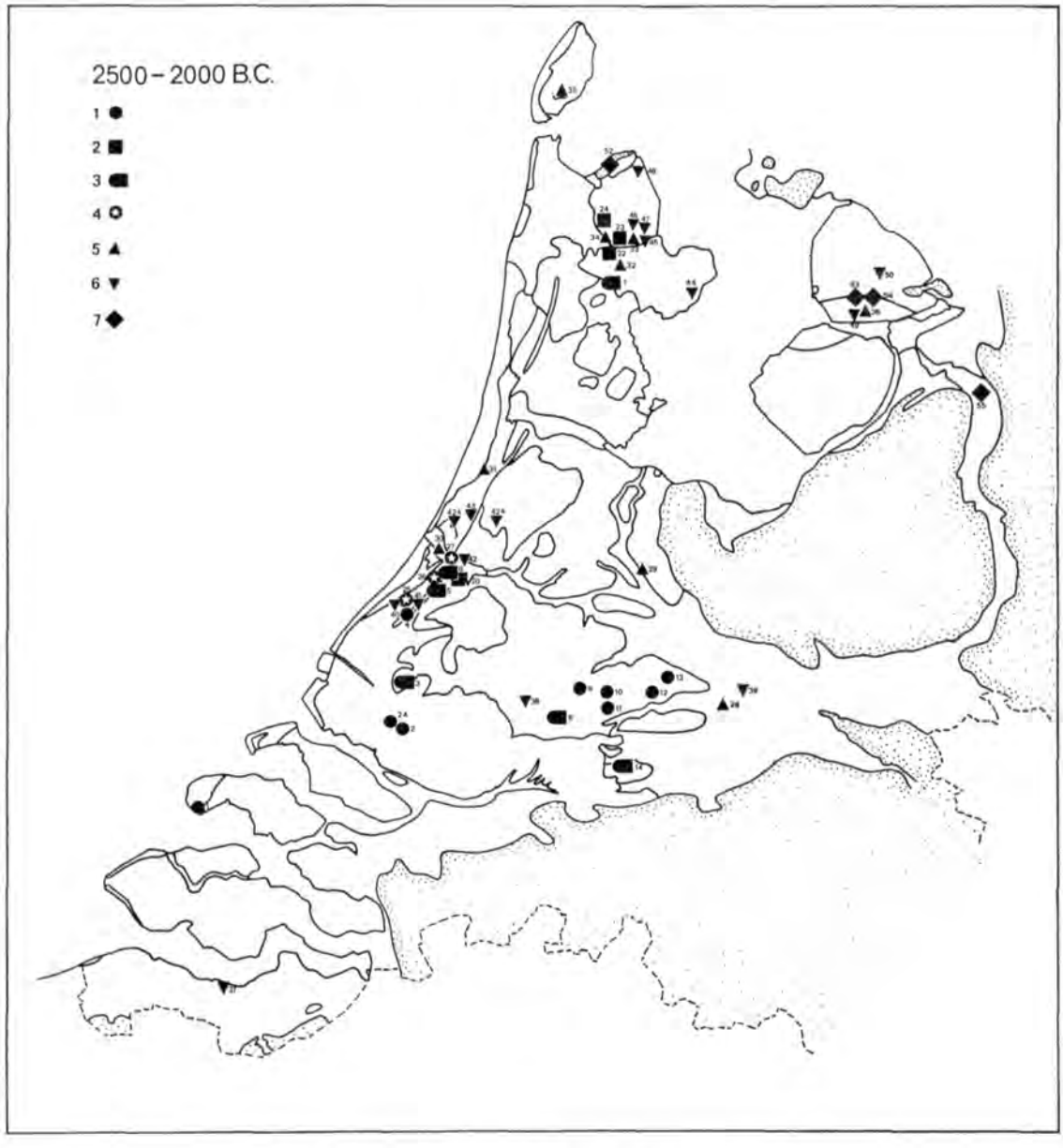

Fig. 5. Prehistoric finds in the Western Netherlands, dated :

— between 2500 and 2000 B.C.
— in the period of the VL Culture
— between the transgression phases Calais IV^{a} and IV^{b}.

The numbers refer to the documentation of the mapped sites in Appendix I, section II.

Legend :

1. VL Culture, settlement or pottery.
2. SVB or Hybrid Beaker, settlement or pottery.
3. 1 and 2 at one site.
4. various artifacts.
5. battle axe.
6. flint axe.
7. TRB Culture, various finds.

Connections with the Southern Netherlands were already evident on cultural grounds: the VL people used flint axes of a southern type and the finds at Stein and Wijchen [56] are closely related to the VL Culture. The pottery of the VL Culture, moreover, shows obvious differences from that of the late TRB Culture of the Northern and Eastern Netherlands (Late Havelte or Angelslo phase), especially in workmanship, shape and the lack of ornament. Judging by the occurrence of decorated clay discs with eccentric perforations and similar undecorated collared flasks in the VL Culture and the Angelslo phase of the TRB Culture it seems that there were also contacts with the north, aside from the dominating southern cultural relations [57]. The routes along which these contacts were maintained may have lain in the IJsselmeer district and/or have been also the same as those used for contact with the south: the active and old river beds in the Holland peat area.

1.4.3.2. *The situation of the settlements*

The three settlements in the estuarine region all lie along the drainage creeks of the end of the C IV^a ("Wieringermeer") transgression. The occupation level lies at about —3 m. NAP at Vlaardingen, between —2.10 and —2.80 m. NAP at Hekelingen I, between —2.70 and —2.90 at Hekelingen II [58].

Five settlements are known on the Older Dunes with a noticeable concentration (of isolated finds also) between the mouth of the Meuse and the mouth of the Rhine. It is very likely that the conditions there were particularly favourable for settlement. The oldest system of coastal barriers, covered with low dunes, was situated there in the form of a broad, high sand ridge behind a very wide shore flat. Its vegetation consisted of a tall-growing forest, undoubtedly full of wild animals; there was a good supply of fresh water and no danger of being flooded. There are, however, so many factors affecting the distribution pattern that we cannot say that the other coastal barriers, existing at that time, were not inhabited. The belt of coastal barriers, which at the time of the VL Culture formed the actual coast or lay in its immediate vicinity, was in any case visited, as appears from a few isolated finds there (a flint axe and whetstone in The Hague [59]), and the find of a sperm-whale tooth and bones of the grey seal in the settlements of Voorschoten and Leidschendam. As this coastal barrier belt was not yet "fossilized" but was still in the process of formation, and was certainly still subject to active dune formation we need not be surprised that all traces of settlement are lacking there. The chance that they would have escaped from erosion is particularly small. On the other hand it can,

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[56] For Stein see Modderman 1964^b, for Wijchen see p. 166, note 70 and p. 21.

[57] We leave another theoretical possibility out of discussion here: the "northern" elements of the VL Culture can be the result of influence from a third culture area, that influenced both areas (the northern, TRB and the western, VL area) more or less independently.

[58] We thank Dr J. A. Bakker, Amsterdam, for his permission to use the height measurements made during the exploration of this site by the IPP, autumn 1970.

[59] *Cf.* Jelgersma *et al.* 1970, 137. The whetstone was found at the base (*i.e.* under the peat) of the 3rd shore flat and almost on the landward slope of the 4th coastal barrier. We must, however, remember that this type of whetstone indeed occurs in graves of the Battle Axe Culture, but that in the Netherlands only two cases are known (both PFB graves). The PFB Culture lasted until about 2000 B. C. (perhaps even one century longer) and this type of whetstones might also have been used in later (*viz.* Bronze Age) times.

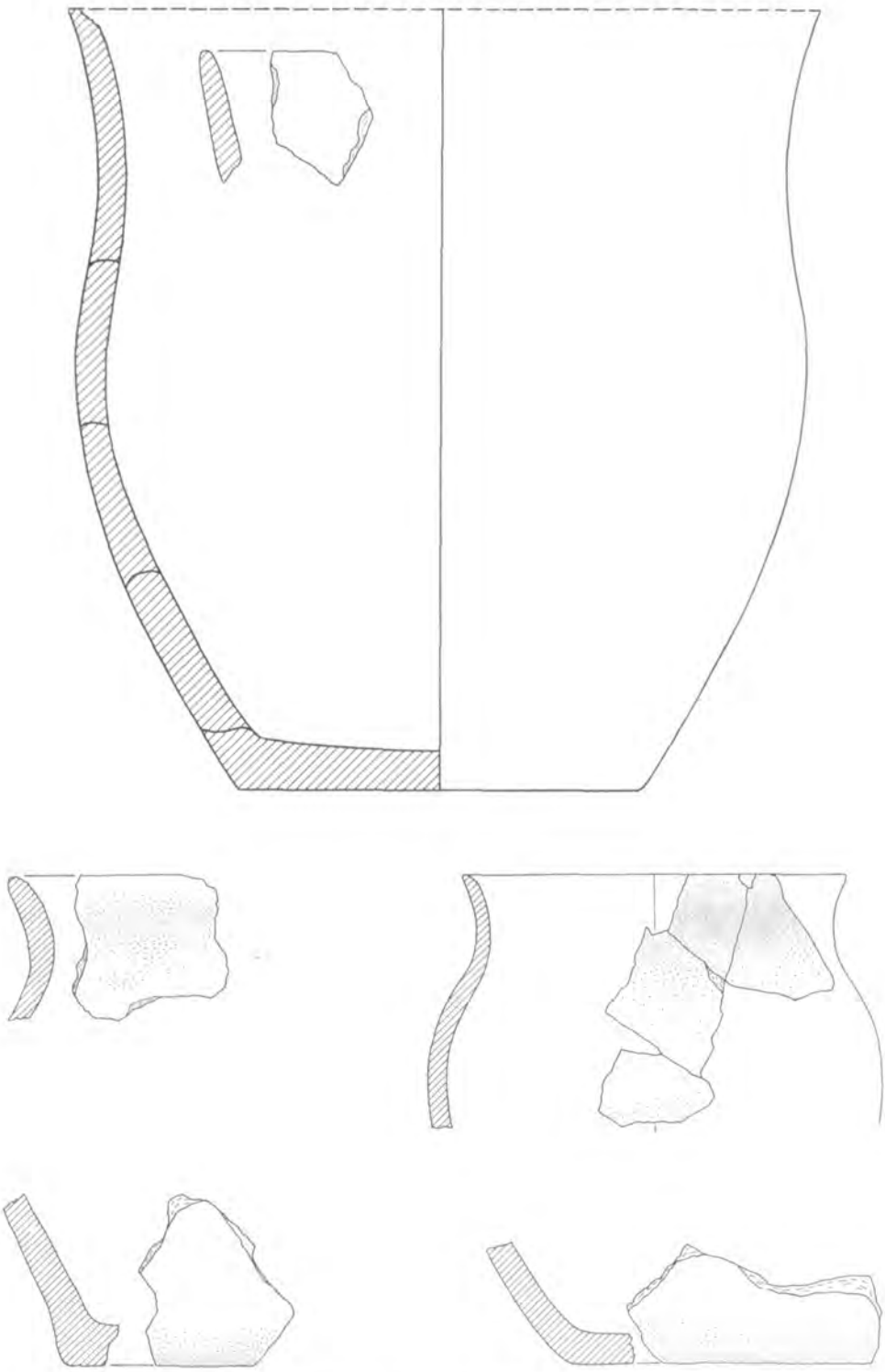

Fig. 6. Vlaardingen Culture pottery from a *donk* near Waardhuizen, mun. Almkerk, North Brabant (fig. 5, no. 14). Scale 1:3.

however, be imagined that the environment of such a coastal strip could not have been very attractive for an agrarian community to establish itself permanently. As the dune formation decreased with a first growth of vegetation, the soil must have still been poor in humus and therefore dry. Fresh water must, however, have been available soon. Although in our view the factor of shelter did also play a role in such a case, people did not wait to occupy these terrains, as is shown for later times (Iron Age, Roman period) by the excavations at Velsen [60].

A number of explanations can also be given for the absence of VL settlements north of the mouth of the Rhine. In this area the seaward shift of the coast-line between C III and C IV was much smaller (see p. 40). The shore flats of this period are much narrower than they are south of the Rhine, or they do not exist at all. In general it may be stated that the coast-line at this time acquired a more concave and less straight outline. It is possible that for this reason coastal conditions, especially the formation of dunes, lasted longer to the north of the Rhine. The same arguments apply to the absence of finds on the coastal barrier Voorhout-Lisse-Haarlem (the second belt), as we mentioned for the contemporaneous coastal barrier south of the Rhine. In this case the find of an axe fragment near Lisse is instructive. This indicates that the VL people at least visited this place, while it is even possible that it is one of the last remains of a settlement of which all traces have disappeared by erosion.

Two entirely different factors appear to us, however, to be all important north of the Rhine. First, the effect of the present use of the land, the bulb cultivation, for which already long ago large terrains were levelled to the most favourable height above the ground water table. Second, its accessibility for the VL people may have played a part. It is possible that the region north of the Rhine estuary was more or less isolated from the southern nucleus of the VL Culture and that the population density was not so high that it was necessary to make use of this apparently less attractive section of the coastal barrier region. In our opinion there is, however, no question that the coastal barrier region as a whole was isolated because of its poor accessibility, as Pons has suggested [61].

Large parts of the former tidal flat area behind the coastal barriers had already become salt marshes during the VL Culture. In the present Wieringermeer Polder the conditions for making finds are relatively favourable: the present day surface was for a long time the sea floor, where often a slight erosion took place. After the reclamation a relatively large number of stone axes, including a number dating from the period under discussion, were washed free or ploughed up. In other polders, where the Old Sea Clay lies at the surface, it was, however, often covered by a deposit of a peat detritus sediment. We should therefore not conclude from the lack of finds that these regions were not made use of. The recent find of a flint axe near Abbenes in the Haarlemmermeer Polder is the first proof of the contrary (fig. 4 b) [62]. It is,

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[60] Jelgersma *et al.* 1970, 140 f.

[61] Pons (see note 54) p. 110 stated: "the coastal barriers were probably more isolated at that time than the Frisian islands are at present. One must postulate water transport, since the barriers would have been inaccessible by land".

[62] This axe was discovered by Mr H. van der Lugt, Utrecht. According to Brandt 1967 (esp. p. 102) the axe is a *Flint Flachbeil* and a transitional form of his variants 1 and 2. Brandt dates these types to the TRB and the Early PFB Cultures, *i.e.* 2700-2300 B.C. The axe was found on the surface of the Older Sea Clay deposits *sensu stricto*, which are dated between the older Hoofddorp and the younger Beinsdorp deposits, the whole sequence being Calais III (Haans 1954). In view of the rather quick rise in sea-level occupation is considered likely only during a few centuries

however, not yet clear whether there were also permanently occupied agrarian settlements on these salt marshes.

1.4.3.3. *The character of the inhabitation*

Thanks to a number of excavations we know that the settlements were small and permanently occupied, with rather small rectangular houses. On the coast, especially where natural pasture land (salt marshes, shore flats) was available, cattle breeding was the most significant means of subsistence, together with arable farming. In the marshy wilderness hunting and fishing were the prevalent sources of food.

1.4.3.4. *Settlement finds of the Battle Axe Culture*

At four or five settlement sites of the VL Culture finds have also been made of the "Protruding Foot Beaker Culture" (PFB, the Dutch *facies* of the Battle Axe Culture, 2400-2000 B.C.). One other, pure PFB settlement was discovered at Aartswoud in West Frisia, a few years ago. The rich finds at this site make future excavations very promising. Outside the Western Netherlands proper, *i.e.* in the northern part of the province Friesland, near Dokkum, two more PFB settlements were discovered in recent years. They are situated on the surface of the Pleistocene subsoil (which is relatively high in this district) at —1.20 m. at Bornwird and at —1.50 to —1.80 m. at Beerdaard [63]. Both are covered with Holocene deposits. The three mentioned sites prove first that the VL Culture and the PFB Culture relate to different groups of people, and second that both these groups were attracted by the low lying regions. The occurrence of PFB Culture remains on VL sites reflect a (seemingly peaceful) intercourse of both groups.

A remarkable change in the influence of man on the natural vegetation of the Older Dunes has been determined at Voorschoten at the moment of the first contacts of the VL people with the newly arrived PFB people. The VL people grazed their cattle on the natural pastures, but after the PFB contacts clearings were made in the forest of the Older Dunes. This also is a characteristic of the PFB Culture in the high sand areas [64].

1.4.3.5. *Settlement finds of "Hybrid Beakers"*

On the PFB settlement at Aartswoud and on some VL settlement sites sherds of the so-called Hybrid Beakers have been found. Both the 1^{II} ("Zigzag Beakers") and 2^{IIb} (All Over Cord Beakers) types are represented [65].

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after the formation of the deposits. Since the geological and archaeological datings agree very well, there is no need to consider the possibility that the axe might come from former covering deposits that were washed away when the Lake Haarlemmermeer came into existence. These were, moreover, mainly peat formations.

It now appears that the RMO, Leiden had received another axe from the Haarlemmermeer Polder as early as 1853, found during the reclamation works in the year before. It is the cutting-edge fragment of an axe with flat sides and convex upper and lower surfaces, made of quartzite or a coarse flint. Inventory no. JvL 43.

63 We thank Mr G. Elzinga, Leeuwarden, for the data of Bornwird and Beerdaard. The last named site is actually situated at Stenendam half-way between Oudkerk and Beerdaard. Dr J. A. Bakker, Amsterdam, kindly informed us about the Aartswoud site.

64 Glasbergen *et al.* 1967.

65 Typology according to Van der Waals & Glasbergen 1954.

They must date from the end phase of the occupation on those sites. It seems that the VL people were able to continue occupation longer on the coastal barriers and the outcropping Early Holocene dunes than in the estuarine area. It is only at the site of the VL settlement at Voorschoten that some Early Bell Beaker sherds have been found. Like the finds on the *donken*, they do not necessarily imply continuity of occupation.

1.4.3.6. *Isolated finds*

As to the isolated finds, we can ascribe most of the flint axes to this period. Twelve pieces are of the southern type (with oval cross section), one belongs to the TRB Culture (with rectangular section, Schokland) and three are difficult to date. The flint axes of southern type may be partly older than the VL Culture like perhaps the pointed-butted axe from the Schoonenburgse Heuvel, Nieuw Lekkerland (fig. 22). Small flint axes on the other hand may have been used until the Early Bronze Age. The majority, however, belongs in all probablility to the VL Culture and form one of the southern elements in this culture.

Seven battle axes or fragments of them belonging to the PFB Culture are indicated on the map at fig. 5. The typologically latest pieces fall, however, in the period dealt with in the map at fig. 7.

We interpret two complete beakers, both from the Wieringermeer Polder, as grave gifts. The circumstances in which one of the beakers was found also point to this interpretation. They are an atypical early "Protruding Foot Beaker" and an equally atypical 2^{IIa} beaker. They indicate that the surface of the Calais IV^a ("Wieringermeer") deposits was inhabitable, at least in places.

The "other artifacts" on the map are a flint dagger blade, a scraper of Grand Pressigny flint and the whetstone from The Hague.

1.4.4. The Bell Beaker and Barbed Wire Beaker Cultures (fig. 7)

1.4.4.1. *The Maritime Bell Beaker phase*

Inhabitation during the earliest phase of the Bell Beaker Cultures (MBB) has been determined with certainty at only one place, namely at the type site of the VL Culture and almost at the same level (—2.90 m. NAP). After the VL occupation a marked change took place in the activity of the creek. In the first phase the creek shows the characteristics of the early stages of quietly silting up. The second creek has an asymmetrical section with an erosion bank in the outside bend and sedimentation in the inside bend. About 1950 B.C. people who used Maritime Bell Beakers established a very temporary encampment on the inside bend deposits [66]. They remained there at most a few weeks, a simple rectangular hut serving for shelter. This brief stay might just be a characteristic of those who used the Maritime Bell Beakers; yet it might be just as well a consequence of the unfavourable conditions during the transgression phase Calais IV^b.

[66] See note 54, esp. 1962, 28-29 and 232, Groenman-van Waateringe & Jansma 1969.

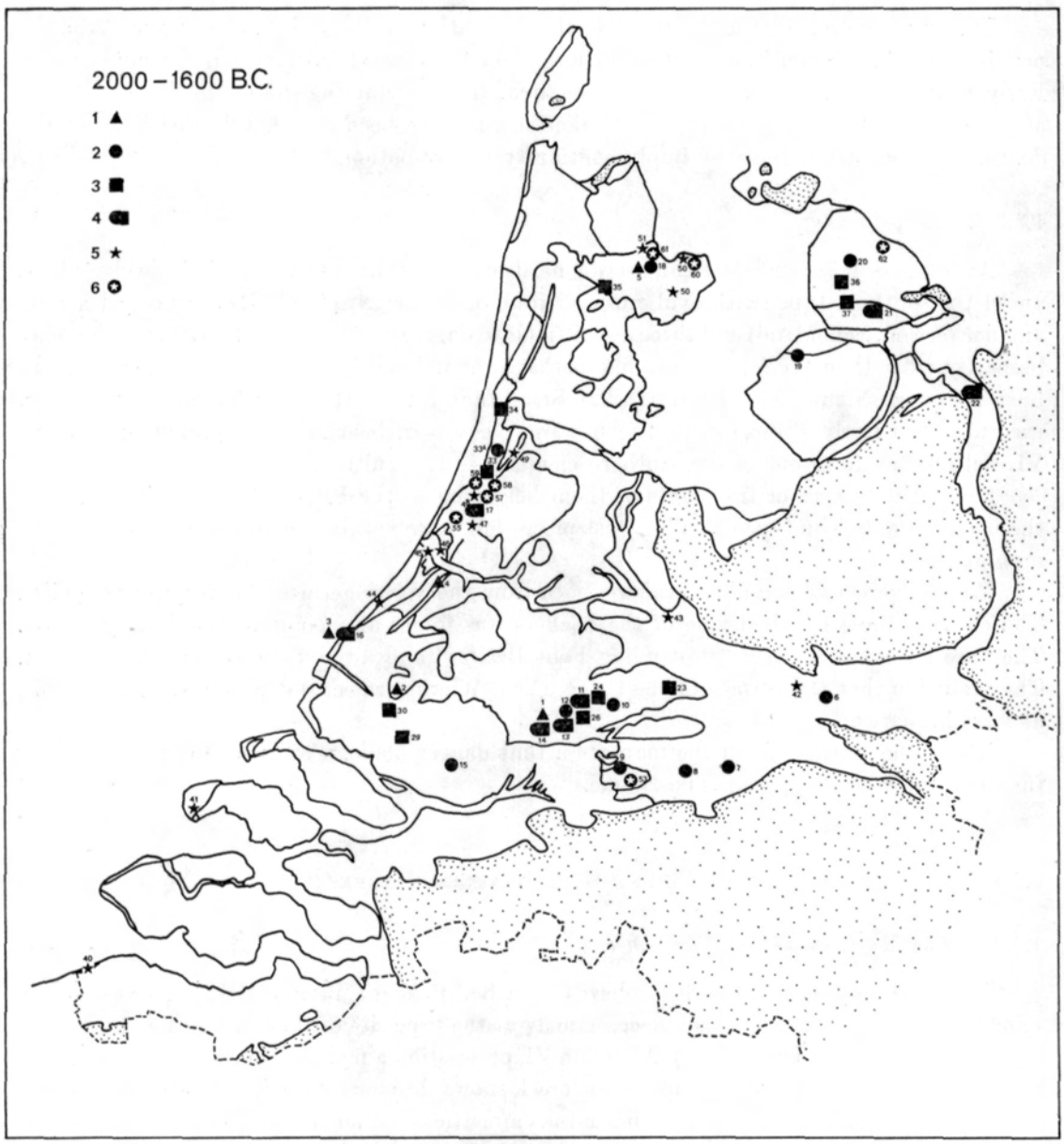

Fig. 7. Prehistoric finds in the Western Netherlands, dated :

— between 2000 and 1600 B.C.
— in the period of the BB and BWB pottery.
— between the transgression phases Calais IV^{b} and Dunkirk O.

The numbers refer to the documentation of the mapped sites in Appendix I, section III.

Legend :

1. MBB, settlement or pottery.
2. VBB, settlement or pottery.
3. BWB, settlement or pottery.
4. 2 and 3 at one site.
5. flint arrow-head, tanged and barbed or hollow-based.
6. various artifacts.

with the earlier VL inhabitation. The ground water table must have risen considerably in the meantime, for no wood was preserved in any of the post holes attributed to the VL Culture. So the clay layer 3 [70] was deposited between 2200 and 1700 B.C., during the transgression phase Calais IV[b] and is as such contemporary with the change in activity in the creek at Vlaardingen, and at the same time with the high water deposits of the Schoonrewoerd stream ridge, which will be fully discussed later.

Verwers [71] has already drawn attention to the clear indications of the existence of communication between the West and East Netherlands through the river area at this time. It must have been a (trade) route running from settlement to settlement, that probably followed the Schoonrewoerd stream ridge [72] through the peat area. On this stream ridge, near Molenaarsgraaf, Ottoland, Goudriaan and Noordeloos at least seven occupation centres, together forming one long settlement are all dated to this period. There were probably other communication routes along (and by) the then active river courses. Widespread isolated finds in the river clay area and the settlement at Dodewaard show more clearly than in the VL Culture that the inhabited area extended from the coast to far into the Betuwe.

1.4.4.3. *The character of the inhabitation*

With the VBB/BWB occupation we are clearly concerned with a settled population in permanent dwellings. On a number of terrains (Oostwoud, Velsen, Molenaarsgraaf, Ottoland-Oosteind and Ottoland-Kromme Elleboog) post-holes have been determined and, at Velsen, cultivation of the soil with the *ard* by the BWB people. At Molenaarsgraaf two large spool-shaped houses were built one after the other. Cattle breeding and fishing were the two most important means of subsistence there, but grain was also cultivated on the narrow stream ridge. Hunting was not of importance. The dead were buried in the settlement terrain. The character of this VBB/BWB settlement is in strong contrast to the observations made of the early BB phase at Vlaardingen. Are these differences primarily cultural or a question of environment?

1.4.4.4. *Isolated finds*

The isolated found implements follow the distribution pattern of the settlements: besides a wirst-guard, a number of flint daggers (partly, especially those in West Frisia, atypical pieces) and thirteen flint arrow-heads. These last, namely the three Sögel arrow-heads, belong partly to the first centuries of the map at fig. 8. The absence of transverse arrow-heads may be attributed to the less easily recognizable shape.

[70] As indicated by Modderman 1953[a], fig. 2.

[71] Verwers 1968.

[72] See p. 97 f. for the Schoonrewoerd stream ridge.

Elsewhere typological early Bell Beaker sherds occur only in insignificant quantities beside later Bell Beaker pottery. This indicates not so much an early occupation phase, but rather forms an old element of a later domestic assemblage.

1.4.4.2. *The Veluwe Bell Beaker/Barbed Wire Beaker phase*

A large number of sites, many of which were only discovered in recent years, are known from the period of the Veluwe Bell Beakers (VBB; 1900-1700 B.C.) and the Barbed Wire Beakers (BWB; 1700-1500 B.C.) [67].

Settlement finds have been made on the coastal barriers, in West Frisia, the IJsselmeer district, the estuarine creek area in the province South Holland and in the whole river area. Graves are known from West Frisia (Oostwoud), the western river area (Molenaarsgraaf) and, if we consider the beaker from the Veenenburg estate near Hillegom as a grave gift, also on the coastal barriers [68]. As the same factors played a part in determining the choice of terrains the distribution pattern of the VBB/BWB finds is identical to that of the VL/PFB inhabitation. There is, however, no continuity in the settlements. With the exception of some *donken* and Hekelingen we are concerned with new terrains, where the oldest finds are sherds of Maritime Bell Beakers.

The inhabitation of the coastal barriers seems to have taken place mostly on the second belt of coastal barriers which had formed the coast in VL times. The oldest coastal barriers and the Older Dunes on top of them were apparently too marshy. This may explain the absence of inhabitation on the coastal barrier of Voorschoten-Leidschendam. At Voorschoten a depression in the Older Dunes was already rather wet during the VL inhabitation, as may be seen from its peaty filling. Another factor was possibly the inaccessibility of the most easterly coastal barrier, which was separated from the later coastal barriers by the then broad and marshy shore flats, while east of it no creeks occured to serve as contact routes. A few finds (a flint arrow-head at Scheveningen, a flint dagger at Voorhout, finds at De Zilk, Noordwijkerhout) indicate, moreover, that the coastal barriers nearer the contemporary coast were also at least visited.

In the marine and fluviatile sedimentation areas the division between VL and VBB/BWB settlements is well-marked because first deposits of the Calais IV^{a} ("Wieringermeer"), then those of the Calais IV^{b} ("Westfrisian I") transgression phases were inhabited. This is the case at Oostwoud, Hekelingen and also at Molenaarsgraaf in the western river area. One or two small decorated sherds found at Hekelingen [69] show BW impressions, some others fingertop imprints in V-motif. They will belong to the level at —1.90 m. NAP, above the fine sandy clay covering the VL remains. From this level pointed wooden posts had been struck into the ground. The occurrence of BWB occupation is here in our opinion fortuitous and has no direct relationship

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[67] For the definition of BWB: Modderman 1955^{b}. His term "thread-wound stamp decorated beaker pottery" gives the most accurate name for this type of beaker ware. We will use, however, the shorter and more commonly used "Barbed Wire Beakers" and the abbrevation BWB (in contrast to Ber. ROB 15/16, 1965/'66, 7-11) for this type of pottery. See further Bloemers 1968, J. N. Lanting 1969^{a}, this paper part IV p. 288 f.

[68] For Oostwoud see p. 310, for Molenaarsgraaf this paper part IV, esp. p. 242 f, for Hillegom: Bursch 1933, *Taf.* III, 10.

[69] Modderman 1953^{a}, 5.

1.4.5. The Bronze Age after the Barbed Wire Beaker Culture (fig. 8)

1.4.5.1. *Introduction*

Half way through the Early Bronze Age, about 1500 B.C. the occurrence of the first Hilversum Urns (HVS) is established in this country. These evolved fairly quickly into Drakenstein Urns (DKS) and finally into the Laren type (LR) [73]. These urns were used as burial pottery until 1000 B.C. In the Northern Netherlands the Barbed Wire Beaker Culture evolved into the Elp Culture (ELP), which is characterized by the *Kümmerkeramik* pottery, the long houses of Elp type and the "family barrows", surrounded by post circles. In the Late Bronze Age late types of *Kümmerkeramik* still might have been in use side by side with early urnfield forms [74]. In the southern part of the country the Middle Bronze Age domestic assemblages are easily recognizable because of the fabric of the pottery. In the Late Bronze Age the *Grobkeramik* (well-known from the HaB urnfields) must be a common type in the domestic pottery (*cf.* also p. 115). It should be borne in mind, however, that typological datings of the pottery are very inaccurate in the period between about 1500 and 700 B.C., because of the small changes in shape and decoration and our ignorance of well-dated domestic find groups. We must in general rely upon direct ^{14}C dates.

1.4.5.2. *The Early Hilversum Culture* [75]

HVS pottery has been found on a number of terrains on the coastal barriers, in three cases on sites where previously (BWB) inhabitation took place (Monster, Velsen and Veenenburg). A single sherd from Vogelenzang shows, moreover, BW decoration [76]. In the whole of the remaining area, that is, outside the coastal barriers, HVS is, however, unknown. The terrains at Oostwoud, Molenaarsgraaf and Dodewaard were abandoned. Again it seems that the coastal barriers were possibly longer inhabitable than other, more vulnerable areas. Also, the HVS occupation was always apparently situated at some distance from the coast-line. In this connection the Sögel arrow-head of Langeveld is interesting. It is an isolated find and at the same time the most coastward find of this period.

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[73] For HVS and DKS: Glasbergen 1954, 1969.

[74] Waterbolk 1964[a].

[75] It is very confusing that the Hilversum Culture includes not only the Hilversum urns but also the later Drakenstein and Laren types. It would be better to change either the name of the whole group, or the name of the earliest type (phase). Since the urn from Drakenstein appeared to be not a typical representative of the group called "Drakenstein Urns" it would be best to give the subphases new names, for instance those of newly excavated settlement sites (*e.g.* Vogelenzang and Zijderveld), as was done earlier with the TRB Culture (*cf.* Van der Waals 1964). In this caption, however, we follow tradition.

[76] Monster: Stuurman 1965, Glasbergen and Addink-Samplonius 1965. Velsen: Vons 1969, Jelgersma *et al.* 1970, esp. 138-139. In both cases BWB and HVS finds were separated by a thin layer of wind-blown sand. Veenenburg: Oppenheim 1927/'28, 1929, Bursch 1933, *Taf.* V, 7. I thank Miss W. Metz, Amsterdam, who drew my attention to the BW imprints on some of the Vogelenzang sherds.

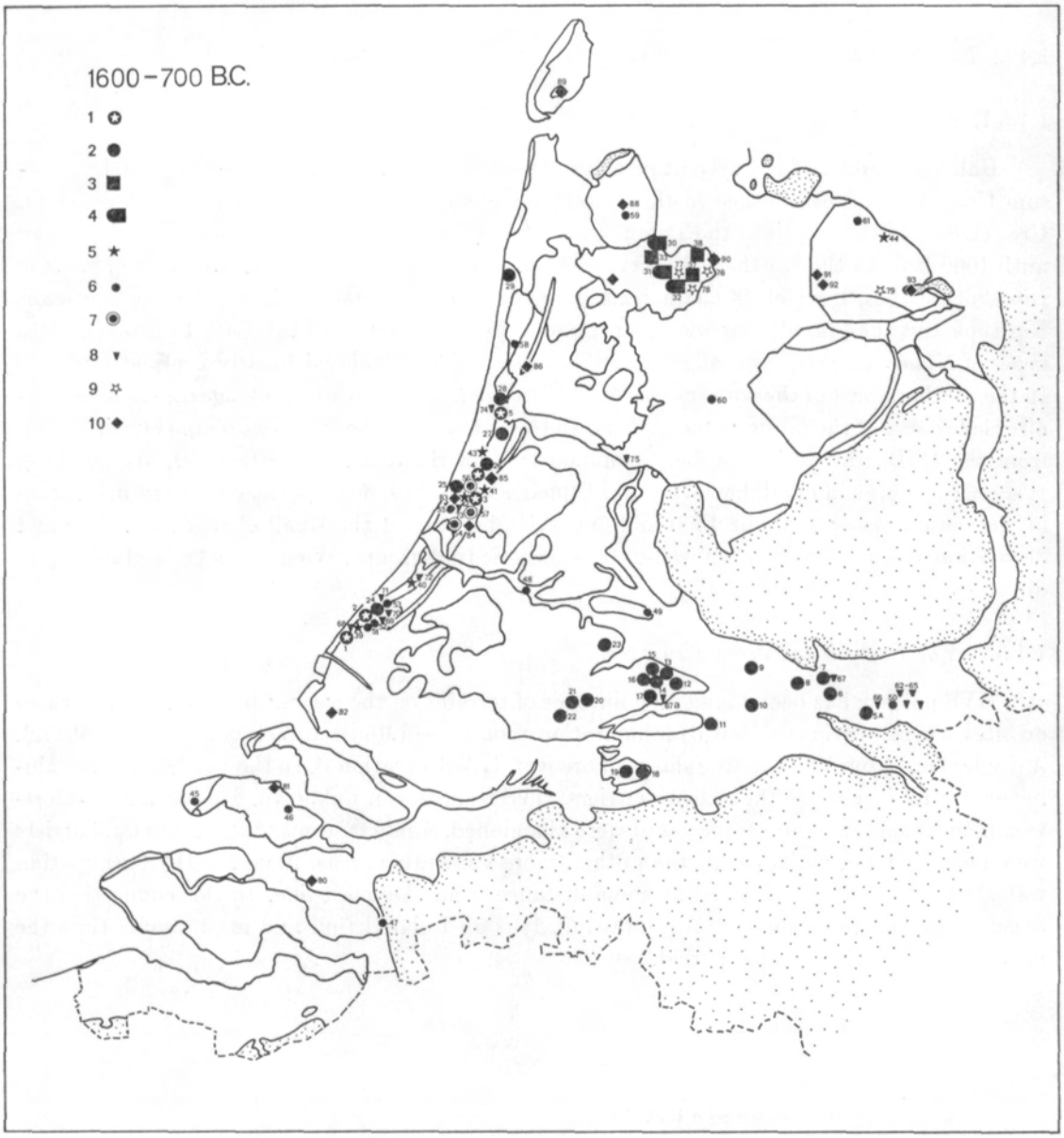

Fig. 8. Prehistoric finds in the Western Netherlands dated :

— between 1600 and 700 B.C.
— in the period of HVS, DKS and ELP pottery and the Late Bronze Age.
— between the transgression phases Dunkirk 0 and I[a].

The numbers refer to the documentation of the mapped sites in Appendix I, section IV.

Legend :

1. HVS, settlement or pottery.
2. DKS or ELP, settlement or pottery.
3. barrow, Middle Bronze Age.
4. 2 and 3 at one site.
5. bronze implement, Early Bronze Age.
6. bronze implement, Middle Bronze Age.
7. Middle Bronze Age hoard.
8. bronze implement, Late Bronze Age.
9. bronze implement, not dated.
10. stone hammer-axe.

1.4.5.3. *The Middle Bronze Age*

There is a great contrast between the distribution of the remains of the HVS and DKS phases. Few settlement sites of the Middle and Late Bronze Age are known on the coastal barriers, particularly in comparison with the relatively long period and with the large number of sites in West Frisia and in the river area. The map of the Middle Bronze Age inhabitation shows therefore a marked difference from that of the VL/PFB and BB/BWB periods.

This picture is probably partly inaccurate, however, since it is influenced by the find circumstances. For if we accept that inhabitation of the coastal barrier area took place chiefly on the seaward part of the coastal barrier complex (although not on the coast-line itself), then the occupation remains of this period will be situated for the greater part beyond our observation, as these coastal barriers are largely under the Younger Dunes (which came into existence after A.D. 1100), or have disappeared through erosion. Only at a few points do they lie at the surface. It is nevertheless clear that a preference developed for the marine and fluviatile sediments which had been deposited shortly before: regions were HVS inhabitation really never took place at all, as it seems.

Renewed inhabitation in the river area took place at a relatively early time, as appears from the ^{14}C dates of some Middle Bronze Age settlements [77]:

Zijderveld	GrN 5376	1420 ± 80 B.C.
	GrN 5220	1315 ± 60 B.C.
Molenaarsgraaf	GrN 5177	1400 ± 35 B.C.
Wijk en Aalburg	GrN 5357	1175 ± 40 B.C.
Benschop	GrN 5356	1010 ± 60 B.C.

In West Frisia the occupation of the deposits of the previous trangression phase (D O/Cardium/Westfrisian II) clearly began later, as appears from the following ^{14}C dates [78]:

Zwaagdijk	GrN 4243	1250 ± 60 B.C.
Oostwoud	GrN 797	1075 ± 80 B.C.
Grotebroek	GrN 160	975 ± 140 B.C.
Wervershoof	GrN 2359	1065 ± 55 B.C.
	GrN 2168	1015 ± 45 B.C.
Hoogkarspel	GrN 5050	1070 ± 40 B.C.

In other sedimentation areas, such as the Meuse estuarine area there are no traces whatsoever of inhabitation in the Middle and Late Bronze Age until now.

These variations in the time of beginning of the (DKS) inhabitation and the occurrence or not of such inhabitation may be connected with the course of the DO (Cardium) transgression. In the river area, far from marine influence, the Cardium transgression has not yet been

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[77] Vogel & Waterbolk 1972, 87-88, 92-94.

[78] Vogel & Waterbolk 1972, 95 (Hoogkarspel); 1967, 134 (Zwaagdijk; *cf.* also Bakker & Brandt 1966, 178 and Bakker & Metz 1967, 214); 1963, 191 (others). See also De Vries & Barendsen 1958, 1141 (Grootebroek) and Waterbolk 1964[a], 114, 121.

identified geologically, not even in the recent and very detailed mapping of the region between Andelst, Zetten and Dodewaard by Havinga [79]. The only marked stream displacements of the otherwise conservative river courses have taken place there between Havinga's deposits 3 and 4 (C IV and older) on the one hand, and 2 and 1 (D I and later) on the other. There is no question of a sedimentation phase in the period between 3 and 2. This was once again strikingly illustrated by the excavations at Dodewaard, where VBB and DKS remains occurred at the same level. In the western river area (the "river clay/wood peat area"), there is hardly any trace of deposits from the D O transgression phase. Verbraeck [80] notes only some thin and local clay deposits, indicating some flooding in quiet circumstances. The same picture is provided by the excavation at Molenaarsgraaf, where at about 1500 B.C. renewed flooding occurred through the already half silted-up break-through channel.

Nearer to the coast, within the area of the marine sedimentation, deposits from this transgression period occur mainly in Westfrisia and the IJsselmeer district. The eastern parts of Westfrisia were built up relatively high at the end of the D O transgression and protected against further marine influence, so that renewed inhabitation was possible there soon after the Westfrisian II sedimentation had finished. The barrows on these deposits lie at almost the same level as the Bell Beaker settlement at Oostwoud. Later compaction has, however, strongly influenced the original height of the bases of the barrows [81].

Near the wide tidal inlets and in the areas where Dunkirk O sedimentation remained incomplete, such as those behind the inlet at Egmond and the "Oer Y" [82], behind the Rhine mouth and at the Maas estuary, marine influence persisted for a longer period. Generally D O deposits in these regions were covered with peat, the base of which usually gives ^{14}C dates of 1100-1000 B.C. In such, less highly built up regions, this beginning of the growth of peat coincides with the continuation of the DKS inhabitation elsewhere.

From the above account of sedimentation and inhabitation the Dunkirk O transgression seems to be mainly a coastal phenomenon. This contrasts with the C IV^b transgression, which was much more widespread and is also clearly recognized in the river area. This will be discussed in more detail when we come to deal with the Schoonrewoerd stream ridge in Part II. The occurrence of this C IV^b transgression must be attributed to generally operative climatological changes. The DO transgression phase might be caused by a climatic change only in the coastal regions (as indicated in the dune investigations) and not in the catchment areas of Rhine and Meuse.

1.4.5.4. *The Late Bronze Age*

It is difficult to determine when the Middle Bronze Age inhabitation (DKS or ELP) ended, especially since domestic assemblages from the Late Bronze Age are hardly known in this country. In the Northern Netherlands the Elp settlement continued until about 800 B.C., with

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[79] Havinga 1969.

[80] Verbraeck 1970.

[81] See p. 55.

[82] Pons & Wiggers 1960, fig. 27, Zagwijn 1971.

in the last centuries a co-existence of late *Kümmerkeramik* and early urnfield material [83]. South of the river Meuse Late Bronze Age settlements are unknown. In general we notice that the Late Bronze Age in this country is only represented by the bronzes and the early urnfields, while settlements are lacking. But in the last few years new discoveries in the Western Netherlands have thrown some light on this period. Van Regteren Altena published recently three find groups from Velsen [84] (that is: from the coastal barriers), dated to the Late Bronze Age partly on the evidence of the occurrence of biconical pots. In West Frisia the end of the occupation falls in the beginning of the Iron Age. A well recognizable new type of pottery is dated there at Hoogkarspel site I at about 700 B.C. [85]. In our opinion it is, however, quite possible that it was already in use in the Late Bronze Age, and that it forms the direct continuation of the "Middle Bronze Age" finds. In the western river area we can distinguish a certain type of pottery that for various reasons must be dated to the Late Bronze Age. It is known from four sites, which means a sharp decrease of the inhabitation density. In the Alblasserwaard the occupation comes to an end about 800 B.C. [86]. In the Iron Age the prehistoric inhabitants established their settlements farther to the east, in the Vijfheerenlanden. The Alblasserwaard will have been uninhabitable at that time due to the extensive peat formation.

Evidently it is difficult to summarize the Late Bronze Age inhabitation. It seems, however, that the Western Netherlands were not uninhabited, but at least sparsely occupied and in various regions. Moreover we presume (also in the light of the earliest Iron Age occupation) a break at least in the most vulnerable areas, at the end of the Late Bronze Age. This will be discussed further in section 1.5.

1.4.5.5. *The character of the inhabitation*

Although our knowledge of HVS settlements is incomplete, the excavations at Monster, Velsen and Vogelenzang provide sufficient information to conclude to a settled way of life. Plough marks of the *ard*, a few postholes and remains of slaughtered animals support this conclusion.

We have recently become much better informed about the Middle Bronze Age. In West Frisia barrows and flat graves, accumulations of domestic refuse, plough marks and a few house plans point unmistakably to a well settled farming community. The extensive permanent settlements consisted of a few widely separated large farms of the Elp type. The recent excavations at Zijderveld and Dodewaard have also thrown much light on the inhabitation of the river area. The extensive settlement at Zijderveld consisted of a large number of round huts and numerous fences. At Dodewaard Elp houses and round huts occur together. Bones and pollen analyses will give a clear indication of the subsistence economy.

1.4.5.6. *Isolated finds*

Bronze implements are fairly rare in the Western Netherlands and are mostly limited to

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[83] Waterbolk 1964[a].

[84] Van Regteren Altena in Jelgersma *et al.* 1970.

[85] Reliable ^{14}C-dates are: GrN 5051,730 ± 50 B.C., GrN 5048,700 ± 45 B.C. (Vogel & Waterbolk 1972, 95-96).

[86] Based on, first, the pollendiagram Molenaarsgraaf and the ^{14}C date GrN 5264, 760 ± 35 B.C. in that diagram, second, the ^{14}C date GrN 6252, 865 ± 55 B.C. indicating the end of the settlement Ottoland-Oosteind. *Cf.* p. 114 f.

the coastal barriers. All periods are represented proportionally, indicating a continuity of inhabitation in a general sense that was not easy to distinguish from the settlement finds. An explanation of the distribution lies in the difficulties of discovering the finds and recognizing them: bronze implements are unmistakable, even to a layman. Today the Older Dunes on the coastal barriers are intensively employed for building, bulb cultivation and other horticulture, whereas the meadows and orchards in the river area and West Frisia are much less favourable to the discovery of archaeological objects. The three bronzes found in West Frisia were all found in horticultural areas in the eastern part. Notable is also the small concentration of (late) bronzes, mostly socketed axes, found in the eastern part of the Betuwe.

In addition to the bronzes the hammer-axes probably belong as a group in the period 1600-700 B.C. These axes, however, can hardly be dated more accurately, except for the Sijbekarspel type that must be placed in the end of this period.

1.4.6. Unreliable and insufficiently dated Finds

The group of finds with unreliable find circumstances, and finds which cannot be dated well enough for our purpose (which we omitted from our discussion above) do not provide us with any essential complementary information. The first group comprises the finds said to be dredged up from the rivers, especially the Meuse and Waal east of Gorinchem, which found their way to the museums via antique dealers. This group comprises firstly at least 25 stone and flint axes, 24 bronzes, 7 antler implements and 2 "various" implements, in addition to a large group of finds from the Waal near Nijmegen. These finds wrongly tend to stress the importance of the eastern river area on the distribution maps.

Apart from the above-mentioned finds we collected at least 27 antler implements from the whole area studied, not including those found at Spoolde. Some finds dredged up in Zeeland and a few pieces found at Krimpen aan de IJssel are interesting. To some extent they fill the blank parts of the map. Among the more than 25 stone axes not recorded on the maps a small axe from Leimuiden [87] deserves special comment on account of the location. Finally, about ten terrains may be mentioned where only a few pieces of worked flint were found. The distribution of this second group of finds, about 60 in number, as a whole only intensifies the distribution patterns, particularly those given on the maps at figs. 7 and 8, where to a large extent the finds probably belong. Only after a special study of the stone and antler axes in this country may it be possible in the future to insert these finds into one or more of the maps.

1.4.7. Some Conclusions

1.4.7.1. *The choice of the terrains for settlement*

We can summarize that the settlements are restricted to the following deposits:

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[87] RMO inventory no. h 1964/12. 1.

— outcrops of the Late Glacial/Early Holocene subsoil (the *donken*)
— the coastal barriers and the Older Dunes on them
— the highest marine, estuarine and fluviatile deposits, *i.e.*
  a) natural levees of creeks in the marine tidal deposits.
  b) natural levees of estuarine creeks.
  c) inversion levees and sand fillings of former river courses (stream ridges) in the peat area.
  d) natural levees in the river clay area.

It is clear that the prehistoric inhabitants in the Western Netherlands have always chosen their settlement sites very carefully. In each period there were extensive regions which were difficult of access or entirely inaccesible, against regions of limited extent constituting the inhabitable area. Within these last regions lay the terrains which were suitable to establish the settlements.

In this respect two regions must be opposed to each other: the coastal barriers, and the area behind them with marine and fluviatile sedimentation and peat formation. The coastal barriers offered good possibilities for occupation when vegetation fixed the sand. These must have been periods with a relatively high ground water table, which means a somewhat higher annual precipitation. In the sedimentation area the most important condition was a restricted inconvenience by water, which meant good drainage and adequate height. Good drainage is necessary to guarantee a reasonable degree of dryness and practicability, particularly after rainfall or flooding. Sufficient height is necessary to remain free from too frequent flooding. The local Mean High Water (MHW) will have been the lowest level that met this requirement.

In the surroundings of the settlements there were often areas which were less suitable for permanent settlement (salt marshes, shore flats, the lower parts of stream ridges and natural levees *etc.*) but usable for the grazing of cattle when reasonably drained. Their presence certainly played a part in the choice of the settlement site. The extensive tidal flats, the peaty salt marshes and the peat moors will have been used only for hunting and fishing.

If the above-discussed requirements are met the accessiblility or isolation of the otherwise suitable land is a further important point. It is clear that in considering these features we must think in different scales: regional and local. In the first case we are concerned with the accessibility of whole landscapes, such as the coastal barrier area (or sections of it) or the *donken* region. In the second case it is a matter of choice within such a region: whether or not a particular dune ridge or *donk* was chosen for occupation. Then, at the same time, other, previously noted factors played a part: sufficient arable land and pasture in the vicinity, enough fresh water, shelter and naturally also drainage and height.

1.4.7.2. *Distribution patterns*

The distribution of finds (and therefore of occupation) shows a high degree of consistency over the various phases of inhabitation.

The continuous inhabitation of the Older Dunes is strikingly shown. The relatively large number of finds is a consequence of the intensive use made of the ground nowadays. The Zeeland coast and the coastal strip north of Egmond would have shown a similar picture, but nearly all evidence is lost through erosion or is inaccessible by being covered with the Younger Dunes.

Behind the coastal barriers lay in the Atlantic and the Early Subboreal a broad belt of tidal flats and salt marshes, of which it is certain that the salt marshes were used for pasture. Only in exceptionally favourable circumstances they were inhabitable. Along the eastern border of these marshes a great peat bog was situated extending up to the high Pleistocene sands. Periodically this uninhabited bog stretched out over the tidal marshes. In this peat area the active river courses and the levees of former ones served as water and land routes of communication between the coast and the high sandy hinterland. There and on the outcropping tops of the Early Holocene dunes are the places where we find the settlements. This pattern was preserved best between Rotterdam and the Betuwe. Between the present IJssel estuary and the tidal inlet near Egmond no coherent picture exists because of the severe later erosion. Along the river Old Rhine, which was active until historical times, the chance of finding traces of early occupation has been much reduced by erosion and covering by later sediments. It is only an occasional find that suggests there too a communication route, perhaps of less importance. In the Scheldt region there is almost no evidence at all, as a result of the later geological events.

These communication routes were the lines along which both the northern and the southern cultures could reach the coastal regions. On the other hand, these are also the routes along which the overseas cultural contacts of the coastal strip could find their way inland.

1.4.7.3. *The character of the inhabitation*

The character of the inhabitation, where it can be determined (*i.e.* from the VL Culture onward), is that of permanently occupied settlements, generally small and consisting of one or several houses. It is only in the Middle Bronze Age that the settlements are of greater extent; this will only be partly the result of the longer duration of the occupation. It seems there was a real increase in population. The subsistence economy has been established in only a limited number of cases, and seems to have been excellently adapted to the environmental possibilities. In the estuarine area hunting and fishing for migratory fish (certainly sturgeon and perhaps salmon) where most common. Among the fresh-water peat bogs there was sufficient agricultural land for the small number of people living there to concentrate on cattle raising and arable farming. The very small amount of hunting was compensated for by fishing in the well-stocked fresh water. On the coastal barriers and salt marshes there was likewise a preponderance of cattle raising over hunting. Large areas of natural pasture land were available there.

1.4.7.4. *The coastal barriers*

A further theme for discussion is the relationship of the finds in the coastal barrier area to the separate coastal barrier belts, and the extent to which these finds may be used to determine the age of these barriers. Van der Meer and Bennema [88] have studied this problem. From the later works of Van Straaten and Jelgersma, among others [89], it appears that it is not the

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[88] Van der Meer 1952, Bennema 1954 esp. 24-29.

[89] Van Straaten 1965, Jelgersma *et al.* 1970. In the latter publication the best map of the coastal barriers is published. For additional maps we name: Buttler 1963[c], Glasbergen *et al.* 1967, Pannekoek (ed.) 1956, Jelgersma & Van Regteren Altena 1969.

coastal barriers themselves, but the Older Dunes which were blown up on them immediately after their formation, that are of relevance here. These dunes do, however, seem to follow the pattern of the coastal barriers below them.

A dating based on archaeological finds, which is always a *terminus ante quem*, is thus less accurate than was formerly imagined. Only the finds made on the coastal barrier surface itself and under the dunes are reliable for dating purposes. Very few of such finds are, however, known. One such a find is perhaps the stone axe of Heemstede, which has already been commented upon [90]. In our opinion, however, the other archaeological material can be used as well for dating, if we are aware of the above-mentioned limitations.

Almost the entire coastal barrier complex, in so far as it has remained intact, has been dated as belonging to the phases Calais III and IV [91], as is shown by the detailed investigations of the dunes carried out in recent years. Immediately after and even during the formation of a coastal barrier the Older Dunes were formed upon it. There are repeatedly aeolic deposits in dry periods with a low ground water table, separated by humic or peaty vegetation layers from periods with a high ground water table. This, however, can only temporarily have hindered inhabitation, or made it difficult. Especially when the growth of peat once occurred in the shore flats west of the coastal barrier concerned (this means that the next coastal barrier was formed at that moment), the supply of sand was largely cut off and caused the formation of dunes to be of only local significance.

It is noteworthy that a general westward shift of finds in the course of time can be determined from the pictures provided by the archaeological maps. The explanation of this can be that the more westward the coastal barriers occur the more recent they are and the later did the first formation of the dunes end. Another factor is of course the relatively low position of the older coastal barriers. It is equally remarkable that the oldest settlements on the various coastal barrier belts (*i.e.* series of Older Dunes) are generally contemporary with the beginning of the growth of peat in the shore flats west of them.

Although it is difficult to get a direct absolute date, it seems, however, possible to get an impression of the relative age of the various coastal barrier belts by means of the archaeological finds.

Other evidence, such as the height of the shore flats and the beginning of peat formation there have also been used for datings. As the subsoil of the shore flats consists also of dune sand, as Jelgersma *et al.* show, we cannot use the level of the surface of the sand in such flats directly for dating purposes, by comparing it with the curve of the relative rise of sea-level. Yet there certainly occurs a gradual rise in level of this sand surface in a seaward direction and, consequently, a later beginning of the peat formation. There is a possible link between the height of the aeolic sand deposit in these shore flats and the original water levels, which has led to

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[90] Louwe Kooijmans 1969; this paper, note 53.

[91] Jelgersma *et al.* 1970. As long as no convincing proof is given for these datings, we prefer to defend the older conception (*viz.* that of Van der Meer and Bennema), which is supported by enough data and theoretical considerations. But there are two ^{14}C dates that give a direct dating to the coastal barriers (shells in life situation from the top of the coastal barrier sand). Both come from the Velsen area and point to a slightly older date than is proposed here. One is published: Jelgersma *et al.* 1970, 109 (note): GrN 5853, 3845 $\pm$ 45 B.P. (1895 B.C.). The other dates the outermost coastal barrier at IJmuiden to Dunkirk O (pers. comm. Mr J. F. van Regteren Altena).

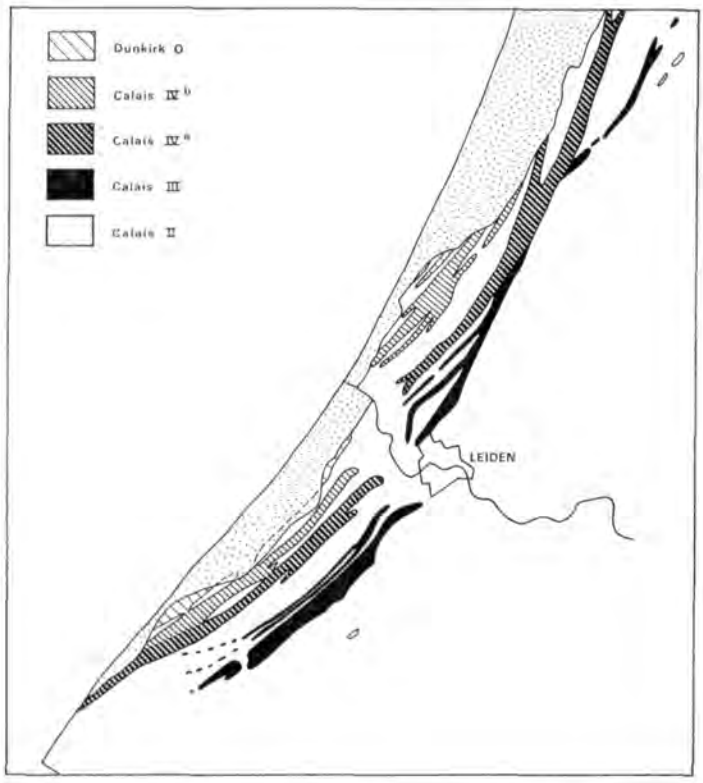

Fig. 9. The coastal barriers between Hook of Holland and Haarlem, differentiated as proposed in the text and as documented in table 3.
Scale 1:500,000.

TABLE 3

Coastal barriers
north and south of the Rhine
Correlation with transgression phases

Sequence	Situation	Arch. finds*	Peat in the strand flat**		Supposed correlation with transgr. phase
			^{14}C date	Depth	
	North of the river Rhine				
5	under the Younger Dunes				D I
4	Langeveld	(EBA) *DKS*			D O
3	Noordwijkerhout / De Zilk	(EBA)	1050	—0.80	C IV^b
2	Voorhout / Lisse / Haarlem	(VL) *BB*	1500	—2.00/1.65	C IV^a
1	Spaarnwoude / Oegstgeest	(pre VL) (VL)	2300	—2.60	C III
0	near the IJ				C II?
	South of the river Rhine				
5	under the Younger Dunes				D I
4	Scheveningen		450	—0.50	D O
3	Wassenaar / Kijkduin	*DKS*	1250	—0.50	C IV^b
2	Den Deil / Monster	(VL) *BB*	1950	—1.65	C IV^a
1	Voorschoten / Voorburg	*VL*	2200/2000	—3.00/2.75	C III
0	Nootdorp				C II?

* Settlements in italics. Isolated finds in brackets.

** The base of the peat in the strand flat to the west of the coastal barrier belt concerned.

the above-mentioned effect. In any case, we are here concerned with a clear chronometer, which provides us at the same time with at least a *terminus ante quem.*

The level of the tops of the coastal barriers themselves also tells us something about their age. For in our view there must be a fixed relationship to a certain sea-level lying considerably above MHW and perhaps corresponding approximately with Mean High Water Springs. Jelgersma *et al.* show in fact that the coastal barriers below the Older Dunes become successively higher seaward. Four coastal barriers, with their highest parts at —1 m. NAP in the east and +1 m. NAP in the west, would all have been formed during Calais IV. It seems to me to be more in accordance with the data given above to attribute the more westerly coastal barriers to the phases D O and D I (a and b). It is even questionable whether the second coastal barrier belt must be dated as C III and not as C IV[a]; for there are no proofs, that the coast-line lay further westward during the Vlaardingen Culture, except for the grinding stone from The Hague, and even that find, in our view, cannot be closely dated.

In a scheme (table 3) we have assembled the available information which is important for dating the coastal barriers south and north of the Rhine, and indicated what we consider to be the most probable ages for the individual coastal barrier belts. This picture corresponds at the same time closely with Bennema's conclusions [92]. He presumed that the formation of the individual coastal barrier belts occurred primarily during transgression phases, and that the shore flats generally originated from regression phases. Hageman [93] gave an explanation for the formation of the coastal barrier complex as a whole. He says there were two operative factors: a diminishing rate of rise in sea-level and an increasing resistance offered by the sand accumulating along the coast.

The turning point, when a landward withdrawal of the coast-line changes to a seaward advance, occurs between 3000 and 2700 B.C., at the end of Calais III, and perhaps even earlier when the formation of the coastal barriers, remains of which were found near Nootdorp and near the IJ, are taken into account. This moment therefore occurs well before the bend in our curve for the rise of sea-level (at least 9 centuries earlier, *cf.* fig. 14) [94]. This turning point must therefore have been caused mainly by balancing around an equilibrium, or a change in the pattern of currents. It cannot be attributed to a sudden change in the rate of rise of sea-level. Yet it is clear that the much smaller rise after 1800 B.C. was in favour of a westward shift of the coastline.

When we consider the period with a generally seaward advancing coast-line it must have been precisely during transgression phases that the separate coastal barriers (or -belts) were

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[92] Bennema 1954, 28-29. The opinion of Van der Meer that the coastal barriers got their form in the "consolidation period at the beginning of a regression", also comes to the same thing. For the genesis of the coastal barrier complex as a whole see Hageman 1969 and this paper p. 7.

[93] Hageman 1969, 385 f.

[94] Also according to the mentioned equilibrium of Hageman, the coastal barriers would have been formed in transgression phases. The equilibrium was shifted then in favour of the landward coast-line displacement. This signifies a phase with a stationary or even a slightly withdrawing coast. In a regression phase with a stationary or slightly rising sea-level, coastal accretion is possible much more easy. When, however, the general tendency shows an eastward shift, as in the Atlantic, it will have been just the regression phases that were characterized by a more stationary coast. So the oldest barrier remains (Nootdorp (Schans & Van der Knaap, 1956) and near the IJ-polders (Pons & Wiggers 1959/'60, figs. 17, 27)) must be dated C II/III rather than C II.

formed, according to the above-mentioned equilibrium suggested by Hageman. For it was then that the relatively rapid rise in sea-level (or at least the greater destructive capacity of the sea) will have caused a retardation or even a stop of the seaward coast-line displacement. On the other hand, it was during a regression phase, during a stationary or slightly rising sea-level, that coastal sedimentation grew and a broad coastal plain was formed.

Apart from the question of the absolute dating, the comparison of the data given in table 3 reveals a correlation of the coastal barriers on both sides of the Rhine estuary. This picture (fig. 9) agrees well with the correlations by Van der Meer and Bennema. The shift at the Rhine estuary has already been recognized and explained by Van Straaten [95].

1.5. AN OUTLINE OF INHABITATION IN THE IRON AGE AND LATER

Although our main interest lies in the Bronze Age and Neolithic, it is useful to give an outline of our knowledge on the later occupation sequence and its relation to the geological events [96]. The wider perspective contributes to a better understanding of the older data and events, since no fundamental changes in the relation men-natural environment occurred before *c.* A.D. 1000, the start of the embankments.

1.5.1. The transition Bronze Age/Iron Age

Inhabitation from the beginning of the Iron Age appears to occur on widely dispersed points in the Western Netherlands, but it remains obscure whether this is a continuation of the previous Bronze Age inhabitation, or whether both were separated by an inhabitation gap.

Continuity may be assumed for sites like Langeveld near Noordwijkerhout (coastal barriers) [97], Hoogkarspel (West Frisia) [98] and Noordeloos (western river area) [99]. It is not surprising that the inhabitation on the coastal barriers was continuous; this has already been suggested by the isolated bronzes. The interruption of inhabitation in both low-lying areas seems to be due to too frequent flooding and/or peat growth, while in the meantime no deposits high enough to establish the settlements were formed [100].

On the other hand sites are known where new settlements were established, as at Holy Polder in the estuarine area, Culemborg in the western river area, and at nearby Zijderveld, where the Iron Age settlement was separated from the previous Middle Bronze Age occupation by a hiatus [101].

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[95] Van Straaten 1965, 44.

[96] Here only a sketchy outline is given, based on comprehensive literature, especially: Edelman 1953, Van Giffen 1954[a], Bennema 1954, Modderman 1955[d], Pons 1957, J. P. Bakker 1954, 1958, Van Hoorn 1967, Van Regteren Altena in: Jelgersma *et al.* 1970. See also notes 9 and 16 for further literature.

[97] De Raaf 1959, 1966.

[98] Bakker 1959, 1966[a], 1966[b], — & Brandt 1966, — & Metz 1967, — *et al.* 1968. *Cf.* also note 85.

[99] Unpublished, see App. I, no. IV-20; App. III, no. 16.

[100] See p. 35 and p. 116.

[101] Holy Polder: Havelaar 1970 and pers. comm. of Mr J. F. van Regteren Altena; Zijderveld: J. de Jong 1970/'71,

In the Northern Netherlands the beginning of the inhabitation of the salt marshes took place in the same period (about 600 B.C.) during the Zijen Culture characterized by the Ruinen-Wommels I pottery [102].

Generalizing the above data, there appear to be enough arguments to accept an interruption of the occupation in the regions outside the coastal barriers between 900 and 600 B.C. coinciding with a transgression phase (sedimentation phase) that cannot be another than the phase Dunkirk I^a. Only in West Frisia and in the Alblasserwaard there seem to have been at least locally possibilities for a continuous occupation. Much study of the period 1000-500 B.C. has to be done, however, before a more accurate statement can be made.

1.5.2. The Iron Age [103]

Our knowledge of Iron Age inhabitation allows only a rough or incomplete outline. A more detailed account must wait until more data, especially from the period 500-200 B.C. are available.

During the Iron Age the Dunkirk I transgression phase occurred. It is dated between 600 and 200 B.C., though it might have started earlier. Pons and Wiggers [104] distinguished two subphases: the pre-Roman transgressions I and II, named here Dunkirk I^a and I^b.

Recent investigations of the Older Dunes revealed that three vegetation levels (peat layers or soil profiles) were formed there during the transgression phase Dunkirk I [105]. The oldest level (Bl, 750-600 B.C.) represents Dunkirk I^a. The second level (B2) is dated 500-300 B.C., the third and highest level (B3, 300-150) can be linked with Dunkirk I^b. The existence of three vegetation levels is a first indication that the Dunkirk I transgression might show a tripartition, and that either the phase I^a or I^b might be divided in two subphases in the future.

From the Early Iron Age date some sites with Ruinen-Wommels I pottery, all in North Holland and three of them on the coastal barriers (Zandvoort, Velsen, Limmen, Den Burg-Texel) [106]. The Spanjaardsbergje near Santpoort was occupied from RW II times onward [107]. Behind the coastline the surface of the peat and the levees of creeks were settled in the Zaanstreek near Assendelft and in the Westland near Vlaardingen (Holy Polder) in Ha C/D times [108]. Other settlements as Bosch en Gasthuispolder near Leiden (on small creek levees) and Escamp Polder near Loosduinen (on remains of coastal barriers) are slightly later. The

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R. S. Hulst 1966 and pers. comm.; Culemborg: excavation by the author (Louwe Kooijmans 1966[b]) ;^{14}C dates: Vogel & Waterbolk 1972, this paper Appendix IV.

[102] Waterbolk 1962, 1970, Boersma (ed.) 1970.

[103] Much of my insight into this period has been formed during the various times I exchanged views with Mr J. F. van Regteren Altena, Amersfoort, for which I am greatly indebted to him.

[104] Pons & Wiggers 1960, 34-38. *Cf.* also Pons in: Stichting voor Bodemkartering (ed.) 1965, and Bennema 1954, 72, fig. 17.

[105] Jelgersma *et al.* 1970, esp. fig. 6 and 32; Jelgersma & Van Regteren Altena 1969.

[106] Van Regteren Altena in: Jelgersma *et al.* 1970; Van Regteren Altena 1969.

[107] Modderman 1960/'61.

[108] Holy Polder: Havelaar 1970 and pers. comm. Mr J. F. van Regteren Altena; Assendelft: Hallewas 1971, Helderman 1971.

Iron Age settlement at Vlaardingen Broekpolder has a ^{14}C-date: GrN 1951 370 $\pm$ 70 B.C. [109] In the western part of the river clay area we have mapped a widespread Iron Age occupation (*Cf.* fig. 31). One of the sites at Culemborg is ^{14}C-dated from *c.* 750 to *c.* 200 B.C. and might have been occupied without interruptions. Another site (Zijderveld) is contemporaneous and also most of the other (not excavated) sites might date from the same period [110]. In the river clay area proper, farther to the east, evidence of the Early Iron Age has not yet come to light, but among the finds of the old excavation at Ressen a group of Early La Tène "Marne" pottery has been recognized recently [111].

A sparsely but widely distributed Early Iron Age inhabitation seems to be the best conclusion. It follows after the early phase of the Dunkirk I transgression phase, when some of the inhabited creek levees will have been formed.

A second well defined period with widespread inhabitation started in the last century before Christ, at the end of the Dunkirk I^{b} phase. In this period two types of pottery were in use. One is a richly decorated ware, often called "Celtic", showing southern relations with the Belgian Late La Panne pottery. The other, the *streepband* pottery, is of Frisian origin and might reflect an expansion of the Frisians to the West. *Streepband* pottery is found as far south as the Hague, the "Celtic" pottery as far north as the Zaanstreek [112].

The "native" ware of the *woerden* [113] in the river clay area shows a relationship to the "Celtic" pottery and might belong partly to a pre-Roman occupation. This supposition is supported by the relatively large number of La Tène glass arm ring fragments, all of the later types from the last century B.C. found on these sites [114]. Perhaps we have here an archaeological proof of the well-known story that the *Batavi* occupied the *Insula Batavorum* shortly before the arrival of the Romans, coming down the river Rhine [115]. A very instructive sequence has been found at Haren (prov. North Brabant) where a back swamp clay deposit was intercalated between two archaeological refuse layers, the lower with Marne pottery, the upper with some late La Tène glass arm ring fragments. The clay layer is thus dated between 400 and 100 B.C. or Dunkirk I^{b} [116].

In the *terpen* district the inhabitants were troubled by renewed flooding soon after the first settlements (the *Flachsiedlungen*) were established. It was there that for the first time the people did not retreat because of deteriorating conditions, but defended themselves by the raising of artificial hills. These first *terpen* or *wierden* were thrown up about 500 B.C. [117]. More favourable conditions seem to have returned about 200 B.C. and seem to have lasted

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[109] Modderman 1952, Bennema 1954, 45 f. (Leiden, Loosduinen). Mr J. F. van Regteren Altena informed me that he identified RW II and III sherds among the material of these sites; Vogel & Waterbolk 1963, 193 (Vlaardingen).

[110] The ^{14}C dates of Zijderveld range from 715 to 200 B. C. (Vogel & Waterbolk 1972, 92-93). The ^{14}C dates of Culemborg are listed in Appendix IV.

[111] Braat 1949, pers. comm. of Mr J. H. F. Bloemers and Mr R. S. Hulst, Amersfoort, who study these finds anew.

[112] Van Regteren Altena in Jelgersma *et al.* 1970, Sarfatij 1971, 38 f., Helderman 1971.

[113] *Woerden* are Roman settlement soils, up to 1 m. thick, generally forming an extensive and marked low hill in the flat river clay area.

[114] Peddemors 1971. The arm ring fragments are dated expecially to the second half of this century.

[115] Byvanck 1943, 49, citing Tacitus, *Germania* 29, *Historiae* IV 12 and 15.

[116] Pers. comm. Dr G. J. Verwers, Leiden.

[117] *Cf.* note 102.

until the end of Roman times. So the western and the northern sequences appear to correspond in broad outline, differing mainly in the slightly earlier start of D I^b in the north. We must, however, be aware that our model of the course of events might be too rough and might obscure finer details, as for instance possibly a finer subdivision of Dunkirk I.

1.5.3. The Roman Period

Remarkably favourable conditions for inhabitation were available during Roman times, as is seen by the widespread settlement, which was only ended by the collapse of Roman power in this country half way through the third century. It was at the same time a period when inhabitation conditions deteriorated as a result of renewed transgressional activity. Although in our opinion there is no need to doubt the existence of this transgression phase, recently, because of a more critical attitude towards the datings and because of a number of new finds, some uncertainty has arisen as to whether this D II transgression was in fact so widespread as was at first assumed. It is sure that a number of phenomena dated as D II must be assigned to a later period [118].

1.5.4. The Merovingian Period

In Merovingian times (5th - 7th century) only a few occupation centres are known on the coastal barriers, namely in Zeeland near Domburg and at Rijnsburg situated on the estuary of the Rhine. The fifth and sixth centuries form a marked interruption of the inhabitation, even of the coastal barriers [119]. In the river clay area (the Betuwe) only a relatively small number of settlements of this period have been mapped. Most of the sites are moreover only based on a few ill-defined sherds among the much greater quantity of Roman and mediaeval sherds. Some doubtless Frankish finds are, however, known, indicating at least a scanty population. The western river area, the estuarine area and self-evidently the peat areas too have yielded no finds whatsoever. Especially for this period we must, however, realize that dates are based on imported material only and that real occupation can escape our observation by the lack of imports in a certain period. In the *terpen* district the centuries after A.D. 200 are marked by increased flooding, the further extension of the salt marshes and the abandon ment and subsequent covering with clay of a series of settlements.

In general everywhere in the Holocene sedimentation area there is a marked occupation hiatus in Merovingian times, exactly corresponding with the transgression phase D II. The beginning of this interruption may have a political cause, the evidence may be seriously influenced by the lack of imports; this can only modifie our statement in degree, not in essence.

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[118] Sarfatij 1971, 171 f.; Jelgersma *et al.* 1970, 144.

[119] Sarfatij 1971; Jelgersma *et al.* 1970, 144.

1.5.5. The Carolingian Period

In Carolingian times a new colonization of the low-lying regions appears, namely in the Betuwe, in Zeeland, on the coastal barriers and in West Frisia. In the *terpen* district new settlements were established on the fresh salt marshes: the third generation in the *terpen* sequence [120]. It is only in this district that the short lived D III^a ("post-Carolingian" or "Ottonian") transgression is recognizable in the inhabitation history: it is the fourth period of salt marsh formation, the last before the construction of the sea dikes. The occupation extended to these new salt marshes already about A.D. 1000, when the *Pingsdorf* pottery came into use.

1.5.6. From the later Middle Ages until Recent Times

The period of the 11th and 12th centuries shows a further increase and extension of inhabitation. Everywhere the settlements became more widespread, even over the peat areas, which in the so-called *Cope* reclamations were within a few centuries entirely parcelled out [121].

At the same time it is the period when dikes were first constructed on a large scale as a more active defence against floods. The transgression phases express themselves from now on as periods of frequent and catastrophic dike-breaching. Such a period occurs in the 14th to the 16th centuries, and a second possibly in our own time [122]. To what extent the frequency of dike breaches is a measure of aggression by the sea is, however, a matter for debate, The quality of the maintenance of the dikes also plays a part. Dike building even leads to more and more serious flooding, because the water storage capacity of the region is reduced [123]. In historic times we see how the inhabitants of the low areas, after the reclamation in a quiet period, persisted in the occupation of their land below sea-level, in spite of the strains and dangers involved.

1.6. INHABITATION AND THE TRANSGRESSION PHASES

A diagrammatic general view of the evidence discussed above appears in fig. 10. Here the facts about inhabitation in each district or area have been brought together, alongside the

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[120] See esp. Haarnagel 1969 and Van Hoorn 1967, further the lit. in note 102.

[121] *Cf.* Van der Linden 1956, Van Regteren Altena in Jelgersma *et al.* 1970, 144 f.

[122] After completion of our manuscript Mrs Dr Gottschalk published the first part (until A.D. 1400) of a very detailed and critical study on storm floods and river floods in the Western Netherlands (Gottschalk 1971). In summary we may learn the following from her book.

Although before A.D. 1000 only one storm flood can be defined with certainty (on 26th Dec. 838) there must have been more in this period. The 11th and the first half of the 12th century seem to have been a quiet period. The fact that no storm floods are known from this period cannot be ascribed to a lack of written sources. During the period 1150-1300 three storm floods are identified with certainty for every half century. After that time there is a marked increase to 12 or 14 storm floods in the 13th century. The quiet period of the 11th and 12th centuries is a period of extensive reclamation and a spread of inhabitation all over the Western Netherlands. Are the following storm floods the result of the dike building all over the country or do they reflect a new transgression phase (D III^a) ?

[123] *Cf.* Zonneveld 1960, part A, 16 f.; Pons in Van Regteren Altena *et al.* 1962/'63, 104.

currently used division of the geologically determined transgression and regression phases. The scheme forms a supplement to similar diagrams made earlier by Bennema and Pons [124] to show the periodicity of the transgression cycles in the Western Netherlands.

The diagram provides a three-dimensional picture (distribution and time) of the information about inhabitation in the Western Netherlands. The maps (figs. 2, 5, 7, 8) may be viewed as sections of a limited duration, showing distribution in more detail.

Information about the period before the VL Culture is incidental only. The peat region between the marine tidal areas and the high sand area seems, however, to have been regularly inhabited. Knowledge rests almost entirely upon finds on the (partly covered) tops of dunes. The chances of discovering settlements on stream ridges are very small since they are covered by an appreciable amount of younger deposits. The limited number of find places and finds does not permit of any comment on the periodicity of inhabitation. The regular division over the time-scale is more noticeable than concentrations in particular periods. If it is possible to speak of any relationship, it is that of inhabitation to the regression phases between C I and C II, C II and C III, C III and C IV^{a}. This would link up with the picture of the later inhabitation. Future evidence will show whether this relationship is apparent or real.

The turning point in the geological development of the coast, as new coastal barriers were formed seawards of the earlier ones and the barriers became more and more closed, is at the same time a turning point in our knowledge of its inhabitation. The preserved coastal barriers as a whole were continuously inhabited ever since the VL Culture. In the estuarine area behind, an inhabitation periodicity has been determined which was dominated by the transgression and regression phases: C IV^{a}, VL inhabitation, C IV^{b}, VBB/BWB inhabitation, DO, DKS inhabitation.

Something of this periodicity can also be traced in the inhabitation of the coastal barriers. In the VL settlements occupation is also broken off, if somewhat later than in the estuarine region. The VBB/BWB settlements have always been found there upon other terrains, on later coastal barriers situated more westward. Settlements of this phase of inhabitation in their turn are similarly abandoned in the low areas (the western river area and West Frisia) while on the coastal barriers occupation is known to have continued at various places during the HVS and DKS phases. Outside the coastal barriers there is no evidence at all of the presence of HVS remains.

The picture of the DKS inhabitation presents a strong contrast to that of the HVS phase. Large parts of previously uninhabited regions were resettled, especially in the river area. Deposits which had been formed shortly before, such as those in West Frisia, were extensively colonized. There appears to be a clear association between the course of the D O ("Cardium") transgression in the various regions and the course of occupation.

For the later times, beginning with the Late Bronze Age, the sequence is: D I^{a}, Early Iron Age occupation, D I^{b}, *streepband*, "Celtic" and Roman occupation, D II (?), Mediaeval colonization and reclamation, as pointed out earlier. This is the model that fits best the available data. We are, however, sure that there are possibilities to refine this model by means of future research on archaeological sites.

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[124] Bennema 1954, 72, fig. 17; Pons 1957, 36 and 38, figs. 26 and 27.

We are aware that a phasing of inhabitation as described above might to a certain degree be the result of cultural discontinuities or the "like" or "dislike", which a culture can show for a marshy environment. We will, however, not discuss these questions here, but only state, that the possibilities for occupation presented by the region itself, must have been the chief cause in the phasing of the inhabitation. To a certain extent the relationship between regression phases and occupation phases, as shown in fig. 10, is already a proof in itself.

Fig. 10. Schematic representation of the inhabitation of the Western Netherlands, between 4000 B.C. and A.D. 1500.
Composed with the data, mentioned in the text and in the cited literature.
Transgression phases after Hageman 1969, division in subphases (a, b) by the present author.

Legend :

occupation, well-established.

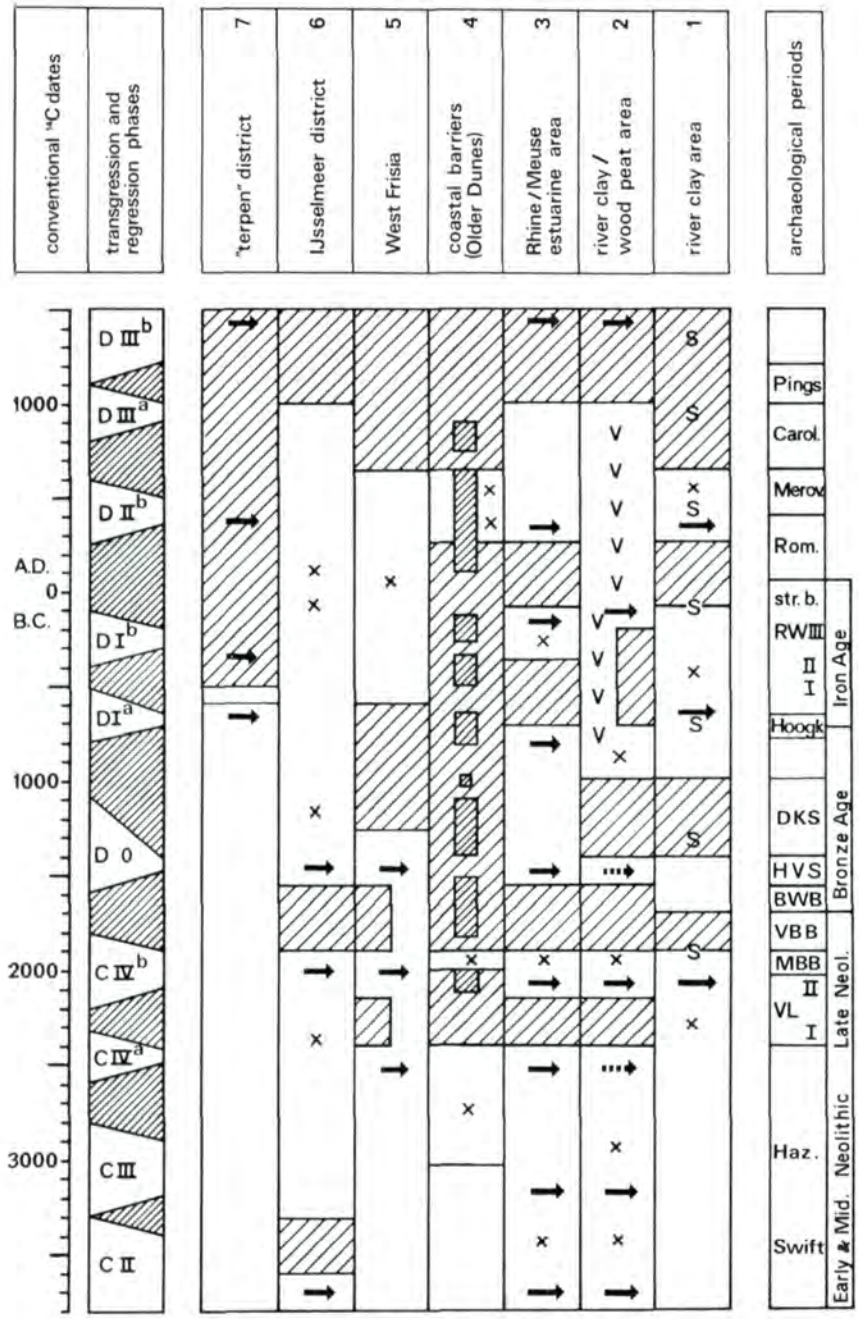
X occupation, scarce evidence.

formation of a peaty layer or soil profile in the Older Dunes, according to Jelgersma *et al.* 1970.

sediment of transgression phase established (in the river clay area after Havinga 1969).

S sedimentation periods in the river clay area, after Pons 1957.

V inhabitation prevented by general peat formation.


conventional 14C dates
transgression and regression phases
"terpen" district 7
IJsselmeer district 6
West Frisia 5
coastal barriers (Older Dunes) 4
Rhine/Meuse estuarine area 3
river clay / wood peat area 2
river clay area 1
archaeological periods
A.D.
B.C.
1000
0
1000
2000
3000
D III b
D III a
D II b
D I b
D I a
D 0
C IV b
C IV a
C III
C II
Pings
Carol.
Merov.
Rom.
str. b.
RW III
II
I
Hoogk.
DKS
HVS
BWB
VBB
MBB
VL II
I
Haz.
Swift
Iron Age
Bronze Age
Late Neol.
Mid. Neolithic
Early

1.7. SEA-LEVEL CHANGES

In a slowly subsiding region such as the Western Netherlands inhabitation is a good natural gauge for measuring former water levels. Archaeological data still have special value because of the sharp, often multiple datings which cannot yet be surpassed by a separate ^{14}C date, certainly not if archaeological and ^{14}C dates can be directly combined. Moreover at archaeological excavations good approximations of water levels existing during the period of inhabitation can often be determined.

1.7.1. Earlier Investigations

The relative rise of the sea-level or the relative subsidence of the land has been the subject of study for long times in the Netherlands. This is very easy to understand, when we realize the consequences of these movements on daily life and the desirability to know the rate and the nature of these movements. In the first instance one was interested in the rate of relative subsidence per century or the mean secular subsidence, especially during the most recent (historical) times [125].

One of the first publications by Van Giffen deals with this subject. He summarizes the findings of a large number of authors who had earlier dealt with the problem of changes in sea-level. He introduces a modern method of reasoning, which has subsequently changed little, by using well-established levels and archaeological dates. From the height of the base levels of the *terpen* it appeared clearly that the relative rise in sea-level since Roman times can have been at most 10 cm. per century and that this very probably was 6 to 7 cm., and that there is no evidence of any drop in sea-level in the Subboreal. Judging by his later publications the problem continued to occupy him [126].

In the first half of this century the knowledge of both the geological structure of the Rhine/Meuse delta and of the forces involved in the relative movements of land and sea became known in detail. A review of the state of research on sea-level changes was given by Escher in 1939 [127]. In the following years the first attempts were made to give a representation in a graph, realizing that the rise of the sea-level is a variable phenomenon. The first curves of Umbgrove and

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[125] This gave rise to two different approaches of the sea-level problem. The one approach is the attempt to measure the present changes by means of the long term registrations of tide gauges and by comparison of precision-levellings. Some serious difficulties are met in the interpretation of the old measurements, because of the displacements and "corrections" of the gauges, and the subsidence of level-marks caused by compaction. But it seems now to be well-established that the sea-level has risen since about 1830 A.D. with a rate of about 12-14 cm. per century, while between 1700 and 1830 the relative sea-level was more or less stable. The mean relative rise of sea-level over the whole period is about 5-6 cm. per century. *Cf.* Van Veen 1945, 1954, Kuenen 1941, 1954, T. Edelman 1954.

The second approach is the one, followed in this paper: the evaluation of the data that are fixed by nature in the level, facies, sequence and human occupation of the Holocene deposits.

[126] Van Giffen 1910, 1916, 1930[b], 1954[a]. By his excavations, especially in West Frisia, Van Giffen made available many new data: Van Giffen 1930[a], 160 and *Taf.* 117; 1944, 1953, 1961.

[127] Escher 1939.

Zwart [128] are both still dominated by the presumed Subboreal fall of the sea-level and handicapped by the lack of good datings. A mile-stone was reached in 1954 when Van Straaten made use of some ^{14}C dates from Velsen and Bennema at the same time assembled the available geological and archaeological evidence [129]. Both resulting curves (for MSL) differed only in detail. Although others [130] had not forgotten the archaeological data, Bennema made use of them in a very intensive and systematic way. It was chiefly for the most recent times (Roman and later) that they could be used. For the older times Bennema had available the observations Van Giffen had made in West Frisia and the results of the investigation at Hekelingen.

Mention should also be made of Jelgersma's important study of sea-level changes in the Netherlands coastal area [131]. Her curve is exclusively based on ^{14}C dates of compaction-free peat samples and as such might be seen as the worked-out version of Van Straaten's curve. She explains that her curve is related not to the MSL but to the MHW level. Both Bennema and Jelgersma give a review of the work of earlier authors. Their curves differ in so far that Bennema's curve provides reliable information concerning the most recent times, after about 500 B.C., and Jelgersma's curve does the same precisely for the period before that. As such both studies are complementary.

It is noteworthy that the importance of exact observations of the level of archaeological finds has been realized for a long time. As early as 1880 a stone axe was reported from Giessen as having been found under a 2.2 m. thick layer of clay and sand, at —4.50 m. NAP. In 1903 a flint axe was found in Terneuzen in a peat layer, at —2.50 m. NAP [132]. It is only now that enough material seems to be available to venture to give a systematic representation in a graph.

1.7.2. The Time-depth Graph of the Archaeological Sites

1.7.2.1. *The depositional level in relation to sea-level*

It may be stated in general that inhabitation under natural (*i.e.* not artificially affected) conditions always took place above local MHW [133]. This level can and does generally differ to some extent from the average MHW in open water near the coast, for settlements were made on relatively sheltered places and not directly near the open sea. For this reason it is possible to find occupation on a level lying just below the coastal MHW level. In the Western Netherlands occupation can also be found appreciably above MHW, namely on outcrops, coastal barriers and salt marsh ridges.

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[128] Umbgrove 1947, Zwart 1951.

[129] Van Straaten 1954, Bennema 1954, 1954[a]; Bennema was seriously handicapped by the absence of an exact dating method. At that time the Cardium transgression was dated too early (or too old deposits were named "Cardium"). The *Pingsdorf* pottery was dated a few centuries too old (Carolingian instead of 11-12th century).

[130] As for instance Tesch 1947, J. P. Bakker 1958.

[131] Jelgersma 1961; data corrected to Suess-effect: Jelgersma 1966 and Hageman 1969.

[132] Giessen, in the "Land van Heusden en Altena", S. E. of Gorinchem. RMO, inventory no: Ggn. Terneuzen: Van der Feen 1952, docum. RMO, Leiden.

[133] For a general description of the landscape in the Western Netherlands before the embankment see Pons in Van Regteren Altena *et al.* 1962/'63, 1963, 97-111.

Inhabitation on the tops of the *donken* means in any case a MHW below the height of the top. If the level corresponding with the inhabitation can be indicated in the peat covering the slopes of the *donk*, then the (compaction free!) "juncture point" of peat and sand gives the original level, corresponding approximately to the local MHW of that time [134].

Another opportunity for establishing settlements well above MHW was provided by the coastal barriers and the Older Dunes covering them. The coastal barriers themselves were probably formed to a height well above MHW, perhaps up to High Water Springs [135]. The low Older Dunes could add a few meters to this. Further the ground-water table in the coastal barrier region was to some extent convex; first as a result of the well-known floating of the fresh water on the salt water just as at present in the Younger Dunes [136], and second as a result of the width of this relatively high strip, hampering the water from flowing off laterally. The relatively high level on which peat formation took place at Voorschoten during the VL Culture in a depression of the dunes on the oldest coastal barrier shows that this was indeed the case. The formation of the various peat layers and vegetation levels in the dunes is explained in the same way [137].

The natural levees along creeks influenced by ebb and flood in open, not embanked tidal regions rise to a maximum of 60 cm., and in general to 25-40 cm. above MHW, dependent upon the absolute level of this high water. The Westfrisian deposits are formed in a region of more marked differences between high and low tide, and the highest creek ridges there lie higher therefore in relation to MHW than normal, In the Northern Netherlands salt marsh area, broad and relatively sandy barriers were repeatedly formed on the seaside. They can reach a height of 120 cm. above MHW [138].

In the river area we must take account of an annual periodicity in the high water levels instead of one occurring twice a day. Moreover, it should be borne in mind that the discharge of the rivers was more regular than now. In the first place the water drained off more regularly, because the natural vegetation in the catchment area was only moderately destroyed or affected by man. In such a dense vegetation the surface run-off of the rainwater was much less than in the present open landscape, which implied more modest extremes in the discharge of the main streams than today. Second, there were no dikes in the sedimentation area, and during high waters the water could be stored in a much larger basin than at present. As a result high water levels (discharges being equal) must have been considerably lower. It seems reasonable to accept the MHW level as the maximum height to which natural river levees in such an unembanked landscape could be formed. "MHW" means, however, something quite different there than in the regions where sedimentation was controlled by the tides.

An intermediate position is taken by the estuarine area with creeks where tidal differences are small and the effect of changes in river levels almost unnoticeable.

Exact data about the relation between deposition and the water levels in the unique freshwater tidal area, the Biesbosch, are available from I.S. Zonneveld's study. The tidal amplitude

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[134] *Cf.* Jelgersma 1961, 31-33.

[135] None of the authors on sea-level changes did, however, express himself in this sense.

[136] Edelman 1960, 90; Van der Meer 1952, 3-4; Pannekoek (ed.) 1956, fig. 58. The occurrence of fresh water of good quality may have been one of the factors, that made the coastal barriers attractive.

[137] Jelgersma *et al.* 1970.

[138] Van Giffen 1921, Bennema 1954, 39-42, 46; Pons in Van Regteren Altena *et al.* 1962/'63, 1963, 107.

is, however, quite considerable there, and in any case greater than it formerly must have been in unembanked estuarine creek systems. In the Biesbosch sandy shoal deposits in the form of ebb and flood scours do not reach to more than about +60 cm. NAP, at a MHW of +130 cm. NAP. In general a change in the sedimentation process appears when the sandy deposits have reached approximately the NAP mark, because they then become covered with a dense vegetation, by which clay sedimentation is very much favoured. In general the levee deposits of the creeks are the highest sandy deposits. They are a few decimetres higher than the sandy shoal deposits. The maximum level of sedimentation seems to lie at about MHW, that is at about +130 cm NAP. As the current velocity in such areas is low at high water (unlike the strong currents at high water in the river and tidal areas) the highest parts of the deposits are never sandy [139].

Since both inhabitation and sedimentation are well defined and directly related to MHW and not to MSL, only former MHW levels can be directly derived from the observations on inhabitation and sedimentation. So in the following pages we will refer only to former MHW levels.

A complication is that at present MHW differs quite considerably at various places along the coast. In Zeeland MHW decreases from +1.60 to +1.25 m. NAP at the mouth of the Meuse, sinks to +0.88 and +0.40 m. NAP between the Hook of Holland and Den Helder, and increases again to +0.61 at Harlingen, +0.98 at Zoutkamp and +1.15 m. at Delfzijl [140]. These differences will have existed also in earlier times and were certainly not less than they are today. Their distribution along the coast might, however, have varied from period to period, on account of changes in the form of the coast-line and sea-bottom morphology. In the region from which nearly all our information is derived the present-day variation is fairly small: +0.60 to +1.00m. NAP. For the time being we have not taken this factor into consideration and in doing so only a small margin of error remains. We shall return to this point later, bringing it into account when considering the Westfrisian deposits.

1.7.2.2. *Compaction* [141]

The base of the settlements is always formed by more or less sandy deposits slightly or not susceptible to compaction. The deposit is usually well-"founded", by which is meant that no compressible deposits such as peat or unripened (not settled or shrunken) clay occur in the subsoil. The elimination or the calculation of the factor "compaction" is always a source of error. This has already been pointed out and taken into account by Van Giffen.

Compaction is the result of shrinkage by (artificial) drainage, the evaporation of plants, the pressing out of water caused by the weight of the sediment itself or by the pressure of overlying layers. This latter cause can influence particularly the height of levels under artificial mounds.

Unfortunately a number of compaction-free deposits, namely the coastal barriers, and

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[139] Zonneveld 1960, Part B, 35, 43, 48 and 132; Part A, figs. 48, 78°; Part C, App. 5, esp. J and K.

[140] *Cf.* Van Hoorn 1967, Van Giffen 1921, Faber 1947/'60, I, 185.

[141] For the mechanism of compaction in general see Bennema 1954, 11; Bennema *et al.* 1954. A more theoretical approach was made by Huizinga 1940. The values given in this paper might, however, be rather out of date.

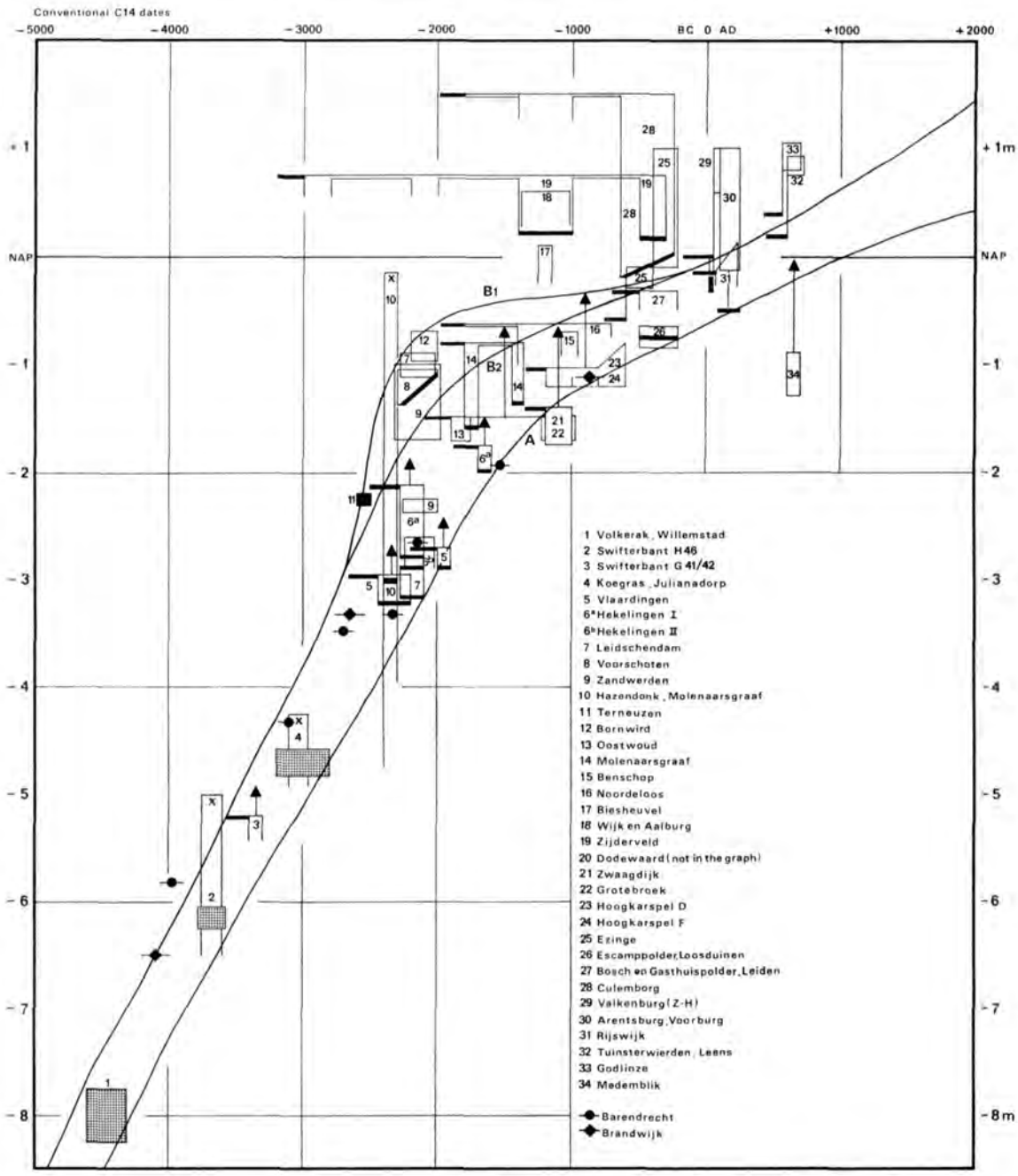

Fig. 11. Time-depth diagram with the most important well-founded archaeological finds and sites in the Western Netherlands. Added are some traditionally used sites that are not compaction-free and the ^{14}C dates of peat from the sites Brandwijk and Barendrecht (Jelgersma 1961 and 1966).

For the documentation of the data used, see App. II.
For the explanation of the symbols used, see fig. 12.

curve A — lower limit of the dated MHW levels.
curve B1 — upper limit of the dated MHW levels.
curve B2 — as B1, but some extreme or less representative sites excluded.

the Older Dunes, are not the most suitable for the determination of former water levels. Most settlement terrains, having some clay in their profile, will have suffered a slight compaction. Bennema assumes that the compaction in such terrains was not more than 20-30 cm., which we can accept as an error. Such a compaction would apply, for example, to Vlaardingen, and to the estuarine creeks inhabited during the Iron Age, *e.g.* Bosch en Gasthuispolder. Ideal places for observations are the *donken* and the well-founded bodies of sandy stream ridges, such as the Schoonrewoerd stream ridge.

The observations in West Frisia require a more detailed commentary. The study of Ente and the data provided by H.H. van Regteren Altena show that these are of less value for the present purpose than Van Giffen and Bennema assumed [142]. The artificial drainage which began at least after 1200 A.D., caused compaction of soft, unsettled clay and peat layers, which are widespread, particularly under most barrows: these are not situated on the sandy filling of the creek itself but somewhat on the side of it. The highest points of these creek levees are now at —0.75 m. NAP [143]. The base of the barrows will have been situated originally on about the same level or somewhat (max. 25 cm.) higher, but have subsided to a present level of —1.90 to —1.30 m. NAP. In our diagram we have corrected the average level of the barrow bases (—1.60 m.) for the average subsidence due to compaction (80 cm.).

The remarkably high level of the Westfrisian deposits can be explained by the landscape at the time of the deposition. It was a region where an extensive sea arm came into existence and where the mean flood height probably differed considerably from that at the open shore.

It is noteworthy that these deposits were silted up approximately to the same height as the most westerly still well-founded part of the Schoonrewoerd stream ridge and that subsequently the course of inhabitation on both deposits is identical. Inhabitation started in both areas with VBB settlements and ended almost simultaneously in the beginning of the Iron Age. In the Alblasserwaard this may be attributed to the continuous growth of peat. In West Frisia too the surface at this time had probably become too marshy.

1.7.2.3. *The graph*

The observations on the levels of the archaeological terrains are assembled in a graph (fig. 11). This time-depth diagram is necessary to give a complete picture of all four parameters (and their mutual relationships) of the inhabitation problem of the Western Netherlands. The chronological column of fig. 10 did show already the relationship between time and distribution, while the distribution in different periods of limited duration is represented in detail in the maps (figs. 2, 5, 7, 8). In the schematic cross-section of the Western Netherlands and the river area (fig. 23) the connection between time and depth is determined, but now in relation to

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[142] Ente 1963, 169-179; H. H. van Regteren Altena & Bakker 1968; older publications dealing with the position of the barrows in relation to the geology: Wensink 1959, Ente 1960, Kwaad 1961. See also Van Giffen 1954[a], Bennema 1954, 40. It is still under discussion whether West Frisia was ever covered with peat. See on this problem: Ente 1963, 16, 40 f. and esp. 146-155, on the "woud" soils: Edelman 1960, 130-131, on the field pattern: de Cock 1969, on the occurrance of peat: H. H. van Regteren Altena & Bakker 1968 and the literature cited there.

[143] The top of the big Westfrisian II ridge lies between —0.10 m. in the west (near Zwaagdijk) and —0.70 m. in the east (Grotebroek). *Cf.* Pons & Wiggers 1960, figs. 27 & 29.

the distance from the open sea. This cross-section, however, does not incorporate any really new factual information.

We were primarily interested in the period prior to the Iron Age, for which period all reliable data known to us have been plotted. To complete the diagram data from some important younger archaeological sites have been included. References for all data provided are given in Appendix II. The majority of the terrains plotted are situated in the Rhine/Meuse estuarine area. The most easterly and those on the coastal barriers are, however, not well suited for our purpose. A second group is formed by the data from the IJsselmeer district, and a third by a few observations made in the Northern Netherlands from the salt marshes around the Lauwerszee.

Plotted is the present depth at which occupation has been established, against the age of the occupation (*cf.* fig. 12). Most ^{14}C dates are based on samples from the site itself. Otherwise the current ^{14}C dates for the relevant culture or period or historical datings have been used. The position of occupation levels relative to NAP is based on the measurements in the field, that are not corrected for possible compaction.

As only terrains with well-founded, sandy deposits, were included, the error due to compaction is estimated to be 20 cm. at most. It seemed preferable to omit corrections rather than to apply them in view of the always somewhat speculative character of the estimations of compaction in the cases under consideration. Only in a few cases has any exception been made: for Vlaardingen, Hekelingen and for the Westfrisian barrows.

The range of level at a site is between the highest point of the former surface and the lowest point of the settlement terrain. The determination of the latter level is not without problems.

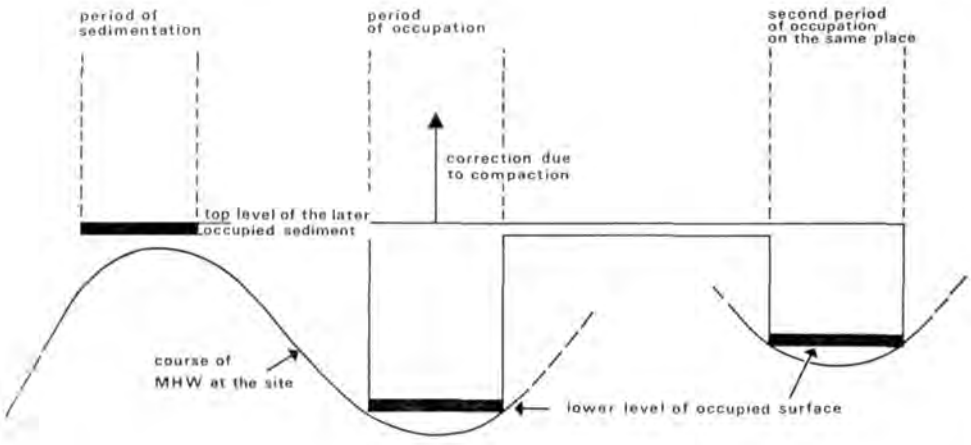

Fig. 12. Diagram illustrating the relation between the MHW level during the sedimentation and the MHW level during the subsequent occupation. This type of representation is used as symbol in fig. 11 and in the construction of the curves C1-C9 in fig. 13.
A dated MHW level is always indicated with a heavy black line.

We took as criteria the continuation of an "occupation layer" into a contemporary natural deposit (peat layer, infilling of a gully and such like), the point beneath which wood has been preserved (this will no longer be the case above MHW, but certainly beneath the then MSL), and the occurrence of soil traces. This lower limit has been determined with the greatest possible care.

Finally, the moment at which the inhabited deposit was formed has been indicated as accurately as possible and is represented by a horizontal line, connected to the right with the highest point of the small squares (*cf.* fig. 12). In this way the line gives the time which elapsed between sedimentation and inhabitation.

1.7.3. The Curve for the Relative Rise of the Coastal Mean High Water Level

1.7.3.1. *A first approximation*

Two dissimilar sets of information have therefore been embodied in the diagram at fig. 11:

1. Inhabitation data, nearly always belonging to a regression phase and originating from sites which, at the time of inhabitation, were generally well above MHW level.
2. Data of the inhabited deposits, generally a sediment from a transgression phase and a relatively high point of this deposit.

The curve A (fig. 11) which forms the lower boundary of the plotted data, indicates the general rise in the MHW in periods when inhabitation was possible: the regression phases. The curve A forms at the same time a lower limit above which the rise of the MHW at the open coast-line must have occurred.

The curve B 1 (fig. 11) links the highest points of the various inhabited sediments at the moments of sedimentation and so forms an upper limit below which the true rise of the MHW occurred. At the same time this curve gives the maxima for the MHW during the culminations of the various sedimentation (transgression) phases. In some cases, however, it indicates points (namely West Frisia (C IV^b and D O) and the Alblasserwaard (C IV^b)) where the local MHW was considerably above the usual MHW. If we eliminate these areas we can draw curve B2 instead of B1, a curve which in our view is a good approximation of the general rise in the MHW during transgression phases. The differences between B1 and B2 are primarily of significance between about 2500 and 1000 B.C. The distance between the curves A and B2 varies between 100 and 50 cm. The ideal curve giving the true mean rise of MHW lies between A and B2, with values during transgression phases nearer to B2 and during regression phases nearer to A [144].

1.7.3.2. *The fluctuations of local Mean High Water at the archaeological sites*

Changes in the MHW can be determined in detail for a few points or limited areas where a number of factors causing regional differences are more or less constant. These factors are:

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[144] In an ideal curve all regionally and locally operating factors are excluded. There is no site where the MHW rise really follows this curve. This will have been the case only in the coastal open sea.

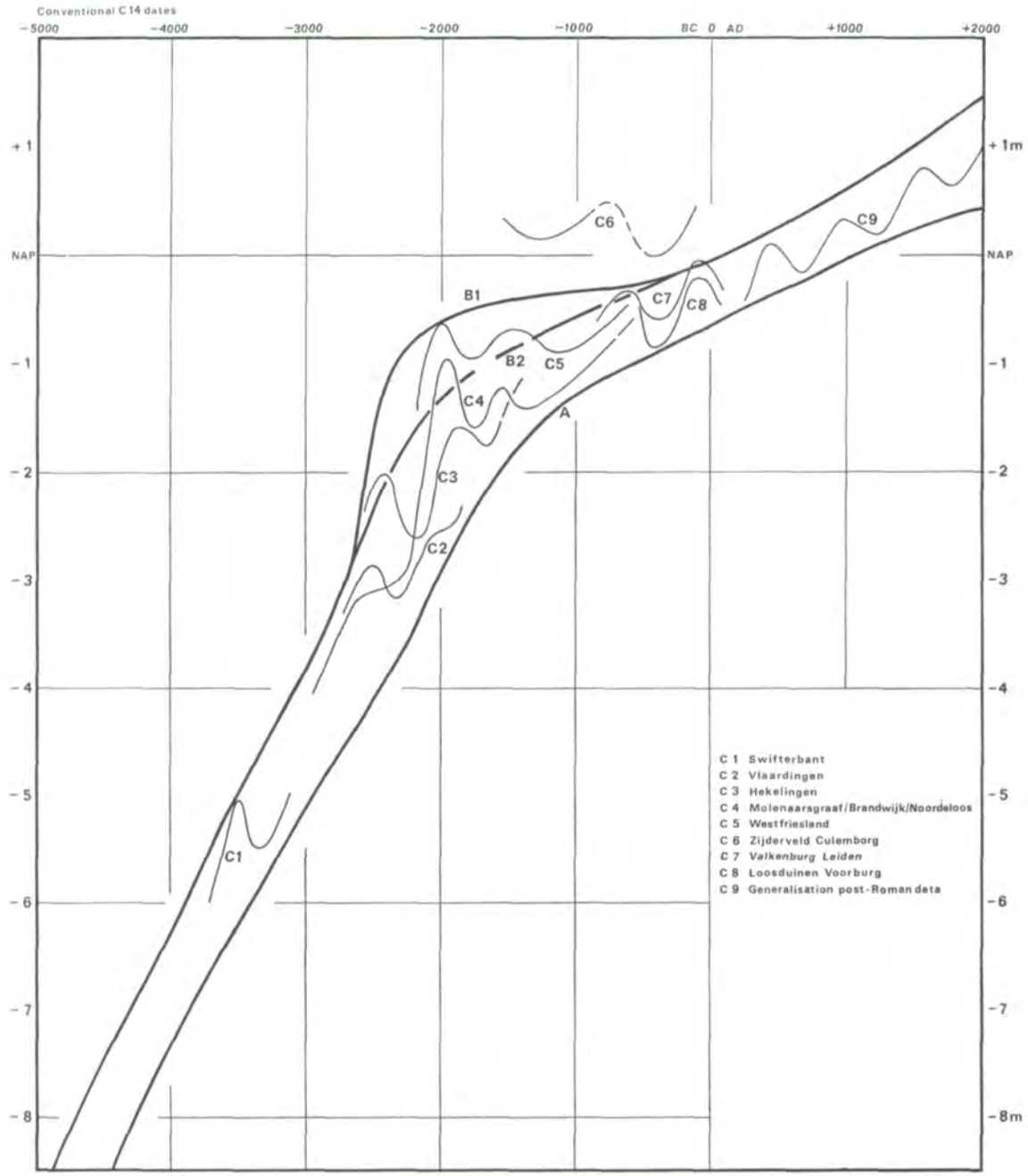

Fig. 13. Time-depth diagram with fluctuations in the MHW level for some selected archaeological sites or areas of restricted dimensions.

Construction of the curves C1-C9 according to fig. 12 and based on the data of fig. 11.

— the distance to the open sea,
— the height of MHW in relation to mean sea-level,
— the influence of the gradient in the river area,
— any small amount of compaction.

In fig. 13 the curves C1-C6 give the changes of MHW for Swifterbant, Vlaardingen, Hekelingen, Molenaarsgraaf and surroundings, West Frisia and Zijderveld. The curves are therefore valid for a number of selected sites or areas having a relatively high sedimentation level and subsequently a relatively low MHW level, coinciding with a transgression phase followed by a regression phase [145]. In general a clear lowering of the local MHW level between deposition and inhabitation applies to these terrains. This, however, does not necessarily imply any real lowering of the MHW at the open coast. Usually it was the result of a decreasing hydraulic contact with the open water and the development of areas with "flood depression".

Such a "flood depression" (decrease of tidal amplitude) occurs in an estuarine area if the possibility exists of collateral flowing off of the inland flowing flood or dammed-up river water. This is the case in the majority of the furcating estuarine creek systems, which mostly have the form of a relatively narrow mouth with a wider drainage basin behind. The absence of discharging rivers, along the gradient of which the flood can run up, is favourable to flood depression. Zonneveld [146] made a detailed survey of this phenomenon, demonstrating the occurrence of flood depression in a present fresh-water tidal area, de Biesbosch, by means of measurements taken in the years 1930-1939. His diagrams are of great importance to us. First, the MHW level in the main creeks of the Biesbosch rises from 30 cm. in the west to 50 cm. in the east above MHW level at the coast. In the smaller creeks this effect is largely compensated for by a flood depression of 10-40 cm. dependent upon the position and dimensions of the creek.

In our opinion the flood depression can certainly reach these proportions in a natural landscape when a number of factors coincide. We refer particularly to situations often occurring on points where prehistoric inhabitation took place. First, a deposit in or near a large water course from the end of a transgression phase. Next the closing of the coast-line and/or the narrowing of the creeks. The first process limits the entrance of the tide, and the second is likely to result in a continually more distant contact with the open water, which, depending upon the distance to it, means a more or less appreciable flood depression. In this way a lowering of the local MHW can occur at an inland point, even when the sea-level at the coast is stationary or slowly rising, so that an opportunity for inhabitation is created.

In the curves C2-C6 the transgression phases CIV^{a}, CIV^{b} and D O are clearly shown as periods of high MHW levels, separated by periods of a much lower MHW. The systematic differences between the sites may be explained by the above-named regionally variable factors.

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[145] Theoretically a transgression phase is a period with a landward shifting coast-line, while during a regression phase there is a seaward shift. So factually the transgression phase is only the period of erosion, while the period of sedimentation belongs to the regression phase. It is, however, common practice to include the period of deposition of mineral sediments in the transgression phase and to restrict the regression phase to the period of peat development. However that may be, in the definition nothing is said about the causes of the phases, and a relative high or low MHW is *not* part of the definition. In the foregoing pages, esp. fig. 10, we demonstrated that inhabitation concentrated in the regression phases, so we can say here that the data from settlement sites relate to regression phases.

[146] Zonneveld 1960, Part A, 16-17, fig. 18-20. See also Jelgersma 1961, 21.

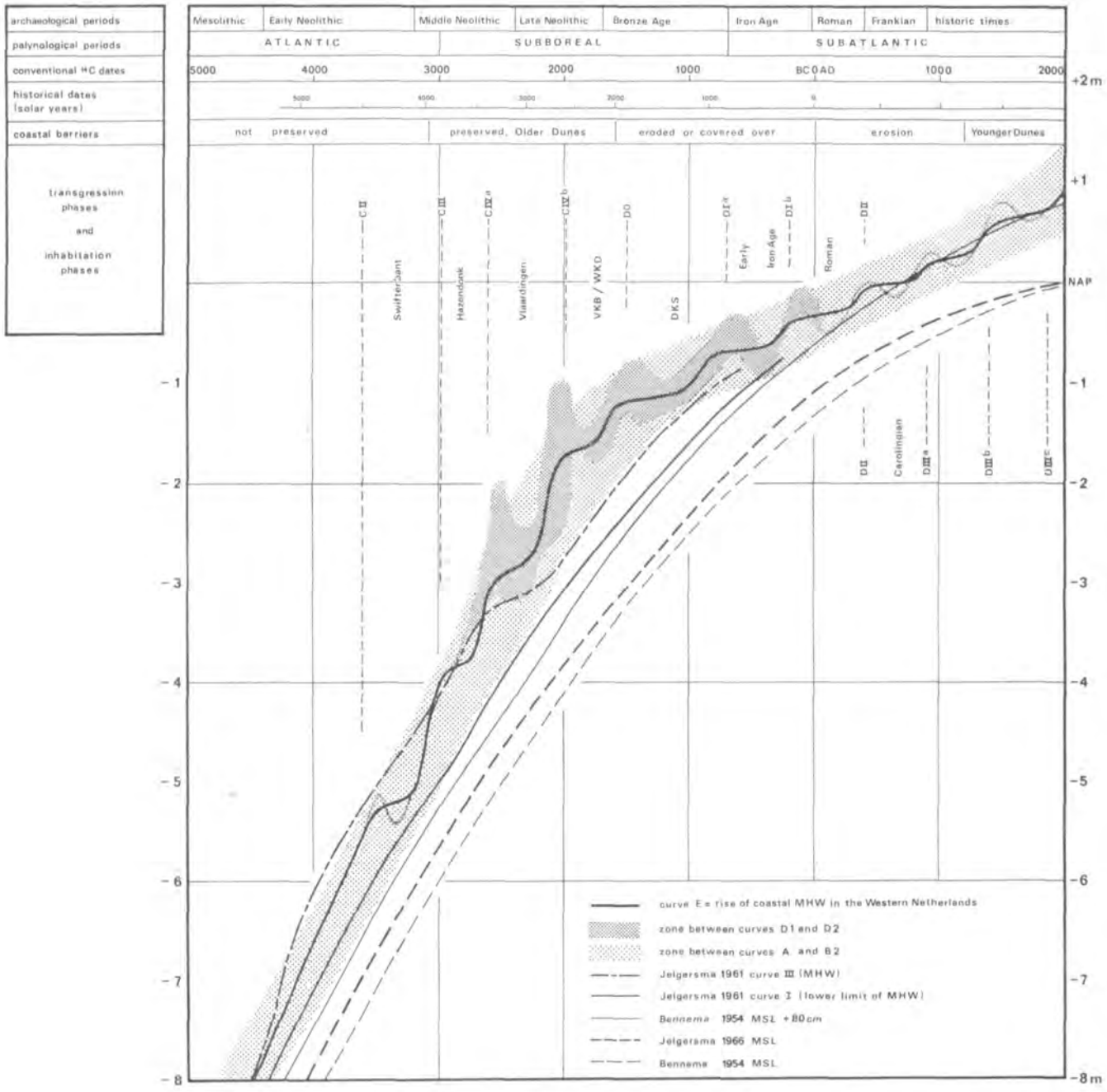

Fig. 14. Time-depth diagram with our curves for changes in MHW level in the Western Netherlands and various curves of Bennema and Jelgersma for comparison.

In Vlaardingen a high MHW at the time of deposition and some compaction, in Molenaarsgraaf no compaction, no high MHW but certainly a small "river gradient effect" [147], which dominates the whole picture somewhat further upstream (Zijderveld). In West Frisia a source of error occurs through the application of a uniform correction of 80 cm. for compaction in the subsoil. The difference between Hekelingen and Vlaardingen, finally, shows strikingly that local circumstances and comparatively small variations in milieu may be of great influence.

The curves C7-C9 give the course of MHW on archaeological sites for the period after the Bronze Age. C7 and C8 depend in the first place upon the given data. C9 is an extrapolation to this, orginating from the equalization of periods of frequent dike-breaches with transgression phases, whereby a relatively high local MHW is attributed to these transgression phases. For these periods of small rises in sea-level the influence of small errors in measurement and local variations is considerable. Human intervention in nature has, moreover, increased local differences. As long as no comprehensive corpus of reliable material from this period has been assembled this approximation seems to lead to a reasonable presentation of the reality. For the construction of curve C9 use was made again mostly of data given by Van Giffen, Bakker, Bennema and Van Hoorn and the other sources for these later times mentioned earlier [148].

1.7.3.3. *The construction of the curve*

Starting from the curves C1-C9 we can make a second approximation of the real relative rise of MHW. The curves D1 and D2 in fig. 14 give the lower and upper limits respectively of the zone within which the fluctuations of C1-C8 take place. Inside this zone lies the curve of the real rise of the coastal MHW level. Because of a lack of data the oldest part of this zone can only be represented as a simple line. For the most recent part we have taken the curve C9. In reality, however, in both these sections also, as in the construction of the curves A and B, the data are spread in a zone and not on a line.

Before we can arrive at a curve giving the real rise and fluctuations of coastal MHW two effects must be evaluated: a local effect, expressed in the sharp fluctuations of the curves C1-C9, and a regional effect that is apparent from the differences in level between these curves.

As far as the first is concerned we start from the fact that in regression phases there is no question of any general fall in Mean Sea Level of any importance. Geologically at least no indications of this exist [149]. The extent of the deviations from the general average, which we can assume for our selected sites, also allows a similar flattening of the sharp local changes: these can be explained entirely by the diminishing or extinction of the tidal amplitude (flood depression) on these points, during the occupation there [150].

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147 By "river gradient effect" is meant the raising of the MHW level (and all other water levels) going up-stream within the reach of the river courses; by other words the effect of the river gradient on the water levels (*cf.* p. 95 and fig. 23).

148 Van Giffen 1954[a], J. P. Bakker 1958, Bennema 1954, Van Hoorn 1967, this paper note 96.

149 Bennema 1954, 30-32 accepts at most short-lived lowering with a maximum of 50 cm. Reference is made in this case to MSL and not to MHW. We are aware that MHW fluctuation may be caused by fluctuations in the mean tidal amplitude and in that case will not be reflected in a MSL curve. This question will be discussed below.

150 *Cf.* p. 59. Rather high values for both the "piling up" of the flood in the sedimentation phases and the flood depression in the occupation phases are needed to explain the fluctuations entirely by these effects. The Biesbosch

As far as the second is concerned we put the case that the most representative point in the Western Netherlands lies in the western river area and so far to the west that the river gradient effect is negligeable but the ebb and flood were already clearly noticeable. The *donk* of Barendrecht, where, moreover, compaction plays no part, appears to approximate best to this ideal point, but the Hazendonk also may be regarded as very representative. Jelgersma is also of opinion that the *donken* are eminently suitable for making observations. In addition to her data on Brandwijk, which may be advantageously combined with those on Molenaarsgraaf, we have therefore set out her data on Barendrecht in the diagram [151].

Taking all known consideration into account, our curve E (fig. 14) is in our view representative for the rise of coastal MHW in the Rhine/Meuse estuarine area. The curve lies within both zones determined for this (A-B2, D1-D2), has no declining sections, but only those which are flatter or steeper, corresponding with regression and transgression phases respectively. The transgression "maxima" lie near B2, the regression "minima" near A.

In constructing the curve, we thought that this curve had to do justice in some extent to the fluctuations shown by the zone D1/D2 and by C9. We tried, moreover, to give the curve a uniform appearance all over its length. But we stress here that we consider the curve E as an idealized one: the lines A, B 1,2, C1-9 and D 1,2 are all based on measured data, but the curve E is an interpretation. Now one can ask whether it is right or not to show the transgression/regression cyclicity in the curve. It is indeed possible to draw a more of less smooth line as an approximation of the real rise of sea-level in open coastal water in between the curves A and B_2, D_1 and D_2. Such a line will certainly raise less discussion. It merely gives the general tendency of the rise of MHW.

Our stepped curve E is in accordance with the theory that the curve of the relative rise of sea-level must show the result of two phenomena:

— the gradual rise of sea-level according to a more or less smooth curve; the result of eustatic, epirogenetic and isostatic movements *cf.* p. 64 f.
— an oscillation, that reflects the transgression cyclicity.

The resulting curve will show steps, which become more and more pronounced, going from older to more recent times [152].

We must ask ourselves now the question whether or not the transgression phases really coincide with a rise of the MHW, and the regression phases with a lowering of it. That is to say whether the transgression/regression cyclicity is (partly) caused by and reflected in a MHW oscillation or not. If this is the case, then the amplitude of this oscillation is unknown. When

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data demonstrate that 50 and 30 cm. respectively for both effects must be regarded as maxima, while 30 cm. for both seem to be more reasonable values for estuarine regions under natural conditions.

[151] Jelgersma 1961, 21, 31-33, 45. In this publication Jelgersma used a uniform correction to eliminate the Suess-effect of 300 years for all ^{14}C dates. According to Vogel and Waterbolk 1963, 164 the corrections vary considerably: 240 $\pm$ 10 for Barendrecht and 0 $\pm$ 20 for Brandwijk. The irregularities, shown by her curve (fig. 22) are less distinct in reality. The corrected graph is published in Pons *et al.* 1963, Jelgersma 1966 and Hageman 1969.

[152] *Cf.* Mörner 1969, 406, fig. 140. Mörner demonstrated that the curve of relative rise of sea-level in uplifted areas must show sharp fluctuations, while the curve in subsiding areas will show only steps. Van Straaten (1954) already used the idea that the sea-level curve must be the result of a continuous rise and an oscillation.

we assume that the transgression/regression cyclicity is mainly or exclusively the result of meteorological (climatic) changes, and that a transgression phase is characterized by a higher precipitation and more frequent and heavier westerly winds (higher gale frequency) [153], then the MHW can rise in these phases. This might be caused by: a more frequent occurrence of extreme high waters, a general stowing of the sea-water towards the Dutch coast (not valid for other coasts around the North Sea !), a more frequent damming-up of the river water, or (hypothetical) a general increase of the tidal amplitude. When the sum of these effects results in an amplitude of the oscillation in the order of 10 cm. or more, then this oscillation will be visible in the sea-level curve. An amplitude of 10 cm. gives an average for the rise or fall of sea-level of 4 cm. per century when we assume an average of 500 years for the transgression/regression cycle. When the amplitude is less, it will be reflected only in the more recent, less steeply sloping part of the curve.

But the transgression phases need not necessarily to be reflected in the sea-level curve, that is to say the amplitude of the oscillation might be very small or even zero. The transgression phases might be periods when only the extreme situations (*i.e.* the storm floods) were relatively worse. It is just during such extreme situations that the major part of the morphological changes in the coastal regions occur, and a transgression phase is defined by such changes: the destruction of land and the extension of drainage creek systems. A few extra high storm floods a year will not influence the MHW level very much. Taking this into account one can for instance explain the sequence of the formation of coastal barriers and strand flats without the assumption of marked fluctuations in the MHW curve.

But in drawing our curve E, we have chosen for an amplitude of about 10 cm. and for a stepped curve, as we said mainly to do justice to the oscillations of the curves C1-9 and D1-2. Future research may reveal whether the steps must be accentuated or smoothenated or that they even must disappear.

1.7.3.4. *The curves of Bennema (1954) and Jelgersma (1961, 1966)*

A comparison of the present curve(s) with those of Bennema and Jelgersma [154] shows as the most important difference a less smooth line in the present curves, with a clear bend in the centuries around 2000 B.C. A period of a rapidly rising sea-level then changes to a much slower rise, with more obvious fluctuations [155]. The transition period (about 2500-1500 B.C.) seems to have been a period when a relatively high MHW level occurred locally. This was the

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[153] Jelgersma *et al.* 1970, 140

[154] Bennema 1954, 56, fig. 13, lower curve; Jelgersma 1961, fig. 22.

We think the curve of Zwart (1951) needs no further discussion after the comments given by Bennema and Jelgersma. We know now that some of Zwart's datings were seriously wrong. Moreover he neglected the margin of error in his calculations (as for instance in the rate of the epirogenetic/isostatic subsidence, which he estimated at 9 cm. per century).

[155] Dr M. A. Geyh, Hannover, pointed out to me, that a too small number of data can easily show false fluctuations that are eliminated when the number of data grows. Since we must reckon also with the transgression periodicity and the inhabitation phases and use this knowledge when constructing the curves, this possibility can be excluded in the present case. We thank Dr Geyh for this comments on this part of the work and for sending us a manuscript of his 1971 paper before its publication.

case behind the wide tidal inlets through the still narrow belt of coastal barriers, where the height of the tide was increased by the damming up of the flood wave.

There is no obvious explanation in our curve for the formation of the coastal barriers themselves, especially not for the change about 3000 B.C. from a retreating to an advancing coast-line. The above-mentioned flattening of the curve appears at least 1000 years too late to be of any relevance here.

Our curve A, being the lowest limit of all MHW data, can be closely compared with curve I of Jelgersma. Our curve lies at most 75 cm. higher, namely in the period 2000-1000 B.C. The correspondence between both curves is otherwise so marked that we see in this fact a confirmation of the supposition that inhabitation always took place above MHW level. At the same time it appears that Jelgersma's curve I must have reference to data of regression phases. The growth of peat on an earlier formed sediment does indeed always characterize a regression phase.

The zone limited by A and B2 (fig. 11), in more detail the zone between D1 and D2 (fig. 14) and as the best approximation curve E, give the true rise of coastal MHW. Jelgersma considered her curve II for the *donken* area as the most reliable for this.

Bennema's curve refers to MSL and must therefore be raised by about 80 cm. to be comparable. The explanation of the difference between our curve and Bennema's in the period 3000-500 B.C. must in the first place be sought in the data used by Bennema. It concerns the bases of the barrows in West Frisia and Hekelingen, with a dating of about 1700 B.C. (about 500 years too late according to the later ^{14}C dates) and the deposits at Hoofddorp, which with an age of about 2300 B.C. have also been placed far too late, by about 1000 years [156].

Both Jelgersma's curve II and the present curve, are based on compaction-free sites, and on ^{14}C ages. Thus differences between the two curves are mainly due to the nature and the interpretation of the material used: ours was indeed very detailed but comparatively lacking in uniformity. Jelgersma's data are more uniform but have a rather wide margin of error. The fluctuations in our curve have further such a small range, that they could not possibly have been established on account of Jelgersma's data. The difference between her curve II and our curve E shows a maximum of 75 cm. about 1800 B.C., while there is no difference at all from our curve A at this point. We do not think that these variations indicate any contradiction, but that Jelgersma's data allow our curve E to be regarded as a refinement of her curve II.

1.7.3.5. *Eustatic, tectonic and isostatic components*

Although we are now going somewhat beyond the boundaries of our subject, we cannot omit a few remarks to the possible role that may be attributed to the various causes of the relative rise in sea-level.

The most important components of the relative rise in sea-level in this country and for the period in question are:

— an actual rise of the water as a result of the waning of continental ice caps: the glacio-eustatic rise in sea-level.

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[156] Bennema 1954, 55; in more detail: 26, 39 and 40 f.

— a long-term subsidence of the Western Netherlands: the epirogenetic subsidence.
— the isostatic movements resulting from the unloading of once glaciated areas and the increased loading of the sea floor:
  a) Glacio-isostatic upheaval of the regions formerly covered with ice caps and (partly) compensating subsidence in the marginal areas.
  b) Hydro-isostatic subsidence of the flooded regions due to the weight of the water, and, especially in the Western Netherlands, the sediment.
— Compaction of the pre-Holocene deposits. We think this factor to be very small and will leave it out of consideration in the following discussion.

The most recent and most detailed curve for the eustatic rise in sea-level available at the moment is that of Mörner [157], resulting from a detailed and exhaustively documented study in the Kattegat area, This eustatic curve (for MSL) shows a rise with small but sharp fluctuations from about —6.5 m. at about 4400 B.C. to the present MSL at about 1800 B.C., after which the rise comes to a fairly abrupt end and only a few fluctuations occur around the level attained. By substracting the value of this eustatic curve from that of the present curve E for the relative rise of MHW we obtain a curve for the isostatic-epirogenetic subsidence (fig. 15). This appears to have been fairly constant at a rate of about 4 cm. per century since 4000 B.C. The bend in our curve E at about 1800 B.C. may be attributed entirely to the termination of the eustatic rise in sea-level. It had already been noted that this bend was contemporaneous with this termination.

We must, however, not omit reference to some problems and sources of error. First, the reliability of Mörner's curve is difficult to assess, as it shows only a result and not the margin of error of the observations. It is particularly difficult to determine whether the fluctuations are in fact as considerable as they are indicated in his diagram, which we venture to doubt on account of the current conceptions in this country and the margin of error of the data used. The dates of the periods of rapid rise and subsequent fall correspond closely, however, with the transgression and regression phases respectively in the Netherlands [158]. We do not think, however, that the occurrence of such strong fluctuations in this country is very likely.

Second, it is assumed without question that the plotted values give the MSL. In the light of our discussion about the relation between the height of the deposits to the various reference levels we think that this may be open to doubt. The tidal amplitude in the Kattegat area is, however, small, so that it is difficult to make this distinction there, while, moreover, it would mean an essential difference only for the period which we have discussed.

The third problem is directly related to this: the absence of facts about the period after Christ. In our view, the course of the eustatic curve does not in the least exclude the possibility of a eustatic rise of about 0.5 m. since Christ; in fact, this is likely to have happened, if the

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[157] Mörner 1969[a], esp. figs. 145 and 160; 1969[b], 1971.

[158] Mörner 1969[a]. 393-401. See also below p. 69 and Geyh 1969, 1971. Of course, the agreement of Mörners curve with our data does not prove this curve to be right. On the other hand, this agreement shows that, at least for the part after 4000 B.C., Mörners curve cannot be very seriously wrong, and this is the more likely, since the curve approximates to a mean of the best curves published earlier.

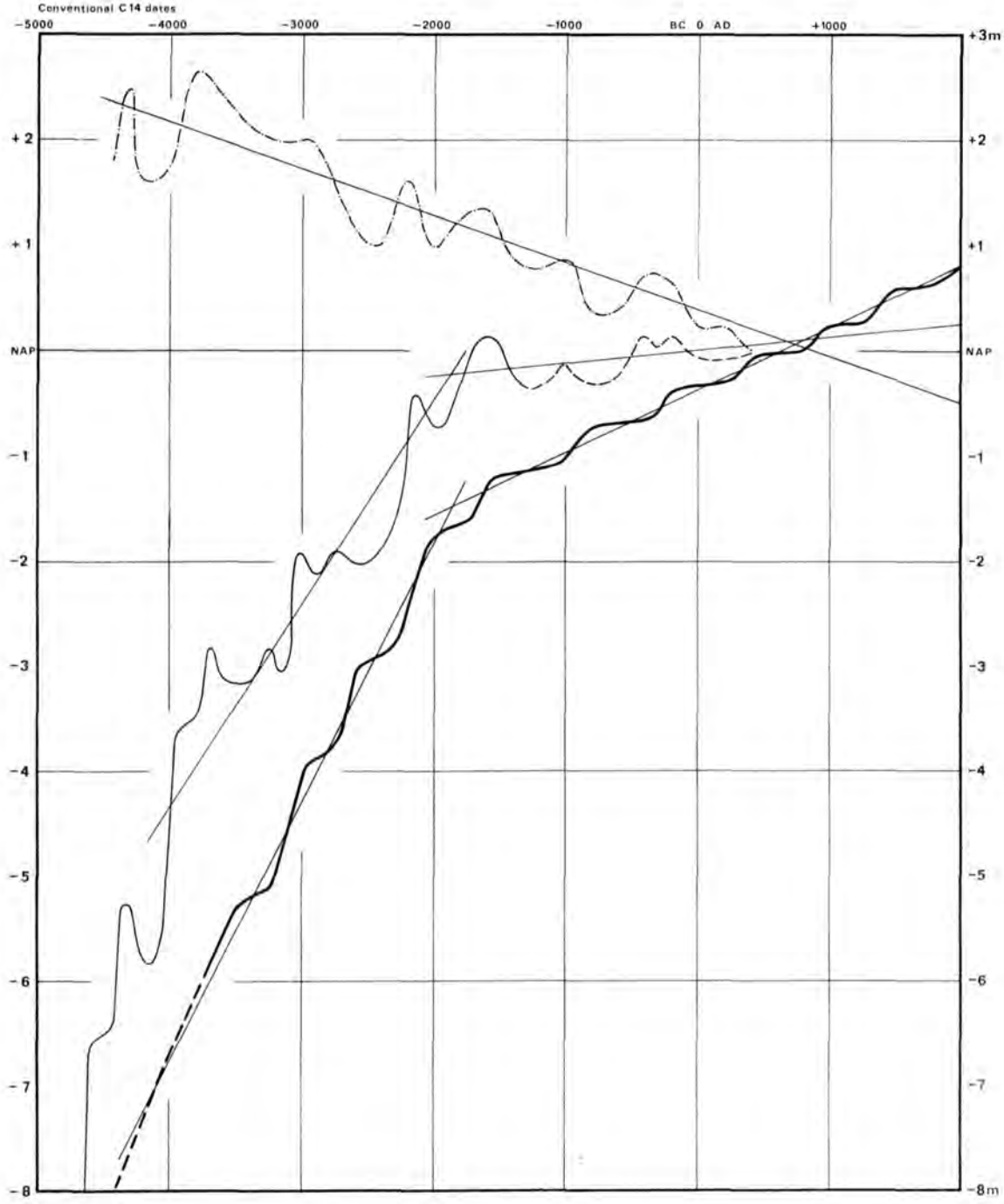

Fig. 15. Comparison of our curve for the rise of coastal MHW in the Western Netherlands (our curve E, heavy line) with the curve for the eustatic rise of sea-level after Mörner 1969 (thin line). The difference between both curves, the isostatic-epirogenetic subsidence of the Western Netherlands (— . — . — .) has been mirrored with respect to the NAP line for the sake of clearness.

given values concern MHW and not MSL. The agreement to the data about the Western Netherlands appears to point clearly in this direction [159].

An isostatic-epirogenetic subsidence of about 4 cm. per century since 4000 B.C. in the Rhine/Meuse estuarine area is a very reasonable amount. By various investigations it has been established now with a great measure of certainty that the subsidence there since the Eemien has been $1\frac{1}{2}$-$3\frac{1}{2}$ cm. per century. It is unlikely that considerable or sharp fluctuations occur, so that we may allow that these values are also valid for the last part of the period [160]. This means that either the highest value of this calculation is the correct one in the Holocene, while there is no question of any isostatic effect, or that only a limited isostatic subsidence, something like 2 cm. per century from 4000 B.C. to our times, has occurred. We consider that in the latter case a hydro-isostatic subsidence caused by the weight of the water and especially of the sediment is the most likely.

Mörner himself compares his eustatic curve with that of Jelgersma [161]. It appears that a few serious problems occur in the period before 4000 B.C. but these fall outside the scope of this enquiry and are not discussed here.

1.7.3.6. *The curve after correction of ^{14}C years into solar years*

A final comment on the influence which will be exerted by the correction of ^{14}C years into solar years according to the dendrochronological calibration data of Suess [162]. The extension of the time-scale in the last four millennia B.C. (in ^{14}C years) by more than 1000 years results in the first place in the oldest part of the curve acquiring a less steep course, so that the bend at about 1800 B.C. becomes less pronounced, but does not disappear by this correction.

We did use (fig. 16) an approximation to a smooth line of the data and the detailed curve given by Suess. So we neglected all oscillations of his calibration curve. Doing so, we show only the general deformation of the sea-level curve. In view of the margins of error in the establishment of both the transgression phases and the oscillations of the calibration curve the use of the detailed curve seems not very sensible to us. This would merely led to some minor and disputable shifts of the transgression and regression phases. At the same time we avoid the question whether the oscillations are true or not [163].

The application of this time correction has a considerable influence on all opinions about a possible periodicity in the geological phenomena, for ^{14}C dates were of no use for comparison with chronologies based on enumeration of stratified annual layers. After application of the correction, the distance between the transgression maxima varies between 1000 and 550 years. If we take, however, into account some other recent studies dealing with transgression

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159 Jelgersma 1966. In fig. 6 she gives a curve for the rise of MSL traced to present times.

160 Jelgersma 1961, 14-15 and 51-52; Bennema 1954, 13; Ahorner 1962, esp. 101.

161 Mörner 1969[a], 433, fig. 153.

162 Suess 1970.

163 Vogel published a calibration curve with only one fluctuation (Bakker, Vogel & Wíslanskí 1969, 19-27). Proof of the existence of another fluctuation was obtained from the material of the Neolithic bog settlement at Niederwiel (pers. comm. of Prof Dr H. T. Waterbolk). It will be very difficult to prove the existence of all fluctuations in view of the required detail of the necessary chronologies.

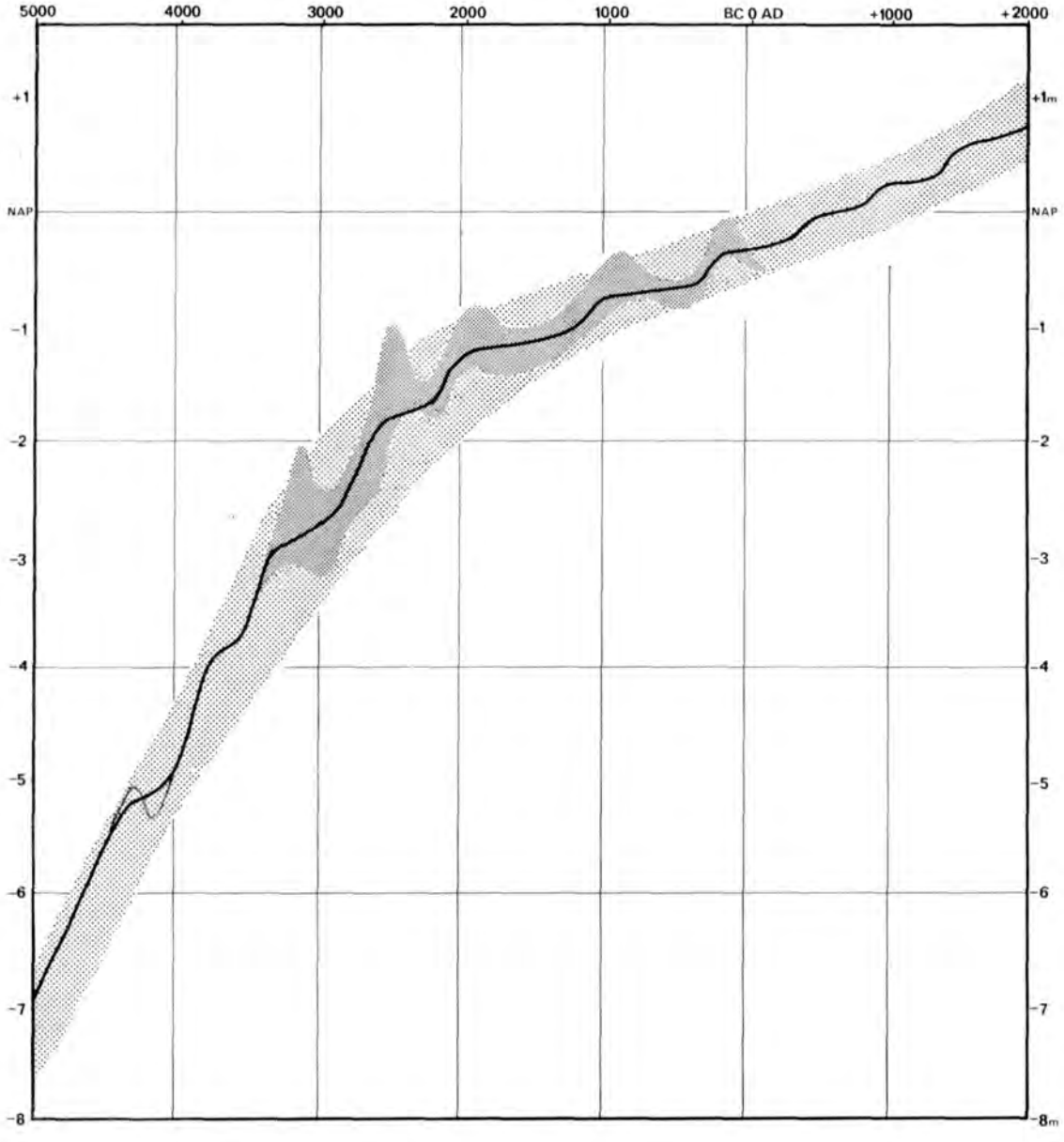

Fig. 16. The curves, constructed with a scale of solar years on the X-axis.

sequences around the North Sea, such as those of Jelgersma *et al.* and Geyh [164], it is clear that most of the transgression phases distinguished at present in the Western Netherlands can be divided up in more phases than shown by us. At any rate this will certainly be possible after future research. So it may be possible to divide C IV into three sub-stages (instead of two), D O into two sub-stages and D I into three (instead of two). These subdivisions will have considerable influence on the establishment of periodicity and the mean duration of one "transgression-regression-cycle". According to Geyh [165] 11 cycles existed since 2900 B.C. (in ^{14}C years) or 3700 B.C. (in solar years), while one cycle has a duration of 250-450 ^{14}C years, or on an average about 500 solar years. Apparently our data do not reflect all these fluctuations.

1.8. NORTHERN GERMANY AND EAST ENGLAND

The above-discussed area between Zeeland Flanders and Texel occupies, as the estuarine region of the Meuse and Rhine, the Scheldt and the Overijssel Vecht with their various tributaries, a special place within the series of Holocene coastal deposits of the southern North Sea. The discharging rivers have exerted a strong influence on the geological history of this area and on its present-day features. Of no less importance is the morphology of the Late Glacial subsoil with the wide river valleys as central elements. A comparison with the other coastal plains around the southern North Sea will therefore only be possible to a limited extent.

1.8.1. Northern Germany

The salt marsh area of Friesland and Groningen forms, together with the coastal region of Niedersachsen (Ostfriesland, Weser/Jade region) and the west coast of Schleswig-Holstein (Dithmarschen, North Friesland) a whole with distinct differences from the Western Netherlands. Nearly all older deposits including possible former coastal barriers were largely destroyed there during the most recent transgression phases (Dunkirk I and later) and replaced by new deposits or in other places covered over. The deposits on which the most ancient traces of inhabitation have been found in the Western Netherlands (tops of Early Holocene dunes, coastal barriers, creek systems of earlier transgression phases, former river courses) are almost entirely lacking here. Recent geological data show, however, that in the whole region a similar cyclicity of transgression and regression phases took place [166]. On suitable sites inhabitation was probably possible also in these regions during the Neolithic and the Bronze Age. A much smaller strip of land was, however, involved, with fewer possibilities for inhabitation than in the Western Netherlands, but a number of finds provide us with some indications of this early presence of men [167]. The distribution of these finds is, in our view, in the first place dependent

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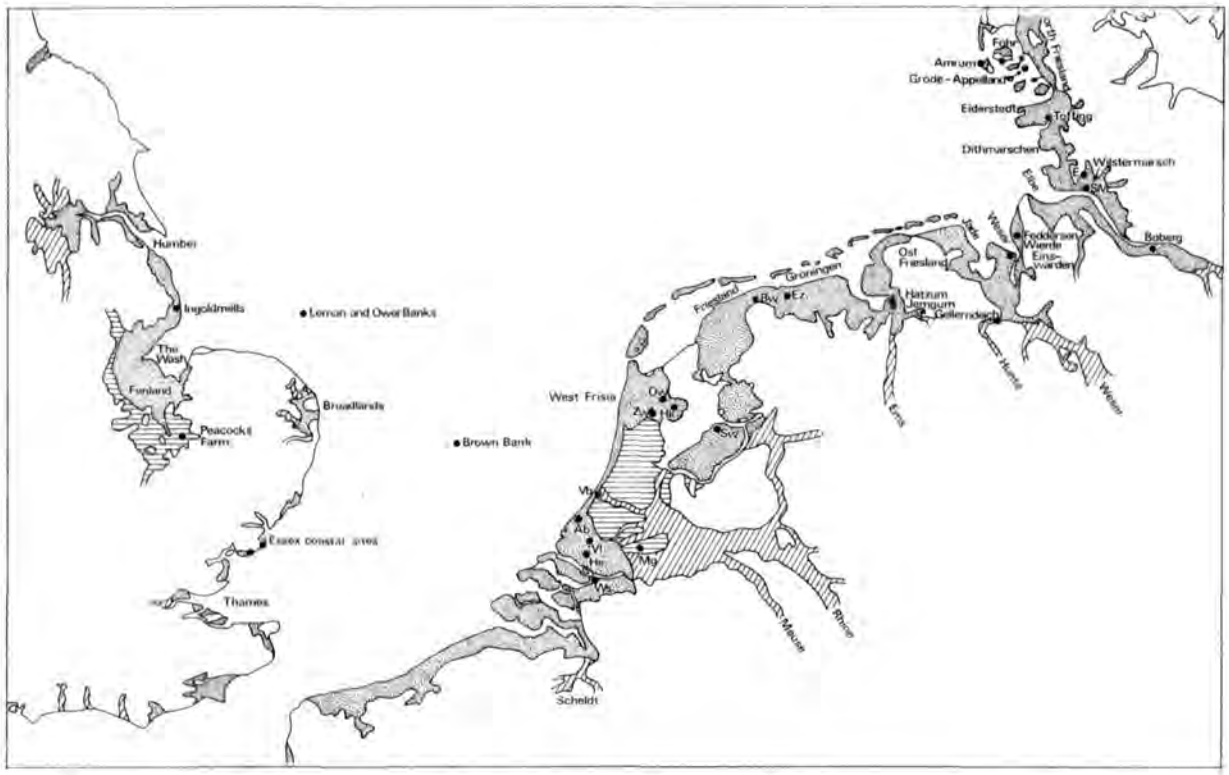
[164] Jelgersma *et al.* 1970, Geyh 1969, 1971, also Müller 1962, D. Hoffmann 1969.

[165] Geyh 1971, fig. 1-4.

[166] Brand *et al.* 1966, Geyh 1969, 1971.

[167] On these finds see especially: Bantelmann 1949, 1967, 18-20; Schindler 1953/'55, Haarnagel 1950, Prange 1963, 62-64; 1967, 53-56.



Ab = Arentsburg; Bw = Bornwird; E = Ecklak; Ez = Ezinge; He = Hekelingen; Hk = Hoogkarspel; Mg = Molenaarsgraaf; Ow = Oostwoud; SM = St. Margarethen; Sw = Swifterbant; Vb = Valkenburg; Vl = Vlaardingen; Ws = Willemstad; Zw = Zandwerven.

Fig. 17. The southern part of the North Sea with the most important reference sites mentioned in the text.

upon the chance of discovery and particularly upon their chance of preservation during later transgressions.

Finds from the Early Neolithic are known from the estuarine region of the Elbe: a remarkably complete *Spitzbodengefäss* from Ecklak in the Wilstermarsch and domestic refuse on the tops of largely covered Early Holocene river dunes near Hamburg-Boberg [168]. Even earlier inhabitation seems to have occurred, judging by the Early Mesolithic barbed point found on the island of Föhr, at a depth of about 4.5 m. in a peat layer under the *Marsch* deposits, north of the hamlet Wyk [169].

From the Middle Neolithic date perhaps a few stone and flint axes from the Holocene deposits along the west coast of Schleswig-Holstein [170]. Further data about the depth of these

[168] Ecklak: Bantelmann 1949, 77, *Taf.* III: 2; Boberg: Schindler 1953/'55, 1961, 1960, 83-85. On the dune tops about 30 sites were discovered, five of them of primary importance because of their extent and finds. The finds comprise: some Ahrensburg Culture artifacts, microliths (at 5 sites), tranchet axes of the Oldesloe Culture, pottery from the Early Neolithic onward ending with the BB Culture.

[169] Bantelmann 1949, 77, *Taf.* III: 1. Another barbed point was found nearby at Amrum (*cf.* Clark 1936, 237).

[170] Bantelmann 1949. 77.

finds are lacking, while the datings of such axes are not without problems. Pätzold [171] describes an interesting find of a TRB settlement below NN near Gellerndeich at the end of the valley of the Hunte river. The finds (at any rate the Drouwen phase and as it seems also the Late Havelte phase are represented) were lying at a depth of between —1.0 and —1.4 m. NN [172], compaction-free on a sandy underground, and they were covered with peat. This depth corresponds with that of the approximately equally old finds of Bornwird [173] and forms an upper limit for the former MHW level.

Not better represented is the *Stein/Kupferzeit*, corresponding to the Bell Beaker Culture and the Early Bronze Age in the Netherlands. It is only at Hamburg-Boberg [174] that there is question of settlement remains. Additionally there are only isolated finds of flint daggers and sickles. These latter, however, do not necessarily all belong to this period. Of importance is the hoard of three flint daggers at Kuhlen near St. Margarethen in the Wilstermarsch (near the estuary of the Elbe) [175]. The daggers lay at a depth of 90 cm. and on the former surface. It is possible that a small concentration of flint flakes and a scraper from Gröde-Apelland [176] originate from the same time. The finds lay on the north-east slope of a "fossil sandbank", of which the top reached to —1.08 m. NN. The sand layer, with a maximum thickness of 1.20 m., lay on a clay deposit, so that it is clear that we are not concerned here with an earlier outcrop. It appears that the inhabitable region to the north of Eiderstedt extended far more westward than was the case more towards the south [177].

In the whole northern clay area the transgression phase Dunkirk I^a is of prime significance. Salt march deposits of this period were inhabited in the Early Iron Age in Friesland, Groningen and Niedersachsen. The reaction of the inhabitants during the next transgression phase (Dunkirk I^b) was not everywhere the same: in the Netherlands the first *terpen* were thrown up (among others the initial *terp* of Ezinge) on which the inhabitants could maintain themselves, while in Northern Germany the settlements were abandoned and the people withdrew to the south on the high, sandy *Geest* soils.

In the first century B.C. the people returned again to the salt marshes; in Dithmarschen the low land was inhabited later: from the first century A.D. During the Merovingian transgression period (Dunkirk II) the tale is repeated: the *terpen* of the Northern Netherlands continued to be inhabited, while the salt marshes of Ostfriesland were abandoned. Finally, from about A.D. 800, the whole salt marsh area from the river Ems to North Friesland was settled once again and for good [178].

Haarnagel gives the following data about levels in Jemgum. At a level of —0.5 m. NN the occupation took place in the 7th century B.C., at +0.2 m. in the 1st-4th centuries A.D. and

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171 Pätzold 1955.

172 We are informed by the Dutch Ordnance Survey, Delft that the *Normal Nul* level (NN) is equal to —0.02 m. NAP.

173 See App. II no. 12. We thank Prof Dr J. D. van der Waals for the information he kindly provided.

174 *Cf.* note 168.

175 Bantelmann 1949, 77; 1967, 19.

176 Bantelmann 1938, 1967, 20-24; Haarnagel 1950, 39-49 and *Abb.* 12.

177 Bantelmann 1967, 13.

178 See Haarnagel 1969, esp. 21-27; Bantelmann 1967, esp. 20-24.

at +0.5 m. today. At Hatzum the level of Early Iron Age occupation lay at —0.4/0.6 m. NN, and the Roman level on a 20/30 cm. thick covering layer of clay. The bank of a creek lay at —1.00/—1.20 m., of which the floor lay at —2.50 m. These data correspond closely with observations made in the Northern Netherlands. The differences with the data from the Rhine/Meuse mouth region are also very small. If isostatic movements played a part, there was no difference between both regions since the Early Iron Age [179].

Just as this more recent sequence of inhabitation reflects the transgression and regression phases, so the limited number of older finds seem to belong to periods of regression. They do not, however, as yet permit of a clear allocation to periods. The Ertebølle/Ellerbek finds were to be expected in the peat area; we were familiar with the BB-*Dolchzeit* inhabitation in the Netherlands also. These finds might also indicate a period of favourable possibilities of inhabitation here. The estuary of the Elbe seems comparable to some extent with the Rhine/Meuse estuarine area: there also the tops of dunes offered good opportunities for inhabitation in corresponding periods. Any inhabitation corresponding with the VL Culture, however, is not yet known. This region was, moreover, the best protected against erosion during later transgressions.

1.8.2. East England

Inhabitation is also known in the regions along the east coast of England which are influenced by the rise in sea-level. Here the Fenland is central. Even more than the estuary of the Elbe, it is comparable with the Western Netherlands, both in its vertical succession and lateral variation as well as in the data about inhabitation [180]. A number of small rivers here flow into a basin sloping very slightly in a north-east direction. Under the influence of the rising sea-level the peat formation begins here in the Atlantic; in the deepest parts (the small river valleys) this had already occurred earlier (Boreal). In the whole region there is one important transgression phase, represented everywhere, to be distinguished in the form of the Fen Clay deposit. Local deposits from earlier transgressions appear to occur along the coast. These, however, are only shown incidentally and are limited to the part nearest to the coast, where the Pleistocene subsoil lies deepest. The oldest of these deposits possibly still belong to the Atlantic period. The Fen Clay itself is dated after 2700 B.C. at the coast, reached its maximum extent at about 2500 B.C. and was covered with peat about 1950 B.C. In the river valleys (for example

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[179] Haarnagel (1963, *Plan* II; see also 1940: *Abb.* 6) gave a schematic representation of the changes in level of the surface of the *Marschen* of Lower Saxony, going form east to west. The Bronze Age level lies between —0.5 and —2 m., the Roman level between 0 and +0,5, the Early Mediaeval level at about +1.00.

The data are constistent with those from the Western and Northern Netherlands. But the level increases considerably when we come east resp. north of the Elbe. *Cf.* for instance Einswarden: +50-70 cm. NN (Schmidt 1957), and Tofting: +145 cm. NN (Bantelmann 1955), dated 1st century B.C. and 1st century A.D. resp. This difference might be partly the result of a large tidal amplitude, partly the influence of the isostatic upheaval of Scandinavia.

[180] The author studied the Holocene of East England during his study of Physical Geography in1965; typescript no. D 1616 in the Geographical Institute, State University, Utrecht.

near Shippea Hill) the transgression was noticeable somewhat earlier, about 3000 B.C. [181]. From these dates it appears that the Fen Clay corresponds with the Dutch Calais IV deposits [182].

The archaeological data correspond closely with these datings.

The investigation by Clark and Godwin at Peacock's Farm and Plantation Farm [183] are of special interest to us, since they have much in common with our discoveries on the Hazendonk and offered comparable results. On small, sandy outcrops with very steep slopes (in our view very probably dunes), lying near the "roddon" of the river Little Ouse [184], the remains of settlements from the Late Mesolithic, the British Early Neolithic and the Early Bronze Age were found. Finds were also made on the covered slope of the outcrops and embedded in the adjacent clay and peat layers covering the slopes. The Mesolithic level is a black, sandy layer, "stinking" and dated by pollen analysis at the end of the Boreal. The Early Neolithic level (Windmill Hill, Neolithic A) is slightly sandy and hardly recognizable in the sections. Both levels lie under the Fen Clay. The Early Bronze Age level lies just above this clay and is dated Early Subboreal [185].

On both sites fairly coarse Early Bronze Age pottery with heavy rims, cordons and decoration of cord impressions was found. One sherd at Plantation Farm even shows BW decoration[186]. Sherds of Late Beaker pottery (Long Necked Beaker, A Beaker) were also found there. In neither case was characteristic pottery found in the peat. The appropriate level could, however, be reliably determined by a number of finds of pig and ox bones.

A series of ^{14}C dates [187] with fairly large margins of error shows a good mutual agreement, except for two charcoal datings of the Early Neolithic level (both agreeing well with each other) which in relation to the peat datings turn out to be 500-300 years too young. It is not possible to find a satifactory explanation for this [188]. In the Mesolithic level two ^{14}C dates lying directly above each other differ by nearly 1000 years (5650 $\pm$ 150 and 4733 $\pm$ 150 B.C.) This is due either to a stationary phase in the growth of peat or to wastage of the peat caused by inhabitation. The whole peat layer under the clay wedge is 140 cm. thick and was formed between about 6600 and 2840 B.C.

The data about the height of the various levels have been summarized in table 4. In comparison with the data of the Western Netherlands both the youngest levels are significantly higher. The difference with the two oldest data is, however, remarkably large. The variations might be explained by assuming that an actual rise took place in the Fenland before 3000

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181 On the geology of the Fenland see: Willis 1961, Godwin & Clifford 1939, esp. 401 and the diagram there; Godwin 1939/'41, Godwin & Edmunds 1933, Jelgersma 1961, 52-53.

182 Bennema 1954, 32-33 says that the Fen Clay corresponds with the Cardium deposits, but at that time Cardium was dated too old (*cf.* note 129).

183 Plantation Farm: Clark 1933; Peacock's Farm: Clark *et al.* 1935, Clark 1955, Clark & Godwin 1962.

184 See esp. the aerial photograph in Clark 1955. For "roddons" see p. 75.

185 Godwin 1939/'41, fig. 22; Clark *et al.* 1935, fig. 18.

186 Clark 1933, PL. XLV, 13.

187 Clark & Godwin 1962.

188 Either the dates of the peat samples are too young by some centuries, due to enrichment with recent humus, or the error is in the charcoal sample. The dates are not Suess-corrected. The differences in the corrections are perhaps the cause of the anomalies.

B.C., compensating almost entirely, but not altogether, for the rise in sea-level. Another interpretation, which appears more probable to us, takes into account the "gradient effect" [189]. In the time of the first peat growth the coast was far distant and the peat formation started mainly because of stagnant ground water. According to this hypothesis the water level near Peacock's Farm first came under the direct influence of sea-level movements about 3000 B.C., while it had previously been but little influenced in this way. The systematic difference in height of the later levels at the Hazendonk and Peacock's Farm can be ascribed to the "gradient effect".

TABLE 4

Peacock's Farm, Fenland. Depths in cms and dates of levels with culture remains

Archaeol. date	^{14}C date (B.C.)		Depth above (+) or below (—) the Fen Clay	Depth below OD of the not "founded" level	Depth of "juncture" (= MHW)	Compaction
EBA	after 1940	peat	+ 5/ 15	— 110/130	— 30	80/100
Neol. A.	2910/2990 ± 120	charc.	— 50/ 70	— 380/400	— 310	70/ 90
Mesolithic	5650 ± 150	peat	— 90/110	— 440/460	— 340/360	100
Mesolithic	6660 ± 160	peat	— 130	— 480	—	—

Data of Clark 1935 (esp. fig. 2) and Clark & Godwin 1962 (esp. figs. 3 and 4 and note 1).

The sequence of occupation and sedimentation at Peacock's Farm and the Hazendonk shows a striking conformity, which is of great importance for the correlation of the Holocene transgression sequences around the southern part of the North Sea.

A number of Neolithic axes, found under the Fen Clay at various places in the Fenland, show that one can envisage general inhabitation in the Early and/or Middle Neolithic. Bronze Age finds, namely a number of spear heads, are always found on the Fen Clay; an Early Bronze Age skeleton was also found at that depth [190]. Bridget Trump [191] refers to no less than 65 Middle Bronze Age swords, found in the Fen District. With few exceptions the find places lie along the edges of the peat areas or in the direct vicinity of the "islands" of outcropping boulder clay. We should not interpret these swords as a proof of intensive inhabitation. It is much more likely that they were used for a kind of ritual offering, buried in the peat by people who had come from different directions, and possibly with this purpose in mind, to the Fen District.

[189] In Clark *et al.* 1935 the surface of the Fen Clay is drawn 0.8 m. too low ! *Cf.* note 1 in Clark and Godwin 1962.

[190] As to the finds see: Godwin 1939/'41, esp. the scheme at p. 281. As to the skeleton: Clark 1933, esp. 278-279. The skeleton was found in the peat at 10 cm. above the Fen Clay.

[191] Trump 1968.

Nor has inhabitation been clearly proved during the Late Bronze Age. The depot of a large number of socketed axes near Stutney, Isle of Ely, shows that the corresponding level must lie some way in the "Upper Peat" [192].

A second, important transgression phase reached less far inland than the Fen Clay. The "Upper Silt" was deposited around the Wash and in and along the river beds in the peat-region. After a "native" inhabitation, an intensive Roman occupation with good water control occurred. The abandonment of the Roman settlements, completed about 425 A.D., coincides with the beginning of a new transgression phase, ending in the 7th/8th century A.D. Subsequent inhabitation was limited chiefly to the deposits of this post-Roman transgression and was concentrated around the Wash. After an inhabitation peak in the 9th-11th centuries a gradual decline occurred, particularly after the 13th century [193]. With the beginning of dike construction, the artificial drainage and the making of polders, especially after about 1630, a new period of inhabitation began. Because of considerable compaction the old creek fillings gradually became visible as ridges ("roddons") after that time [194].

The entire history of sedimentation and inhabitation in the Fenland corresponds in its overall picture with that of the Western Netherlands. Not only the transgression phases Calais IV and Dunkirk I, but also Dunkirk II and III are clearly recognized. The absence of Dunkirk O may be explained by the wide distribution of the Fen Clay (Calais IV) sediments and the resistance offered by these. Moreover, it is possible that a part of what is called Fen Clay is of later age and in fact can be dated as Dunkirk 0.

Data about places outside the Fenland are more sparse. To the north of it, near Ingoldmells and at the estuary of the Humber, only the younger (Dunkirk I, Dunkirk II) transgression phases have been identified. Further north we come to the region of land-upheaval and coastal terraces [195].

South of the Fen District data are available about the Norfolk Broadlands [196]. Two transgression phases are known there, represented by a Lower Clay (between —11.5 and —9.5 m. OD) [197] and an Upper Clay (between —5.5 and —1.5 m. OD). The first, lying on 1 m. peat, is Early Atlantic, the second is Late Subboreal and/or Subatlantic. The oldest clay seems to begin certainly earlier than the Fen Clay, in view of its depth, but the end of both occurred at about the same time. The Upper Clay corresponds with the Upper Silt of the Fen District. The considerable differences in height are certainly attributable partly to compaction, and partly perhaps to a deeper real subsidence in the Broadlands. No archaeological data about Neolithic or Bronze Age inhabitation exist.

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[192] Clark 1940.

[193] See Hallam 1961, also Green 1961. After completition of the manuscript a detailed monograph on the Roman occupation of the Fenland came out (Phillips (ed.) 1971). Miss Hallam gives therein a full account of her observations (p. 22-126).

[194] Fowler 1931/'32, 1932, 1933/'34, 1934; Godwin 1938. As to compaction: Fowler 1933. The roddon at Peacock's Farm has a height of 2 m ! The "shrinkage" of the peat there amounts to 45 cm. between 1935 and 1962. Since 1660 the peat surface has been lowered locally 5 m., of which at least 3 m. in the last century.

[195] Swinnerton 1931, A.G. Smith 1958[a], 1958[b].

[196] Lambert *et al.* 1960, I. S. Zonneveld 1960[b].

[197] By OD we mean Newlynn ODN. The Durch Ordnance Survey, Delft, informed us that this level is situated at —0.23 cm. NAP.

The transgression over the well-known Lyonesse surface along the east coast of Essex has been dated closely after the BWB pottery from the beginning of the Bronze Age [198]. Remains of inhabitation on the surface fall into three groups: an inhabitation phase in the beginning of the Neolithic with (early) Windmill Hill pottery, a phase with Peterborough ware and finally inhabitation by people using beaker pottery. The beaker sherds were found as far as low tide level. They were covered by a thin layer of peat and by about 3 m. of *Scrobicularia* clay, of which the upper surface lay about 1 m. beneath the present MHW level. All this implies in our view an occurrence of Beaker pottery to at least —1 m. OD. Inhabitation did not take place along the open seaboard, but on the banks of the creeks behind. The coast-line itself was possibly formed by a sand spit or a coastal barrier. The finds include wooden objects: a canoe, paddles and even the remains of wooden structures (huts). These can only have been preserved by a very short interval of time between inhabitation and submergence. The submergence seems therefore to have happened during the transgression phase Dunkirk O, which we were not able to identify in the Fenland.

The inhabitation remains show a close correspondence in their dating with the Fenland on the one hand and with this country on the other hand. In East England also a sequence of trangression and inhabitation phases, such as we were able to determine in the Netherlands seems to be applicable, especially during the most recent times, but perhaps also during the Bronze Age and the Neolithic.

1.8.3. Conclusion

The data which we collected on the inhabitation history of the Holocene regions around the southern parts of the North Sea, namely the area indicated by Willis [199] as a subsiding region, seem to show a large measure of mutual agreement. This is probably to an important degree the result of the considerable similarity in the history of the development of the various regions. The succession of transgression and inhabitation phases determined for the Western Netherlands, appears to apply not only to Northern Germany but also to the East England coastal regions, as far as the later times are concerned. But for pre-Roman times in England, and the Neolithic and Bronze Age in Germany the information is still too vague to allow any detailed comparison with the Netherlands.

The Western Netherlands stand out as a unique region having complex origins. Further, the inhabitation of this relatively large region shows a remarkably varied picture because of the different possibilities it presented. For coastal barriers and former river courses were entirely lacking elsewhere. Because geological and archaeological investigations in the Rhine/Meuse delta are relatively far advanced for various reasons, it was possible to make in this region a detailed picture of the inhabitation history in relation to the development of the landscape.

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[198] I. F. Smith 1955; see also Zeuner 1958, 97-99; Warren *et al.* 1936, Warren and Smith 1954.

[199] Willis 1961.

2. GEOLOGY AND INHABITATION OF THE RIVER CLAY/WOOD PEAT AREA

The discussed area forms a vast geological "window", where old morphological units are preserved. Explorations since 1963 by a group of amateur archaeologists revealed an extensive prehistoric occupation in this formerly blank area. The inhabitation history is described, from the Early Neolithic throughout prehistory up to historic times. The sequence and patterns of human occupation appear to be closely linked with the geological events and the changes in environment. These are, therefore, also discussed.

2.1. HISTORY OF THE ARCHAEOLOGICAL AND GEOLOGICAL INVESTIGATION

The investigation has concentrated upon the South Holland peat area, and especially the southern part included in the Alblasserwaard and the Vijfheerenlanden. Here, in the extension of the river clay area, a number of former river courses lie as stream ridges in the landscape, as do also outcrops of the deeper subsoil, the *donken*. Both were visited by prehistoric man, and both have already been discussed above.

In 1846 L. J. F. Janssen supplemented a report of the find of a Roman coin at Oud Alblas with a description of a conspicuous hill in the Alblasserwaard landscape, the so-called Brandwijk Donk. His idea that these hills supported the oldest inhabitation of the district appears to be confirmed by our enquiry, if in another sense than that intended by Janssen[1]. Later Brunsting and Van Giffen [2] conducted a small investigation in Oud Alblas in the hope of finding evidence of Roman inhabitation. *Pingsdorf* pottery, however, formed the oldest finds. In 1941 Braat visited the Overslingeland Donk in the municipality of Noordeloos, in connection with a proposed plan for dredging sand there. Although no traces of inhabitation were observed,

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[1] Janssen 1846. Janssen published a letter of 2 August 1845 by Mr S. H. van der Noorda of Dordrecht. Mr van der Noorda appears to be well informed on the theory of a former lower level of the sea and applies this theory on the *donken* in the Alblasserwaard, saying: "Starting from this theory some people have claimed that, before the quoted rise of the water level of the sea and when our inhabitable soil was lying lower, this soil might have been covered with low, dune-like hills, forming a row, which met the Gelderland "mountains"; that the more scanty and less firm hills that were lying in the *Alblasserwaard* (for, where that *Waard* is lying now), might have been eroded by the sea water and for the greater part washed away; that the three hills, yet present there, might have belonged to the eroded row and thereof, as originally higher and firmer, might have been left. But I have not contented myself with this theory and the conlusions based on it, how ingenious these may be, but I have made a preliminary investigation on one of the hills, named the *Donk*, near *Brandwijk*, situated three hours from here (*Dordrecht*)." After some discussion Mr van der Noorda continues: "A skilful surveyor, well-informed on the local situation, told me that according to his feelings *de Donk* was not formed by nature but was raised artificially, many centuries before the embankment of the [Alblasser] Waard; that in older times the soil, later again raised by natural deposition, in the surroundings was dug away, as appeared to him by the still existing regular depressions, situated around the *Donk*; that the dug-out ground was used to raise the base of the hills and that subsequently this base was heightened more with river sand and that he thought that the three hills in question were the oldest inhabited places of the Alblasserwaard." Janssen comments: "This last feeling appears to me the most reasonable too, because it is supported by many examples in this country, as the *woerden* in Gelderland and North Brabant, the *wierden* in Groningen and the *vlietbergen* in Zeeland; ....".

Our comment is, first, an appraisal of the keen observations of the surveyor. Around most of the *donken* a slight, wet depression is indeed present. It is caused by seepage at the *donk* feet, resulting in wet conditions that favour the growth of reed and horse-tails. The turf is soft and peaty and is easily destroyed by grazing animals. Second, Janssen thought of Roman or Mediaeval occupation as the oldest of the district, since he and Mr van der Noorda had chosen the wrong theory. They never will have imagined that Neolithic remains would ever be found on the *donken*.

[2] The investigation was carried out in 1938 and has not been published. We thank Prof Dr H. Brunsting, Leiden, and Mr J. N. Lanting, Groningen, for this information.

Fig. 18. Map of the Prehistoric and Roman occupation of the river clay/wood peat area, in relation to geology. The thin post-Roman clay, which covers almost the entire area is left out of consideration. Scale 1:100.000,

The geological map has been composed by the author with the aid of the following unpublished maps of the Soil Survey Institute :

Alblasserwaard	scale 1:10,000	by J. van der Linde	1953/55
Vijfheerenlanden	scale 1:20,000	by L. J. Pons	1950/51
"Lek en Linge" district	scale 1:25,000	by J. N. B. Poelman	1965
Tielerwaard	scale 1:20,000	by P. van der Sluijs	1955/56

of the geological map scale 1:50,000, sheet Gorinchem Oost (38 0) by A. Verbraeck 1970, and of some data by the author.

The archaeological data are all assembled by the author. The numbers refer to Appendix III.

Legend, grey : geology

1. crevasse deposits (dike breach deposits), after A.D. 1200
2. fluviatile levee deposits, post-Roman
3. back swamp clay belonging to the same system as 2
4. levee deposits with Roman occupation (pre-Roman *sensu stricto*); old stream channels in black
5. back swamp clay belonging to the same system as 4
6. pre-Roman levee and back swamp deposits in the east of the Tielerwaard, probably older than the system 4-5
7. estuarine creek levee deposits with small branches, post-Roman
8. estuarine creek levee deposits with small branches, with Roman occupation (pre-Roman *sensu stricto*)
9. stream ridges, Late Atlantic and Early Subboreal; old stream channels, if clearly present, in white
10. as 9, but covered with peat
11. *donken*, tops of Early Holocene dunes
12. peat
13. natural water-courses in the peat-district, the main drainage lines before the embankment
14. break-through channels through the Subboreal stream ridges :
    a. Molenaarsgraaf,
    b. Ottoland-De Put,
    c. Ottoland-Kromme Elleboog,
    d. Hoog Blokland,
    e. Culemborg-Den Heuvel.

Legend, red : archaeology

1. various axes
2. older than VL Culture
3. VL Culture
4. VBB and/or BWB Culture
5. Middle Bronze Age (DKS)
6. Late Bronze Age
7. Iron Age
8. Roman : settlement
9. Roman : unreliable
10. Roman : coin
11. Prehistoric, indefinite

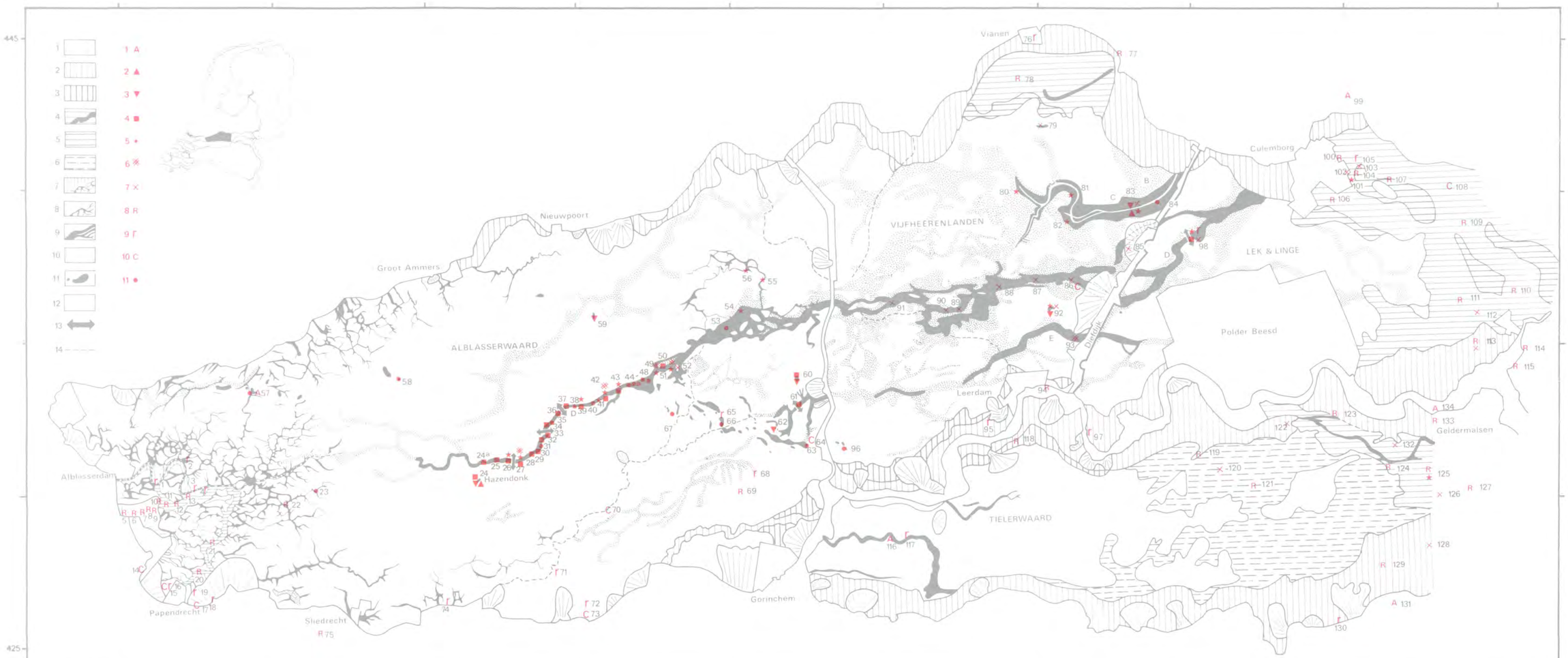

Fig. 18. Map of the Prehistoric and Roman occupation of the river clay/wood peat area, in relation to geology

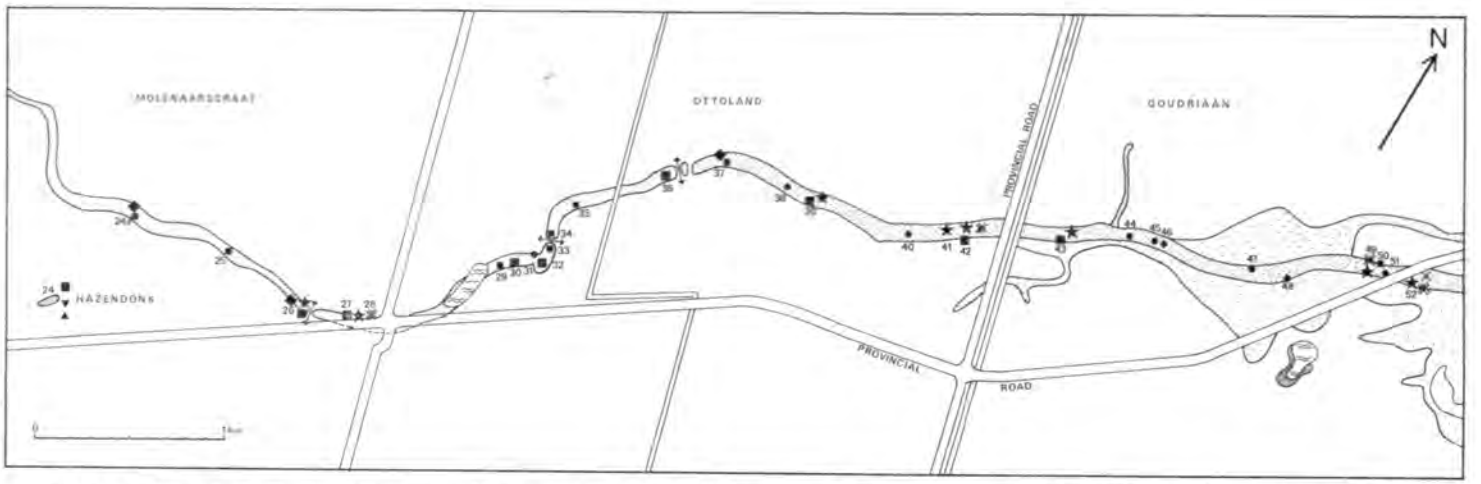

Fig. 19. Prehistoric sites on the Schoonrewoerd stream ridge between Molenaarsgraaf and Noordeloos. Scale 1:40,000. For the situation see fig. 18.

	donk	×	Iron Age	◆	VBB/BWB-graves
	stream ridge	⁂	Late Bronze Age	▾	VL Culture
	other sandy deposits	★	Middle Bronze Age (DKS)	▲	older than VL Culture
	water	■■	VBB/BWB-settlements (certain, probable)	•	prehistoric, indefinite

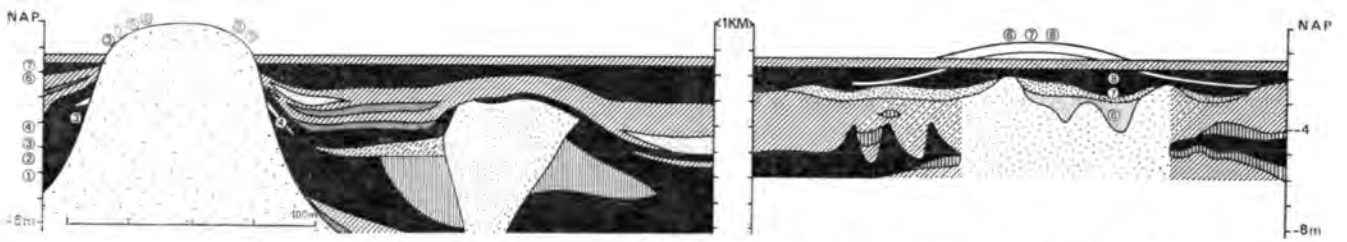

Fig. 20. Section across the Hazendonk and the Schoonrewoerd stream ridge (through the break-through channel of Molenaarsgraaf). Generalisation of figs. 34, 36 and 61. Horizontal scale 1:3000, vertical exaggeration : 10×.

Indicated are data on prehistoric occupation :

1. Early Neolithic (?)	4100 B.C.	5. Hybrid Beaker, MBB	2200-1900 B..C
2. Early Neolithic	3400 B.C.	6. VBB/BWB	1900-1600 B.C.
3. Middle Neolithic	3000 B.C.	7. Middle Bronze Age (DKS)	1400-1000 B.C.
4. VL Culture, PFB	2500-2200 B.C.	8. Late Bronze Age and Early Iron Age	1000- 500 B.C.

the presence of Neolithic remains seems, however, not improbable, in the light of our present knowledge. As the slopes of the *donk* have been spared, the most important data will have been preserved [3].

The maps of the stream ridges made by Vink [4] were the first to give an impression of the geological structure of the district. The soil maps made by Pons, Van der Linde, Van der Sluijs and Poelman complete this picture [5]. Another important result of their work was the discovery of a fairly large number of archaeological sites [6]. Instructive aerial photographs had been published previously by Buringh and Von Frijtag Drabbe. These aerial photographs were chosen from a large number made by the R.A.F. in the winter of 1944/1945 when large parts of the region (where the front lines then lay) were badly drained while the higher and dry stream ridges were covered with snow or hoar-frost. They give a very sharp, detailed picture of the courses of the peat stream ridges [7]. In the future similar results may be expected from the infra-red aerial photographs, which were made for the geo-hydrological investigation of the area by De Hoop [8].

In recent years the investigation has been carried out for the most part by the Geological Survey. In particular, a systematic mapping of the entire complex of Holocene deposits is being currently conducted under the direction of Verbraeck. The first sheet — Gorinchem Oost — has recently been published [9]. These maps are, however, less concerned with the uppermost sediments than are the soil maps, so that they are less suitable for archaeological explorations. In this case the archaeological research primarily provides datings for the geologist.

In 1960 the AWN work-group "Lek en Merwestreek" [10] was set up by, among others, the late Mr van Hoogdalem, who had discovered, as early as 1941, a Roman settlement near Gorinchem [11]. The work-group chiefly concentrated on Mediaeval (the Giessenburg) and Roman (Alblasserdam) objects [12]. The sites discovered by the Soil Survey Institute, however, quickly

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[3] Rijksmuseum van Oudheden, annual report on the year 1941, 5. A detailed report by Dr Braat on this prospection is in the RMO archives.

[4] Vink 1926, 1954.

[5] The Vijfheerenlanden were mapped by Pons in 1950/'51 (Pons 1951, De Boer & Pons 1960), the Alblasserwaard by Van der Linde in 1953/'55 (J. van der Linde (1955), the Tielerwaard West by Van der Sluijs in 1955/'56 (J. van der Sluijs 1956) and the Lek en Linge district in 1965 by Ir J. N. B. Poelman. I express my gratitude to the Stiboka for permission to make use of these maps. *Cf.* also Van Wallenburg 1966, 16; Stichting voor Bodemkartering 1965, 126.

[6] These sites have been dealt with only cursorily before. Only reports on those in the Vijfheerenlanden have been published (Modderman 1951[a], Pons 1961). Moreover, many finds were lost. The Tielerwaard finds were registered in the documentation of the ROB. The Lek en Linge sites were explored by the author in 1967. *Cf.* also the remarks on the sites Hoog Blokland and Molenaarsgraaf no. 27/28 (p. 98, note 62 and p. 175, note 6).

[7] Buringh 1949, 52, photo 4; Von Frijtag Drabbe 1948, photo 3. Large series of R.A.F. aerial photographs are in the archives of the Topographic Service, Delft, and at the Soil Survey Institute, Wageningen.

[8] I thank Mr D. de Hoop, I. T. C. Delft, for showing his photographs to me.

[9] Hageman 1961, Verbraeck 1958, 1961, 1964, 1970.

[10] *Cf.* the journal "Westerheem" 9 (1960), 114, and 10 (1961), 80-81.

[11] Documentation at the RMO Leiden and pers. comm. by the late Mr van Hoogdalem. An *in memoriam* to Mr van Hoogdalem can be found in the journal "Westerheem" 19 (1970), 219 and in "Holland" 4(1973), 300-301.

[12] De Kok 1964, Van den Beemt 1967. Mr H. Voogd of Rijswijk (Land van Heusden en Altena) participated in the work of the group in the first years of its existence, Earlier Mr Voogd had discovered a considerable number of Roman and Mediaeval sites in the Land van Heusden en Altena. The work-group might unconsciously have taken advantage of Mr Voogd's experiences.

drew their attention and under the direction of Mr H. A. de Kok a systematic survey was made of the *donken* and the stream ridges. A large number of new prehistoric settlement terrains were discovered during the digging of numerous small test pits through the clay layer which covers the old deposits. The work-group can justly claim the honour of having demonstrated the extensive prehistoric inhabitation of this part of the peat area [13]. Later, after co-operation with the author, a number of find places were discovered north of the Lek in the Lopikerwaard and south of the Merwede in the Land van Heusden en Altena [14]. Further east, in the river clay area, independently of the above-mentioned investigations, a large number of Middle Bronze Age settlement sites were discovered in recent years during the soil mappings conducted by Havinga [15]. In a few years a large area that had previously been blank in the prehistoric distribution maps has thanks to this work become filled up.

In a preliminary form the prehistoric and Roman sites in the western river district are documented in Appendix III and mapped in the maps fig. 18 and 19 in relation to the geological structure of the area [16].

2.2. THE GEOLOGICAL STRUCTURE

The river clay/wood peat landscape or the "western river area" or "southern peat area", as we may call the region here under discussion, coincides with the region named by Pons: IV^{c} — "fluviatile deposits in wood peat landscape", lying between the region with fresh water tidal deposits at the seaward side and the purely fluviatile area of the Rhine and Meuse upper courses. It is the western part of the area defined by Hageman as "perimarine" [17]. The geological development of such a region occurs in a fresh-water environment but is nevertheless dominated by the rise in sea-level and its variations. The region lay during the whole sequence of Holocene deposition between the zone of influence of the marine transgressions (the sea clay area) in the west and that of the fluviatile sedimentation (the river clay area) in the east. It remained unaffected by influences from either side so that old deposits (with the archaeological remains on them) have been preserved. We are justified in regarding this region, like a few smaller regions

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[13] Reports on the discoveries: De Kok 1965, 1966.

[14] North of the Lek a Middle Bronze Age settlement was discovered at Benschop (App. II, no. 15). The occupation and the ^{14}C date (*cf.* Appendix IV) give a *terminus ante quem* of the N-S running Blokland stream ridge, mapped already by Vink (1926). South of the Merwede, in the Land van Heusden en Altena, a site near Biesheuvel, mun. Wijk en Aalburg (App. II, no 17) gives most information. Here Middle Bronze Age occupation has been confirmed by a ^{14}C date (*cf.* Appendix IV). Some flint, which can be attributed to the BB Culture gives a *terminus ante quem* of the Babyloniënbroek stream ridge. Louwe Kooijmans 1967^{c}, 1968^{b}, Sonneveld 1958.

[15] *Cf.* Hulst 1967, Havinga 1969; as to the older finds: Modderman 1955^{d} and Pons 1957, 35-42.

[16] We thank the Soil Survey Institute (Stiboka) for their kind permission to make use of the unpublished maps and to publish the map at fig. 18.

[17] Pons in Van Regteren Altena *et al.* 1962/'63, 1963, fig. 35. Earlier Pons named the area "river clay/peat inversion landscape" (De Boer & Pons 1960, Pons 1951), a name embodying the three most important features of the landscape and the reversal of the relief, caused by the artificial drainage in historic times. For the definition of the perimarine area: Hageman 1969, Verbraeck 1970, 51-52.

elsewhere, as an archaeological "window" [18]. In general we are concerned with an exceptionally quiet, fresh water environment, which was only liable to slight fluctuations in ground water level (due to ebb and flood, or changes in river levels) [19]. We refer the reader to the map at fig. 18 for the situation of this area in the Western Netherlands, and to the schematic section at fig. 23.

Since the end of the Boreal, peat formation took place here. Almost exclusively a more or less clayey wood peat originated, caused by the inflowing eutrophic and muddy river water. Elsewhere in the South Holland peat area, where riverine influences were less, or entirely absent, a *sphagnum* peat could develop in an oligotrophic environment. These places are, reckoned from the river courses (Vecht, Old Rhine (Oude Rijn), Holland IJssel), the central parts of the peat. It is these areas that have disappeared because of the cutting of peat throughout history: the places of the present day polders and lake bottom reclamations [20]. All traces of possible inhabitation of these areas have therefore disappeared. It appears to us unlikely, however, that prehistoric inhabitation did in fact take place there.

The peat (the Holland peat, according to the new geological nomenclature) forms the matrix within which the mineral deposits of the above-mentioned former water courses and smaller creeks are embedded. These were called by Pons [21] "peat stream ridges". These ridges and the *donken* form the units on which the traces of prehistoric inhabitation occur and on which took place both the excavations at Molenaarsgraaf which are described in the parts III and IV of this paper. For this reason we propose to discuss the *donken* and stream ridges at greater length.

2.3. THE "DONKEN"

2.3.1. Earlier Investigations

The *donken* [22] are the oldest landscape forms in the Western Netherlands. They are, as we have already said, outcrops of the Late Glacial/Early Holocene subsoil, of which the tops rise above the Holocene deposits which are here 8-12 m. thick. The sides, however, are covered with these deposits. Although the *donken* were already known to Staring as diluvial sands [23],

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[18] *Cf.* p. 12. Factually the river clay/wood peat area extented originally farther to the south (as far as the Pleistocene sands of North Brabant). Parts of the peat district north of the Lek belong also to this area, especially the region between Benschop and IJsselstein. We directed our investigations also to the parts south of the Merwede, preserved there between or below younger deposits and to the region north of the Lek. But we concentrated on the extensive coherent part embodied in the Alblasserwaard, Vijfheerenlanden, Lek en Linge district, and Tielerwaard, shown on the map at fig. 18.

[19] Jelgersma 1961, 31-33.

[20] Bennema 1950, Van Wallenburg 1966.

[21] Pons 1951.

[22] We will use the name *donken* for these sandy outcrops since it is used in the larger part of the western river area. In other districts they are named *berg* (= hill) or (in the Bommelerwaard) *loo* (*i.e.* forest), which is perhaps a reminiscence of their former wooded appearance.

[23] Staring 1859-1867; 1860, 15: "So it (*viz.* the "sand-diluvium") lies *e.g.* below the moors, where it forms a small hill south of Streefkerk, formerly settled by the Donk cloister".

they were first subjected to a comprehensive investigation by Vink [24]. He considered them to be the last erosion remnants of the Lower Terrace, against which Steenhuis [25] adduced as an argument the fact that under a number of *donken* a clay layer occurs which certainly cannot have been formed before the Lower Terrace. Crommelin conducted a few analyses of heavy minerals in 1938 [26]. The flora of the *donken* had already been the subject of a special study in 1927 [27]. In 1946 Edelman and Vink [28] appealed for the preservation of the *donken* on account of their value from a scenic, geological and botanical point of view. We may add here their archaeological value.

2.3.2. Origin and Dating

It was the studies of Pons that first made it apparent that we are concerned with largely covered dunes [29]. Their aeolic character was established by the sand analyses of Faber [30]. Bennema and Pons [31] described the sand as "homogeneous, not clayey, fairly coarse wind-blown sand" with more than 50% by weight larger than 200-300μ. It is remarkable that this idea was known to Janssen [32] as early as 1846. He rejected it, however, as being too fantastic, and preferred to believe that he was dealing with elevations raised by human hands, analogous with the "*terpen*, *woerden* and *vlietbergen*" (refuge mounds) in Groningen and Friesland, the Betuwe and Zeeland respectively.

Of special importance for dating and understanding the origin of the *donken* are the mapping and studies of the Lower Terrace, where this occurs at the surface farther upstream, eastwards of Nijmegen [33]. Along the Meuse the middle three out of the five sub-levels are dated to the Allerød period, as is the final stage of the braided river system between Wijchen and Nijmegen [34]. There the system is covered by a maximum of 1.5 m. river clay ("river loam") which is comparable to the German *Hochflutlehm*. The terrace was intersected during the Allerød. This old river valley is on the east side accompanied by a series of river dunes, which partly lie on the older sub-levels and which are dated to the Younger Dryas period by pollen analysis and by their direction [35]. They consist of sand blown out of the frequently dried-out river beds. In Central Limburg this river bed is mapped as Terrace X, level of

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[24] Vink 1926, 1954.

[25] Steenhuis 1941.

[26] Crommelin 1938.

[27] Van Steenis 1927. At present not much is left of the characteristic flora, because of the abundant use of artificial fertilizers.

[28] Edelman & Vink 1946.

[29] Pons 1954, Bennema & Pons 1952, Pons & Wiggers 1958.

[30] Faber 1960, 560.

[31] Bennema & Pons 1952.

[32] Janssen 1846, *cf.* the quotation at p. 79, note 1.

[33] Koenigs 1946, Schelling 1951, Pons & Schelling 1951, Pons 1957, 1966, Quitzow 1956, esp. 374; Quitzow & Zonneveld 1956, 428.

[34] Van den Broek & Maarleveld 1963, Teunissen & Van Oorschot 1968.

[35] During the Allerød period winds were mainly north-westerly; during the Younger Dryas period they were predominantly south-westerly. Maarleveld & Van der Schans 1961, Van der Sluijs & Maarleveld 1960, Maarleveld 1960, Pons & Bennema 1958.

Overasselt, or Lower Terrace III. Near Wijchen the gullies in this terrace are filled with Younger Dryas peat. During the Early Holocene, especially in the Boreal, drift sand dunes were blown up in the older river dune regions.

The *donken* are the western continuations of these river dunes. They lie in the region of the Late Glacial braided river system and appear to lie generally on the right-hand banks of the former gullies and especially at the eastern ends of the east-west running gully stretches. It is precisely there that the sand, blown out of the gullies by westerly winds, would pile up. The *donken* lie generally on a layer of clay, 10-100 cm. thick, the top of the deposit of the braided river system: the Kreftenheye Formation. This light-grey clay can be related to the above-mentioned river clay (*Hochflutlehm*), but in the Alblasserwaard it seems to have been partly deposited later, up until the Boreal. It is therefore possible that the *donken* were partly formed in the Boreal. However, Boreal peat has never been encountered between the clay and the sand of the *donken* [36]. Support for dating the *donken* up until the Boreal is found, moreover, in the study of Florschütz and Jonker [37], who in 1939 dated a 45 cm. thick sand layer in the sluice pit near Wijk bij Duurstede in the Late Preboreal/Early Boreal. The end of the formation of the *donken* took place at any rate before the beginning of the Atlantic, when the gully system of the braided river in our area was covered with a dark, blue-grey clay.

To summarize, we may interpret the *donken* as river dunes, originating from the end of the Late Glacial up until the beginning of the general development of peat in the Early Altantic.

2.3.3. Shape and Distribution

The shape of the *donken* is very similar to that of the Late Glacial river dunes. They are often very elongated in a south-west/north-east direction with a steep (about 20°) north-east slope and a long, gradually dipping "tail" in the south-west [38]. The Hazendonk is a fine example of this. They are sometimes sickle or point-shaped (fig. 21). In the peat area they are generally not at all, or only slightly, eroded, but gradually overgrown with peat. In the places more to the west or east where they originally occurred they have completely disappeared because of later erosion.

The Late Glacial relief and the situation of the *donken* has been illustrated in more and more accurate contour maps [39]. In the very wide (30 km.) and shallow (2-5 m.) Late Glacial Rhine/Meuse valley they lie in two groups: one in the Alblasserwaard and the adjoining area in the centre of the valley, the other in a few small concentrations along the southern perimeter, in the basin clay regions of the Bommelerwaard and the Land van Heusden en Altena, where tributaries from North Brabant flow into the valley. Within these two main areas of occurrence we can distinguish smaller groups and isolated *donken*.

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[36] See Hageman 1961, 1969, Verbraeck 1970, 38-46.

[37] Florschütz 1944, Florschütz & Jonker 1939, Pons & Bennema 1958.

[38] For sections across *donken*: Vink 1926, figs. 9, 13; Edelman 1947, fig. 29; Faber 1947/'60, vol. III, fig. 31; Bennema & Pons 1952, fig. 4; Jelgersma 1961, figs. 4, 5; Voorrips 1964, 242; Verbraeck 1970, figs. 13, 15, 16 and map 5.

[39] Faber 1947/'60 (vol. III, fig. 29; IV, fig. 122); Pannekoek (ed.) 1956, Pons & Bennema 1958, Jelgersma1961, fig. 3; Pons *et al.* 1963, enclosure 2.

2.3.4. Prehistoric Occupation

2.3.4.1. *The Finds*

The oldest traces of inhabitation in the district are to be expected on the *donken*. They could, however, only have become attractive for occupation when the land around them, at about 5000 B.C., changed to a peat marsh, inside which these dunes formed dry islands. On the other hand the dunes remained available for settlement until they were covered by peat. We may therefore expect to make finds from the Late Mesolithic and later periods on the uncovered dune tops.

Throughout prehistoric and historic times the *donken* were easily recognizable, not so much because of their height as because of their divergent tall growing forest vegetation of oak, elm, lime and ash (see p. 137).

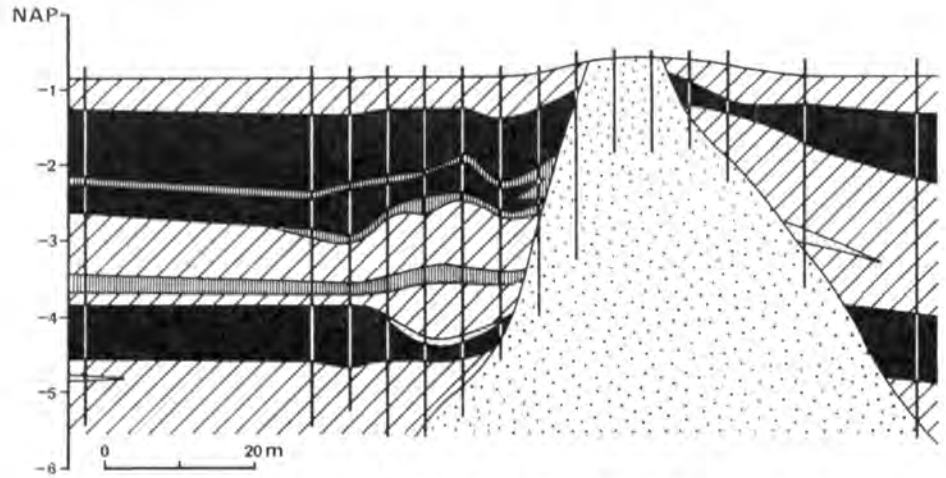

Fig. 21. W-E section across a very small *donk* near Hoog Blokland (site no. 60). At the left the clay wedge of the Schaik stream ridge between —3 and —4 m. On the top of the *donk* VL Culture and Late Beaker sherds were found. Horizontal scale 1:1000, vertical exaggeration : 10×. Legend as fig. 34.

Most *donken* have been investigated by means of borings, test-pits and field observations in sand excavations. In this way finds have been made on a number of them. It is noteworthy that these have been preponderantly the fairly small *donken* in isolated situations, and that the large *donken* and groups of these (such as those near Nieuw Lekkerland and Hoog Blokland and the Brandwijk Donk) yielded hardly any finds, except an occasional sherd or flint chip (nos. 57, 58, 63, 65, 66, 67). An explanation of this may be that the chance of finding something on a small *donk* is much greater, and that they have usually not been seriously disturbed (as have the large *donken*) by house building and sand digging.

The oldest finds, made during the preliminary investigations, belong to the VL Culture. On five occasions certainly, and once perhaps, the presence of VL occupation was ascertained:

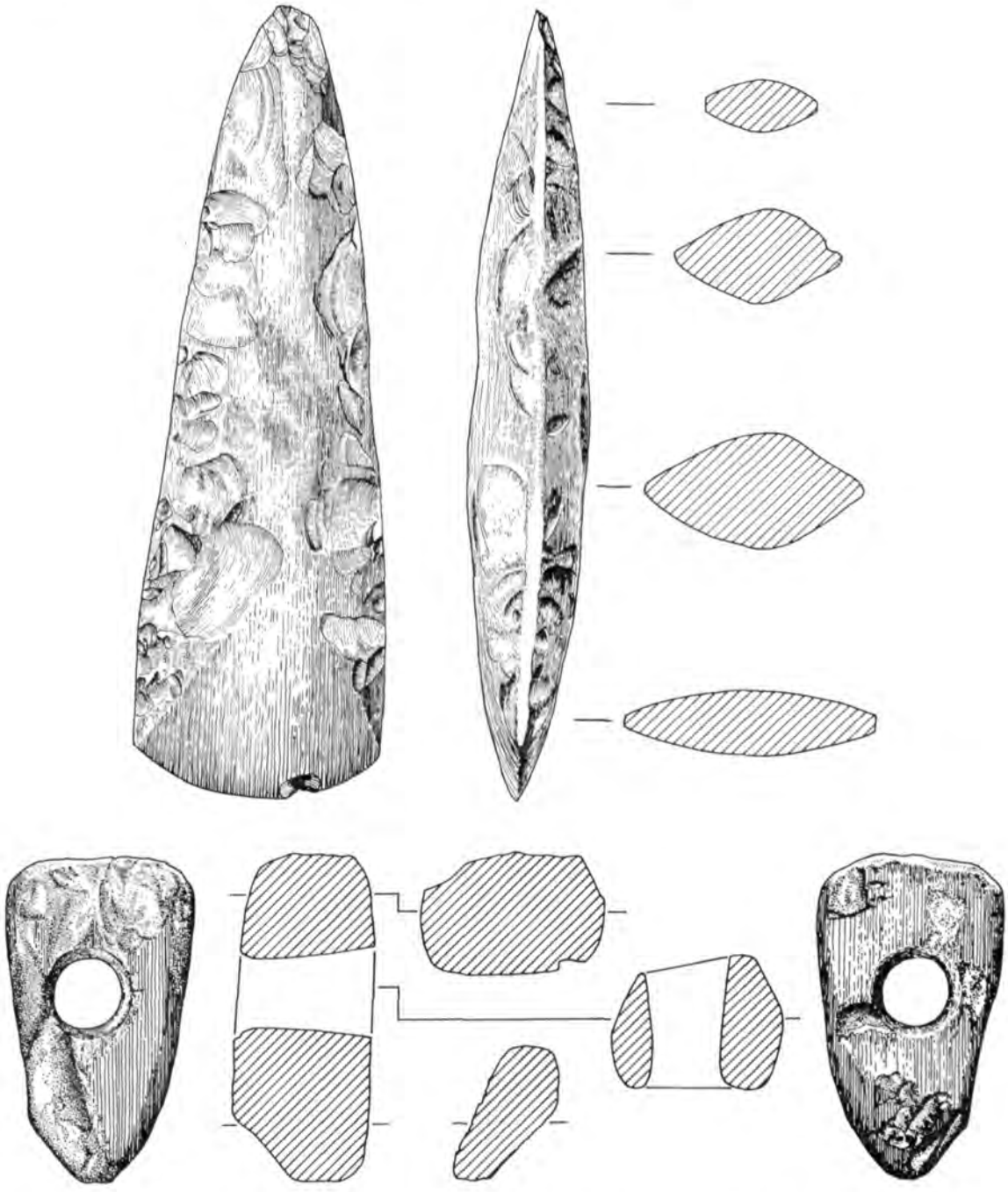

Fig. 22. Two stone axes from the river clay/wood peat area. Scale 1:2.

a) Flint axe, Nieuw Lekkerland (fig. 5, no. 38; fig. 18, site no. 57)
b) perforated *Breitkeil*, Spijk (fig. 2, no. 25; fig. 18, site no. 116)

Hazendonk (no. 24), Goudriaan (no. 59), Hoog Blokland 1 and 2 (nos. 60, 62), Schoonrewoerd (no. 92) and Brandwijk (doubtful, no. 58). Outside the area much VL material was found on a *donk* near Almkerk (fig. 6, fig 5, no. 14) and recently also on a *donk* in the western part of the Bommelerwaard [40].

Older occupation was demonstrated on the Hazendonk by means of archaeological finds and a pollen diagram with ^{14}C dates. About 4100 (?), 3400 and 3000 B.C. the *donk* was inhabited, but in the intervening periods it was abandoned. A new group of pottery was dated to the last period (3000 B.C.) and provisionally referred to as "Hazendonk pottery". We refer to Part III for full details on this site. In the material from the *donk* near Almkerk (fig. 5, no. 14) there are also a few sherds, possibly from the last two phases (3400 B.C. "Swifterbant" and 3000 B.C. "Hazendonk"). Finally we must mention a small trapezoid flint artifact from the *donk* near Schoonrewoerd (no. 92), possibly dating from the Mesolithic.

On the Schoonenburg Hill a large flint axe was discovered. The axe (fig. 22 a, no. 57) is made from a somewhat granular, flecked flint and has a brown (7.5 YR 5/4) surface. It has a pointed top, a diamond-shaped oval section and flattened sides. The surface is incompletely polished and shows no lengthwise facets. Only the cutting-edge is carefully finished. The axe certainly does not belong to the so-called Vlaardingen type and is possibly older than the VL Culture. We assume that the axe was found in its original place, although on the site once stood a castle, of which almost all traces and finds have disappeared.

Domestic refuse of the Beaker Cultures has only been found a few times on the *donken*. This was the case in our investigation on the Hazendonk, where various Beaker groups are represented. Further, at Hoog Blokland (no. 60) the remains of a beaker with irregular impressions were found which, among other things because of the workmanship, must be included in the BW Beakers. At Almkerk the VBB period was represented by flint and a few sherds. Finds from the Middle Bronze Age were only made at Arkel (no. 63) and Schoonrewoerd (no. 92), and from the Iron Age at Autena (no. 79) and (again) Schoonrewoerd (no. 92).

2.3.4.2. *The occupation of the "donken" in relation to that of the stream ridges*

We must relate the *donk*-finds to the total inhabitation pattern in order to interpret them properly.

For the period of the VL Culture and earlier only a few finds are known on the stream ridges or natural levees. This has for the greater part to be explained by the fact that the deposits from this period lie too deep, while the high stream ridges came into being later. This does not apply, however, to the Zijderveld ridge. The (almost) complete lack of finds there indicates that there was certainly a preference for the dune tops. Only future finds may disprove this.

A large number of settlements from later times are indeed known on the stream ridges. It appears that preference was given to the stream ridges, at least after the VL Culture. This may have been the consequence of changes in the way of living, such as the diminished importance of hunting, the need for larger areas of arable and grazing land and perhaps a preference for moist soils. This assumption was certainly true to some extent of the Middle Bronze Age,

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[40] *Cf.* p. 21, note 55.

for the settlements of those times are not poor in finds and should be just as easy to discover as the VL Culture remains. For the Beaker Cultures, however, this does not appear to be correct. Beaker sherds have always been found on the *donken* in fairly favourable find circumstances, *i.e.* recent diggings of some extent (a large test-pit, an excavation, a new ditch); then they occur in very inadequate quantities alongside much more richly represented groups (particularly VL Culture). The notorious poverty of finds on Beaker sites appears, therefore, to be here of paramount influence. The dense concentration of finds elsewhere (Schoonrewoerd ridge) is only due to the very intense explorations carried out there. The above-mentioned assumption must also be modified for the Iron Age: in fact both *donken* lying within the inhabited area were used.

Roman times are only represented by a coin and a sherd (sites nos. 64, 65). In reclamations after the 11th century A. D. grateful use was made, however, of these natural sandhills, which were to prove of use as safety zones during flood disasters.

2.3.4.3. *Conclusion*

To sum up, we may say that the *donken* were chosen for inhabitation during the whole prehistoric period. Perhaps in the Mesolithic, sometimes in the Early Neolithic and generally during the VL Culture, their tops served as places of settlement. In later times, especially in the Middle Bronze Age, preference was given, however, to the stream ridges. In addition to this preference, the accessibility of the *donk* also played a role: the *donken* were abandoned when their accessibility was seriously hindered by the general growth of peat. In the Alblasserwaard finds from the Early Bronze Age are the youngest, farther to the east, in the Vijfheerenlanden, inhabitation continued (as on the stream ridges) until the Iron Age.

Using the data of the above paragraph and those of Part III, especially the Hazendonk pollen diagram, we demonstrated earlier (Part I, p. 49) that the occupation took place especially during the regression phases.

It seems that a superficial investigation is not enough to determine the occupation sequence on a *donk*: for this a much more thorough examination, such as that begun on the Hazendonk, is necessary.

2.4. THE STREAM RIDGES

2.4.1. General Characteristics

The peat stream ridges are usually narrow bodies of sand, one to some hundreds of meters wide, which reach as deep as the Late Glacial subsoil in the most important ridges, but which are not "founded" [41] in the smaller ones. The sand body is surrounded by a clay mantle which develops laterally into a clay layer, stretching out far into the peat and wedging out there. Incorporated in these clays we find sand lenses and the fillings of small creeks. Because of

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[41] By "founded" is meant the absence of soft sediments (esp. clay and peat layers) below the mentioned deposit. We can compare such a deposit with a building on a good foundation, such as, for instance, wooden or concrete piles in the Western Netherlands.

compaction of the surrounding peat, especially since the artificial drainage of the region, the founded sand bodies are now visible as ridges of about 80-120 cm. in height. Except for the uppermost tops they are covered with a thin clay layer, the "Alblasserwaard cover". All ridges lying on the surface run approximately parallel in an ENE/WSW direction. In a westerly direction they become covered with peat [42].

Both Vink and Pons regard the peat stream ridges as the western continuations of the river courses. In the peat area the pattern of sedimentation changes its character. The greatest part of the sediment load, namely the coarse fraction, was already deposited in the river clay area upstream. More to the west, the natural levees become more and more clayey, and the basins more and more peaty. In the peat area it was only in the river bed itself that sand was deposited. At high water level the water flooded into the countless lateral creeks. This water was loaded only with fine silt, that could sink there. At extreme high water levels the whole surrounding peat was flooded and clay settled down at both sides outside the gully, forming the later "clay wedges". The narrow sand cores of our peat stream ridges may be interpreted as stream channel sediments, deposited in deeply-cut gullies, the counterparts of the meander-belt-deposits according to Havinga. The clay mantles and clay wedges are the high water deposits. At the end of the activity began the process of peat overgrowth [43].

2.4.2. Distribution and Dating

From north to south the following important peat stream ridges have been mapped in the Alblasserwaard and the Vijfheerenlanden:

(Vink 1926/1955)		(Pons 1950/1960)
Autena *spranken*	=	Tienhoven ridge
Vijfheerenlanden stream	=	Zijderveld ridge
Overlek ridge *etc.*	=	Schoonrewoerd ridge
Loosdorp stream	=	Schaik ridge

These are all older than the three young rivers in this area: the Lek, the Linge and the Hagenstein stream ridge (a part of the so-called Linschoten system).

Although Vink [44] assumed a great age for the peat stream ridges, and Bennema also estimated a dating around the Cardium transgression, based on the high elevation of the Schoonrewoerd ridge in the west of the Alblasserwaard [45], Pons was the first to give exact datings [46] based on:

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[42] See esp. Pons 1951, De Boer & Pons 1960.

[43] On the sedimentation mechanism in the peat area see: Edelman 1960, I. S. Zonneveld 1960, Stichting voor Bodemkartering 1965, Hageman 1969, Verbraeck 1970, 50-51. On the river clay area: Havinga 1969 and lit. cited there.

[44] Vink 1926, 1954.

[45] Bennema 1954, 39. We presume Bennema referred to the height of the clay wedges, and not of the ridges themselves, when he mentioned a depth of —250 to —275 cm. NAP. His dating ("Cardium") based on the presence of the BB settlement at Hoog Blokland was in the main correct, but subsequently the Cardium transgression itself was dated later.

[46] De Boer & Pons 1960, 23 f.

TABLE 5

Alblasserwaard and Vijfheerenlanden. Datings of the stream ridges

	Name [1]	Pollenanalytical date [2]	Transgr. phase [3]	Occupation [4]	Height top sandbody [5]	Sequence
	Lek natural levees	recent	D III	*Late Mediaeval*		6
A	Hagestein stream ridge	Subatlantic	D I/II	Roman, *Carolingian*		5
B	Tienhoven stream ridge	*Late Atlantic*	C II	—	— 2.7 — 1.0	1
C	Zijderveld stream ridge	Late Atlantic — Early Subboreal	C III	Middle Neolithic, VL, *Middle Bronze Age, Iron Age*	— 1.7 + 0.7	2
D	Schoonrewoerd stream ridge	Early Subboreal	C IV^b	*VBB/BWB, Middle and Late Bronze Age, Iron Age*	+ 0.4 + 1.1	4
E	Schaik stream ridge	*Subboreal*	C IV^a	*VBB, Late Bronze Age*	— 0.8 —0.1	3
F	Spijk stream ridge	*Subatlantic*	D I	Roman (native)		5
	Gorkum stream ridge		C II	Early Neolithic		1
	Linge natural levees	recent	D I/III	*Roman*		5

[1] Stream ridges from the north to the south. Capitals refer to the map at fig. 18.

[2] *Cf.* De Boer & Pons 1960. Direct datings in italics.

[3] *Cf.* the text.

[4] Data by the author. Settlements in italics. The other data are predominantly isolated finds.

[5] At the Diefdijk (left value) and at the Zouwedijk (right value). In this stretch the ridges are "founded". Depths in m. below or above NAP.

— the age of the inhabitation on the ridges
— a comparison of the relative height of the various clay wedges
— a comparison of the absolute height of the upper side of the clay mantles of the well-founded ridges
— pollen analysis of peat in which the clay wedges are embedded.

His dates appear to be for the most part correct and are merely fixed a little more closely by our investigation, for we have more information about prehistoric inhabitation and a number of ^{14}C dates at our disposal. The streams do not appear to have been active simultaneously but to have originated at different times in the Late Atlantic and the Subboreal. The morphological variations also indicate that they belong to different times.

The information about the ridges is summarized in the tables 5 and 6. Ridges of approximately the same age have also been located in our investigation to the north of the Lek (near Benschop) and south of the Merwede (near Wijk and Aalburg and Babyloniënbroek). Equally old deposits are known in the Utrecht river area and the Betuwe [47].

TABLE 6

Alblasserwaard and Vijfheerenlanden. Phases of the Late Holocene development

Sequence	Deposits	Datings		Transgression phases
9	Dike breach deposits		after A.D. 1300	D III^{b-c}
8	Lek and Waal rivers Alblas estuarine creek (?)		after A.D. 800	D III^{a-c}
7	Linge; Hagestein and Spijk stream ridge; estuarine creek ridges of Alblasserdam and Papendrecht	pre-/early Roman	before A.D. 100	D I-II
6	2nd phase break-through channels	Middle Bronze Age	c. 1500 B.C.	D O
5	break-through channels	VBB/BWB	c. 1800 B.C.	C IV^{b}
4	Schoonrewoerd stream ridge (2nd "wild" phase)	Subboreal; before VBB	2100-1850 B.C.	C IV^{b}
3	Schaik stream ridge; 1st phase of Schoonrewoerd stream ridge ?	Subboreal; before VBB	before 1900 B.C.	C IV^{a}
2	Zijderveld stream ridge	Late Atlantic/ Early Subboreal	before 3000 B.C.	C III
1	Tienhoven and Gorkum stream ridges	Late Atlantic/ Early Neolithic	before 3000 B.C.	C II

2.4.3. The Gradient Lines

The position of a number of important stream ridges in the peat area, which we will discuss here at greater length, is illustrated by means of a schematic section of the river area and its extension from Lobith to Den Briel (fig. 23). First, the position of the peat area itself, between the river clay and the sea clay areas, is clearly shown therein. Its low position is the consequence of compaction, at an average of 90 cm., caused by artificial drainage in recent centuries. In both clay districts a few "archaeological windows" are shown schematically. For the construction of the gradient lines of the peat stream ridges the average height of the top of the sand bodies has been chosen, over the stretch where these sand bodies have not

[47] *Cf.* note 14 and Van de Voorde 1963. The "Houten system" is dated by a ^{14}C date to Dunkirk 0: GrN 1010-3440 $\pm$ 60 B.P. (1490 B.C.), De Vries & Waterbolk 1958, 1552, corrected according to Vogel & Waterbolk 1963, 164 with 240 $\pm$ 10.

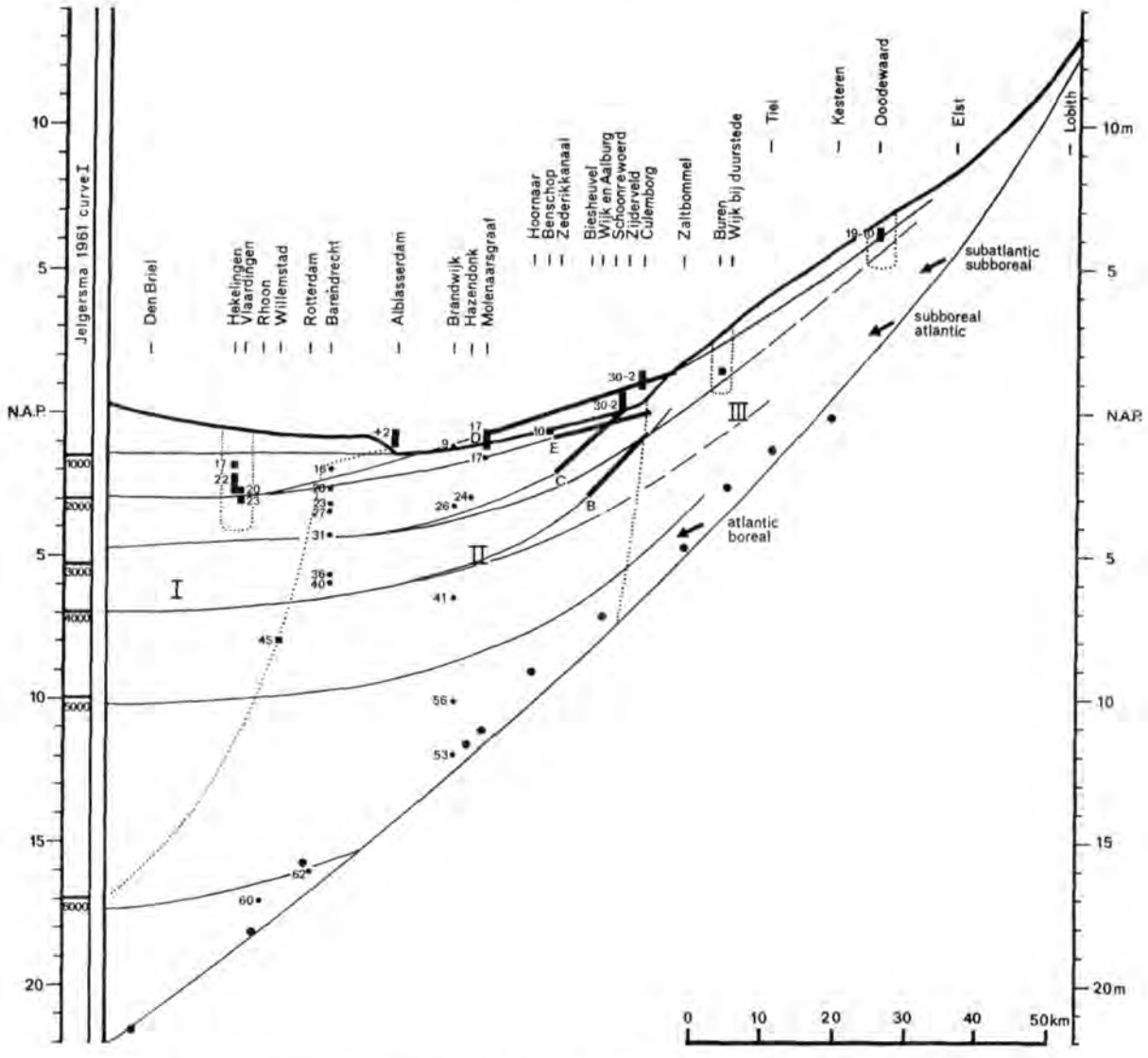

Fig. 23. Schematic west-east section through the Netherlands, from the coast at Den Briel through the river clay area to the German border at Lobith.
Horizontal scale 1:1000,000. Vertical exaggeration : 4000×.

Indicated are :
— prehistoric settlements.
— dated former MHW-levels.
— the top of the most important peat stream ridges, as far as they are "founded".
— a number of "archaeological windows".

The numbers are ^{14}C dates in centuries B.C. The stream ridges are indicated with capitals (see table 5 and fig. 18).
The figure has been constructed with the aid of data by the following authors :
— Pons 1954, 1957, — & Bennema 1958 : depth Late Glacial subsoil.
— De Boer & Pons 1960, contour maps of the *Cultuurtechnische Dienst*, soil maps of Stiboka: top of the stream ridges.
— Topographic sheets 1:50,000 : height of present surface.
— Jelgersma 1961 : MHW-levels at the coast and at some localities further inland.
— The relevant excavation-reports, personal communication and data by the author; levels of the archaeological sites (*see* Appendix II).

been liable to compaction [48]. Both on the map (fig. 18) and in the schematic section (fig. 23) striking variations appear to exist between the stream ridges, namely those of Zijderveld and Schoonrewoerd, which are the most important in our investigation. When we discuss these stream ridges, these variations will be dealt with in some detail.

A second aspect, of which the diagram gives us an idea, is the extent of the "gradient effect" (see p. 61) on the determined height of former water-levels. For this purpose, gradient lines have been drawn as well as possible with the help of the plotted data, with 1000 year intervals. Although the amount of information is still limited, it appears that the "gradient effect" is already slightly perceptible at Molenaarsgraaf. Particularly in the oldest times (before 3000 B.C.) the effect is considerable. The flood depression to which the high waters in the peat area were subjected will have largely compensated for this effect, at least in the vicinity of Molenaarsgraaf, so that the data from the centre of the Alblasserwaard may be taken as being very representative.

Finally fig. 13 seems to imply that the terrace-crossings in the river area indicated by Pons [49], lie much lower than might be thought from the gradient lines. The dated peat was perhaps formed at places lying far from the open water.

2.4.4. The Oldest Stream Ridges: Calais II and III

2.4.4.1. *Calais* II

Thanks to the current geological mapping new information has been come available, particularly about the oldest Holocene water courses in the region, covered with some meters of younger deposits and dated in the phases Gorkum III and older [50].

Among these is the Tienhoven stream ridge, which seems to be a part of the extensive system of the Benschop stream. According to Pons [51] this Tienhoven ridge was already overgrown with peat before the end of the Atlantic so that Gorkum II (= Calais II) is the most likely dating.

A second system, the Middelkoop stream, lies in the heart of the Alblasserwaard. Deposits of this stream were found in the Goudriaan boring beneath —4.50 m. NAP, dated there as Gorkum II and III [52]. These are perhaps the same deposits as we found in the subsoil at Molenaarsgraaf and near the Hazendonk below —7 m. NAP [53].

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[48] Mr A. Verbraeck, Geological Survey Haarlem, kindly gave us much information about the stretches where the various ridges have solid foundations. With the Tienhoven and Zijderveld ridges this is the case in the Vijfheerenlanden only. With the Schaik ridge only east of Leerdam, but with the Schoonrewoerd ridge at least westward as far as the excavation "Molenaarsgraaf". Sometimes however there occurs some peat below the sand locally, which may be one of the causes of the bumpy character of some stretches. But the highest points will not have been subject to compaction.

[49] Pons 1957, 31, fig. 21.

[50] Verbraeck 1970, 84.

[51] De Boer & Pons 1960, 26.

[52] Verbraeck 1970, fig. 44.

[53] See figs. 20, 34, 61.

A third stream system is the Gorkum stream. For this deposit we have, by a lucky accident, an archaeological dating, which may, however, not be altogether reliable. During a large-scale sand dredging in the Spijk Polder (Tielerwaard), where this stream ridge is crossed by the much younger Spijk ridge, a small perforated *Breitkeil* was found in 1964 (fig. 22 b) [54]; this implement is characteristic of the period between 4000 and 3400 B.C. Although the axe was found during the removal of the top-soil (which sometimes can take place to a considerable depth), it is almost impossible in view of its dating that it came from any other level than the surface of the Gorkum stream. This stream ridge must therefore be dated Gorkum II.

2.4.4.2. *Calais III: the Asperen and Zijderveld ridges*

The deposits from three former river courses were dated as a group by Verbraeck later than the above-named streams. They are the Asperen, the Schaik and the Zijderveld streams. For the dating of the first there are no details available, but in view of the fact that it cuts across the Gorkum stream it cannot be older than Gorkum III. The Schaik stream will be referred to later when we discuss the Schoonrewoerd ridge; a fairly late date (C IV) will then be proposed for it.

The Zijderveld stream ridge cuts across the Tienhoven ridge (C II) and was dated Late Atlantic or Early Subboreal, *i.e.* Gorkum III, by the excavations at Zijderveld, in agreement with data supplied by Pons. It is a wide, meandering river course. An easily made out old stream channel follows the outer bends of the natural levees [55]. In the east the ridge is broad and sandy, to the west it becomes narrower and more clayey. Finally the river course can hardly be made out, because of its furcations in the peat region and because it becomes covered with peat. The old stream channel also seems to split up in this direction. The inflowing river water had already lost most of its sediment load, especially the coarser fraction, in the eastern part of the area. In the west there remained only the fine sediment, which could then be deposited because of the slight current velocity.

2.4.4.3. *The oldest prehistoric occupation of the Calais II and III deposits*

The data of the prehistoric occupation of the Calais II deposits are limited to the above-mentioned perforated *Breitkeil* from the Spijk Polder (no. 116).

On the relatively high Zijderveld ridge, covered only by the thin (max. 50 cm.) "Alblasserwaard cover" a number of settlements and finds have, however, been discovered. The oldest data give a *terminus ante quem* for the stream ridge: the pollen diagram of the former stream channel at Zijderveld, in which both below and above the ^{14}C date GrN 5221, 2670±80 B.C. the influence of human occupation can be distinguished [56]. The oldest originates possibly from the time of the "Hazendonk" pottery, while the most recent may be alloceted to the VL Culture. A few VL finds from the vicinity confirm the presence of this culture. The flint axe

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[54] Appendix II, no. 116.

[55] De Boer & Pons 1960, Appendix, photos 5 and 6; Archives of aerial photographs, Topographical Service Delft: 38, Gorinchem-Oost, Nos. 4910-4918, made by the R.A.F. December 31th 1944. *Cf.* note 7.

[56] Vogel & Waterbolk 1972, J. de Jong 1970/'71.

found just east of our area, near Buren, indicates that under the younger deposits in the river clay area further to the east possibly more VL settlements lie concealed on natural river levees from Calais II or III times.

The later occupation of the Zijderveld ridge (in the Middle Bronze and Iron Ages) will be discussed after we have dealt with intermediate important geological events (p. 111). We can then fit these into the general occupation pattern.

2.4.5. The Schoonrewoerd and Schaik Ridges: Calais IV

2.4.5.1. *Description and dating*

Much has become known, in particular about the Schoonrewoerd ridge, by means of the documentation of the archaeological finds in a kind of *Landesaufnahme* and by the excavations at Molenaarsgraaf. The dating data arrived at there are summarized in the section at fig. 20. The ridge can be followed from the western margin of the younger river deposits near Culemborg for more than 30 km. to Bleskensgraaf, where it becomes covered over, and finally can no longer be made out because of the presence of a younger system of estuarine creeks (Dunkirk I and later) [57]. At the Hazendonk investigation it was determined that the most important activity must have taken place some time after 2350 B.C. and was ended before 1700 B.C. Further the occupation of the ridge proves that it was already formed as early as the 19th century B.C. The oldest finds are dated to the VBB phase with ^{14}C dates:

Ottoland-Kromme Elleboog II	GrN 6384	1870 ± 45 B.C.
Ottoland-Kromme Elleboog I	GrN 6216	1845 ± 55 B.C.
Molenaarsgraaf	GrN 5132	1830 ± 50 B.C.
Ottoland-Oosteind	GrN 6217	1705 ± 55 B.C.

The period in which the clay wedge was deposited and the stream bed was sanded up is thus closely dated between 2200 and 1850 B.C., the Calais IV^b transgression phase. Such a date agrees well with Verbraeck's, who dates this ridge later than all the streams mentioned above [58].

The Schoonrewoerd stream ridge is a comparatively narrow ridge along nearly its whole length, consisting mainly of fine sand. Laterally it is connected fairly abruptly with an extensive deposit of high water clay extending often more than a kilometer into the peat. The sand ridge itself is irregular and hump-backed. In the Vijfheerenlanden the ridge is much more widely extended with a number of supplementary branches and with locally very high and broad sand deposits. Old stream channels are nowhere visible [59], and there are no traces of clear meanders.

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[57] The dating of the creek system is based on the absence of prehistoric occupation and on the occurrence of a fairly large number of Roman settlements on the sand of the creek ridges. See also Van den Beemt 1967, Wallinga 1966, 16 and fig. 13; Bennema 1954, 43; Edelman 1953, 353. It is questionable whether the river Alblas originated during this transgression phase. In spite of intensive reconnaissance, until now only a few washed Roman sherds are found. Some sites with *Pingsdorf* pottery are the earliest known. A date of Dunkirk II or III^a seems most likely.

[58] Verbraeck 1970, 84.

[59] Such a gully seems visible in some aerial photographs (De Boer & Pons 1960, app. 3, photo 5), but could not be demonstrated by us in the field.

The ground plan sometimes shows long straight stretches, but a number of sharp bends also occur.

The Schoonrewoerd ridge and its high water deposits must have been built up in two phases, of which the last one is described as a "rejuvenation". During our investigations it appeared that the clay wedge indeed was divided at many points by a thin humic or peaty band, which confirms the existence of both phases. Below we will deal more precisely with these two periods of activity.

As to the Schaik ridge a problem was presented by the linking of the maps on both sides of the Diefdijk. However, it now seems clear that the Schaik and Schoonrewoerd ridges belonged originally to two independent streams, as is indicated on our map, and that they did not form one system which furcated at the point of the present Diefdijk [60]. The Schaik ridge has been dated by Pons by means of pollen analysis to the Subboreal [61]. A *terminus ante quem* is given by the (Veluwe) Bell Beaker settlement, discovered during the soil survey 1953/'55 near Hoog Blokland [62].

It is indeed noticeable that both ridges possess a number of common characteristics, such as the lack of old stream channels and meanders and their fairly slight gradient. The inhabitation data are also similar. The most significant difference is that the Schaik ridge strongly furcates near Hoog Blokland. Among the *donken* some narrow on-flowing streams have been mapped. The similar forms of the Schaik and Schoonrewoerd ridges combined with the small difference in height of the well-founded parts (the smaller Schaik ridge is somewhat lower) point in our opinion to only a small age difference.

2.4.5.2. *The "lung system" and the conditions, that led to the formation of the Schoonrewoerd stream ridge*

In every way the Schoonrewoerd ridge shows a strong contrast with the regular form and balanced map-picture of the Zijderveld ridge. The most important explanation of these differences is, we think, that with the Schoonrewoerd ridge we are concerned with a through-flowing stream. In this way the slight gradient as compared with the Zijderveld ridge can also be explained. When the current was very strong (especially when there was a high water level in the rivers) sand transport could reach far into the peat region, resulting in a building-up of the sand ridge that was unusually high for its age. Although some are mapped, the branches extending in the peat seem to be much less important in this ridge, than in the Zijderveld ridge. We must, however, be aware that the existence of such streams, when no mineral deposition occurred and when they were filled up with peat, can hardly be established during a general soil survey.

An explanation of the character of, and the mutual differences between, the ridges can be found in the theory that describes the drainage pattern of the peat area as a "lung system".

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[60] *Cf.* also the aerial photograph in Von Frijtag Drabbe 1948, photo 3, which appears to confirm the second construction.

[61] De Boer & Pons 1960, 26.

[62] Modderman 1955[d], 32; Modderman 1951[a], Bennema 1954, 39; Pons 1961, Pons 1957, 41; Annual Report of the State Archaeological Service 1958, 33 under the heading "excavations, not carried out": Hoog Blokland; De Kok 1965.

We will summarize this here [63]. The mouth of the Rhine was established near Katwijk, at least since the formation of the oldest coastal barrier, and stream ridge deposits of the same period have been mapped in the Utrecht river area. We may therefore accept as certain that the then course of the Rhine was already mainly that of the present Kromme and Oude Rijn (Old Rhine). As for the Meuse, a course south of the Alblasserwaard to the estuary near Rotterdam is most probable. Between both rivers there was an extensive peat area overgrown with a dense swamp forest. According to the theory of the "lung system" various river arms branched out in the eastern part of this peat area [64]. On the west side of the peat the water then gathered again to flow via tidal creeks, growing ever broader, into the sea. The eastern and the western systems, if this theory is right, must have been connected in the middle of the peat area via countless little creeks. The eastern system formed an overflow zone for excessive water in the river clay area; in the western system coastal flood water could be piled up during high floods.

The development of an extensive system of little creeks is understandable if we realize that this part of the "Holland peat" was covered with a widespread, dense swamp forest with big trees in the period now under consideration. Such a region could stand flooding easily. The water encountered great resistance from the vegetation and little erosion occurred, so that there was little opportunity for the water to concentrate in large streams. On the other hand, the growth of a peat forest itself can be explained by the inflowing and extending over the whole area of the eutrophic river water from the east.

In our opinion the Zijderveld stream is to be regarded as such a water course flowing from the east into the peat area, while it is possible that the similar Tienhoven stream also had the same character.

As to the Schoonrewoerd ridge we give the following representation of the course of events, which gives an explanation of all the important peculiarities observed. Originally there existed as a first and "quiet" phase a furcating water course, which normally formed a part of the eastern half of the "lung system", be it a younger phase than the system to which the Zijderveld ridge belongs. In the second or "wild" phase, sometimes called: "rejuvenation", there is a question of a through-flowing stream. As a result of some extreme high waters (or a general rise of the mean high water in the river clay area) there originated a kind of break-through across the centre of the peat area, making use of a number of the small creeks already present there by widening them. To this second phase must belong the supplementary gullies (esp. in the Vijfheerenlanden), the second phase of the clay wedge and especially the high sandy filling of the stream channel.

Once formed, the stream channel stayed sharply localized between the dense vegetation

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[63] I am much indebted to Prof Dr L. J. Pons. Without his remarks and the discussion of the many problems offered by the stream ridges, the interpretation given here would not have been possible.

[64] We found this idea in Pannekoek van Rheden 1936, 354. He presumed that the river water flowed only partly to the sea via the main through-flowing water courses. Another part might have been absorbed by the peat by means of numerous furcating creeks in the east and might again flow out at the other side into another creek system. The same is suggested by Hageman 1961, with the aid of general mapping of the upper 3 m. This map (as in Verbraeck 1970, fig. 25) indeed shows such a system. Units of widely differing age are, however, brought together: the western part of the map consists of the Dunkirk I (and later) estuarine creeks, the creeks in the central and eastern part include the Late Atlantic and Subboreal stream ridges and their side branches.

on the banks at both sides. Also when the surroundings were flooded during high waters the main stream stayed concentrated in this channel, because of the stream-resistance of the vegetation. In such a situation the high stream velocities necessary for sand transport could occur far into the peat area. This sand was deposited exclusively in the stream channel itself in the form of sandbanks (the later ridge) or in the immediate vicinity along the banks (the later mantles). The great stream resistance and the (modest) levee deposits resulted also in a considerably higher water level in the channel than at a distance of some hundreds of meters from this channel, especially during high waters. The sand banks could be built up thus considerably higher than the high water clay (the later clay wedges) in the inundated forest. Indeed a difference of about 100 cm. was observed in the surroundings of the Hazendonk (see p. 134).

The Schaik ridge most probably is contemporaneous with the first ("quiet") phase of the Schoonrewoerd stream ridge, when both formed the main streams of the eastern part of the same "lung system".

The origin of the Schoonrewoerd stream and the formation of the sand ridge in the South Holland wood peat area are geologically fairly remarkable events. At the same time there is evidence of an intensification of the sedimentation processes further upstream in the river clay area (the Betuwe). Strong natural levee formation took place there, characterized by irregular levee patterns with "levee splays" of various types. Crevasse deposits, laid in front of the mouth of overflow channels in the basins, were also formed at this time [65]. The settlement at Dodewaard (VBB and Middle Bronze Age) lay on such a levee-splay. This is one of a large number of settlements in a region that later was always a basin and where the older deposits have been preserved under some basin-clay layers. It is one of our "archaeological windows". Both this intensified sedimentation in the Betuwe and the formation of the second (through-flowing) phase of the Schoonrewoerd ridge can be attributed to an increased discharge of the rivers or at least the appearance of more and/or higher high water levels.

It is of especial importance that a direct correlation is made in the above between a transgression phase on the coast (Calais IV^b) and a period of intensive sedimentation in the river clay area. Such correlations are of particular importance for our understanding of the causes of the occurrence of transgression and regression phases. These phases cannot therefore have been a purely marine question; they must have been the result of more generally operative factors, of which climatic fluctuations are the first that come to mind [66].

2.4.5.3. *The break-through channels*

Soon, or perhaps directly, after the sanding up of the stream gully the sand body of the Schoonrewoerd ridge must have been lain in the landscape as a low, long ridge (see p. 134).

When the drainage system was restored there may have been times when rain or flood water could not flow away but was piled up aside the ridge. This is the more likely, since the Schoonrewoerd ridge will have formed a kind of divide between the drainage basins of the lower courses of the rivers Rhine and Meuse. Especially during high water in one or both rivers,

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[65] Havinga 1969, Hulst 1967.

[66] In our opinion these climatic changes may be characterized by a higher precipitation and a higher frequency of (south-)western gales during a transgression phase. *Cf.* p. 10.

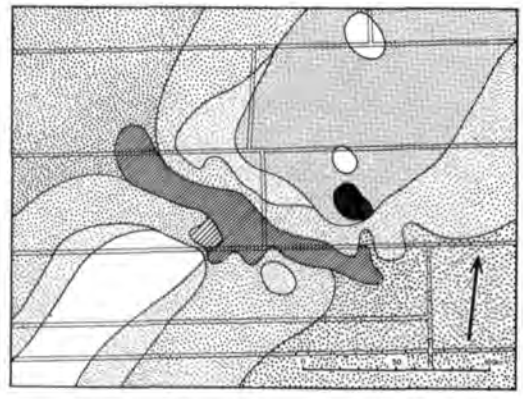

Fig. 24. Physiographic map of site no. 61, "Hoog Blokland-Nieuwvlietje", showing part of the Schaik stream ridge, a break-through channel and a BB settlement, discovered during the soil survey in 1953-'55. Based on 125 borings of 1.20-2.60 m. Scale 1:4000.

Legend :

Sand of the Schaik ridge, not covered with peat and

- coloured dark grey or black for over 30 cm. Prehistoric (BB) settlement.
- coloured grey for less than 30 cm.
- not coloured grey.

Deposits belonging to the Schaik ridge covered with :

- a humic clay only.
- peaty clay or peat, base at 40-70 cm. depth.
- peat, base at 75-95 cm. depth.
- peat, base at 75-125 cm. depth.
- peat, base below 100 cm. depth.

All sediments are covered with 35-50 cm. clay.

unequal water levels at both sides of the ridge will have come into existence. At various points breaches were formed through the ridge, now to the north (when the Meuse reached a high level), now to the south (when this was the case with the Rhine). Once formed, the break-through channels could act as a spill-way for water from both sides. The fact that these channels are found in fairly high, sandy parts of the ridge might be the result of later compaction of the now lower parts of the ridge, or of a morphological obstruction at lower adjacent points. Seepage might also have played a role.

There is now a total of four of such break-through channels known through the Schoonrewoerd ridge and one through the Schaik ridge [67]. Those in the Alblasserwaard are all of modest dimensions, about 100 m. long and 20-30 m. wide. The gully at Culemborg, more situated to

[67] *Viz.* Molenaarsgraaf (this paper, part IV), Ottoland-De Put (see p. 107), Ottoland-Kromme Elleboog (see p. 108, Louwe Kooijmans 1969[b]), Culemborg (Louwe Kooijmans 1966[a]).

the east is larger and has a slightly different appearance. The three gullies at Molenaarsgraaf and Ottoland were mapped already during the soil survey of the Alblasserwaard, but only recognized as such during our investigations. On the banks of all these gullies people using VBB and/or BWB pottery established themselves. At Molenaarsgraaf and Ottoland-Kromme Elleboog it was found that the occupation was contemporaneous with the first phase of the filling of these gullies *i.e.*, in both cases, a peaty clay. In this way it is proved that these gullies were really formed very shortly after the formation of the sand ridge. One of the BB settlements on the Schaik ridge, discovered during the soil survey at Hoog Blokland, also appeared during our investigation to lie beside such a transverse gully through the ridge [68]. This confirmed again the contemporaneity of both ridges.

At the mouths of the break-through channels lobate sand deposits of slight extent were laid down. They must entirely consist of the washed-out sand of the eroded part of the stream ridge, because we are concerned with inundation water, by which no sand is transported. At Molenaarsgraaf the sand lobe was mapped and it appeared that its volume is of the same order as the volume of the not-sandy deposits in the gully. At the other sites only some sections were bored. The sand lobes were of comparable dimensions. At Culemborg both the gully and the washed-out sand were of a different order.

It is remarkable that there are no break-through channels in the Schoonrewoerd ridge between Noordeloos and the Diefdijk. Moreover, VBB/BWB as well as Middle Bronze Age remains have been lacking also in this stretch until now, but a number of Iron Age settlements is known. The absence of transverse gullies might be the result of a too high elevation of the ridge. The ridge here has an entirely different character: there are various sand bodies next to each other, sometimes surrounding small peat areas. Here and somewhat further to the west near Noordeloos, sheet-like sand deposits connected with the ridge have been mapped by Stiboka. All these features will have been originated during the second phase of formation of the ridge. Now that we have dated at about 2100-1850 B.C. the sandy body of the ridge, where it occurs without any complications, as in the east near Culemborg and in the west near Molenaarsgraaf and Ottoland, it is difficult to assume that the intermediate part involves a rejuvenation at a later date, or to explain the absence of the earliest inhabitation in this way.

Gullies, comparable to the break-through channels described in this paper, but of larger dimensions (even larger than the Culemborg gully) were described by Havinga from the district south of Wageningen, situated in the river clay area proper [69]. These gullies cut across a fossil stream system and formed a connection of two basins. They were the spill-ways for the flood water in the upstream basin into the basin downstream. Because of this function they were named "basin drainage gullies" by Havinga. To our opinion the basin drainage and the break-through channels described in this paper form one group. Within this group the gullies demonstrate a gradual change going from the peat area in the west to the river clay area in the east. They are small in the peat area and much bigger in the river clay area with the Culemborg gully in an intermediate position. In the west they could be a spill-way in two directions

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[68] We mapped this gully in 1966, by means of a great number of borings in 10 m. squares. The former stream channel appeared to have been constructed on the evidence of only one boring. I thank Ir J. van der Linde for the information and the help he gave to me.

[69] Havinga 1969, esp. 18-22.

(although one might predominate) because of the absence of any gradient, in contrast to the situation farther upstream. The washed-out deposits show consequently other dimensions and texture going from west to east. The variation in the nature of the gully fillings (peat in the west, (humic) clay in the east) is also a result of environmental differences.

In this connection it must be stressed that in the class of gullies described above there is no question of a river breaking its levees and then forming lobate or tongue-shaped sandy extensions of the levees into the basins, as described by Havinga from the river clay area as "levee splays" and known from recent sedimentation areas as "crevasse deposits". The sandy sediment originates in such cases only partly from the eroded river levee and mainly from the load of sediment in the river itself. It is therefore not allowed to call the deposits at the mouth of the break-through (and the basin drainage) gullies "crevasse deposits". We propose the name (alluvial) outwash deposit or outwash fan.

In view of these considerations it does not seem to us to be right to interpret the peculiar deposits near Middelkoop as deposits from a break-through gully. We even doubt whether the author is right when he describes them as "crevasses". The detailed soil map of Pons shows clearly that we have not to do with a break-through gully, but with a system of side creeks and sheet-like sand layers belonging to the Schoonrewoerd stream ridge itself. Similar creek systems have also been mapped of other stream ridges (*e.g.* the Zijderveld stream ridge and a ridge in the Zevenhoven Polder north of the river Lek) [70].

2.5 PREHISTORIC INHABITATION IN THE CENTURIES AFTER THE CALAIS TRANSGRESSION PHASES

2.5.1. Introduction

After the formation of the Schoonrewoerd stream ridge and the break-through channels through it, no new water-courses of such proportions appear to have developed in the region. A lengthy period of rest begins, the opening of a second peat formation phase [71]. The close of the Schoonrewoerd stream's activity is at the same time the beginning of a long period during which inhabitation was possible. New deposits, elevated and inhabitable, giving access to large areas of the peat region (so that many *donken* were also accessible) lay ready for use. These, like the *donken*, were recognizable from far not so much by their height as by their lofty timber growth of oak, elm and ash.

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[70] Verbraeck 1970, 65, 86, 87. The dating seems rather uncertain: p. 86: Tiel (O ?), p. 87: Gorcum (IV ?); Pons 1951, De Boer & Pons 1960.

[71] Verbraeck 1970, 75. The first phase of general peat formation is dated to the Atlantic, esp. after 4500 B.C. This phase ended in Middle Atlantic times, when extensive fluviatile sedimentation started.

2.5.2. Explorations

During our field explorations the Schoonrewoerd stream ridge was given special attention, not only because it is one of the most prominent landmarks, but also because of the execution of a land reallotment during the years of our enquiry. In particular in the stretch Molenaarsgraaf-Noordeloos a systematic survey was carried out by means of borings and test-pits in the years 1963-1970. One of the most promising terrains (Molenaarsgraaf, no. 26) was selected for excavation. Part IV of this publication gives a report on this. Below we shall make repeated use of the data given in that report.

Without these efforts most of the terrains would have been thoroughly disturbed by the making of the reallotment roads nos. 51 and 53, which were for the most part to follow the axis of the Schoonrewoerd ridge. A special word of thanks is due here to the local reallotment commit-

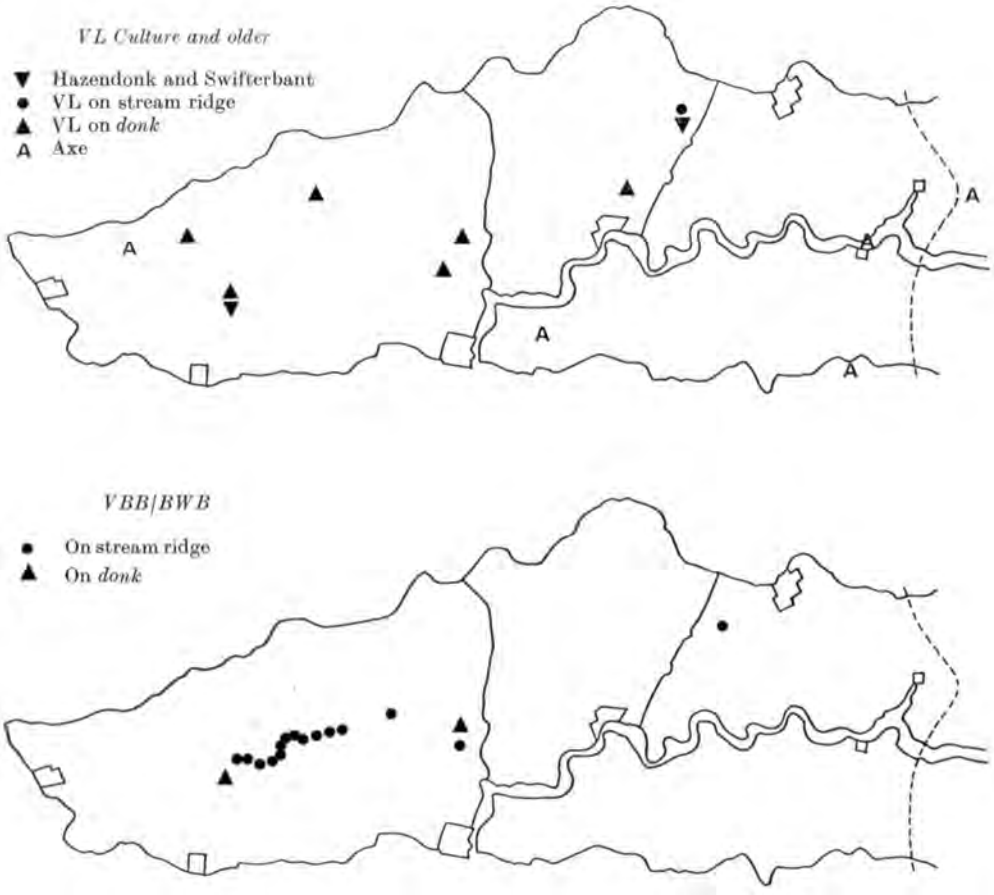

Fig. 25. Alblasserwaard, Vijfheerenlanden, Tielerwaard, Lek en Linge district.
Distribution of Neolithic finds and sites.

tee for the understanding they displayed of the importance of the archaeological terrains and for their readiness to alter the course of the proposed roads to the northern slope. This meant that only a few terrains were marginally disturbed, while two others in the district of Ottoland ("Oosteind" no. 42 and "Kromme Elleboog" no. 36) could be examined in good time. They provided valuable complementary information for the Molenaarsgraaf enquiry. Finally, during the road-construction of 1970-1971 a few further discoveries were made in the dug-out stretches and the new roadside ditches.

The distribution maps clearly show the influence of the intensity of the investigation, but the distribution of find-places is not only to be explained by this. Investigation also took place between Noordeloos and Meerkerk (between the nos. 54 and 91), particularly on terrains classified during the soil survey as "old occupation soil". However, these have so far proved fruitless. East of Meerkerk finds were indeed made, but they dated exclusively from the Iron Age. Only an occasional isolated find at Culemborg-Den Heuvel (no. 98) also indicates VBB/BWB occupation there. The Schaik stream ridge received little attention from us, which may explain the few finds made there. We believe, however, that the various maps may nevertheless be regarded as representative to a certain extent of the actual distribution of the prehistoric inhabitation. Only the accent on the western part of the Schoonrewoerd ridge is somewhat too strong.

2.5.3. The VBB/BWB Inhabitation (fig. 25)

Prehistoric inhabitation on the Schoonrewoerd ridge begins, as we have said, with the Bell Beaker Culture. In none of the excavations on this ridge could the early (MBB) phase be proved, so that we assume that the Veluwe phase signifies the opening of the occupation on this ridge. A few sherds on the Hazendonk show that indeed there was some occupation during the early Bell Beaker phase, that is during the time when the Schoonrewoerd ridge was an active stream.

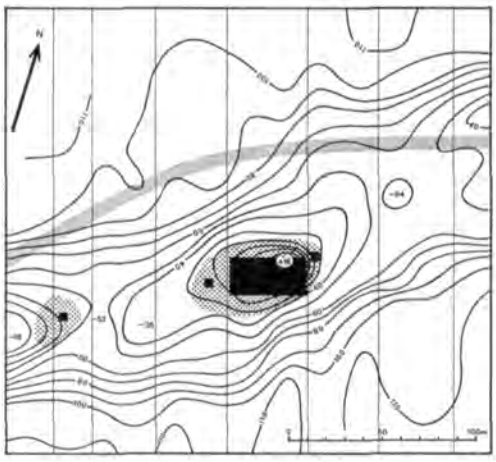

Fig. 26. Contour map of a part of the Schoonrewoerd stream ridge at Ottoland-Oosteind (site no. 42), showing a very high elevation, occupied (perhaps with interruptions) from 1800 (VBB) till 900 B.C. (Late Bronze Age).
Excavated area in black. Legend : see fig. 27. Scale 1:4000.

The inhabitants of the Schoonrewoerd stream ridge settled preferably near the narrow break-through channels, then flowing with clear running water (figs. 27, 28, 58) [72]. Elsewhere occupation took place on the highest elevations (fig. 26).

At Molenaarsgraaf we were able to determine that after a first occupation phase, characterized by VBB pottery, BWB sherds were characteristic in a second phase, and, in a third phase, mainly undecorated pots. Only during the use of the terrain as a cemetery, between phase 1 and 2, was the terrain perhaps uninhabited for a short period. Both beaker groups (VBB and BWB) are also represented at Ottoland-Oosteind (no. 42) and at Ottoland-Kromme Elleboog (no. 36). Elsewhere the quantity of material is too small to place any meaning on the absence of one of the types of pottery. It appears, therefore, that there was almost an unbroken continuity in the inhabitation. As it is, moreover, difficult or impossible to distinguish both phases on the basis of a small number of finds we have made no attempt to do this.

In addition to settlements, graves are known in three places: first, the small cemetery at Molenaarsgraaf (no. 26) (see p. 242 f.); then a grave near Ottoland-Kromme Elleboog (no. 37) and a grave at Molenaarsgraaf (no. 24a). In both the last two a body was buried not in its anatomical cohesion, but completely disarticulated. The first is placed in the VBB phase by a ^{14}C date: GrN 6384, 1870 $\pm$ 45 B.C. The second grave is undated, yet there are sufficient arguments in favour of allocating it also to the VBB/BWB period. This is not the place further to discuss burial customs.

Apart from the evident concentration on the Schoonrewoerd ridge, finds on two *donken* are known from this period (Hazendonk no. 24, Hoog Blokland no. 60), and also on the *donk* near Almkerk, which is outside our area [73]. On the Schaik ridge at Hoog Blokland (no. 61) a settlement was found which appears to lie next to a break-through channel (fig. 28, see also p. 98). At Culemborg (no. 98) a few isolated finds indicated BWB occupation. It is expected that future investigations will fill up the gaps in our knowledge.

It is remarkable that no settlements dating from these times have yet been found on the Zijderveld stream ridge. It is possible that this somewhat lower ridge was too wet at that time. This is easily understandable, as the circulation of water after the activity of the "Schoonrewoerd stream" and the formation of the ridge must have been thoroughly disturbed, and a new drainage system had to develop.

2.5.4. Quantitative Assessment of the Sites on the Schoonrewoerd Stream Ridge

It is of especial importance that the Molenaarsgraaf-Noordeloos stretch of the Schoonrewoerd stream ridge has been so intensively explored that we may state that we know, if not all, at least nearly all the prehistoric settlement terrains there. Only at the recreation centre "De Put" (between find-places nos. 28 and 29) a part of the stream ridge is *terra incognita*

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[72] We generalize here from the data of the Molenaarsgraaf break-through gully. We know that the gully at Ottoland-Kromme Elleboog at least has a similar sequence of deposits.

[73] This site was mentioned already in part I, (p. 24); Appendix I, no. 14.

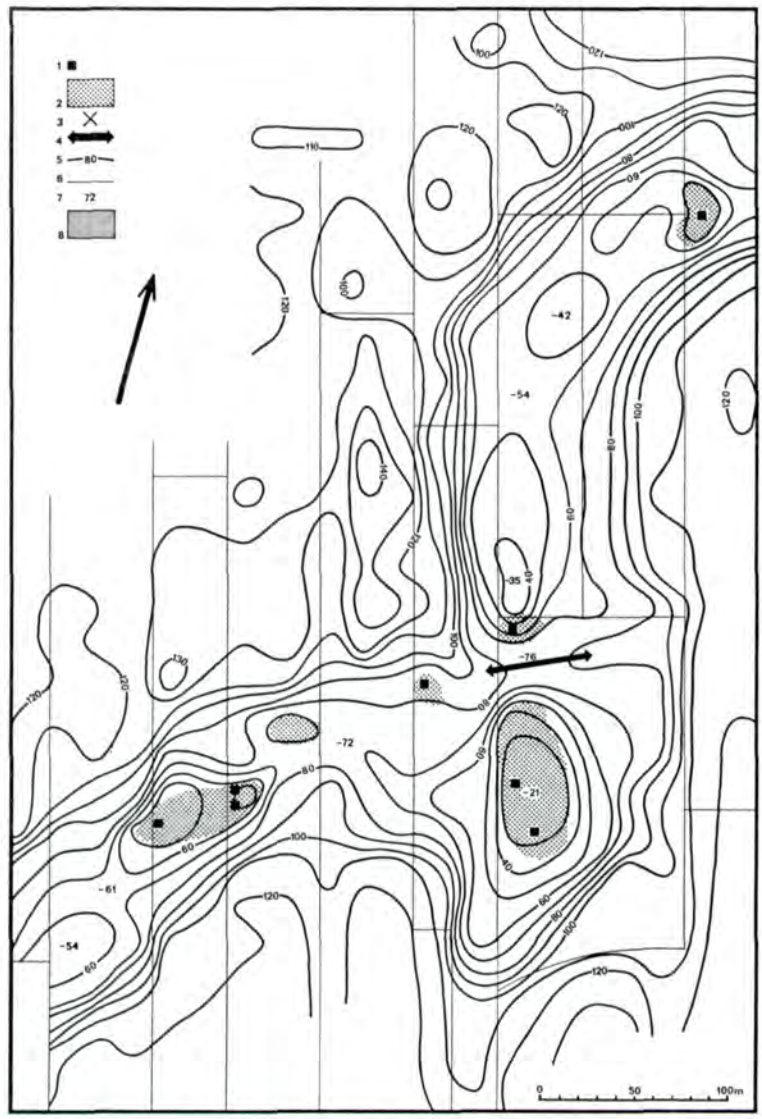

Fig. 27. Contour map of a part of the Schoonrewoerd stream ridge with the break-through channel at Ottoland-De Put. The contour lines are based on measurements in a system of 20 m. squares. Indicated are the sites nos. 29-35. Scale 1:4000.

Legend :

1. find spot or test pit producing finds
2. presumed extent of settlement
3. pollen sample
4. break-through channel (centre)
5. contour line with height in cm. below NAP
6. modern ditches
7. height in cm. below NAP
8. recently constructed roads

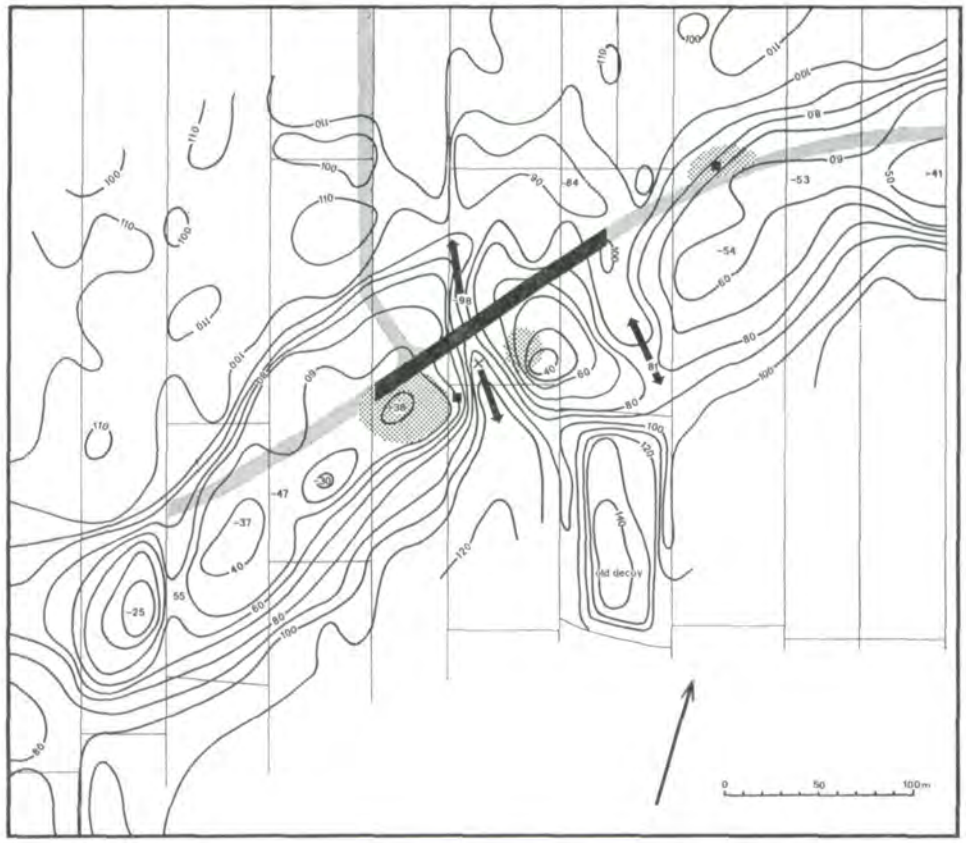

Fig. 28. Contour map of a part of the Schoonrewoerd stream ridge with the double break-through channel at "Ottoland-Kromme Elleboog". Indicated are the sites nos. 36 and 37.
Excavated part of road under construction in black. Legend : see fig. 27. Scale 1:4000.

because of the general disturbance there before our investigation began. The exact archaeological documentation, together with the limited extent of the land suitable for inhabitation, creates the possibility of a fairly exact determination of the agricultural land belonging to each of the occupation centres, and thus to the average number of inhabitants of each of these centres.

In the above-mentioned stretch at the moment seven small occupation centres or settlements are known; they are dated by VBB and/or BWB sherds (or by domestic pottery corresponding to "Molenaarsgraaf") in the appropriate period. They are: in Molenaarsgraaf, the Boon and Baan terrains; in Ottoland, De Put, Kromme Elleboog, "behind the church", Oosteind; in Goudriaan, Smoutjes Vliet; respectively the sites nos. 26, 27; 32-34, 36, 39, 41-42; 43. Outside these places and among them lie about an equal number of terrains where an occasional find indicates the possible presence of a Beaker settlement (or one in the direct vicinity); We must realize that the poorness in finds does not make the identification of beaker settlements easy.

We now assume that all the terrains were continuously and contemporaneously inhabited, basing our assumption on the general contemporaneity indicated by the archaeological

finds and on our experiences at Molenaarsgraaf, where no break of any significance in the occupation sequence could be shown. Even if we do not entirely accept this assumption and agree that a few settlements may have changed their position [74] during this period, our conclusion is still valid. This assumption partly compensates for the ignorance of the "unimportant" find-places, some of which perhaps really do conceal a comparable settlement.

The seven named terrains are all small (not longer than 60 m.) and are separated by distances of 200 to 1000 m. on the ridge, the average distance being 700 m., or 600 m., if we include one disturbed terrain near "De Put" in our calculations.

Only the sandy ground of the ridge itself can be considered as arable land. Elsewhere the drainage was too bad and the ground water level too high. For each settlement, therefore, a strip of 700 to 800 m. in length (we must also reckon with the terrains west of no. 26 and east of no. 43) and 70-100 m. in width — *i.e.* 5 to 8 ha. — was available. Of this at least 1 ha. must have been taken up by the farm yard, fences, tracks and some timber, so that 4-7 ha. remained. The area of productive arable land necessary in prehistoric farming to feed one person for one year has been estimated at between $\frac{1}{2}$ and 2 ha., an average of 1 ha [75]. This means that, if maximum use was made of the arable land, a minimum of $\frac{4}{2} = 2$ and a maximum of $\frac{7}{1/2} = 14$ persons, and most probably 4 to 7 persons per occupation centre, could have been fed. As we may reckon children as a $\frac{1}{2}$ person this amounts to from 2 adults with 4 children to 4 adults with 6 children. If, however, we assume a certain amount of crop rotation, which appears to us to be reasonable [76], then our figures will be further reduced by a factor of 2 or perhaps even 3. Our final conclusion must be that according to this calculation each occupation unit must have consisted of at most two, but probably only one family or farm household. It is interesting that the results of the excavation at Molenaarsgraaf lead to the same conclusion (*cf.* p. 275).

From the above calculations one has to conclude that the stretch of the ridge covered by the small village was used completely as arable land and must have been deforested to a large extent. To the west and to the east the forest cover was not seriously touched. During our investigation on the Hazendonk we demonstrated that at that point (400-500 m. from the ridge) the clay wedges were so damp that peat formation took place there in this period. The clay there, moreover, is not ripened and certainly not suited to the grazing of animals. But we cannot take this as a measure for the whole of the clay wedges, since the dampness of the clay must have been dependent of the compaction in the first decennia after deposition and this compaction can vary considerably. We can get an impression of this (but not more than that) from the present-day height of the top of the clay. We took that into account when we drew fig. 29. A number of ^{14}C dates of the covering peat might give a better and at least more exact information.

After the foregoing we may ask whether we are justified in speaking of a "number of settlements". It seems much more likely that we are concerned with one long ribbon settlement

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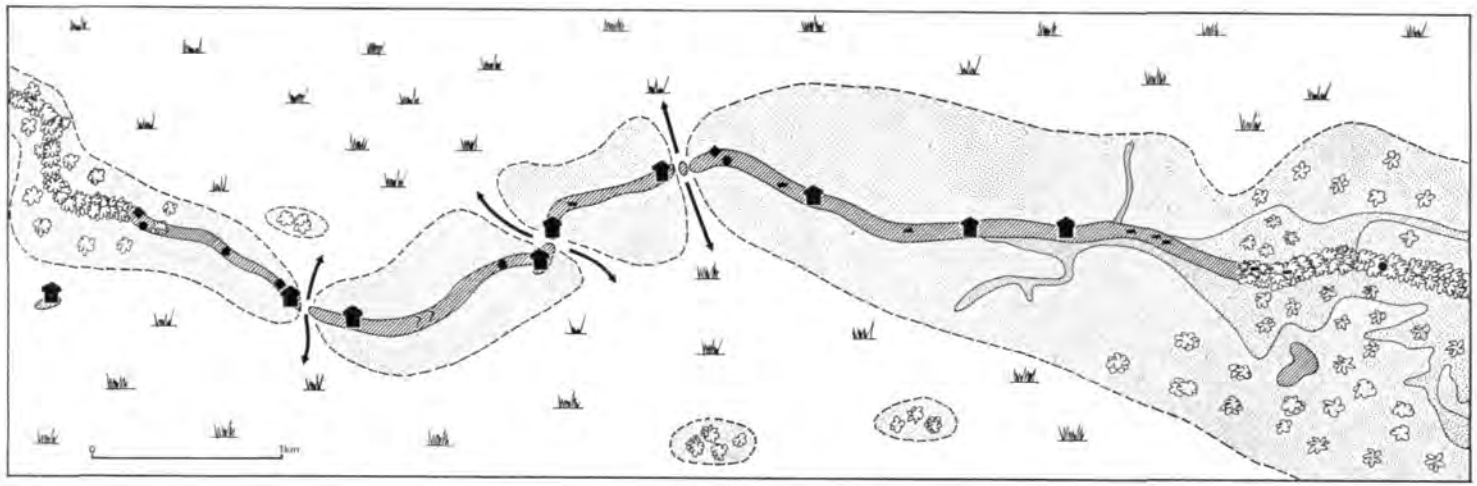
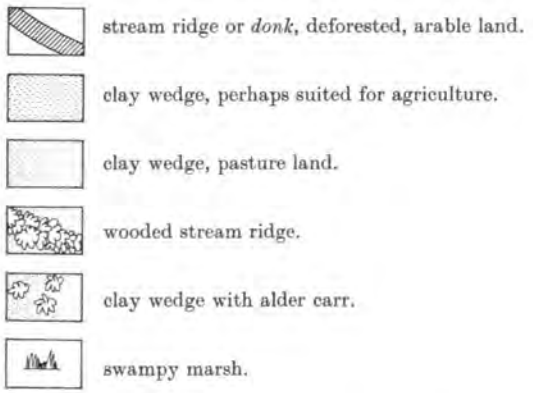
[74] *Cf.* for instance Waterbolk 1964[a] on the Middle Bronze Age settlement at Elp. We must bear in mind that a new farm-yard might not have been erected at or near the site of the old one, but farther away.

[75] We owe these data to Mr J. A. Brongers, Amersfoort. *Cf.* also his thesis: Brongers, in prep.

[76] The pollen diagram of the peaty gully filling of Ottoland-Kromme Elleboog contained some indications of crop rotation that must be examined further, before any account can be given of them. We can hardly imagine, however, that no crop rotation was practised.





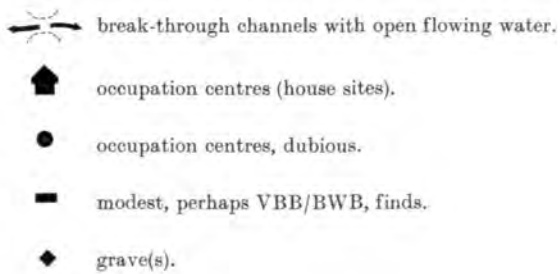


Fig. 29. Alblasserwaard. Tentative reconstruction of the VBB/BWB hamlet on the Schoonrewoerd stream ridge and its environment. Scale 1:40,000. *Cf.* fig. 19.

consisting of a number of separate units or farms bordering the arable land, belonging to them. These farms were preferably built near open water or on an elevation, while the arable fields were laid out on the somewhat lower intermediate parts of the ridge. The cattle grazed outside there on the low land adjoining the ridge. The population figure of the village may be estimated at 8 households, or 16-28 adults, or 30-50 persons.

It appears to us to be reasonable to assume that the settlement communicated via a track or path over the Schoonrewoerd ridge with the high sandy area of the Central Netherlands where the centre of the Veluwe Bell Beaker Culture was situated [77]. The same route served as a communication in the village between the farms. It is even possible that such a route also followed the ridge in a westerly direction, forming an important means of contact between the coast and the sand regions. The Bell Beaker village would thus have come into existence on this route half-way between the coast and the hinterland, on a place where nature offered an attractive situation.

In fig. 29 we sketched a tentative reconstruction of this hamlet, based on the arguments, mentioned above.

2.6. LATER LANDSCAPE DEVELOPMENT AND INHABITATION

2.6.1. Dunkirk O and the Middle Bronze Age (fig. 31)

In the second half of the Early Bronze Age (this is the early phase of the "Hilversum Culture") a short interruption in inhabitation apparently took place. Fragments of genuine Hilversum urns have not yet been found in the region, not even on the Schoonrewoerd stream ridge. To be able to identify these, however, a substantial quantity of not too fragmentary material must be available and this happens all too rarely. At Ottoland-Oosteind (no. 42) this phase between the older (VBB/BWB)and later (DKS, LBA) material is missing, however. At Molenaarsgraaf occupation ceased about 1500 B.C.

Exactly during this brief pause in inhabitation there was a renewed flow of water through the partly filled-up transverse channel at Molenaarsgraaf. In the Culemborg break-through channel there is also evidence of a second activity phase, in which lobate sand deposits were laid down in the basin on both sides of the ridge. At Molenaarsgraaf this second activity phase is dated shortly before 1400 B.C.; in Culemborg we only know that it was certainly ended in the course of the Iron Age, about 400 B.C. Confirmation of the unavoidable conclusion that the Alblasserwaard suffered from some flooding at this time is found in data supplied by Verbraeck that deposits dated Tiel O (= D O) occur only sporadically in the area and then in the form of shallow sheets of clay. This clay evidently settled down on the flooded parts of the terrain, presumably the lowest parts [78].

In this connection it is useful to examine critically the reference-section of the Geological Survey at Goudriaan [79]. In our opinion the deposit dated there as Tiel O must be envisaged

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[77] *Cf.* p. 30 and Verwers 1968.

[78] Verbraeck 1970, 76-77.

[79] Verbraeck 1970, 79, fig. 44.

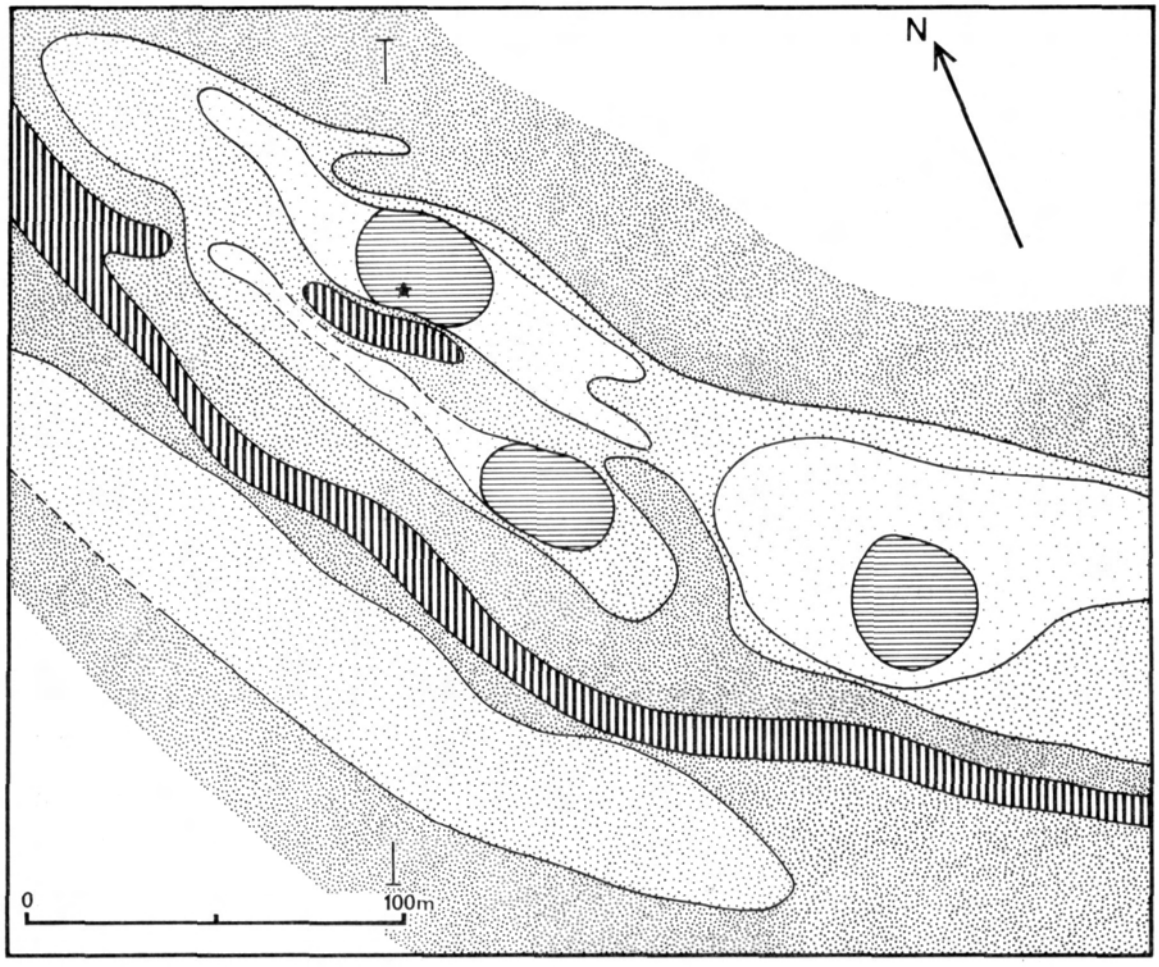

Fig. 30[a]. The Middle Bronze Age settlement on the Zijderveld stream ridge near Hei- en Boeicop (site no. 80). Physiographic map. Scale 1:2000.

Legend :

- "occupation layer" 30 cm. (settlement sites)
- depth of the top of the stream ridge:
  - <75 cm.
  - 75-125 cm.
  - >125 cm.
- >100 cm. peat on the sand (stream channels)

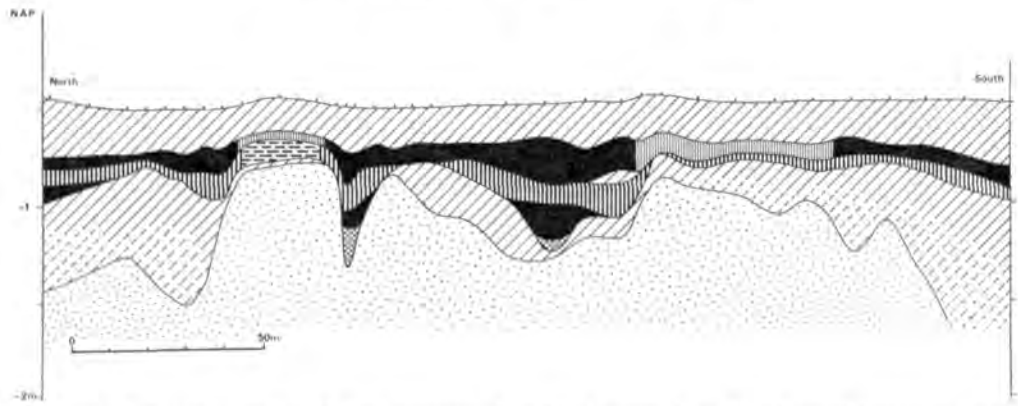

Fig. 30[b]. Hei- en Boeicop (site no. 80), N-S section across the residual stream channels and one of the occupation centres. Horizontal scale 1:2000, vertical exaggeration : 25×.

Legend :

- "occupation layer"
- black clay
- wood peat - peaty clay
- humic clay
- clay with plant remains
- clay
- sandy clay
- clayey sand - sand

only as the upper part of the "clay wedge" of the Schoonrewoerd ridge, where the peat development began exceptionally late, namely about the time when the district was uninhabited in the course of the Late Bronze Age.

Following this, such a large number of settlement terrains from the Middle Bronze Age are known that it is difficult to avoid the conclusion that there occurred a phase of intensive occupation. On the Schoonrewoerd stream ridge some of the same favourable points were sought as in the VBB/BWB phase. The break-through gullies had, however, lost their attraction; they were partly filled in and contained stagnant water [80]. None of the terrains adjoining them were again taken into use. But a few settlements are known on the narrow sand bodies of side creeks of the Schoonrewoerd ridge, projecting far into the peat (nos. 55, 56). As we have said, the *donken* were, however, hardly used at all. A remarkable fact is that the Zijderveld ridge was colonized in the Middle Bronze Age. Apparently the drainage there was so improved that people could live there and cultivate their arable land without risk of flood. Four settlements of considerable extent are now known, all lying near the former stream channel (which was already entirely filled with peat) and consisting of a number of smaller centres (fig. 30).

We see, therefore, that in the Middle Bronze Age inhabitation was more widely distributed than in the VBB/BWB phase. The inhabited area was enlarged into landscape units, which did indeed exist in the earlier phase but were unused; this points to improved conditions (the recovery of the drainage system ?) and/or a greater population pressure. The last is acceptable when we realize that the mapped settlements are the most westerly of the general inhabitation of the river clay area in this time. By a number of ^{14}C dates, already recorded in Part I (p. 33), we know that inhabitation had already started in the beginning of the Middle Bronze Age, about 1400 B.C.

[80] *Cf.* note 72.

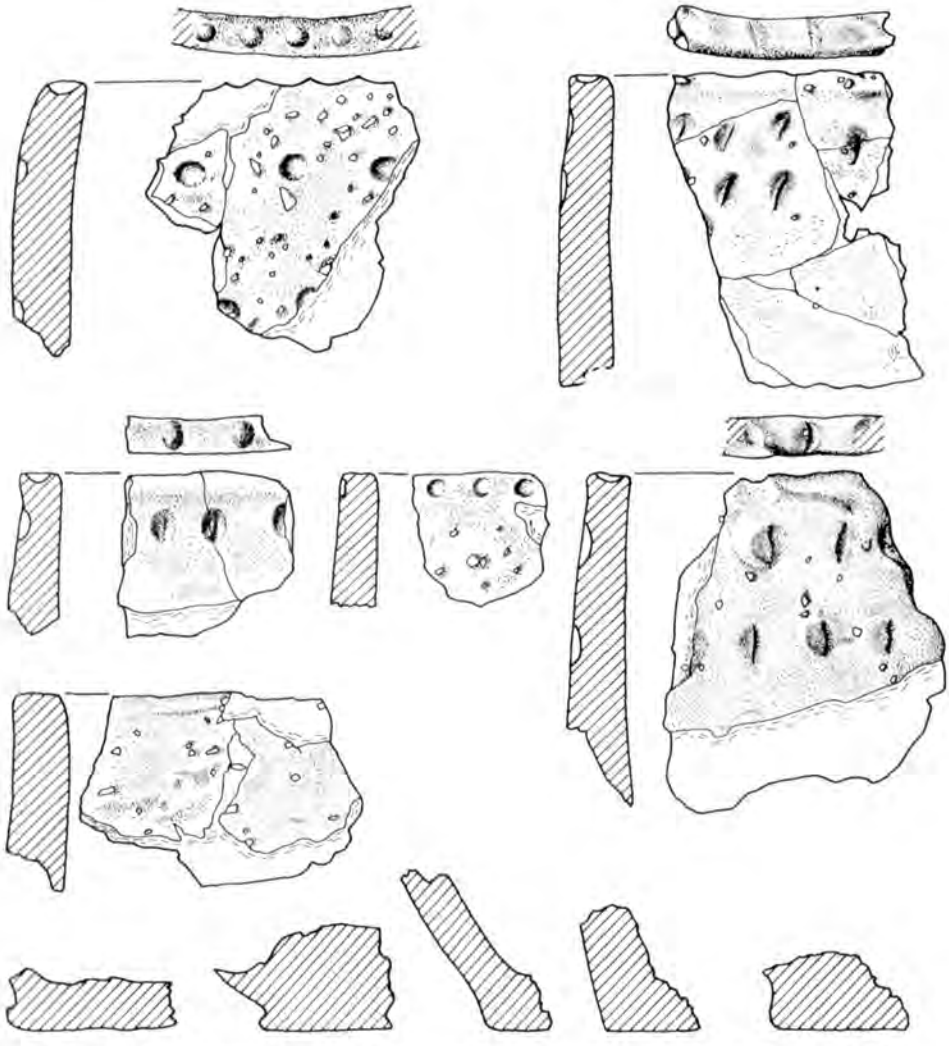

Fig. 30c. Hei- en Boeicop (site no. 80), pottery from the test pits (star in fig. 30a). Scale 1:2.

2.6.2. The Late Bronze Age (fig. 31)

On a number of terrains on the Schoonrewoerd stream ridge (nos. 28, 42, 49 and 52) inhabited in the Middle Bronze Age, pottery also has been found of a kind that we now date to the Late Bronze Age. It seems, therefore, that the occupation of these terrains continued until the Late Bronze Age, although naturally interruptions in occupation might have occurred. A decline in inhabitation, as revealed by the limited number of find-places, is confirmed by the pollen diagram I of Molenaarsgraaf (fig. 66, p. 190). In this we see, after the influence of the Middle Bronze Age inhabitation, a reduction of human activity and a recovery of the natural vegetation, particularly of the timber growth on the ridge. This was completed on a level with a ^{14}C date: GrN 5264 2710 $\pm$ 35 B.P. (760 B.C.).

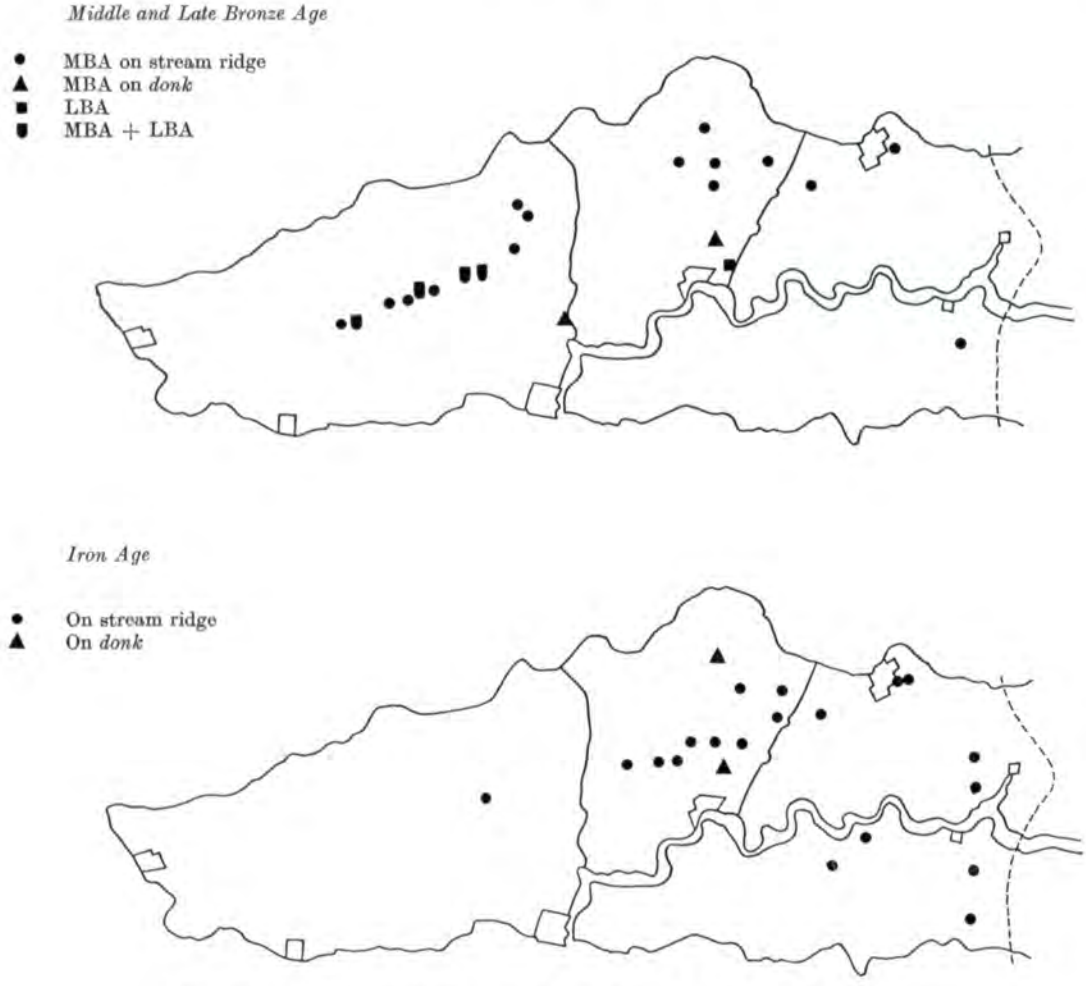

Fig. 31. Alblasserwaard, Vijfheerenlanden, Tielerwaard, Lek en Linge district.
Distribution of Bronze Age and Iron Age finds and sites.

The pottery that we dated in the Late Bronze Age during the course of our investigation was tempered with pounded pottery. It has a smooth surface, is fairly thick (8-12 mm.) and often well-fired. Most pots have a smooth profile with frequently a row of fingertip impressions as decoration on the belly or in the neck [81]. At Ottoland-Oosteind the filling of a pit containing some sherds of such pottery was dated by a ^{14}C date: GrN 6252 2815 $\pm$ 35 B.P. (865 B.C.).

[81] It was only in an advanced state of our investigations that we identified this type of pottery as belonging to the Late Bronze Age. We thus did not use this information in Part I.

The occurrence on three of the above-mentioned terrains together with DKS and once with DKS and Iron Age sherds indicates likewise a Late Bronze Age dating. It is also important that on one terrain at Schaik near Leerdam (no. 93) only pottery of this kind occurs, from which it appears that it occupies a separate chronological position. Among the finds made on this site (which were numerous for a test-pit) are a few fragments of flint sickles: artifacts for which a Late Bronze or Early Iron Age date seems at the moment most likely [82].

Similar pottery occurs in the material from Velsen dated Late Bronze Age by Van Regteren Altena [83]. Among the urns from the Hilvarenbeek urnfield, dated with certainty to the Late Bronze Age, similar types are relatively frequent [84].

In the Vijfheerenlanden and further east the Middle Bronze Age settlements were abandoned. Renewed colonization did not occur until the Iron Age. The already-mentioned settlement at Schaik near Leerdam is an exception.

The deteriorating inhabitation possibilities in the Late Bronze Age are thus clearly shown. We will relate these to an early phase of the Dunkirk I transgression period.

2.6.3. The Iron Age and Dunkirk I (fig. 31)

In the Alblasserwaard conditions after the Late Bronze Age had apparently become unfavourable for good. Only one point, the unusually high elevation near Noordeloos (no. 52), was occupied until the Iron Age, as appears from the occurrence of a few deliberately roughened sherds. In relation to the preceding era the inhabitation had moved further eastwards. In the Vijfheerenlanden we now know of a limited number of settlements, of which 8 were on the Schoonrewoerd stream ridge and 2 on the low Zijdeveld ridge: an indication of a relatively low ground water level. Also further east, in the Lek en Linge district, the Tielerwaard, the Bommelerwaard and the Land van Heusden en Altena, Iron Age settlements have been discovered [85].

The lack of Iron Age finds in the greater part of the Alblasserwaard may be attributed to the rise of the ground water table and the consequent growth of peat. It was always the well-drained sand bodies of the stream ridges, easily recognized by their lofty growths of deciduous forest [86], that were chosen for inhabitation. These ridges provided at the same time passable tracks in the peat area. Gradually, however, they became marshy and will have been overgrown for the greater part with peat. The highest parts perhaps were never overgrown, but their inaccessibility, like that of the *donken*, will have largely diminished their attractiveness.

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[82] Groenman-van Waateringe & Van Regteren Altena 1961.

[83] Van Regteren Altena in: Jelgersma *et al.* 1970, 140-141.

[84] The Hilvarenbeek urnfield (near Tilburg) lies at the NW margin of the HaB urnfields of the Southern Netherlands. The urns show a preponderance of *Grobkeramik* types (*cf.* Desittere 1967), while the finer HaB pottery (thin polished ware, *Kerbschnitt* decoration) is only very modestly represented. Since the rough *Grobkeramik* pots are doubtless the domestic storage vessels, the Hilvarenbeek material gives a good impression of the forms that can be expected of domestic assemblages. We thank Dr G. J. Verwers, who is preparing a publication on this urnfield, for his information.

[85] Iron Age settlements in the Tielerwaard and the Lek en Linge district: see fig. 18 and App. III; in theBommelerwaard: Modderman 1947, 1949[c]; in the Land van Heusden en Altena: data by the author.

[86] *Cf.* the discussion of the Molenaarsgraaf pollen diagram at p. 188.

From the excavation at Culemborg we know that the terrain there was inhabited (apparently continuously) from about 670 to 260 B.C. The ^{14}C dates are as follows [87]:

Culemborg 93	GrN	4946	2620 ± 50 B.P.	(670 B.C.)
101	GrN	4945	2600 ± 70 B.P.	(650 B.C.)
210-214	GrN	4947	2360 ± 75 B.P.	(410 B.C.)
post 8	GrN	5001	2210 ± 50 B.P.	(260 B.C.)

The Zijderveld settlement, separated from the preceding DKS settlement by a break in occupation, is dated in the same period [88]:

Zijderveld D	GrN	5574	2665 ± 80 B.P.	(715 B.C.)
E	GrN	5351	2565 ± 100 B.P.	(665 B.C.)
C	GrN	5573	2390 ± 65 B.P.	(450 B.C.)
$I/_1$	GrN	5218	2260 ± 30 B.P.	(310 B.C.)
F	GrN	5352	2150 ± 90 B.P.	(200 B.C.)

On another terrain (no. 82) it was determined that Middle Bronze Age and Iron Age finds were separated by a thin deposit.

The interruption in occupation at about 200 B.C. may be the consequence of a late phase (D I^b) of the Dunkirk I transgression period.

The transgression phase Dunkirk I (Tiel I) left clear traces behind it, if only at the edges of the great peat area. In the west these traces took the form of the estuarine creek system of Alblasserdam and Papendrecht. These creeks are dated to Dunkirk I^b by the absence of prehistoric inhabitation and by the occurrence of a large number of Roman settlements on the fillings of the main gullies of this creek system, which consist of a clayey sand. So in Roman times they were already completely filled up [89].

In the east the Spijk ridge, running in a bend north of Gorinchem, has been dated as pre-Roman by the isolated find of some native Roman pottery. The ridge is older than the Linge (which at least in Roman times was already an active river course), or perhaps contemporaneous with only the first phase of it.

Two ^{14}C dates, related to Tiel deposits in the river clay/wood peat area have been published recently [89a]. At Hellouw (Tielerwaard) a dark layer (*laklaag*) between two clay deposits, indicating an interruption of the sedimentation was dated GrN 4600, 510 ± 75 B.C. At Bunnik (north of the Lek) charcoal pieces from a layer between underlying (clayey) peat and overlying river clay was dated: GrN 4371, 980 ± 60. At Hellouw the clays might be Dunkirk I^a and I^b, at Bunnik D I^a. But we must be cautious: the ^{14}C dates give only a *t.a.q.* for the underlying deposits and a *t.p.q.* for the overlying layers. It is, however, remarkable that the Hellouw date concurs very well with the Iron Age occupation phase established at Zijderveld and Culemborg.

[87] Vogel & Waterbolk 1972, 96-97; Appendix IV.

[88] Vogel & Waterbolk 1972, 92-93.

[89] *Cf.* note 57.

[89a] Vogel & Waterbolk 1972, 39.

From the streams mentioned a first cover of back swamp clay was deposited over a great part of the Vijfheerenlanden. In the west there was almost certainly a deposition of clay also between the estuarine creeks. The heart of the peat area, however, remained untouched [90].

2.6.4. The Roman Period (fig. 32 a)

In Roman times the central peat region was uninhabited. It will have been in those times an almost inaccessible bog in which the few more or less dry sand hills presented little that was attractive. Yet we find inhabitation everywhere along its perimeter, where new deposits offered an opportunity for it.

The Linge was an important approach route with intensive occupation of its banks [91]. The Hagestein stream was also possibly in existence at this time, in view of the find of some Roman sherds on its banks near Vianen. We are here concerned with a number of find places which form the western limit of the densely inhabited river clay area [92].

In the south some Roman settlements and isolated finds mark the edge of an inhabitable area that lay on the site of the former Great or Holland Waard and that was entirely lost in the St. Elisabeth's flood of A.D. 1421. All old deposits were eroded there and replaced by the new Biesbosch deposits. The Roman Meuse probably flowed through this region to the well-known mouth (Helinium) where the present Europoort is situated [93].

In the west of the Alblasserwaard we find the already mentioned intensive inhabitation on the Dunkirk I creek system of Alblasserdam-Papendrecht. These settlements also in our view mark the northern boundaries of an area occupied by the Romans, the western continuation of which is to be found in the only locally preserved terrains of the Hoekse Waard and the Roman occupation of the Westland.

In a northern direction Roman settlements are only met along the frontier river, the Oude Rijn (Old Rhine) between Utrecht and Leiden [94].

The peat area of the Alblasserwaard formed a whole with the peat to the north of it, since the river Lek is a very recent phenomenon and did exist in this time at most in the form of one or more creeks, draining the peat bogs [95].

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[90] *Cf.* Verbraeck 1970, 79: the vast part of the Tiel deposits was formed after 700 B.C. and measures outside the gully and levee deposits from some decimeters up to 2 m. in thickness. See also Pons 1951. Only the Hagestein stream ridge is dated there somewhat later. Roman inhabitation at Bleskensgraaf on the easternmost extensions of the estuarine creek system proves that the "pre Roman" transgression reached so far inland.

[91] Some years ago a more than 30 m. long bottom fragment of a Roman ship was excavated near Kapel Avezaath, situated in a former stream channel of the river Linge; Louwe Kooijmans *et al.* 1968.

[92] The Hagestein stream is a part of the so-called "Linschoten system", that flowed north towards the Old Rhine at Woerden. But no Roman occupation along its banks north of the Lek is known. For the distribution of Roman settlements in the river clay area, see Modderman 1955[d].

[93] *Cf.* Sarfatij 1971, 164 f. and *afb.* 13; Bogaers 1967, Voogd 1955,

[94] *Cf.* Sarfatij 1971.

[95] The Lek came into existence as one of the main branches of the Rhine in the 9th-10th century (De Boer & Pons 1960, 28). It is most probable that in this case a main drainage creek of the extensive peat bog took over the function of lower Rhine course.

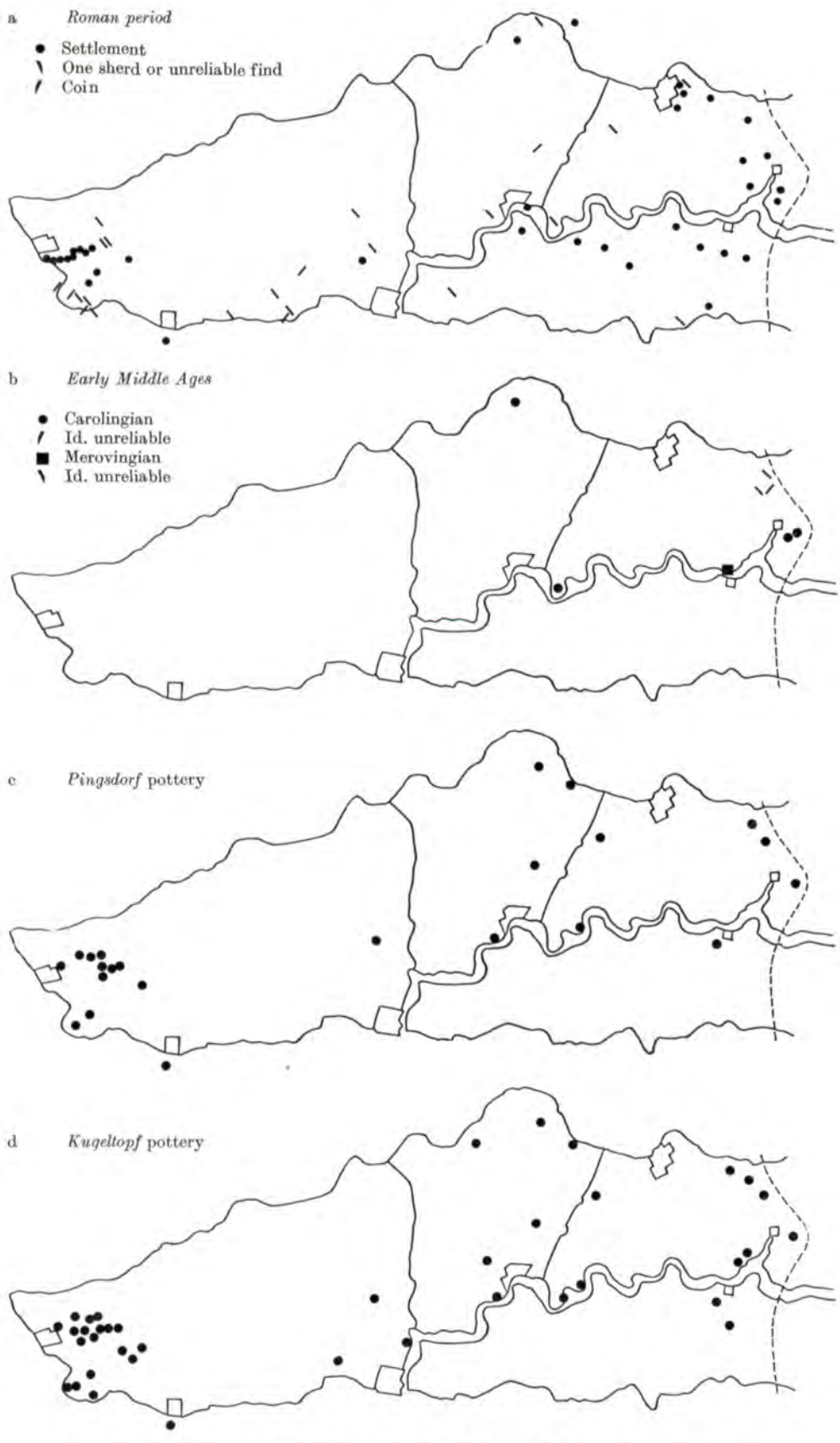

Fig. 32. Alblasserwaard, Vijfheerenlanden, Tielerwaard, Lek en Linge district.
Finds and sites of the Roman period till the 12th century A.D.

2.6.5. The Early Middle Ages (fig. 32 b)

Between A.D. 250 and 650 the river clay area went through a period of extensive sedimentation which obstructed almost all possibilities of inhabitation. In Carolingian times the natural levee deposits were again and definitely colonized [96]. A few Carolingian finds and a single Merovingian find in the easternmost parts of the region covered by our map tell us that occupation did not extend beyond the natural levees of the river clay area proper.

With the appearance of the Waal and the Lek as chief drainage channels of the Rhine in the 9th century, both the older streams ceased activity. The Hagestein stream was sanded up about A.D. 900, and the Linge was dammed up at last in A.D. 1304 [97].

In the west too inhabitation stopped on the old creek system after Roman times. Renewed inhabitation did not take place until the beginning of the "Cope"-reclamations in the 11th century.

A young clay layer covers the whole of the Alblasserwaard and Vijfheerenlanden, with the exception of the highest parts of the Schoonrewoerd ridge and the tops of the *donken* [98]. We have already said that the oldest parts originated from the phase Dunkirk/Tiel I, especially in the farthest west and in the east of the region discussed [99]. During the post-Roman inhabitation break a continuation in the process of its formation took place in the shape of the basin clay deposits of the Linge and Hagestein stream, and later in that of the Lek and Waal in the east. In the west deposition took place when river water was stowed up, during exceptionally high waters at the coast. In the centre of the Alblasserwaard, however, the clay is much younger. At Molenaarsgraaf we found 16th century sherds at the bottom of pits filled with this clay. The clay cover here seems to be later than one of the present day ditches, which themselves cannot be older than the 11th century. Near Papendrecht we could observe a *Pingsdorf* level half way through a 120 cm. thick clay layer covering a Roman settlement.

2.6.6. The 11th Century and Later (figs. 32 c, d)

2.6.6.1. *Reclamation*

While new inhabitation after the Merovingian break in inhabitation occurred elsewhere (in the river clay area, for example) already during the Carolingian period, the peat region remained unattractive. Not until the 11th century was this wilderness made available by its owners, the Bishop of Utrecht and the Count of Holland, for reclamation in the form of the so-called *Cope* [100].

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[96] *Cf.* Modderman 1955[d], Pons 1957.

[97] Ramaer 1899.

[98] *Cf.* p. 132.

[99] *Cf.* p. 118 and De Boer & Pons 1960, 17.

[100] Van der Linden 1956. See also Pons 1951 and Teixeira de Mattos 1933, 163 f. and 263. The latter states that most of the places are mentioned after the middle of the 13th century. Only villages and towns along the rivers

The first *Cope* reclamations were laid out from the natural drainage streams of the peat area (Graafstroom-Alblas, Giessen, Lede and Laak), but later from artificial water-courses. Finally in the 13th century, when the remaining "centre blocks" were also reclaimed, the whole area was taken into use. The standard measurements of a farm were 30 rods (= 114 metres) by 6 *voorling* (= furlongs = 1250 metres) or 33 hectares (Neder Boeicop) [101]. The prosperous villages raised large sums of money as credit on cattle and grain (barley and rye). The more effective drainage will have produced the first compaction, but in our view, this must have reached only an inconsiderable amount.

We compiled two distribution maps of pottery types, which were in use during the period of reclamation: The *Pingsdorf* ware (especially the light yellow, brown painted, 11th century) and the *Kugeltopf* ware (mainly *Paffrath*, 11-12th century). Both maps illustrate the first phase of colonization, as it started from the natural water courses. We must, however, warn that the blank parts in the central part of the map might be the result of a lack of investigation in the village centres there, while the dense distribution around Alblasserdam and Oud Alblas reflects the very intensive explorations, carried out by Mr G. van den Beemt.

2.6.6.2. *Dike building and artificial drainage*

Reclamation, the cessation of peat growth and cultivation, the damming of the creek system and perhaps also a new transgression phase, made dike building essential throughout the Western Netherlands.

At 31th March 1277 Floris V Count of Holland granted very extensive dike rights to the Alblasserwaard. On this occasion the *Hoogheemraadschap* (the Water Authority) probably was founded. A ringdike named "Zijdwende", surrounding the greater part of the Alblasserwaard existed already at this time. In April 1281 new measures were made for the Alblasserwaard. At 11th April 1284 a treaty was concluded to construct a ringdike around the Vijfheerenlanden, especially also along the north-south running "Diefweg", where the "Diefdijk" came into existence. This dike Diefdijk is mentioned for the first time in 1305 or 1306 and in 1342 it dammed up a flooding to the east of the Vijfheerenlanden. At any rate the whole of Alblasserwaard and Vijfheerenlanden were surrounded by a ring dike in the year 1320 [102]. These were very low dikes; it is only repeated raising that has brought them to their present height. Artificial drainage was improved: since the 15th century with windmills and since the 19th century with motor pumps. It is only then that compaction of the soil will have started in earnest, resulting in a constantly increasing need for more effective artificial drainage. The fact that in establishing themselves and in founding new villages the people did not make use of the old stream ridges (contrasting to their use of the more recent, active streams and the *donken*) proves that the stream ridges had lost their attractiveness and that they were invisible due to overgrowth of peat.

(Linge, Merwede) are named earlier (12th century, beginning 13th century), very rarely in the 10th century (*viz.* Arkel and Asperen).

[101] Van der Linden 1956, 25-26.

[102] Gottschalk 1971, 219, 228, 338, 339; Teixeira de Mattos 1933, 163 f., 264-265; Ramaer 1899, 249.

The construction of dikes meant that the natural drainage system was enclosed and had to be largely replaced by an artificial system. This is the place to say something about the likely age of these peat streams, the Giessen, Laak, Lede and also the Alblas. The map shows that they all start in or near the important Schoonrewoerd stream ridge. It is clear that for a great part they are fed by seepage from this sand body. This will certainly have been the case after the Lek became the main outlet of the Rhine, for it cuts the Schoonrewoerd ridge near Culemborg. Although the laying out of their courses was perhaps older, and although they may even have already existed in Roman times, it seems to us that these streams in their present extent are very new and not in fact older than about A.D. 900. Support for such a late date is given by the archaeological finds. So far no reliable finds older than the 11th century have been made along these streams.

Near the Hazendonk we were able to collect reliable information about the degree of the compaction of the peat. Compaction there due to the artificial drainage was 70 to 80 cm., a figure agreeing with the maximum value of 80 to 100 cm. for the Vijfheerenlanden [103]. Before the reclamation all compaction was caused by the pressing together of the peat under its own weight and especially under the weight of the covering clay deposit. Near the Hazendonk we were able to determine that compaction was very slight between the deposition of the clay wedge of the Schoonrewoerd ridge and the beginning of the artificial drainage. The weight of this clay, however, caused considerable compaction of the underlying peat, especially while it was being deposited [104].

2.6.6.3. *Dike breaches*

The Alblasserwaard lies in a position in the Netherlands where the "water-wolf" could strike from two directions [105]. Since 1320 the ring dike has been breached 36 times, both by high water levels in the rivers and by spring floods. During extremely high river levels, usually in December-March, it was chiefly the Lek dikes in the eastern part of the *waard* that broke. They also collapsed sometimes because of the formation of ice-dams in the river in December and January. When the Diefdijk gave way and the flood water from the Betuwe poured over the Vijfheerenlanden and the Alblasserwaard the consequences were catastrophic. Less serious were breaks in the dike near Papendrecht, caused especially by storm floods at times of south-west gales. As the water streamed out again during the ebb the flooding was often limited only to the south-west part of the *waard*. Finally, we must refer to the military inundations, especially those of the 80 Years' War (1568-1648), when the *waard* "floated" from 1574 to 1578, after having already suffered four floods since 1565 caused by dike breaching.

From the list of breaches (table 7), which we compiled with the help of data from Schakel, Gottschalk and Teixeira de Mattos [106], it appears that, particularly in the second half of the

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[103] Pons 1951, 4 and 44-47; as to compaction in general: Bennema *et al.* 1954, I. S. Zonneveld 1960[a], Bennema 1954.

[104] See p. 134.

[105] Schakel 1954, 1963[a], [b].

[106] Schakel 1954, Gottschalk 1971, Teixeira de Mattos 1933, see also Fockema Andreae 1953.

TABLE 7

Alblasserwaard and Vijfheerenlanden. Dike breaches
After Teixeira de Mattos 1933, Schakel 1954 (breaches after 1373) and Gottschalk 1971 (before 1400).

date	cause*	date	cause*
9th cent.		1-11-1570	s
1260	r	11/12- 2-1571	r D
years before 1281	r	14- 1-1573	i r D
28-10-1320		1574-1578/1581	M
1322 or 1323		19- 3-1593	r
24-12-1330	s	28- 3-1595	r
2- 2-1373	s	...-11-1599	s
9-10-1374	s	1- 1-1624	i
...- 3-1375 ?	r	27-12-1655	i
-1413	r	30-12-1658	i
10- 4-1446	r	20- 1-1663	i
21-10-1468	s	June 1672-end 1673	M
1-11-1470	s	19- 3-1709	i
16-12-1496	r	7- 2-1726	r
14- 1-1497	r D	24-12-1740	r
-1523	r D	3- 1-1741	r
5-11-1530	s	12- 3-1744	r
1-11-1532	s	29- 1-1809	r
14/15- 1-1552	r	25/26- 1-1820	r
14-11-1552	s	1- 2-1953	s
22- 3-1565	r D		

* i = icedams in the rivers (esp. the Lek) causing high waters.
r = high water in the rivers, not caused by ice dams.
s = storm floods.
D = breaches of the Diefdijk.
M = military inundations.

Remarks

— The dike breaches of 1374 and 1375 are mentioned by Gottschalk only. At the other hand she only mentions the storm flood of 2-2-1373 in polders other than the Alblasserwaard.

— The Diefdijk suffered a breach once before 1413.

— The cause of the breaches given by Teixeira de Mattos and by Schakel are not alike :
1571 Teix. : r Schakel : i.
1573 Teix. : i Schakel : r.

— The duration of the military inundations during the 80 Years War is given by Teixeira de Mattos as seven years from 1574, by Schakel as 1574-1578.

— Schakel gives November 1599, while Teixiera de Mattos gives 1598 or 1599.

16th century, the land remained very often and for long periods of time under water. Our dating of the clay cover at Molenaarsgraaf therefore fits well with the picture we get from the floods: the clay cover in the centre of the Alblasserwaard was deposited mostly in the 15th and 16th centuries, the period of heavy inundations.

The population was very well prepared for the regularly returning floods. The farms often lay on an artificial mound as did the churches. Often the *donken* were entirely built up. The farms had a "flood attic" for the cattle, while the roof construction was not supported by the walls, which could be washed away without any grave consequences and easily replaced when the land became dry again.

3. NEOLITHIC OCCUPATION ON THE HAZENDONK, MUNICIPALITY MOLENAARSGRAAF, 4000-1600 B.C.

On the top of an Early Holocene dune, surrounded by later peat and clay deposits, occupation was demonstrated about 4100 (?), 3400, 3000, 2400, and 1700 B.C., concurring with the geological regression phases. A new group of pottery, provisionally named "Hazendonk pottery" and dated c. 3000 B.C., is presented. The Schoonrewoerd stream ridge, an important fossil river course, is dated between 2100 and 1700 B.C.

3.1. INTRODUCTION

In the west of the polder (= municipality) of Molenaarsgraaf lies a small *donk*, already known to Vink [1] as the Hazendonk ("Hares-donk"). This is not a unit in a group, as is generally the case, but lies isolated at about 500 m. distance from the Schoonrewoerd stream ridge and about 1300 m. to the west of the VBB/BWB settlement on that ridge (fig. 19) [2]. The donk rises to about 110 cm. above the surrounding ground and has an elongated form lying in a south-west/north-east direction. Both the long north-west and the long south-east slopes are steep (about 20°), like the short north-east extremity. Towards the south-west, however, the donk very gradually dips away under the young deposits. We can make out a long top of about 100 m. in length and a fairly constant width of 40 to 50 m., to the west of which there is a smaller, low elevation (fig. 33, Pl. XVI B). The donk continues in the underground and is perceptible there in relief for at least 170 m. Its total length is therefore certainly at least 350 m. Because of its isolated situation and comparatively small size the donk has never been built up in historical times. Also hardly any sand was dug from it, so that it has remained remarkably well preserved.

Prehistoric occupation was recently confirmed by members of the AWN work-group "Lek en Merwestreek", who dug a number of test pits here at the end of 1963, in which besides some pottery sherds that were difficult to date a fairly large number of flint flakes were found. Occupation during the Neolithic seemed therefore likely [3]. In the summer of 1966 a resident of Molenaarsgraaf dug another pit on the Hazendonk. This pit, about 4.5 square metres and subsequently referred to as pit B (fig. 40) enclosed an unexpectedly large amount of big sherds, most of which could be fit together to some large pot fragments (figs. 51, 52). The exact documentation of the excavator on his work leaves no doubt that nearly all the finds must have come from a prehistoric refuse pit with a diameter of about 2 m. [4]. The size of the sherds and the fact that they can be mostly assembled into a few large pot fragments present a marked contrast to the finds made during our investigation, which supports our suggestion that they are the contents of a prehistoric pit. The find during the excavation of two sherds which fitted one of the pot fragments from pit B proves that the finds in fact originated from there.

The pottery forms a new group for this country, which we shall refer to as "Hazendonk pottery". From pit B come also two small grindstones with a groove, an anvil stone and a

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[1] Vink 1926, 37; 1954, 24.

[2] For *donken* in general see p. 84 f. For the Schoonrewoerd ridge p. 97 f.

[3] The finds were not made on the highest top, but on the parcel to the west of it. Most of the flint is, however, not preserved. One of the sherds is decorated with the "scratched impressions" described below (p. 154), characteristic of the "Hazendonk pottery".

[4] The finds were collected in 1 m. squares. In the map the find concentration was indicated in a grey discolouration and also in the drawing of a section one could recognize a shallow pit. We thank Mr Bliekendaal for his information.

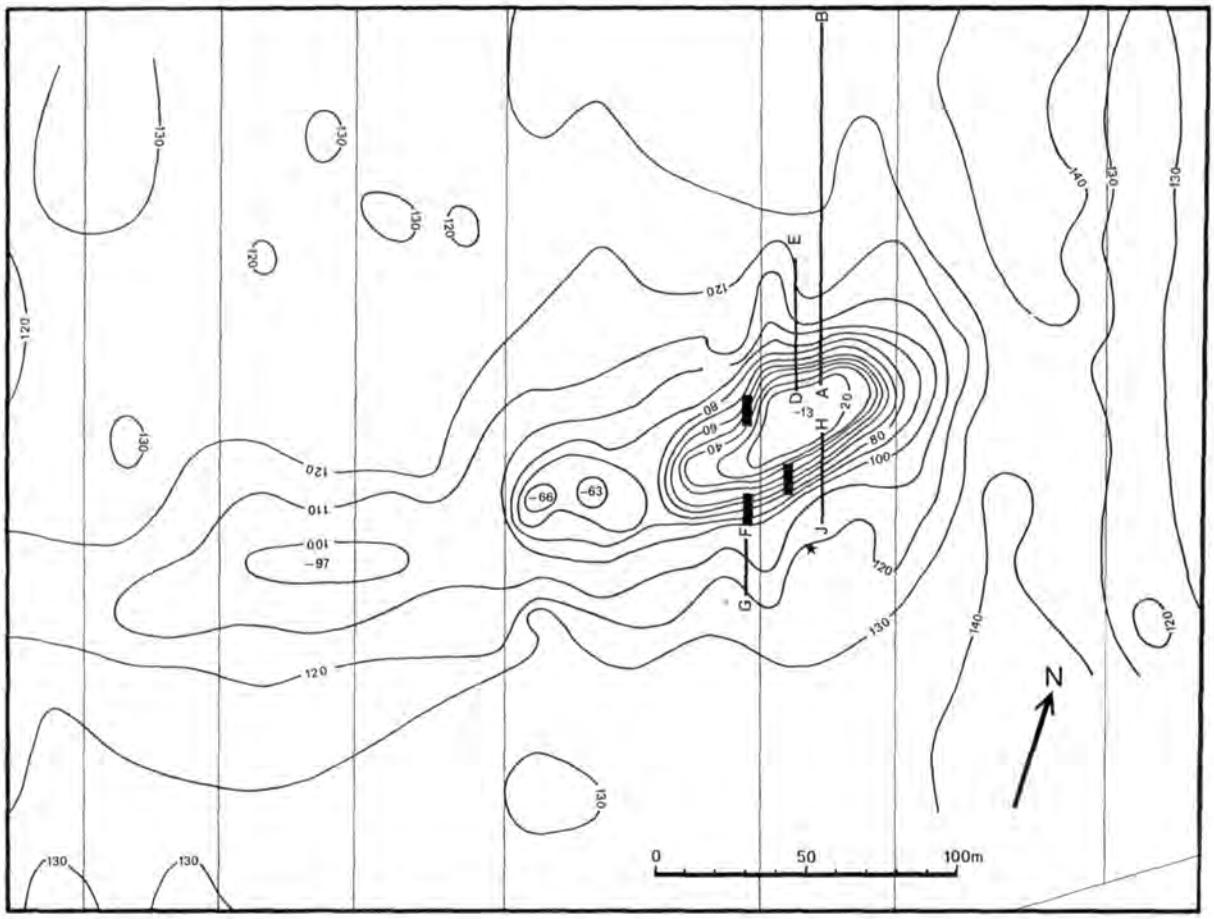

Fig. 33. Hazendonk. Contour map, based on measurements in 20 m. squares, but near the donk at every 10 m. Indicated are the pits I-III, the sections and the site of the pollen diagram (black star). The thin lines are modern ditches. Height in cm. below NAP. Scale 1:2500.

number of flint pieces, among which are fragments of axes, one of them an axe of oval section (fig. 55 f). Although it is not completely certain that this also comes from the prehistoric pit, it is very probable that this is the case. Among the excavation finds from an area twenty times greater 9 fragments of axes (of which this is the largest) and no worked stone at all of any importance have been found. The "Hazendonk pottery" most probably must be dated to the Middle Neolithic, partly on the ground of this association, as we shall explain later (p. 160).

The excavation on the Hazendonk was a preliminary enquiry. Between 22nd and 28th August 1967 three pits of 3 × 10 m. were made on the slope of the donk. These will be referred to as Pits I, II and III. The material found in them was collected in squares of $1\frac{1}{2} \times 2$ m. The pits were made at points where in borings alongside the donk an old surface in the peat had been discerned and where finds on the slopes could be expected. Pit III was made especially

to gain more information about the finds in the vicinity of pit B [5]. The ultimate purpose of the investigation, described in this account, was the preparation for an archaeological enquiry into the deposits alongside the donk. With an eye to its technical planning, as well as to gain as much knowledge as possible of the problems and possibilities, we considered that such an exhaustive preliminary investigation was necessary.

3.2. THE GEOLOGICAL SITUATION

3.2.1. Stratigraphy

The immediate surroundings of the Hazendonk were examined by means of borings. The extent of the outcropping sand was mapped and a number of cross-sections were constructed [6].

The section A-B-C (fig. 34) from the northern flank of the donk in the direction of the Schoonrewoerd ridge yielded the most detailed picture. At the left side the very steep slope of the donk, rising from at least —9 m. NAP, is visible. We can distinguish the following deposits, which cover the slope:

(1) A deposit of sandy clay and clayey sand, the high water deposit of a system on a present depth below —8 m. It is separated from the sand of the donk by a thin humic clay and has undergone a considerable compaction. After the deposition of this sediment a lengthy period of (wood) peat formation followed.

(2) The sandy filling of the bed of a small creek cuts through all older deposits. At both sides of the sand body a mantle of a clayey reed/sedge peat or peaty clay occurs over a width of 30-50 m. at both sides. The top of these sediments has locally developed as a pure clay. In figure 34 the data of two parallel sections, 10 m. apart, are combined as far as this clay is concerned. We interpret this mantle and the clay together as the high water deposits of the little creek. All sediments of this phase (2), including the creek ridge itself, were overgrown with peat before the next mineral sedimentation started.

(3) The thick clay deposit (3) (80-220 cm.), consisting of an unripened sandy clay with sand lenses, is the high water deposit (the "clay wedge") of the Schoonrewoerd stream. Northward the deposit becomes thicker and 150 m. north of C it is connected with the sand body of the stream ridge. At some places (*e.g.* between the donk and the creek ridge (2), the base has developed as a humic clay, indicating a gradual start of the inundations there, but most times the transition is sharp. In the clay a humic or peaty band causes a bipartition: the 10-60 cm. lower clay (3^a) might be brought in connection with a first activity phase

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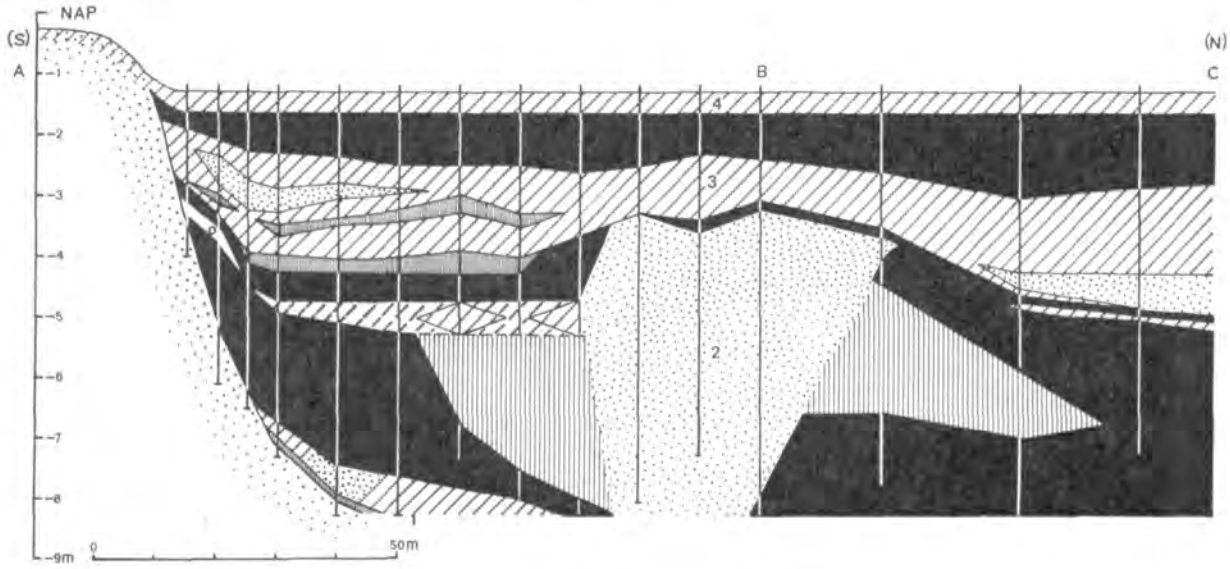
[5] We are greatly indebted to Mrs M. Kuipers-den Butter, of Wijngaarden and Mr B. Prins, of Molenaarsgraaf, the owners of the terrains, for their permission to dig the three pits. Preliminary report on the excavation: Louwe Kooijmans 1967[d].

[6] I thank the Geological Survey for the assistance given to me, esp. by Mr H. Kok and Mr M. van Meerkerk who did the borings of profile A-C. For a general survey of the geology of the Alblasserwaard see Part II.



Legend :

- donk sand
- fine sand - clayey fine sand (stream ridge)
- clay - sandy clay
- projection of clay (3) from section D-E into section A-B
- clayey reed/sedge peat - peaty clay
- humic or peaty clay
- wood peat
- black level

Fig. 34. Hazendonk. Section A-B-C. Horizontal scale 1:1250. Vertical exaggeration : 10×.
In the black level in the peat, the position of the ^{14}C sample GrN 5175 is indicated with an 0.

of the Schoonrewoerd stream, the higher clay (50-210 cm) is the high water clay of the last phase, during which the ridge itself was formed. On top of the sand of the creek (2) the humic level is absent and the differentiation into 3^a and 3^b cannot be made there. The most likely explanation is, that drainage conditions on this sand were better than at both sides.

(4) The covering layer of clay, which is described as "Alblasserwaard cover". This originates in Molenaarsgraaf from the 16th century A.D. and later.

(—) Peat, the "Holland peat", forms the matrix, as everywhere else in the Alblasserwaard, in which the stream ridges and their high-water deposits are embedded. In this peat and under the clay wedge (3) of the Schoonrewoerd ridge a 10-20 cm. thick level has been ascertained. The peat there is black, much weathered and contains much sand, pieces of charcoal and some burnt and unburnt bone. The old surface (sloping because of compaction) can be traced up to about 12 m. from the present foot of the donk and there links up with the clay wedge (2) of the small creek.

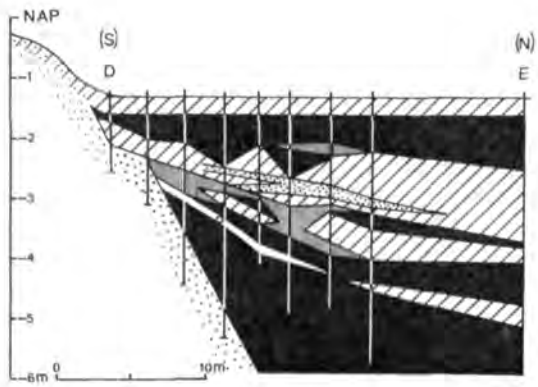


Fig. 35. Hazendonk. Section D-E. Horizontal scale 1:1000. Vertical exaggeration : 8×. Legend : see fig. 34.

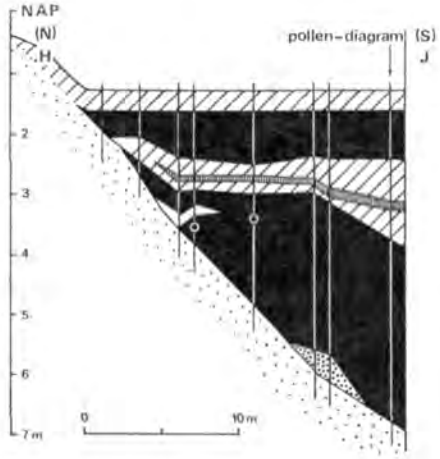


Fig. 36. Hazendonk. Section H-J. Horizontal scale 1:1000. Vertical exaggeration : 8×. Legend : see fig. 34.
Below the black level the position of the sherd referred to in the text is indicated;
in the other boring the occurrence of charcoal.

The section D-E (fig. 35), also made on the northern slope of the donk, shows the situation near the donk in greater detail. There is a marked change in facies over a short distance in the organic deposit between the clays 3^a and 3^b. The surface of clay 3^b is irregular. Both features may be the result of the local drainage conditions (especially seepage) at the foot of the donk.

The section H–J (fig. 36), on the southern flank of the donk, shows a much thinner clay wedge, perhaps because we are here (when we look from the Schoonrewoerd ridge) behind the donk. Further away the clay is locally much thicker.

In both sections, as in others not given here, a black level was again found in the peat. In some places it was, however, missing even in the direct vicinity of the donk. From the sections it becomes clear that the depth of the level in the peat varies fairly considerably. The depth in relation to the clay (3) and the uniform height of the point of juncture of the level on the slope of the donk make it clear, however, that these variations are the result of variations in compaction. These were caused by the varying thickness of the covering clay wedge (3) of the Schoonrewoerd ridge. The old level is therefore everywhere more or less of the same age and must be considered as a synchronous horizon in the peat.

At about 30 cm. under this level, in section H–J, a small sherd was found in a boring carried out with the gouge. It was black in colour (as all finds in peat usually are) and was richly tempered with broken quartz.

3.2.2. Compaction [7]

In the immediate vicinity of the donk all layers dip away from it, as a consequence of the compaction of the peat. Where the deposits rested on the donk slope, however, they were well "founded" and so not subject to compaction. Two facts now emerge. First, the original height (depth) of each deposit. Second, the compaction which these subsequently underwent. Especially the section A-B-C contains very instructive information in this respect. The data, to be derived from this section have been assembled in table 8 and were used to construct the graph in fig. 37. The total lowering due to compaction undergone by each level is given. The differences of the amounts given for the various levels give the compaction in the period between their formation.

A detailed knowledge of the compaction is necessary when we want to understand the deposition sequence in detail and when we want to work with the ages and depths of certain levels and deposits.

clay 4

The original height of the top clay, where this was laid on the peat, is difficult to estimate. At Molenaarsgraaf the clay was deposited for the most part, if not entirely, during inundations following the frequent dike breaches after about A.D. 1500. The clay cover was evenly deposited over slight unevennesses. We must realize, moreover, that the present stream ridges were covered with peat and only became visible as such in the landscape due to compaction after artificial drainage. On the highest points, particularly on the higher parts of the donk slopes, the clay is thin and sandy because it mixed with the underlying sand. The original maximum level

TABLE 8

Hazendonk. Height of the deposits north of the donk

Deposit	Date	Juncture point on donk slope	Between donk and creek (2)	North of creek (2)	Top of corresponding ridge	Compaction
clay 4 (top)	A.D. 1600	— 0.30 ?	— 1.20	— 1.30		<90
clay 4 (base)	A.D. 1200	— 0.90*	— 1.50	— 1.60		60- 70
clay 3 (top)	1800 B.C.	— 1.70	— 2.60	— 3.00	— 0.70	90-130
humic level in clay 3	c. 1950 B.C.	— 2.50	— 3.40	— 5.00		90-250
clay 3 (base)	2100 B.C.	— 2.70	— 4.20	— 5.20		150-250
clay 2 (top)	2400 B.C.	— 3.00	— 5.00	— 6.00	— 3.30	200-300
clay 1 (top)	4100 B.C.	— 6.50	— 8.10	—		⩾260

* *Cf.* fig. 38.

[7] Surveys of the mechanism of compaction are given by Bennema *et al.* 1954 and Huizinga 1940.

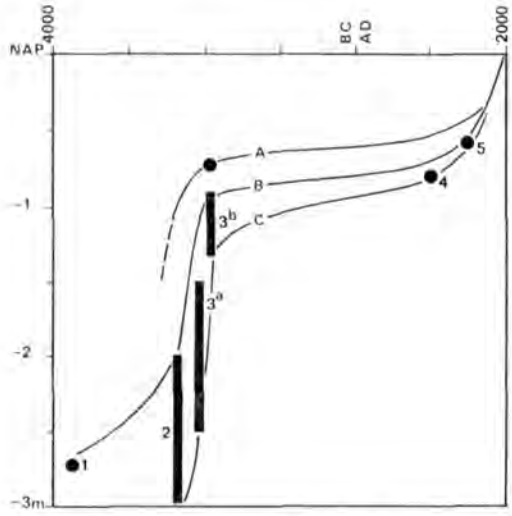


Fig. 37. Hazendonk. Compaction. Age of the deposits on the X-axis, the lowering due to compaction on theY-axis.

A : south of the donk	1 = clay 1 (top)	3^b= clay 3 (top)
B : between donk and creek (2)	2 = clay 2 (top)	4 = Pons 1951
C : north of creek (2)	3^a= clay 3 (base)	5 = clay 4

of deposition is therefore difficult to determine and, moreover, it does not give the level of the former peat surface.

There are, however, a number of considerations which may give us some idea of the height of the former peat surface. These will be discussed when we deal with the sections of the VBB/BWB settlement [8], from which it appears that the sinking of the peat surface since the deposition of the "Alblasserwaard cover" cannot have been much more than about 60 cm., which gives an original height at Molenaarsgraaf of about —60 cm. NAP. The compaction between reclamation and clay deposition will not have been more than 10 or 20 cm. All this agrees very well with data given by Pons about the Vijfheerenlanden. The compaction of the surface there is at most 80-100 cm. The peat surface there sloped originally from about +50 cm. NAP. in the east to about —50 cm. in the west [9]. Bennema assumed a height of the peat surface before drainage roughly equivalent to NAP [10].

clay 3

The compaction which occurred before artificial drainage was the result of the weight of the deposits themselves or of the load of the covering deposits. With the clay wedge of the Schoonrewoerd ridge most of the compaction occurred during deposition, as appears from the

[8] See p. 183 f.

[9] Pons 1951, 44.

[10] Bennema 1954, 11. This height seems to be rather low and in conflict with the opinion that the level of eutrophic peat growth lies at about the MHW level (*cf.* p. 52, note 134). But we can imagine that the reclamation and the first cultivation of the peat resulted in a modest wastage of the top of it. *Cf.* the situation in the English Fenland (p. 75, note 194).

variations in thickness and depth of the clay, above and on both sides of the small creek (2). This is a case, therefore, of an intensification of the process, through the filling up of depressions caused by compaction, until a balance was achieved. The compaction above the donk slope is similarly somewhat less than it is further north. During the sedimentation, (a period of only two or three centuries) a compaction of 60 to 120 cm. occurred, after which the compaction during about 3000 years of exclusively peat growth was only 30 to 60 cm. The subsidence after the deposition was therefore small. We see that at point C 120 cm. of the total of 240 cm. of sediment was formed as the compensation of the compaction. The deposition of the other 120 cm. must have resulted in a real rising of surface. But in the period after the sedimentation compaction caused a further lowering of this level of 60 cm. : a real heightening of the surface of only 60 cm. remains. The difference in height (80 cm) of the top of the clay (3) at point C (fig. 34) and at J (fig. 36) can be explained by the absence of the last mentioned effect at J.

Of importance is the comparison of the original height of the clay wedge, as this appears from the juncture on the slope of the donk, with the height of the top of the sand body of the Schoonrewoerd ridge. The difference in height is about 100 cm ! Already during the deposition, the highwater clays near the Hazendonk lay therefore about a metre lower than the sand in and near the gully about 500 m. farther north. We have used this important observation already in Part II (see p. 100).

clay 2

The top of the small creek (2) has about the same height as the juncture of the black level in the peat. The compaction here totals about 200 cm. and resulted in a steep dip of the layers near the donk. Farther toward the north the point of maximum extent of the high water deposits lies at a depth of about —6.00 m. NAP ! This point must have sunk about 3 m. as a result of compaction; about 1.70 m. of this amount is the result of the load of the clay (3).

clay 1

The clay deposit (1) at the base of the section is not directly dated. With the aid of Jelgersma's curve and our own curves [11] we may date this deposit about 4100 B.C. We can supplement our data about compaction with Jelgersma's conclusion about compaction near the Brandwijk Donk. The top of a clay layer dated 5665 $\pm$ 220 B.P. and covered exclusively with peat was lowered there, from about —600 cm. to —870 cm. NAP [12]. In view of the similarity in age and depth we may assume that for the top of the clay (1) near the Hazendonk the lowering as a result of compaction must have been of the same magnitude and probably slightly more. In view of the 3 m. lowering of the peaty clay (2) it must have been at least 3 m.

South of the donk (fig. 36, 37 curve A) the compaction was much less marked, at least in the higher layers, than was the case to the north. The modest deposition of the high water clays of the Schoonrewoerd stream must be the reason of this.

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[11] Jelgersma 1961, fig. 22; this paper fig. 14.

[12] Jelgersma 1961, 32.

TABLE 9

Hazendonk. Comparison of the dated levels with human influences and the corresponding MHW levels, with data of the Brandwijk and Barendrecht "donken" (Jelgersma 1961 *, nos. 14-16 and 19-25)

Site	^{14}C date B.C.	Depth of former MHW in cm. below NAP	
		Barendrecht	Brandwijk Hazendonk Molenaarsgraaf
Molenaarsgraaf	760 ± 35		— 110
Brandwijk	880 ± 155		— 115
Barendrecht	1530 ± 60	— 195	
Hazendonk	1680 ± 35		— 150
Molenaarsgraaf	1690 ± 30		— 160
Hazendonk	(1900)		(— 250)
Barendrecht	1950 ± 80	— 265	
Barendrecht	2320 ± 65	— 325	
Hazendonk	2340 ± 40		— 270
Hazendonk	2530 ± 40		— 270
Brandwijk	2640 ± 170		— 330
Barendrecht	2700 ± 80	— 345	
Hazendonk	2985 ± 40		— 370
Barendrecht	3080 ± 80	— 430	
Hazendonk	3370 ± 40		— 430
Barendrecht	3630 ± 70	— 570	
Barendrecht	3995 ± 100	— 585	
Hazendonk	(4100)		(— 620)
Brandwijk	4100 ± 200		— 650

* Jelgersma's ^{14}C dates have been corrected according to the list, given by Vogel & Waterbolk 1963, p. 164, of the correction of Gro values into GrN values (correction for "Suess-effect").

We compare our data on the original depths of deposition with those of Jelgersma (table 9). There is a close agreement, especially when we take the strong influence of the Schoonrewoerd stream ridge into account.

3.2.3. Sections of the Excavation

In the sections of the three excavated pits the wedging out of the peat on the slope of the donk can clearly be studied. The best and most detailed were the sections of Pit I, which was the lowest on the slope (fig. 38). At the base we find the sand of the donk, at the top the "Alblasserwaard cover". Between these two the peat wedges out.

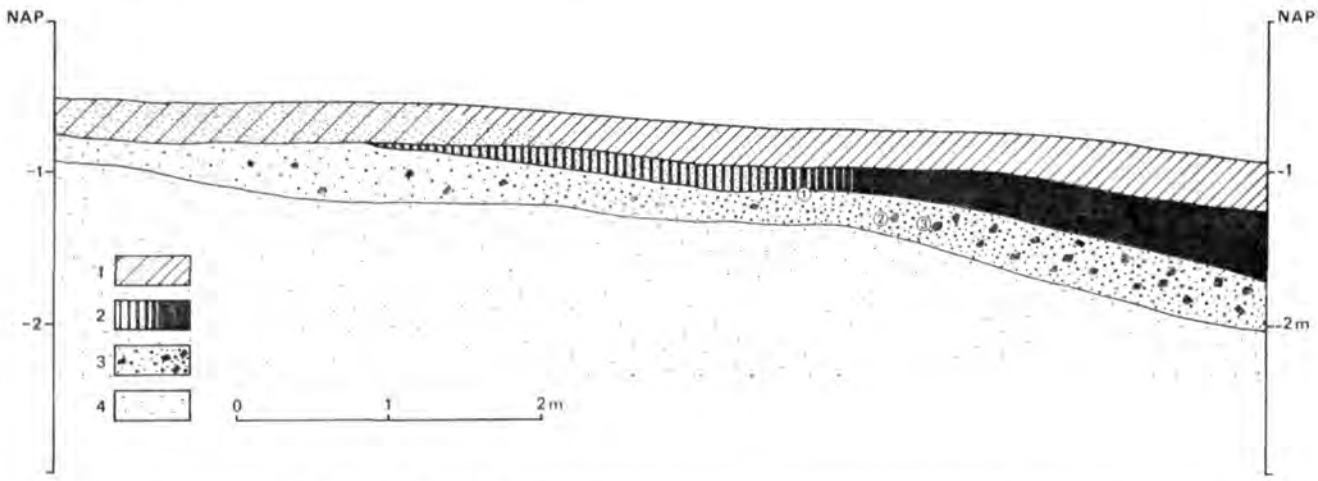

Fig. 38. Hazendonk. Pit I, west section. Scale 1:50. Indicated are : 1 Veluwe Bell Beaker sherd (fig. 46 upper row, left), 2 tanged arrow-head (fig. 55b), 3 parallel-lined Bell Beaker sherd (fig. 46 upper row, 2nd from the left).

Legend :

1. turf passing into clay
2. (dark) grey sand passing into peat
3. light violet sand with few finds, passing into dark grey sand with many finds
4. unaffected donk sand

The top of the sand is darker in colour for 40 cm. at the lowest point and for 20 cm. higher on the slope. This will be the result of the covering with peat, which reached higher on the slope before the artificial drainage. On the top of the donk, which was not reached in the section, the grey layer is missing. So the peat never reached this top (—20 cm. NAP). Moreover, the turf here generally shows hardly any traces of clay.

The position of a few interesting finds is given in the section. The whole situation shows that we may take the VBB inhabitation to have been the last.

3.3. POLLEN ANALYSIS, ^{14}C DATING

3.3.1. General Remarks

The site offers very favourable opportunities for pollen analysis, because the donk is surrounded on all sides by peat, several meters thick, covering the whole period during which the top of the donk was suitable for occupation. It was to be expected that the various occupation phases could be identified from a pollen diagram. By choosing a very small distance between the place of the diagram and the donk small disturbances in the natural vegetation could also be noticed.

As the first step in a more general palynological investigation a profile, situated ca. 20 m.

south of the present foot of the donk (*i.e.* the boundary between the sand outcrop and the peat), was palynologically studied. The boring lies as close as possible to the excavation pits in which the archaeological remains, described below, were collected. It may therefore be accepted that at least the cultures represented there would be traced by their disturbance of the vegetation.

The palynological investigation of the Hazendonk was conducted by Mr A. Voorrips of Amsterdam, as a part of his enquiry into Holocene vegetation development in the western river area [13]. The following paragraphs were written in close collaboration with him. The interpretation of the diagram is the work of Mr Voorrips; the archaeological commentary is largely the work of the writer.

The natural vegetation of the donken landscape was determined by the height in relation to the ground water level on the one hand, and by the presence or absence of a mineral soil on the other hand.

In the landscape around the donken considerable peat formation had already occurred at the beginning of the period we are discussing. The ground water table was at or near the surface and the vegetation consisted chiefly of alder carr and the preceeding vegetational succession stages (such as reed and sedges) in places where water of any depth was present. The alder carr was characterized, with the preponderant *Alnus glutinosa* (alder), by the climbing-plants *Humulus lupulus* (hop) and *Solanum dulcamara* (woody nightshade) and by marsh plants such as *Iris pseudacorus* (iris), various *Carex* (sedge) and *Lysimachia* (loosestrife) species, and *Dryopteris thelypteris* (marsh fern). It was fairly difficult of access and certainly not suitable for (the grazing of) heavy hoofed animals.

Where the mineral subsoil emerges on the donk and the peat ends against the foot of it, more elm and ash are encountered, while the proportion of alder is reduced. The firmer ground makes this strip of vegetation, running like a ribbon around the donk, suitable for grazing. On the permanently well-drained and fairly nutricious soil of the donk itself, there is real forest in which the oak dominates. The undergrowth, a large part of which consisted of hazel would spread when the oaks were uprooted, and in any case would bloom to a much larger extent, as may be seen from a pollen diagram.

The pollen sum (the basis for the frequency calculations in the draughting of the diagram) is so selected that human influence on the vegetation becomes apparent as clearly as possible. As human activity took place primarily on high ground, all pollen types belonging to the series from open water up to and including alder and/or willow carr were excluded from the pollen sum, as were the pollen types which could originate both from species in this series or from species in a drier position.

In the interests of clarity only those curves have been included in the diagram which are necessary to comprehend the man-vegetation relationship. The complete diagram, together with the diagrams of other archaeological terrains in the Alblasserwaard will be fully discussed in due course, particularly as far as the vegetation development is concerned [14].

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[13] We are much indebted to Mr Voorrips for his readiness to co-operate in the study of the river clay/wood peat area and for putting the important results of his work at our disposal.

[14] Mr Voorrips is preparing a thesis on this subject.

The counts were made by Mrs J. Mekel-te Riet and Mr A. Voorrips. The diagrams were calculated and drawn with the help of a computer programme [15].

3.3.2. The Pollen Diagram (fig. 39)

The lithology of the boring is a follows:

cm. in relation to NAP	
—120	surface clay (4)
—145	wood peat (165/145 disturbed)
—250	clay (3) humic level at *c.* —310
—365	wood peat
—375	wood
—405	wood peat
—655	donk sand

In the pollen diagram seven zones can be distinguished, in which a more or less obvious anthropogenous influence is evident; they are numbered from below upwards 1-7. The data about depth, the corresponding MHW levels, ^{14}C dates and correlation with prehistoric cultures have been assembled in table 10. The zones exhibit the following characteristics:

zone 1 (—635/625 cm. NAP)

In the spectrum —635 cm. NAP occurs one pollen grain of *Cerealia* (cereals). Together with the presence of *Urtica* (stinging nettle) and *Artemisia* (mugwort) in this zone, this would be an indication of the presence of human inhabitation. There appears, however, to be no questions of any interference with the vegetation.

zone 2 (—550/540 cm. NAP)

In this zone also a single *Cerealia* pollen grain occurred, here accompanied by distinct tops of *Urtica*, *Artemisia* and *Chenopodiaceae* (goosefoot fam.). At the same time *Plantago lanceolata* (ribwort plantain) was found for the first time in this zone. The vegetation on and around the donk does not appear, however, to have been affected by any possible inhabitation. We suppose that in this zone occupation at some distance away is reflected in the pollen diagram.

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[15] Voorrips 1973. We give here some instructions on reading the diagrams. There are two scales: one at the top, one at the bottom of the diagram; the latter gives the tenfold of the former. The counted samples are plotted with the)))) signature and relate to the upper scales. The |||| give the interpolation between the counted samples. The **** give the same data, but related to the scales at the base of the diagram and consequently the tenfold diminution of the)))) and |||| curves.

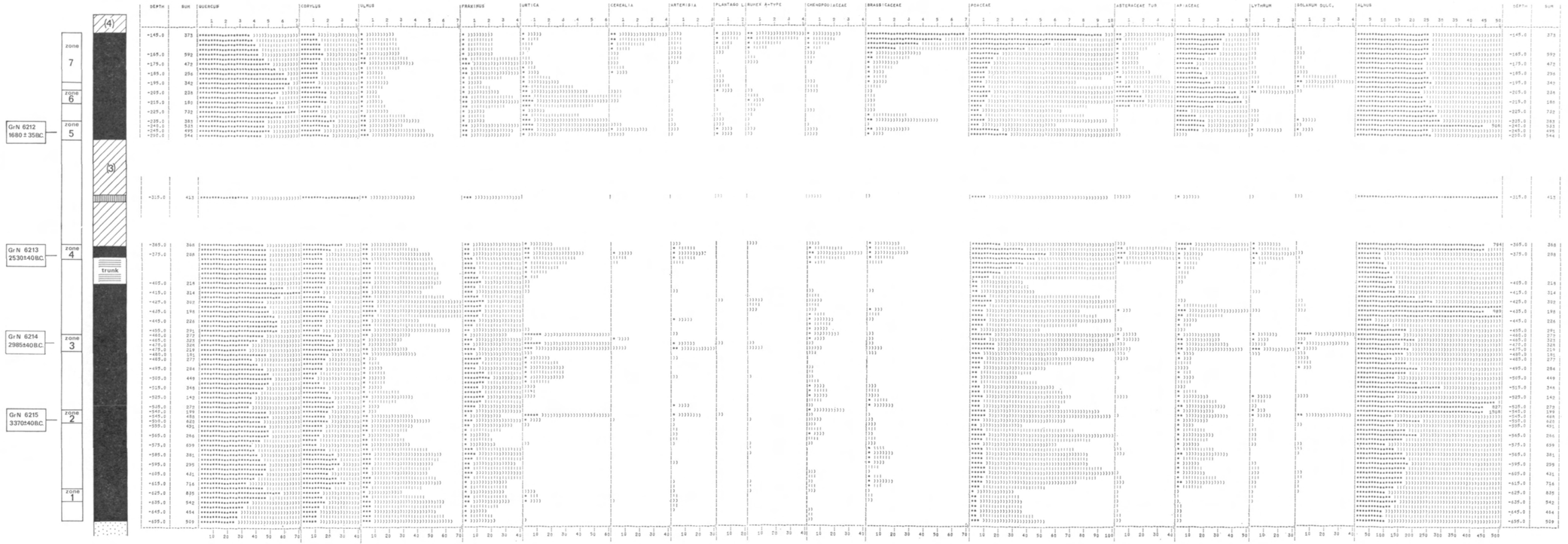

Fig. 39. Hazendonk. Pollen diagram. *Cf.* figs. 33 and 36.

zone 3 (—475/460 cm. NAP)

This zone is characterized not only by the presence of *Cerealia* pollen grains but also by high values for *Urtica* and *Artemisia* and a rise in the *Chenopodiaceae* curve. *Corylus* shows a top, while *Quercus* and *Fraxinus* have lower values. The curves of *Brassicaceae*, (wall flower fam.) *Asteraceae* (compositae) *tubuliflorae*, *Lythrum* (purple loosestrife), *Solanum dulcamara* (woody nightshade), *Apiaceae* (umbelliferae) and *Poaceae* (grasses) also show higer values. All this indicates an inhabitation which disturbed the forest vegetation on the donk (*Quercus*) in favour of arable land and at the same time cleared to a limited extent the bush vegetation on the foot of the donk and the adjacent peat, so that marshy underwood developed at the foot of the donk. This could have been used as grazing land.

zone 4 (—375/365 cm. NAP)

Zone 4 shows again high values for *Cerealia*, *Urtica*, *Artemisia*, *Chenopodiaceae*, *Brassicaceae*, *Asteraceae tubuliflorae*, *Lythrum* and *Poaceae*, and a *Fraxinus* minimum. Noteworthy is the absence of any top in the *Plantago lanceolata* curve. There is no *Quercus* minimum in this zone. Men appear to have established themselves on the then donk slope and the adjoining peat, so that the forest vegetation on the donk top was not disturbed.

zone 5 (—250/235 cm. NAP)

The comparatively low values for *Poaceae*, *Chenopodiaceae* and *Artemisia*, together with the high *Alnus* values, show that the surroundings of the donk in this zone were not reclaimed. The donk vegetation itself was, however, only very partially removed and recovered quickly after the cessation of the occupation. The values for *Cerealia* and *Plantago lanceolata* are considerable.

zone 6 (—215/205 cm. NAP)

Zone 6 shows in many respects the same picture as zone 5. The human influence is, however, much weaker.

zone 7 (—195/145 cm. NAP)

The very strong traces of human activity in the top of the diagram (high values for *Cerealia* and farmland weeds), combined with the considerable reduction in forest vegetation, undoubtedly reflect the large-scale peat reclamation of (sub)recent times. Disturbance of the top of the profile by ploughing and a possible slight surface erosion before and during the deposition of the top clay make it, however, uncertain whether these spectra really indicate the beginning of the reclamations since the 11th century (here it possibly did not occur until the 13th century). If this were indeed so, we can place this moment at about —185 cm. NAP.

3.3.3. The ^{14}C Dates

Four of the seven zones with human influences distinguished in the pollen diagram (the zones 2, 3, 4 and 5) have been given ^{14}C dates. The samples were taken from a second core

specially bored for this purpose and directly adjoining the palynologically examined core. For each ^{14}C sample a pollen spectrum was taken as a check. For the age determination the centre part of a 10 cm. long sample was used in each case. The dates all concern the initial phase of the relevant inhabitation. They are as follows:

GrN 6212	3630 ± 35 B.P.	(1680 B.C.)	zone 5	—255 cm.
GrN 6213	4480 ± 40 B.P.	(2530 B.C.)	zone 4	—375 cm.
GrN 6214	4935 ± 40 B.P.	(2985 B.C.)	zone 3	—470 cm.
GrN 6215	5320 ± 40 B.P.	(3370 B.C.)	zone 2	—550 cm.

A ^{14}C dating was also carried out during an earlier phase of the investigation of the old surface in section A-B-C (fig. 34). Here we were concerned with a mixed sample of material from this level. We argued above (p. 131) that the old surface in this section must be equally old as that in section H-G, which can be correlated to zone 4. This ^{14}C date, therefore, also has relevance to zone 4:

GrN 5175	4290 ± 40 B.P.	(2340 B.C.)	zone 4	—330 cm.

The ^{14}C dates appear to agree very closely with the ages expected from the curve for the sea-level rise (fig. 14) after a correction for subsidence due to compaction (fig. 37). First, therefore, a determination of age based on depth appears to give a satisfactory result, at least if the compaction can be accurately determined. Second, in this way the accuracy of both curves is shown.

Comparison of the dated pollen zones with the succession of transgression phases (table 10) demonstrates that the periods of occupation on the Hazendonk always fall between two transgression periods: in a regression phase. This observation formed one of our arguments for assuming that there were periods of more and less intensive (or no) inhabitation in the Western Netherlands in respectively regression and transgression phases (p. 47 and fig. 10).

3.3.4. Archaeological Commentary

zone 1

Zone 1, by reason of its depth, can be dated about 4100 B.C. (p. 134). The determination of one *Cerealia* grain does not lead us to conclude that there was arable farming and a true Neolithic culture in the Western Netherlands around 4000 B.C. Pollution of the sample in question can, however, be practically discounted. In our further enquiries we will devote special attention to this oldest zone.

On the donk no finds have (yet) been identified which may be dated in this period, such as, for example, microliths, although amateur archaeologists examining the donk in 1963 further west apparently found small concentrations of flint (exclusively waste) but no pottery in their small test pits. This is encouraging for further research. The very slight human influences in this zone indicate that the occupation took place not in the direct vicinity but some distance away.

zone 2

The date of zone 2 concurs with that of the Early Neolithic inhabitation at Swifterbant [16] (*cf.* p. 163).

Culture remains comparable to "Swifterbant" are known in the Western Netherlands (*cf.* p. 164), but have not yet been identified on the Hazendonk. The occupation possibly took place on the western part of the donk, or on a (now covered) creek ridge.

If the occurrence of *Cerealia* in zone 1 was particularly unexpected, in this zone 2 it can readily be accepted in the light of the Swifterbant discoveries. In fact, the spectra from zone 2 form the first good documentation of Early Neolithic inhabitation in the Rhine/Meuse delta area.

zone 3

In this zone for the first time occupation in the immediate vicinity of the diagram was proved. The ^{14}C date indicates that this occupation was older than the Funnel Beaker Culture (TRB). From the Northern, Central and Western Netherlands no archaeological finds can be attributed to this period. In the (otherwise badly known) Southern Netherlands two features are contemporaneous with this occupation: the St. Geertruid flint mines and the Stein burial chamber [17]. Both have ^{14}C dates:

St. Geertruid	GrN 4544	3120 ± 60 B.C.
	GrN 5549	3050 ± 40 B.C.
Stein	GrN 4831	2830 ± 60 B.C.

The finds from the Stein burial chamber are related to both the SOM and VL Cultures. The domestic material (esp. the pottery) used by the flint mine workers at St. Geertruid is hardly known [17a]. When we, therefore, propose to combine this zone with the "Hazendonk pottery", this is done mainly on negative arguments: the new pottery is combined with a phase, from which we practically do not know anything. But it is supported by other arguments that tell in favour of a Middle Neolithic age for this pottery (see p. 160 f.).

The distribution of the Hazendonk pottery along both slopes and the position of the refuse pit in Pit B (about 1 m. under the top and about 2.5 m. above the then foot of the donk) show that the higher parts of the donk were utilized. The local occurrence of a sandy layer in the peat at a confirmatory depth, and the sherd found in a boring (p. 131, fig. 36) reveals the use of the donk foot and the adjoining peat. All this concurs exactly with the conclusions from the pollen diagram.

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[16] Vogel & Waterbolk 1972, 82.

[17] Vogel & Waterbolk 1967, 129; 1972, 83.

[17a] Van Giffen 1925, 498 and Pl. 4. VII. 35: some sherds of thick, yellow-reddish brown pottery, tempered with big and angular quartz grit were found. One base sherd shows a somewhat pinched-out foot. The pottery seems to be similar to that of the Stein burial chamber.

zone 4

On the strength of both ^{14}C dates zone 4 can be attributed without reserve to the Vlaardingen Culture (*cf.* table 2, p. 21).

The black level revealed at various points along the donk — a former surface — and the distribution of the VL material (especially in pit I), in so far as this is not determined by differences in conservation, confirm the conclusion reached from the pollen diagram that occupation took place primarily along the donk foot and also on the adjoining peat. The low values for *Plantago lanceolata* have also been noted in other VL sites (Vlaardingen and Voorschoten) before the advent of the PFB Culture.

zone 5

The ^{14}C date of zone 5 gives a *terminus ante quem* for the clay wedge of the Schoonrewoerd stream ridge (deposit 3), and as such a confirmation of the data yielded by the settlements on the ridge. The ^{14}C date demonstrates that peat formation started already shortly (or directly ?) after the sedimentation period. Already in VBB/BWB times the terrain was so damp that it was not suited to graze cattle there. This must apply to the terrain at the northern side of the donk too: although it was silted up higher there, subsequent lowering caused by compaction must have resulted in equally damp circumstances. Near the Hazendonk the strip of grazable land on the clay wedges, bordering the Schoonrewoerd stream ridge, can not have been wider than about 200 m.

The diagram shows that the donk itself was used for growing grain and that the undergrowth was partially replaced by a track vegetation. But the timber was left untouched: this is a remarkable difference from the practice on the Schoonrewoerd ridge in the same period.

At last it should be mentioned that the older beaker occupation of the donk must be contemporary with the activity phase of the Schoonrewoerd stream. But the spectrum at —315 cm. shows a remarkable absence of human influence on the vegetation. This means that at any rate the early beaker occupation did not take place when the humic level in the clay was formed.

zones 6 and 7

The disturbance in zone 6 was caused by inhabitation in the outer surroundings, while the donk itself was apparently not used for inhabitation or human activity. In the whole period between the VBB/BWB inhabitation phase and the mediaeval reclamation there are only two periods when this may have happened: the Middle Bronze Age, in which the Schoonrewoerd ridge was widely inhabited, and Roman times, when the western part of the Alblasserwaard was also the scene of intensive inhabitation. A comparison with the datings and depths of the various zones in diagram II of Molenaarsgraaf (p. 189) makes it apparent that zone 6 dates from the Middle Bronze Age and that traces of the Roman period were lost during the mediaeval reclamation (zone 7). This means that we must assume that the top of the diagram was disturbed during the mediaeval reclamation. That this disturbance and the effect of the reclamation on the peat were covered by the clay (4) means that here too this clay is dated after the 11th-12th centuries A.D.

3.3.5. Summary

In the pollen diagram of the Hazendonk seven zones with human influence have been documented. These must partly (zones 3, 4 and 5) be correlated to the archaeologically documented occupation phases of the sand outcrop. Of these the correlation of zone 3 to the new "Hazendonk pottery" is of particular importance because of its dating value. Both the oldest zones (1 and 2) show inhabitation a short distance away, perhaps elsewhere on the donk. Zone 1 gives an unexpected first indication of the existence of a very Early Neolithic Culture in the Western Netherlands. Zone 2 confirms the presence of the "Swifterbant Culture". Zones 6 and 7 are closely connected with the later inhabitation history of the region.

Table 10 gives the correlation of depths, pollen zones, deposits, occupation phases and ^{14}C dates.

TABLE 10

Hazendonk. Correlation table

Pollen zones	Depth*	Date	Culture	MHW**	Deposit	
					clay 4	D III
7	— 1.45/95	A.D. 1100-1500	Mediaeval	— 0.30 ?		
6	— 2.05/15	c. 1200 B.C.	MBA	—		
5	— 2.35/50	1680 ± 35 (— 2.55)	VBB/BWB	— 1.50		
					clay 3	C IV^b
4	— 3.65/75	2340 ± 40 2530 ± 40 (— 3.75)	VL	— 2.70	clay 2	C IV^a
3	— 4.60/75	2985 ± 40 (— 4.70)	"Hazendonk"	— 3.70		
2	— 5.40/50	3370 ± 40 (— 5.50)	"Swifterbant"	— 4.30		
1	— 6.25/35	c. 4100	?	— 6.20		
					clay 1	C II

* In m. below NAP.

** Estimated depth of the "juncture point" of the level on the donk slope.

3.4. SOIL TRACES

None of the three pits showed clear soil traces. In pit I we found only numerous animal tracks, as in pit III. In pit II two depressions were revealed, filled with dark soil but not containing any finds, They were probably prehistoric pits. The general impression was that the sides of the donk at least, and perhaps also the top, were too much eroded and disturbed by animals to yield soil traces.

3.5. THE FINDS [18]

3.5.1. Pottery

3.5.1.1. *General remarks.*

The pottery belongs to a number of different cultures, some of them well known, but partly not described before. On account of technical pecularities (tempering, way of construction, finish), shape and decoration we may distinguish the groups discussed below. The distribution of these groups over the three excavation pits shows significant differences, as will be seen from the distribution maps at figs. 40-45.

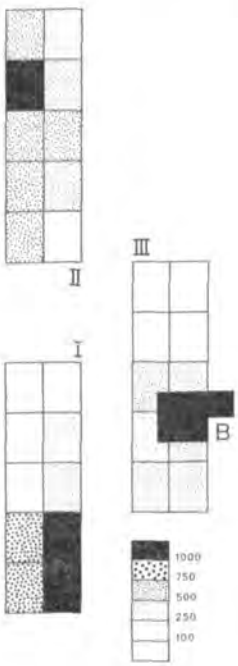

Fig. 40. Hazendonk.

Distribution of the pottery.

Weight of the sherds by square and in grammes.

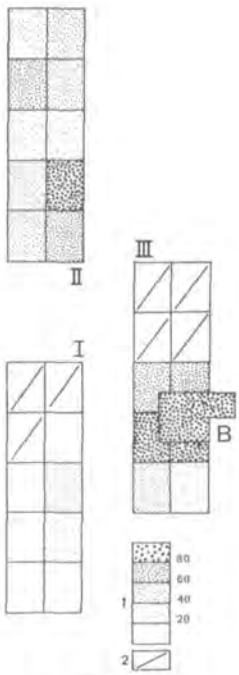

Fig. 41. Hazendonk.

Distribution of quartz-tempered pottery as percentage of the total weight.

1. Sufficient material for establishing a reliable percentage
2. Insufficient material

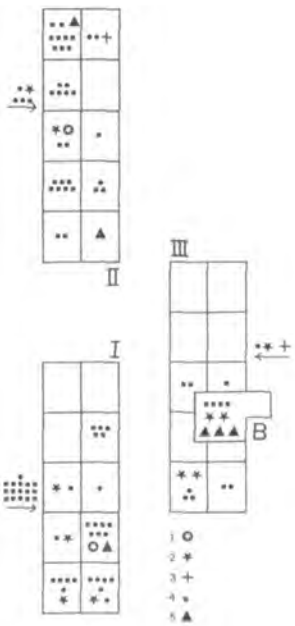

Fig. 42. Hazendonk.

Distribution of the flint and the worked stone.

Every symbol represents one piece.

1-4 flint 1 artifact
2 axe fragment
3 retouched flake
4 flake

5 worked stone.

[18] The finds are registered in the RMO, nos. h 1968/1.1-48.

TABLE 11

Hazendonk. Pottery. Weight in grammes

Tempering	Pit I	Pit II	Pit III	Total
Stone grit	1259	2604	4397	8260
Pounded pottery	4421	2627	1083	8131
Total	5680	5231	5480	16.391

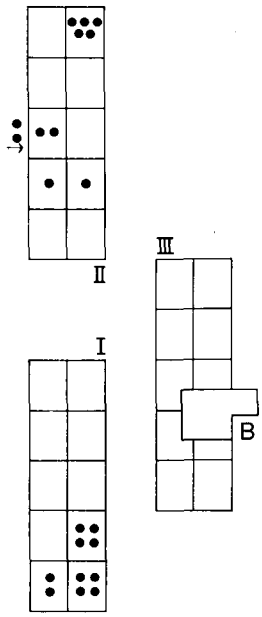

Fig. 43. Hazendonk.

Distribution of decorated Beaker pottery.
Every dot represents one sherd.

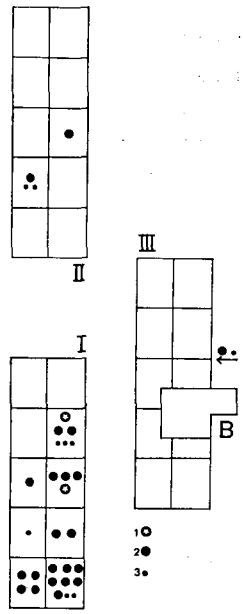

Fig. 44. Hazendonk.

Distribution of VL pottery.
Every symbol represents one rim sherd.
1. Early phase
2. Late phase
3. very small rim sherds

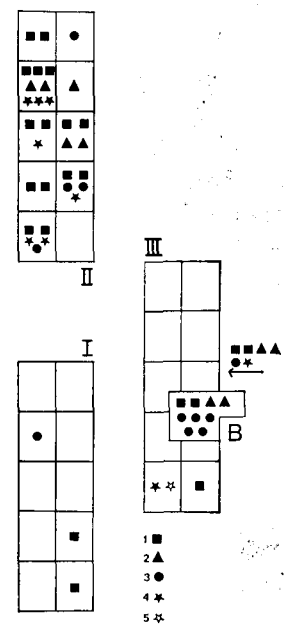

Fig. 45. Hazendonk.

Distribution of some types of decorated "Hazendonk-pottery".
Every symbol represents one sherd.
1. nail impressions
2. fine scratched lines
3. scratched impressions
4. grooved lines
5. grooved lines, V-motif

General remarks on the distribution maps figs. 40-45:

the pits (I-III) are shown much closer together than in fact they were. For the actual situation see fig. 33. Pit B is indicated with "B". Finds which were not collected in squares are shown beside every pit, together with an arrow. Scale 1:300.

The distribution of the total amount of pottery (fig. 40), of which the weight per square is shown, reveals that the upper part of the donk slope is very poor in finds. Where it had been covered with peat the sherds were well preserved in the darker coloured top of the donk sand. Apparently the conditions on the uncovered part of the slope were particularly bad. Those finds that were quickly covered by peat were situated during the inhabitation at the foot of the donk. Probably we are concerned with discarded refuse.

The total weight in each pit is approximately the same (table 11) but the distribution varies considerably. In pit I there is a strong accent on the lowest part, in pit II a fairly even distribution, and in pit III most of the finds come from pit B.

We describe the pottery beginning with the youngest.

3.5.1.2. *Beaker pottery*

A small, clearly distinguishable group consists of characteristically decorated sherds, tempered with pounded pottery and belonging to the various Beaker Cultures (fig. 46). In general it is thin-walled (5-6 mm.) and found in small sherds. A few thick sherds, also assigned to this group, are much bigger. We have not been able to identify the undecorated pottery of this group. The amount of this was probably not large, as the percentage of decorated pottery in these cultures generally seems to be rather high [19] and the Beaker pottery on the Hazendonk is only a small percentage of the total amount. The Beaker sherds are distributed similarly to the total amount of pottery, but are completely lacking in pit III (fig. 43). The finds in pit II are somewhat older that those in pit I, as appears from the following description.

The material from pit II includes a BWB sherd as the only datable find. A number of small sherds decorated with a plain spatula, reed and finger impressions (in V motifs) from three different pots (beakers) have much in common with the BWB phase material from Molenaarsgraaf [20]. We must assume that both groups are contemporaneous. A thick sherd with V impressions probably also belongs here.

The material from pit I uncludes a VBB sherd, two sherds from an earlier type of Bell Beaker [21] and two sherds from an All-Over-Cord Beaker (2^{IIb}) [22]. A rim sherd with two parallel cord impressions under the rim is difficult to date, but could be from a Protruding Foot Beaker. We cannot date the small sherd with a few parallel grooved lines. The two thick sherds decorated with broad grooves will be from the same pot. It is not yet possible to assign a date to the strange rim profile. In this pit all the sherds were found in the dark-coloured top of the donk and among the material which will be discussed below. Only the VBB sherd and the

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[19] *Cf.* p. 293 and D. L. Clarke 1966, 181.

[20] See p. 227.

[21] The decoration consists of undecorated and decorated zones, the latter filled with horizontal lines executed with a dentated spatula. This motif is not well dated; it might be rather early and related to the MBB, but it occurs also in BW technique. In view of the find circumstances and the depth (see fig. 38) we prefer a rather early dating.

[22] The late Dr R. S. Levison studied both these sherds during his study of the cord impressions on the Dutch beaker pottery. He demonstrated that both sherds display a sequence, consisting of a repetition of one "Z-twisted" and two "S-twisted" twines. On the rim sherd a slight irregularity occurs near the rim. According to Dr Levison (and we agree with him) we have not to do with *Häckelmaschen* (*cf.* Gersbach 1957) in these and similar impressions, but with a number of ordinary twined cords.

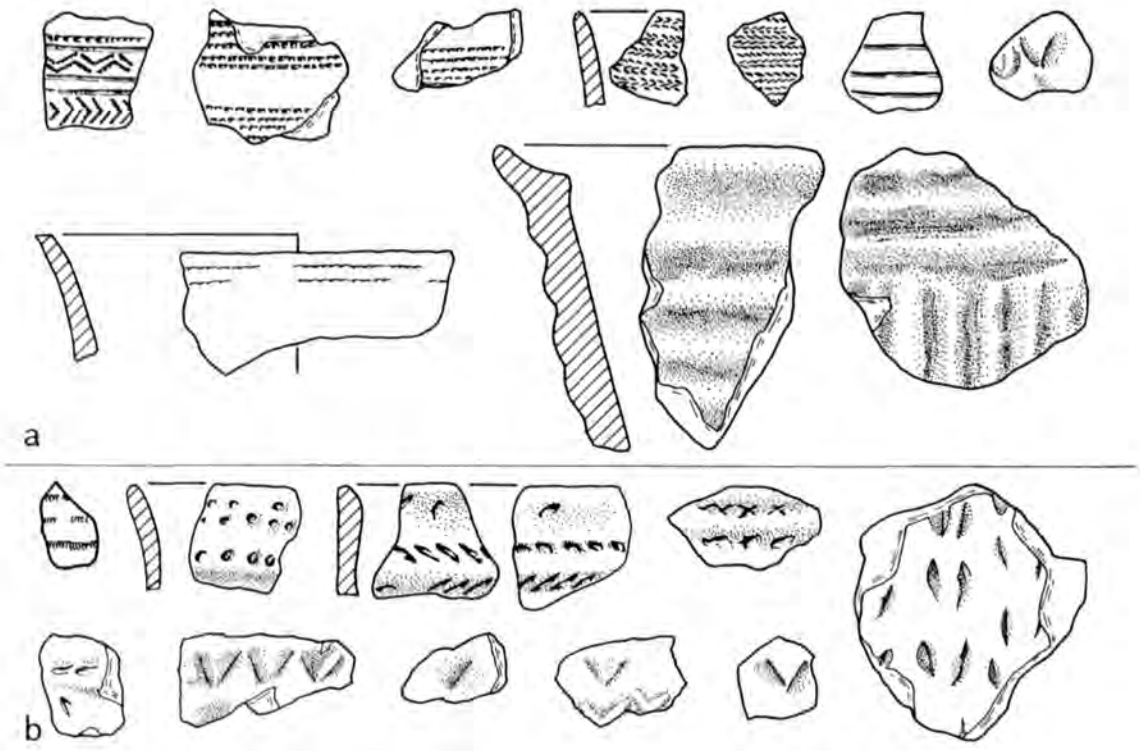

Fig. 46. Hazendonk. Beaker pottery. Scale 1:2.
a Pit I b Pit II

small sherd with the V-motif lay higher up, directly under the peat on the sand surface (see fig. 38). These observations are in accordance with our knowledge of the deposits on the donk slope, where there must be a VBB level above the clay wedge of the Schoonrewoerd ridge and older finds under it.

3.5.1.3. *Vlaardingen pottery.*

By far the largest part of the finds from pit I consists of sherds of undecorated vessels tempered with pounded pottery which we attribute to the (late) Vlaardingen Culture (fig. 47). The pottery is in general 8-9 mm. thick, its surface is somewhat uneven, seldom smoothly finished and never polished. In two instances the pottery seems to have been made from broad bands of clay, although this is clearly exceptional. The profiles show a rim bent slightly outwards and a not very pronounced belly. Sharp breaks in the profile of the shoulder do not appear. The pot bases show no or an only slightly projecting foot. The wall rises steeply upwards. The pottery conforms in the main to the late VL pottery from Voorschoten, with the base-types B and C and the rim-types a and b. The outward bent rims seem to be rather uncommon, however, in this pottery although they do sometimes occur [23].

[23] Glasbergen *et al.* 1967, fig. 10, 33. The pottery at fig. 33 is, however, tempered with quartz grit.

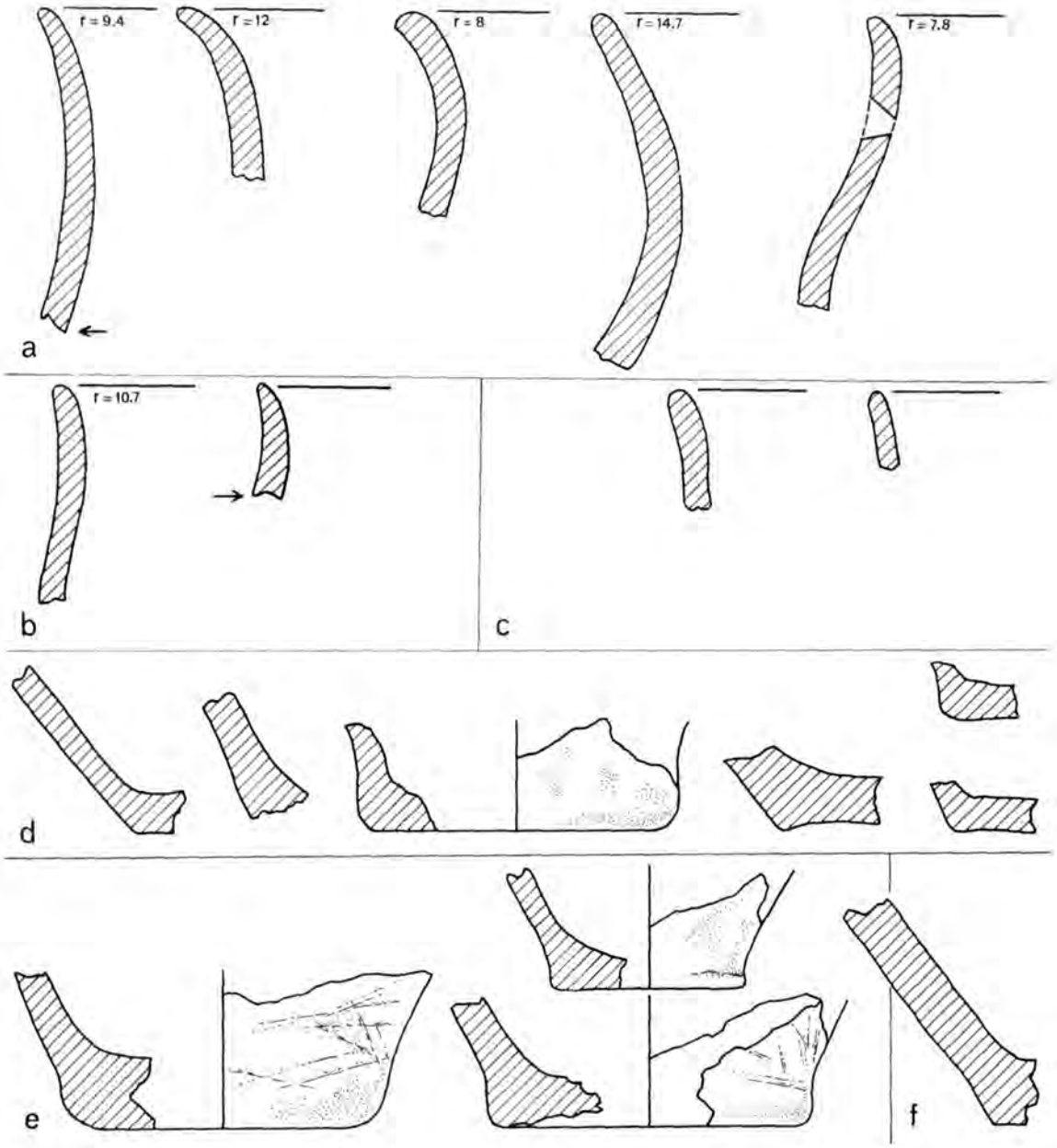

Fig. 47. Hazendonk. Late VL pottery. Scale 1:2.
a, d) Pit I b, e) Pit II c, f) Pit III

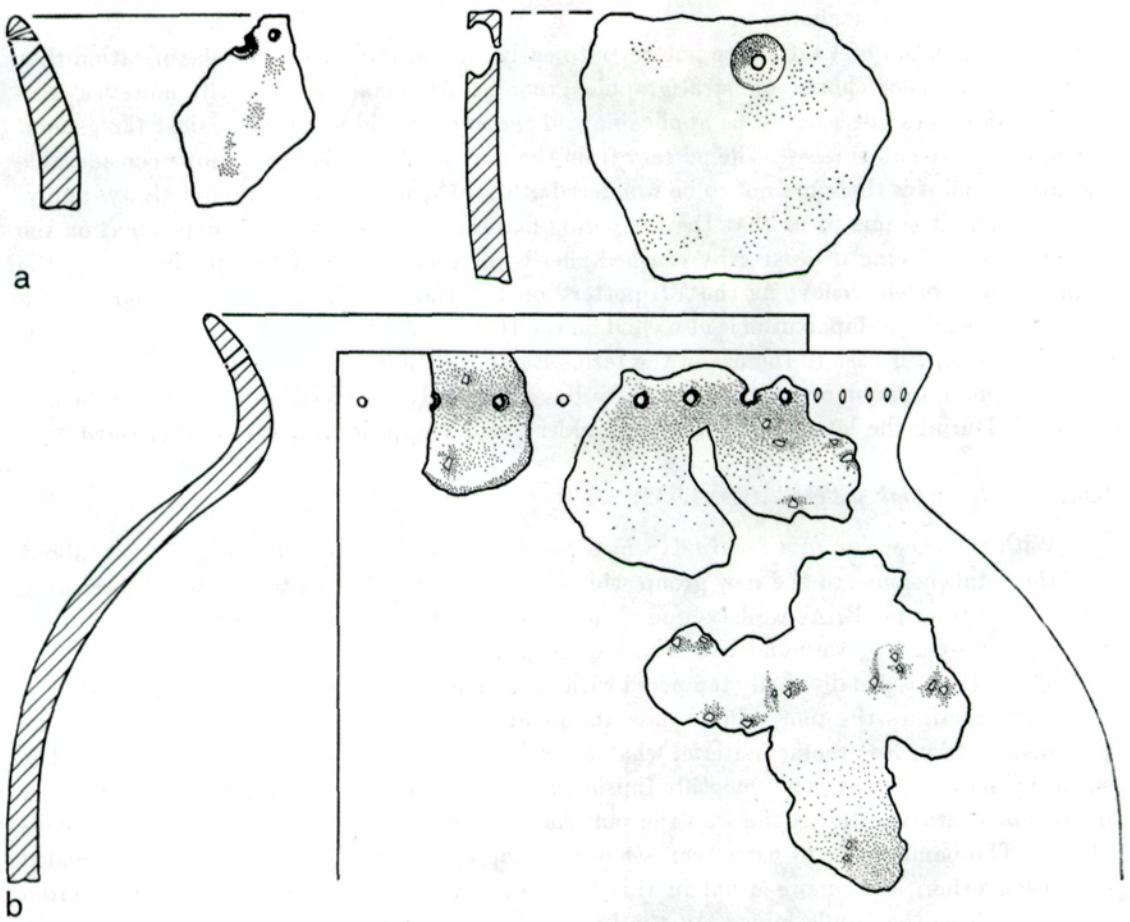

Fig. 48. Hazendonk. VL pottery. Scale 1:2.
a) Two sherds with repair holes, the left one an Early VL rim sherd.
b) Reconstructed fragment of an Early VL pot.

Of the 19 large rim profiles from pit I we have drawn a representative selection of 5 examples. In the other pits the late VL material hardly occurs at all (fig. 44), and when it does it is, with one exception, only by its tempering and finish that it may be included in this group, and this is insufficient to date it properly as (late) Vlaardingen.

Early VL pottery is scarce, but we consider that the sherds of two pots, both from pit I, belong to this group (fig. 48). It is undecorated pottery, richly tempered with broken quartz, generally 7-11 mm. thick and with a surface so smoothly finished that the tempering is hardly visible. One of the rim sherds shows a repair hole and a narrow hole bored under the rim, which must have been made before the firing. The profile of a large pot with a bulging belly and an everted rim, under which was a line of small holes, could be reconstructed from a

number of very badly preserved sherds, found together. This type is characteristic of the lowest layers at Voorschoten [24].

In our division of VL Culture pottery into early and late we follow the classification that was made at Voorschoten on stratigraphic grounds. At Vlaardingen itself, however, this classification does not seem to be applicable and the authors did warn me against the general use of these two categories [25]. The pottery from the various VL settlements shows considerable variations and it is therefore not to be wondered at that the usual criteria do not always apply. In particular it seems to us that the tempering material used was strongly dependent on the milieu. The replacing of quartz by crushed sherds for tempering can be explained from the point of view of efficiency. As the VL pottery on the Hazendonk finds its best parallels in Voorschoten, and the bipartition is also valid on the Hazendonk, it would seem that there can be no objection in our case to the use of the terms Early and Late Vlaardingen. It is noteworthy that the small amount of Early VL pottery has been badly damaged, in contrast to the late material. During the later inhabitation the older pottery appears to have been crushed.

3.5.1.4. "*Hazendonk pottery*" (figs. 49-52)

With the exception of a few finds which are hard to place, the remaining pottery, about half the total, belongs to the new group which we have already mentioned when discussing the pottery from pit B. As we have found no parallels for this pottery and the Hazendonk is the only find-place [26], we named it "Hazendonk pottery".

The pottery is usually richly tempered with broken quartz or (less frequently) with crushed granite. Sometimes the tempering is less abundant and at the same time mixed with some pounded pottery. No organic material whatsoever seems to have been used for tempering. The surface is moderately or very smoothly finished and sometimes even polished. One of the most important characteristics is the way the pots have been built up from broad bands or coils of clay. The bands seem to have been set one on top of the other and only slightly kneaded over each other, as is more usual in this technique. This explains why fractures so often occurred where the bands joined. In the figures the form of these fractured edges has been exactly drawn and indicated with an arrow.

A large part of the pottery is decorated. A general characteristic is that the whole surface is covered with areas of uniformly directed impressions carried out in various techniques. Only occasionally is there an example of a stricter design in vertical rows, or the placing of motifs at right angles to each other. The techniques consist of:

— sharp nail impressions, in which finger-tip impressions are only rarely visible,
— sharp, shallow short lines, scratched with a sharp pen or nail,
— "ordinary" fingertip impressions,
— scratched impressions, made by a clawing movement of the finger-tip, so that a

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[24] Glasbergen *et al.* 1967, figs. 7, 8, 33. The fragmentary pot from Almkerk (Louwe Kooijmans 1968) also shows a bulging belly, has a well-finished surface, and is tempered with broken quartz (fig. 6).

[25] We are indebted to Prof Dr W. Glasbergen and Mrs Dr W. Groenman-van Waateringe for their remarks.

[26] *Cf.* p. 19, note 46 and p. 166, note 77.

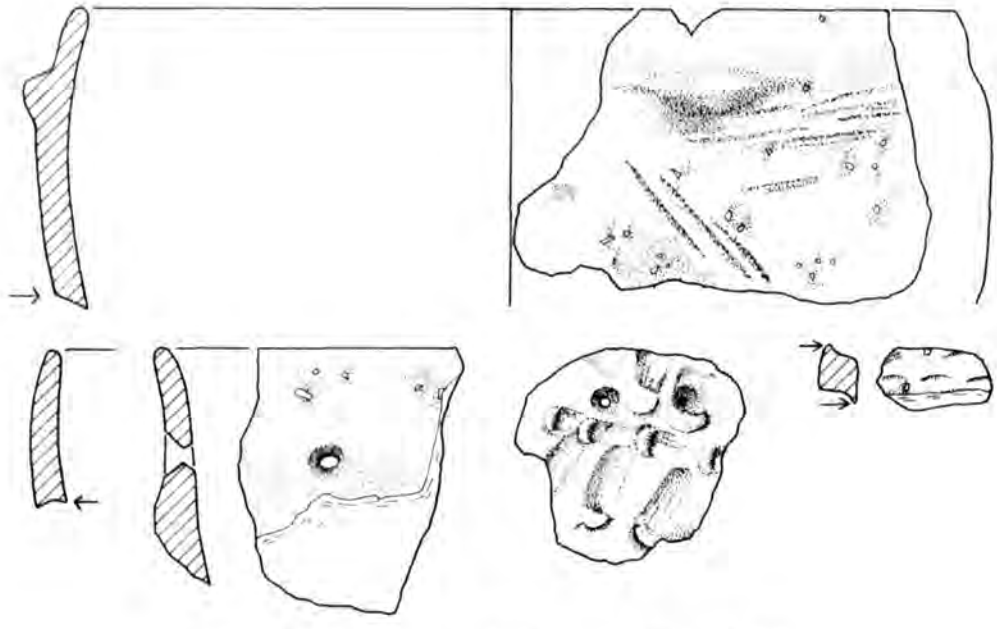

Fig. 49. Hazendonk. "Hazendonk pottery". Pit I. Scale 1:2.

shallow groove on the surface of the pot is drawn, with every time a little lump of clay at its end (fig. 49, lower row; fig. 51, middle) [27],
— comparable impressions, but carried out with a small stick or something of that kind,
— impressions of an irregular blunt object,
— irregular, fairly deeply cut, long parallel vertical lines,
— a deliberately strongly roughened surface (fig. 53),
— a kind of brush mark (fig. 49, above).

Although complete pots cannot be reconstructed, we have nevertheless some large fragments (all from pit B), which give a good idea of the shapes of the pottery. These appear to be predominantly barrel, ball and bowl shapes. The rims are usualy curved inwards. A number of profiles show a pinched-out, somewhat thinner rim below which the pinching has caused a shoulder. Round bases which have been flattened and ordinary flat bases occur alongside each other. The first type somewhat resembles the so-called *Wackelboden*, especially because the wall does not rise at all steeply [28]. At the only flat base the wall does rise, however, fairly steeply. On three sherds a horizontal knob ear occurs; two of these also showed a small shoulder. Perforations made before firing occur once on a sherd decorated with characteristic scratched

[27] On one pot all possible variations of this type of impressions and "ordinary" fingertip impressions can occur. To the author the "scratched" type of impressions is not known on any other type of prehistoric pottery in the Netherlands, although the technique seems to be known on some Iron Age ware (*cf.* Mezger 1961).

[28] For *Wackelboden* see: Schwabedissen 1957/'58, 7, fig. 11; Deichmüller 1965, 8.

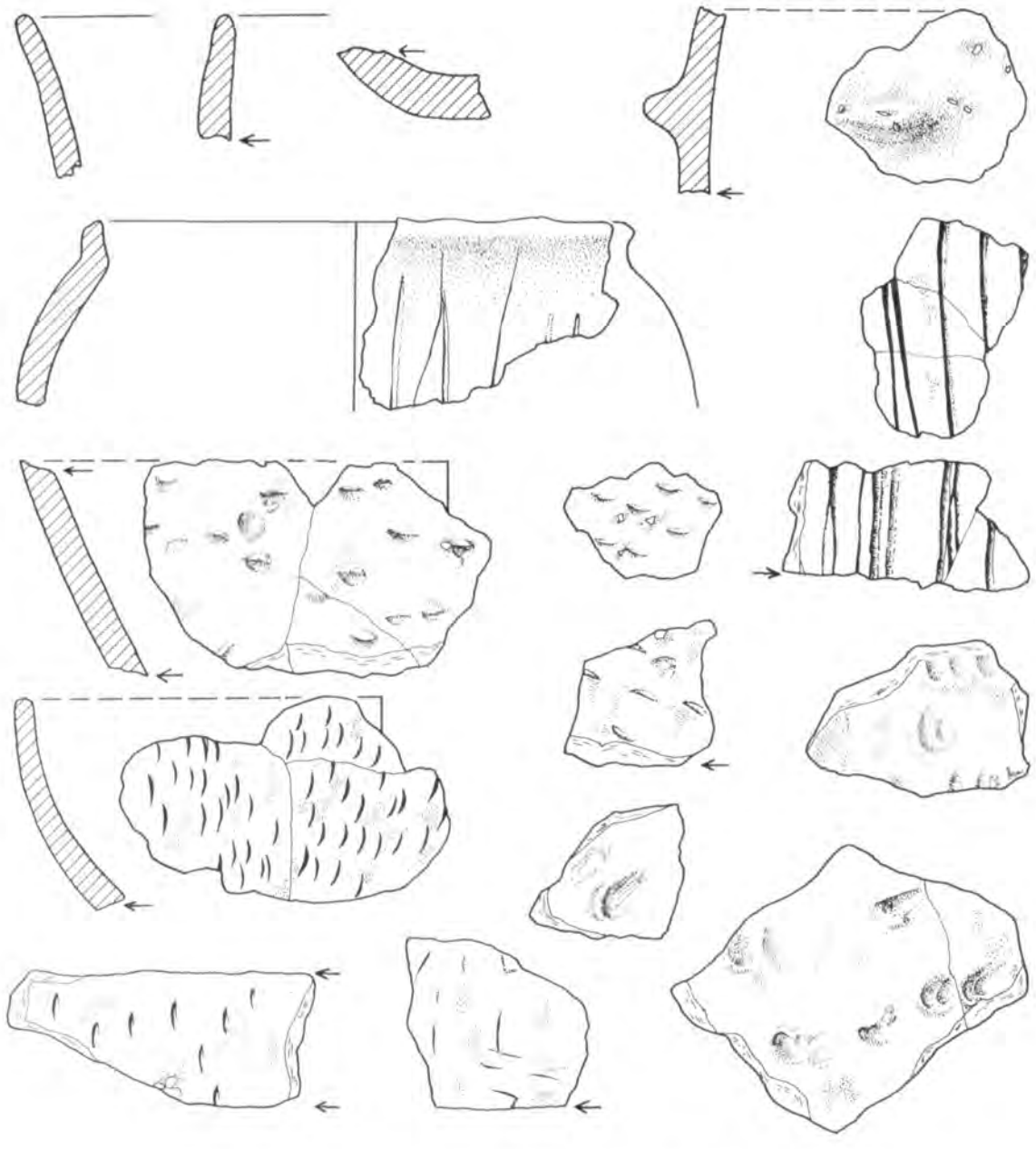

Fig. 50. Hazendonk. "Hazendonk pottery". Pit II. Scale 1:2.

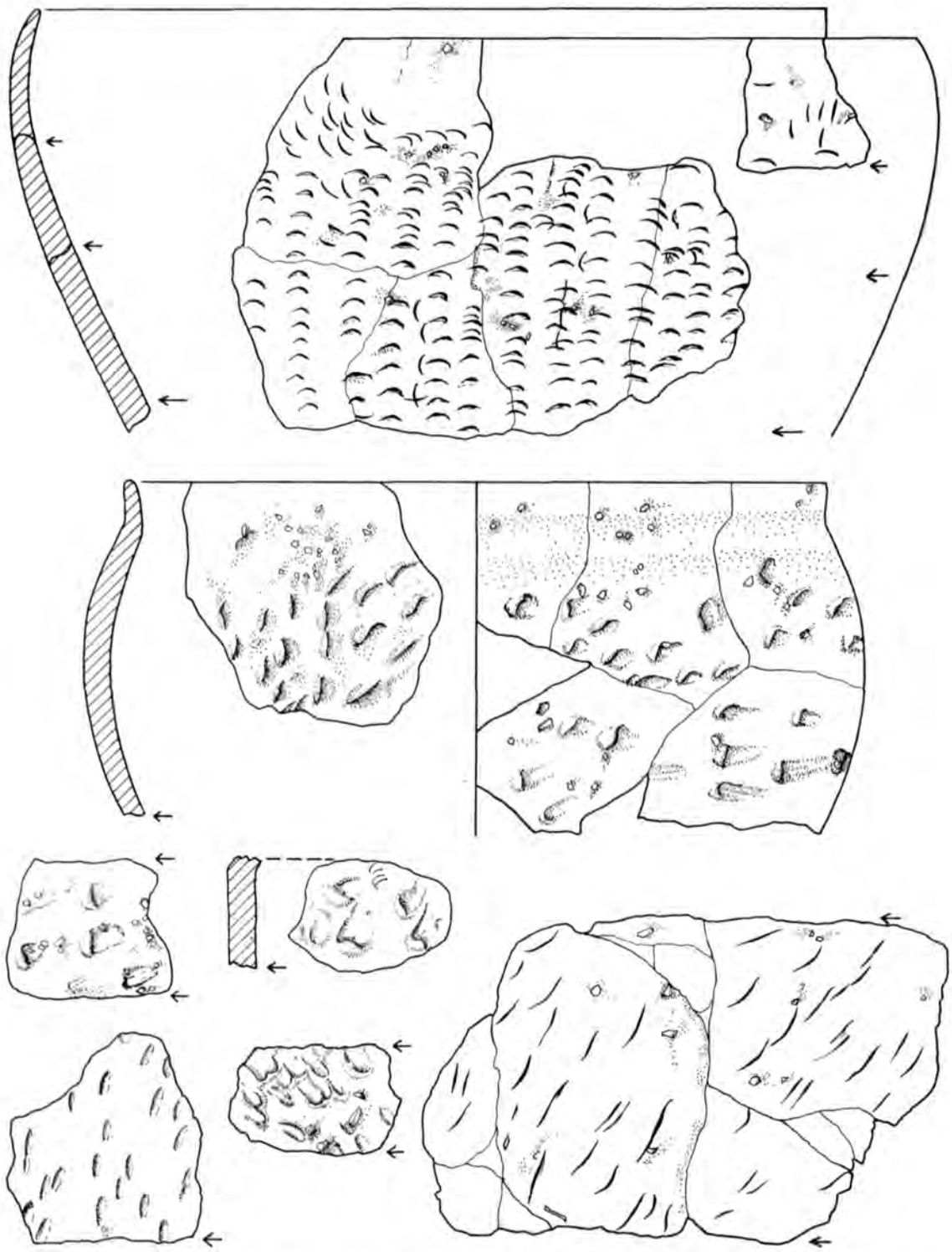

Fig. 51. Hazendonk. Decorated "Hazendonk pottery". All originating from Pit B, with the exception of two sherds of the bowl at the top (left below and upper right) which were found nearby in Pit III. Scale 1:2.

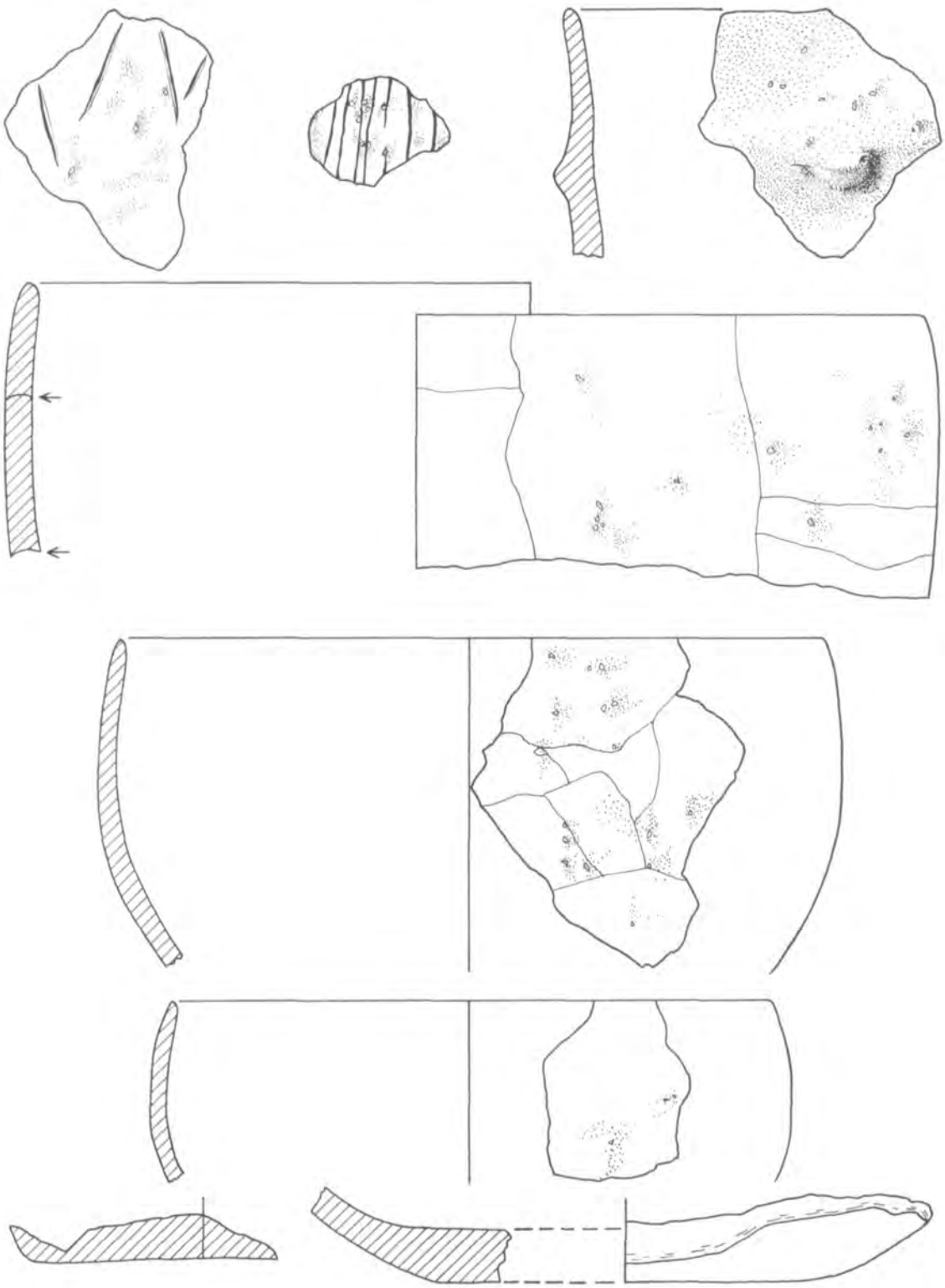

Fig. 52. Hazendonk. "Hazendonk pottery". Upper row from Pit III, all others from Pit B. Scale 1:2.

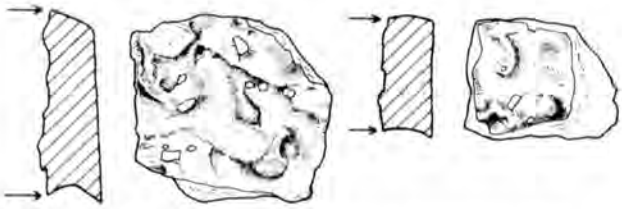

Fig. 53. Hazendonk. Two deliberately roughened sherds from Pit B. Scale 1:2.

finger impressions. Apparently this was one of a row (partly incomplete) of perforations under the rim of the pot.

In pit I this pottery forms only a small percentage of the total (fig. 45). In pit II about 50% of the finds belong to this group. In pit III this pottery preponderates. Most of the finds there, however, come from pit B. In the small number of finds outside it tempering by pounded pottery occurs most frequently. Once again it seems that we are concerned in this trial pit B with the contents of a prehistoric refuse pit. Not only in the distribution map of the decoration types (fig. 45) but also in the map showing the percentage of stone-tempered pottery (fig. 41, table 12) the distribution of this pottery is clearly expressed. A separate paragraph will be devoted later to the dating and the cultural relationships of this "Hazendonk pottery." A dating in the beginning of the Middle Neolithic [29], about 3000 B.C., will be proposed as the most likely.

TABLE 12

Hazendonk. Pottery. Ratio of tempering with stone grit and pounded pottery

Tempering	Pit I	Pit II	Pit III	Total
Stone grit	22.2	49.8	80.4	50.4
Pounded pottery	77.8	50.2	19.6	49.6
Total	100.0	100.0	100.0	100.0

3.5.1.5. *Other pottery.*

A few sherds tempered with pounded pottery are not considered to belong to the late VL Culture. First there are three rim sherds of thick-walled (9-12 mm.) pots with rims curved inwards (fig. 54 a). Two rim sherds are clearly polished; one rim is broken off at the joint of a clay band. A fourth rim sherd, fairly badly preserved, shows a grooved decoration (V or W motifs) under the rim.

[29] We prefer to date the Middle Neolithic in the Southern Netherlands from the time when polished flint axes came in use, since there are no other finds, that can offer a better definition. The Middle Neolithic ended with the introduction of the Protuding Foot Beakers.

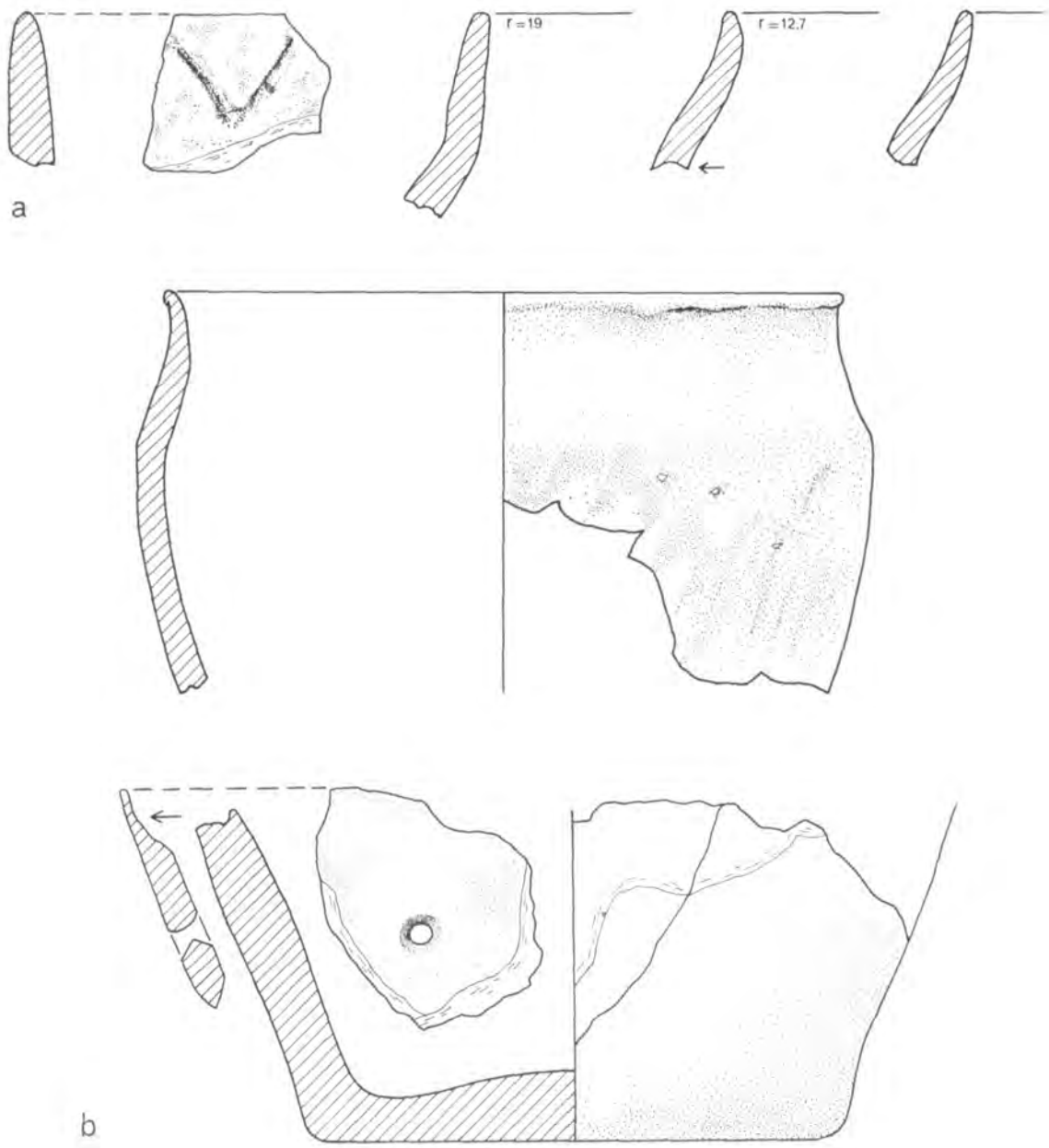

Fig. 54. Hazendonk, Other pottery. Scale 1:2.

a) *Sherds, tempered with pounded pottery, not VL Culture.*
From left to right : Pit III, B, B and III.
b) *Sandy pottery, Pit II.*

Second there is a small number of sherds made from a sandy clay moderately tempered with both pounded pottery and broken quartz, up to 15 mm. thick. They were found in two small concentrations in pit II. The sherds could be joined to a large extent to the illustrated rim and base fragments (fig. 53 b). The rim fragment has a high shoulder with a slightly inward sloping rim. The outer edge is bent round which resulted in a small ridge just below the rim. The surface below the shoulder is provided with long vertical finger marks. The base fragment shows a steeply rising wall. One of the sherds, which does not fit any of the others, shows a perforation, made after the firing. In this sherd the joint of a clay band is clearly to be seen. The two bands were not placed on each other, however, as in the Hazendonk pottery, but mostly kneaded over each other. In the other sherds no clay-band joints are visible.

It seems not possible to date both groups of sherds at the present state of research. In view of their distribtution (all were found in the pits B and III), the first group might belong to the Hazendonk pottery. But we must also consider the possibility that it has a separate chronological position. The same applies to the second mentioned group. On the ground of their tempering, workmanship, form and finish both pot fragments can be allocated to the VL Culture [30]. But the sherds differ in some respect from the VL material, derived from pit I. The planned continuation of the investigations might produce some new data about this material.

3.5.2. FLINT (fig. 55, table 13)

Flint was found in all the pits dug and showed the same distribution picture (fig. 42) as the pottery. In pit III the quantity was somewhat smaller, but this corresponds with the limited amount of pottery found outside pit B. Its occurrence in pit III and, in less pronounced measure, its occurrence in pit II shows that the Hazendonk pottery was in any case associated with flint. This idea is strengthened by the occurrence of six flakes in pit B, including two fragments of axes.

TABLE 13

Hazendonk. Flint. Numbers

	Pit I	Pit II	Pit III	Total
Artifacts	1	1	0	2
Retouched flakes	0	1	1	2
Axe fragments	4	2	5	11
Flakes	42	36	13	91
Total	47	40	19	106

[30] *Cf.* Van Regteren Altena *et al.* 1962/'63 esp. 1962, fig. 7; Glasbergen *et al.* 1967, Modderman 1953[a].

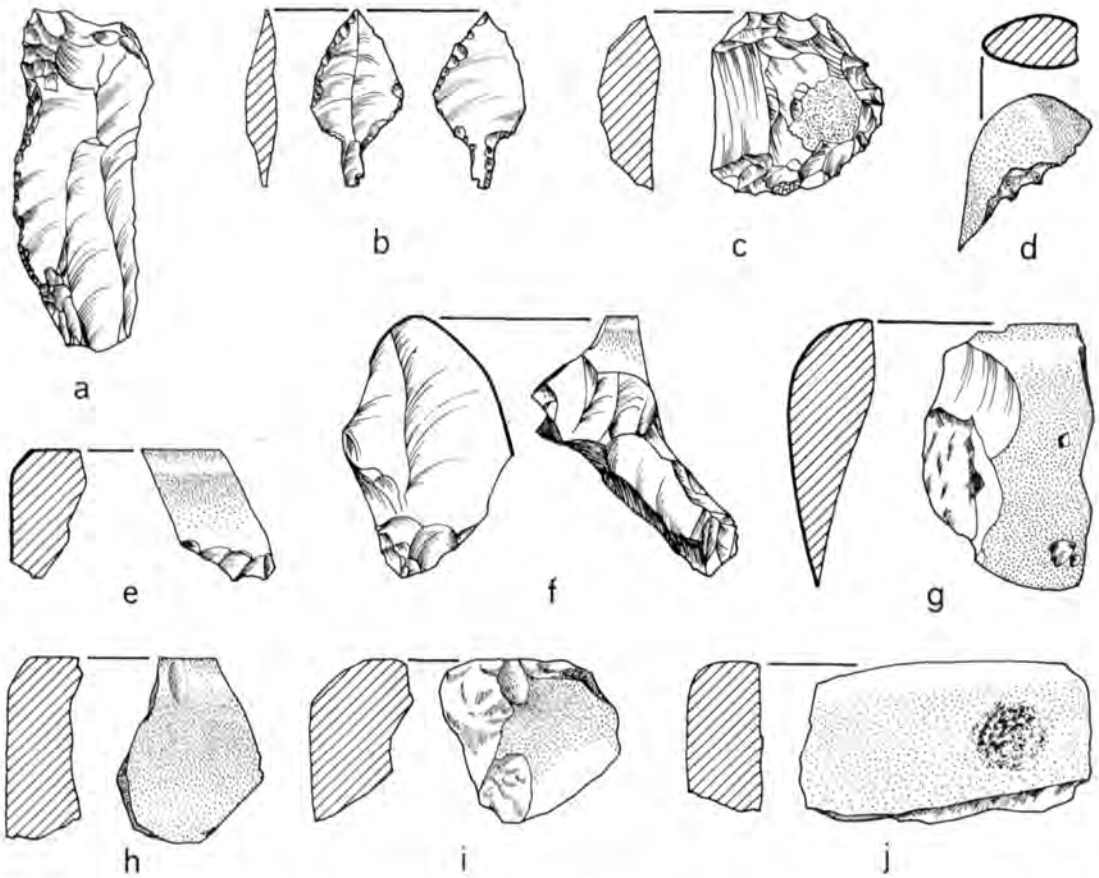

Fig. 55. Hazendonk. Flint and worked stone. In the sections polished axe surfaces are indicated with a heavy line.

a-g flint; h-j stone. Scale 1:1.

b, d, e	— Pit I	g	— Pit III
a, c	— Pit II	f, h-j	— Pit B

Four or five artifacts were found:

— a small, fairly crudely shaped tanged arrow-head, without barbs (fig. 55 b). It was found in the south of pit I amidst the numerous Late VL sherds found there. But the find-place permits no certain allocation to this occupation phase, since remains of the other groups ("Hazendonk", Early VL, Beakers) were also found there. The arrow-head is difficult to date for typological reasons and has more or less close parallels in widely different archaeological contexts. We know a good parallel in a somewhat bigger specimen from the Linear Band-ceramic settlement at Sittard [31]. The type is there, however, exceptional. More carefully worked arrow-heads of the same kind are generally associated with the SOM Culture of Northern

[31] Bohmers & Bruijn 1958/'59, 186, *Abb.* 113 no. 348.

France [32]. A few arrow-heads of this type were found in our country in graves of the PFB Culture [33]. An arrow-head from the VL settlement at Voorschoten is much less comparable [34]. In close association with BB pottery similar arrow-heads were found at Oldesloe Wolkenwehe [35]. A "freakish tanged arrow-head" at Plantation Farm was attributed to the BB/EBA occupation there [36].

— a round scraper, found in pit II (fig. 55 c).

— two big flakes with retouche along both sides (one: fig. 55 a).

— the above-mentioned (p. 128) axe fragment with traces of working (fig. 55 f).

The small number of axe fragments come from axes of various types. We can distinguish a pointed-oval, a round-oval and a facetted rectangular section (fig. 55 e-g). Important is the top of a pointed-butted axe, on which a few polished facets are visible (fig. 55 d). In view of the absence of axe-flakes in the Bell Beaker associations known to us in the Western Netherlands, particularly that of "Molenaarsgraaf", all the fragments must belong to the other groups, the VL Culture and the Hazendonk pottery. Axe fragments are indeed precisely one of the characteristics of the settlement finds of the VL Culture. As they generally occur also in the Neolithic flint complexes of the Southern Netherlands, among others among the finds at Echt and Koningsbosch [37], the occurrence of two fragments in pit B should not surprise us. The finds show that Hazendonk pottery is also most probably associated with them. One of the two pieces, the largest piece of flint found, shows the pointed oval section of an axe of the Southern Netherlands type.

The flakes are all shorter than 5 cm. and irregular in shape. No blades were found. Only a few of them show signs of slight retouche or damage by use.

3.5.3. Worked Stone [38]

A total of six pieces of stone with traces of working were found. They were:

— the fragment of a flat grindstone, with a carefully applied small groove perpendicular to one of the edges, made from dense light-grey quartzite (fig. 55 h).

— a similar fragment with a broader groove, also made from dense light-grey quartzite, which shows a strong resemblance to the previous piece (fig. 55 i).

— a piece of stone with a naturally flat upper side, showing serious damage in one place caused by intensive treatment with a hard, sharp object. The interpretation as the anvil of a

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[32] Bailloud 1964, fig. 39.

[33] Mr J. N. Lanting, Groningen, informed me that flint arrow-heads of this type are a minor characteristic of the PFB graves in the Netherlands. One specimen was found in a flat grave at Angelsloo, another in the primary grave of barrow III at Langedijk (Van Giffen 1930[a], *Abb.* 94, no. 16; A. E. Lanting 1969, 175).

[34] Glasbergen *et al.* 1967, fig. 19.

[35] Schwabedissen 1958, fig. 5.

[36] Clark 1933, fig. 2, no. 36.

[37] See p. 165.

[38] We thank Mr C. J. Overweel, keeper of the National Museum of Geology, Department of Petrology, Leiden, for his determinations and descriptions of the stones.

flint worker appears to us to be the most likely. Originating from pit B, it would then be one more proof of the correlation between Hazendonk pottery and flint. It consists of a grey, fine quartzite (fig. 55 j).

— the fragment of a quernstone, in view of the slightly convex surface apparently a rubber made from a coarse grained reddish sandstone.

— two small fragments of grindstone, one of them from a badly weathered gneiss.

As there is no local stone available on the site and its wide surroundings, these pieces must have been brought from elsewhere. The same remarks are valid for the Hazendonk as were made during the discussion of the stone material from Molenaarsgraaf [39].

Both the quartzite pieces with grooves and the small anvil came from pit B, and were therefore very probably made by the users of the Hazendonk pottery. The other stones cannot be attributed to any of the occupation phases.

3.6. THE "HAZENDONK POTTERY"; DATING AND CULTURAL RELATIONS

3.6.1. Dating

For the dating of the new pottery group, the Hazendonk pottery, we possess the following summarized information.

— The finds from pit B come mostly (90% or more) from a prehistoric refuse pit. From this pit B there is no pottery originating from any recognizable culture. There are, however, a few pieces of flint, among which at least one is a fragment of an axe of oval section, and further three pieces of worked stone, which are quite different from anything else found in the excavation.

— The distribution picture of the excavated pottery differs so considerably from that of all other groups of pottery encountered (VL-I to BWB) that any contemporaneity with one of these groups is out of the question.

— From the distribution pictures it appears that the pottery is very probably associated with flint.

— In section H-J a small sherd, by reason of its workmanship to be included in the Hazendonk pottery, was found in a boring at about 30 cm. under a dated old surface in the peat (2340 $\pm$ 40 and 2530 $\pm$ 40 B.C.). The depth (—3.60 m. NAP) agrees with a dating at least earlier than 2500 B.C. A really exact dating is difficult to give for two reasons. First, its situation is so near the donk that the levels slope sharply, which gives rise to a considerable uncertainty. Second, it is always possible that the sherd moved secondarily from the donk slope to a higher (later) peat level. A dating of the sherd of between 3000 and 2500 B.C. appears, however, to be very likely.

— In the pollen diagram near the boring mentioned above human influence on the vegetation was recognized at a number of levels. All but one of the zones could be linked up with

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[39] See p. 229.

well-known cultures, partly represented in the material found on the *donk*. Only the pronounced zone 3, ^{14}C dated about 3000 B.C. and indicating human presence in the immediate vicinity (at the site itself) remained not attributed. A correlation of the new pottery group with this zone seems to be very plausible, the more since the detailed interpretation of this pollen zone was in good accordance with the distribution of the pottery.

If each datum in itself has only limited validity as proof, the total number of these data makes it very likely that with Hazendonk pottery we are concerned with a Middle Neolithic group. The pottery is associated with flint axes of a southern type and must date about 3000 B.C., well before the VL Culture.

3.6.2. Cultural Relations

3.6.2.1. *Introduction*

Until the present time two groups of Neolithic finds have been defined in the Netherlands coastal region.

First, the Late Neolithic Vlaardingen Culture, which we have referred to repeatedly above. Thanks to a number of detailed investigations of settlement terrains it is now one of the best known cultures of this country. The earliest phase took place a good five centuries after our dating of the Hazendonk pottery.

Second, the Early Neolithic finds of Swifterbant (the "Swifterbant Culture"). Although material in any considerable amount is only known from the IJsselmeer polders, from a few finds its presence also in the western river area can be accepted. The youngest dating of this group of finds is at least four centuries older than that of the Hazendonk pottery. With the presentation of a third group of Neolithic finds, this time Middle Neolithic and dated in the middle of the "empty" millennium dividing both cultures, the relationships to both groups are at issue.

3.6.2.2. *Relation to the Vlaardingen Culture*

Material of the Vlaardingen Culture [40] was likewise found on the Hazendonk and the fact that the Hazendonk pottery was easily distinguishable from it already indicates that there exist a number of clear differences between both.

In workmanship there are some similarities to the early VL pottery, especially in the rich tempering with broken quartz. The construction from bands of clay also occurs in the VL Culture, if only in very minor quantities. Band construction may be seen to very good advantage in, for example, the VL-I pot fragment of Almkerk [41]. The lowest part of this pot, between the base and belly, is built up from three bands of about 7 cm. broad. In the VL-I sherds from the Hazendonk itself a possible band construction cannot be ascertained because of the frag-

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[40] As to the VL Culture, see p. 20 f.

[41] Louwe Kooijmans 1968[b], this paper fig. 6. The recently found VL sherds at the *donk* in the Bommelerwaard (*cf.* p. 21) also clearly show a band construction.

mentary character of the material. In a few VL-II rims joints between bands of clay are, however, clearly recognizable in the fracture. In the material from Hekelingen [42] the band construction may also be seen in a few examples. In the pottery from Vlaardingen itself it does not in any case generally occur, and probably is lacking entirely [43]. In the surface treatment the correspondence is small. It varies in the Hazendonk pottery from smooth to badly finished, is very carefully done especially in the VL-I pottery, so that the tempering with stone is hardly visible, and in VL-II pottery is of lower quality.

There is a great contrast in the assortment of shapes. Rims curved inwards, round shaped and barrel-shaped pots do not occur in the VL Culture, nor do flattened round bottoms [44]. Only the shoulder is seen in both groups, if in different forms. On the Hazendonk, moreover, clay-discs and collared flasks are not found, neither in the Hazendonk nor the VL pottery, so that it is not necessary to attach much significance to whether or not they occur. The fairly extensive material of Hekelingen contains, for example, also only two clay-disc fragments and no collared flask fragments at all [45].

Two remarkable characteristics especially of Early VL pottery are (usually pointed) knob ears and (often unfinished) perforations under the rim. Perforations of the same type occur once in the Hazendonk pottery. Knob ears are common, although they are horizontal in form.

The most striking difference between the two groups of pottery is the decoration. In the VL Culture there is hardly any, or it is limited to a few scratched-in lines. The rich decoration of the Hazendonk pottery has been described above. Although it is simple in excecution and motifs it possesses a number of highly individual characteristics, which were apparently not carried on into the VL Culture.

Common to the VL Culture and the Hazendonk pottery is the use of southern flint axes and the occurence of flakes from these. Possibly the occurrence of the top of a pointed axe on the Hazendonk is a notable chronological difference.

To summarize, we suggest that the differences noted are so great that any cultural continuity between the users of the Hazendonk pottery and the VL Culture, which spans the four intermediate centuries, can be ruled out. Every comparison reveals contrasts — in the form, decoration and workmanship of the pottery. At most a few elements of the VL pottery can be traced back to the Hazendonk tradition, such as the way the clay bands are joined together, the rare decoration with lines and the shoulder kink.

3.6.2.3. *Relation to "Swifterbant"*

With the discovery of the settlement terrains at Swifterbant in the north of the East Flevoland polder it has become possible to define Early Neolithic inhabitation of the Northern

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[42] Modderman 1953[a].

[43] We thank Prof Dr W. Glasbergen and the staff-members of the IPP, Amsterdam, for the permission to see and study the material of the Vlaardingen site various times.

[44] There is only one round base (and this is reconstructed) known of the VL Culture (Van Regteren Altena *et al.* 1962/'63, 1962, fig. 7).

[45] Altough the excavator identified both sherds as clay disc fragments in the *m.s.* find-list he did not mention them in the publication (Modderman 1953[a]).

Netherlands in the 4th milennium [46]. Here were seven terrains lying on the tops of Early Holocene dunes and on the natural levees of former river courses dating from Calais II and belonging to the IJssel system [47]. Two terrains, the one on a natural levee (G 42), the other one on a dune top (H 46), were partly excavated. At present the BAI, Groningen, executes renewed excavations on a larger scale at both sites.

Although both sites show some differences, the many similarities justify a common description. At both sites a coarse pottery goes together with a microlithic flint industry of rather poor quality, related to the well-known foregoing Mesolithic tradition(s) in this country. The pottery was tempered either with stone grit (parcel H 46), with organic material (parcel G 42) or (less common) pounded pottery, and clearly built up from narrow bands, about 3 cm. wide, placed against each other with perpendicular joints and badly kneaded together. The bases were pointed and perhaps sometimes round. The pots generally had a bulging belly, sometimes a neck kink and an everted rim. The sparse decoration consists of various types of fingertip and nail impressions, small and deep pits and short parallel grooves. The arrangement in horizontal or vertical rows prevail. In some instances the inner side of the rim is decorated. In the settlement terrains small hearth places were found. At both sites a number of graves, with the dead extended on their backs, were discovered. The age of the levee deposits and the height of the dune top provide a date in the middle of the fourth millennium. Three ^{14}C-dates gave the same result [48]:

parcel H46	GrN 5067	3660 $\pm$ 60	(peat)
parcel G42	GrN 5443	3350 $\pm$ 40	(charcoal)
parcel G42	GrN 5606	3590 $\pm$ 65	(bone)

The settlement at Swifterbant provides an entirely new insight into the beginning of the Neolithic in the north and centre of this country. We are here concerned with a western variation of the Ertebølle/Ellerbek group, related to the find groups at Hamburg Boberg no. 14 [49] and, if less strictly, also those at the Dümmersee [50].

From this period Van der Waals mapped two types of characteristic implements in this country [51]: the *Tüllengeweihäxte* (T-shaped antler axes) and the perforated *Breitkeile*. Moreover, some new settlement terrains have been found: Heemse on the Overijssel Vecht [52] and De Gaste near Meppel [53]. Although some Rössen sherds from this country are now known from Middle Limburg [54] it seems clear nevertheless that in the fourth millennium B.C. the indigenous

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[46] Van der Waals 1972; Van der Heide 1964, 1965, 1965/'66. We thank Mr Van der Heide for the opportunity to study the material; Prof Dr J. D. van der Waals for his discussion and for permission to read the manuscript of his new paper and make use of it; Dr Ente, National Service for the IJsselmeer Polders, for his information on the ^{14}C dates.

[47] Ente 1971.

[48] Vogel & Waterbolk 1972, 81-82.

[49] Schindler 1953/'55, 1960, 1961.

[50] Deichmüller 1963, 1965.

[51] Van der Waals 1972.

[52] As note 51.

[53] As note 51, and pers. comm. Mr O. H. Harsema, Groningen.

[54] Pers. comm. Mr J. H. F. Bloemers, Amersfoort; also: Bloemers 1972. The sherds from Rosmeer, Belgium (De Laet 1966) certainly do not belong to the Rössen Culture.

population here was small, having a preference for a wet environment, living outside the Rössen Culture area and linked to it by trade contracts in the form of the imported *Breitkeile.*

It is of especial importance to us that between the river clay area (the Betuwe) and the coast a number of finds were made from which we can conclude that this "Swifterbant" group was present in this area, bearing in mind that the discovery of these finds was seriously limited by the great depth at which the cultural remains of this period generally lie.

The most important proof that we possess is the base sherd of Schiedam [55] (fig. 4 a): a round base fragment, tempered with organic material, which is very similar to the Swifterbant material and which at the same time contrasts clearly with the Vlaardingen Culture material, both in workmanship and shape. Further study of the find circumstances shows, moreover, that the interpretation given by Van Regteren Altena *et al.* is most likely incorrect and that the sherd must originate from a level of greater age than the Vlaardingen Culture. The detailed bore samples taken before the dock's construction [56], during the building of which the sherd was found, show that a peat layer with a top at —6.5 m. NAP was eroded with the exception only of the assumed find-place during the deposition of a covering clay layer. This clay doubtless must be attributed to the Calais IV phase. In view of the colour of the sherd and the indication that it was found "at a depth of about 8 m.", it is more acceptable that the sherd comes from this peat and not from a gully in the Calais IV deposits, the presence of which cannot be supported by the bored sections either. With the help of the curves for the rise of sea-level and a correction for compaction, the top of the peat cannot be dated later than 3000 B.C., which marks a *terminus ante quem* for the sherd.

A second find from this period is the perforated *Breitkeil* from the Spijk polder near Gorinchem [57]. Further, the Vianen skull [58] and possibly also a *calotte*, recently discovered at Kapel Avezaath near Tiel [59], belong to this period. The occurrence of inhabitation in this period on the Hazendonk itself appears from the pollen diagram, but has not yet been confirmed by any finds. At the donk near Waardhuizen, municipality of Almkerk, one sherd decorated with small pits is very similar to some of the sherds at Swifterbant, while another sherd seems to be a rim sherd of Hazendonk pottery. Since the mass of the sherds there belongs to the VL Culture and all are surface finds, we have here a first indication only, not a proof, of Early and Middle Neolithic occupation. In view of what has been said above about choice of milieu and the situation at Swifterbant, moreover, we can hardly be surprised that such inhabitation does occur in the Rhine/Meuse estuarine area.

A comparison of the Hazendonk pottery with that of the few centuries older Swifterbant shows a number of noteworthy similarities. In the workmanship it is not so much the use of broken quartz for tempering (as at H 46) that strikes one, as the building-up from bands of clay placed on top of each other and only crudely kneaded together. These bands are somewhat

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[55] Modderman 1955[c]; *cf.* Van Regteren Altena *et al.* 1962/'63, 1962, 19-20. The lost sherd was rediscovered some years ago and is now in the RMO with no. h 1969/1.1.

[56] We thank Mr A. Bergkotte, building department of the Wilton-Feyenoord Ship Yard, for his friendly help.

[57] Appendix I, I-21.

[58] Appendix I, I-10.

[59] Not indicated on the map at fig. 2, awaiting definitive determination.

wider on the Hazendonk than at Swifterbant, where they are even wider than the usual narrow rolls (or coils) of the Ertebølle/Ellerbek pottery, The careless surface treatment is another aspect common to both, but the similarity of decoration technique and motifs is much more remarkable. The general use of regular fingertip and nail impressions is a dominating feature of both groups. There are of course differences in detail: the Λ motifs, for example, are found only at Swifterbant, and the "scratched impressions" only at the Hazendonk.

Entirely contrasting with the similarities in the above-mentioned points are the shapes of the pottery: base and rim shapes on the Hazendonk are essentially different from those of Swifterbant. As we deduce nevertheless from the other points of similarity a cultural relationship, it is natural that the origin of the form typology of the Hazendonk pottery should be questioned.

3.6.2.4. *Relation to other Neolithic groups*

Theoretically there are three possible ways to explain the forms of the Hazendonk pottery: a typological development during the four centuries difference in time, the influence of southern cultures, or a combination of both. Any choice of one of these possibilities is extremely speculative, as we have practically no knowledge of the Neolithic pottery in the Southern Netherlands after the time of the Bandceramic Culture, and what we do know is limited to the Middle Limburg Meuse valley.

First we know there the "Limburg Culture" [60], contemporaneous with, but peripheral to the region of the Linear Bandceramic Culture. The Limburg Culture might reflect the first stage of "neolithisation" of indigeneous Mesolithic groups in the fifth milennium. A next stage is formed by the already mentioned Rössen remains [61], joining the distribution area in the nearby German districts. From the third milennium a few modest find groups are known in Middle Limburg at Echt [62], Neer [63] and Koningsbosch [64]. The collared flask is a common characteristic of these assemblages, the cultural relationships of which still seem to be unclear.

When we consider a wider region, there are in the first instance three groups that might have contributed to the southern Dutch Middle Neolithic. First, the Belgian Michelsberg group [65], finds of which were discovered as north as the Dutch border at Lommel and Antwerp, but not (yet) in the Netherlands itself. The possibility of an occurrence of the Michelsberg Culture in the Netherlands, as far as (the yet completely blank !) North Brabant is concerned, must be seriously considered. Second, the *hessische Galeriegräber* [66], that contained pottery which seems to have its relationships predominantly to the west, with the French Chasséen. They have the frequent collared flasks in common with the Middle Neolithic finds in the Dutch

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[60] Modderman 1970, 141f. and 1968[a].

[61] See note 54.

[62] Investigation of Mr H. M. E. van Haaren, Echt. We thank him for the opportunity he gave to us to study his finds.

[63] Bloemers 1970, 1971[b, c], 1973, 20, *afb.* 6. Some of the Neer finds were also shown to us by Mr van Haaren.

[64] Pers. comm. Prof Dr P. J. R. Modderman.

[65] Lüning 1967, De Laet 1966, Mariën 1952, fig. 59; De Laet 1958, fig. 22, 1968.

[66] Schwabedissen 1966, esp. 433 f. and *Abb.* 13, 14.

Limburg groups. Third, the finds in the Stein burial vault [67], that reflect the influences of the Seine-Oise-Marne Culture (SOM) from northern France. The burial vault has a ^{14}C date of about 2830 B.C. [68]. On the other hand an indisputable relationship is to be seen with the somewhat younger VL Culture. A small group of finds from Toterfout-Halve Mijl near Eindhoven [69] and a pot from Wijchen [70] belong perhaps to this phase.

We can conclude from this short survey of the modest Neolithic finds in the Southern Netherlands that it is not possible to indicate any group from which the "Hazendonk pottery" could have derived its forms. We are, however, seriously hindered in this respect by the lack of material. For some single elements we can, however, be more positive. It is true that the construction of the pottery from bands or rolls is a general characteristic of the Middle Neolithic pottery, to judge by the TRB [71], the Michelsberg [72] and the Middle Limburg find groups [73]. Yet these always consist of narrow bands which are well kneaded over each other and firmly joined together, and the pottery is always of good quality, with a polished surface. The few coarse, deliberately roughened sherds have their counterparts in the Michelsberg Culture, the flat base sherd in the pot from Stein.

Although we cannot exactly name the origin of the bowl- and barrel-shaped forms, it is true that these forms are a common feature in the contemporaneous Neolithic groups of the "western tradition", in which we also find the horizontal knob-ears. This applies to the Chasséen of North and West France [74] and also to the earliest phase of the English Windmill Hill Culture [75]. As the crow flies the distribution area of the last named culture is moreover not farther away from the Hazendonk, than Middle Limburg, while particularly at Peacock's Farm [76] this culture occurs in an identical situation and in a comparable environment. However, as long as more concrete proof is not forthcoming of such relations to North-west France or across the North Sea in the period around 3000 B.C. we cannot be more concrete in this respect and must view such possibilities only as working hypotheses [77].

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[67] Modderman 1964[b].

[68] Vogel & Waterbolk 1967, 129; *cf.* p. 23.

[69] Van Regteren Altena *et al.* 1962/'63, esp. 1962, 32-34.

[70] The narrow pot has a rim which is slightly bent outwards and four horizontal knob ears. Other pots from nearby sites are undeniably Drakenstein Urns and the pot mentioned here might be another one, but of a somewhat deviating type. As we will argue below (p. 167 f.) it is very difficult to distinguish certain kinds of Neolithic and Middle Bronze Age pottery, when no associations are known. For the Wijchen pot see: Glasbergen 1954, esp. fig. 58; Den Biesen 1963, Pl. VII and VIII; Van Regteren Altena *et al.* 1962/'63, esp. 1962, 34-35.

[71] Van der Waals 1965[a].

[72] Lüning 1967, esp. 12 f.

[73] Observations of the author, *cf.* notes 62, 63.

[74] *Cf.* note 66.

[75] Piggott 1954, I.F. Smith 1965, 44-48.

[76] See p. 73.

[77] These cautious statements seem to be confirmed by a recently discovered second find group of Hazendonk pottery at a site named Het Vormer near Wijchen. Hazendonk pottery is associated there with the fragments of some thin-walled bowls, which have the best counterparts in the Belgian Michelsberg group (Michelsberg III according to Lüning 1967, *i.e.* at the end of the fourth millennium). A few other sherds show profiles that resemble most those of Windmill Hill bowls. The author is preparing a detailed report on these finds that will appear in the Oudheidkundige Mededelingen of 1974 or 1975. The "Peterborough" sherd from Spiennes becomes now the more interesting (Verheylewegen 1964).

3.6.2.5. *Conclusion*

We can sum up the Hazendonk pottery as a rather independent Middle [78] Neolithic group, chronologically half-way "Swifterbant" and the Vlaardingen Culture. It might have its roots in the "Swifterbant" pottery, but any relationship to the later Vlaardingen ware is hardly discernable. If any influences of contemporaneous Neolithic Cultures on this pottery existed, then these must have come from one of the early groups of the Neolithic of "western tradition" (as Chasséen or Windmill Hill), where we encounter some of the same form characteristics. But in this stage of research such ideas have a hypothetical character.

3.6.3 The Impossibility of a Dating to the (Late) Bronze Age

On purely typological grounds it is possible to date the Hazendonk pottery in the Bronze Age. We must then reject the association with flint, the correlation with the human influence in the pollen diagram at about 3000 B.C. and the allocation of the sherd from profile H-J to the Hazendonk pottery. This sherd would then have to be assigned to the Early VL Culture. No other finds from this culture were found near this profile on the donk, however, while it was precisely there that pit B containing exclusively Hazendonk pottery was situated. Higher than the clay of the Schoonrewoerd ridge we find in the pollen diagram important human influence on the vegetation only in the first 10 cm. of peat on the clay; this influence must be attributed to the VBB/BWB occupation. In a trial pit dug near and to the south of pit I no archaeological material was found above the clay of the Schoonrewoerd ridge. Although it is difficult to deny these mutually supporting arguments, it seems reasonable to us to discuss the consequences of such a denial. Apart from a dating before the VL Culture there is also the possibility of a dating after the BWB pottery.

Due to the absence of deliberately roughened pottery of the type of the Harpstedt *Rauhtöpfe*, it appears that the Hazendonk pottery cannot be dated in the Iron Age. Also what is generally known about inhabitation in the area makes an Iron Age inhabitation at this point unlikely. From the pollen diagram of the Hazendonk no certain conclusions on this subject can be drawn, but from the Molenaarsgraaf diagram it clearly emerges that all human influence ended at about 800 B.C. [79].

The Hazendonk pottery is fairly similar in form to the *Kümmerkeramik* of the Elp Culture. The workmanship, however, is entirely different. *Kümmerkeramik* is for the most part tempered with crushed cristalline rock (granite) and not built up with bands but drawn up from the base [80]. Band construction is, however, characteristic of the HVS/DKS pottery [81], which is generally tempered with broken quartz. It was particularly in the western river area,

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[78] *Cf.* note 29.

[79] See p. 190, 114.

[80] Van der Waals 1965[a]. The weak shoulder with thin rim occurs among others at Margijnen Enk, Deventer (Modderman 1955[a]).

[81] *E.g.* Berghem (Verwers 1966) 5 bands; Vorstenbosch (Modderman 1959[c]) 5 bands; Hei- en Boeicop (own observations) small bands of 2-4 cm.; Hatert (Hulst 1962/'63).

however, that the tempering was done with fine gravel [82]. The Hazendonk pottery is, moreover, not so thick and shows a different surface treatment. The rich decoration and also the technique and arrangement of the impressions are, however, unknown in both HVS/DKS pottery and *Kümmerkeramik*. Somewhat comparable decoration occurs only in the Hoogkarspel group in the beginning of the Iron Age. The decoration is there more stifly arranged, while the forms of the pottery are also different. In Hoogkarspel the pottery is significantly less thoroughly tempered with more or less smaller quantities of crushed granite. Band construction does indeed occur, but is not so apparent as on the Hazendonk. At Hoogkarspel the "scratched" impressions and horizontal knob ears are in any case absent, while, on the other hand, real handles, clay discs with a central hole, spindle-whorls, "bell-shaped objects", thin well-polished pottery and flint sickle fragments, are all absent on the Hazendonk. The similarities of the whole cultural assemblage are therefore not very impressive [83]. The (incomplete) perforations and horizontal knob ears are, however, two characteristics to be found in Bronze Age pottery [84].

A dating in the Late Bronze Age would therefore require an interpretation of the Hazendonk pottery as a group in which northern and southern elements can be recognized, while the decoration forms an entirely new element which reoccurs perhaps in the Hoogkarspel group. Such a construction is, however, unlikely for a number of reasons. First, Molenaarsgraaf lay during the whole of the Middle Bronze Age within the DKS Culture area, which embraced the whole coastal region and the Central and Southern Netherlands. A strong northern influence at this point seems to us to be very unlikely, although there are indeed some indications that the influence of the Northern Netherlands Culture area extended at this time to the Veluwe and the coastal strip [85]. Second, some recent but still scanty settlement finds which may represent the Late Bronze Age domestic pottery, namely those at Velsen [86] and at four sites in the Alblasserwaard and Vijfheerenlanden (one of them at Molenaarsgraaf!) [87] are quite different from the "Hazendonk pottery".

We think that the arguments in support of a Middle Neolithic date, summarized in the opening lines of this paragraph, are certainly convincing enough in their totality to justify a dating in the Middle Neolithic. The above discussion served merely to demonstrate the improbability of some possible alternatives.

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[82] *E.g.* at Zijderveld, Hei- en Boeicop, Noordeloos, Goudriaan and Ottoland. At Vogelenzang (Groenman-van Waateringe 1966[b]) predominantly pounded pottery was used.

[83] Bakker & Brandt 1966. *Cf.* also p. 42, note 98. We thank Dr J. A. Bakker, Amsterdam, for his comments on the Hazendonk pottery.

[84] *E.g.* Vorstenbosch (Modderman 1959[c]), Neer (Harsema 1965), Nierssen, barrow D 4 (Holwerda 1910, esp. Pl. VIII).

[85] *Viz.* the socketed axes of Northern Netherlands type, found on the coastal barriers.

[86] Van Regteren Altena in Jelgersma *et al.* 1970, 141.

[87] *Cf.* p. 115, 175.

4. A LATE BELL BEAKER/BARBED WIRE BEAKER SETTLEMENT AND CEMETERY ON THE SCHOONREWOERD STREAM RIDGE AT MOLENAARSGRAAF, CIRCA 1700 B.C.

On the sand body of an important fossil river course and at a break-through gully, a small settlement dating from the transition period Neolithic/Bronze Age (VBB/BWB) has been excavated. The settlement is one of a number of comparable occupation units on this stream ridge, which together formed a small elongated hamlet. In the settlement two subsequent house plans were recognized. Three graves and an ox burial contained well-preserved skeletons: an extraordinary phenomenon in the Netherlands. The investigation of the gully filling yielded much information about the subsistence economy and environment. It was possible to construct a detailed chronological diagram of the settlement. The transition from Neolithic to Bronze Age seems to be marked by a great measure of (cultural) continuity. The cultural background of the house-plans, finds and graves are discussed in a separate paragraph.

4.1. INTRODUCTION

4.1.1. Discovery and Excavation

In the south-east of the Molenaarsgraaf polder the members of the AWN work-group "Lek en Merwestreek" discovered in June 1966 a small Late Neolithic settlement lying on the sand body of the Schoonrewoerd stream ridge. It appeared soon that an unusual geological situation distinguished this site from find places which had already been discovered some years previously. For this reason the settlement was selected for excavation [1]. The elevation on which the find place lay was accentuated by an adjoining depression, formed by a gully cutting right across the ridge, filled with peat. This small water course apparently provided an attraction to the prehistoric inhabitants. At the time of the excavation three other compar-

Fig. 56. Situation of Molenaarsgraaf.

[1] This site was named "Molenaarsgraaf". The Hazendonk, although also situated in the municipality of Molenaarsgraaf was named "Hazendonk", or "Hazendonk-Molenaarsgraaf". Preliminary notes on the excavation: Louwe Kooijmans 1966[b], 1967[c], Leeuwis 1966.

able settlements were known at similar gullies [2]. The motives for especially selecting the Molenaarsgraaf site for excavation were fairly insignificant. One was its proximity to the Hazendonk, with which Molenaarsgraaf could be linked by a geological section. Another — not the least — was the friendly cooperation and interest of the owner of the land, Mr A. Boon, and his willingness to give permission for the investigation.

The excavation was carried out in two operations: 15th August to 30th September 1966 and 17th July to 18th August 1967 [3]. Except for the digging of a cross-section over the gully (pit C8) all the work was done by hand, in pits of 5 by 20 meters indicated by a letter-number combination [4]. These excavation pits were made at right angles to the ditches, approximately parallel to the axis of the ridge and approximately at right angles to the gully. Although the pits were of maximum size for efficient work, it seems nevertheless that they were too narrow to provide a good general view. At later excavations of similar sites we worked therefore in pits of much larger dimensions [5]. The area of the excavated terrain is 1200 m².

4.1.2. The Geological and Archaeological Situation

The geology and inhabitation history of the region where Molenaarsgraaf is situated were fully dealt with in Part II of these studies. As to the geological situation of the excavated terrain the paragraphs 2.4.5.1-3, dealing with the Schoonrewoerd stream ridge and the break-through channels are relevant. These paragraphs may be read as an introduction to the following account of the geological situation of the immediate surroundings of the excavation.

The archaeological environment, discussed in paragraph 2.5.3.4. is of extreme importance for a good understanding of the excavated settlement, discussed in the following pages. We demonstrated that "Molenaarsgraaf" is part of a long ribbon-like VBB/BWB settlement, consisting of about seven "occupation centres", of which "Molenaarsgraaf" itself is the westernmost. Starting from an estimate of the available surface of arable land, we could calculate that every occupation centre consisted of only one and at most of two farmer's households. The total number of inhabitants of the entire long settlement amounted 30-50 persons. The situation of this hamlet was about half-way a route which connected the Veluwe district with the coastal regions.

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[2] For the Schoonrewoerd stream ridge see p. 97 f., for the break-through channels see p. 100 f., for the AWN work-group "Lek en Merwestreek" see p. 82.

[3] During both operations the drawings were made by Mr J. P. Boogerd, draughtsman of the Institute for Prehistory, Leiden. Miss E. J. Brinkman (now Mrs E. J. Schreve-Brinkman) assisted during the second operation and the work on the finds. The digging was done with workmen of the Koninklijke Nederlandsche Heide Maatschappij (Royal Dutch Reclamation Company).

[4] *E.g.* B8, A6. The pits are indicated at fig. 76. They were excavated in the following sequence:
1966 : B8, B6, A10, A8, C8, A9, B7;
1967 : B9, Z9, Z10, Z8, Z11.

[5] *Viz.* at Ottoland-Oosteind two pits of 10 × 40 m. (together 20 × 40 m.) and at Ottoland-Kromme Elleboog one pit of 8 × 150 m. (the stretch of a road under construction) were laid out. But this could only be done because of our experiences at Molenaarsgraaf, where we became aware that the sections did not yield much information.

Fig. 57. Molenaarsgraaf. Contour map of the surroundings of the excavation. Scale 1:10,000. Based on measurements of the *Cultuurtechnische Dienst* (Governments Service for Land and Water Use).

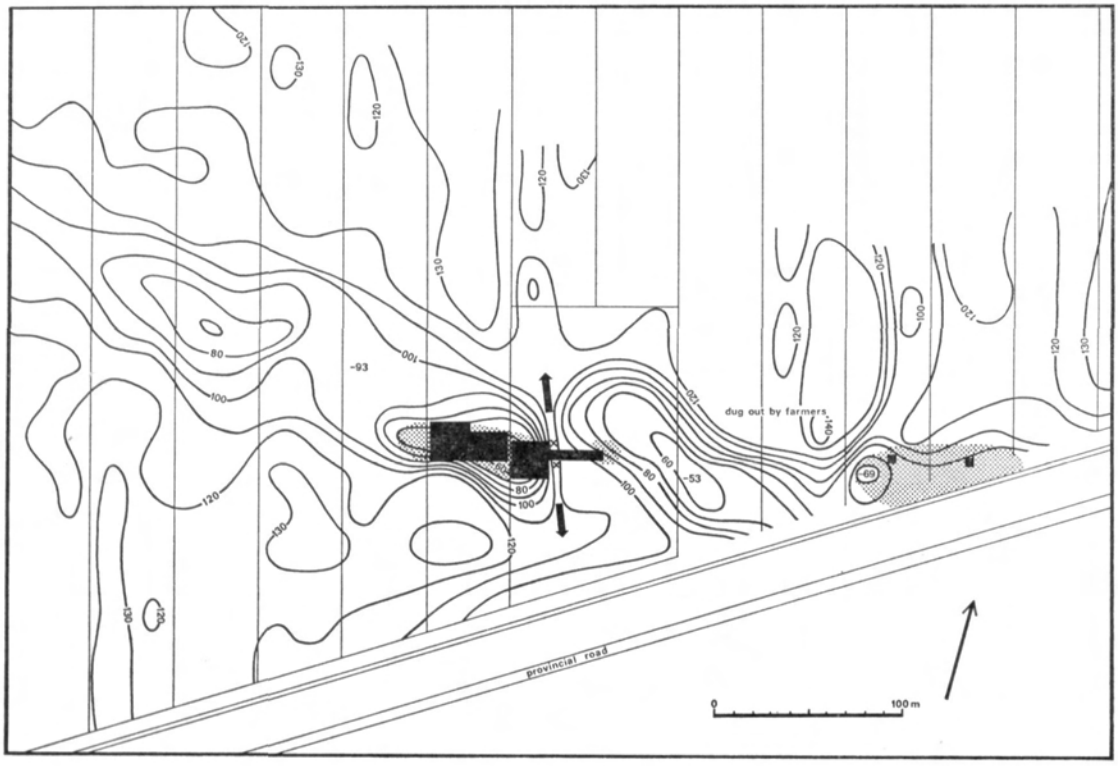

Fig. 58. Molenaarsgraaf. Contour map of the direct environs of the excavation based on measurements in a system of 20 m. squares. Excavated area in black. At the right the site no. 27/28. Legend : see fig. 27. Scale 1:4000.

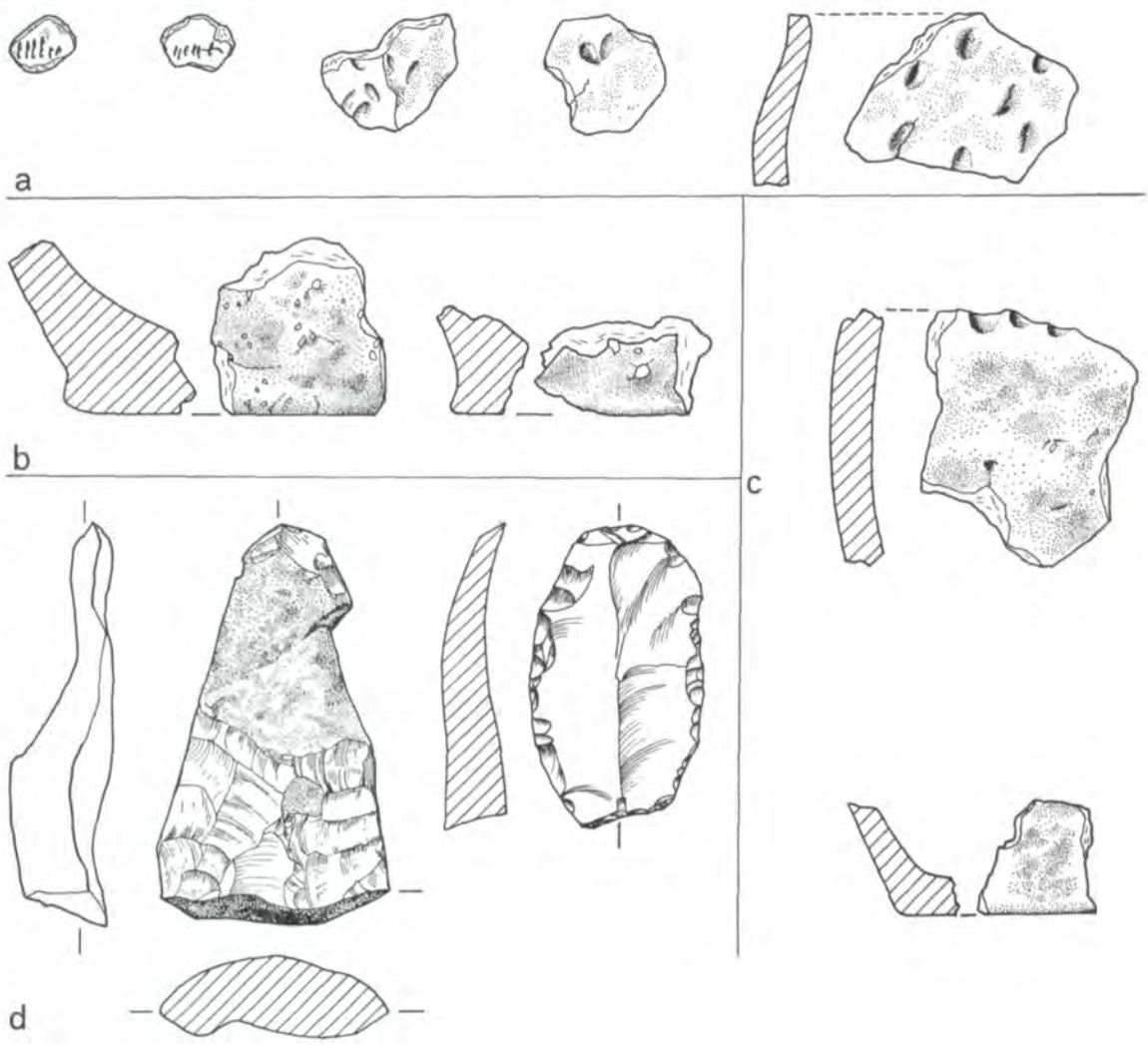

Fig. 59. Alblasserwaard, site no. 27/28 (*Cf.* fig. 19 and 58), situated *c.* 200 m. to the east of "Molenaarsgraaf".

a) Barbed Wire Beaker pottery. Scale 1:2.
b) Middle Bronze Age pottery. Scale 1:2.
c) Late Bronze Age pottery. Scale 1:2.
d) Flint scraper and dagger grip. Scale 1:1.

Some results of the excavation discussed in the following pages were used to reach these conclusions. It is not allowed, therefore, to adduce these facts as evidence for any statement, made below, to avoid circular reasoning.

We will name some features in the immediate surroundings, which might have had their influences in the excavated terrain. First, there is the settlement no. 27/28 (figs. 19, 58), dated

by Late Beaker (esp. BWB), MBA and LBA pottery (fig. 59) [6]. A particular find is the haft of a flint dagger, which is dated here provisionally to the Early Bronze Age (= BWB) or later; earlier occupation of the site might be unnoticed! Apart from this, we can say that the later phases of the occupation at Molenaarsgraaf are contemporaneous with the start of the occupation at site 27/28, but the occupation there was, apparently, continued until a moment in the Late Bronze Age. The presence of this settlement gives an explanation of some features in the excavated terrain (*viz.* the hearth no. 29, p. 193), in the gully filling (p. 185), and in the pollen diagram II (p. 190). We considered this site 27/28 to be the next "occupation centre" of the ribbon settlement. The very short distance of only 200 m. is refound only at the other end of the settlement between Ottoland-Oosteind and Goudriaan (fig. 19, nos. 42 and 43: 400 m.). In this we might find an indication that the arable land of Molenaarsgraaf extended especially to the west of the site.

Second, some observations were made in pit C8 on the eastern bank of the gully. A small undated hearth pit was attested in the east section, but only a very modest amount of domestic refuse was found. Although there are, therefore, some traces of human activity, no settlement was situated on the other bank of the gully. Some test pits there confirmed this conclusion: they yielded no finds.

Third, we must mention that the Schoonrewoerd stream ridge is low, with only one or two elevations, to the west of "Molenaarsgraaf". On two relatively high terrains some finds were made. One site (no. 25) is largely disturbed and might have been another "occupation centre". On the other terrain (no. 24[a]) the rest of a peculiar grave, probably of Beaker Age, was discovered. Some scarce finds point to human activity. A settlement might have been situated in the immediate vicinity.

The Hazendonk at last is situated 1300 m. west of the site. It is the westernmost point with VBB/BWB occupation in the river district. The high water clay of the Schoonrewoerd stream is dated there between c. 2100 and 1700 B.C. (*cf.* p. 143).

4.2. GEOLOGICAL CONDITIONS [7]

4.2.1. Mapping

Directly after the discovery of the terrain the immediate surroundings were mapped, as far as the deposits were concerned, which were later than those of the Schoonrewoerd ridge. Depending upon the detail required the distances between the borings varied from 10 to 40 m. When the excavation was finished a few supplementary sections were bored, particularly a section along the longitudinal axis of the gully and through the terrain near both mouths

[6] This site was discovered as early as 1954 during the soil survey, but it was not registered and so forgotten until 1964, when the terrain was explored by amateur archaeologists. About 1969 the original finds were rediscovered in the ROB store rooms. We thank Ir J. van der Linde for his information, which made it possible to determine the exact find spot.

[7] Here only the immediate surroundings of the excavation are discussed. For the geology of the Alblasserwaard in a more general sense see p. 79 f.

(fig. 61). The filling of the gully could be studied in detail in the two sections of pit C8 (figs. 63, 64). Because the finds there were at a greater depth than was anticipated [8] and because of the unexpectedly large seepage neither of the sections of the pit could be dug so deep as was desirable. As the south section seemed to the most representative, maximum attention was devoted to this section, so that it could be fully drawn. As for the north section, its lowest levels were investigated by means of incidental observations. Both sections were linked together, as far as the deepest deposits are concerned, by two transverse sections.

4.2.2. The Geological Structure of the Site

With the help of the map and the above-mentioned sections we will describe the structure of the terrain. The code numbers in the text correspond with those in the figures.

(0) A central place is occupied by the sand body of the Schoonrewoerd ridge. It consists of fine sand, with little or no clay content. Locally thin clay layers or some coarser sand layers occur. Laterally the sand gives way fairly abruptly to the clay mantle and the clay wedge, both consisting of sandy clay. As its distance from the ridge increases, the clay wedge becomes less and less sandy and consists finally of heavy clay. At a fairly long distance from the ridge the clay wedge can, however, sometimes be locally very sandy, which indicates that the clay must have been deposited from small creeks. The erosion of the underlying peat at some points supports this. This also seems to have been the case in our section A-B (fig. 61). The difference in height from the top of the sand body and the surface of the clay wedge in the immediate vicinity of the ridge (a maximum of 170 cm.) gives the maximum compaction. As the clay must have lain somewhat lower originally than the sand body now lies, compaction has, in fact, not been as great as this. A maximum of 130 cm. appears to be acceptable and concurs with the Hazendonk data (*cf.* p. 133).

At the base of section A-B another clay deposit is visible. With the aid of the section by itself it cannot be decided whether this deposit represents another phase of the Schoonrewoerd ridge. This we do not consider likely. We think that it belongs to another and older system. Its age can be estimated after comparison with the Hazendonk data (p. 143) and using the height of the surface and an estimate of possible compaction. It appears then that the age is the same as deposit (2) at the Hazendonk or slightly older, *i.e.* Calais IV[a] or (less probable) Calais III [9].

(1) The following phase in the development of the landscape is the formation of the transverse gully, a break-through channel, which has earlier been discussed in detail [10].

Directly after its formation the sand body lay in the form of a low natural dike in the landscape, so blocking the water circulation. At places where this water was dammed up against the

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[8] When mapping, the borings were stopped when the sand 2 was reached, on the assumption that these were the bottom layers of the gully.

[9] This deposit belongs consequently to a younger system than deposit 1 at the Hazendonk.

[10] *Cf.* p. 100 f.

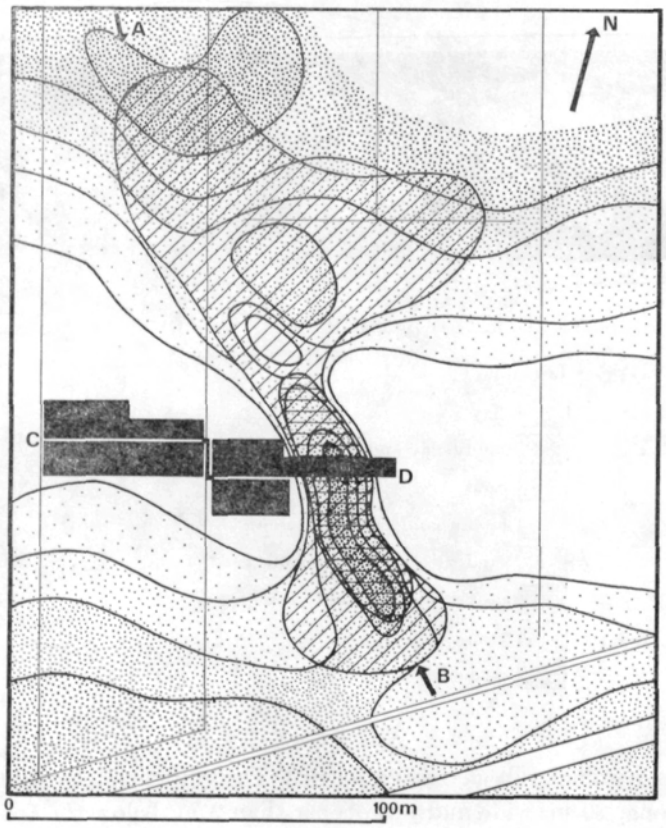
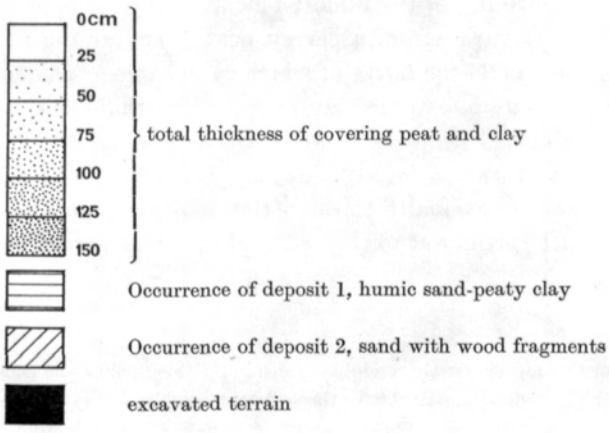


Fig. 60. Molenaarsgraaf. Physiographic map of the deposits which cover the Schoonrewoerd ridge and its clay wedges. Based on 83 borings of 1.20-3.20 m. Scale 1:2000.

Legend :



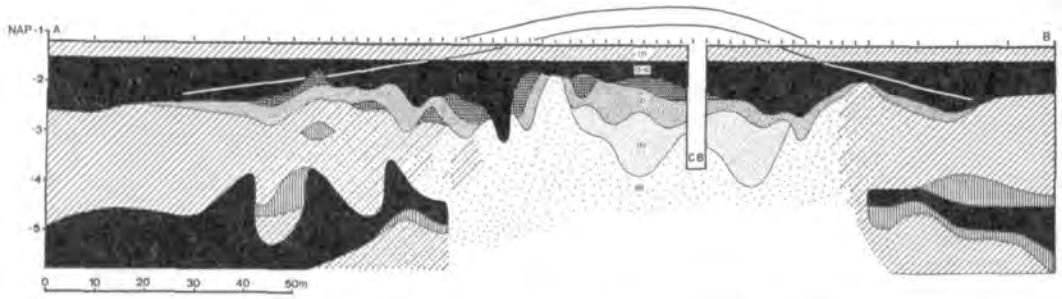


Fig. 61. Molenaarsgraaf. Section A-B (see fig. 60). Horizontal scale 1:1500. Vertical exaggeration : 10×.

Legend :

- clay
- sandy clay and clay with sand lenses
- sand
- humic sand - peaty clay
- sand with wood fragments
- peat with some sand
- humic clay
- peat

ridge a few transverse gullies will have been formed. The gully at Molenaarsgraaf was of small size: about 90 m. long, 20 m. wide and not deeper than 3 m. below the top of the ridge. The water current caused erosion of the surface at both mouths. The sand that was thus washed away has not been identified during the mapping. It must have been spread over a large area. The gully did not exist for any length of time and was quickly blocked by the formation of sandbanks near the northern mouth. It seems to us that the break-through came from the south, mainly because of the greater erosion at the northern mouth and the subsequent piling-up of sand there.

The beginning of the infilling of the almost blocked gully is represented by a deposit of widely different material. It varies from a clayey peat [11] containing little (1^d) or much (1^c) sand to a slightly humic sand (1^b) the facies of which can change considerably over very short distances. Locally there is even some sterile, clay-less sand (1^a), that like the original gully bottom deposits cannot be distinguished from the sand of the ridge itself (0). The south section does show this very well. The picture can be explained by assuming that during the formation of a *gyttja* some water passed occasionally through the gully, especially through its centre.

Laterally this deposit 1 spread out to the banks of the gully and changed to a weathered,

[11] In its extreme form the deposit closely resembles a *gyttja*. At these points the conditions for sedimentation might have been very quiet. The general appearance of the sediment complex indicates, however, that running water was present.

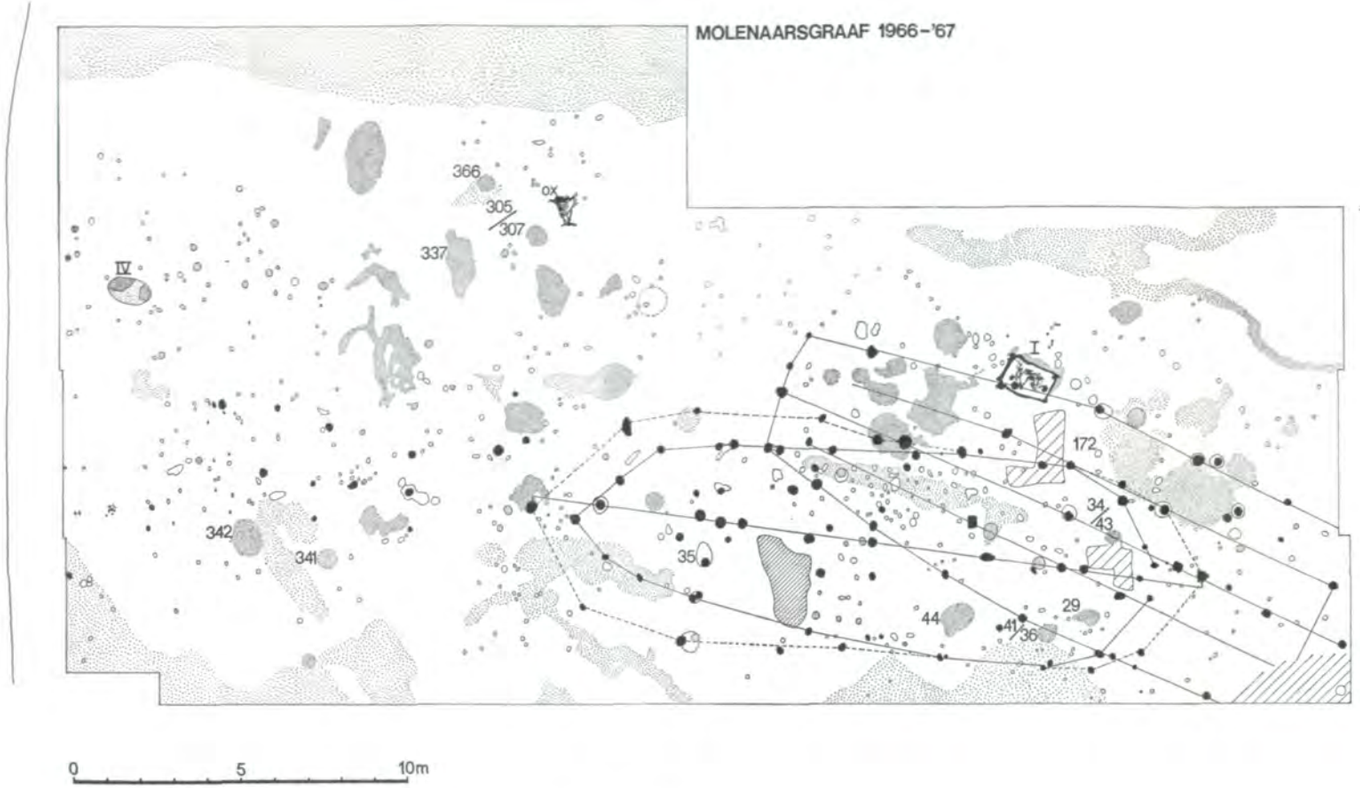
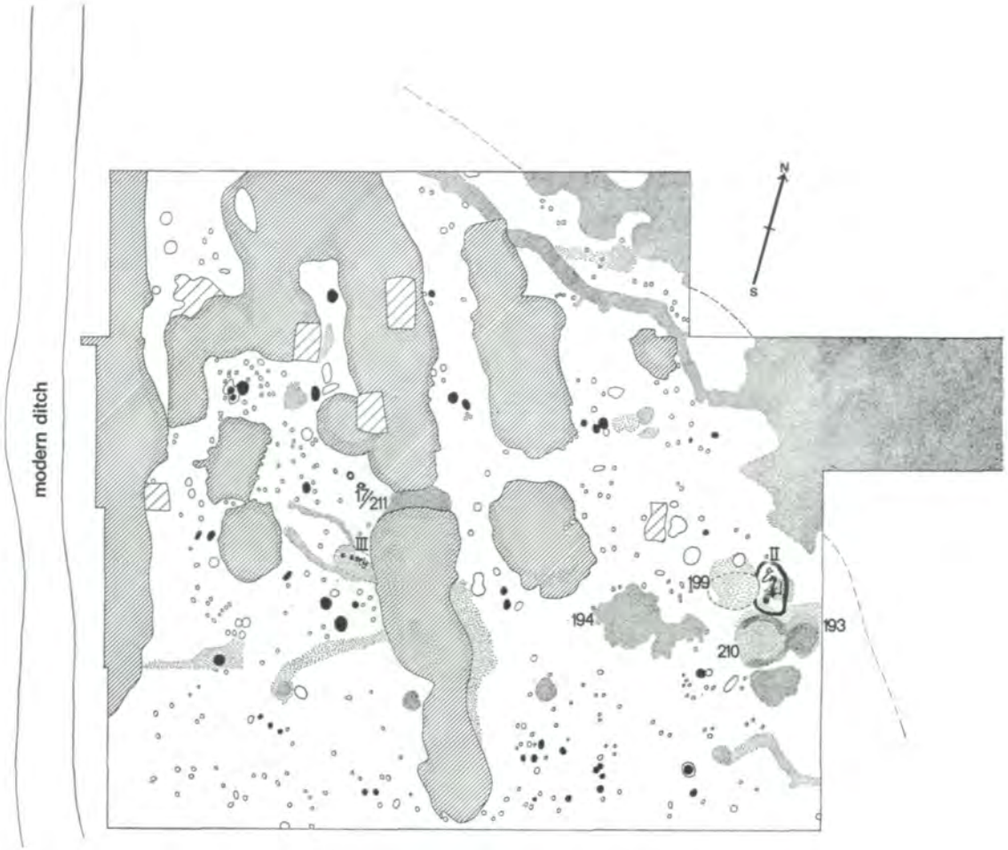
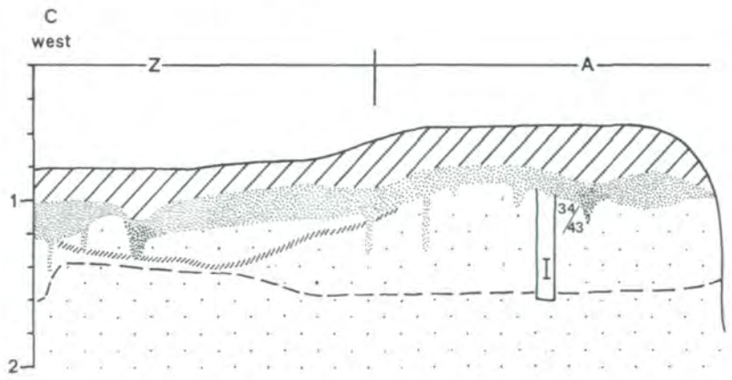


Fig. 68. Molenaarsgraaf. Excavation plan. Scale 1:200.

- (dark) grey post holes
- light grey post holes
- other small discolourations

- prehistoric pits, trenches etc.
- 16th century sand digging pits
- recently disturbed (test pits)





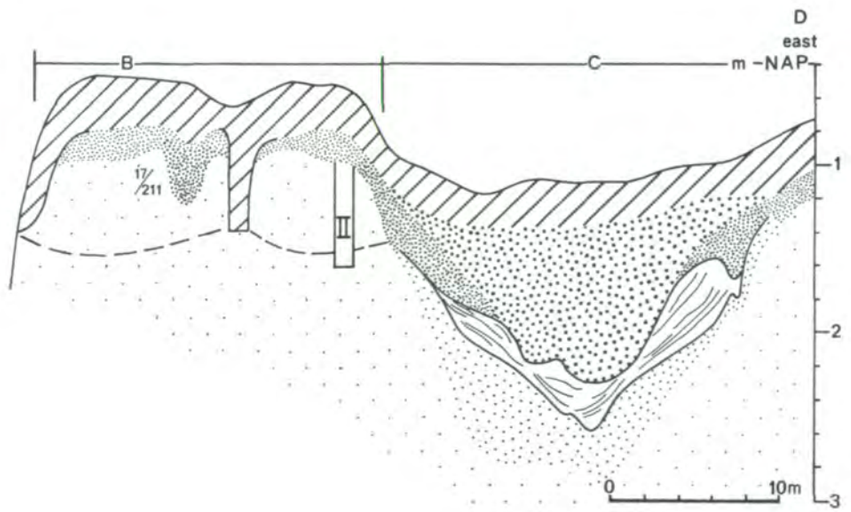


Fig. 62. Molenaarsgraaf. Section C-D (see fig. 60).
Composed with sections of the excavation.
Horizontal scale 1:400. Vertical exaggeration : 10×.

Legend :

- top clay with 16th century pits
- gully deposits (4-6). Mainly peat.
- gully deposits (3). Peat.
- gully deposits (2). Sand with wood fragments.
- gully deposits (1). Humic sand - peaty clay.
- sand of the Schoonrewoerd ridge with thin clay layer.
- "occupation layer" with post holes and pits.
- graves
- present mean water table.
- ⊢B⊣ excavation pit.

structureless reed/sedge peat containing sand, and then to very humic sand, reflecting a vegetation of reed and sedges along the gully banks. This last deposit occurs up to a level of about —1.70 m. NAP, which must have been about the ground water table or MHW level of that time [12]. Before the sedimentation started the water in the gully must have been between 130 cm. deep at the relatively shallow point where the excavation-trench C8 was dug: the point where the settlement bordered the gully. On both sides of this, however, depths to —3.70 m. NAP (*i.e.* a water depth of 2 m.) occurred at that time. At the end of the formation of deposit 1 the whole of the gully was filled and changed into a damp depression. The present low position of the top of deposit 1, at that time rather soft and wet, can be explained easily by compaction as a result of the later covering [13], especially with the sand 2.

The forming of the deposit 1 is contemporaneous with the settlement next to the gully, as is shown by the pollen diagram and the position of the finds in this deposit.

(2) The infilling of the gully, started with the *gyttja* formation (1), was suddenly interrupted by renewed flowing through. This is proved by a 30-40 cm. thick layer of clayless sand (2) covering (1). The sand shows a finely laminated structure, dipping to the centre of the gully, and it also shows an alteration with thin layers of redeposited peat and wood fragments. The dip may be partly an original one, but will be mainly the result of compaction of the underlying clayey peat. Locally, especially in the bank zones, the preceding deposit was eroded. Also the formation of peat along the banks was restricted to a narrow zone and the growth of reed and sedges might even have been temporarily interrupted as may be concluded from a division line (a change in colour only) in the peat there in the sections of the trench C 8, especially visible when dried out. During the second phase of activity the gully was about 14 m. wide. As a result of the subsequent compaction the original depth cannot be fixed accurately, but we can say the gully certainly was very shallow in this phase. At a ground water table of about —1.50 m. NAP the water depth was less than 1 m.

When we discuss the finds it will be seen that a date of about 1500 B.C. is the most probable for this second phase of activity.

(1/2) In front of the northern mouth and to a less extent also in front of the southern mouth, two lobate sand deposits of washed-out material were mapped. The material consists of greyish clay-less sand with wood fragments and peat-remains. The maximum thickness is 50 cm. These sandlobes lie on the eroded parts of the clay wedge and are only locally separated from it by a somewhat sandy peat. As the top of the sandlobes, now between —2.00 and —2.50 m. NAP, may have lain originally much higher than the corresponding deposit in the gully, its compaction cannot be calculated. It is, moreover, difficult to determine the correct correlation with the gully deposits. It seems logical that the sand is in the first instance the washed-out sand from the times, when the gully came into existence about 1800 B.C. The

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[12] The decomposed state of the peat is one argument for a ground water table at this level. The bad condition of the bones at find places situated higher is another. *Cf.* also the discussion of the pollen diagrams at p. 188.

[13] *Cf.* the pollen evidence (p. 188): the deposit was formed up to about the ground water table. A compaction of 100 cm. (c. 50%) is a very acceptable amount,

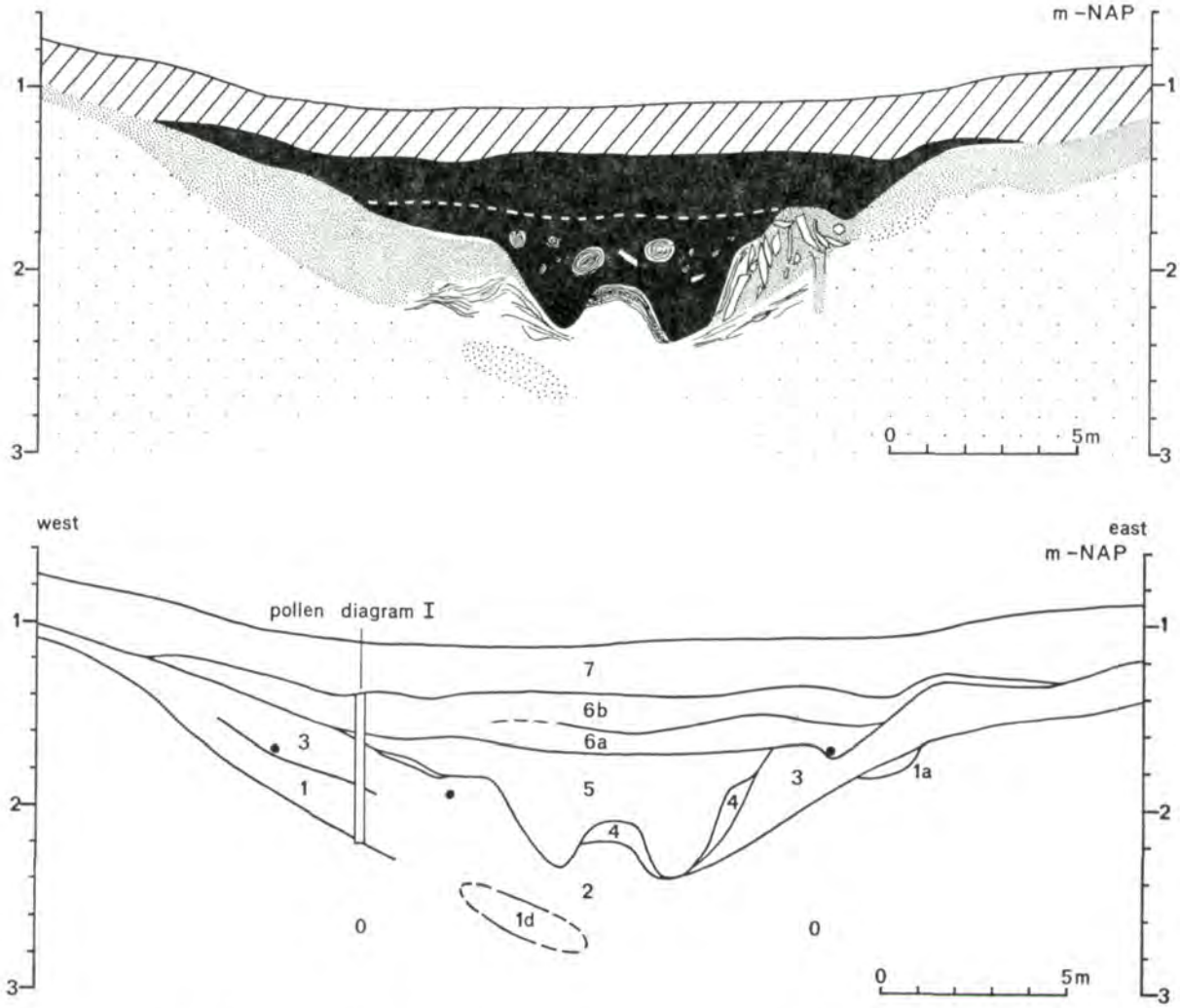

Fig. 63. Molenaarsgraaf. Pit C8, north section. Horizontal scale 1:200. Vertical exaggeration : 5×.

a) Section.
b) Scheme, with the position of three finds above deposit 1.

composition of the sandlobe is, however, very similar to that of gully-deposit 2. This makes it very likely that the original sandlobe was reworked in the second activity phase, which is quite plausible.

At this point in the peat district the inundation water will not have transported any sand. After flowing through the gully the current will have diminished suddenly in strength, so the washed-out sand was not transported far from its mouth. That this really was the case appears from the calculated volumes of the sandlobes and of the "missing sand" of the ridge. Both are in the same order of magnitude: about 1200 m³.

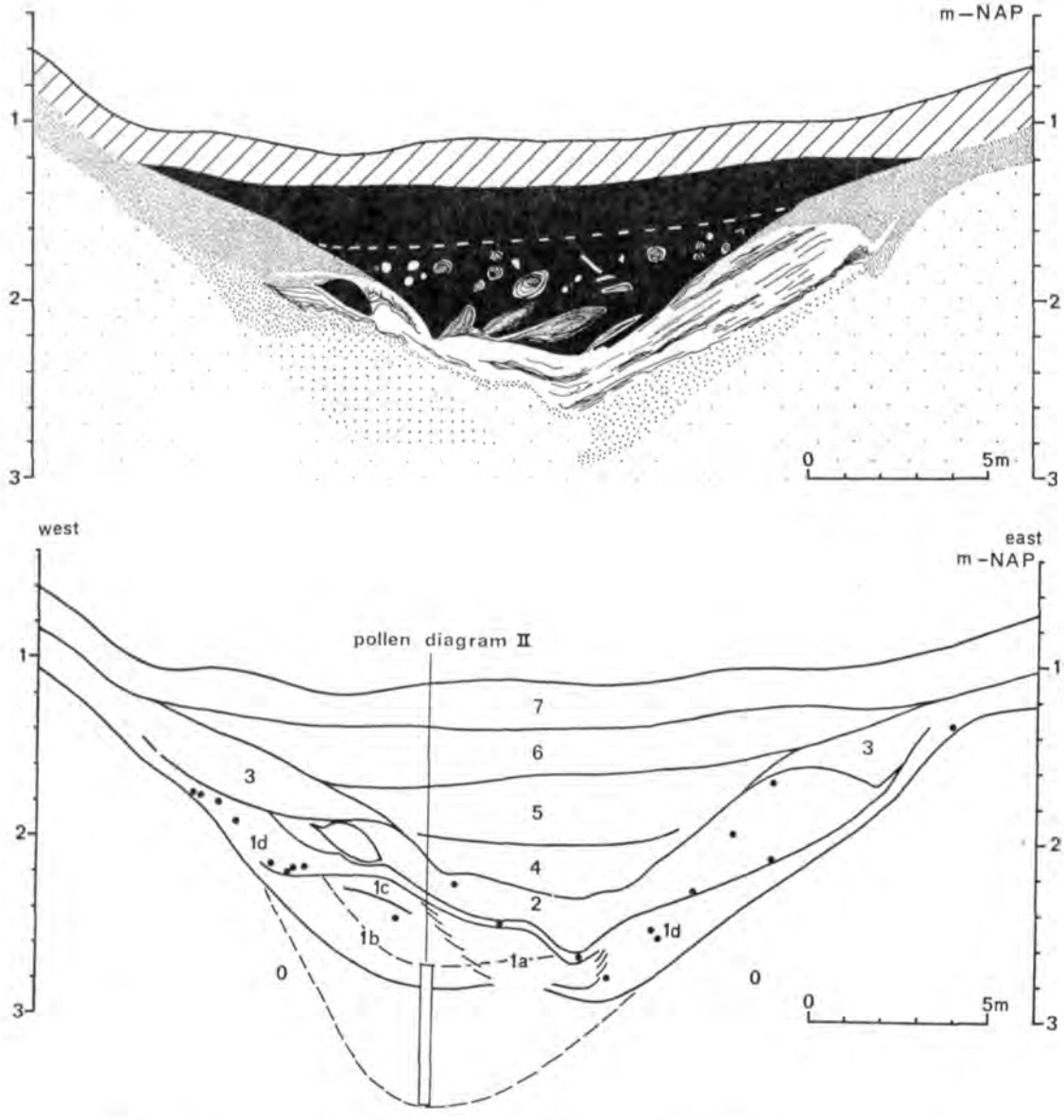

Fig. 64. Molenaarsgraaf. Pit C8, south section. Horizontal scale 1:200. Vertical exaggeration : 5×.
a) Section.
b) Scheme, with the position of some finds.
The boring of pollen diagram II is projected on the section.

Legend of figs. 63/64. All numbers correspond with those used in the text.

7	clay
6 b/a	wood peat, not clayey
5	peat with much wood and trunks
4	sand with wood fragments
3	weathered peat
2	finely bedded sand with thin layers of washed wood and peat
1d	clayey peat - peaty clay
1c	clayey peat with some sand - humic sand
1b	slightly humic sand
0 & 1a	fine sand

(3-5) All deposits after the second activity phase indicate a slow filling up of the gully with peat. The growth of reed and sedges, resulting in a continuation of the weathered reed/sedge peat (3), spread over a wide zone along the banks. As a result of the compaction of the soft sediments (1) in the central part of the gully a narrow central channel came into existence. In the north section of C8 (fig. 64) especially this little gully of 5-10 m. width can be clearly distinguished. The peaty banks were overgrown with alder as the preserved root systems show (Pl. III B). The current seems to have flowed at a slow rate, judging by the sand mixed up with wood fragments on the bottom and along the banks (4). Finally, what was left of the gully became filled with clayless wood peat and even more with the debris of the bank overgrowth, including heavy alders which tumbled from the banks into the marsh (5). At a higher level oaks were also found.

(6) With the increasing rise of the ground water table the depression, which remained of the former gully, was also filled with peat: the extension of the general peat cover of the clay wedges outside the ridge. At the lowest parts this peat growth began shortly after the clay wedge was formed as was shown at the Hazendonk (p. 142). Gradually the higher parts will have been grown over too. At Molenaarsgraaf a few centuries will have elapsed between the deposition of the clay wedge and the start of the peat cover. In that period the lobate sand deposits were formed: they rest directly on the clay wedges, with the exception only of some eroded places in front of the northern mouth of the gully.

The peat outside the gully has a maximum thickness of 110 cm. The difference between the height where the peat wedges out on the ridge (—1.00 m. NAP) and the height in the peat area (—1.40/—1.60 m. NAP) gives a compaction of at least 40-60 cm. The occurrence of a dark soil profile in the whole settlement site (up to —0.80 m. NAP) gives reason to think that originally the entire ridge was overgrown and that the compaction is in reality certainly *c.* 20 cm. more.

(7) The "Alblasserwaard cover" lies over all deposits and has a uniform thickness of 30-40 cm. It is clear that the ridge at the time of the sedimentation was not, or hardly, visible. Even when a clay is deposited during an inundation a somewhat thinner covering may be expected on relatively high points. Later compaction caused a difference in height of a maximum of 70-80 cm. between the clay on the ridge and that in the peat area.

4.2.3. Compaction

The data given above about compaction are embodied in table 14. They closely agree with the data applicable to the Hazendonk, especially when we take into account the differences of the geological structure at both sites.

TABLE 14

Molenaarsgraaf. Height of the deposits

Deposit	Height (m. below NAP) at :			Compaction (cms.)
	Ridge	Boundary ridge/clay wedge	Clay wedge	
Clay 4 (top)	— 0.50	— 0.90	— 1.20/1.30	70/80
Peat (top)	— 0.80*	— 1.10	— 1.40/1.60	60/80
Sand lobe (top)	—	— 1.70	— 2.00/2.50	>30/80
Clay/sand 3 (top)	— 0.80	— 1.20	— 2.50	c. 130
Clay 3 (top)		— 3.50	— 5.00	>150

* Top of grey "occupation layer".

4.2.4. The "Occupation Layer"

The top of the sand body of the Schoonrewoerd ridge has been discoloured to a dirty grey to a depth of 20-30 cm. Such a grey layer at the top of the sand was determined during our prospections and investigations almost everywhere in the stretch between Noordeloos and Molenaarsgraaf. But especially on the settlement sites the layer is much darker, while in between it is coloured to a light grey. Factually it is one of the features by which a former settlement was recognized. This was also the case at Molenaarsgraaf: in the centre of the settlement the layer was much darker than at the rims. According to usage we will name this fossil soil "occupation layer" in the following pages.

The discolouration of the top of the sand that has formed the surface for so many centuries need not surprise us, altough it is difficult to indicate the processes involved in its formation. The long section at Ottoland-Kromme Elleboog was most informative for this problem. The section ran from the bank of a transverse gully, via an unhabited terrain to a settlement. The clayey top of the sand generally was light grey, the normal reduction colour of moist clay. But below the peat cover in the gully bank zone the top few cms. were very dark. During our investigations we found that such a dark coloured top is a common characteristic of mineral deposits, where they are covered by peat. Within the reach of the settlement (defined by soil traces and finds) the clayey top of the sand has been reworked, an admixture of sand had taken place, and the limitation of the under side of this layer had become irregular. But the most conspicuous was the change to the same colour as below the peat on the gully bank. We assume that the change in structure is the result of the prehistoric occupation and that the change in colour is a soil formation below a (now disappeared) covering peat; this was more intensive, where the soil structure was disturbed.

The same could be observed at Ottoland-Oosteind, and at Molenaarsgraaf the fossil soil in the centre of the settlement was also the most sandy and the darkest in colour, while outside it and certainly on the clayey sides of the ridge, the colour did not differ from that of reduced clay.

Primary differences, particularly a high humus content on the site of the prehistoric settlement, will in the course of time have entirely disappeared, especially as inhabitation took place on the highest points, which were most subject to oxydation and animal activities. The absence of any discolouration of the sand on the highest points at Ottoland-Oosteind and Noordeloos and also upon the *donken*, supports this explanation. These points were probably never covered with peat. Where the discolouration reached only a shallow depth at Ottoland-Oosteind, the surface was almost completely disturbed by animal holes. At Molenaarsgraaf the animals (moles, mice) made their holes, however, under this layer, since in dry conditions the 20-30 cm. thick layer became, because of its texture (a sand-clay mixture), as hard as concrete. These disturbances at the depth of the highest level where soil traces could be preserved, were a constant handicap to our enquiry.

This version of the course of events to explain the existence of the "occupation layer" here cannot, however, be applied to the Roman and later occupation sites in the river clay area. The dark colour there must be primary [14].

The highest point at which such a grey level occurs may therefore be accepted as a measurement of the original height of the peat. On the Hazendonk this was —1.00 m., at Molenaarsgraaf —0.80 m., at Ottoland-Oosteind —0.60 m. NAP.

4.3. THE POSITION OF THE FINDS IN THE BREAK-THROUGH CHANNEL

4.3.1. Vertical Distribution (figs. 63-64)

The south section of pit C8 was cut off to some extent, during which all finds were measured. With the aid of this information and observations made during the collection of finds in the excavation pit — which gave similar results — the following comments on the vertical distribution may be made.

Nearly all finds were made in deposit 1, namely the unstructured peat on the western bank, in the thick clayey peat deposit in the eastern part and in the thin clayey peat in the western part and the centre of the gully. The sand 1^a yielded no finds, nor were there many in the sand 1^b. The latter can be the result of the short period during which this deposit was formed. The finds occur at all depths in this layer. We believe, however, that because of homogenizing processes, and because of subsidence in the clayey peat, the level at which a find was made does not necessarily indicate that it belonged to that particular level. As an illustration may be mentioned the occurrence of charcoal and the sherds of the large pot with reed impressions (fig. 88) found on the western bank. Both concentrations lie together and are clearly the result of the same action: charcoal and pot were toghether thrown away at

[14] *Cf.* Pons 1957, 45 and fig. 31.

this point. Both charcoal and sherds are chiefly found in the lower part of the deposit 1; a number of sherds even lay at the basis of the peat on the sand lying underneath it. In small quantities the sherds and especially the smaller charcoal pieces were found higher up, as far as the bottom of deposit 3. It is probable, however, that these sherds and also the charcoal (which was found nowhere else) originally lay at the same level, and, in view of the distribution, this was most likely to have been at the bottom of the peat. These conclusions will be of importance when estimating the relative chronology within the settlement. The pot with reed impressions will then be related to grave II, as is confirmed by ^{14}C dates. This means that the grave directly precedes the finds from the gully in time. The small BB sherds (from one beaker ?) both lay on the western bank at the base of the peat layer and so come from the surface on which pot and charcoal were thrown. We cannot directly include these among the finds from the gully filling.

After the mechanical removal of the highest deposit (6 and 7) a level was made in the gully filling, where some finds were made, all in the western bank zone and lying in the top of the deposit 1. These finds (fig. 89) were kept apart and will be later correlated with the last phase of the occupation of the settlement site.

The sand 2 contained a small number of finds. These probably consist mainly of material from places where deposit 1 was eroded. On the bottom of the remaining gully also — that is, directly under 4 — there were a few finds which had certainly been washed up there. We do not imagine that inhabitation continued until this phase.

From the bottom of the peat 3 came three finds which cannot be closely dated: two jaw bones and a piece of burnt wood. They are indicated in the north section. As digging from this level was done by hand the small number of finds cannot be attributed to carelessness. The finds occur at a level, where the pollen diagram shows a slight revival of human activity in the surroundings (zone 3), which we attributed to the Middle (and Late) Bronze Age occupation, documented by some finds in the vicinity (site no. 27/28, *cf.* p. 174) and at the site itself (hearth, find no. 29, *cf.* p. 193). In this way deposit 2 and the phase of renewed activity in the gully is dated before or in the beginning of the Middle Bronze Age, or in other words to the transgression phase Dunkirk 0.

4.3.2. Horizontal Distribution Patterns (fig. 65)

Nearly all finds come from deposit 1. The various groups of finds reveal somewhat divergent distribution pictures. The pottery occurs chiefly on the western bank near the settlement, the bones on both sides of the central channel and the wood for the most part in the centre of the gully. These differences are not differences in age. The few sherds from the centre of the gully or from the eastern bank were found in the same deposit as the bones and belong to the same find-complex as the finds on the western bank. A small concentration on this bank was found with both the bones and the pottery. The differences almost surely arise from the way in which the finds reached their present position and from variations in their reaction to unfavourable conditions for preservation.

The pottery must have reached the bank zones mostly by chance. Because of the good conditions most of it has been well preserved there. It is clear that it originated from the western

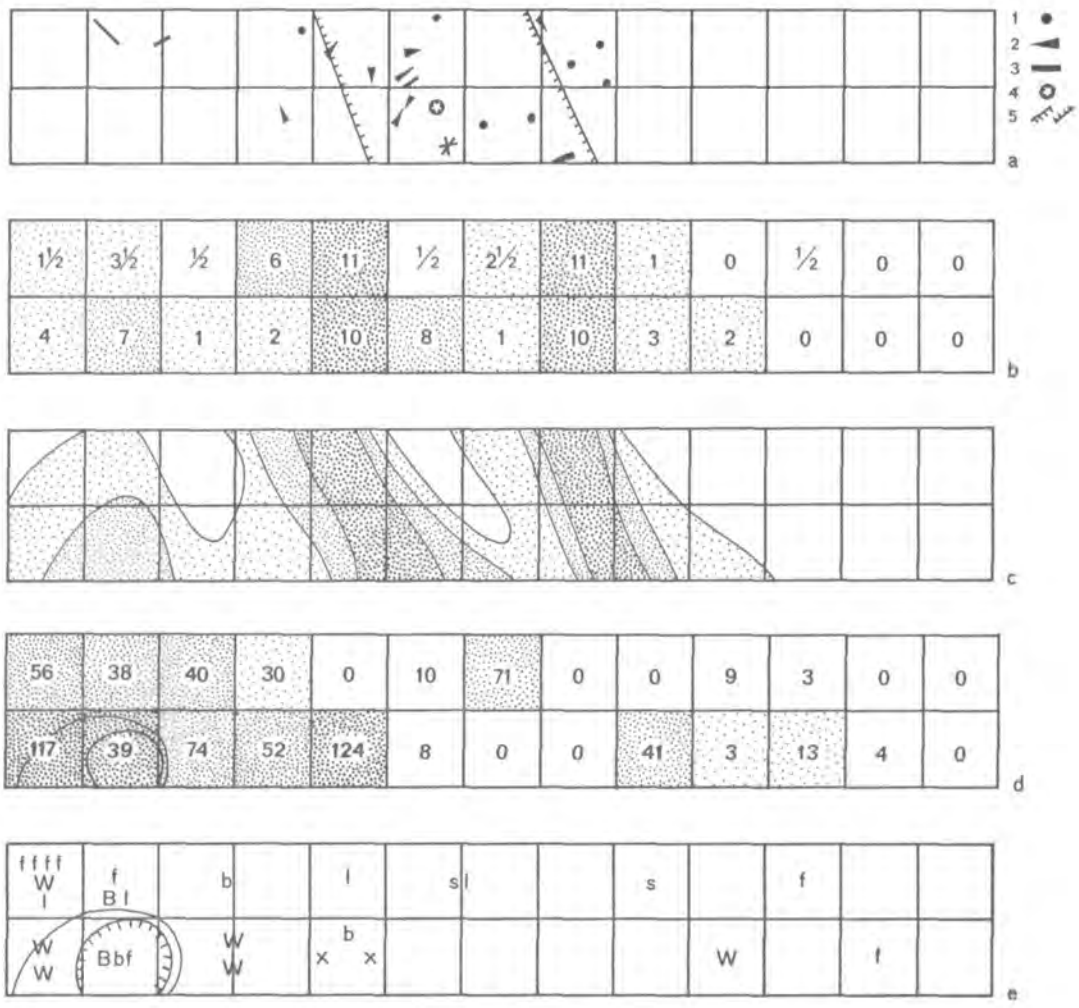

Fig. 65. Molenaarsgraaf. Distribution of various find groups in Pit C8. Scale 1:200.

a) Worked wood
1. pointed post, vertical
2. pointed post, oblique or horizontal
3. other worked wood, horizontal
4. fragment of a tenon
5. limitation of central part of the channel

b) Bone. The numbers give an estimation of the found volume. Boundaries of the signature (dots) at 1, 5 and 10 units.

c) As b) but interpreted according to the observations in the field.

d) Pottery, weight in grammes by 5 m². Boundaries of the signature at 10, 25 and 75 grammes.

e) Various finds
B = BB sherd
b = to BB related sherd
W = BWB sherd
l = loam
f = flint
s = worked stone
x = bottom and sherd of pot with reed impressions (fig. 88).
= concentration of sherds of pot with reed impressions
= concentration of charcoal

MOLENAARSGRAAF I

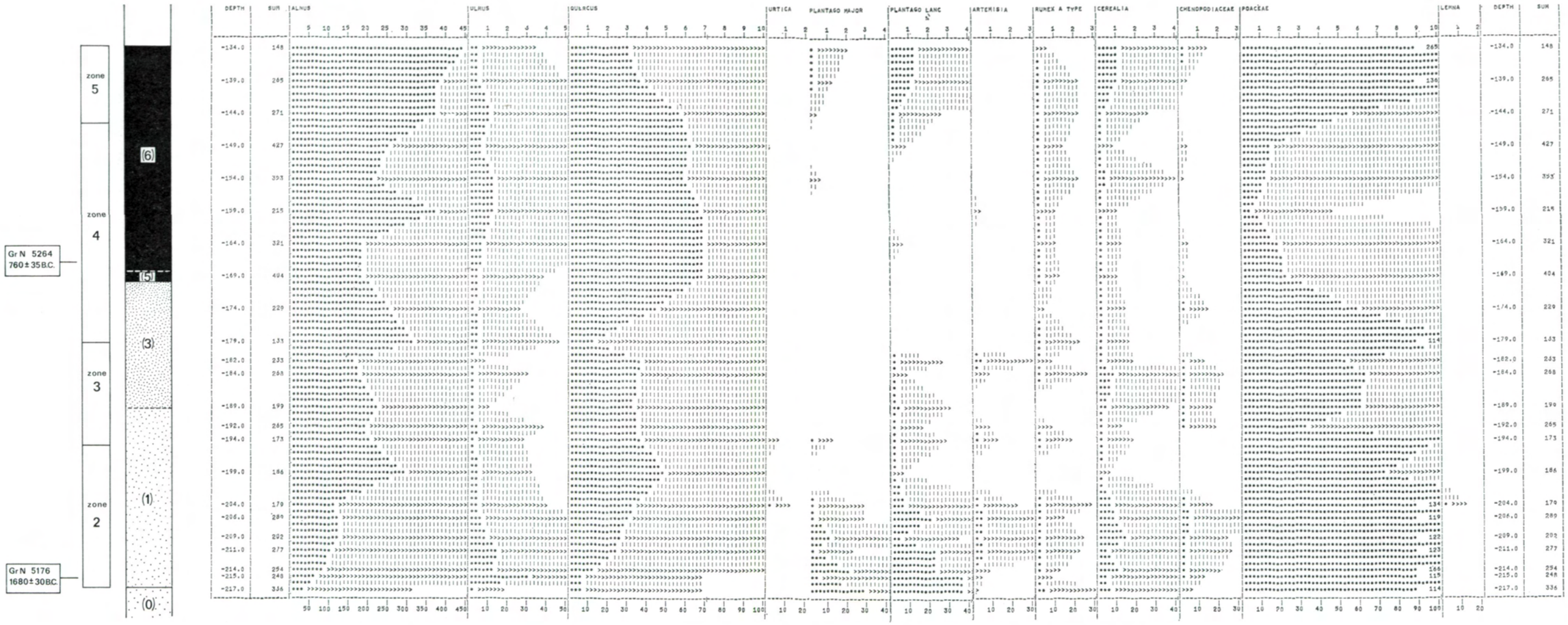

Fig. 66. Molenaarsgraaf. Pollen diagram I. Pit C8, north section. See fig. 63 for the position of the samples and for the legend of the lithology.

MOLENAARSGRAAF II

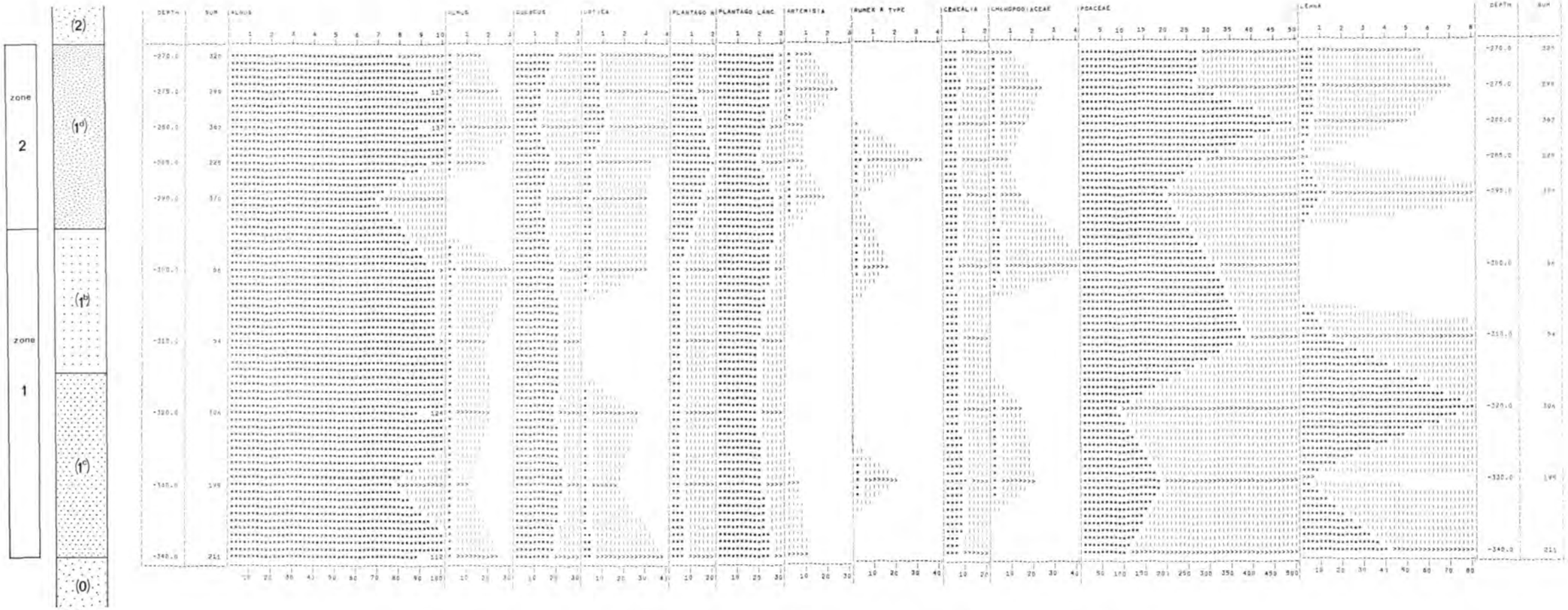

Fig. 67. Molenaarsgraaf. Pollen diagram II. See fig. 64 for the position of the boring and for the legend of the lithology.

side of the gully. The same will partly apply to the bone material, especially to the small concentration on the western bank. Most of the bones, however, were probably thrown in the gully itself and were washed away in the central part, where the strongest current will have occurred. We can say so that the archaeological material in the gully is derived from and associated with the settlement to the west of it. On the east bank of the gully (east end of trench C8) we did find, moreover, only a few pieces of flint and no other soil traces than a small undated fire place, proving that no settlement was situated there.

It is noticeable that the bones and the wooden objects have a different distribution. Although the circumstances were perhaps worse for wood preservation in the bank zones than in the centre of the gully, this had no influence on the distribution picture. In the bank zones also, a few pieces of wood and the roots of a somewhat later growth of alder vegetation remained very well preserved. All pointed wooden poles were therefore knocked into the ground expressly in the centre of the gully. A number were washed out of the vertical but remained in position and were preserved by being covered with sand. Other poles, however, must have been washed away during the second activity phase. The special placing of the poles must have been connected with their function. When we discuss the wooden objects we shall assume that they were used for fishing. Probably nets or traps were fixed to them [15].

4.4. PALYNOLOGICAL INVESTIGATION OF THE GULLY FILLING

4.4.1. The pollen diagrams

The palynological research was also conducted in the Molenaarsgraaf excavation by Mr A. Voorrips. The counts were made (as in the Hazendonk diagram) by him and Mrs. J. Mekelte Riet. The diagrams were completed in the same way as the Hazendonk diagram [16]. Both the following paragraphs were written in close collaboration with Mr Voorrips; the interpretation of the diagrams is his work, while the archaeological commentary is largely the work of the author.

The peaty gully filling lying directly next to the settlement offered ideal opportunities to determine the effects of human presence on the vegetation. For this purpose two profiles were pollen-analytically investigated:

Profile I, monolith from the north section of pit C8 (*cf.* fig. 63 b).

cms below NAP	
— 110	surface
	clay
— 134	
	wood peat
c. — 170	
	weathered reed/sedge peat
— 217	

[15] Cf. p. 236 and 300. An important find, not discussed here, is the *radius* of the skeleton of grave II, found in square b4. It comes from the humic layer (deposit 1) there. The find is very important for the chronological relationship of the graves and the settlement. *Cf.* the discussion at p. 253.

[16] We refer to our remarks at p. 137-138, notes 13-15.

Profile II, boring *c.* 10 m. south of the south section of pit C8 (*cf.* fig. 64 b).

cms below NAP	
— 270	clayey, weathered peat
— 295	sand
— 315	humic sand
— 340	

Both pollen diagrams show perhaps a slight overlap, so that the uppermost centimeters of Profile II are isochronous with the lowest centimeters of Profile I. The rise of *Quercus* and *Corylus* in the lowest part of Profile I can be identical with that in the uppermost part of Profile II, especially as these are the only places in both diagrams where curves for both types show the same direction and amplitude.

From a stratigraphic point of view there is not the slightest objection to this correlation; in fact, such a correlation was assumed, although it was also anticipated that Profile II as a whole could synchronize with the basis of Profile I. This appears, therefore, not to be so. The number of spectra from Profile II, especially from the lower half, is too small to permit drawing any important conclusions.

What we said in 3.3. (p. 137) about the vegetation on the *donken* applies, *mutatis mutandis*, equally to the natural vegetation on the stream ridge. In this river forest the oak dominates, while elm and ash occupy an important place. Extending down from the stream ridge, the forest changes, via a zone with ash and alder (the breadth of which is dependent upon the development and elevation of the clay wedges on both sides of the ridge) to the alder carr of the surrounding peat.

By combining both pollen diagrams five zones can be distinguished.

zone 1

This zone, a clear underwater deposit in view of the high values for *Lemna* (duckweed), is further characterized by high values for *Plantago lanceolata* (ribwort plantain) and constant quantities of *Cerealia* (cereals). On this account there is no doubt about occupation of the settlement terrain from the beginning of the formation of deposit 1. The low values — in comparison with zone 4 (Profile I) — for *Quercus* and *Ulmus* at the base of this diagram, show that the stream ridge at that time was already (partly) deforested. We can therefore conclude that the settlement already existed before the sedimentation began.

zone 2

In Profile II zone 2 shows great similarities to zone 1; as for the differences, more *Plantago major* (great plantain), *Artemisia* (mugwort), *Rumex acetosa/acetosella* (sorrel) and *Urtica* (stinging nettle) indicate that the plant growth had acquired more the character of a track vegetation. The general picture shows indeed that the deposit was formed at the height of the then average groundwater level. The gully, in other words, got filled up with sediment, at least at the site of the diagram. The site of the profile may have been used as marshy meadowland.

The decline of *Quercus* in this zone, although small, may indicate some expansion of the occupation of the stream ridge and a consequent continuation of the deforestation.

In Profile I a gradual lessening of the occupation intensity is apparent, together with a regeneration of the forest on the stream ridge.

zone 3

Zone 3, at the base of deposit 3, comprises a renewed occupation of the stream ridge near the gully. The intensity is lower than in zone 2, while the lack of *Plantago major* and the relatively low values for *Plantago lanceolata* and *Poaceae* (grasses) suggest that the bank zone of the gully was not in use during this phase.

zone 4

This zone comprises the upper part of deposit 3 up to and including the base of deposit 6. A thorough regeneration of the stream ridge vegetation takes place, which is complete at — 167 cm. At the site proper there is no occupation in this zone, but the continuous curves of *Cerealia* and *Rumex a-types* indicate that there was in fact a continuation of the inhabitation in the surroundings or in the region as a whole.

At — 154 cm. a slight increase in *Cerealia* and a corresponding decrease in *Quercus* indicates a period of intenser inhabitation of the district.

zone 5

Zone 5 comprises the upper part of deposit 6. It shows the picture characteristic of the general reclamation of the 11th and 12th centuries: a rapid increase of *Cerealia*, *Poaceae* and all herbs to high values, and a general decrease in all trees (particularly *Quercus*), with the exception of *Alnus* and *Salix*, as a consequence of the deforestation. Disturbance is here unlikely in view of the locally (and generally) present clay covering of (here) 30 cm. thickness. Some erosion of the peat surface during the deposition of this clay is possible, but it is not very probable, in view of the quiet circumstances in which the clay was deposited (*cf.* p. 192).

4.4.2. Archaeological commentary

In our discussion of the find material and particularly of the pottery, we shall distinguish three phases in the occupation of the settlement beside the gully (see p. 226). In the following archaeological commentary on the pollen diagram we shall employ these divisions and correlate these occupation phases with the pollen zones.

zone 1

Zone 1 is dated by the ^{14}C date at the base of zone 2 in Profile I, and by the *archaeologica* found in deposit 1 of pit C8. This gives an age before 1680 $\pm$ 30 and before phase 2 of the settlement. We may thus propose that with zone 1 the existence of phase 1 of the settlement is also demonstrated palynologically. The beginning of this first occupation phase occurs, however, before the beginning of the diagram.

zone 2

Zone 2 is dated by the archaeological remains found in the relevant deposit, which are representative for phase 2 of the settlement. The ^{14}C date: GrN 5176, 1680 ± 30 B.C. dates the base of this zone and forms a *terminus post quem* for the archaeological material.

Phase 3 of the settlement took place, in view of the position of the archaeological finds (*cf.* p. 184) in the uppermost part of deposit 1, at the end of zone 2.

The absence of any recognizable reduction of the anthropogenous influence in the pollen diagram in zones 1 and 2 indicates that there can be no question of a break in occupation of any duration. Brief pauses would not, however, be recognizable in the diagram. The considerable deforestation on the stream ridge in this period concurs with the cultivation of a strip of many kilometers long, as discussed on p. 109.

zone 3

Since, in phase 3 of the settlement, the bank of the gully formed part of the settlement terrain, zone 3 can hardly give evidence of (the end of) phase 3. The resumption of human activity can, on the other hand, be related to the occupation in the Middle (and Late) Bronze Age, which took place a few hundred meters east of the gully, and which left traces in the settlement terrain also and in the gully filling itself *cf.* p. 185 and 193).

By dating this zone in the (Middle) Bronze Age, the second activity phase of the gully (deposit 4) is dated to the transgression phase D 0.

zone 4

The complete recovery of natural vegetation at — 167 cm. is dated: GrN 5264, 760 ± 35 B.C. This accords with the inhabitation history of the Alblasserwaard: many Middle Bronze Age settlements are known, but only a few in the Late Bronze Age and we know only one find place from the Iron Age. For the slight revival of human activity at — 154 cm. only Roman times can be considered.

zone 5

The dating of the top clay after the mediaeval reclamations was confirmed during the excavation by the find of 16th century pottery on the bottom of a pit which was filled with this clay (p. 192).

4.4.3. Summary

In both successive pollen diagrams I and II five zones were distinguished. The occupation of the settlement beside the gully is documented in the zones 1 and 2. Zone 1, an initial filling up of the open gully, began during the first occupation phase. Zone 2 represents the phases 2 and 3. The forest vegetation on the stream ridge appears to have been largely cleared in order to lay out fields (for grain cultivation). No lengthy breaks in occupation can be evidenced. The Middle Bronze Age occupation is clear in zone 3. In zone 4 we see a complete revival of natural vegetation and an end to all inhabitation about 760 B.C. In zone 5 the (slight) reaction

of Roman inhabitation further away, and, on the top, the mediaeval reclamation. Fig. 120 (p. 272) gives the correlation between pollen zones, gully deposits, occupation phases, and ^{14}C dates.

4.5. SOIL TRACES

4.5.1. Short Survey

On the excavation map the following features can be distinguished:

— a number of (very) recent (test) pits,
— a number of large 16th century sand digging locations,
— a hearth with clay lumps from the Middle Bronze Age,
— a number of older pits,
— a large number of post holes (post traces), chiefly from two houses, and a very large number of very small or very shallow discolourations,
— a few small trenches,
— a concentration of (rolling) stones,
— three graves with interments and a cenotaph,
— an ox's skeleton,
— the bank zone of the break-through channel.

4.5.2. Test Pits

The five or six small, rectangular or L-shaped pits, dug by members of the work-group "Lek en Merwestreek" of the AWN, are all indicated on the excavation plan [17]. Their small extent (about 1×2 m.) caused hardly any loss, which would certainly have happened with bigger pits. On the bottom of one of the pits post holes were still preserved.

4.5.3. 16th Century Sand Pits

The eastern part of the settlement site immediately bordering the gully was seriously disturbed by a large number of more or less rectangular pits measuring 1-2.5 m. wide and 2-10 m. long. The largest clearly consisted of several smaller pits. The smallest pits were carefully rectangular and had vertical or even receding walls, undermined by washing. The lay-out of the pits is clearly parallel to the gully in the east, but in the west more at right angles to the ridge. West of the present day ditch there is only one such pit. The pits were mostly filled with very heavy clay, which contained a large admixture of sand on the highest parts of the site, and in the lowest parts had become peaty, especially at the base. Along the edges, but also sometimes on the bottom, a primary filling of a dirty-grey to dark grey loamy

[17] It is necessary to dig test pits everywhere in the Alblasserwaard, because of the 30-40 cm. thick clay cover.

sand occurred in nearly all cases; in our view, this consisted chiefly of material of the grey "occupation layer", tumbled down when the fresh sides of the pits were subjected to erosion. Here (as will appear below: in secondary position) there were a number of BB and BWB sherds. Often large and small clods of clay were recognizable in the base of the filling, and also traces of the holes of fairly large animals (rats ?).

Fig. 69. Molenaarsgraaf. Glazed brown pottery, dated in the 16th century A.D., from the bottom and the fillings of the subrecent farmer's sand pits. Scale 1:2.

The total impression was that we had to do with very young pits. This, however, was not confirmed until the second operation, when on the floor of one of the pits in excavation pit B9 a few sherds with a pinched-out footring and a greenish-brown glaze were found (fig. 69). Also in the filling there were a few small sherds of this pottery, apparently originating from the 16th century [18]. Bones which must originate from one cow also lay in and under the filling of this pit; they were not in any anatomical relationship, so we must assume that the animal was slaughtered on the spot. The state of preservation of the bones differed considerably from that of the bones in the settlement site and in the gully.

A former owner of the land on which the pits B6-9 were situated apparently profited from the presence of sand on the rear part of his land. Until the end of the 19th century very little care was taken of this land and it was not especially drained. The cubic capacity of the pits is approximately that of a cartload of sand, which could be transported via the "rear quay" of the polder. Fortunately his western neighbour was not so enterprising.

During a survey for a reallotment road being constructed over this ridge in the Goudriaan polder many such pits were found in numerous parcels of land. We must, moreover, realize that farmers up to about 50 years ago were in the habit of burying cattle that died in the countryside on the spot where they were found. This place very often was the high and dry sand ridge where cows prefer to rest. A few such fairly recent pits were also found during both excavations at Ottoland. In both cases one of the pits also contained the remains of an animal that had died there and was buried on the spot. Large parts of the skeletons were undisturbed, but others were detached, from which the (well-known) fact must be assumed that in those times such corpses were partly used for consumption.

It must finally be observed that the ditch cutting through the excavation site, judging by the pit distribution, existed already in the 16th century, when it was most likely a boundary between properties.

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[18] Mr C. Hoek, Rotterdam, stated that the sherds could not be older than the end of the 15th century A.D. Mr H. Sarfatij, Amersfoort, thought that they might be as late as the 17th century. Since the date of the sherds forms a *terminus post quem* for the clay cover, it is most reliable to take the oldest age. The pottery itself has a light red (2.5 YR 6/8) colour, dark yellowish brown (10 YR 4/4) where it is glazed.

4.5.4. Middle Bronze Age Remains

In the eastern part of excavation pit A8, within both house plans, a concentration of charcoal showed up in the top of the grey occupation layer. The charcoal appeared to come from a shallow pit (no. 29) which could still be made out in the occupation layer and must therefore have been dug relatively late in the history of the settlement. Most of the charcoal clearly came from large blocks and branches. In between was a large quantity of lumps of lightly baked loam, at least some of them fragments of weights, judging by the shape and traces of perforations.

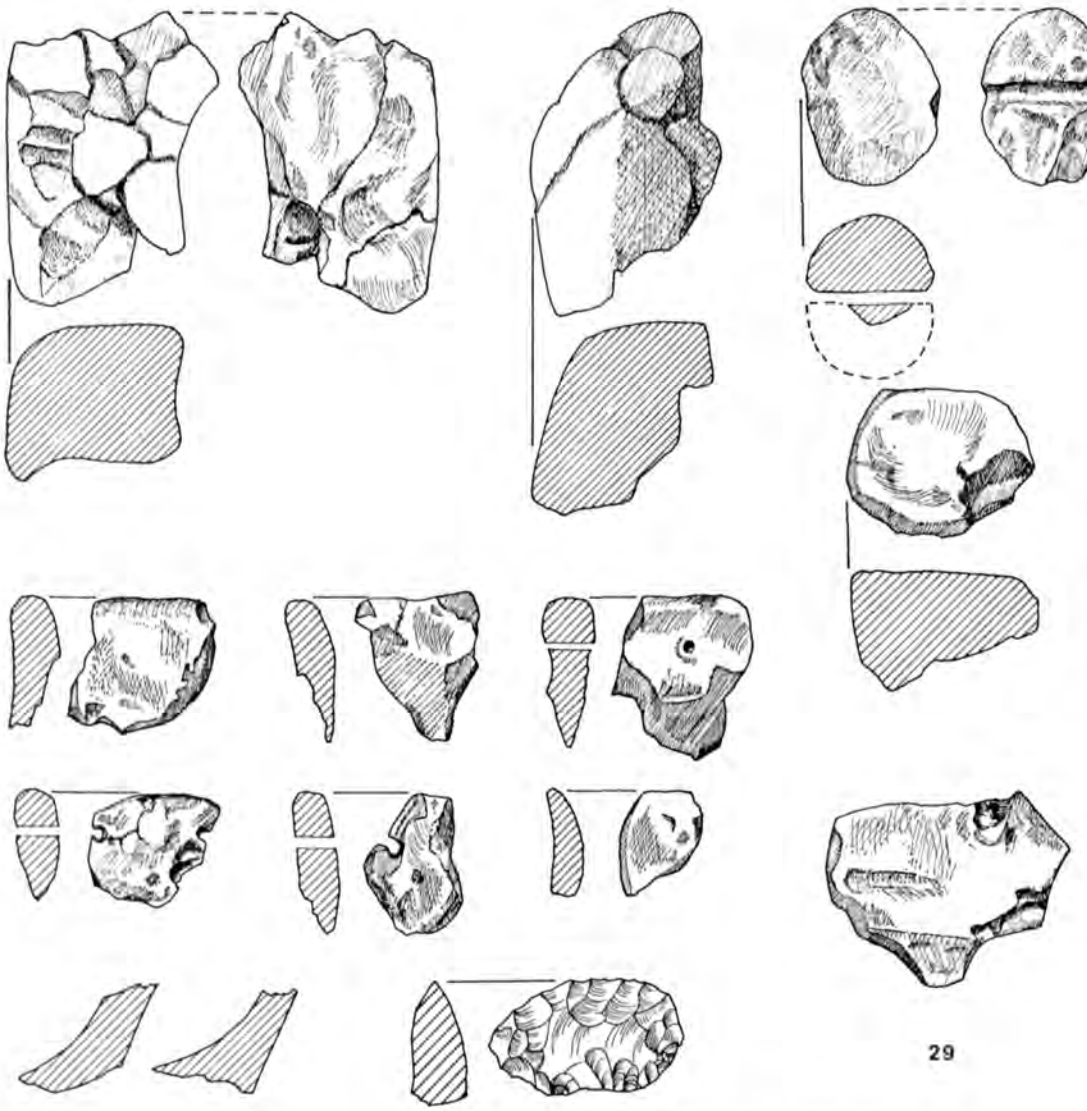

Fig. 70. Molenaarsgraaf. Fragments of loam weights, sherds and a flint scraper from the small Middle Bronze Age hearth place no. 29. Scale 1:2, scrap r 1:1.

A few sherds from the hearth give an archaeological date. They are very pale brown (10 YR 8/3) [19] to reddish yellow (5 YR 7/6) in colour, with sometimes a dark gray (7.5 YR 4/0) coloured centre. They are badly fired, untempered or only slightly tempered with pounded pottery or broken quartz, and fairly thick (8.5-16.0 mm.). A number of thick round rims with small perforations and a somewhat thinner, outward-bent rim are illustrated in fig. 70, as well as a few base sherds. All sherds are undecorated, except for two, on which a few coarse, shallow impressions are to be seen. Among the settlement pottery there are indeed a few sherds which are comparable for technical reasons, but the rim shapes and the decorations do not occur here. A flint scraper, white in colour and crackled by firing, differs by its flat retouches from the scrapers from the settlement, and is situated in a marginal position in the diagrams of the scrapers (figs. 96-97). Although neither the sherds nor the scraper are very characteristic, a Middle Bronze Age dating seems most likely, chiefly because of the similarity of the sherds to DKS pottery. A ^{14}C date gives a confirmation of this supposition:

Molenaarsgraaf no. 29 GrN 5177 3350 $\pm$ 35 B.P. (charcoal) (1400 $\pm$ 35 B.C.).

Since the charcoal generally came from rather large blocks this value might be some decades older than the moment the pit was dug. The small hearth is, at any rate, a later (MBA) element in the former VBB/BWB settlement site.

We pointed out in Part II (p. 113) that apparently the break-through channels lost their attraction and that no settlements were founded along their banks in the Middle Bronze Age. But the hearth no. 29 proves that the channels were visited incidentally, perhaps by a fisherman who merely fired a few weights near his fishing ground. The find tallies with a number of other indications of Middle Bronze Age occupation in the immediate neighbourhood (*cf.* p. 174).

4.5.5. Small Discolourations and Post Holes (Pl. II A, B)

Numerous small discolourations are partly traces of poles, but partly old holes of moles and mice. We are dealing with all soil traces which cannot be regarded as pits, and which are clearly to be distinguished from them in spite of their great variations in measurement, form and colour. The diameters vary from 34 $\times$ 34 and 24 $\times$ 48 cm. to smaller than 4 cm. The shape was generally circular; only the largest traces were sometimes oval or rectangular. Aminal and root activity have generally made bulges and other irregularities in the biggest traces. The depth beneath the highest level, where soil traces were preserved, was small : in one case 50 cm., otherwise less than 35 cm. The original depth reckoned from the former surface (the top of the grey layer), was about 30 cm. more, or 65-40 cm. In vertical section the traces were mostly rectangular with flat and round bases. A sloping direction was noted only in the smallest traces. We can therefore state that the majority of the discolourations took the form of long or short cylinders, if they went deep enough to make their shape observable. The colour varied from very dark grey to very light grey. In general the large traces were fairly dark in colour and the traces in the centre of the settlement were darker than those at its perimeter.

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[19] Colour Code of the Munsell Soil Color Charts.

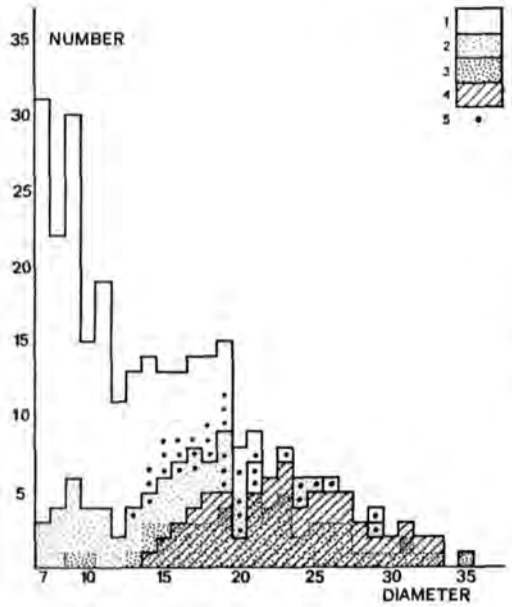


Fig. 71[a]. Molenaarsgraaf.

Diagram, showing the relation between diameter (in cms) and number of all "small discolourations" in the Pits A 8-9 and Z 8-11. For each diameter the mean has been plotted of the number of post holes of the value itself plus the numbers of both adjoining values, in order to reduce fluctuations.

For example : diam. 14 cm. : 11, 15 cm. : 19, 16 cm. : 8 postholes listed.

Plotted at 15 cm. is $\frac{11 + 19 + 8}{3} = 13$.

Legend :

1. depth 0-10 cm.
2. depth 11-19 cm.
3. depth 20 cm. or more
4. post holes of houses I and II
5. discolourations in the Pits Z 8-11, comparable to the postholes of the houses

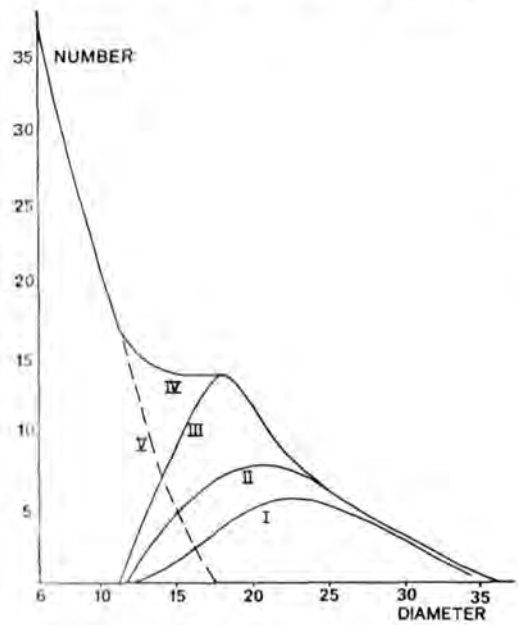


Fig. 71[b]. Molenaarsgraaf.

Graph, generalization of the diagram fig. 71[a].

I : post holes houses I and II
II : I plus the comparable discolourations in Z 8-11
III : all post holes (group a)
IV : all "small discolourations" (a + b)
V : all very small plots (animal holes, group b)

The colour of the post holes did not differ from that of the occupation layer at the same place. The post holes probably had acquired their colour in the same way as the occupation layer. A small number of traces, scattered around the settlement, were very light in colour.

All small discolourations have been sectioned, measured (diameter and depth) and registered in lists, with annotations on pecularities. With the help of this a work-map was made at the end of the first operation. After the second phase the map was completed with new data.

An over-all view of these soil traces is given in the diagram (fig. 71[a]). All the soil traces

from the excavation pits A 8-9 and Z 8-11 are contained therein. Data from pit A 10 are not included, as only a very large number of very small soil traces occur there. Pits B 6-9 were unsuitable for inclusion because of the great disturbance to which they had been subjected. Traces smaller than 6 cm. were ignored as they are very numerous, often very shallow, difficult to measure and only listed as "little spots". For each diameter the mean value has been plotted of the number of post holes of the value itself plus the numbers of both adjoining values. In this way we have largely eliminated the excessive fluctuations in the diagram used earlier [20], which originated mainly from a preference for certain values when measuring, especially *e.g.* 6, 8, 10, 12, 15, 18 and 20 cm. as diameter. Within the columns a division has been made according to depth ($\leqslant$10, 11-19, $\geqslant$20 cm.). The diagram has been generalized into a graph (fig. 71[b]).

The diagram shows clearly what was already suspected during the excavation, namely that we are concerned with two groups of soil traces of different character. The curve for the total number of soil traces may be seen as an addition curve of

a) a group of soil traces roughly distributed according to a curve of probability with extreme values at about 13 and 35 cm. and a top at a diameter of about 23 cm.
b) a group with mainly very small diameters and small numbers with larger diameters with a maximum of about 17 cm.

The existence of these groups appears to be confirmed by the depth division. This also expresses an obvious relationship between diameter and depth.

In the work-map mentioned the plans of two houses were determined. The soil traces used for this are also given in the diagram. The distribution of these post holes is the same as that of the soil traces of the above group a. This group as a whole may therefore be said to be formed by post holes.

A number of soil traces in group a, *i.e.* post holes, does not belong to the house plans. A part of this number, mainly of relatively small measurements, is located within the site of the house plans. A larger part, however, is scattered over the western part of the excavation (Z 8-11), but can hardly be combined in any plan. Perhaps we are here concerned with the remains of a third construction. These post holes are also indicated in the diagram.

As for the small soil traces of group b, we can be brief. In view of the sloping or even irregular section of several of them they are almost certainly not post holes but the holes of animals, although one cannot exlude the possibility that a few of them are in fact traces of posts. However, as there is a total lack of any regular configuration of these discolourations this is unlikely.

4.5.6. House Plans.

4.5.6.1. *Construction of the plans*

In the concentration of post holes in the western part of the excavation (pits A 8-9 and the east of Z 8-9) there is at first sight little connection to be found. It is clear that we are concerned

[20] This diagram is not illustrated here. See also the explanation of fig. 71[a].

neither with rectangular nor round dwellings; even after an intensive study of the work-maps no plans of such houses can be made. The post holes have, however, the same dimensions as the post holes, which have been found generally in the Western Netherlands and also elsewhere in similar cases in house plans. There are, moreover, various lines (rows of post holes) visible on the map, which were also noticed in the field. The fairly small excavation pits provided, however, too small an overall picture to enable our ideas about them to be worked out fully in the field. Finally, the regular distance of about 3 m. between the post holes is noticeable.

Without much difficulty the majority of the post holes can be grouped as parts of the plans of two large houses of similar shape. Starting from both axis lines of these houses and the easily recognizable slightly curved southern walls, we can recognize the northern walls easily by symmetrization. A number of remaining, heavy posts stood regularly spaced out in the aisles of house II and, in this wider house, will have been a part of an extra roof support. Finally there remain only a few post holes, and of these only one or two have a larger diameter than 20 cm.

The measurements of the post holes appearing in both house plans are recorded in two diagrammatical sections (fig. 74), in which at the same time an occupation layer of 30 cm. is drawn in order to indicate generally the original surface and the original depth of the post holes. The thickness of this occupation layer is the reason why only traces of the heavy posts which supported the roof have been found. The wall construction apparently descended to too shallow a depth.

The dimensions of both houses are listed in table 15.

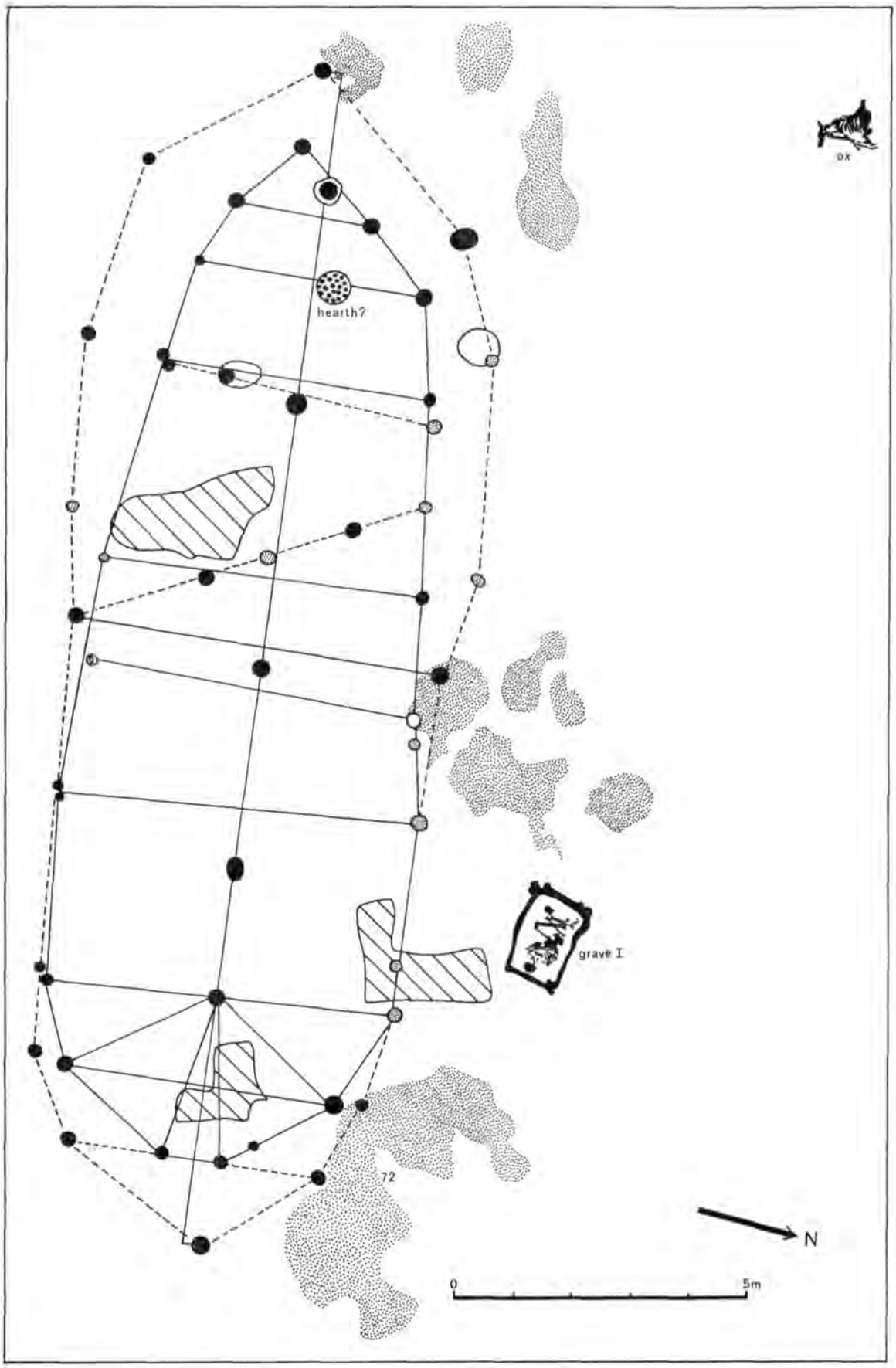
TABLE 15

Molenaarsgraaf. Houses, dimensions

	Length	Max. width
House I (A)	17.40 m.	6.00 m.
(B)	20.50	6.20
House II	>18.80 (c. 23 m.)	6.80

4.5.6.2. *House I* (fig. 72)

House I is almost exactly orientated in an east-west direction, it has two aisles and is oval in shape, with a broad round end in the east and a narrowing western extremity. In the middle the heavy supporting posts of the ridge-pole stood in an exactly straight line, 3.20-4.60 m. from each other. Outside the ends, in both cases 1.40 m. away from them, there stood another heavy pole not in, but 20 cm. alongside the axis line. The wall posts were all placed opposite each other, but not opposite the central poles. They were probably also supporting the roof construction. In both walls the poles near the extremities of the house were much closer together (to a minimum of 1.00 m.) than in the middle (to a maximum of 3.20 m.). The eastern end


ox
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72
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takes the form of an exact semi-circle. The situation of two posts on either side of the axis line suggests an entrance here of about 80 cm. width. The western extremity is clearly asymmetrical; no entrance can be pointed out here. Around both extremities the traces of a ring of poles was found, but its function is not clear. At the eastern end the regular placing of the posts of this ring follows fairly closely the semi-circular extremity. In the west the ring of posts is much wider and its relationship with the wall posts, although present, is less clear. It cannot be decided whether this is a case of a later extension of the house, or a construction forming part of the original house. In the latter event one imagines the poles may have been placed at an angle outside the house to support the roof. Such a construction can, however, have been added later. It is even possible that these posts mark the real wall and the rows of posts described above as the wall were in fact posts within the house.

4.5.6.3. *House II* (fig. 73)

House II has been only partly preserved. It is orientated in a WNW-ESE direction and like house I has an oval, or more accurately a spool-shaped, plan. The south-east end was lost during the digging of the ditch running through the middle of the settlement, while near the north-west end the soil traces are very vague, apparently because the sediment here becomes somewhat clayey. The supporting posts in the axis line of the house stood in an almost perfect straight line but the distances between them vary considerably (2.00-5.40 m.) In this house too the wall posts were opposite each other. The distance between posts in one wall gradually increases from 1.80 m. at the north-west end to a maximum of 3.20 m. in the middle of the house. In both aisles there were a few posts which also must have had a load-bearing function. These stood in pairs at 1.00-1.50 m. on both sides of the central axis and approximatily in one line with a pair of opposite wall posts. The pairs stand very far from each other: 5.00-5.60 m. By reason of these rows of posts the house may be said to have had four aisles, with a central aisle (divided into two) of a maximum of 2 × 1.50 m. = 3.00 m. in width, and side aisles of a maximum of 1.80 m. in width.

The house plan can be made out over a length of 18.80 m. The original length was certainly not more than 26 m. and probably about 23 m. as the following arguments show.

— The house is a somewhat bigger and in particular more regularly built version of house I. It must have resembled house I also in the missing parts.

— In view of the course of the walls and the shape of the western end of house I, the corresponding (north-west) end of house II must have lain within a distance of 2 m. from the westernmost mapped posts.

— At the east of the ditch we have insufficient evidence of the continuation of the house, although an occasional post indeed lies in line with a row of poles. An extremity of the house cannot in any case be identified in pit B 8, so that we must assume that it must have been situated where the ditch now lies. In that case the house must have been at most 5 m. longer in a south-west direction. The soil traces in pit B 6-9 must have been caused by other structures which are difficult to make out because of the 16th century diggings.

— The south east end was possibly semi-circular, as it was in house I. It is noticeable that both south-east load-bearers of the roof-pole stand relatively close together, as they do in house I.

Fig. 72. Molenaarsgraaf. House I and surrounding features, preceding house II.
Dark grey postholes in black, grey ones dotted. Scale 1:100.

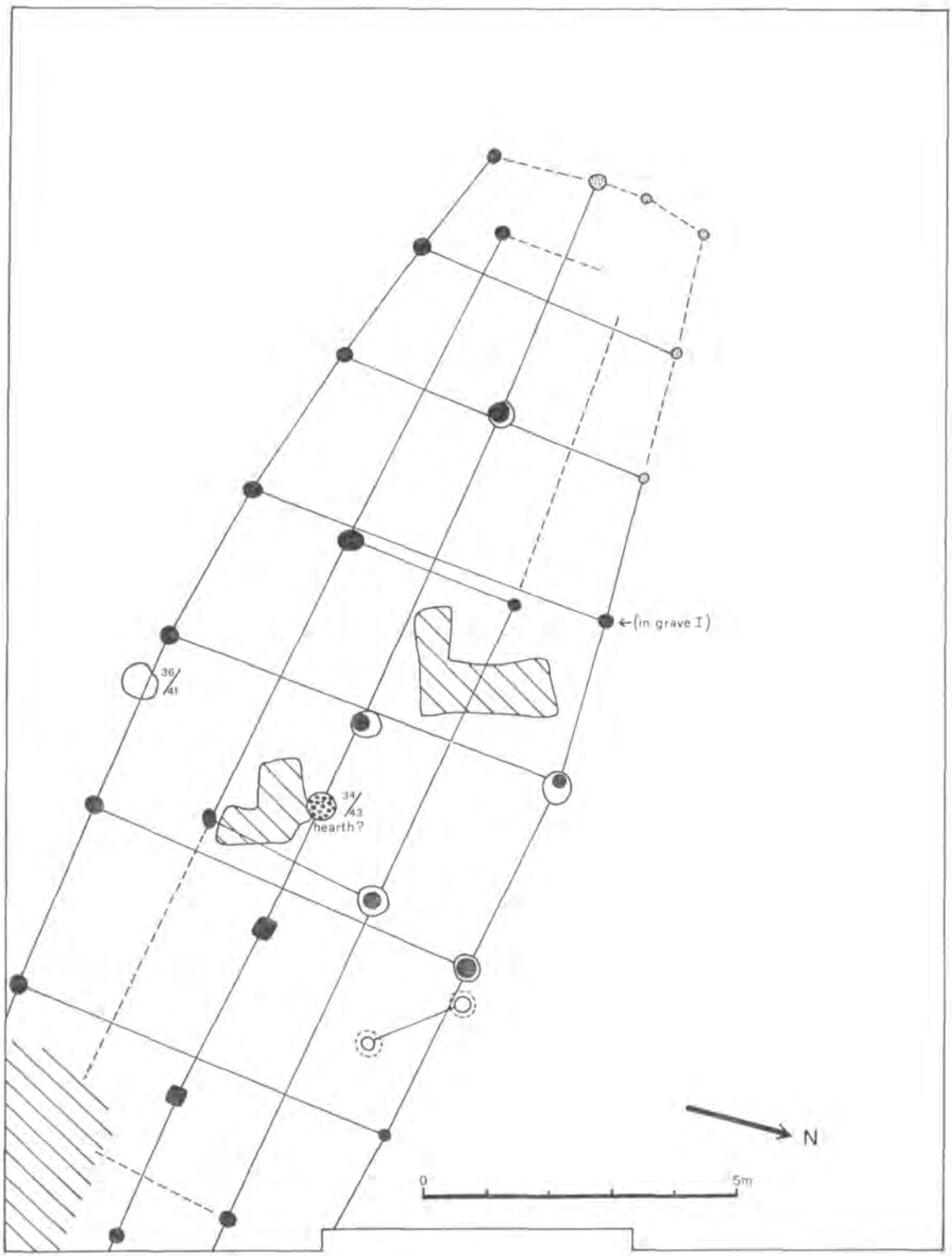

Fig. 73. Molenaarsgraaf. House II. Two big post holes with unknown function are also indicated. Scale 1:100.

4.5.6.4. *Comparison, construction and sequence of both houses*

In spite of some differences the similarities of both houses are so great that we may speak of two variations of one type, and of a typological development from house I to house II. For they correspond in dimensions, in the oval (spool-shaped) plan and in the measurements and position of the posts. These similarities become particularly clear if transparent paper plans of the two houses are laid one over the other.

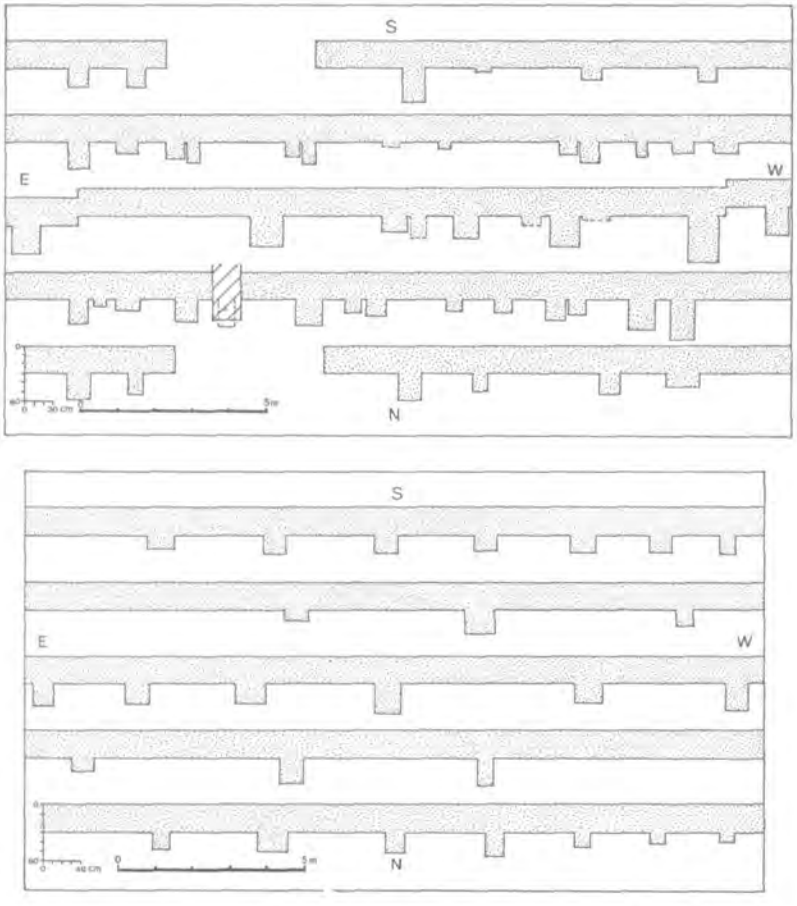

Fig. 74. Molenaarsgraaf. Sections through the post holes of house I (above) and house II (below).
The top of the grey occupation layer of about 30 cm. gives approximately the former occupation surface.
The long scale (1:200) refers to the distance between the post holes, the small scale to the post holes themselves.

Something can be said about the construction of the houses. Since the wall posts were placed in pairs a crosswise connection of them seems likely, but there is no obvious relationship to the central posts. When the wall posts (like certainly was the case with the central posts) were covered lengthwise by horizontal poles, then the rafters needed not to correspond to any of the verticals, although there might have been a relationship to the wall posts. The extra posts in house II were certainly connected crosswise, since they were placed in pairs. They were

probably also connected with the wall posts, that were in one line with them. When these extra pairs were also covered by horizontal poles in the lengthwise direction of the house, this would yield maximum profit of their presence. Although the houses are not directly dated by finds in the post holes, we will demonstrate below that house I is older than house II. The development was in the first place a constructional change by the placing of load-bearing poles in the side aisles necessitated by the greater breadth. Second, a more regular placing of the poles, and third, a greater length.

As the ground plans of both houses are largely superimposed on each other it is impossible that the houses existed at the same time. This makes it even unlikely that the one house is the direct successor of the other, unless we suppose that the first house was broken down. It is more likely that they are separated by a (short) hiatus, during which a house might have been built elsewhere on the site (for instance more near the gully, in the disturbed part) or the site might have been abandoned.

There are a number of indications that make it apparent that house II was built later than house I.

— The north wall of house I forms a southern boundary for the series of pits b. Furthermore, the situation of grave I between these pits is such that we must assume contemporaneity. There are no arguments which contradict the assumption that these three elements—house I, grave I and pits b. form a chronological unit. The diggers of grave I took in account the situation of the pits, or the diggers of the pits respected the grave. As far as the relationship with house I is concerned, it is most probable that the pits were dug next to the house. The exact sequence unfortunately cannot be determined. Yet it would be interesting to learn whether the grave was dug next to the house and during its occupation or after it was abandoned, or the other way about, so that the house was built in the cemetery next to the grave. The first alternative seems to be more likely. In this view house I is contemporaneous with, or slightly older than grave I.

— Post holes of house II can be made out in the filling of the pits of group b. One of the posts of this house was even placed into the filling of grave pit I. It is therefore probable that the builders of house II were not aware of the (exact) location of grave I. There must accordingly have elapsed some time between the burial in grave I and the building of house II.

— One post hole from house I, in the middle of the north wall, showed up under the pit filling. Two other posts, however, belonging to the outside circle, appeared in the edge of the pit filling. What significance such traces in the edge of a pit filling have at our site, however, we are unable to judge. We do not regard these observations as being of much importance.

4.5.6.5. *Other post holes*

First, we draw attention to a pair of large posts at the north wall of house II and indicated at fig. 73. After the construction of the house plans both post holes were the most conspicuous of the few post holes that could not be fit into the plans. They are perhaps the traces of a special construction, of which we only can say that it cannot be contemporaneous with house II [21].

[21] A similar pair of large posts was found outside the house at Gwithian, belonging to Layer VIII, and dated by sherds of European Bell Beakers. The author suggests: "it may well be the supports for a corndrying rack". Simpson in Simpson (ed.) 1971, 138.

In the pits B 6-9 much has been lost because of serious disturbances and considerable activity by moles in the preserved intermediate sections. Together with a large number of unimportant traces a limited number of big post holes can be seen. Most of them seem to lie in a few straight, or slightly curved, lines which cross each other at right angles. The distances of 3-4 m. between them are common, as with the house plans. Although it is therefore clear that considerable structures must have stood here too, it is difficult to say anything of their nature. We said above that no continuation of house II was recognizable southwards, although a few poles are correctly aligned. Apparently there is some question of one or more (smaller ?) buildings and perhaps an occasional fence. We cannot exclude that in a certain phase of the settlement even the main house was built here.

Outside both house plans the number of post holes in the western part of the excavation is fairly small. Only to the west of house I did we find a small group. It is, however, impossible to make out a house plan with any certainty there. But some traces might be missing and this post hole concentration might indicate a former house site or an additional building to house I or II.

This post hole concentration is of special interest since we will demonstrate that they might have to do something with the earliest phase of the occupation of the settlement, when we discuss the finds. First, the post hole group is situated in a pit-free zone: to the north we find the pit group a, to the south a few small round pits. It is likely that we have to do with generally contemporaneous phenomena. The pits of group a are dated by their (few) finds as an early group. Second, we will demonstrate by means of the distribution of the decorated sherds, that the oldest (VBB) occupation concentrated more in the west than was the case in the later phases.

4.5.7. Pits

All the pits indicated on the map are drawn as they appear in the highest level in which soil traces were preserved, about 5 cm. below the base of the grey occupation layer, *i.e.* about 35 cm. below the former surface. The pits therefore appear to be smaller on the map than they were during the inhabitation and the less steep the inward slope is, the more is this the case.

The pits are irregularly distributed over the settlement site, but occur especially on the highest parts of the ridge. They only seem to avoid the site of house I. It is possible to distinguish a few groups of pits having similar characteristics, namely:

(a) A few generally oval pits near the ox skeleton and the western end of house I. The dimensions vary from 80 × 160 cm. to 120 × 220 cm. Two pits have been considerably disturbed by recent root activity, so that they are very irregular in shape. Most pits have, moreover, a humic centre, in which they differ from the majority of other pits. They can clearly be distinguished, however, from the 16th century sand digging places: on the highest parts of the terrain the filling of the last is very sandy, while their outline is much sharper. We believe that in the pits dealt with here there was considerable biological activity (roots, animals) above and in the somewhat loamy and wet pit fillings, in the midst of an occupation layer that had dried out as hard as cement. Above we made some remarks on the relation of these pits to the concentration of post holes in the western part of the excavation.

(b) A few irregular and shallow depressions in a 13 m. long and 5 m. broad strip near grave I. The diameter of these pits is at most 2 m. We discussed above the relation of these pits to the houses I and II and to grave I.

(c) A few large round pits near the bank of the gully and grave II. The diameter is 160-180 cm., the inward slope is steep and they are deep. Pit 210 is especially unusual because of its steep slope, its flat base and the abundant traces of burning. The pit was certainly dug as a part of the burial ritual (*cf.* p. 257). The other pits are more irregular. In view of the whole situation and the concentration around the grave a contemporaneity in a general sense with this grave seems probable. This is supported by the finds from these pits (p. 218).

(d) More than 20 small round pits spread over the whole terrain. The diameter is 45-100 cm.; the inward slope is fairly steep. A few occur among the above-named groups a and b. The position of these pits is such that we cannot attribute them to any particular phase of the occupation. We can only say that they must belong at least to the house I phase.

(e) Four pits within the plan of house I (36/41, 34/43, 44 and a small pit in the west of the plan) require some special remarks.

— Pit 34/43, a small round pit with a diameter of about 50 cm., appeared already high in the section, the finely dispersed charcoal colouring the filling black. As such this small pit is identical with the much larger pit 27/211. The situation on the axis line of house II and presumably fairly in the middle of the house makes it probable that the small pit was dug in the vicinity of the hearth of this house, or even was part of it.

— Pit 36/41 was not exactly round and contained no charcoal, yet was very dark in colour. The pit adjoins the house II wall.

— Pit 44, a perfectly round pit with a diameter of 100 cm. and a light grey filling, contained no finds other than some fragments of the large loam weight no. 44 shown at fig. 94. The pit lies within both house plans but cannot be attributed to either. Although the loam weight suggests this strongly it is not likely that this pit can be grouped with hearth no. 29, the weights of which are of a totally different type, and in no. 44 there was neither any trace whatsoever of charcoal nor any other find.

— The small pit west of house I, where no finds were made, strongly resembles no. 34/43. The filling is blackened by finely dispersed charcoal. Because of its unusual situation we may think here too of a proximity to the hearth of house I. The finds derived from the pit fillings and their dating consequences are discussed below (p. 218).

4.5.8. Trenches

At the perimeters of the small settlement site a number of small trenches can be distinguished. In view of their irregular course it is not certain whether they were dug by men or came into existence through natural circumstances.

The long trench running along the northern limit of the settlement site (a part has not been excavated) drained the stagnant water from an area with clay lenses at its beginning into the gully and certainly not along the shortest route. Also during the occupation the water on the place in question will have drained away more slowly; it is possible that the inhabitants were inconvenienced by this and so dug a drainage trench.

Along the southern boundary the terrain has a much steeper slope and the draining away of surplus water there will have been much easier. Here also a few, much smaller trenches drained the site.

We have no explanation for the remarkable little trenches near grave III. Did the water gather along them, to a place where the 16th century pit is lying now?

The nature of the trench fillings and the occurrence of a few small sherds in them indicate in any case that they were contemporaneous with the inhabitation.

4.6. THE FINDS [22]

4.6.1. General remarks

The following groups of finds may be distinguished according to the find circumstances.

— Finds from the grey occupation layer of the settlement site, named below "settlement finds" [23].

— Finds from the pit fillings in the settlement site.

— Finds from the filling of the break-through channel.

— Finds from the graves.

These groups may be characterized as follows.

— The settlement finds consist of material from the whole settlement period. In view of the dating of the stream ridge (about 2000 B.C.) pollution by older material can be ruled out. As for later pollution we have no evidence other than the Middle Bronze Age hearth no. 29. Among the settlement finds, however, there is no material directly comparable to no. 29. Furthermore, we know that the area was no longer inhabited after about 800 B.C. [24]. Later pollution can also be excluded, therefore, so that we may accept this as a true domestic assemblage from the transition period between the Neolithic and Bronze Age, with, as its only datable elements, sherds of Veluwe Bell Beakers and Barbed Wire Beakers. Sherds from the opening phase of the occupation will have largely been lost during its continuation but the closing phase will be relatively well represented by the pottery.

— In the pit finds we are concerned with a small number of very small sherds distributed at random throughout the pit fillings. These, in our view, did not lie in their primary position, but must have reached their position as a part of the sand that makes up the pit fillings.

— The gully finds might represent a part or the whole period of the occupation. They nearly all come from deposit 1 [25]. There is no later pollution.

— The grave finds are closed finds. As the whole cemetery occupies a fairly short time in the occupation period [26], the finds in the graves are broadly speaking contemporaneous.

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[22] The finds are registered in the RMO, nos. h 1967/1.1-368.

[23] The finds from the pits and from the gully of course are domestic refuse too, but these are excluded when we speak of "settlement finds".

[24] See p. 190, and the pollen diagram Molenaarsgraaf I, fig. 66. Description of the finds no. 29 at p. 193.

[25] Description at p. 220.

[26] See p. 270 for this question.

The quantity of material is exceedingly small, and comprises, with the exception of the grave finds:

9450 grams of pottery
64 lumps of loam (baked clay)
477 pieces of flint
55 pieces of worked stone
— a quantity of natural stone
338 pieces of bone
23 pieces of worked wood.

4.6.2. Distribution of the Finds over the Settlement Terrain

All settlement finds came from the occupation layer or from the primary filling of the 16th century sand digging pits. They were collected by digging away the occupation layer very carefully, so that very small objects could also be recovered. During the first part of the first operation the finds were kept together according to the excavation pit, while notes were made of the distribution within each pit. Later we changed over to collecting according to squares of 2 × 2½ m.

The poverty of finds is partly explained by the long time that the old occupation level formed the surface, while circumstances were unfavourable for the conservation of pottery: alternately more or less damp. Less perishable material such as stone is, however, also sparse, so that the poor number of finds must also be partly primary. Even under more favourable circumstances elsewhere a scarcity of finds is common in Beaker settlements.

The distribution maps (figs. 77-80) all show the same general picture: a concentration of finds over a strip of about 60 m. long by 9-15 m. wide, lying in an east-west direction, and coinciding with the highest and most sandy part of the ridge. This crest lies somewhat south of the ridge centre. Northwards the slope drops gradually and clayey layers are intercalated in the sand; southwards the slope is fairly steep. Eastwards the find strip ends against the break-through gully. Only in the west do the changes in the site occur gradually, like those of the finds. The site is in its most westerly part a little lower than in the centre of the settlement. It is only at the other side of the ditch limiting the excavation site that the ridge becomes significantly lower. The find distribution follows therefore the natural conditions of the site very closely.

The distribution patterns of the finds and the soil traces also correspond closely. The effects of later erosion can be left out of account. For the occupation layer is of regular thickness over the whole site, and the present very slight relief is mainly the result of the recent compaction in the surroundings. The extent of the settlement is therefore correctly shown on the maps. If we take the amount of find-material to be a measure of the intensity of the occupation, the western—the least favourable—part of the site was less intensively occupied (or for a shorter period) than the highest part. As both houses also stood there we may call this the centre of the settlement, which in the absolute sense was very small.

Although it is the correspondences in the distribution maps which are the most striking, there are nevertheless important differences, particularly in the extent of concentration. The

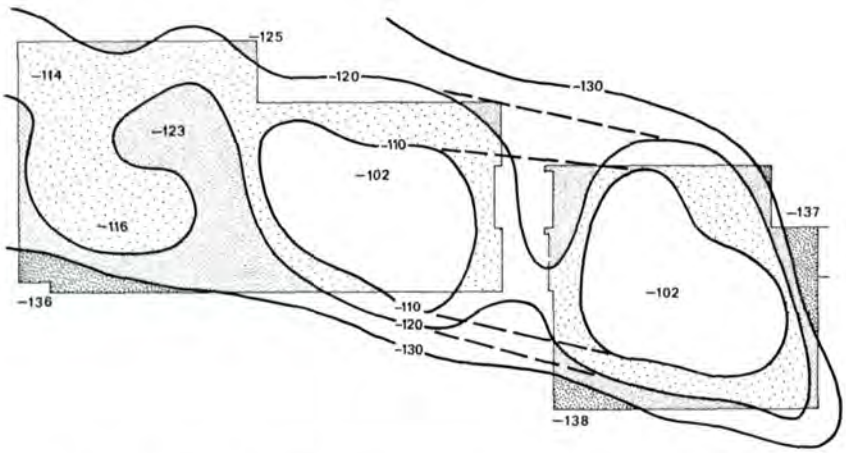

Fig. 75. Molenaarsgraaf. Contour map of the highest excavation level, situated 5-10 cm. below the base, 30-40 cm below the top of the "occupation layer" and 60-70 cm. below the present ground surface. Height in cm. below NAP. The broken lines represent the contour lines before the digging of the modern ditch. The core of the settlement corresponds with the terrain above —110 cm., which corresponds in its turn approximately with that above —60 cm. in fig. 58 and above —50 cm. in fig. 57. Scale 1:300.

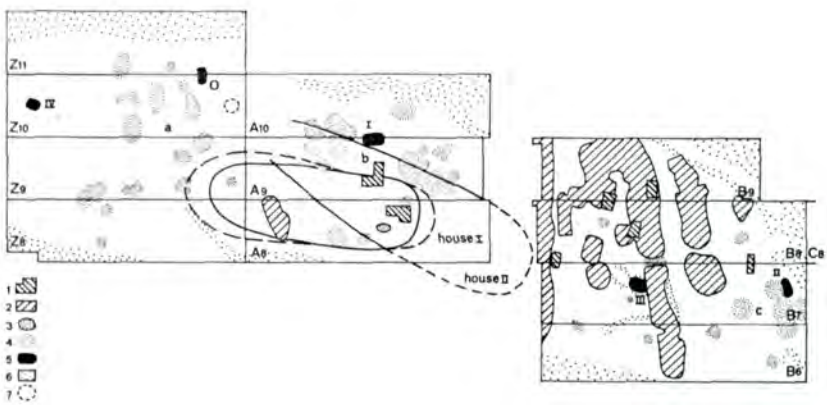

Fig. 76. Molenaarsgraaf. Outline of the most important features in the excavation.

1. test pits, recent
2. farmer's sand-diggings 16th century A.D.
3. hearth no. 29, Middle Bronze Age
4. other prehistoric pits
5. graves
6. lower part of the ridge with thin clay layers in the sand, the break-through channel and ditches
7. concentration of stones no. 308

pottery is strongly concentrated in a narrow zone having both house plans as its centre. The same applies to the large pieces of worked stone. The small pieces, however, are much more widely distributed. In the case of the flint there is hardly any question of a concentration. The loam occurs for the most part in the western part. These variations may be the result of differences in the method and/or place of use, but also of differences in age. We shall be reverting to this in more detail when we have discussed the distribution of the various types of deco-

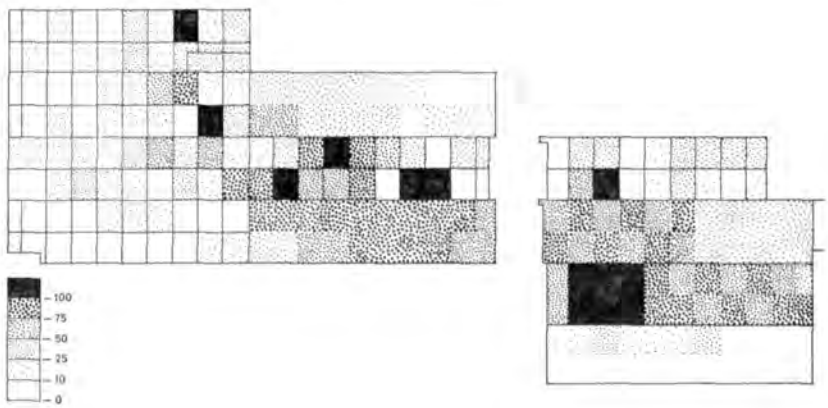

Fig. 77. Molenaarsgraaf. Distribution of the pottery. Weight of the sherds by squares and in grammes. Where the finds were not collected by squares, the total is divided according to the observations in the field. *In that case the squares are not separated by solid lines.*

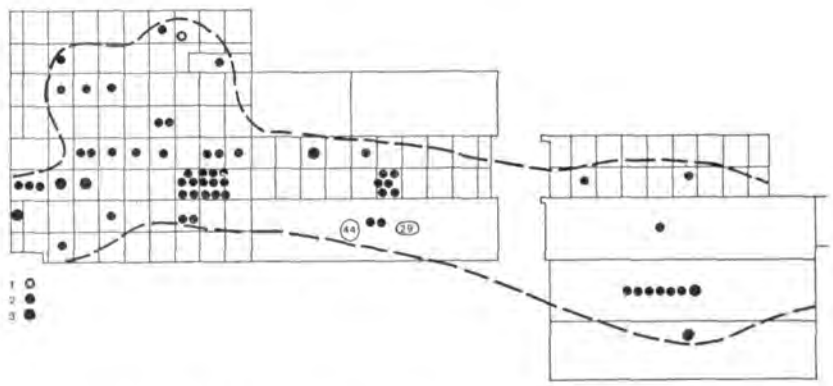

Fig. 78. Molenaarsgraaf. Distribution of lumps of loam, with the exception of very small fragments.
1. lump of potter's clay no. 365
2. relatively small lumps
3. relatively big lumps

rated pottery. That the differences cannot be explained by a difference in reaction to later replacement due to animal activity is clear from the variations in distribution of the loam and the pottery. A factor which was probably of importance was the influence of later occupation on the remains of a preceding occupation phase. If the part used as yard remained the same, the older refuse must have been considerably crushed, in so far as it is liable to damage (*e.g.* loam and pottery).

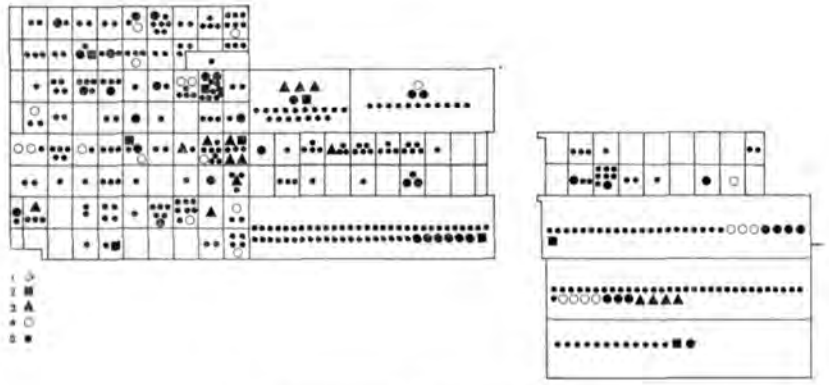

Fig. 79. Molenaarsgraaf. Distribution of the flint.

1. scrapers
2. borers
3. various artifacts
4. cores and irregular pieces
5. flakes and retouched flakes

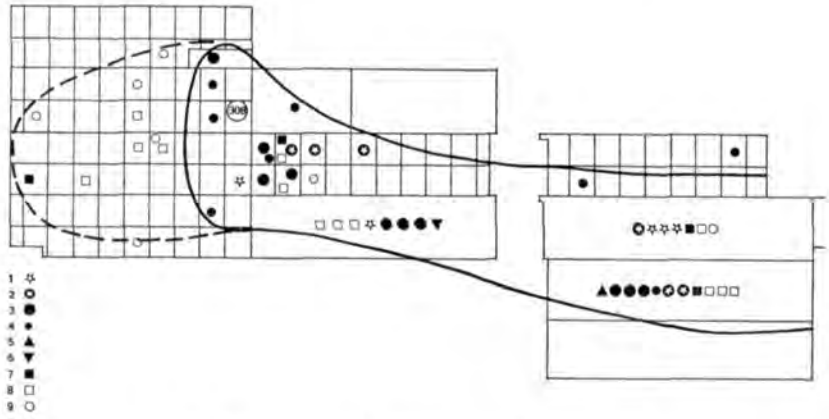

Fig. 80. Molenaarsgraaf. Distribution of the worked stone.

1. retouchoirs
2. quern stone fragments
3. ball-shaped polyhedrons
4. as 3, fragments
5. fragment of perforated axe
6. fragment of arrow-shaft straightener
7. grinding stone fragments (big)
8. grinding stone fragments (small)
9. various pieces of worked stone

4.6.3. Pottery

4.6.3.1. *General remarks*

In the pottery occur two archaeological elements which are datable:
— sherds of Bell beakers (BB)
— sherds of Barbed Wire Beakers (BWB)

BB pottery is the youngest Neolithic pottery in this country, dated between about 2000

and 1700 B.C. BWB pottery is the oldest Bronze Age pottery, less closely dated, but in any case used between about 1700 and 1500 B.C. We must, however, reckon with the possibility that there was a phase in which both types of pottery were used together although this could not be proved until now [27]. After the description the most important consideration will be the problem of the chronological differentiation of the pottery on the ground of its typology, associations and distribution. A differentiation into consecutive phases will then be compared with the chronology that we determined with the soil traces.

4.6.3.2. *Pottery form the settlement terrain*

Of the 8300 grams of pottery from the settlement site, 25.5% by weight is decorated. When counting the sherds, limited to the rim and base sherds, we reached a somewhat higher percentage (33%), which may be attributed to the average greater thickness and thus to the larger size of the undecorated sherds.

The fragmentary material yields little information about the forms. In general we are dealing with slightly S-shaped pottery without an accentuated bend at the neck or at the body. Only once do we find a sharply bent neck, in one of five sherds found together, tempered with quartz grit and decorated clumsily with rows of coarse impressions (fig. 84, upper row, middle). Although thicker, rougher and more clumsy than this, the profile strongly resembles that of the Necked Pot Beaker. At the bases we find both the true Bell Beaker base and the pinched-out protruding foot. Although all transitional forms occur, the first form seems to be limited to the finer pottery, while the last occurs in the thick pottery as well. The cordoned rim and a row of perforations below the rim are fairly common. Sometimes both occur in combination. We estimated that they occurred in about 20% of the rim sherds, of which about 35% were decorated, particularly with BWB impressions. The percentage of sherds with stone tempering was remarkably high (about 50%) in this group with cordoned rims and/or perforations. Impressions on top of the rim occur three times. Repair holes (made after the firing) are rare.

About the mean distribution of the decoration over the surface of the vessels the material gives no information. The occurrence of decorated base sherds shows, however, that also the lowest part of the pottery was sometimes decorated as well.

4.6.3.3. *Decorated pottery; decoration types* (figs. 81-85)

The decorated pottery was sufficient to demonstrate a number of decoration techniques and motifs, and to construct a table (table 16) giving a quantitative survey of these. On the other hand the number of sherds is so small that it was possible to give drawings of most of them. The decorated pottery is fairly varied, from thin, fine pottery to very thick-walled and coarse pots. The thickness varies from 4.5-13 mm. (generally 6-11 mm.), the colour is mostly pale yellow or light orange. The tempering, where it can be identified, consists in most cases of pounded pottery. In about 20% of the sherds, and occurring with all the decoration types, small stones were present, but in only about 10% we may really speak of tempering with fine gravel or quartz grit. The lack of stone in the area certainly influenced the material used for tempering.

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[27] This problem is discussed in detail in paragraph 4.9.3.2, p. 288 f.

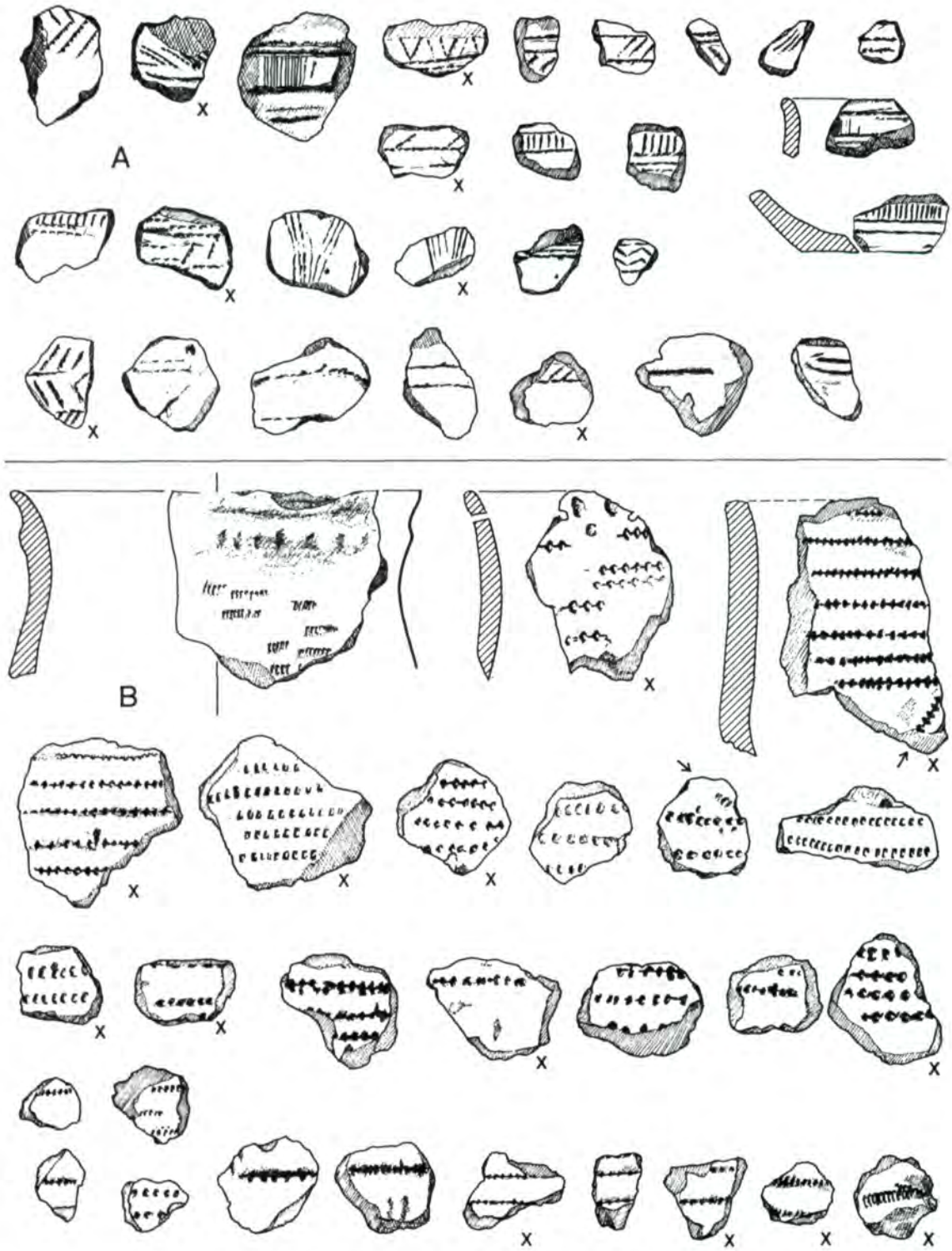

Fig. 81. Molenaarsgraaf. Pottery from the settlement terrain.
Sherds tempered partly or exclusively with stone grit are indicated with a ×. Scale 1:2.
A : BB pottery. B : BWB pottery.

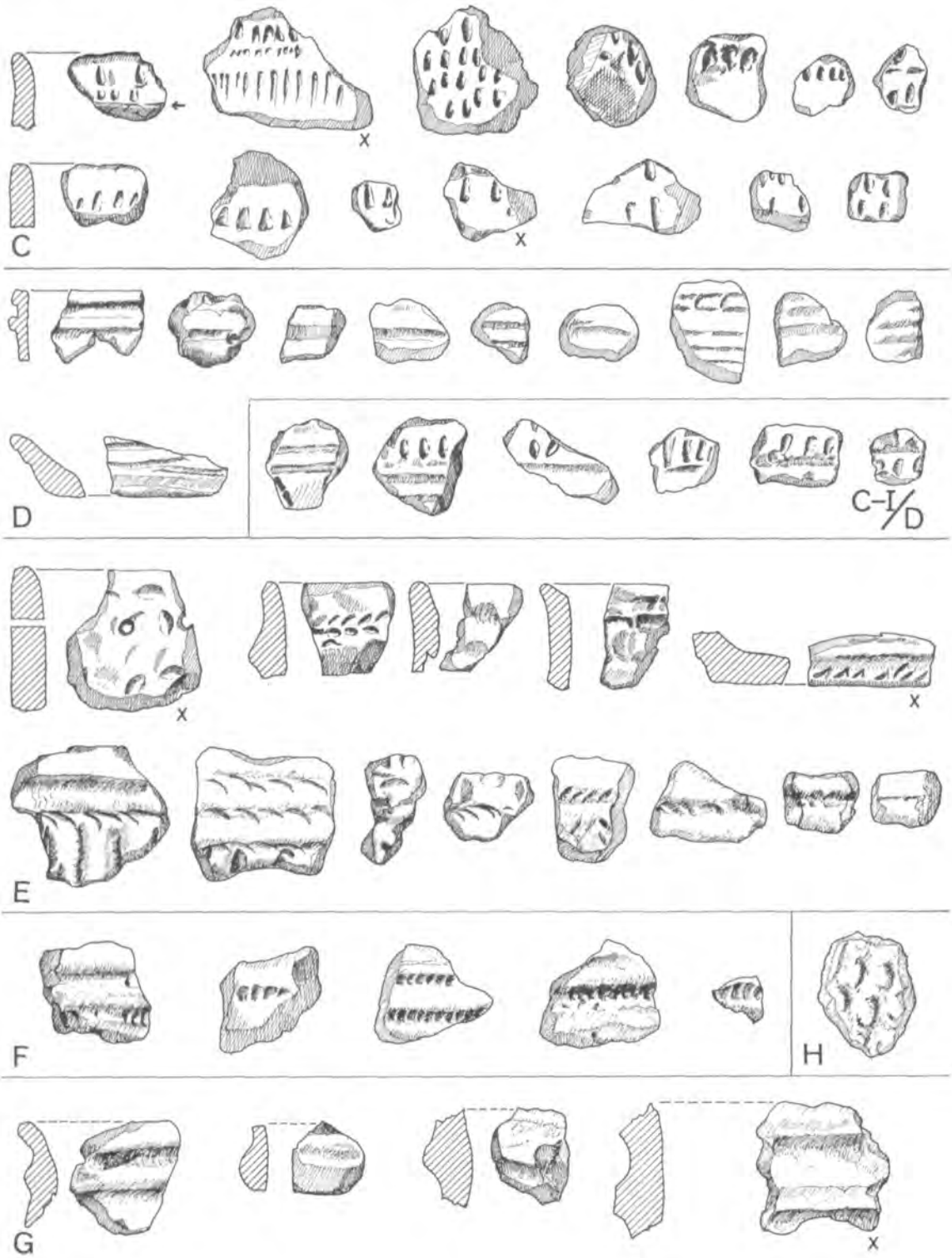

Fig. 82. Molenaarsgraaf. Pottery from the settlement terrain. Decoration types C-H. Scale 1:2.

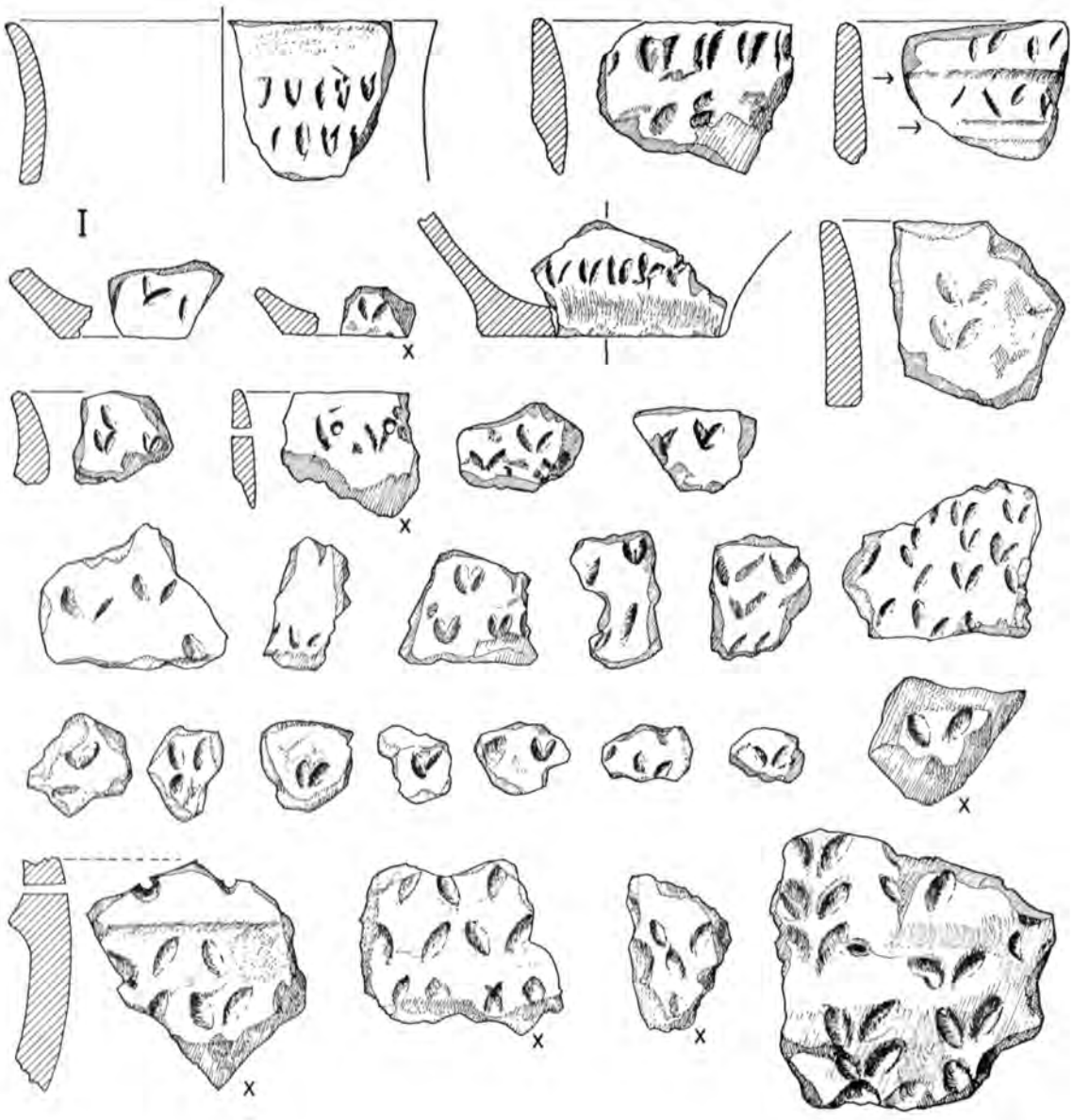

Fig. 83. Molenaarsgraaf. Pottery from the settlement terrain. Decoration type I. Scale 1:2.

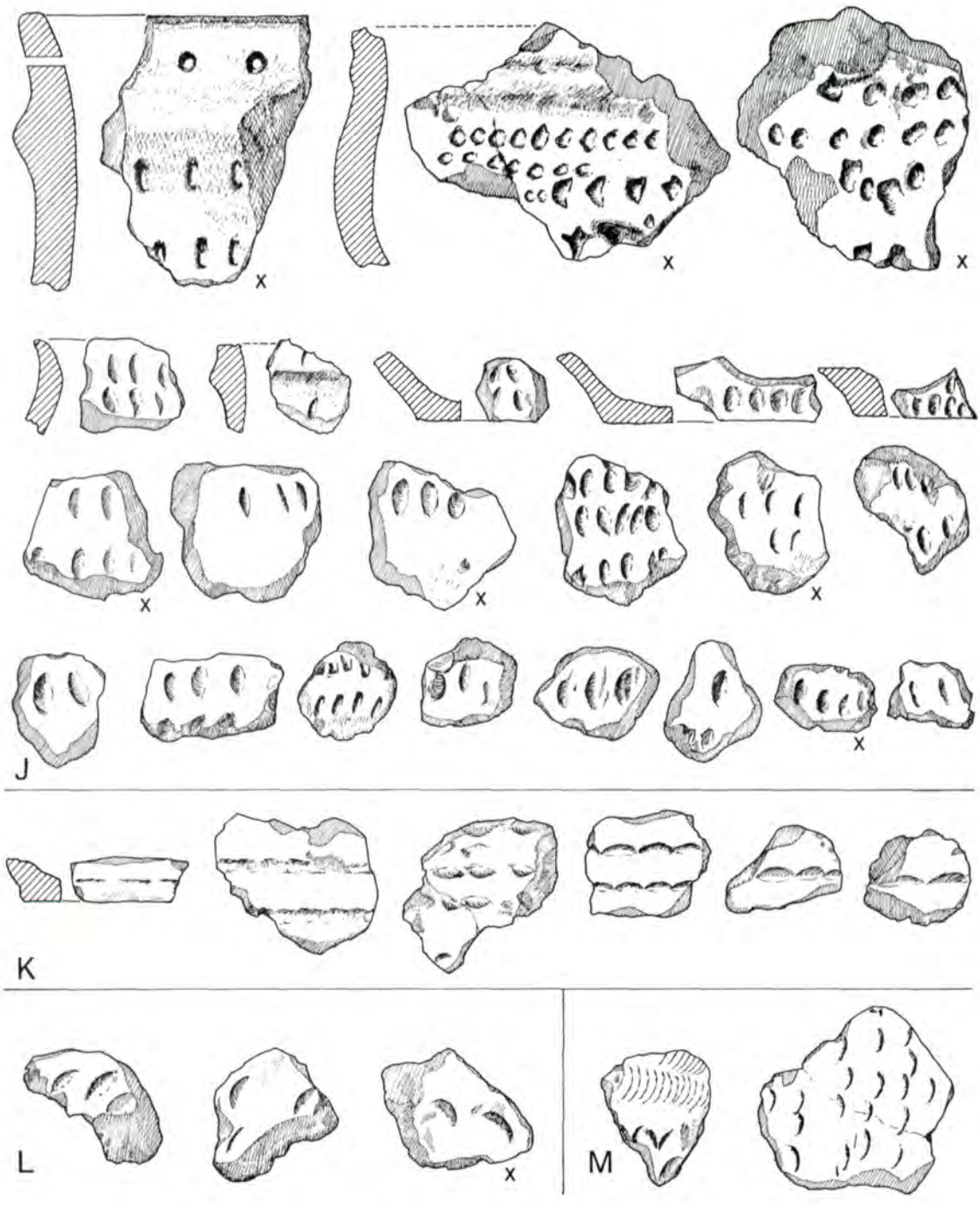

Fig. 84. Molenaarsgraaf. Pottery from the settlement terrain. Decoration types J-M. Scale 1:2.

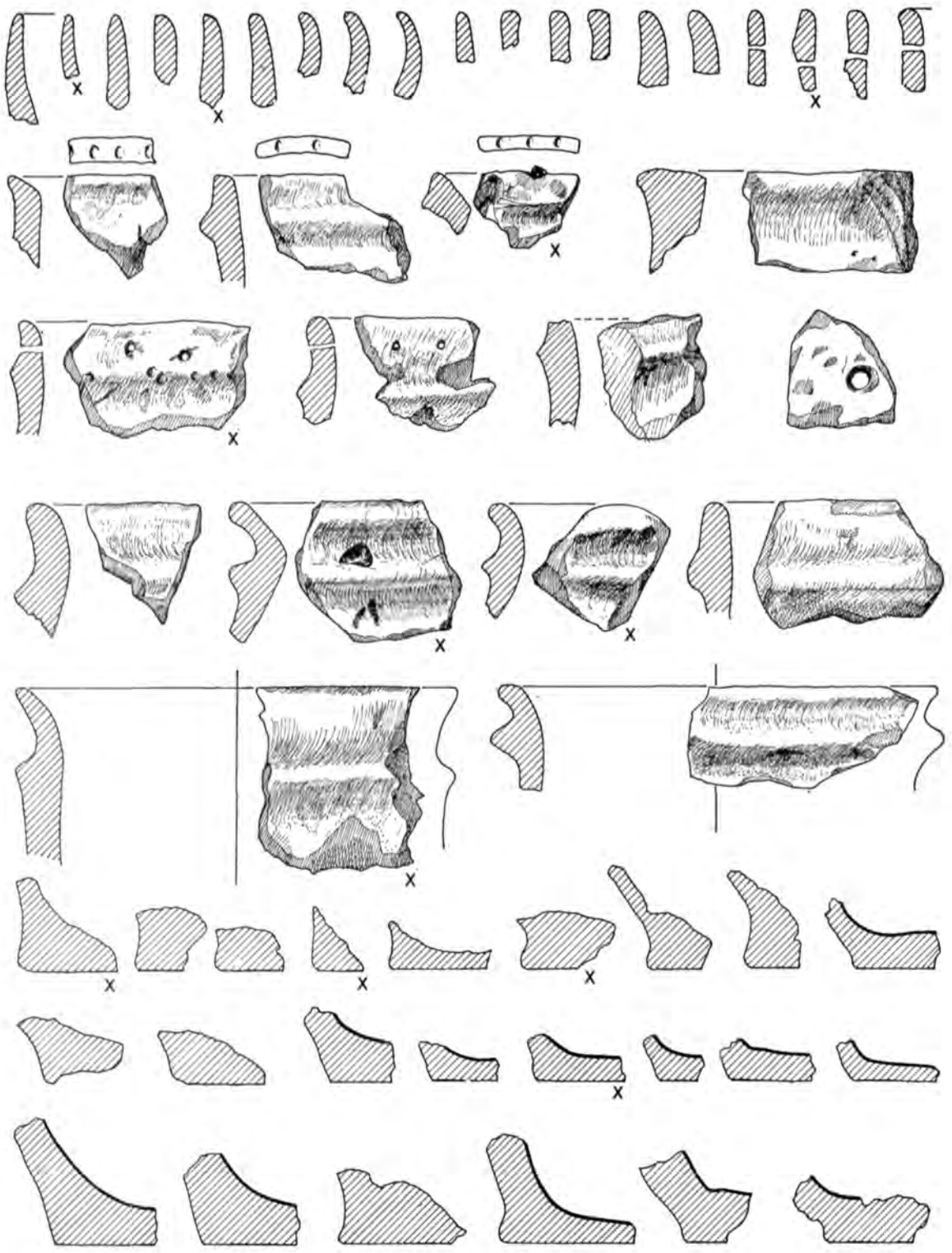

Fig. 85. Molenaarsgraaf. Undecorated pottery from the settlement terrain. Inner side of all rim sherds is at right. The heavy lines with the bottom sherds indicate preserved inner surfaces. Scale 1:2.

TABLE 16

Molenaarsgraaf. Decorated pottery (sherds) from the settlement terrain

	Decoration	Weight		Numbers		Tempering*		Wall thickness
		grammes	%	number	%	stone grit	pounded pottery	(mm)
A	Bell Beaker	95	4.5	30	9.1	4	26	4.5- 6.5
B	Barbed Wire Beaker	266	12.6	31	9.4	13	18	8-11
C	stabs	92	4.4	21	6.4	3	18	6-11
D	channelling	74	3.5	20	6.1	1	19	5- 8
E	plastic decoration	219	10.4	27	8.2	3	24	7-11
F	grooves with fine impr.	38	1.8	6	1.8	0	6	—
G	deep grooves	34	1.6	3	0.9	0	3	—
H	bumps	8	0.4	1	0.3	0	1	—
I	fingertip, V-motif	412	19.5	52	15.8	7	45	6-11
J	— vert.; rows	357	17.0	40	12.0	10†	30	6-13
K	— horiz.; lines	253	12.0	41	12.4	6	35	7.5-11
L	— obl.; rows	34	1.6	4	1.2	1	3	8-10
M	nail impressions	38	1.8	3	0.9	0	3	5-10
N	reed impressions	—	—	—	—	—	—	—
O	impressions of?	—	—	—	—	—	—	—
—	unclassified fingertip	186	8.8	51	15.4	**		5-12
Total		2,106	99.9	330	99.9	48	231	4.5-13

* Every sherd showing some stone grit or fine gravel is included in the column "stone grit". The percentage of true stone-gritted pottery is therefore smaller (about half the value according this table).

† Four of these 10 sherds belong to one pot.

** The unclassified fingertip impressions are not divided according to the material used for tempering, since the smallness of the sherds might be a cause of error.

TABLE 17

Molenaarsgraaf. Decorated pottery from the settlement terrain

	Decoration	Weight		Numbers	
		Grammes	%	Number	%
A	Bell Beaker	95	4.5	30	9.1
B	Barbed Wire Beaker	266	12.6	31	9.4
C-E	stabs, channelling, plastic decoration	385	18.3	68	20.7
I-M	fingertip and nail impr. (unclass. incl.)	1280	60.7	191	57.7
F-H N-O	other	80	3.9	10	3.1
Total		2106	100.0	330	100.0

We can distinguish the decoration types on account of their techniques and motifs.

A — *Bell-Beaker*. Fine designs, cut or impressed with a dentated spatula. Thin and badly preserved small sherds. A few sherds are recognizable as deriving from the Veluwe type of Bell Beaker. Typological Early (Maritime) Bell Beakers cannot be identified with certainty. This, however, may be because of the very fragmentary character of the pottery.

B — *Barbed Wire*. Impressions arranged in horizontal lines, occasionally combined with obliquely placed impressions, carried out with a thread-wound stamp. In general the threads are wound wide apart, but occasionally closely or very closely [28]. The thickness varies from thin beaker-like pottery (5-6 mm.) to thick, fairly coarse pottery (about 10 mm.). Two beaker-type rims, one with a weak cordon, the other with a row of perforations and a sherd from a large, thick-walled pot are the most characteristic. Noteworthy is the relatively high percentage with quartz tempering (13 of the 31 illustrated sherds). A number of sherds is included in the BWB pottery purely on account of the general appearance of the decoration. It is generally difficult, especially in view of the state of preservation of the pottery, to prove the use of the true thread-wound (BW) stamp [29].

C — *Stabs*. Impressions, irregularly placed or sometimes arranged in rows, executed with a sharp object such as a pointed stick or a quill of a feather.

D — *Channelling*. Average to very fine grooves running round the pot, applied with an instrument similar to those mentioned under C.

E — *Plastic decoration*. By the application of a spatula and/or fingertip impressions a relief effect is achieved, running usually in mutually right angular directions (*i.e.* horizontal and vertical). In some cases the sherds may originate from Pot Beakers, as those of fig. 82 on the second row, at the left.

F — *Grooves with closely spaced impressions*, as if with a very crude BW stamp.

The motifs C-F occur mainly on fairly fine pottery that is seldom tempered with stone grit or fine gravel. On one sherd C/D and C/I occur in combination.

G — *Deep grooves*. Similar to D, but much heavier in execution. Part or all of them may be judged to be fragments of cordoned rims.

H — *Small bumps*. Only on one sherd, on which the technique used cannot be ascertained because of weathering. Possibly a badly weathered pot beaker sherd.

I — *Fingertip impressions in V-motif*. Fingertip or nail impressions placed in pairs in V or inverted V motifs, only rarely arranged in any kind of regular pattern. Twice on one sherd combined with D.

J — *Fingertip impressions in rows*. Vertically placed fingertip or nail impressions arranged in horizontal rows. Sometimes they change to I. One sherd appears to come from a Necked Pot Beaker.

The motifs I-J occur on fine, beaker-like to crude pottery, in the latter case often with stone tempering.

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[28] Closely wound: fig. 81 B, first row left, and last row right.

[29] One type of decoration was erroneously included in the type B. This is the decoration of horizontal lines, executed with a dentated spatula. Since we realized this error only at the end of our study, we could not change fig. 81 in this respect. We verified that this did not influence our conclusions. Two sherds show this decoration: fig. 81 B, 2nd row, the 2nd and 6th sherd from the left.

K — *Fingertip impressions on lines.* Horizontally placed fingertip or nail impressions arranged on lines running round the pot, only on fairly fine pottery. A few of the sherds may have formed part of motifs which, we suggested under E, resemble Pot Beaker decoration.

L — *Oblique fingertip impressions,* in rows.

M — *Fingernail impressions.* Once, combined with I.

Two decoration techniques do not occur in the pottery from the settlement terrain, yet they are to be found in the other find groups.

N — *Reed impressions.* Once in a pit filling and once among the gully finds.

O — *Impressions made by an irregular object.* Once in the gully filling.

Unclassified fingertip impressions. Quite a number of sherds with fingertip impressions cannot be attributed to any of the named types because of their small size. These are small sherds with one or two impressions, of which the motif cannot be identified.

The tables 16 and 17 give a quantitative survey of the various decoration motifs. The differences between the weight and number percentages are not big. What is remarkable, is the large number of sherds decorated with fingertip impressions (about 60%) and the small number of BB and BWB sherds. The differences between numbers and weights in both types demonstrate clearly that BW decoration also occurs on crude pottery, and at the same time that the BB sherds are of small size.

In the decoration motifs, lines, rows or bands of impressions running round the pot play a predominating role. In nearly all cases it is possible to distinguish some clear arrangement but there are exceptions to this in the stabs (C) and in the finger impressions of the V motif (I). Sometimes oblique lines are to be seen, parts of a horizontal zig-zag motif, in combination with lines running round the pot. This is one of the (few) motifs of the BWB pottery and occurs here also in the channelling technique (D).

4.6.3.4. *Pottery from the pit fillings* (fig. 86)

The quantity of pottery from the pit fillings is remarkably small. Of 282 grams of pottery 51% by weight is decorated. These are 23 small sherds distributed over 12 pits. No 258/301 (182 gram) has not been included here.

In five pits there are 6 BB sherds, two of them clearly belonging to a Veluwe Bell Beaker and the other four to a type which cannot be identified. Early (Maritime) Bell beakers cannot be identified, but this is not of much significance in such a small number of sherds. The BB sherds in the pit fillings are associated with channelling as decoration (D, 6x) and fingertip impressions (I-L, 2x). One sherd with channelling shows the motif of the zig-zag line running round (no. 305/307).

Two pits each contain a BWB sherd, once as the only find, together with a few undecorated sherds tempered with granite grit. The other pit (no. 27/211) contained examples of finger impressions (I-L, 2x), a base sherd with heavy protruding foot and a cordoned rim.

The pits with BB sherds yielded, in comparison with the settlement material, a remarkable number of sherds with channelling and especially a small number of sherds with fingertip impressions. The percentage of BB sherds is also relatively high, and three base sherds of the BB type are noteworthy. The contrast of this group with the finds from pit 27/211 and the

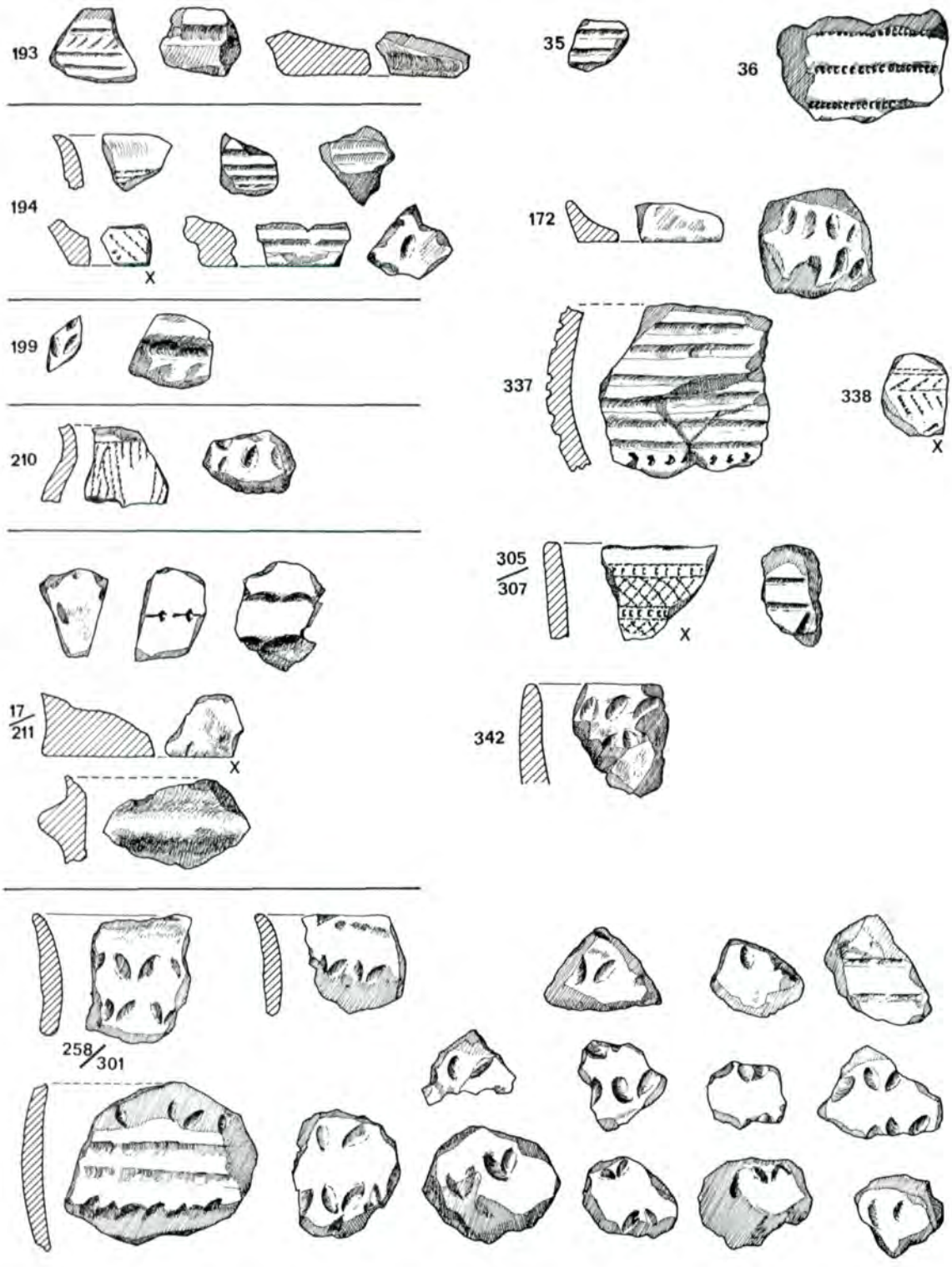

Fig. 86. Molenaarsgraaf. Pottery from the fillings of prehistoric pits.
The find numbers are also indicated on the excavation plan. Scale 1:2.

differences from the settlement material are a strong indication of the existence of an older (Veluwe) BB association and a later BWB association on the site, with a few common elements, such as the occurrence of fingertip impressions on the pottery. That BB and BWB sherds do not occur together in one pit filling points also to a difference in age. We can indeed state that most of the pits were dug during the early part of the occupation and were largely filled up before BWB pottery was present among the refuse on the settlement site [30]. Pit 27/211 is one of the elements belonging to this later occupation. Some of the pits are not dated, however, because of a lack of finds (as for instance group b), which lack at the same time supports a relatively early dating: little or no refuse was present on the surface, when they became filled up.

4.6.3.5. *Pottery from the filling of the break-through gully* (figs. 87-89)

The gully filling yielded 729 grams of pottery, mainly (92% by weight) decorated. There were 39 sherds of large dimensions, compared with the settlement finds. A larger number of sherds from a pot with reed impressions and a number of sherds from the uppermost find-level are left out of consideration here [31]. The BW element predominates. Only two small pieces were true Bell Beaker sherds: they were found on the western bank of the gully at the base of the peat layer, and we may consider both of them as older refuse, not necessarily belonging to the finds in the deeper parts of the gully filling [32]. Perhaps three other sherds found in the peat are possibly from Bell Beaker-like pottery [33], although the most characteristic signs are missing: they are thick-walled and not decorated with a dentated spatula. Six BWB sherds (exclusively of the widely wound type) were found spread over the gully filling (deposit 1). The finds from the gully thus form a BWB association, with possibly slight reminiscences of the Bell Beaker ware in a few sherds. This is a marked difference to the finds from most of the pits. All the common decoration types from the settlement are represented. The complex is further characterized as follows:

— occurrence of BW decoration,

— very high percentage of decorated pottery,

— preponderance of fingertip impressions (22 pieces, 56%), especially the V motif,

— occurrence of channelling as decoration and BB-like material in insignificant amounts,

— occurrence of perforations under the rim (twice), of a cordoned rim (once) and of heavy bases with protruding foot, while sherds of bases of the BB type are absent,

— the occurrence of rims which are fairly markedly bent outwards, a type not occurring in the settlement finds.

A number of unusual finds form part of it:

— The fragment of a flat oval weight with eccentric perforation, entirely decorated with finger impressions. In view of the find-place this may be interpreted as a fishing-net weight.

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[30] The period when BW decorated pottery was in use might be included in this period. It was *during* the use of a certain type of pottery that its remains became intermingled with the domestic refuse, which was already present on the surface. So there was a small chance for these sherds to occupy a secondary position in the filling of a pit.

[31] The vertical and horizontal distribution of the finds is discussed at p. 184 f.

[32] When the sherds were thrown into the gully, older refuse (*e.g.* the BB sherds) might have lain on the gully banks.

[33] Fig. 87, top left.

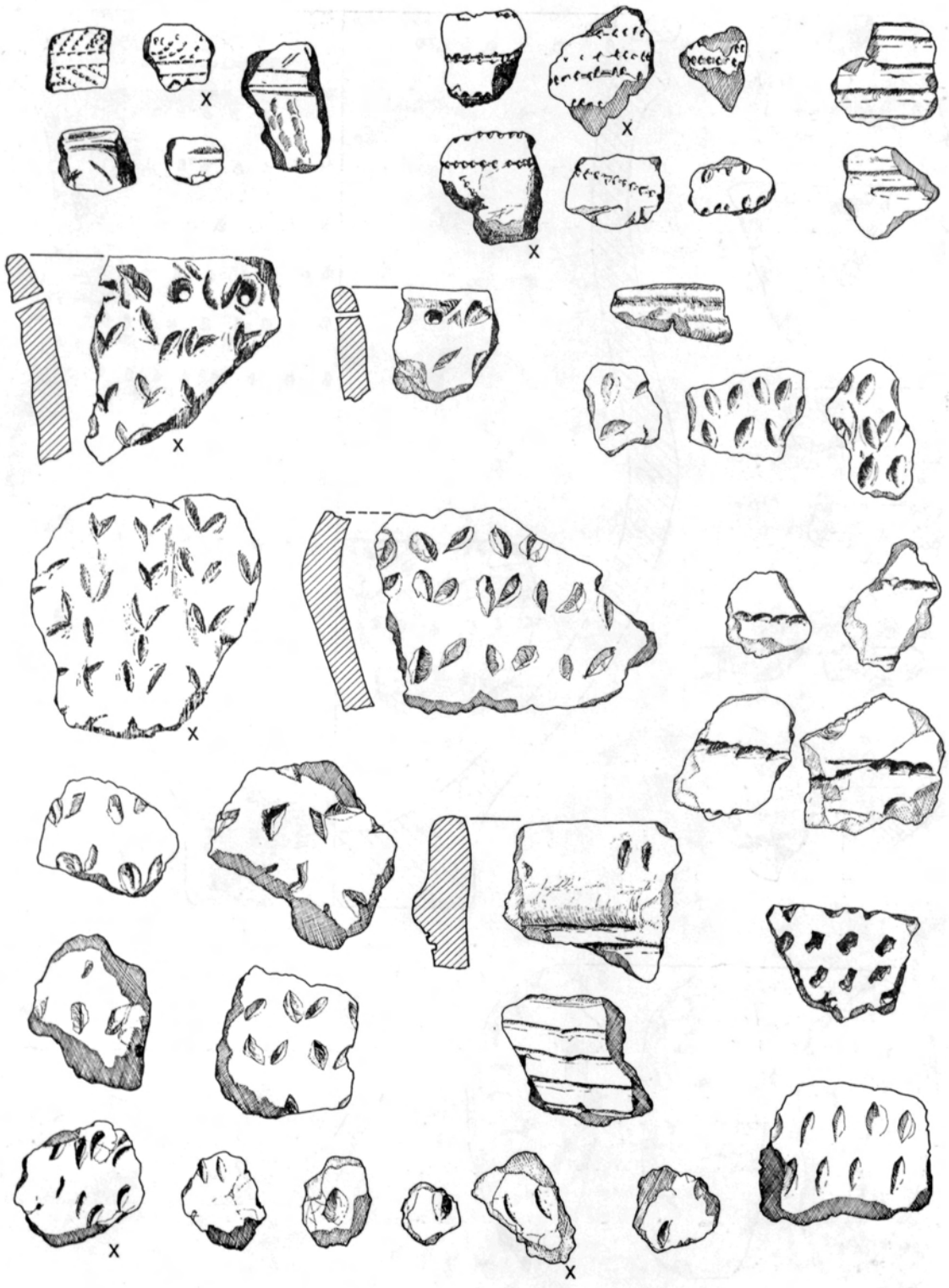

Fig. 87. Molenaarsgraaf. Pottery from deposit 1 of the break-through gully. Scale 1:2.

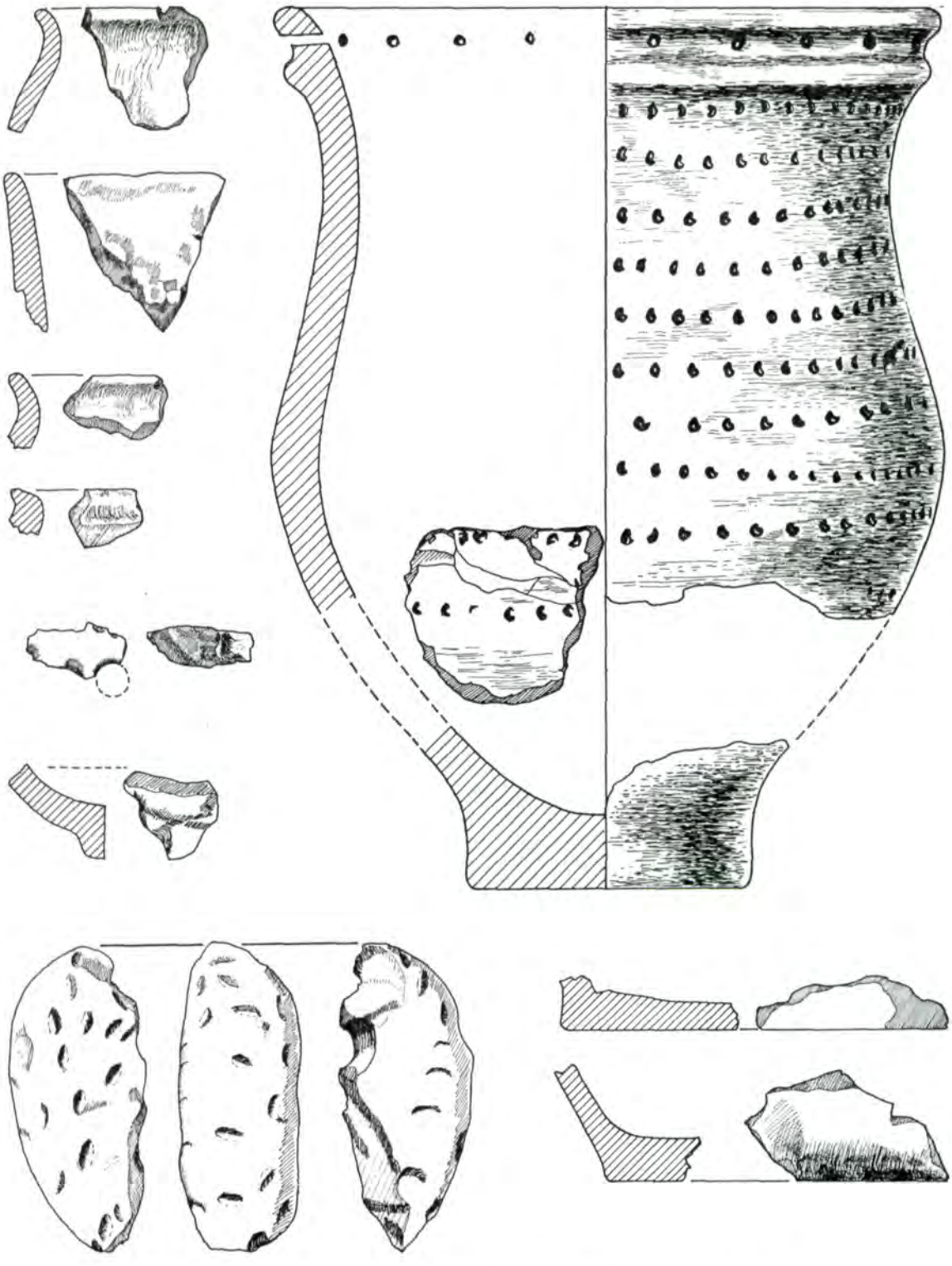

Fig. 88. Molenaarsgraaf. Pottery and loam weight from deposit 1 of the break-through gully. Scale 1:2.

— One flat sherd, showing part of a perforation, made before firing, might be a clay disc ("backing plate") fragment.

— One sherd has a type of impression not seen anywhere else on the site: impressions made with an irregular pointed object, possibly a broken bone or stick (type 0),

— Very important is the large fragment of a pot, reconstructed from a large number of sherds found close together. These lay within a charcoal concentration, especially at the base of the peat layer in the western bank area (square b1). A large number of the characteristics, described above, of the pottery from the gully filling are represented in this pot: perforations and a cordon under the rim, a heavy base, everted rim and a decoration, clearly related to the BWB motifs, consisting of almost horizontal lines encircling the pot. We have associated this find with grave II and discuss it more fully under that heading (p. 258).

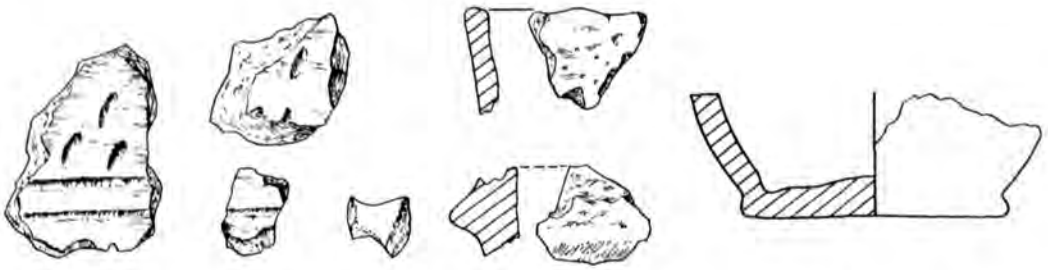

Fig. 89. Molenaarsgraaf. Pottery from the top of deposit 1 of the break-through gully. Scale 1:2.

The finds already reported, which were made in the highest part of the find-layer (deposit 1), totalled 210 grams of pottery, of which only a small part (three pieces, 20% by weight) is decorated (fig. 89). These pieces consist of a badly weathered sherd with shallow grooves and impressions, and two sherds, one with a roughly grooved line and the other with impressions in rows. The undecorated pottery is characterized by a straight outstanding rim, a fragment of a cordoned rim, the pin used for fixing a handle in the wall of the pot, and the base of a round pot with a pinched-out foot. With the exception of the low percentage of decorated pieces the material is very similar to the pottery from the gully filling described above. It seems that at the end of the occupation, after a period of abundant decoration, pottery having the same forms, but mainly undecorated, was in use.

4.6.3.6. *Distribution patterns of the decorated pottery* (figs. 90-93)

The distribution of the decoration types confirms the above distinction of three consecutive associations, namely:

(1) a BB association,

(2) a BWB association,

(3) a group of mainly undecorated pottery.

The numbers of BB and BWB sherds are roughly equal, so that both distribution pictures may easily be compared (fig. 90). Both types occur in exactly the same area. The only difference is a difference in concentration: in the case of the BWB sherds there is an accent on the eastern

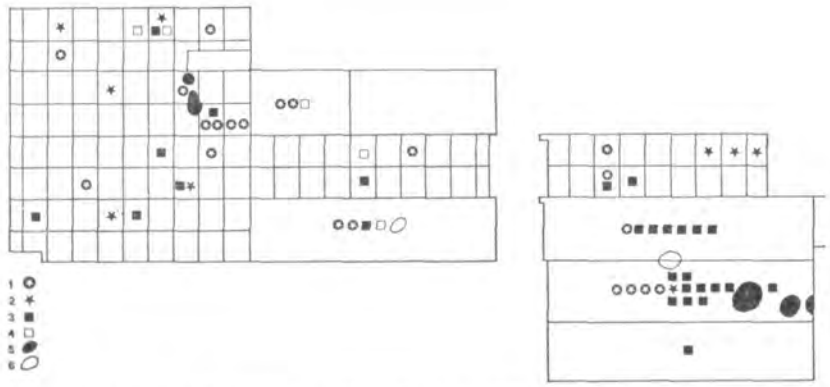

Fig. 90. Molenaarsgraaf. Distribution of BB and BWB pottery.

1. BB sherd
2. BB ? sherd
3. BWB sherd
4. BWB ? sherd
5. pit with BB sherd(s)
6. pit with BWB sherd(s)

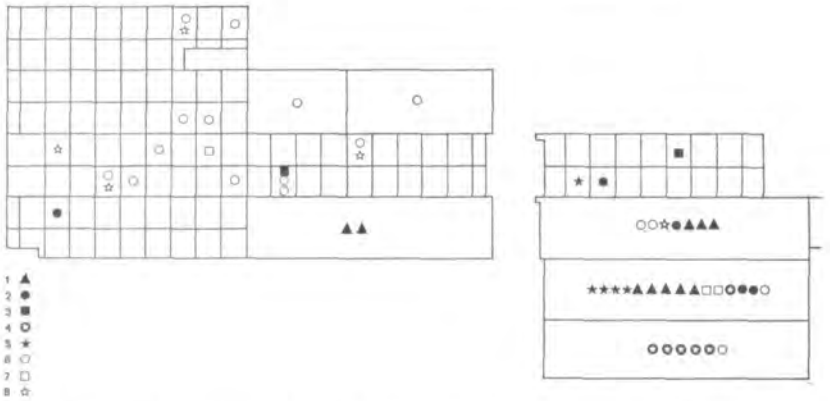

Fig. 91. Molenaarsgraaf. Distribution of decoration types, or pecularities which show some association with either BB or BWB.

Association with BWB :

1. *Cordon below rim*
2. Perforations below rim
3. 1 and 2 on one sherd
4. decoration type F
5. decoration type G

Association with BB :

6. *decoration type D*
7. decoration type C/D
8. decoration type I/D

part and the area near the gully ; in that of the BB sherds the distribution is fairly even. It is remarkable that there are so few sherds of both groups in the central part of the settlement itself.

The channelling (D, fig. 91) follows the BB pattern, with a slight preponderance in the west of the site. Cordoned rims and perforations under the rim are obviously concentrated in the gully bank area. The decoration types F and G are also found there. These associated finds conform therefore, even in a somewhat greater measure, to the differences between BB and BWB pottery (*fig. 91*).

The types of decoration which cannot be attributed directly to any given phase show no

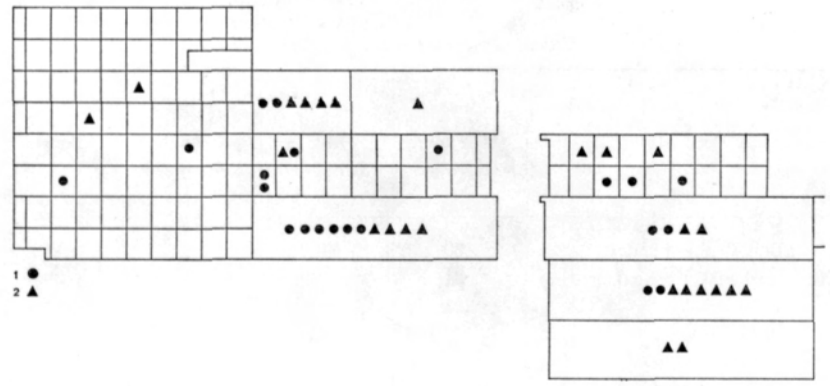

Fig. 92. Molenaarsgraaf. Distribution of decoration types C and E.
1. type C 2. type E

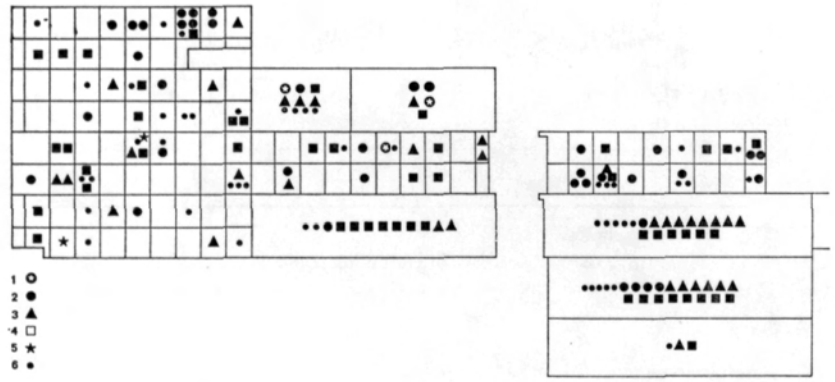

Fig. 93. Molenaarsgraaf. Distribution of decoration of fingertip and nail imprints.
1. type L 4. type I
2. type K 5. type M
3. type J 6. unclassified

significant distribution picture. Stabs (C) and plastic decoration (E) appear to be absent to some extent from the western area of the site (fig. 92). Finger tip impressions are distributed very evenly (fig. 93). The widespread distribution in the western part is noteworthy.

None of the distribution maps illustrate the distinct concentration near the house plans, as the total quantity of pottery, expressed by weight, showed so clearly (fig. 77). The western area, which is so poor in finds, has a relatively large number of decorated sherds. It can only be the undecorated element that forms the accumulation around the house plans. Of the total amount of settlement material, spanning the whole period of occupation, the undecorated material therefore occupies a special place by the concentration round both house

TABLE 18

Molenaarsgraaf. Decorated pottery. Numbers of sherds

	Decoration	Settlement terrain	Pit fillings*	Break-through channel**	Total
A	Bell Beaker (& deriv.)	30	6	5	41
B	Barbed Wire Beaker	31	2	6	39
C	stabs	21	0	0	21
D	channelling	20	6½	5	31½
E	plastic decoration	27	1	0	28
F	grooves with fine impr.	6	0	0	6
G	deep grooves	3	0	0	3
H	bumps	1	0	0	1
I	fingertip, V-motif	52	2	11	65
J	— vert.; rows	40	2	3	45
K	— horiz.; lines	41	1	4	46
L	— obl.; rows	4	0	1	5
M	nail impressions	3	0	0	3
N	reed impressions	0	½	(pot)	(pot)½
O	impressions of ?	0	0	1	1
—	unclassified fingertip	51	2	3	56
Total		330	23	39	392

* No 258/301 excluded.

** The sherds from the highest part of the filling (fig. 89) are not included.

TABLE 19

Molenaarsgraaf. Decorated and undecorated pottery. Weight in grammes

	Settlement terrain	Pit fillings*	Break-through channel**		Total
			Deposit 1	Top of deposit 1	
Decorated	2106	326	672	20	3124
Undecorated	6181	138	57	190	6566
Total	8287	464	729	210	9690
Ratio Decor. : undecor.	1:3	2:1	10:1	1:10	1:2

* No. 258/301 (fig. 86) (182 gms) included. If we exclude this find the values are 144:138 = 1:1, total weight 282 gms.

** The big pot with reed impressions and the loam weight fragment excluded.

plans and next to the gully. In view of the fairly high percentage of decoration of the BB association in the pits and the very high percentage of decoration of the BWB-association in the gully filling, it was already clear that the total settlement material must include a phase with comparatively little decorated pottery. This must be correlated with the finds in the uppermost part of the deposit 1 in the gully, where the percentage of decoration was also low. So the largest part of the undecorated pottery, which is similar in form to the BWB pottery must have originated from the closing stages of the inhabitation. During this last phase the characteristic decorated pottery (BB and BWB) of the preceding phases will have been largely crushed in the centre of the settlement, which explains the small quantities of these types found there.

4.6.3.7. *Conclusions: the occupation phases.*

To recapitulate, we may say that in the Molenaarsgraaf settlement the pottery used there underwent changes, which can be divided into three consecutive stages, covering the whole period of the occupation.

Phase 1) is distinguished by the occurrence of genuine Bell Beakers, some of Veluwe type, decorated with a dentated spatula. The rest of the pottery shows mostly channelling as decoration, some in the form of horizontal zig-zag lines, and, to a smaller extent, fingertip impressions. Heavy pinched-out feet apparently do not occur. About 50% of the pottery is decorated. Typical of this phase are the finds of most of the pits.

Phase 2) is distinguished by the occurrence of BW decoration especially of the widely wound type. Most of the pottery is decorated with fingertip impressions, the V-motif dominating. Relatively little channelling occurs, and is carelessly executed. Cordoned rims, perforations under the rim, and heavy, often pinched-out bases occur for the first time. There is relatively frequent (although it is still not a high percentage) tempering with quartz and granite grit. About 90% of the pottery is decorated. Typical of this phase are the finds from deposit 1 of the break-through gully.

Phase 3) is distinguished by a small percentage of decorated pottery (10-20%). The forms have not changed and include cordoned rims, perforations and heavy, pinched-out bases. Typical of this phase are the finds from the top of the find-layer in the gully and apparently the largest part of the undecorated pottery from the settlement terrain.

During phase 1 it is probable that the whole excavated terrain was occupied. In phase 2 the occupation moved to some extent towards the gully, and in phase 3 it seems that the occupation was limited to the highest part of the terrain and the bank of the gully. The western part of the site was then apparently no longer in use as a yard.

A number of elements cannot be attributed to any one of the phases, or if they can, only with great reserve; or they may have belonged to more than one phase.

Finally we must emphasize that the phases defined above are in reality only the recognizable stadia of an either continuous or discontinuous occupation. By means of the pottery and its find circumstances alone neither real continuity nor the existence of short time interruptions can be demonstrated. Continuity seems, however, very likely at least from phase 2 to phase 3.

In phase 2, however, so many new elements are introduced that in our opinion there may have been an hiatus between the phases 1 and 2, or a not recognizable intermediate phase.

4.6.4. Loam (fig. 94)

Lumps of fired loam were found scattered over the whole settlement. These were all shapeless, small, and very small pieces. The distribution of the somewhat larger lumps is denser in the western part of the settlement, which could mean a dating mainly in the first part of the occupation. The distribution (fig. 78) is such that any connection with the Middle Bronze Age hearth no. 29 is unlikely.

Three objects of fired loam merit special attention.

— In pit 44, which otherwise did not contain any finds, some pieces of a large, disc-shaped loam weight were found. The weight has a diameter of about 14 cm. and is about 6½ cm. thick.

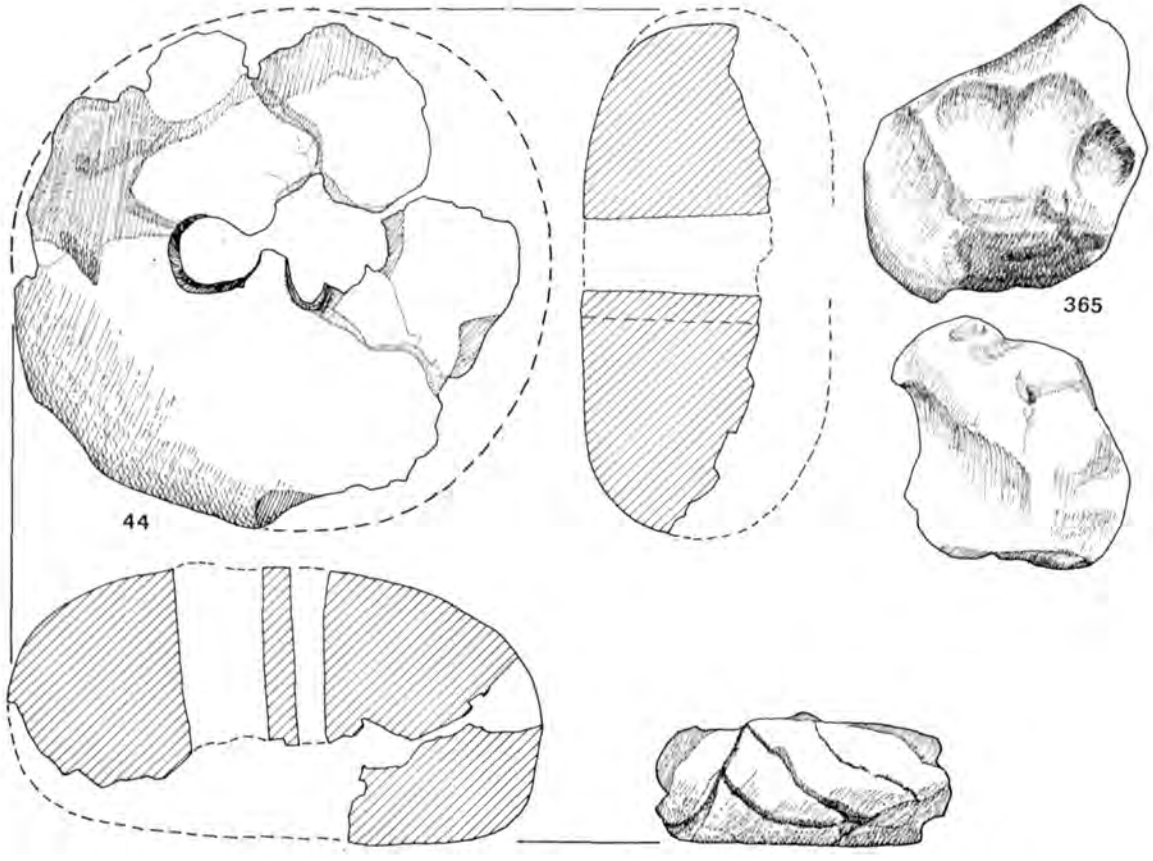

Fig. 94. Molenaarsgraaf. Loam weight and lump of potter's clay. Scale 1:2.

The two fragments which were preserved weighed 400 and 150 grams, from which is may be deduced that the original weight of the complete object was about 1 kg. In the middle there are two holes, made before firing. The rough inner surfaces of these show that the weight was kneaded around two sticks or branches. As such it can have formed part of a number of implements: a digging stick, a fish-trap, etc. A large number of points of difference between the pieces of loam from the hearth and the weight described here, make contemporaneity unlikely. The find should be included in the settlement material.

— We have already described the fragment of a second disc-shaped weight from the filling of the gully [34]. The fragment weighs about 130 grams, which means an original weight of about 400 grams.

— From the occupation layer to the east of pit Z 11 comes a piece of fired loam (no. 365) which is much bigger than the other pieces found scattered about. Moreover, tempering material (pounded pottery and burnt bone) is visible in the clay, as are the clear impressions of the five fingers of a right hand. The colour varies from red (7.5 R 5/8 - 10 R 5/6) to very pale yellow (10 YR 7/3) and dark gray (7.5 YR 4/0). The measurements are 8.7 × 6.8 × 5.6 cm. This must be a piece of potter's clay that fell (by chance ?) in the fire and was fired there in a mainly oxidizing environment. This proves that pottery was made on the site [35].

4.6.5. Flint (figs. 95-98)

Scattered over the whole settlement site 477 pieces of flint were found. The high density of finds in the west proves that the flint belonged mainly to the first or the first two occupation phases. It originates partly, however, from the last phase, since in the level corresponding to this phase in the gully we found one flake of grey granular flint. Even the finds from the hearth no. 29 include a scraper (*cf.* p. 193).

Fairly small pebbles were used as raw material; they were apparently collected from among the Meuse shingle. We must make an exception here only for the largest implements and retouched flakes (fig. 97 a-e). Since no raw material of comparable dimensions occurs, we must assume that they were imported as such into the settlement. The flint that was used is of highly inconsistent quality and varies from glassy to coarsely granular. The colour is also variable: from light grey to black and from pale yellow to orange and brown. The sources of these flints were likely to have been those nearest to hand, which were the North Brabant sand grounds or the then active course of the Meuse on the one hand, and on the other the ice pushed ridges of the Utrecht hills. The first lay at a distance of at least 30 km. through the peat area and at right angles to the main river arms. The second involved a distance of at least 40 km. along the Schoonrewoerd stream ridge.

Of this material 70% does not show traces of working or use, 15% is slightly retouched and 15% (69 pieces) has been worked into some kind of artifact. This fairly high percentage does not, however, mean a maximum use of the flint, for among the flakes there are many

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[34] See p. 220 and fig. 88.

[35] We realize that the tempering is unusual and that the lump might originate from the later MBA visit to the terrain.

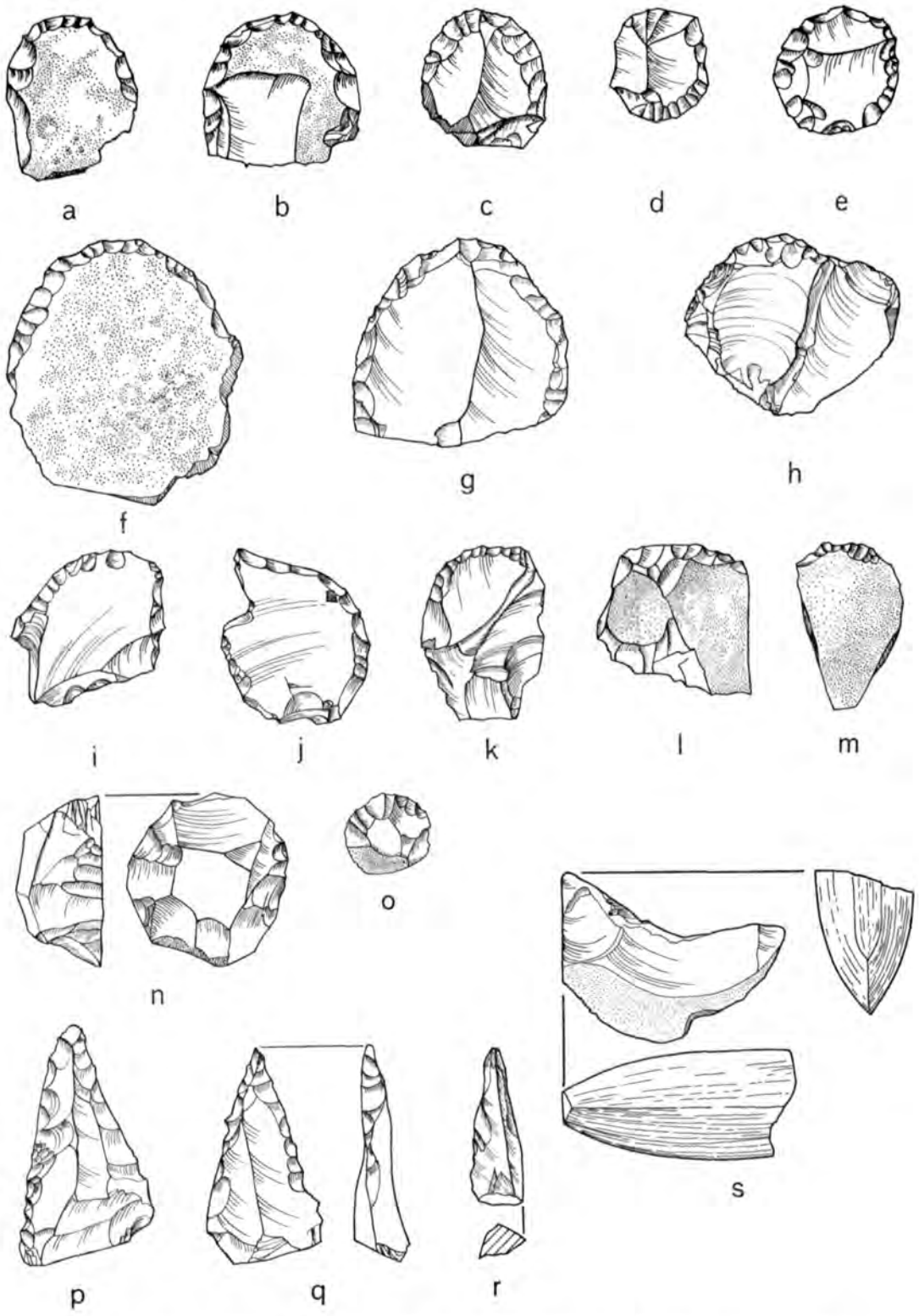


Fig. 95. Molenaarsgraaf. Flint. Scrapers, borers and the cutting-edge of a flint axe. Scale 1:1.

TABLE 20

Molenaarsgraaf. Flint

	Numbers	
Scrapers	52	
Borers	8	
Various artifacts	9	
Artifacts, total	69	(14.8 %)
Retouched flakes	74	(15.2 %)
Cores	5	
Irregular pieces	20	
Flakes	309	
Unworked flint, total	334	(70.0 %)
Total	477	(100.0 %)

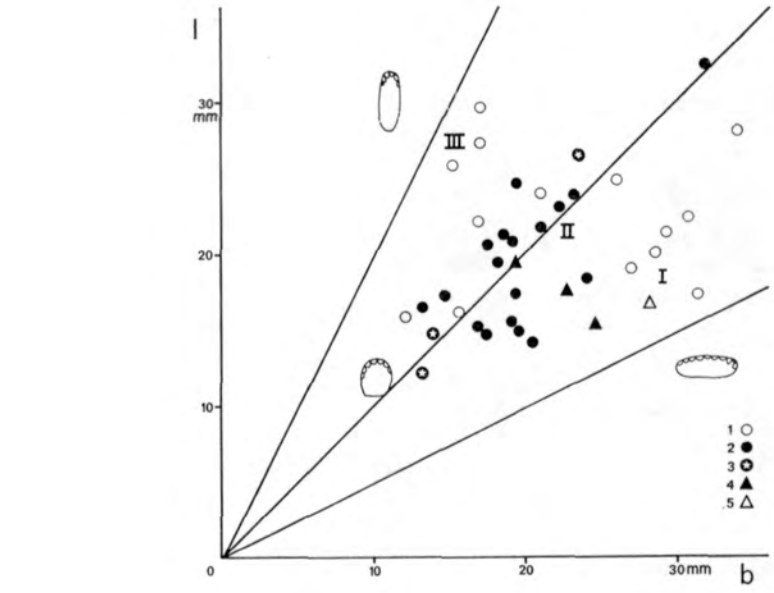
suitable for further treatment. These may, however, have been used for some unknown purpose. Most of the implements are scrapers (52 pieces, including fragments). We possess 8 bores and 9 other artifacts of various kinds. The absence of any arrow-heads is remarkable. Five core stones (*cf.* fig. 97 i) are irregular in shape. Among the flakes we have separated a group of irregular "pieces", of which it cannot be determined that they are the result of flint working. The true flakes are irregular in shape and generally as wide as they are long. There are no blades. Cores, flakes and retouchoirs [36] provide convincing proof that flint working took place in the settlement itself. If the flakes are plainly bad, the cause of this lies largely in the bad quality of the raw material. The retouche of the artifacts is often of much better quality.

The scrapers are small (12-33 mm. long, 1 × 42 mm.) and more or less round in shape ($\frac{1}{2}b<l<2b$). The thickness is 4.0-11.0 mm., with a few exceptions, such as some very small thin scrapers and a thick core scraper (fig. 95 n). Where the scraper end is made on the flake seems to depend largely on the shape of the flake. In 14 of the 34 scrapers, where it was possible to ascertain the pressure bulb, the scraperhead was not made opposite it against 20 "normal" pieces. Occasionally a double scraper occurs, or a flake is retouched all round. The angle of retouche depends on the thickness of the flake and varies from about 45° in thin scrapers to about 70° in thick examples.

Two diagrams show the measurements and variations of 42 measurable scrapers. Fig. 96 a gives the shape (l:b ratio) and the size, fig. 96 b gives the relative thickness [37] and the shape. In both figures core scrapers and scrapers with superficial retouche (among others the scraper from hearth no. 29) are separately indicated. Among the remaining scrapers a division into two

[36] See fig. 97 h, i.

[37] We mean here the largest dimension divided by the thickness.



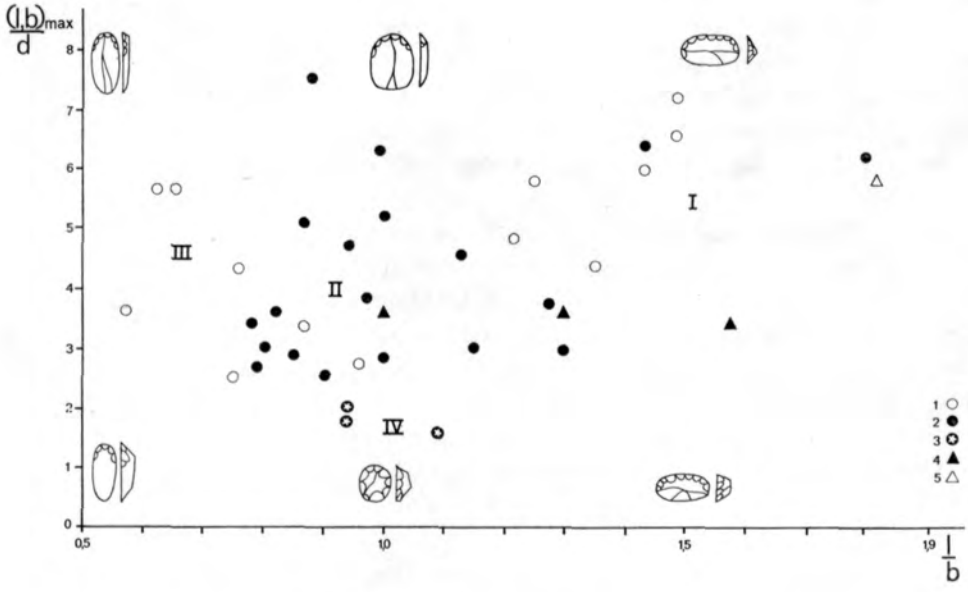


Fig. 96a, b. Molenaarsgraaf. Two graphs showing the relation between length (l), width (b) and thickness (d) of the flint scrapers.

1 scraper arc $< 180^o$
2 scraper arc $\geqslant 180^o$
3 scraper arc $= 360^o$ (core scrapers)
4 scrapers with superficial retouche
5 no. 29

I wide, scraper arc $< 180^o$
II round, scraper arc $\geqslant 180^o$
III long, scraper arc $< 180^o$
IV core scrapers

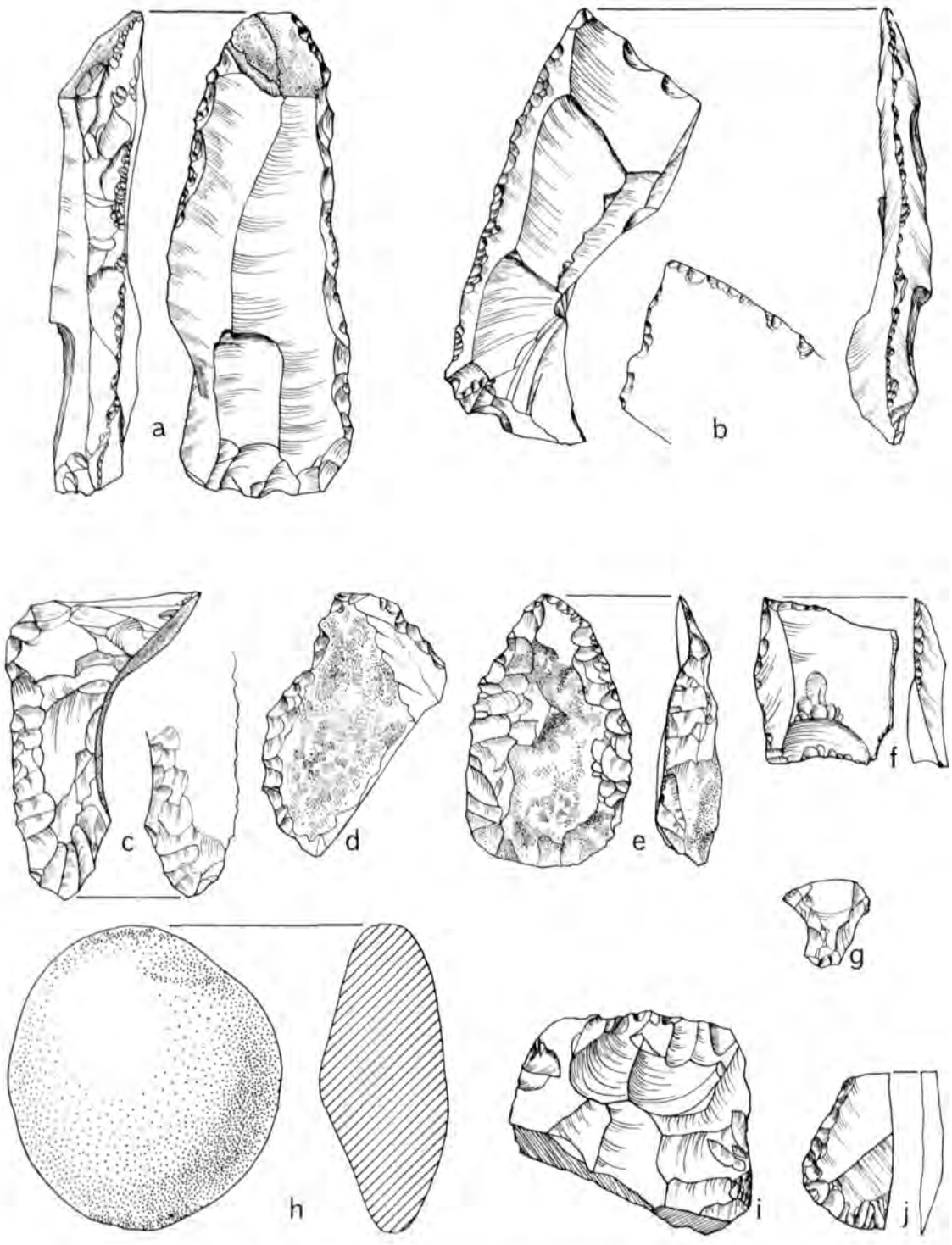


Fig. 97. Molenaarsgraaf. Various flint artifacts, a core and a quartz pebble used as retouchoir. Scale 1:1.

groups has been made, according to the size of the scraper arc [38]. A central place is occupied by round, 12-25 mm. large scrapers with a wide scraper arc (> 180°) and a fairly large variety in thickness. Two other groups are formed according to relative width and length, both with a small scraper arc. The size of the scraper arc will have been determined mainly by the shape of the flake. We can assume that the small round scraper (fig. 95 a-e) ,with a few core scrapers (fig. 95 n, o) as an extreme form, constitutes the only clear type, and that less suitable flakes were worked to a group of less carefully made scrapers of wide variety. Two large, round and relatively thin scrapers (fig. 95 f,g.) are exceptional by reason of their size. The scrapers with superficial retouche correspond in shape to the other material. The marginal position of scraper no. 29 provides a confirmation of the dating after the VBB/BWB occupation.

In addition to the scrapers there is a minority of other artifacts. Of 8 borers 5 are irregular in shape. The three others (fig. 95 p-r) include two characteristic pieces of triangular shape, made by retouching a long flake along both sides. The last example is very small and is made from the cutting edge of a flint axe.

The other implements are:

— A large flake, with retouche and much damage by use along both sides (fig. 97 a).

— A fragment of a large flake, intensively retouched along the sides. Possibly half of an originally triangular artifact. In view of the condition of the retouched edges the piece was apparently used as a scraping implement (fig. 97 b).

— A large flake of which the shape was chiefly determined by a big piece of cortex. It is retouched along one side and at the point, where the pressure bulb has been removed by superficial retouche (fig. 97 c).

— An irregular flake, intensively retouched all round. A part has been broken off (fig. 97 d).

— An almond-shaped artifact or knife, made by superficial retouche at one side. Large parts of the cortex are still present (fig. 97 e).

— A small, rectangular flake, retouched and damaged by use (fig. 97 f).

— The tang of an arrow-head (?) (fig. 97 g.).

— Half of a leaf-shaped artifact, broken (unfinished ?) after retouching (fig. 97 i).

Of interest is a fragment of the cutting edge of a flint axe (fig. 95 s) calcined and fire-cracked. The fragment comes from the direct vicinity of pit 27/211, together with various similar pieces of calcined and fire-cracked flint, possibly from the same axe. In view of the traces of fire in this pit a connection with this and thus a dating in phase 2 is probable. The axe has an oval section, with flattened sides, and its cutting edge was about 5 cm. in width. A second very small fragment of a flint axe is the already mentioned small borer. This is, however, too small to permit any comment on its shape. Among the flakes there are no fragments of axes.

4.6.6. Worked Stone [39] (fig. 98)

Stone bearing traces of having been worked (55 pieces) was scattered all over the settlement site. The large and characteristic pieces are, however, limited to the area in which the pottery

[38] By scraper arc we mean the angle of the circle segment that shows retouche.

[39] *We thank Mr C. J. Overweel, Leiden, who gave us his opinion on the used stone and who made a petrographic report on the small axe fragment.*

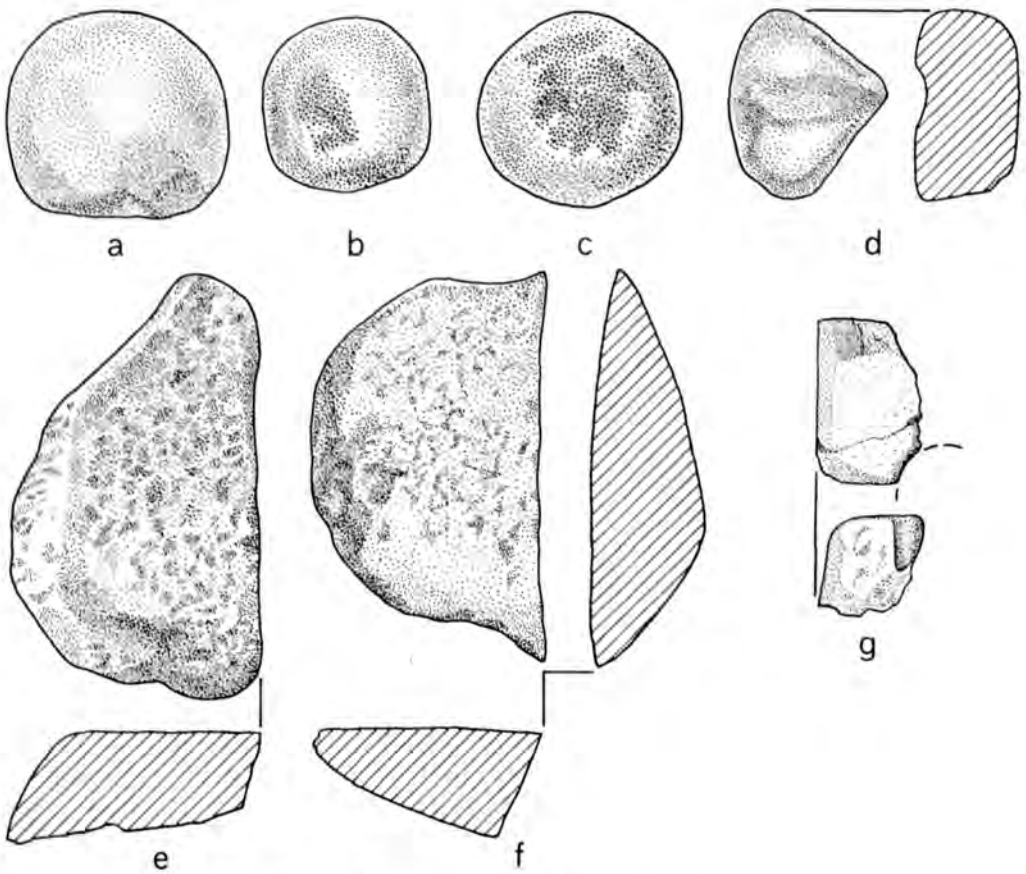


Fig. 98. Molenaarsgraaf. Worked stone. Scale 1:2.
a-c ball-shaped polyhedrons
d fragment of arrow-shaft straightener
e-f quern stone fragments
g fragment of perforated axe

is concentrated. This seems to us, however, to be an insufficient reason for allotting this part of the material exclusively to the last occupation phase.

The following pieces and types are to be distinguished:

— A fragment of a socketed axe (fig. 98 g). The small size of the fragment makes any reconstruction impossible. A flat upper surface, in which a shaft hole was bored vertically, and a flat side making an obtuse angle with the upper surface, are recognizable. The stone used is an amphibolite of unknown source.

— A stone with a shallow groove is undoubtedly the fragment of arrow-shaft smoothener (fig. 98 d). The stone is a sandstone consisting of sand unusually rich in feldspar.

— A group of objects may be included under the heading of ball-shaped polyhedrons (fig. 98 a-c), all made from a carefully selected massive quartzite consisting of cemented clean sand. Only one is made of quartz showing a strong resemblance to the above-named quartzite.

A total of 18 ball-shaped polyhedrons, and fragments of them, are limited to the highest part of the site and the bank of the gully (fig. 80). In the western part they do not appear at all. Because of this distribution we believe that the first occupation phase at least must be excluded for dating. The occurrence of two fragments at the bank of the gully might indicate that they were probably used during the second (BWB) phase. It cannot, however, be determined whether the pieces of stone in question lay here on the appropriate surface, or dropped through the loose peat deposit to a lower level.

— A number of pieces of granite and sandstone we interpret as fragments of quernstones. They all have one whetted (or worn) surface and are relatively thin. One piece (fig. 98 f) is undoubtedly half of the runner of a hand quern, which has become so thin by protracted use that it has broken. These quernstone fragments also are only found in the central part of the settlement. All the types of granite used are not very characteristic and may be from northern or southern sources. One piece, found in the gully filling is, however, fairly certainly of northern origin.

— A number of pieces of quartzite with one whetted facet and clearly not fragments of a ball-shaped polyhedron are interpreted as pieces of whetstones. The quartzite used is fairly variable and never the kind used to make the ball-shaped polyhedrons.

— A number of quartz pebbles, possibly used as retouchoirs, in view of the traces of damage. One of them is a characteristic piece and there is no doubt that this was used as a retouchoir (fig. 97 h).

Within the settlement-terrain there was a dense concentration of a large number (79 pieces) of large and small pebbles at a depth of about 40 cm. under the former surface (fig. 80 no. 308). There was no evidence of any pit here, but as there was no such trace at the ox burial either, and as burial pits generally were only distinguishable with great difficulty, not much importance need be attached to this. We can think of a depot of stones for some domestic use in the settlement, such as for example the tempering of pottery. But it is also possible that the stones were brought at this spot by a natural cause, for example frozen in an ice-floe during the formation of the ridge. In that case we would, however, expect more of such concentrations. Moreover, there seems to have been some selection, not of the dimensions, but of the kind of stones: the material consists almost exclusively of quartz and quartzite, with only one pebble of a soft clay-stone.

4.6.7. Worked Wood [40] (fig. 99)

In the gully 28 pieces of wood bearing more or less clear traces of having been worked were found. Of these 26 were recovered, but later five were rejected, as they showed no signs of working after closer study. All the worked pieces of wood were found beneath —180 cm. NAP under or at the base of sand 2; they are therefore clearly associated with the other archaeological remains. We give now a description of the pieces.

[40] We thank here Mr A. Voorrips, Amsterdam, who made the determinations of the wood species used.

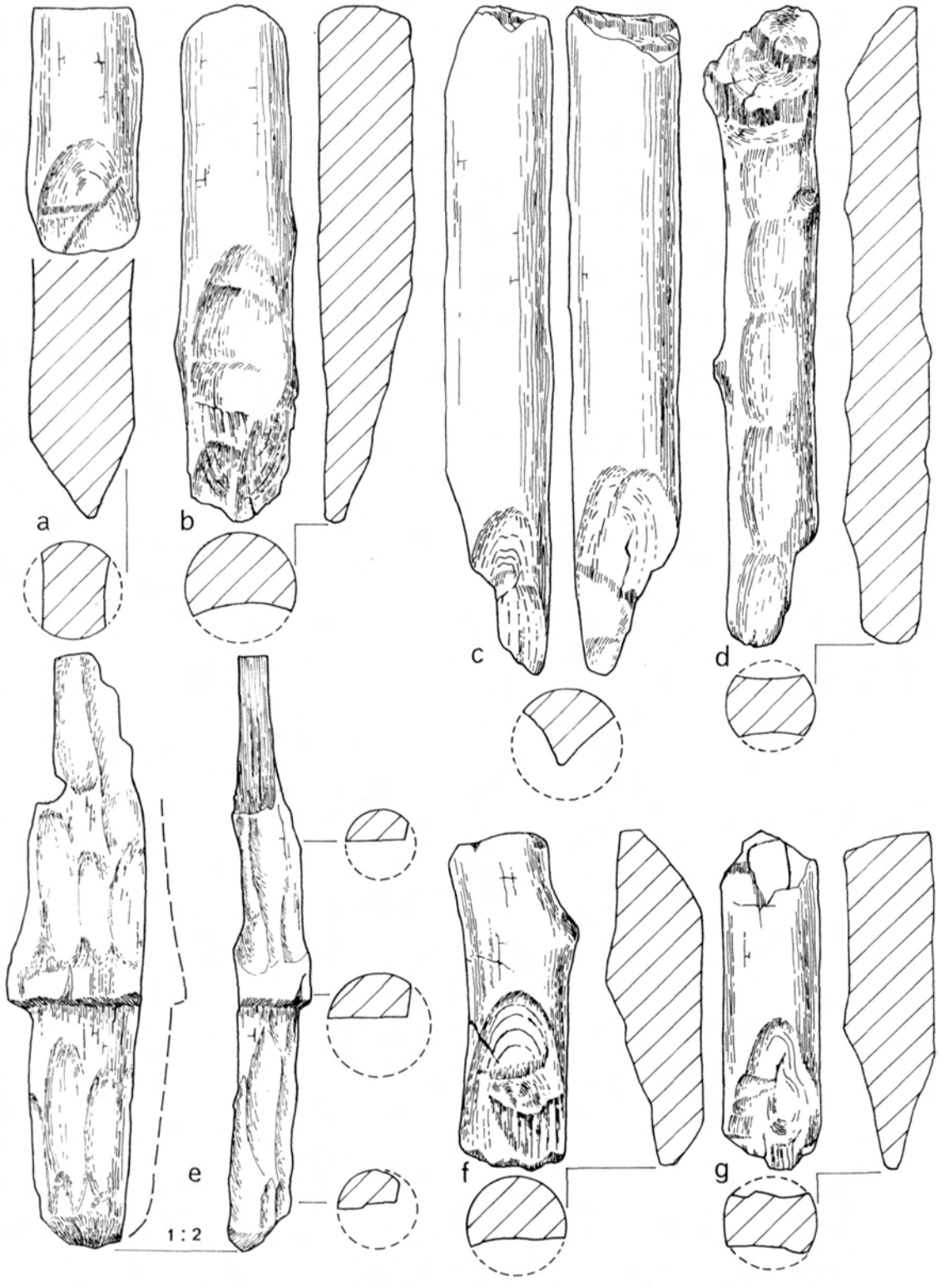


Fig. 99. Molenaarsgraaf. Worked wood. Scale 1:4, except e.

a-c, f-g pointed posts.

d beam, worked with an adze on two opposite sides.

e fragment of tenon.

— A segment of the pin of a pin-hole construction shows a carefully trimmed blunt point and projecting flange. It is made of wood from the purging buckthorn (*Rhamnus cathartica* L.), a tree which must have grown rarely in the surrounding vegetation (see p. 188) and was carefully selected in order to make this pin (fig. 99 e).

— An alder-wood post about 6 cm. thick, of which 41 cm. have been preserved, was flattened with an adze on two opposite sides to a thickness of 3.3-4.3 cm. One end was cut at an angle with a few powerful axe blows (fig. 99 d).

— Ten poles were cut to a point (fig. 99 a, b, c, f, g). These ten pieces comprise all poles found in a vertical position, plus five sloping (washed over) poles and one lying horizontally. They were all round thin tree-trunks with a diameter of 4½-7 cm. preserved to a length of 13½-60 cm. The pointing was done on one side (five poles), on two opposite sides (two poles) or on two adjoining sides (one pole). Trimming to a point on all sides was done on two poles. The area trimmed generally shows no more than the traces of four or five blows with a breadth of up to 6 cm. This means, in our view, efficient work with an average-size axe. It cannot be determined whether this was a flint, stone or bronze axe. The type of flint axe, found in the settlement terrain fits the scars well, however. The wood used was again alder (*Alnus glutinosa*), with one exception (ash, *Fraxinus*).

— The other pieces are five triangular, two flat pieces of split wood and two pieces of burnt wood, one of which, pointed and 12 cm. in length, was found in vertical position.

Examination of the species of wood chosen for the worked pieces shows that alder, which was in plentiful supply, was nearly always used (table 21). The only exceptions are the thinnest vertically placed pointed pole (ash) and the fragment of the wooden pin (purging buckthorn).

TABLE 21

Molenaarsgraaf. Worked wood

		All pieces collected	Worked pieces only
Quercus sp.	oak	1	—
Fraxinus excelsior L.	ash	1	1
Alnus glutinosa (L.)	alder	22	19
Rhamnus cathartica L.	buckthorn	1	1
Unknown	—	1	—
Total		26	21

One can only guess what the function of the poles knocked into the former gully bottom was. The situation of the vertical posts and those washed sideways shows no regularity of any kind. The slenderness of the poles would seem to rule out the possibility of any heavy construction such as a bridge. In our view the most acceptable supposition is that they formed

some part of the fishing equipment of the inhabitants: we have other proofs that they practised fishing. We imagine that nets and traps were fastened to the poles. In the beginning of the second phase of activity (sand 2) of the gully most of the poles were washed over to a sloping or horizontal position, but they were not carried away because they were covered with sand 2 or still firmly embedded.

Two characteristic pieces and the pin have been preserved with Agrical-C.

4.6.8. The Faunal Remains [41] (table 22)

A number of bones, badly or very badly preserved, were found scattered in the gully filling and the settlement terrain, 289 of which have been indentified [42]. The most and least badly preserved bones came from deposit 1 of the gully filling and belong therefore to the second (BWB) occupation phase of the settlement. In the distribution [43] we found concentrations on both sides of the central part of the gully and on the western bank. In the central part of the gully a few bones were found on the sand 2. They are all cattle bones. These have not been included in the count lists as they must perhaps be connected with the Middle Bronze Age inhabitation in the immediate vicinity. The same applies to two jaw bones found at a higher level near the north section, indicated in fig. 64. In the grey occupation layer of the settlement site the conditions were much less favourable for preservation. The finds consisted chiefly of molar teeth. Bones from the 16th century sand digging site have not been included in our report, although they will be largely prehistoric. As there appeared to be no essential differences between the composition of the finds in the gully and in the settlement terrain, as there is hardly any time difference, and since the numbers are very small no distinction has been made between both find-groups and all bone material has been treated as a whole.

The large majority of bones comes from domestic animals (92%). Hunting large and small wild animals and birds probably was of limited importance as a source of food in Molenaarsgraaf.

Cattle (*Bos taurus*) were the most important domestic animals. Only a few bones could be measured, but the measurements that could be taken fit in the sequence found for Hekelingen and Vlaardingen. The cattle were slaughtered at all ages (table 23). The remarkable find of the complete skeleton of a young animal of about 1½ year old will be discussed later in connection with the graves. Of little importance were the pigs (*Sus domesticus*), which again were slaughtered at all ages (table 23). In the third place came the small ruminants (sheep/goat, *Ovis aries/Capra hircus*). Osteologically it is difficult to separate these two species, but in Hekelingen as well as in Vlaardingen the horn-cores or skulls of both species were found, so it is reasonable to assume, that both were known in Molenaarsgraaf. As the dog (*Canis*

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[41] Miss Dr A. T. Clason did the time-devouring work of identifying the bones. She made a report which we used in writing this paragraph. The results of her investigation will be published by her in more detail.

[42] In this number the human *radius* (*cf.* p. 253) is not included. Antler fragments were left out of consideration. No attempt was made to identify the fragmentary ribs and *vertebrae*.

[43] See p. 187 and fig. 65.

TABLE 22

Molenaarsgraaf. Animal bones

		Number		%
Bos taurus	cattle	218		81.7
Sus domesticus	pig	33		12.4
Ovis aries/Capra hircus	sheep/goat	14		5.2
Equus caballus	horse	2		0.7
Domestic animals total			267 (92.4 %)	100.0
Castor fiber	beaver	8		
Cervus elaphus	red deer	4		
Alces alces	elk	3		
Ursus arctos	brown bear	1		
Sus scrofa	wild boar	1		
Wild animals total			17 (5.9 %)	
Avis sp.	birds	3		
Acipenser sturio	sturgeon	1		
Piscis sp.	fishes	1		
Miscellaneous total			5 (1.7 %)	
Total			289 (100.0 %)	

TABLE 23

Molenaarsgraaf. Mandibles classified by the age

Cattle	1-6 months	2
	28-34 months	3
	>3 years	4
Pig	c. 6 months	2
	c. 2 years	3
	>2 years	2
Total		16

familiaris) was not a meat animal, the absence of this species among the bones does not imply there were no dogs at Molenaarsgraaf. Interesting are two fragments of horse (*Equus caballus*) bones: the proximal end of a *radius* and the proximal end of the right *tibia* of a young animal. As they were too fragmentary to take measurements of them it is impossible to say whether they are from wild or domesticated animals. There are some facts, however, that may suggest that they are from early domesticated animals. In the first place, the marshy environment was not very suitable for horses; secondly, also in later settlements, as for instance Culemborg [44], where many horse-bones were found, no wild animals occurred; and thirdly, in the transition period from Neolithic to Bronze Age the domesticated horse spread over Europe. The horse bones were both found in the western bank zone in the gully deposit (1). They undoubtedly belong to the domestic refuse of the settlement, and the possibility that they belong to a later period than the second occupation phase can be excluded. These belong to the oldest remains of the domesticated horse in this country [45].

The wild animals that were hunted were those that could be expected in the vicinity of the settlement site. Of the red deer (*Cervus elaphus*) a few long bones and two antler fragments were found. Interesting is the finding of elk (*Alces alces*). This species was not found in any of the VL Culture sites, which had, contrarily to Molenaarsgraaf, no direct connection with the sand area in the east [46]. Also the wild boar (*Sus scrofa*) and the brown bear (*Ursus arctos*) were present. The relatively numerous bones of beaver (*Castor fiber*) are characteristic of the marshy environment with its many fresh water creeks.

Fishing can have been much more important than appears from the table, and might have been of similar importance as fishing was elsewhere in similar environments in the western Netherlands [47] as a source of supply for animal proteins. This is suggested by other finds especially from the graves and it seems that fishing partly compensated for the small interest of hunting at Molenaarsgraaf. The absence of fish waste may be the result of the rather poor conditions for preservation. Moreover, fish waste other than the big sturgeon bone plates thrown in the gully was probably carried away much more readily by the current than heavy animal bones. It seems to us that it is unjustifiable to draw conclusions from the table 22 about the importance of fishing as compared with hunting and cattle breeding. We prefer to rely on other evidence, such as the poles in the bed of the gully, the loam weight fragment from the gully filling and the data provided by the graves, especially grave II.

The emphasis on cattle raising and the very small interest in hunting must find their cause in the environment. As we know (*cf.* p. 137 and 188), the clay wedges of the stream ridge offered plentiful grazable land. The landscape and the economy of Molenaarsgraaf resemble the Vlaardingen Culture settlements on the coastal barriers to a large extent and contrast to those along the estuarine creeks (*cf.* p. 332).

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[44] Louwe Kooijmans 1966[a].

[45] *Cf.* p. 330.

[46] But Mr G. Kortenbout van der Sluijs informed me that there are two elk bones from the Western Netherlands in the collection of the National Museum of Geology at Leiden: an antler from Stompwijk and a skull fragment with the antlers sawn off from Heusden. Both pieces are, however, undated.

[47] For example at Vlaardingen and Hekelingen and during the earliest phase of Voorschoten.

4.7. THE GRAVES

4.7.1. Introduction; the Cemetery.

In the settlement terrain five flat graves were found. Three of them were human inhumations, one contained the skeleton of an ox and one was a pit without skeletal remains or grave goods, yet having all the characteristics peculiar to burial pits in Molenaarsgraaf and in general. The graves were documented by vertical photographs taken with the aid of a rod on a tripod [48]. From these photographs (Pls IV, VIII, X, XII), from subsidiary measurements taken in the field and by reference to the skeletal material, the drawings in this publication were made. The anthropological discussion of the skeletons was written by Miss A. Knip [49]. Her report is added as Appendix V to this paper. The anthropological data in the description of the graves were taken from this report.

The good state of preservation of the skeletons and of the bone grave goods is caused firstly by their position below the ground water table, since shortly after the inhumation until recent times. The bottoms of the graves lie now about the present ground water table, but some decades ago the drainage of the parcels near the low "rear dyke" of the polder was much worse and consequently the skeletons were well under water. A high lime content might be a second factor. But the sand of the ridge is only very locally rich in lime and this generally was not the case in the excavated part: only near grave I a fairly high lime content could be demonstrated. It seems, as if there the unusually thickly developed occupation layer (*i.e.* the pit filling above the grave) had considerably hindered percolation and so had prevented the removal of lime from the sand.

Because the bone had been preserved at Molenaarsgraaf, some new elements were added to the VBB grave good assemblage: the bone fish-hooks and the antler hook.

The five graves all lie in a row approximately along the top of the sand ridge (the line linking the highest points) and the axis line of the find concentration. The intervening distances show great regularity:

grave II	— grave III	8.0 m.
grave III	— grave I	15.5 m.
grave I	— ox burial	9.5 m.
ox burial	— grave IV	8.8 m.

It is noteworthy that the distance between grave III and grave I is almost twice that of the other distances. It is possible that between both graves there was a sixth grave which disappeared when the modern ditch was being dug. This regularity convinces us that we have not

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[48] We heartily thank the staff-members and the technicians of the Institute for Prehistory, Leiden, for their help during the excavation of the graves and for the making of the vertical photographs.

[49] We are much indebted to Prof Dr J. Huizinga, Institute of Human Biology, Utrecht. He visited the excavation when the graves I and II were discovered and gave his comments on the skeletons, while they were *in situ*. To Miss A. S. Knip we are indebted for the exhaustive anthropological report she made of the skeletons.

overlooked any graves. There seemed to be some possibility of this when three graves were discovered one after the other at the end of our first operation; they were mostly hardly recognizable in the levels of the excavation pits. During the second operation none of them can have escaped observation, however, because we took a great deal of care and trouble not to miss any.

It seems to us to be important that, in view of the above mentioned regularity, we are justified in talking of a cemetery. This is not a case of a number of isolated burials, but of the repeated use of the site by a group of people who were at least familiar with the general situation and apparently with the exact situation of the other graves, the location of which in all probability was not, however, marked by a barrow but might have been visible by another mark. On the basis of these considerations it is difficult to conceive that this little cemetery existed for long; it is more likely that we are here concerned with a fairly short phase in the occupation period. It is even possible that the cemetery represents a short period when the site was not occupied. If this is the case, then these were not interments in the settlement itself, but a former settlement site was being used for burial purposes. After discussing the individual graves, we shall examine what contribution to the solution of these problems is made by the facts which emerge.

4.7.2. Grave I (figs. 100-104, Pls. IV-VII, XIII)

Grave I was the first grave to be discovered (by chance) in the fifth week of the first operation, during the digging of sections on what was thought to be a refuse pit in the middle of pit A9, next to the north wall of house I. The pit differed somewhat in its regular oval shape and its darker filling from the neighbouring pits, so that more attention than usual was paid to it. The examination of a vague discolouration under the filling of the pit led to the skull being damaged by a spade and the discovery of the grave. The section pit was filled up, and we began to excavate by means of levelling off.

Five of the plans drawn of eight levels are illustrated here (figs. 100, 101). In the lowest level an irregular, rectangular, violet-grey trace could be made out: the remains of a timber casing of the burial pit. A thickening of the trace at the corners indicated that they had been reinforced by vertical poles, of which the traces show a diameter of 14-20 cm. In each corner apparently stood two poles. As traces below ground water level had completely disappeared, it cannot be determined how deep the poles were knocked into the ground. Only at one place was a faint trace to be seen of the outline of the pit itself in which the casing was made. The large oval "refuse pit" (70 × 130 cm.), visible in the highest level, in which unfortunately no finds were made, must have come into being during the collapse of this burial chamber. In the intermediate levels the burial pit could be seen as a rounded rectangle of slightly dirty sand, in which the rust formation was different in character from that outside it. The causal relationship of "refuse pit" and burial chamber is illustrated best by the superposition of the most characteristic levels, as shown in fig. 102. Starting from the plans it was possible to construct two cross-sections through the grave which also permit a better insight in its structure (fig. 103).

The burial chamber lay almost exactly in an E-W orientation and its interior measurements were 130/135 × 80/95 cm. The soil traces of the casing were 7-10 cm. wide, which indicates

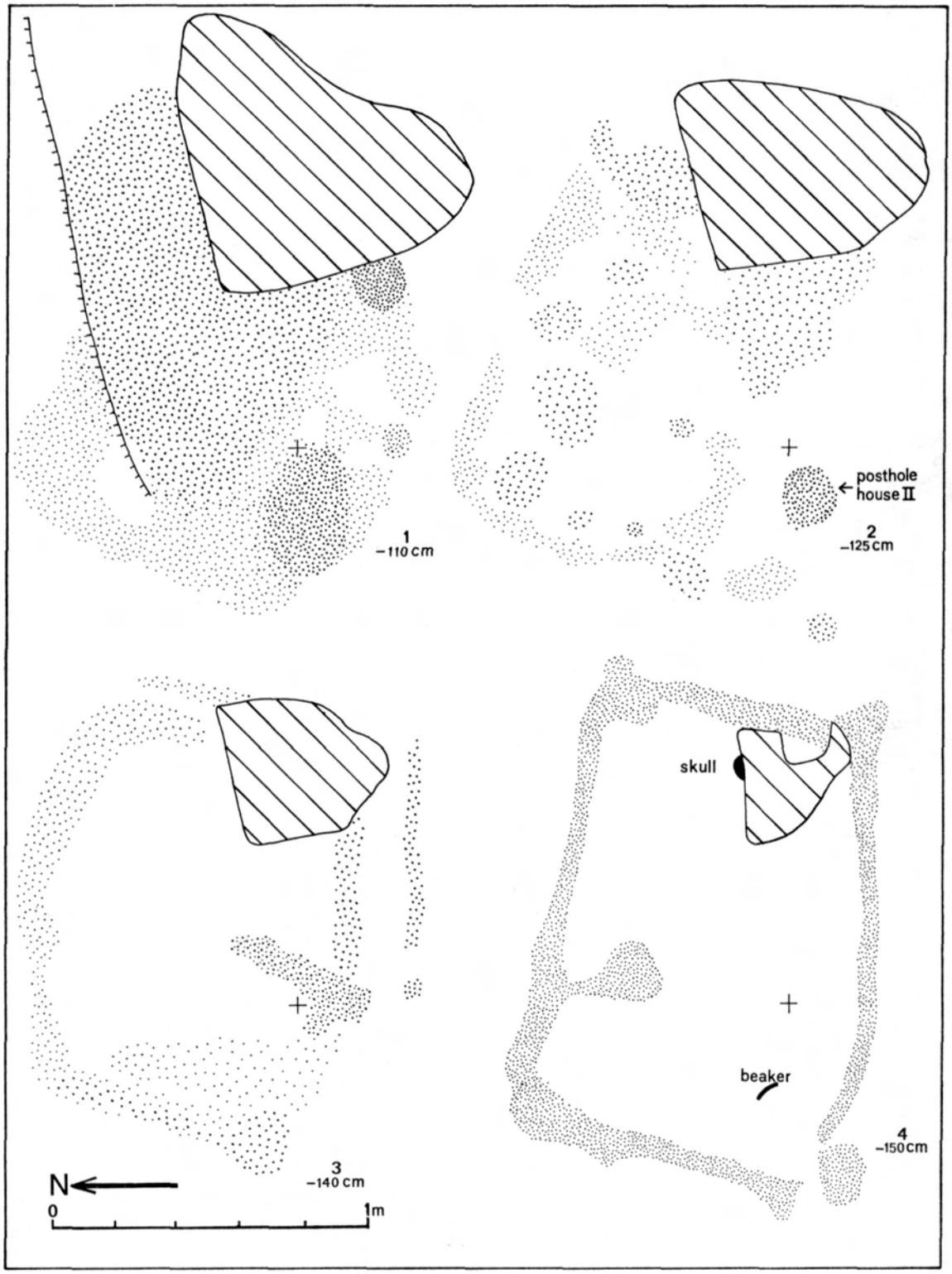
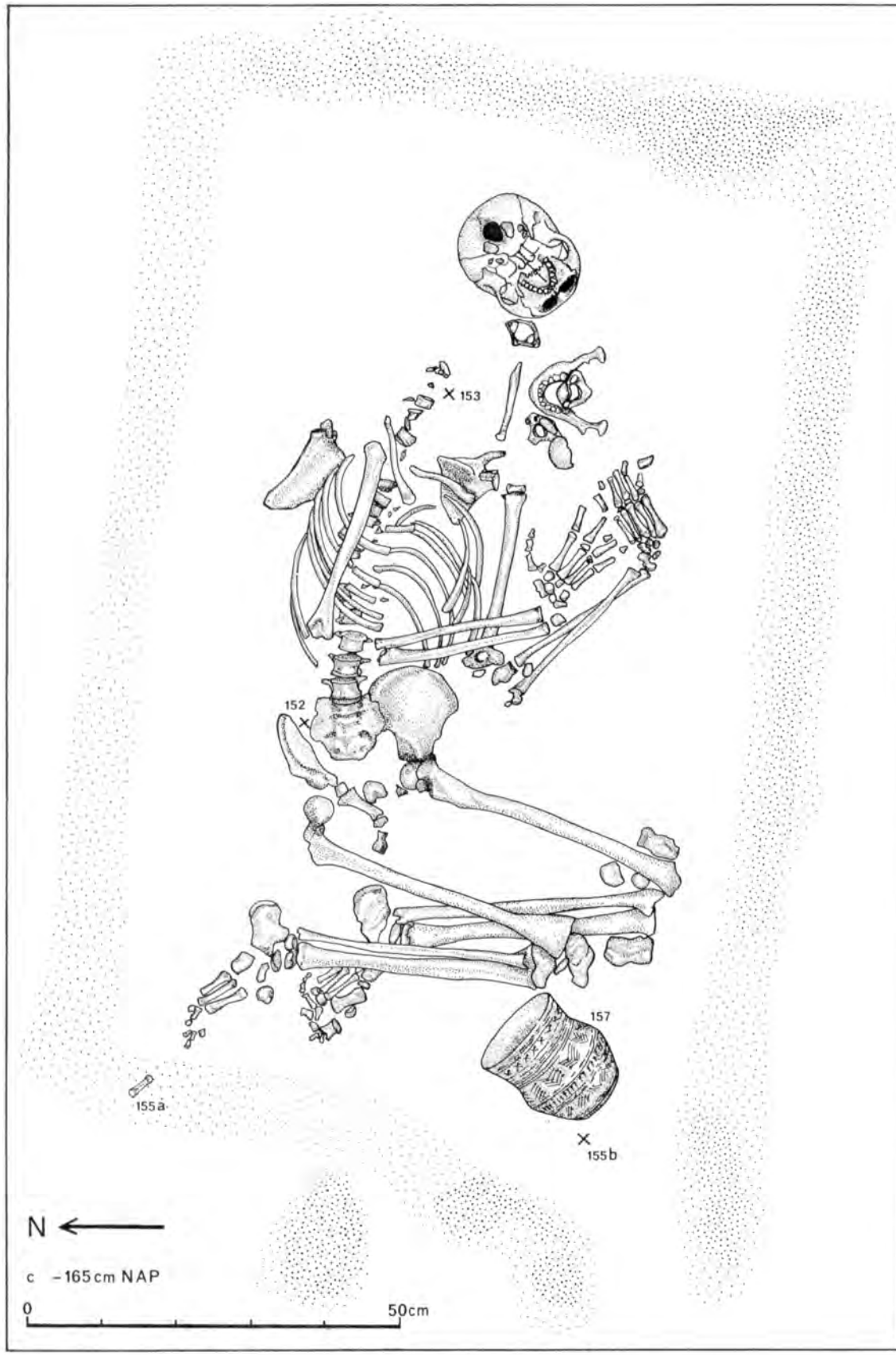


Fig. 100. Molenaarsgraaf. Grave I. Plan of the grave at various levels. Depth below NAP. Scale 1:20.

Fig. 101. Molenaarsgraaf. Grave I. Scale 1:8. 152 : some small sherds. 153 : fin-ray of pike. 155a : phalange of right foot. 155b : small piece of bone. 157 : Veluwe Bell Beaker.


153
152
157
155a
155b
N
c -165 cm NAP
0
50cm

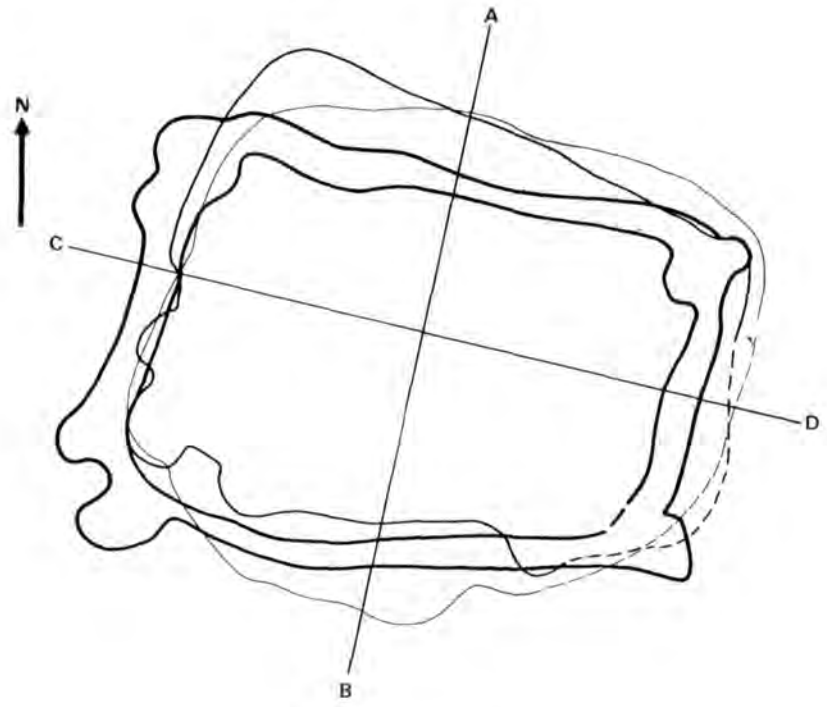


Fig. 102. Molenaarsgraaf. Grave I.
Superposition of the plans of three characteristic levels :
thin line = —110, medium line = —125, heavy line = —150 cm. Scale 1:20.

the use of heavy planks of possibly about 4 cm. thickness. The height of the chamber will not have been more than about 50 cm. The distance between the floor and level 3, in which a part of the roof construction was recognizable as a violet-grey trace, was 28 cm., while the refuse pit was a good 20 cm. deep. Various observations mentioned below show that the casing was a solid construction which could have remained standing for at least a few decades. The floor of the grave lay at —165 cm. NAP.

The crouched skeleton (fig. 101, Pl. IV) lay not exactly on its left side, but turned somewhat on its back, with the head to the east and facing south. The hands were folded before the chest, the hand of the left arm (the lower one) on the right hand, and both palms downwards. The wrist joint of the left arm was therefore completely turned round, so that *radius* and *ulna* crossed each other. As the body decomposed the arm bones must have twisted further as the skeleton settled down. Both legs were bent to an angle of about 90° between the *femur* and the spine. The knees were sharply bent to an angle of 20-30° between the *femur* and the *tibia*. The pelvis had become somewhat displaced. The right underarm was no longer connected with the *humerus*, but had rolled or slipped slightly out of place. The ribs under the right *humerus* were splintered. The skull, lower jaw and a number of *cervical vertebrae* were also no longer

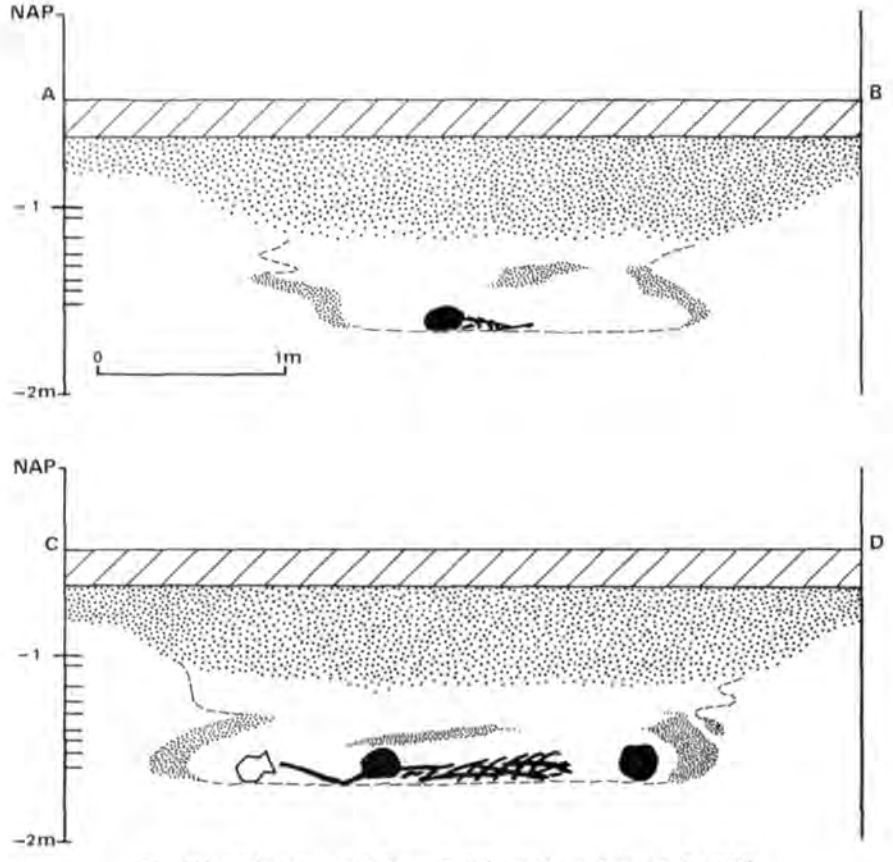


Fig. 103. Molenaarsgraaf. Grave I. Schematic sections (*cf.* fig. 102) derived from the drawn plans. Scale 1:20.

connected anatomically. After the complete decomposition of the body, including the sinews, the skull apparently tumbled aside until the *foramen magnum* lay uppermost. The lower jaw and some *cervical vertebrae* consequently fell aside [50]. This can only have been possible because an underground hollow space must have been preserved for some decades, due to the strong construction of the burial chamber.

That one metatarsal and half of the phalanges of the feet are missing and that one of these is displaced over about 20 cms will be mainly the work of animals.

The skull (Pl. XIII) is markedly *brachycranic* and unusually broad (an *index cranicus* of 94.6) and shows a very clear *planoccipitaly*. All the cranial sutures are still open. In the lower jaw both M_3's have not grown through. In the upper jaw the right M^3 has almost grown through and the left M^3 is present but loose. The articular ends (*epiphyses*) have not yet grown fixed to the long bones. The skeleton is that of an adolescent, very probably male, of about 15 years of age. The long bones are not very robust. The anthropological length of the body, estimated from measurements of the long bones, is 162-163 cm. Measurements from the vertical

[50] This is according to the comments of Prof Dr J. Huizinga.

photograph (Pl. IV) gave 164 cm., and thus the two estimates correspond very well. The individual would certainly have become taller in maturity. The teeth show no reduction. Only a few molars are slightly worn [51].

At the throat side of the *cervical vertebrae* a fragment of a fish bone was found (fig. 101 no. 153; Pl. VII B). It is the 2.16 cm. long fragment with articular end of a fin-ray of an unpaired fin (the belly- or the back-fin) of a pike (*Esox lucius* L.). The position (exact find spot)of the fin-ray fragment suggests strongly that the boy had originally this tiny bone in his throat. Although an ordinary fish bone hardly can have caused death, we must assume the contrary of this relative large object. It is likely that the fin-ray, when stucked in the boy's throat caused a serious infection and an abscess, which ultimatily might have caused death [52]. We hardly could get a more dramatic proof of the consumption of fish.

Near the pelvis lay a few small, undecorated beaker sherds which had apparently come here from the filling of the burial pit (fig. 101, no. 152).

Fig. 104. Molenaarsgraaf. Bell Beaker of Veluwe type from grave I. Scale 1:2.

A Bell Beaker had been placed as a gift in the grave near the knees (fig. 101, no. 157). As the timber casing of the pit decayed sand fell into this corner, as appears from an interruption in the soil trace and a vague pale discolouration inside the grave there. This caused the beaker to fall against the right knee of the skeleton. The Bell Beaker (fig. 104, Pl. VII A) is 13.7 cm. high, the external diameter of the rim is 13.1-13.5 cm. and of the belly 13.8 cm. A clear neck

[51] These anthropological remarks are derived from the report of Miss Knip, Appendix V.

[52] This small fin-ray has been examined and identified by Dr Johannes Lipsikaar, Museum for Natural History, Gothenburg, Sweden, through the kind intermediary of Miss Dr A. T. Clason, Groningen.

and belly bend divide the beaker into three approximately equal parts, a division accentuated by the decoration. Starting from the top we can distinguish:

— three horizontal lines under the rim,
— a band of small lines crossing each other obliquely,
— a band of 8-9 horizontal lines, reaching as far as the neck bend,
— a band of 6-8 (in general 7) zigzag lines on the shoulder,
— a row of vertical lines on the belly bend limited on both sides by three surrounding lines,
— a row of 4-6 zigzag lines,
— 2-4 (in general 3) horizontal lines at the base.

If the design of the decoration is carefully chosen, as usual in Bell Beakers, the execution is rather crude, and not done with a dentated spatula or a sharp object, but with a fairly broad plain spatula. The other characteristics also show that this is not one of the best examples of a Bell Beaker. The rim is simply rounded, the base is flat, the walls are rather thick 6-8 mm.). The surface, which is not particularly smooth was not polished. The pale colour varies from very pale yellow to light yellowish brown (10 YR 7/3-6/4) with some greyish marks. There is hardly any sign of tempering except a few small pebbles and a little pounded pottery. The pottery is not especially hard. As it lay on its side the opening has become slightly deform-(ed, causing a small crack.

The beaker certainly does not belong to the best beaker pottery used in the settlement. A few sherds were found in the pits which were similar in quality to the best beaker pottery known in this country. Many of the BB sherds from the occupation layer are of better quality pottery. As the burial gifts in the Beaker Cultures were generally selected from the best pottery, we must assume that this is an exception to the rule or that the grave belongs to a phase in the settlement when no better pottery was in use. The most likely dating in this case is the end of the first (VBB) occupation phase, with the possibility of a somewhat earlier or later dating.

For a ^{14}C determination use was made of the middle section of the left femur with the result:

GrN 5131 3635 ± 40 (1685 BC) bone.

This date corresponds very well with the known data and confirms the above-discussed archaeological-typological dating.

Recapitulation

About 1700 B.C., at about the end of the first occupation phase, a boy of about 15 years of age and about 163 cm. tall was buried in a crouched position on his left side and with his head to the east, in a burial chamber lying accurately in an East-West orientation. The chamber, measuring about 90 × 130 cm. and with the bottom at —165 cm. NAP, was solidly constructed and lay immediately against the northern wall of a contemporaneous house. As a burial gift a Veluwe Bell Beaker of comparatively careless execution was placed near the knees. The skull is planoccipital-brachycranic.

4.7.3. Grave II (figs. 105-109, Pls. VIII-IX, XIV-XVI)

Grave II was found on Saturday, 24th September, 1966, when a few boys began digging in an open excavation pit. Fortunately they were caught in the act, so that the disturbance was limited to a small area around the neck and skull of the skeleton.

The presence of a grave was indicated in this case only by a few irregular grey marks in the yellow sand between the large round pits in the western part of B7. Nor was any clearly marked pit revealed during the subsequent levelling off. Only between about —150 cm. NAP and the bottom of the burial pit (—159 cm. NAP) did a faint but unmistakable trace, about 5-10 cm. wide, oval and light violet in colour, become apparent round the skeleton (fig. 106). As with grave I, we consider this to be the trace of a shoring up of the burial pit, for which, in view of the shape, wickerwork will have been used, rather than planks. The interior measurements are 80 × 145 cm. The axis is roughly orientated SSE-NNW, parallel to the gully, against which the grave directly lies. The height of the burial chamber could not be determined. The reinforcement of the grave pit was less solid than that of grave I: no parts of the skeleton had rolled or slipped out of place.

The skeleton lay in a crouched position on its left side with the head to the south, facing west. The most noteworthy feature was the absence of a number of bones. which must have disappeared during the digging of a pit (no. 199) which cuts through the grave on the western side (fig. 105, 107, Pl. IX A). In the filling of this pit one of the missing parts of the skeleton, the 15.5 cm. long proximal part of the left *radius* (Pl. XIV), was found. There was no sign, however, of all the other missing parts, which consisted of almost all the left leg, except for the upper end of the *femur* (the pelvic joint), and the lower end of the *tibia* with the foot. The same applies to the left arm: only the top of the shoulder-joint of the *humerus* and the left hand with the wrist-joints of the *ulna* and *radius* remain. The whole of the right hand with the wrist and most of the *radius* is also missing. It is curious that the parts named are not broken off at the point where pit no. 199 was dug, but some distance behind this in the undisturbed sand. Where the pit was dug it seems that only the parts of the skeleton that projected most were touched during the digging: the left knee, the left elbow and the right hand. That the fracture did not occur where the digging took place, but in the sand behind it, seems to be normal. The bone joints which are still preserved had not at all, or only slightly, been forced out of their correct an atomical positions, which proves that the tendons of the dead person had not yet seriously rotted[53]. The appearance of the separate *radius* fragment in the pit 199 filling, on the other hand, supports the assumption that the body was in an advanced state of decomposition. All this implies a time difference of two or three decades between the grave and pit 199. The disturbing pit was intentionally refilled immediately after the digging with the soil that had been removed; this is apparent from the nature of the filling, which consisted entirely of the same loose sand, with a small clay content, as the ground in the vicinity, and which only differentiated itself by the somewhat dissimilar soil processes caused by the disturbed structure of the sand. It was only at a much higher level that a smaller, irregular pit was seen, with a "normal" filling (*cf.*

[53] This is according to the comments of Prof Dr J. Huizinga.

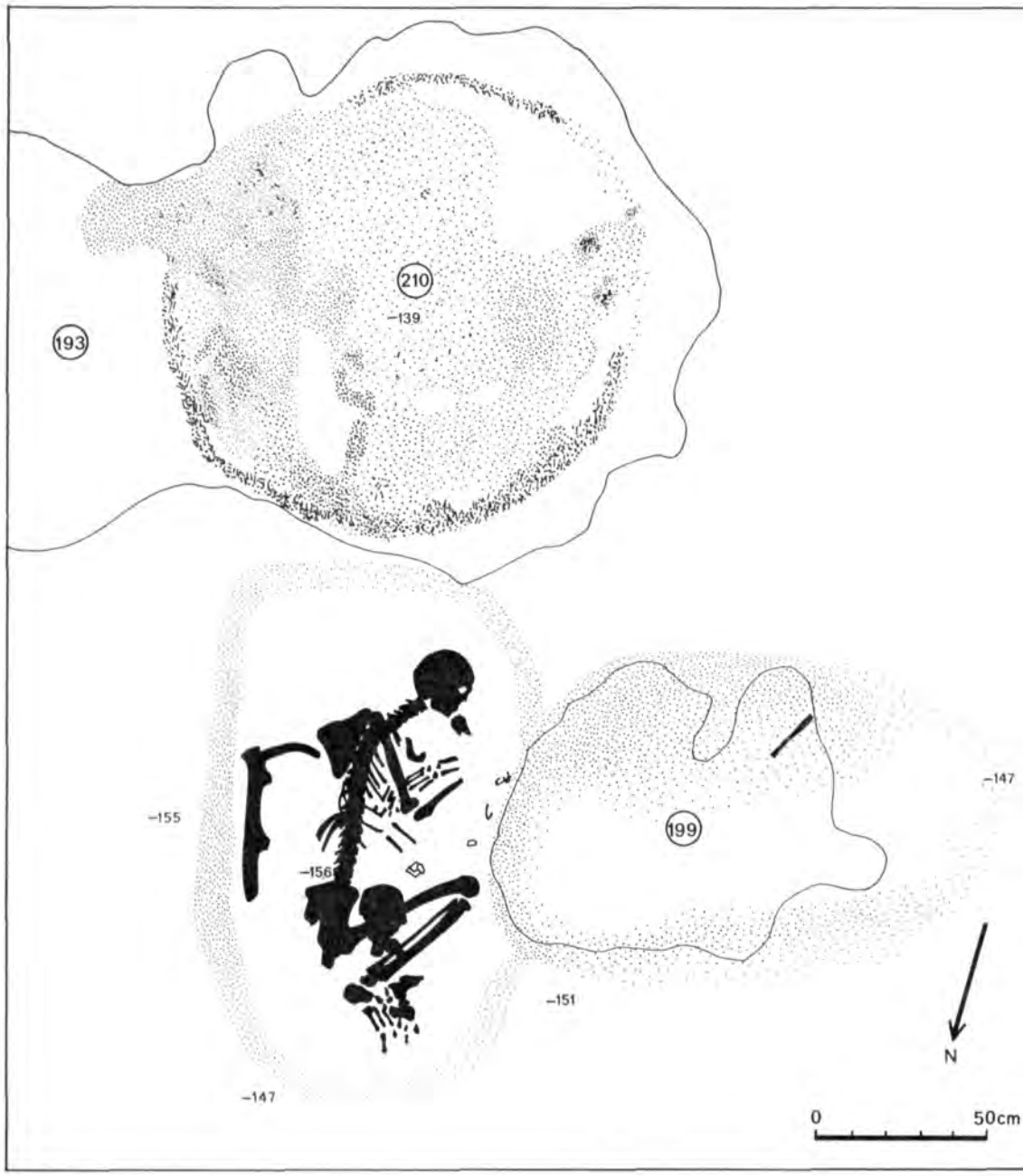


Fig. 105. Molenaarsgraaf. Grave II and surroundings. Extent of pits at a higher level indicated with a thin line. Find numbers encircled. Depth in cm. below NAP. Scale 1:20.

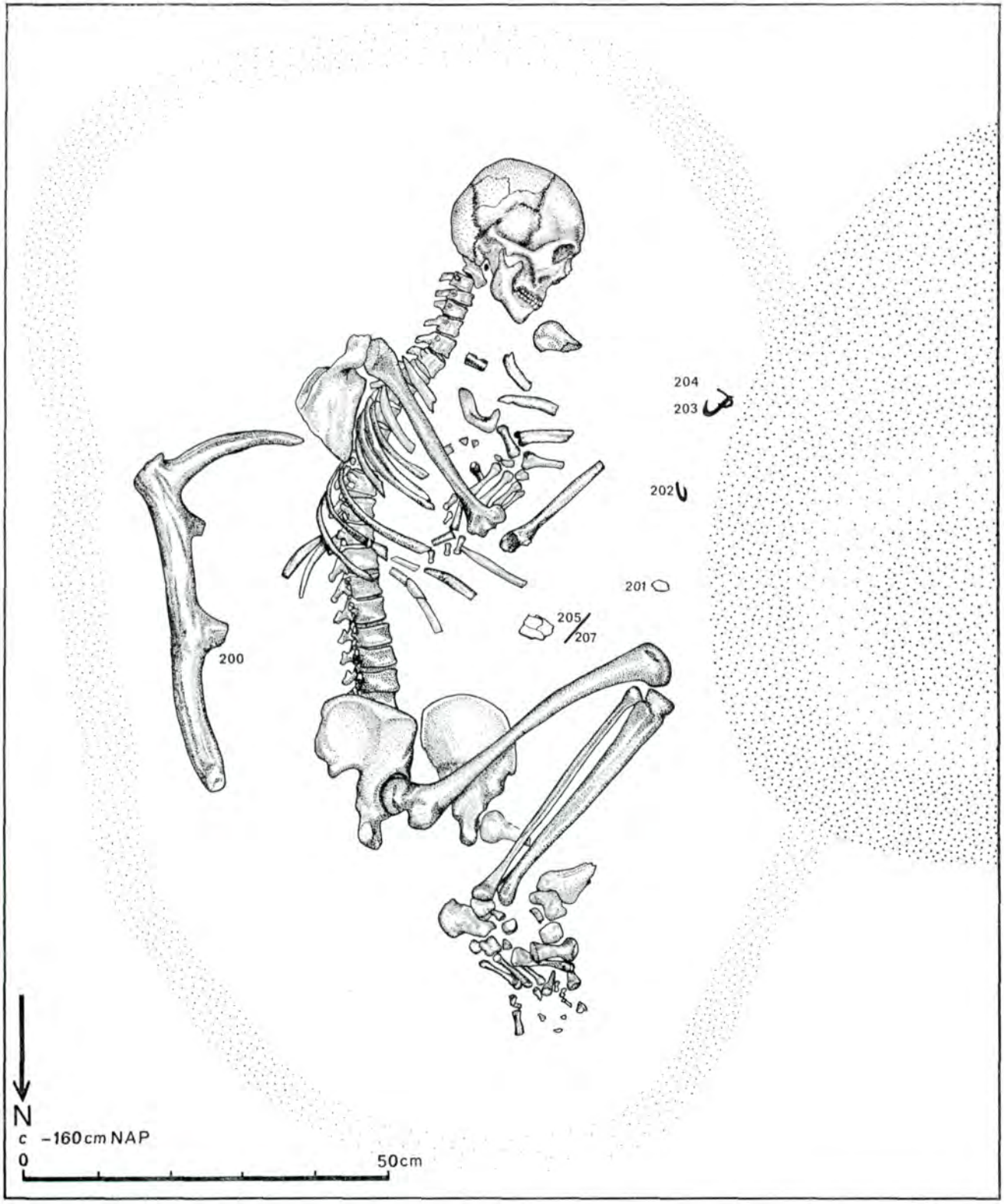


Fig. 106. Molenaarsgraaf. Grave II. Scale 1:8. *Cf* also note 55.

fig. 105). This depression will have been caused by the settlement of the sand which had been thrown back. In addition to the above-named *radius* a few very small sherds were found in the pit; two of them were decorated with fingertip impressions, on one in a V-motif and on the other arranged in lines (fig. 86 no. 199). Scattered about in the otherwise clean filling there were small pieces of charcoal, sufficient to form a ^{14}C sample. In view of their occurrence, both the charcoal and the sherds are in secondary position. They must have been lying at the surface and became mixed up with the sand when it was thrown back [54].

It is very astonishing that we recovered another missing bone from the gully filling. It is the 18.5 cm. long part of the other (right) *radius* (Pl. XIV), that fits well to the distal articular end that was preserved in the grave [55]. It was found in the "humic band" (*i.e.* deposit (1)) in the fifth square from the west, southern row (*cf.* fig. 65) during the 5th week of the first operation, so about two weeks before grave II was discovered and excavated. The bone was not recognized in the field but later by Miss Clason, during her study of the animal remains. The bone is important for two reasons. First, we can say now that the people who dug pit 199 did not do this for the human remains and that they threw them away in the gully. It is reasonable to assume that the other missing bones lie in the not excavated parts of the gully filling. Second, it is a very important chronological key. The find situation of this bone proves that the disturbance (pit 199) of grave II occurred in the second occupation phase. So pit 199 is contemporaneous with the gully finds and grave II slightly older: it is dated just before or in the beginning of the occupation phase 2.

The question whether the grave was disturbed intentionally or by accident is especially interesting. We can only offer a few ideas by way of answer. It is noteworthy that the direction, shape and measurements of pit 199 conform to those of a burial pit: oval, deep, with fairly steep sides, and 110 × 160 cm. in size. Possibly the digging of a second burial pit disturbed the earlier grave. The emerging human remains were thrown away in the gully, the intention to bury a person was abandoned and the pit was immediately refilled. It is equally possible that the situation of the grave was unknown and that the course of events was an accident and yet that somebody wished to bury near the earlier grave a person who had died later. Since we refound some of the removed bones we can say that the object was not the parts of the body themselves. So we can exclude reason of magic or religion for the disturbance of the grave. A more profane purpose seems more likely, namely an ordinary grave robbery. Costly grave goods such as a copper dagger or a wrist guard might very well have lain in the disturbed area. Moreover, these are the type of burial gifts of a grown man. The fact that a big part of the wickerwork was disturbed and then the skeleton, in two places, confirms in our opinion this last assumption of intentional disturbance of the grave. All we can say with any certainty, however, is that not much respect was shown to the dead person and that the disturbance took place shortly after the burial. Finally, we must mention the possibility that the disturbance might have been the work of dogs. The refilling of the pit and the recovery of some of the bones makes this, however, very unlikely.

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[54] For the charcoal see p. 259, for the sherds see p. 218.

[55] The articular end is not shown on the plan (fig. 106) because its true position is not certain: it was slightly displaced when the skeleton was cleaned. Its approximate position is visible on the photograph Pl. VIII.

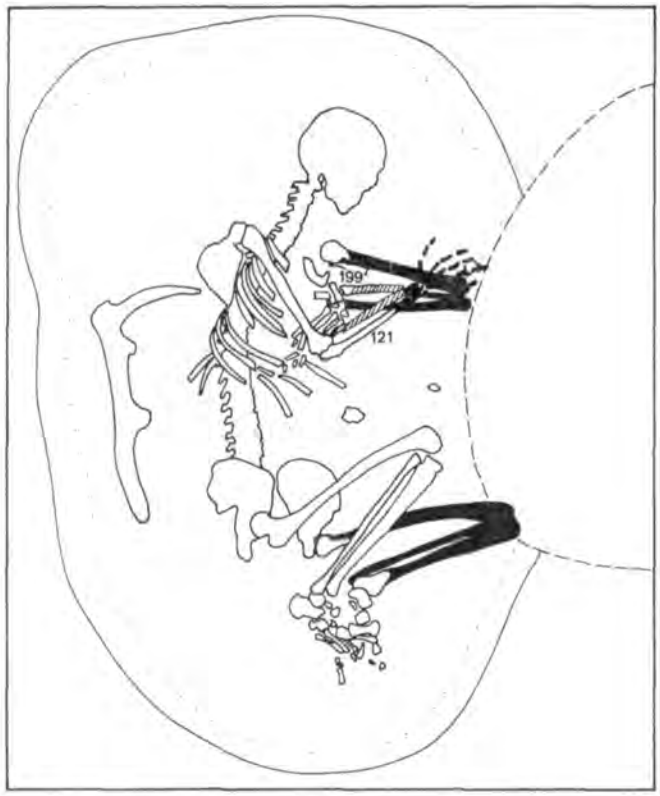

Fig. 107. Molenaarsgraaf. Grave II. Reconstruction of the original position of the missing skeletal parts. Bones recovered outside the grave are hatched, the other missing bones are black. Scale 1:20.

In spite of the absence of important skeleton parts, the position of the dead person could be exactly determined (figs. 106, 107). The crouched skeleton lay on its left side, with the head to the south, facing west. The arms lay folded before the breast. The left arm pointed from the body and was bent strongly at the elbow, so that the hand lay before the breast with its back uppermost. The right arm lay over the left and was slightly bent at the elbow, so that the (missing) right hand must have rested on the (missing) left elbow. Both legs were bent strongly, the right one to an angle of 70° to the spine, the (missing) left leg to about 100°. Both knees were bent at a sharp angle. Only the pelvis was somewhat displaced by the pressure of the sand filling of the burial pit. The other dislocations were caused by disturbance during the digging of pit 199. Only four phalanges of the hands and five of the feet are missing. This might be the result of various causes: the prehistoric and recent disturbance, the work of animals, decay and perhaps a slight carelessness during the excavation.

Although the skull was somewhat deformed after death, reliable measurements were possible. The skull (Pl. XIV-XVI) was clearly *brachycranic* with an *index cranicus* of 84.5 and shows a clear *planoccipitaly*. From the pattern of the skull sutures and the wear of the teeth it appears that the person died at about 30 years of age. All the teeth had come through, but a number, especially from the lower jaw, are missing as a result of the damage caused during

the weekend mentioned above. The teeth show clear traces of wear, both in the upper and the lower jaw. The skull gives the impression of belonging to a male person. Measurements of the right *femur*, *tibia* and *humerus* would seem to indicate a body height of 163 cm. Measurements from the vertical photograph showed about 162 cm. The long bones are not very robust. The left *os coxae* was clearly pathologically deformed (Pl. XV). Yet no manifest irregularities were found in the *femur* and *tibia* which can be linked with the above mentioned deformation [56]. The *corpus sterni* of the skeleton consists of three parts which have not yet grown together, which should have been the case at an age above 25 years [57].

The grave goods (fig. 108) consisted of a pick-shaped antler implement, three bone fish-hooks and an awl, and four pieces of flint (a scraper, two retouched flakes, and one unworked flake).

The pick-shaped implement had been placed at the back of the body. It had been broken into three pieces in the recent damage; fortunately one of them remained in position, so that the original place could be exactly fixed. The pick is 45 cm. long and made from a naturally thrown right antler tine of a red deer, by breaking off the crown and the second and third tines. The break was done crudely without first weakening the place of fracture by carving or any other technique. The broken end of the main branch has, however, been trimmed to some extent. The branch seems to have been worn somewhat smooth at the place where the grip must have been. The only tine left (the eye tine) has a small worn surface at its point and longitudinal scratches, which were certainly caused by wear. The small facet at the tip could even have been made intentionally [58]. A great part of the rose at the rear side of the antler has disappeared by some form of use. It was used either to beat on or with it. In paragraph 4.9.4.5 we will discuss its possible use (p. 304). These possibilities comprise an agricultural hoe or a fish trap lifter. In the last case the instrument might also have been used to knock the poles, on which the nets and traps were tied, into the bed of the gully.

The three bone fish-hooks (fig. 108, Pl. IX B) lay in front of the body near the missing right hand. They are 4.3, 3.1, and 2.7 cm. long and fashioned from a flat or curved piece of bone. Clearly the piece of bone was first bored to make the bend of the hooks and then cut to shape. There are no barbs and no eyes. The largest hook has two notches round the top for the firmer attachment of the line. In cooperation with Dr R. Boddeke we made some experiments to determine the possible way of use and the fishes that might have been caught [59].

The flint lay near the right knee, the small, carefully worked scraper separately, the three flakes touching each other. It cannot be determined whether they are the remains of one composite implement or whether they were placed there as separate gifts. It is noteworthy, however, that the retouched side of one flake and the side, with damage by use, of a second flake were

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[56] But the left leg is almost completely missing!

[57] According to Miss A. S. Knip, the *corpus sterni* possibly belongs to a third individual. This is, however, impossible for archaeological reasons. Between the skeletal remains from grave II also one epiphysic disc was found, that must belong to another individual, but not to the boy of grave I. The anthropological data of grave II are also derived from Appendix V.

[58] We discussed this question with Mr G. Kortenbout van der Sluijs, Leiden, whom we thank for his valuable advice.

[59] The esperiments are discussed in paragraph 4.9.8.7 at p. 333. We thank Dr Boddeke for his enthusiastic help and for his advice. Dr Boddeke is one of the most outstanding fishery experts in the Netherlands. He is a staff-member of the National Institute for Fishery Research at IJmuiden.

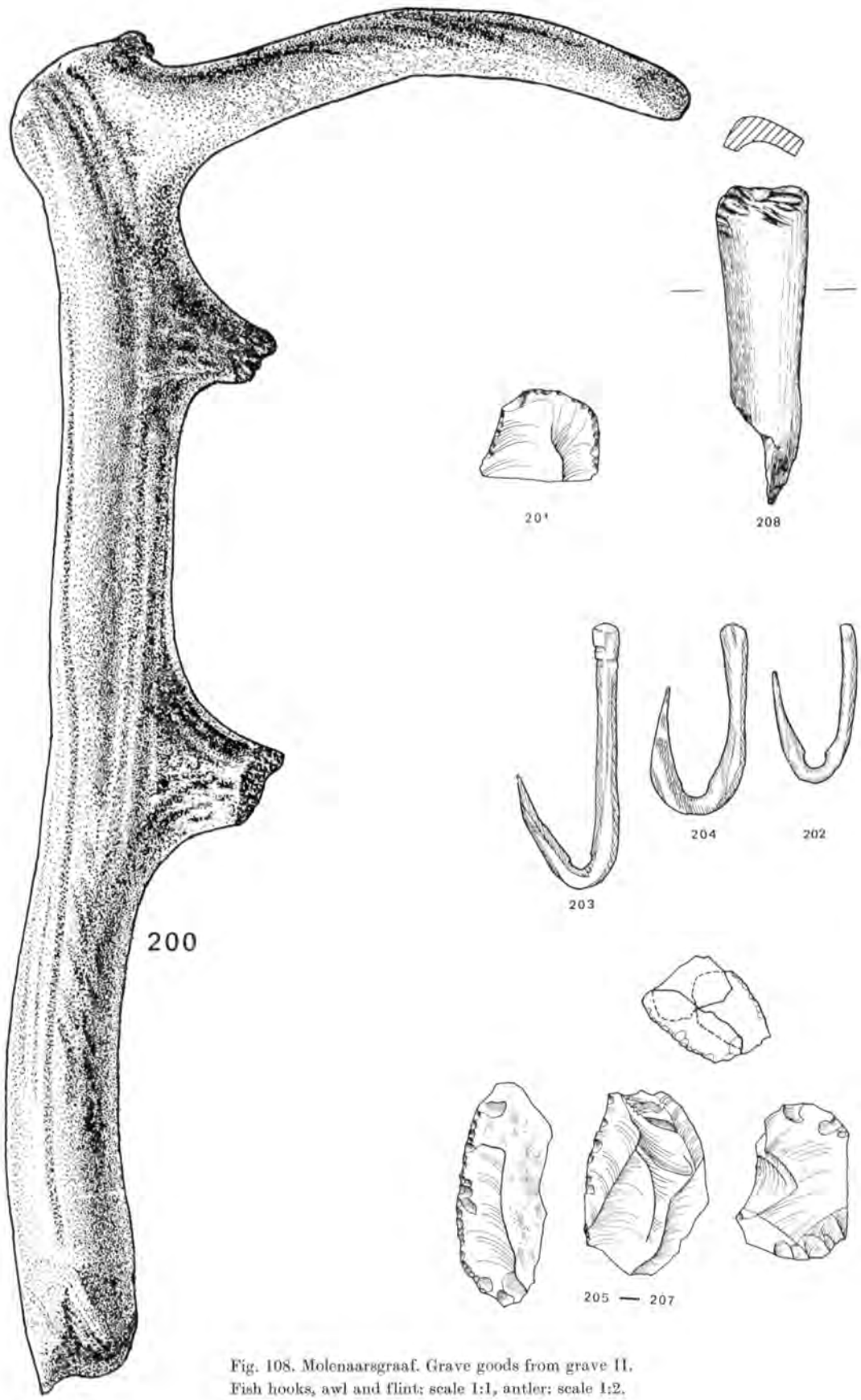

Fig. 108. Molenaarsgraaf. Grave goods from grave II.
Fish hooks, awl and flint: scale 1:1, antler: scale 1:2.

directed outwards. The third flake is unworked. It is possible that, when pit 199 was dug, some more pieces of flint and some fish-hooks were lost already in prehistoric times.

It is attractive to view all the grave gifts as associated with fishing. This is undoubtedly the case with the fish-hooks. The flints might have been used for scraping scales off the fish, and the hook we have already interpreted as a fish-trap lifter. The grave's situation alongside the gully also inclines us to consider it as the grave of a fisherman.

When the skeletal remains were studied in the Institute for Human Biology, Utrecht, some fragmentary animal bones in a variable state of preservation were found among the human remains. These are the second milk-molar of an ox, a fragmentary left *ulna* of a sheep or goat and three bone splinters. Moreover an implement was found: a fragmentary awl, with a highly polished surface (which points to a long use), probably made out of a metapodal. The point was recently broken off (fig. 108, no 208). This can be said of the relations of these finds with the interment: they must have been mixed up with the skeletal parts that were not collected one by one, but collectively, *i.e.* between the bones from the recently disturbed area near the skull and breast or between the ribs. The first possibility seems most probable. In view of the fact that no worked bones were found at all among the collected bone material from the site, it is highly probable that the awl once formed part of the grave inventory. The other bones, however, are ordinary refuse that got either in prehistoric times or recently mixed up with the sand of the grave filling.

Near the head end of the grave and on its axis line, but without cutting across it, there was a large pit (no. 210) with abundant traces of fire along its walls and floor (fig. 105). The pit is perfectly round (diameter about 140 cm.), has steep sides and a fairly flat floor. The peculiar situation of this remarkable pit can only be explained by an exact contemporaneity with grave II, which is confirmed by the ^{14}C date (p. 259). The very scanty finds from pit 210 consist only of two decorated sherds, one of which plainly comes from the neck of a Veluwe Bell Beaker (fig. 86). As these sherds are very probably in a secondary position we must take this dating as a *terminus post quem* for the pit and accordingly for the grave too [60]. This implies its placing at the end of phase I or later. We interpret the pit as the remains of a large fire which burned as an element in the burial ceremony. With the contents of the pit a small mound was perhaps thrown up over the grave. No traces of this were found, however. The other pits in the group around grave II contain hardly any charcoal, yet they are of similar shape, and the finds in their fillings indicate a dating in the same occupation phase. It is possible that they also played a part in the burial ceremony.

We will at last mention a find, that on various grounds (the situation, some stratigraphic arguments, ^{14}C dates, its extraordinary character and comparable finds at other excavations), must be brought in connection with grave II. On the western bank of the gully at about 5 m. distance to the north-east of grave II a concentration of charcoal and sherds from one pot was found. By their similar extension and concentration it was clear that both, charcoal and sherds, belonged together. Only a half of the concentration was situated in the excavation pit. We argued above (p. 185) that the finds originate from a phase when the part of the bank

[60] When we convert the line of reasoning, the well-founded dates of grave II prove that the sherds are indeed in secondary position.

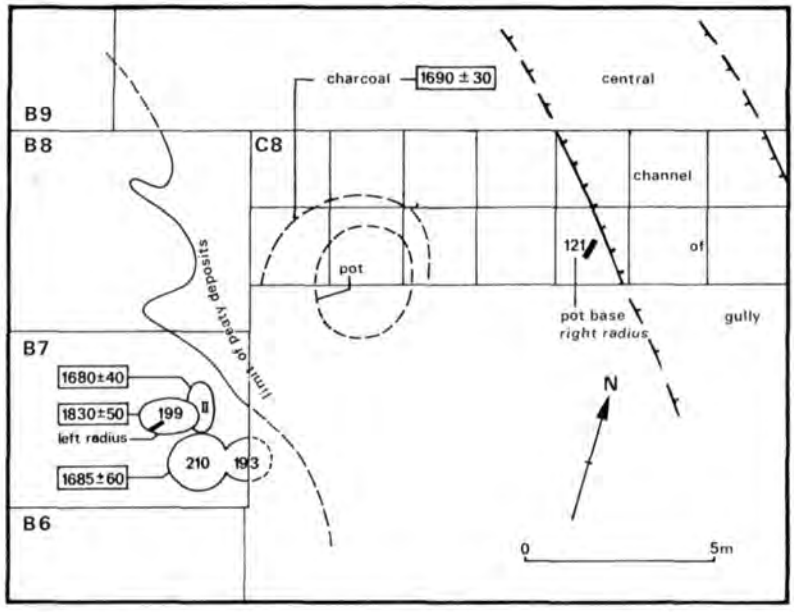

Fig. 109. Molenaarsgraaf. Grave II, surrounding features and finds that are brought into connection with it. Scale 1:200.

concerned was not, or only slightly, covered with peat and so may be placed before, or contemporaneously with the oldest finds in the gully filling. This means before or at the beginning of the occupation phase 2. That both concentrations partly coincide with a slight concentration of domestic refuse (*cf.* fig. 65 c, d) can be the result of the local topographical situation.

That this is an unusual find emerges clearly from the fact that these are almost the only sherds found during the whole excavation which fit each other and made out in this case almost half of the upper part of a pot. An occasional sherd which does not fit fills in the picture that is completed by a base sherd found some distance away in square b4, which is undoubtedly a part of the pot in view of its workmanship, colour, form and size, and also by a sherd found in the direct vicinity bearing the same reed impressions as this pot [61]. The rest of the pot probably lies for the most part still in the ground.

The pot (fig. 88) is preserved to a height of 18 cm. which is increased to 20 cm. by the sherd which does not fit. The original height was probably about 27.5 cm. The outer diameter of the rim is about 21 cm, of the belly about 20 cm., which measurements cannot, however, be exactly fixed because of the fragmentary character of the pot. It has an S-shaped profile. The rim is turned outwards, the belly (at about half the height) is somewhat accentuated, the accentuated foot is massive. Directly under the thick, round rim and separated from it by a deep groove, runs a pronounced cordon. In the groove there are a large number of fairly small perforations at distances of 1½-3 cm. Most of the pot under the cordon is decorated with

[61] That this is the same square in which the *radius* was found, might be purely accidental.

impressions from a thin, hollow stick, probably a reed, at distances of 3-8 mm. in somewhat sloping lines, 11 in number and mutually separated by about 1.5 cm. The lowest part (10 cm.) of the pot is undecorated. The reed impressions only appear in a few places as pure circles; usually the reed was held at an angle and it seems as if it was frequently blocked with clay. The colour of the pot is grayish brown (2.5 Y 5/2) to black (5 Y 2/1), like all the sherds from the peaty gully filling. The thickness of the walls is generally 11-12.5 mm. although at some points at the belly it is as much as 16.5 mm. The foot is internally bowl-shaped and in the middle 25 mm. thick. The somewhat sandy clay is sparsely tempered with some pounded pottery and stone grit. The horizontal break below the belly lies at 1/3 of the total height and is situated at a point where two clay coils or bands were kneaded together. Apparently the pot was built up in three stages: first the bottom up to 9 cm. and subsequently two equally wide clay bands. The surface is somewhat uneven, yet it has been smoothly polished. On the inside, especially at the belly, and along the outside around the neck there is a charcoal crust, so that we may say this pot was used for cooking. It was finally thrown into the damp bank zone of the gully, with part of the fire. Typologically the pot fits very well to the other finds from the gully, and must undoubtedly be attributed to the BWB Culture.

The reasons why we connect this find with grave II are first, the very similar ^{14}C dates of both features. Second, the stratigraphical position of the pot, which implies an equal or slightly older age than the *radius* fragment found in the gully filling. Third, the extraordinary character of the find and its position at a very short distance from grave II. Fourth, the connection is supported by parallel finds, as we will point out in paragraph 4.9.3.2 (p. 288).

The ^{14}C dates of grave II and the features connected with grave II are:

GrN 5566	3630 ± 40	(1680 B.C.)	bone, right *femur* skeleton II
GrN 5132	3780 ± 50	(1830 B.C.)	charcoal, from pit 199
GrN 5705	3635 ± 60	(1685 B.C.)	charcoal, from pit 210
GrN 5176	3640 ± 30	(1690 B.C.)	charcoal, concentration near pot on the gully bank

As already stated, these ^{14}C dates confirm the situation suggested by archaeological considerations. Yet the remarkable correspondence of three out of the four dates does not prove in itself exact contemporaneity. The ^{14}C dates by their margin of error permit a fairly substantial time difference between the dated objects. The same applies to the equally remarkable similarity to the date of grave I. Both graves may very well vary in age by a few decades, although bearing all data in mind, a fairly close contemporaneity seems most likely. The only divergent element is the date of pit 199. But we argued already above (p. 253) that the charcoal is in secondary position and does not necessarily date the moment when the pit was dug. Before the ^{14}C dates were known we imagined that the charcoal in the pit 199 filling came originally from the fire in the somewhat older pit 210. The extent of the difference between both dates now renders this improbable. The charcoal is more likely to have been already present on the site before the laying out of the cemetery. It may be that the site was burnt out when it was taken into use or that a small, older fire place was disturbed during the digging of pit 199. The dating represents, in our view, phase 1 and perhaps its beginning.

Recapitulation

About 1700 B.C., shortly before or at the beginning of the second occupation phase, in

the immediate vicinity of the gully, a 30-year old man, 163/164 cm. tall, was buried in a crouched position upon his left side in a burial pit situated at —160 cm. NAP and with a SSE-NNW orientation, with his head to the SSE and facing west. The oval burial pit was 80 × 145 cm. and reinforced with wickerwork. The man was given burial gifts of an antler hook, three small bone fish-hooks and four pieces of flint, from which we may assume that he was a fisherman. His skull was clearly planoccipital-brachycranic. At the head end of the grave a large fire was burnt in a pit as a part of the funeral ceremony. A large pot, attributable to the BWB Culture and in every respect resembling the material of the occupation phase 2, was used in this ceremony and thrown into the bank zone of the gully together with the remains of a fire. Shortly (about 20 years) after the interment a pit was dug, partly disturbing the grave and resulting in the loss of some of the skeletal parts. The pit was filled up immediately after the digging and the removed human remains were partly left in the pit and partly thrown in the gully .The position of the *radius* in the gully demonstrates that the disturbance took place during phase 2.

4.7.4. Grave III (figs. 110-113, Pls. X-XI A)

Grave III, in the middle of B7, was only visible in the excavation by a few irregular grey marks. Only after digging to some depth did an E-W orientated, rectangular pit with rounded corners of 80 × 120 cm. reveal itself, mainly by a different colouring of the naturel rust (fig. 110). In comparison with the other graves the pit was very shallow, only reaching —123 cm. NAP. There was no evidence of reinforcement of the pit by some way of casing. A curious phenomenon, for which we have no explanation, was the presence of two ditch-like traces connecting with the western end of the grave pit. The extreme eastern end of the grave had been disturbed during the 16th century sand-digging operations.

The skeleton of a small child (fig. 112, Pl. X) lay, somewhat to the east of the middle, in the pit, which was far too big for its occupant. It was not lying exactly on its right side, but was turned a little on its back, with its head to the west and facing south. The left arm rested on the ribs and was bent to about 90° at the elbow so that the hand lay in front of the belly. The lower (right) arm will also have lain in this position, although this arm was not observed *in situ*. The legs were drawn up to angles of 80° and 90° between the *femur* and spine. The knees were well bent. The upper part of the paper-thin skull had been pressed into the cranial cavity by the ground lying on top of it. A number of small holes were made with measuring pegs between and through the parts of the skeleton by the same people who disturbed grave II, without their being aware of this skeleton. Near the knees a few loose skeletal parts were found, namely the right *scapula* and *clavicle*, and a few rib fragments. These must have been displaced by digging animals.

The skeletal remains are probably those of a female child of about 1½ years of age. The state of preservation made it impossible to take reliable measurements for a comparative enquiry. The length of the body, determined in the excavation photograph, is 75-76 cm. [62].

In the western part of the grave pit, near the head, lay a small beaker as the sole burial

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[62] The anthropological data of grave III are derived from Appendix V.

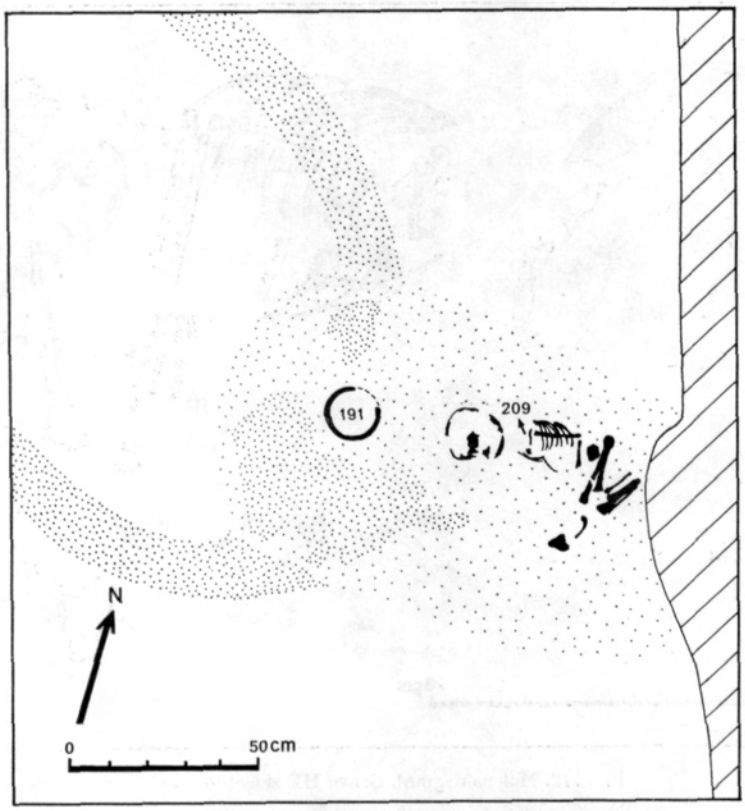

Fig. 110. Molenaarsgraaf. Grave III and surroundings. Scale 1:20.

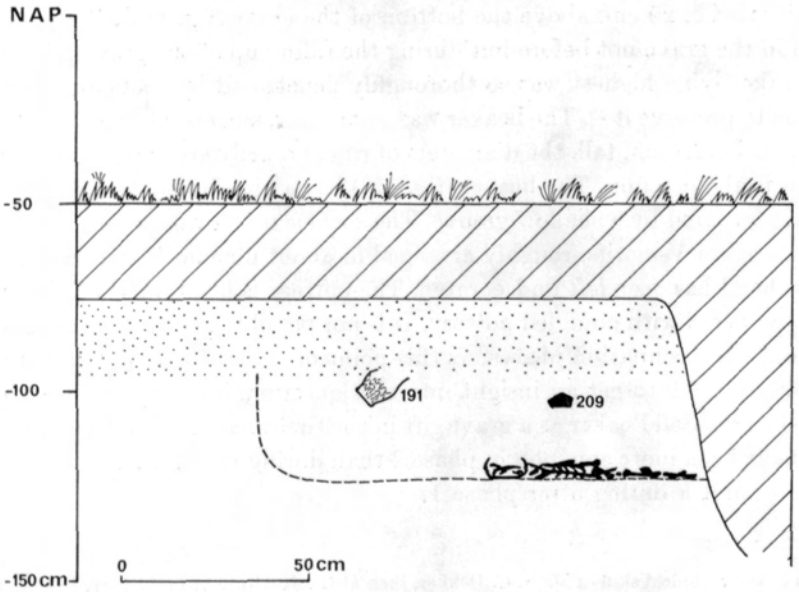

Fig. 111. Molenaarsgraaf. Grave III. Schematic west-east section. Scale 1:20.

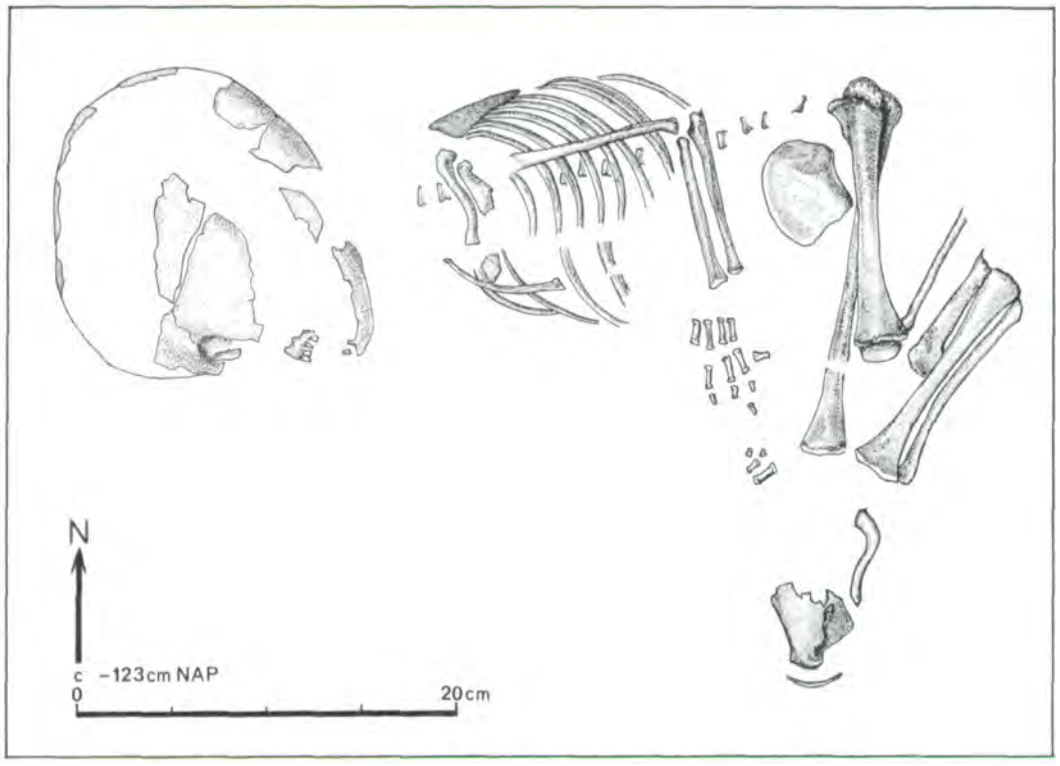

Fig. 112. Molenaarsgraaf. Grave III, skeleton. Scale 1:4.

gift. It lay at a somewhat higher level than the skeleton, to be exact the lowest point of the beaker was situated *c.* 20 cm. above the bottom of the grave (fig. 111). We must assume that it was placed in the grave not before but during the filling up of the grave pit. The part of the wall of the beaker lying highest was so thoroughly penetrated by roots and destroyed that it was impossible to preserve it [63]. The beaker was, moreover, somewhat deformed by the pressure of the ground. It is 13.1 cm. tall, the diameters of rim and belly are both about 12.6 cm., and the wall thickness is about 6 mm. The beaker (fig. 113) has a high belly and a funnel-shaped neck. The neck is accentuated by a shallow groove. The surface under this is decorated with fingertip impressions placed in V-motifs, roughly arranged in about nine horizontal rows. At the widest part a narrow band has been left undecorated. The pottery is black with a light gray (2.5 Y 7/2) surface; it is tempered with pounded pottery. It is not possible to attribute the simple domestic beaker to one of the occupation phases, at this point of the discussion. We will need the data presented in section 4.9 to get an insight into this question. We only can say that we should have expected a true Bell Beaker as a grave gift in the first phase and that fingertip impressions, appeared to have been more common in phase 2 than during phase 1. But these are not enough arguments to permit a dating after phase 1.

[63] Thanks to the technical skill of Mr B. C. Dekker, then at the Institute of Prehistory, Leiden, the greater part of this small pot has been preserved.

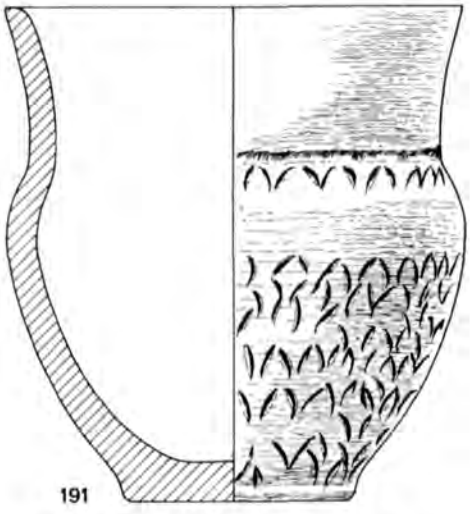

Fig. 113. Molenaarsgraaf. Beaker from grave III. Scale 1:2.

Also in the pit filling, about 20 cm. above the shoulders of the skeleton, lay a very badly weathered piece of granite (figs. 110, 111 no. 209) which might be a grave gift or came there accidently during the filling of the pit.

Owing to the lack of suitable material no ^{14}C determination could be carried out.

The child skeleton was removed in its entirety. To do this the surrounding sand was excavated until a block of sand, as small as possible yet fairly high, remained under the skeleton. A sharpened steel plate was pressed under it by using spades as a lever and, on the other side of the block of sand, using a wooden board to give counter-pressure. Around the block of sand and on the steel plate a wooden frame was built, after which the cavities were filled up with sand and the skeleton was covered with sheet plastic and sand. The whole, weighing about 70 kg., was lifted by two men and, completely intact, was sent by car to the Institute of Human Biology in Utrecht.

4.7.5. Grave IV (fig. 114)

In the west of pit Z10 grave IV became visible with the same characteristics as grave I (level 2) and grave III, as such burial pits elsewhere also generally are revealed. The fairly small pit (60 × 105 cm.) was orientated in an E-W direction and was rectangular in shape with rounded corners. The sides were practically vertical. The bottom of the pit lay at or below —150 cm. NAP, the present ground water level. The filling was pale yellow with a few marks of "dirty soil" in the upper levels, and was distinguished from the undisturbed soil especially by a different colouring of the natural rust. Very careful search revealed, however, neither a skeleton nor grave goods, so that we must conclude that the pit, from every point of view a grave pit, was never used as such and is, in fact, a cenotaph.

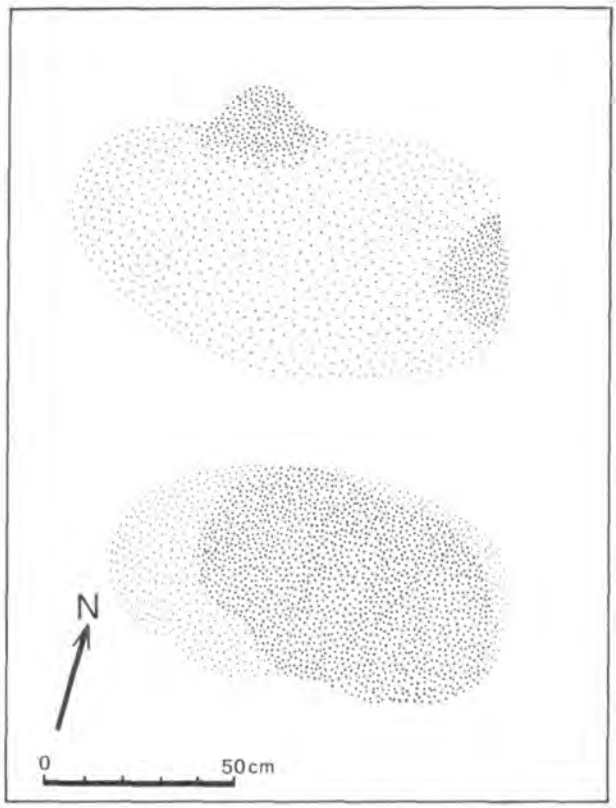

Fig. 114. Molenaarsgraaf. Plan of grave IV at two levels. Scale 1:20.

4.7.6. Ox Grave (figs. 115-116, Pls. XI B-XII)

In the fourth week of the second operation a bovine animal's skeleton was found near the north section of pit Z10 when sections were cut across a number of small irregular discolourations. To examine adequately all the soil traces in the surroundings the pit was enlarged northwards by means of a small extension.

No trace was found of any pit whatsoever, although it was clear from the skeleton's position that the animal had been buried in a pit. The animal lay at ground water level (about —150 cm. NAP), a depth at which soil traces have completely disappeared. But no pit was observed at a higher level either. All this indicates an especially clean filling of the pit, which may mean a dating early in the occupation period. The pit is located, however, somewhat marginally in the settlement terrain and in an area where the "occupation layer" has not been very strongly developed.

All observations, namely those relating to the position of the skeleton, the situation in comparison with the human graves, and the situation in the settlement, refute any idea that the animal got buried accidentally and by natural forces, for example during the sanding-up of the river as washed-up carrion.

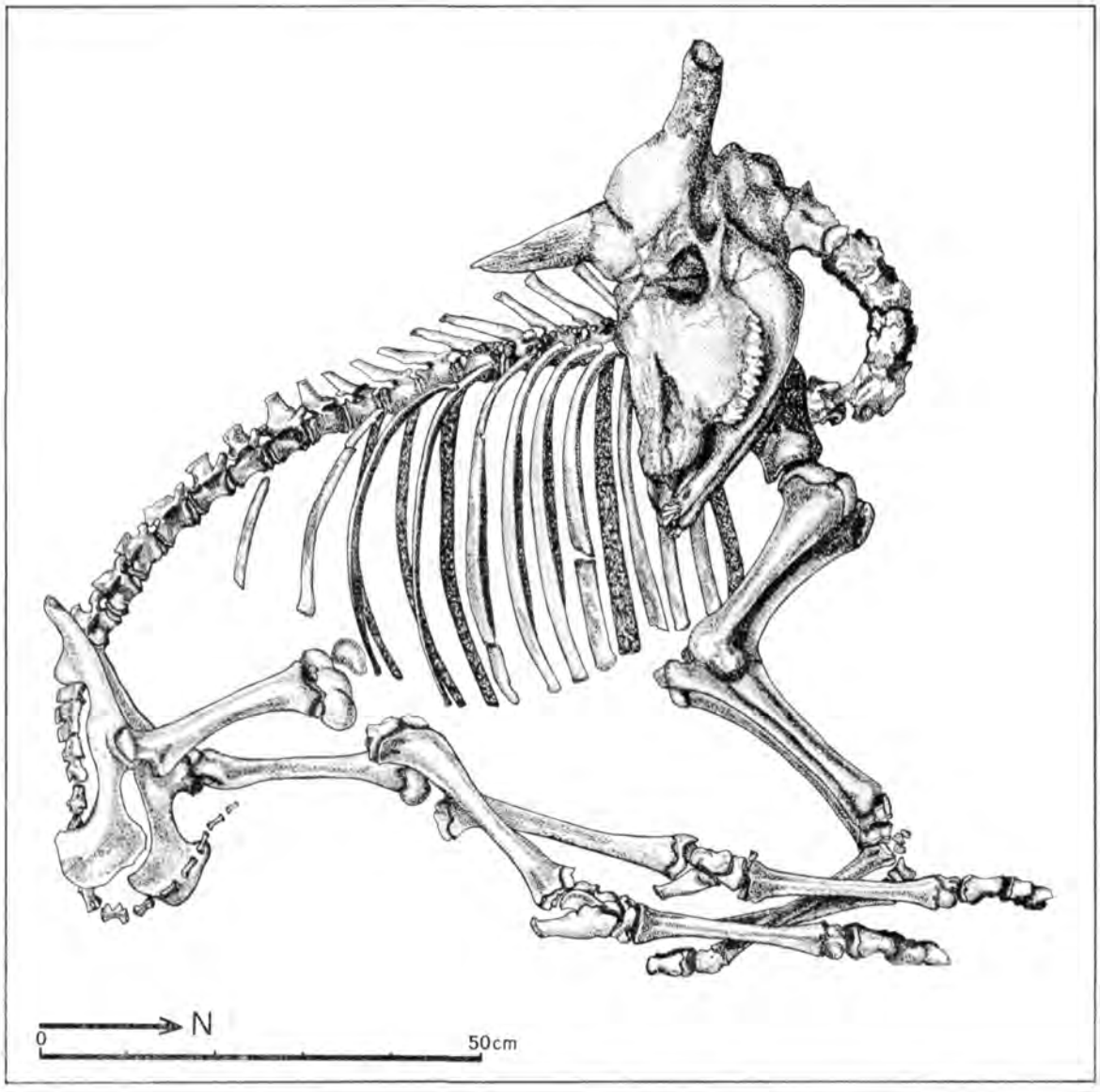

Fig. 115. Molenaarsgraaf. Skeleton of a young domestic ox. Scale 1:8.

The ox was about 1½ years old, and its sex cannot be determined. It was fairly sturdy and short-horned [64].

The animal lay on its left side, in a N-S direction, with its head to the north. The neck was folded back, so that the skull rested on the right shoulder-blade. The rear legs were

[64] Identified by Miss Dr A. T. Clason, Groningen.

stretched out along the belly over the *metacarpals* of the front legs, which were folded right back. The tail lay between the legs and along the underbelly. It was noteworthy that most of the *phalanges* were missing from both forefeet (*cf.* fig. 116). The two last *phalanges* on the left and right were missing from the right forefoot, as were all three *phalanges*, left and right, from the left forefoot, and also the distal articular ends of the *metacarpal*, which had been broken off at the growing-zone.

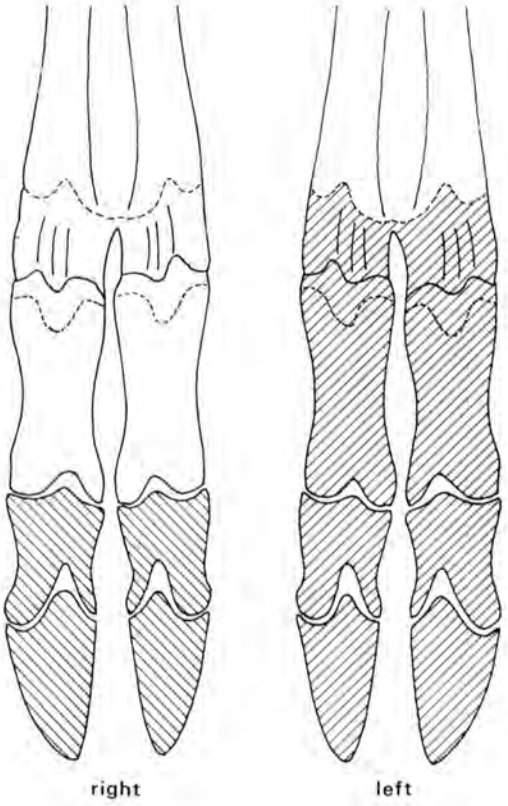

Fig. 116. Molenaarsgraaf. Ox skeleton. Forefeet, missing *phalanges* hatched. Scale 1:4.

It is important that the frontal legs were bent below the rear legs, and that they lay on a depth where preservation conditions were very good. So the fact that the *phalanges* were missing is certainly not the result of poor conservation. Only the uppermost skeletal parts were in a bad or even very bad condition: the skull, the *cervical vertebrae* and the right transverse projections of the other *vertebrae*. The *phalanges* of the rear legs were also in a poor state, but it was attested that all were present, although the hoof *phalanges* of the uppermost (right) leg could not be preserved. For the interpretation of the lack of the mentioned *phalanges* carelessness during the excavation can be excluded. It might be the work of digging animals, but we do not think this very likely. Most probable seems to us that the forefeet of the ox were cut off

when it was buried. This might have been the case when the animal was skinned before the burial [65]. But why the rear *phalanges* are still present then?

As to the dating of the ox grave we name the following arguments. First, the situation demonstrates a relation to the other graves: the ox burial seems to be part of the cemetery, which means an age about 1700 B.C. Second, we might use the lack of a visible pit filling as an argument in favour of a very early date, a moment when the occupation layer was not yet formed. One thinks in this case of an initiation sacrifice. But we said already that the marginal position of the grave must have played also a role. Moreover, the other grave pits (esp. grave II) were likewise hardly discernable. To bring some clarity into this problem, a metapodal was ^{14}C dated, but with a disappointing result:

GrN 6218 4385 $\pm$ 105 B.P. (2435 B.C.) (bone)

This date must be at least 3 centuries too old, in view of all the geological and archaeological evidence. So we will leave this ^{14}C date out of consideration. It is not possible to explain the discrepancy at the moment.

The question why the ox was buried cannot be answered, since the excavation itself gives us hardly any information on this problem. We only can say that a connection with the cemetery seems more probable than one with the settlement at this point of the discussion. But this theory is seriously undermined by the situation in another "occupation centre" on the Schoonrewoerd stream ridge (Ottoland-Oosteind), where only one grave, containing a pig, was found in an area of 20 $\times$ 40 m. But we must refer to section 4.9.7. for further comment.

4.7.7. Comparison of the Graves

The data about the individual graves are here summarized to facilitate comparison.

The orientation of the graves was E-W or about N-S. A factor in the orientation could be either a possible cultural tradition or the direction of the ridge and gully.

The measurements of the pits are fairly uniform; the large pit for the small child is remarkable in this respect.

The depth of the pits provided us with a reliable, closely dated ground water table, for they could not have been dug deeper than the ground water table of that time as they would immediately have filled up by seepage. The bottoms of the grave pits all lie between —165 and —150 cm. NAP, while the depth of the pit is dependent upon the height of the place (fig. 117). Only grave III (the child's) diverges markedly from this. The floors lie in two graves directly below the present ground water level, except for grave II. There the ground water table is now relatively high due to the direct proximity of the moist gully filling. But when the gully was open, the phreatic surface here must have sloped more steeply towards the open water. The floor of grave IV also lay below the present ground water level; the pit left traces down to

[65] *Cf.* Groenman-van Waateringe 1970, 5.

TABLE 24

Molenaarsgraaf. Survey of the data from the graves

		Grave I	Grave II	Grave III	Grave IV	Ox
Grave pit	orientation approx.	E-W	NNW-SSE	E-W	E-W	N-S
	orientation exact	10° S. of E.	20° E. of S.	10° S. of E.	5° N. of E.	15° E. of S.
	measurements (cm)	130/135 × 80/95	145 × 80	120 × 80	105 × 60	
	depth (cm)	89	63	39	62	c. 63
	bottom at ...cm NAP	— 165	— 159	— 122	— 150	c. — 150
	structures	rectangular chamber	oval chamber	none	none	none
Skeleton	on the... side	left	left	right	—	left
	details position	turned on the back	strictly	somewhat turned on the back	—	—
	head in the...	east	south	west	—	north
	looking...	south	west	south	—	—
	angle at pelvis	90°	70° & 100°	80° & 90°	—	—
	angle at the knees	sharp	sharp	sharp	—	—
	arms, hands	before breast	before breast	before breast	—	—
	sex	male	male	female	—	—
	age	c. 15 yrs.	c. 30 yrs.	1½ yrs.	—	1½ years
	length (cm)	162-163	163-164	75-76	—	—
	skull, index	94.6	84.5	—	—	—
	skull, type	brachymorphic planoccipital	brachymorphic planoccipital	—	—	—
	grave gifts	Veluwe B.B.	antler hook, awl 3 fish hooks 4 flints	domestic beaker	none	none
	^{14}C dates, bone	1685 ± 40 B.C.	1680 ± 40 B.C.	—	—	2435 ± 105 B.C.
	^{14}C dates. other	—	1685 ± 40 B.C.	—	—	—

this level, but the lack of finds made it impossible to determine the depth of the floor itself. There must have been a ground water table of about —160 cm. NAP or slightly lower at the time of the cemetery, about 1690-1680 B.C. We obtained the same result based on the sediments and finds in the gully.

The structure of the graves varies. In two instances reinforcement of the burial chamber occurs, yet these two graves are of rather different character. There are no indications of surrounding structures or barrows.

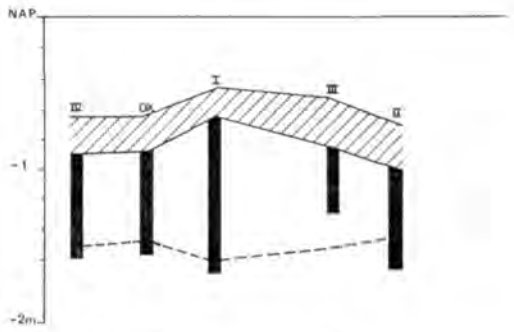

Fig. 117. Molenaarsgraaf. Depths of the graves and the present ground water table.

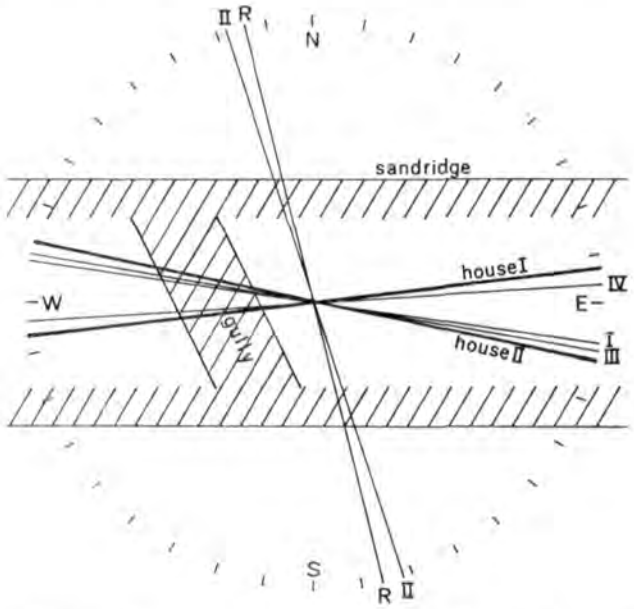

Fig. 118. Molenaarsgraaf. Schematic representation of the directions of various features. R = ox burial.

The dead in all cases lie in a crouched position, although there is a fairly considerable variation in details. The position of the arms in particular varies widely, even though the hands were always laid in front of the breast. The backward turn in graves I and III as against the skeleton lying exactly on its side in grave II is an important difference. Both men were buried on their left sides, with their heads in a comparable direction in the grave. We can say that grave II shows a clockwise rotation of about 70° in relation to grave I. The little girl lies on her right side, with her head in the other direction facing south, which direction again is similar to that of the other two. Three skeletons provide naturally insufficient evidence to deduce any rule.

Anthropologically the only two measurable skeletons (I and II) are very similar. Both

skulls are clearly brachycranic and planoccipital. The body length corresponds well (but the boy was not yet full-grown !), as does the limited robustness of the bones.

— Grave-goods were encountered with each skeleton. The variation is fairly considerable: the child having a simple little pot, the boy a better piece of pottery and the man some equipment, used to obtain food. Also the position of the grave goods in relation to the skeleton varied.

4.7.8. The Cemetery: Dating and Relation to the Settlement.

The interpretation of the data provided by the graves requires the proposal of a number of more or less likely alternatives, which increase in number the more one goes into detail. It is indisputable that the occupation and the cemetery coincide both in space and time, although the cemetery was in use for only a part of the occupation period.

The absolute duration of the cemetery is difficult to determine. Here it is mainly the interpretation of the data concerning each of the graves which is of importance. By emphasizing the differences and using the margin of error of the ^{14}C dates we can form a sequence of the longest possible duration of the cemetery, although even so this can have lasted no longer than about two centuries. The sequence in this model is as follows: ox (initiation sacrifice about 1800 B.C.), grave I (1750 B.C.), grave II (1675 B.C.), grave III (1600 B.C.). The cemetery thus occupies almost the entire phases 1 and 2, as we defined these when discussing the pottery. So in this model the burials took place certainly in the occupied settlement. This "long chronology" has to our opinion, however, a rather artificial character. We prefer to reject this model in favour of the alternative interpretation, which stresses the contemporaneity of events: all graves may have been dug in a short period about 1690/1680 B.C. Supporting this interpretation are the corresponding ^{14}C dates and the positions of the graves I and II in the relative chronology of the occupation. The regular lay-out of the cemetery and the small number of graves are also more in accordance with a short period of use. The "short chronology" appears to make more sense and it seems best to assume a period of some decennia for the cemetery. This view implies a very small chronological distance of the Bell Beaker from grave I and the large, typical BWB Culture pot from the gully bank. So we can say that the cemetery has the characteristic: "transition from VBB to BWB". In section 4.9.5 (p. 305 f.) we will concentrate on this problem and demonstrate that the "outside evidence" [66] confirms that during the period in which the cemetery was in use, the change took place from the late BB Culture to a complex of finds that may be classified as Barbed Wire Beaker Culture.

The relation between the cemetery and the settlement is the second point for discussion. It is a complex problem, since so may sequences and relationships, factually the complete internal chronology of the site, are involved. The cemetery has a key position in the construction of a chronological model of the site. The most important relationships are shown in the scheme at fig. 118. The large scheme at fig. 119 is a correlation table of the various chronologies of the settlement and forms a schematic representation of the geological and archaeological events at the site. We have the sequences:

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[66] *Cf.* p. 279.

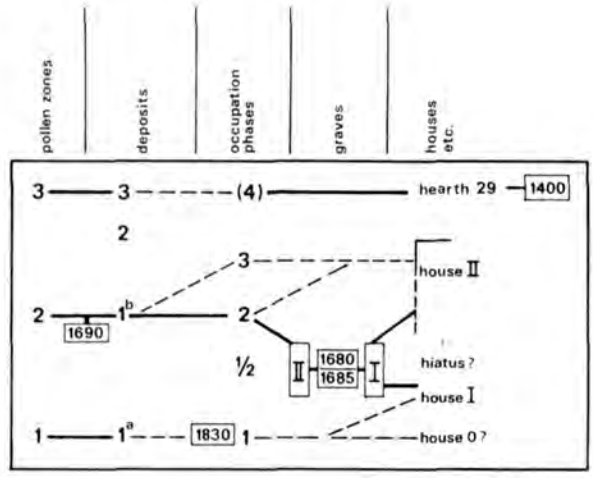

Fig. 119. Molenaarsgraaf. Chronological relationship of the most important features.

— of the gully deposits (0, 1, 2, 3 *etc.*),
— of the pollen zones (1, 2, 3 *etc.*),
— of the occupation phases, based on the archaeological material (pottery) (1, 2, 3, (4)),
— of the soil traces (house I, hiatus (?), house II),
— of the ^{14}C dates (1830, *c.* 1685, 1400 B.C.).

The pollen zones and the gully deposits are self-evidently firmly linked together. By means of the gully finds the occupation phases could be easily linked to this system too. The cemetery is of much aid when we want to attribute the houses to a special phase. We established the following sequence of relationships:

— house I belongs to the early soil traces,
— grave I is contemporaneous or slightly later than house I,
— grave II is contemporaneous (^{14}C dates) with grave I,
— the beginning of occupation phase 2 is contemporaneous or slightly later than grave II.

Following this line of reasoning, house I is dated to occupation phase 1 or to the last part of it. House II is later and must belong to phase 2 and/or phase 3. The distribution patterns of the pottery informed us that the house at least belongs to phase 3, since the undecorated element concentrates in the zone, precisely covered by house II. In this model there is room for a "house 0", that might have existed in the western part of the excavation, during the beginning of phase 1. There is also room for the supposed hiatus between the houses I and II during (the first part of) phase 2.

In this model, which fits all data best, the grave field itself is fixed in between the phases 1 and 2 in a transitional phase 1/2. We must conclude that it is not possible to make out whether the settlement was occupied or not. The phase 1/2 will have been short and might be simply the end of phase 1. House I still might have been inhabited. Moreover the gully finds do not necessarily include the moment when the new find complex of phase 2 was introduced for the

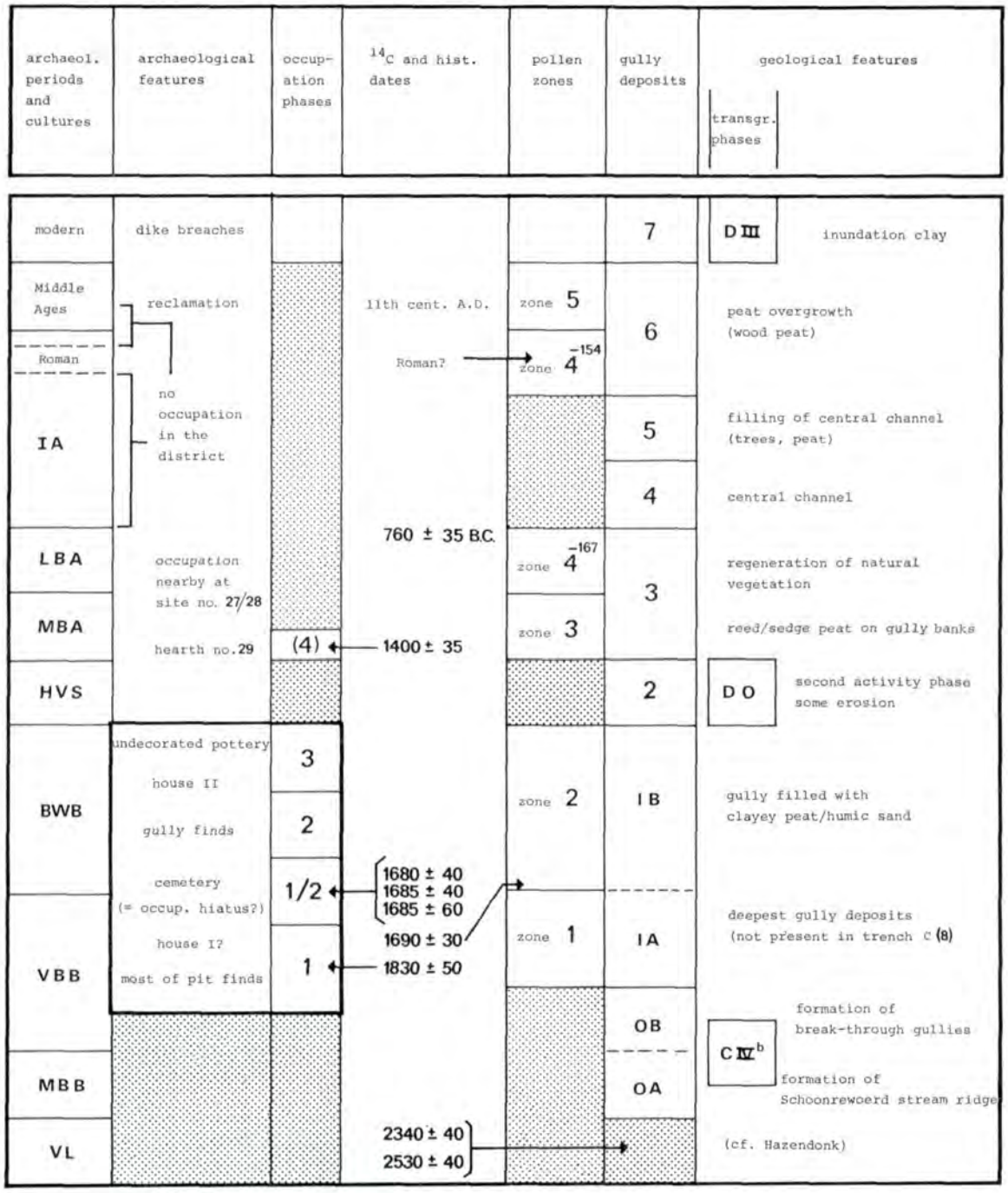

Fig. 120. Molenaarsgraaf. Schematic chronological representation of the settlement.

first time. They might comprise only a (the later) part of it. So a seeming occupation hiatus, which might be concluded from the sudden change in the pottery between the phases 1 and 2 might merely originate from a lack in our information.

Must we leave now the question: "burial in the settlement or during a hiatus?" unanswered? We do not think so. There are arguments that plead for the last-named possibility. First, the chronological position itself in between the two well recognized occupation phases. Second, why no people were buried before and after this short phase 1/2, in the time we know that the terrain certainly was occupied? Third, we know two other graves on the Schoonrewoerd stream ridge and both were certainly not situated in a settlement. At Ottoland-Oosteind no human graves were found in the 40 × 20 m. large area which we excavated and which certainly comprised the centre of the Beaker settlement there. So burial in the settlement certainly was not common practice. To our opinion it's certainly allowed to consider the habits observed at these sites appropriate also to Molenaarsgraaf, since all VBB/BWB occupation centres ("settlements") on the Schoonrewoerd stream ridge factually formed together a whole. *i.e.* a long settlement consisting of single farms, of which "Molenaarsgraaf" is one, as we explained at p. 106 f.

After the foregoing considerations it is interesting to make an approximation of the time the cemetery was in use. For this purpose we must start from the following presumptions:

— The cemetery was in continuous use by the inhabitants of one of the farm sites on the Schoonrewoerd stream ridge. Above (p. 109) we demonstrated that a number of 7 inhabitants appears to be the most likely.

— The mortality rate in such a farm site was about 50 ‰ per year (babies of less than one year old included) or about 40 ‰ per year, when we exclude these [67].

Reasoning from these starting points we arrive at one burial every 4 year, which means a duration of about 20 years for a cemetery consisting of 5 graves. A duration of a few decennia concurs well with the data mentioned earlier in this paragraph and the model we worked out for the Molenaarsgraaf settlement. It would mean that the short hiatus between the phases 1 and 2 (*i.e.* phase 1/2) might have had a similar short duration.

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[67] Modderman (1970, 206) used slightly lower values in establishing the number of inhabitants of the Linear Bandceramic settlement of Elsloo: a mortality rate of 30-40 ‰ of which $^1/_2$-$^1/_3$ was formed by children of less than 10 years old, who were generally not buried in the Bandceramic cemeteries. The best demographic data for a Late Neolithic community are given by Buchvaldek & Koutecký 1970, 272 f. In the *Schnurkeramik* cemetery of Vikletice 33.8% of the individuals were not fully grown (*i.e. infans* or *juvenil*). The very low rate of *infans I* (1 individual without grave goods in a small pit grave 3/1964, p. 265) against the high percentage of *infans II* (21 individuals or 17.9%) means in our opinion that the very young children were not buried in the cemetery. The mean age of the individuals found is 26.3, which gives a mortality rate of about 40‰. When we take the *infans I* mortality into account this value must have been about 50‰ for the entire community. We must remark here that apparently *Infans I* are the children of less than 1 year, *Infans* II 1-6 years and *Infans* III about 7-14 years old (see the description of the graves). Feust *et al.* 1966 established for a group of *Schnurkeramik* people that 46% were *Jugendlich*; when older finds were considered too this percentage was 38%. But they argued that the predominance of male over female finds implied that there must also have been a selection of adults over juveniles as a result of the way of collecting. In the Early Bronze Age cemetery of Singen-Hohentwiel (Gerhardt (1964)) 33% of the total of 36 individuals were not fully grown. Of the 40 individuals in the Bell Beaker cemetery at Nähermemmingen (Breitinger 1939) 17 persons (or 42.5%) were younger than 14 years, and 3 persons (7.5%) between 15 and 20 years old. All these data agree that the percentage of not fully grown individuals is very high (38-46%) and that a mortality rate of about 40‰ (or 50‰, *infans* I included) is very likely.

4.8. SUMMARY AND CONCLUSIONS

4.8.1. Environment

Situation

During the transition from Neolithic to Bronze Age in this country, between 1800 and 1500 B.C., a small settlement lay in the heart of the South Holland peat area, in the present polder Molenaarsgraaf. In the settlement Veluwe Bell Beakers and Barbed Wire Beakers were used. It was one of a series of similar occupation centres, lying on the so-called Schoonrewoerd stream ridge, and together forming a long ribbon settlement with widely separated farmer's households.

The Schoonrewoerd stream ridge

The more than 35 km. long Schoonrewoerd stream ridge is formed by the sandy bed deposits of a former river course, which for a short period (about 2100-1850 B.C.: transgression phase C IV^b), directly preceding the inhabitation, traversed the peat region. The river flowed through from the river clay area to the estuarine area near Rotterdam, and was active in a period when the river-clay suffered heavier and freakish sedimentation. At high water large areas of the peat on both sides of the river were flooded, resulting in an extensive clay deposition. Right after the active phase the sandy bed deposits formed a fairly evident ridge, restricting the north-south water circulation. Flooding took place and at some points break-through gullies were formed.

Vegetation and fauna

The sand ridge bore a lofty timber vegetation with oak, elm, ash and alder. Outside this narrow strip of gallery forest was a rather open alder brushwood vegetation with an abundant growth of herbs. As hunting played a very minor role in subsistence our knowledge of the wild animals living near the settlement is deficient. Beaver, red deer, boar and bear were among them, as is proved from carcass refuse. For the first time in the prehistory of the Western Netherlands the elk also appears. This animal, like man, will have made use of the sandy stream ridge. The other animals too probably lived there most of the time.

The VBB/BWB hamlet

About 1850 B.C., shortly after the formation of the sand ridge and of the transverse gullies through it, people using Veluwe Bell Beakers established themselves on an about 4 km. long stretch in the present polders Molenaarsgraaf, Ottoland and Goudriaan. In this period the sand ridge may have formed an important dry east-west communication route between the coast and the sand region of the central Netherlands (the Veluwe) where the centre of the VBB Culture was situated. The settlement lay about half way this route. It consisted of several units or occupation centres, separated by distances of 300 to 1000 m. and preferably founded on the bank of a transverse gully or on a relatively high point of the ridge. Each of the occupa-

tion units, of which "Molenaarsgraaf" is the most westerly, consisted of one or at most two families or farmer's households. The total number of inhabitants of the entire settlement was estimated at 30-60 persons, children included.

The narrow strip of sandy and well-drained soil of the stream ridge itself (*c.* 100 m. wide) was the only landscape unit, suited for agriculture. As the pollen diagram shows many trees on the ridge were cut down: we can say that this stretch of the ridge was seriously deforested. The fields were lain out there, in between the houses and beyond the outermost to the east and to the west. The clay wedges at both sides offered grazable land to a distance of some hundreds of metres. Going farther away from the ridge the landscape became more and more marshy and gradually changed into a peat swamp.

4.8.2. The site "Molenaarsgraaf"

Character

The excavation report of the site "Molenaarsgraaf" provides a closer view of one of the "occupation units" and thus also provides a better insight in the structure of the entire settlement.

At Molenaarsgraaf two oval houses, each more than 20 m. long, were built consecutively. Other post holes might be the remains of one or two other buildings or structures like sheds and fences. The both houses and the varying ages at which cattle and pigs were slaughtered are arguments in favour of a continuity in the occupation of the terrain. Further neither the pollen diagram nor the archaeological material gives reason to assume one or more breaks in the occupation of any length. Only in the short period when the terrain was used as a cemetery the site probably was uninhabited.

Chronology

It was possible to divide the total occupation period into four phases.

Phase 1

The first people to establish themselves were the users of pure VBB pottery, shortly after the formation of the ridge and of the transverse gully. The process of silting up had not yet started in the gully, so that we must assume that open flowing water occurred in it. A relatively large part of the excavated site and especially also the somewhat lower western part was taken into use. Only a small number of the finds originate from this phase: representative are the finds from most of the pit fillings, characterized by an association of VBB pottery with pots decorated by channeling and less frequently with fingertip impressions. The pits themselves may, however, be partly of a somewhat later date. House I is dated to this phase, especially the end of it. Possibly the post holes in the western part of the excavation are the traces of another (earlier or supplementary ?) building. A ^{14}C date of 1830 ± 50 B.C. might date the beginning of the occupation.

Phase 1/2

In the cemetery and associated with it, we find elements of both the preceding VBB and the subsequent BWB associations. The cemetery thus has the characteristic: transition from VBB to BWB, and so can be said to constitute a phase 1/2. This phase must have been short and restricted to the decennia around 1680 B.C.

The cemetery consists of 3 or 4 flat graves, plus the grave of an ox, lying in a row on the crest of the ridge. It is exceptional for the Netherlands and the result of the wet conditions that well-preserved skeletal material was found. Primarily because of this it was possible to give a detailed picture of the burial ritual of each interment. The cemetery includes the graves of a man of about 30 years, a boy of 15, a little girl of 1½, a 1½ year old domestic ox and a cenotaph. Both men had skulls of the planoccipital brachycranic type.

The house plan I is slightly older or contemporaneous to grave I. This relationship, however, gives no explanation of the problem whether the terrain was actually occupied during its use as a cemetery, or had been temporarily abandoned. But there are some arguments in favour of the assumption of a short hiatus of the site between the phases 1 and 2, when it was in use as a cemetery, perhaps by the inhabitants of the nearby settlement no. 27/28.

With the help of the graves an average ground water level of about —160 cm. NAP. at about 1700 B.C. can be determined.

Phase 2

The second occupation phase is characterized by the use of Barbed Wire Beakers. Other features of the pottery are: a very high percentage of decoration (90%), the predominance of fingertip impressions (especially in V-motifs), the occurrence of cordoned rims, perforations under the rim, heavy bases and a somewhat higher percentage of stone tempering than formerly. Representative are the finds in the first silting-up deposits of the gully: during phase 2 the gully was gradually filled up with humic sand and clayey peat up to about the mean ground water level.

In the settlement the activity was moved more towards the gully. We cannot attribute a house with certainty to this phase: house I was abandoned at this time, perhaps house II was already built or a not recognizable house in the disturbed gully bank zone.

The account of the economy of the community, described below, rests mainly on the finds in the gully and primarily concerns this phase 2. It is, however, unlikely that the subsistence of the earlier and later inhabitants showed significant differences.

Phase 3

At the end of the occupation pottery was only slightly decorated. In shape and other characteristics it does not, however, differ from that of phase 2. House II was inhabited in this phase. The somewhat lower western part of the terrain was abandoned. The finds are concentrated in a narrow strip at the highest point and on the bank of the gully. Possibly these are the first indications of the water becoming troublesome, which may have been the reason why the settlement was ultimately abondoned. This took place well before 1400 B.C., let us say about 1500 B.C. The renewed flow of water through the transverse gully, which followed, as we know, may be connected with the Dunkirk 0 transgression phase.

4.8.3. Subsistence Economy

Crop farming

That agriculture was practised is apparent from the occurrence of millstone fragments, a single impression of grain (Einkorn ?) [68] in a sherd and especially from the pollen diagram. The unusually high values for *Cerealia* and track weeds indicate that the fields lay in the direct vicinity of the settlement: certainly on the eastern bank of the gully but probably also on the stream ridge to the west of the settlement. The total area of arable land (productive and bare), belonging to the Molenaarsgraaf "occupation unit" amounted 4-7 ha.

Cattle farming

Cattle farming was of supreme importance for the meat supply of the community at Molenaarsgraaf, in comparison to hunting: 92% of the carcass refuse came from domestic

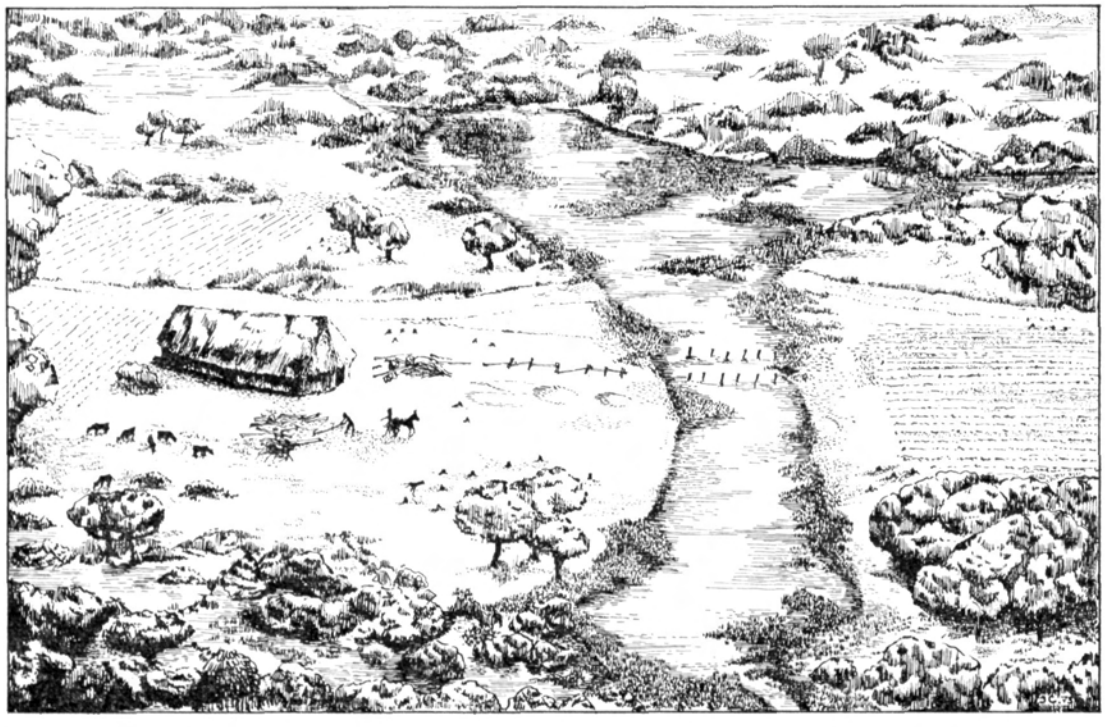

Fig. 121. Molenaarsgraaf. Tentative reconstruction of the settlement and its surroundings.

[68] Dr van Zeist examined the impression but he could not identify it with certainty, because of the lack of clear characteristics. Einkorn grain (*Triticum monococcum*) seemed the most likely. (Letter of Dr van Zeist to the RMO 9-4-1968).

animals, of which cattle formed by far the greatest part (81½%). From an economical point of view this predominance, because of the large size of the animals, is even greater. The importance of cattle breeding is emphasized by the animal which, in any case a sacrifice, had been buried. In the second and third place come pigs and sheep or goats. Two bones certainly of the domesticated horse are among the oldest dated in this country.

By their accent on cattle farming, the inhabitants took advantage of the broad stretches of grazable land, offered by the clay wedges at both sides of the sand ridge.

Hunting and fishing

While hunting was of modest importance this probably was not the case with fishing. Proof of this is seen, not in animal refuse, but in the graves (the fish-hooks in grave II and the fin ray in grave I) and in the gully in the form of pointed wooden poles and the loam weight fragment. The choice of terrain also appears to indicate this. The fairly numerous small scrapers would be especially useful in this fishing activity. In view of the presence of only a single bone plate of the sturgeon, the catching of this fish was probably not of importance as was the case at some of the more westerly Vlaardingen Culture sites. More probably the catches consisted of pike, eel, roach and perch [68a], which inhabit the still or sluggish water of the peat regions. Hunting made only a small contribution therefore, as we have said, to the subsistence economy; it will have been also skins and furs that were the objective, as will appear from the list of wild animals.

It appears that the VBB/BWB people at Molenaarsgraaf took advantage of their environment and made the best use of it.

4.8.4. Later Features

After the abandonment of the terrain as a settlement it was occasionally used about 1400 B.C. by the inhabitants of a nearby settlement, possibly to go fishing in the gully, which in the meantime must have undergone a second activity phase.

The end of the inhabitation within a wide radius came about 800 B.C., when nearly all inhabitable deposits were covered with peat. Only in the 12th century A.D. did colonization and parcelling out of the central peat region of the Alblasserwaard take place. In the 16th century the owner used the terrain for digging sand pits. During heavy floods caused by dike breaches since that time the sand pits filled up with clay and the prehistoric settlement terrain and the surrounding countryside over a wide area became covered with a 30-40 cm. thick layer of clay. As a result of compaction, consequent upon intensive artificial drainage, the prehistoric contours of the land have again become visible during recent centuries.

[68a] *Cf.* also the experiments carried out by Dr R. Boddeke, discussed at p. 333.

4.9. CULTURAL PREHISTORIC CONTEXT

4.9.1. Introduction

Especially in an excavation, where many interrelations are involved (as that at Molenaarsgraaf is), the "inside evidence" should be separated from the "outside evidence". With the first, the observations and analyses and the conclusions based exclusively on these are meant:; with the later the comparable results of other investigations and the generalizations based on these.

Separating both groups of information, we avoid reasoning from the one group to the other to reach a preconceived theory. We think induction (to draw conclusions from data) is the more proper way of archaeological reasoning. A second reason to separate both groups of evidence is the preference to describe the results of the excavation from a neutral point of view, not influenced by the current theories, so that these can be used every time as basic data in general studies and for comparison.

We tried to give the "inside evidence" on the foregoing pages but we realized that it is hardly possible to follow the above principle consequently and to keep the publication readable at the same time. One has to use some well established facts, for instance in chronological respect, in that stage.

After the descriptions and the conclusions the results must be checked to the outside information. These considerations might led to a more detailed insight in the investigated object or reversibly it might appear that the Molenaarsgraaf evidence contributes to a better general understanding of the period concerned. Assumptions made on the foregoing pages might be contradicted or affirmed.

At Molenaarsgraaf information on two different fields of research has come to light. First, the purely prehistoric data, relevant to our knowledge of the Beaker Cultures. Second, data of geologic-geographical character, relevant to the development and occupation history of the region, in which the site is situated. The first two parts (especially part II) of this book give the context of these geologic-geographical data. So in this section only the cultural prehistoric context of Molenaarsgraaf need to be discussed.

One of the major problems in the following discussion is the notorious lack of information on other aspects of the Bell Beaker Culture than the beakers themselves. The material from many regions, factually covering almost the entire distribution area, has been described monographically. But everywhere the available material permitted not much more than working out a beaker typology [69].

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[69] We list here the most important regional surveys:

Netherlands	— Bursch 1933, Van der Waals & Glasbergen 1954, 1959, Van der Waals 1964[a].
Belgium	— Marien 1948, 1952, De Laet 1963.
Northern Germany	— Stegen 1942, Struve 1955.
Rheinland	— Stampfuss 1929, Albrecht 1934, Hofmann 1938, Gatermann 1943.
Hessen	— Sangmeister 1951.
Upper Rhine	— Sangmeister 1964[a], Köster 1965/'66.

4.9.2. Soil Traces

4.9.2.1. *Post holes*

A comparison of the post holes at Molenaarsgraaf with those of the unmistakable house plans of the few centuries older VL Culture and the some centuries younger Elp Culture shows much similarity.

At Haamstede (VL) the heaviest post holes were 30 cm. in diameter. At Deventer (ELP) the diameters were 20-30 cm., and at Elp the same; exact measurements, however, were not given [70]. The depths were a maximum of 45 cm. at Haamstede, 50-80 cm. at Elp and more than 10-20 cm. (most probably originally about 60-70 cm.) at Deventer. The posts themselves at Vlaardingen seem to be somewhat thinner (10-16 cm.) [71] than the post holes. The different soil conditions of the different terrains seem to have had a fairly small influence on the measurements of the post holes. At Vlaardingen it is thought that the post holes indicate places where a post was pulled out of the ground. Otherwise the wood would have remained [72]. At Molenaarsgraaf it is more likely that the places where the posts had decayed were gradually filled with topsoil. At Elp strong podzolisation occurred in the loose fillings.

The similarities are so great, however, that we may say that the measurements of the postholes at Molenaarsgraaf are indeed those that may be expected in a house of considerable size.

4.9.2.2. *The house plans*

Early and Middle Neolithic

Since Van Giffen [73] dealt at length with prehistoric house plans in the Netherlands the material has been considerably increased. From the Early and Middle Neolithic we only know the house of the Linear Bandceramic Culture although this is remarkably well-documented with 197 house plans [74]. For the TRB the Dümmer See houses are the nearest house plans [75].

Saxony-Thuringia — Neumann 1928.
Bohemia — Stocký 1928, Hajek 1962.
Great Britain — Piggott 1963, Clarke 1966, 1970; Lanting & Van der Waals 1972.
Wales — Griffiths 1957.
France — Arnal & Blance 1959, Riquet *et al.* 1963, l'Helgouach 1963, Guilaine 1967.
Spain — Castillo 1928, M.A. Smith 1953, Blance 1961, Sangmeister 1966, Blance 1971, Leisner 1943-'65.
Sardinia — Bray 1964.
General — Sangmeister 1963, Gersbach 1957, Sangmeister 1964[b].

[70] Haamstede-De Brabers: Trimpe Burger 1960/'61, Van Regteren Altena *et al.* 1962/'63 esp. 1962, 20-21, Van Giffen 1958, 40; Deventer-Margijnen Enk: Modderman 1955[a]; Elp: Waterbolk 1964[a].

[71] Glasbergen *et al.* 1966, 56.

[72] As note 71, 55-56.

[73] Van Giffen 1954[c], 1958.

[74] Modderman 1968.

[75] Reinerth 1939.

The Vlaardingen Culture

In their situation and dating the Vlaardingen Culture house plans are the closest to those of Molenaarsgraaf. They could be their direct predecessors, if considerable cultural changes had not occurred in the intervening centuries, which will certainly not have left building traditions undisturbed. The VL Culture was followed by the Protruding Foot Beaker Culture, which in its turn was followed by the Bell Beaker Culture. In the period of the early Bell Beaker Culture moreover, a hiatus in inhabitation in the Western Netherlands could be established [76]. But to what extent do all these cultural changes signify also ethnic or anthropological changes? To what extent were elements such as building traditions also replaced by new ones?

The VL Culture houses are of the two-aisled type with central ridge-pole, from small to average size, common in Europe north of the Alps at this time. There is, however, a fair amount of variation.

Three house plans at Haamstede [77] are two-aisled and 3.5 × 8 m. in size. The ridge-pole was supported by four posts, the wall construction was situated within the outermost row of roof supporting posts. The post-holes have already been discussed.

At Hekelingen [78] and Leidschendam [79] it was possible to determine only that the houses were rectangular, but house plans could not be retraced in the confusion of post holes.

At Vlaardingen three house plans are known, measuring 3.5 × 7.2, 5 × 10 and 5.5 × 10 m. The measurements of the first house (cutting 13) [80] conform to those of Haamstede. The second house (cutting 15) [81] had a central row of 4 posts, on each side of which, 1.5 m. distant, a row of roof supports, and 1 m. outside that the walls, formed of small posts. The house plan of the third house (cutting 10) [82] has been published. It must have been the last of a number of houses which were built one after the other on the same site. The ridge-pole was supported by 6 uprights at regular distances (1.80-2.10 m.). The walls show themselves to be slightly curved rows of somewhat thinner posts, between which wattle work will have formed the original wall. The NE end was somewhat broader (5.80 m.) than the SW end (5.30 m.). Both aisles were covered by a single span from the ridge-pole. The rows of supporting posts and the walls thus coincided. The sequence used here may have a chronological value, for while Haamstede has a very early dating, the last described house in Vlaardingen must be considered as being very late. First, the Vlaardingen Culture houses show that the building material available in the Western Netherlands permitted the construction of houses such as those we envisage in Molenaarsgraaf, and that this was in fact carried out some centuries earlier. Second, the development of the house as sketched above may be regarded as a model for house 1 at Molenaarsgraaf. The occurrence of slightly curved walls in the house in cutting 10 is all the more remarkable. Moreover, the construction and the shape of both ends of this house cannot easily be determined. The

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[76] See p. 27 and 47, There are four centuries between the end of Vlaardingen and the beginning of Molenaarsgraaf.

[77] *Cf.* note 70.

[78] Modderman 1953[a], Van Regteren Altena *et al.* 1962/'63 esp. 1962, 13-19.

[79] Glasbergen *et al.* 1967 esp. 99-101.

[80] Van Regteren Altena *et al.* 1966, 56.

[81] Glasbergen *et al.* 1967, 100 and fig. 26.

[82] Glasbergen *et al.* 1966, 55-59, plan at fig. 31.

question arises as to what extent the builders of this house already had contacts with the PFB Culture.

The Beaker Cultures

Data about the housing of the Beaker Cultures themselves are scarce in this country. The almost complete absence of post holes in combination with the assumed (although nowadays not generally accepted) nomadic character of the Battle Axe Culture (PFB Culture) led indeed to the supposition that these people lived in tents or other similar light constructions. It seems to us that we must give this serious consideration. It agrees with the great mobility of the users of the various beakers which emerges from the typological studies. Why are the traces of the palissade clear at Anlo, while traces of houses are completely lacking [83]?

The circumstances in which the Maritime Bell Beakers were found at Vlaardingen also indicate that the existence of their users was not very static. All observations indicate a very short stay of a few days or weeks dated about 1940 B.C. The finds consisted of two very small find concentrations and the traces of small huts built of thin posts. One of these measures about 3 × 7 m. [84]. The difference between this find and that of Molenaarsgraaf seems to us to be characteristic of the difference between the earliest phase and the end of the Bell Beaker Culture in this country. If in the first phase we are concerned with non-settled people who stay only a short time in one place where they erect only provisional shelters, in the later (Veluwe) phase we are concerned with an established farming community.

To complete this picture it can be mentioned that post-holes are known on a number of Bell Beaker sites in this country, but no house plans. This was the case in Ottoland-Oosteind, Ottoland-Kromme Elleboog [85], Oostwoud [86], Meerlo Heath [87], Arnhem-Gulden Bodem [88]. At Dodewaard [89], where moreover the conditions were favourable, as will appear from the excellent house plans from the Middle Bronze Age, unfortunately no soil traces could be attributed to the VBB occupation.

The Elp and DKS Cultures

The Middle Bronze Age house plans (Elp Culture and DKS Culture), found at Deventer, Elp, Angelsloo, Zijderveld, Dodewaard, Nijnsel, and Medemblik and the similar Late Bronze Age house plans at Hoogkarspel [90], are as near as those of the VL Culture in location, but a

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[83] Waterbolk 1960. See also for example R. R. Clarke 1960, 62 and 65; Simpson (ed.) 1971, 132.

[84] Glasbergen *et al.* 1966, esp. 62-65; Van Regteren Altena *et al.* 1962/'63 esp. 1962, 29 and 232-235. I thank Dr J. A. Bakker, Amsterdam, for showing me the maps and for allowing me to refer to them here. The three posts on the axis line and the 13 posts of the walls had a diameter of only about 8 cm.

[85] Louwe Kooijmans 1969[b].

[86] Van Giffen 1961, 1962, 1966, De Weerd 1966, also 1967, Van Regteren Altena *et al.* 1962/'63 esp. 1962, 233-234.

[87] Verlinde 1971.

[88] Van Giffen 1958, esp. 39-40; Modderman 1955[a], esp. 31; Annual Report RMO 1939, 5 and documentation RMO. To us, however, the sherds do not seem to be beaker ware nor the post hole configurations to be house plans.

[89] Hulst 1967 and pers. comm.

[90] Deventer: Modderman 1955[a].
Elp: Waterbolk 1964[a].
Angelsloo: Van der Waals 1961, 1965[b], 1966, 1967.

few centuries later in time. There are two very different types. Fairly big round huts with a diameter up to 8 m. form a typical Southern Netherlands element, which fits entirely in the pattern of the cultural relations of the DKS Culture in that area with Southern England [91]. The second type is that of the long three-aisled farms of the Elp type, a typical northern element. In the river region (Dodewaard, Zijderveld; but also Nijnsel!) both types occur alongside each other. The Elp type is the oldest form of the three-aisled hall house, characteristic of the regions along the Netherlands- German North Sea coast. It is possible in our country to follow the development of this type of house from the beginning of the Middle Bronze Age to historical times.

The Elp type of house is three-aisled and long to very long: at Elp 12.0 - 41.3 m., at Angelsloo 18 - 65 m. (77.5 m. in more than one building phase). The large houses at Elp are 5.4 - 4.4 m. wide, the smaller ones 4.8 - 3.7 m. Round ends with the entrance there seem to be the most common. Rectangular ends also occur, however. The entrance can often be distinguished by two posts on each side of the axis, but at Angelsloo they may occur in the long sides as well. Especially at Elp, and less frequently at Angelsloo, a two-roomed division can be noted. In a stall part boxes for the cattle were made by placing less heavy posts between the roof supports. The other part was the living area. The wall posts and the somewhat heavier roof supports are generally in one line, although it is not very straight. These units generally stand 2 - 3 m. apart, although smaller and larger distances also occur.

In our view it can be assumed that house II at Molenaarsgraaf corresponds in many respects to the Elp type, although there are clear differences. It is possible in fact to regard the Elp type as a sequence to the development which we have already mentioned in connection with the sequence of house I and house II. The asymmetrical oval form of house I develops into the regular spool form of house II, and then into the Elp type with its two parallel walls. There is a development from two-aisled (house I) to three-aisled (ELP), with house II occupying an intermediate position. The occurrence of extra posts in the axis line, mostly in small groups of about 3, in the Elp type, supports this reasoning [92]. The abandonment of the heavy middle posts resulted automatically in a narrower width in the Elp type. Subsequently there is a clear tendency towards ever longer houses.

Some further details may be mentioned. The internal division into stall and living part is not known in Molenaarsgraaf. This might be original or might be caused by the disappearance of all shallow soil traces. The general appearance of the settlement also shows remarkable similarities. There are always a few large farms with outbuildings, which are continually rebuilt on almost the same spot. The graves lie in the immediate vicinity of the settlement. Although the morphology of the terrain probably plays a part in this, there exists a certain regularity in the

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Zijderveld: Hulst 1965, 1966.
Dodewaard: Hulst 1967.
Nijnsel: Beex & Hulst 1968.
Hoogkarspel: *Cf.* p. 42 note 98, esp. Bakker *et al.* 1968.
Medemblik: H. H. van Regteren Altena *et al.* 1968, — & Bakker 1968.

[91] See Glasbergen 1954, 1969, I. F. Smith 1961.

[92] Waterbolk 1964[a], 100; the houses 4.6,7 and 9.

orientation of the houses: between WNW-ESE and NNW-SSE [93]. Finally we draw attention to the occurrence of somewhat curved walls (house 5 at Elp, the oldest house at Emmerhout [94], and of posts on the axis line but outside the house (Elp).

European context [95]

The oval construction is exceptional in wooden houses in most of Europe. It does, however, occur occasionally in the Neolithic. Technically such a construction seems to have been among the possibilities [96]. We must assume, however, that the oval forms, not very suited to wood constructions, were borrowed from a building technique in other materials, such as stone and sods (or tents ?).

As we have already said, Beaker Culture houses and Early Bronze Age houses are extremely rare. A few round huts were reported at Ørnekul and Klein Meinsdorf, an oval *Wohngrube* (pit dwelling) of 6 × 15 m. with posts placed alongside one side at Schelditz and a few small rectangular huts with sunken floors at Mayen, Eifel; Mühlheim, Kr. Koblenz; Haffen-Mehr, Kr. Rees [97]. All are connected with the Battle Axe Culture. At Olfen, Kr. Lüdinghausen [98], post holes were found in a BWB settlement. With a little good will some round or oval structures might be distinguished.

The few house plans from the Early Bronze Age, such as at Postoloprty, Czechoslovakia, and Crestaulta, Switzerland [99], indicate a continuation of the rectangular Late Neolithic

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[93] NNE — SSW : Elp.
NNW — SSE : Deventer.
NW — SE : Dodewaard, Angelsloo.
WNW — ESE : Hoogkarspel, Elp, Molenaarsgraaf.

[94] Emmerhout is the northward extension of the Angelsloo excavation. Van der Waals defined the type, dated about 1400 B.C., at the Bronze Age—Iron Age symposium at Assen 25/26-5-1972.

[95] In the following only a general outline is given. No attempt is made to give a complete review of the Neolithic and Early Bronze Age houses. General information on Neolithic and Bronze Age houses in: Radig 1930, Stieren 1934, *Butler* 1938, *Childe* 1949, *Bailloud & Mieg de Boofzheim* 1955, *Arnal & Burnez* 1956, Schlette 1958, *Clark* 1965, *Piggott* 1965, Müller Karpe 1968, Simpson (ed.) 1971.

[96] We name some Neolithic oval houses or houses with round ends. Bylany (Lengyel Culture): Müller Karpe 1968, no. 250, esp. *Taf.* 194 H. Zengővarkony (Lengyel Culture): Müller Karpe 1968 no. 244, *Taf.* 188. Vučedol: Schmidt 1945, Schlette 1958, 137 and *Taf.* 89. Hurbanova (?) (*Zselizer Gruppe*, contemporaneous with *Stichbandkeramik*): Müller Karpe 1968, no. 257, *Taf.* 196. Curved walls are well-known characteristics of some *Stichbandkeramik* and Rössen houses (Müller Karpe 1968, *Taf.* 213, 234). A remarkable oval house plan was found at Wittenwater, Kr. Uelzen, East Niedersachsen (Voss 1964). The 16 × 6 m. two-aisled house was divided into three by two transverse walls. The house is dated by means of the pottery to a late phase of the TRB Culture. A few sherds with cordon decoration show, however, the presence of another, unknown element.

[97] Klein Meinsdorf: Schwantes 1939, 211.
Ørnekul: Brøndsted 1960, 173-174; Becker 1952.
Schelditz: Amende & Frauendorf 1926.
Mayen: Wagner 1938.
Mühlheim: Wagner 1938/'39.
Haffen-Mehr: Stuckmann 1914.

[98] Stieren 1950, no. 164.

[99] Postoloprtý: Soudský 1953, Piggott 1965, fig. 63. Crestaulta: Burkart 1946.

house of modest dimensions in Central Europe. Along the North Sea coast Elp houses were then built, however [100].

Real parallels for both the Molenaarsgraaf plans must be sought on widely separated points in Western Europe. In view of the scarcity of material, the wide distribution of the Bell Beaker Culture and the clear cultural contacts over long distances, this has not to be considered as a difficulty.

In Great Britain in recent years a few houses have been found. At Northon, Isle of Harris, the Hebrides [101], an oval house plan of 9 × 5 m. was found in 1965 in dune deposits between a Neolithic and an Iron Age level; it was dated by means of some Necked Beaker sherds. The wall was formed of loosely piled stones, originally about 2 m. high, shoring up the sand outside the dug-out dwelling. The roof was supported by a number of posts placed about 1 m. from the wall. The oval type of house is a foreign element in Great Britain also, although round houses occur there beside rectangular ones in the Neolithic [102]. Although about 100 domestic sites are known, further data about houses are remarkably few [103]. At Easton Down, Wiltshire [104], there are some pits, surrounded by post holes, possibly seasonal or temporary dwellings of the miners, of the flint mines there. At Belle Tout, Sussex [105], small round huts (diam. 3 m.) appear to have been built.

Rather large oval houses occur in the Southern French Chalcolithic, especially in the Couronnien of Provence and the contemporary Pasteurs des Plateaux (Fontbuxien and Ferrerien II) of Languedoc. They are built of loosely piled stones, the typical Mediterranean tradition, with roof constructions of different kinds: made by dry corbelling or constructed from wood or wattle. The houses are free-standing or are built-on. Particularly for the technique of loosely piled stones, the round and oval form is the most suited. It is of importance here that these Chalcolithic groups had cultural contacts with the Bell Beaker Culture. In addition to these large oval houses, small round and rectangular huts were built [106].

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[100] For instance: Ristoft, West Jutland, esp. house III, 20 × 6 m., Late Bronze Age (Becker 1968); Norddorf, Amrum, 10 × 4 m., Early or Middle Bronze Age (Struve 1954).

[101] Simpson 1966. Professor A. C. Thomas, Leicester, kindly informed me about both round Bell Beaker houses, excavated by him at Gwithian. After this part of the manuscript was completed the book of Simpson (ed.) 1971 appeared in which he gives a complete account of all Beaker houses in the British Isles. The occurrence of round huts with diameters of up to 6 m. seems well established now for the Bell Beaker Culture.

[102] Clark 1965, 131-133; Simpson (ed.) 1971, 137.

[103] Clarke 1966, 181; Clarke 1970, 258.

[104] Stone 1958, 66; Simpson (ed.) 1971, 135 f., fig. 25 B.

[105] Bradley 1970.

[106] At Tourelles, Vailhauquès, Hérault: two complete oval houses measuring 10 × 5 and 13 × 5 m., Arnal & Burnez 1956/'57, 88 and fig. 37.3. At Cante Perdrix, Calvisson, Gard: two oval or rectangular (with rounded corners) plans of about 15 × 5 m., Escalon de Fonton 1963, 266-269. At Coquette, St. Martin-de-Londres, Hérault: seven complete or partially preserved plans with dimensions within the walls: 3-5 by 7-13 m., Escalon de Fonton 1963, 247-249; 1966, 560-564. Other sites seem to give less detailed or less reliable information, such as Gagnière 1963 (esp. 349-353), 1966 (esp. 607) on Martigues. Small round huts at Fontbouisse: Louis *et al.* 1947. The fortifications, re-used or made by the Bell Beaker Culture such as Lebous (Arnal & Granel 1961, Arnal & Sangmeister 1963), Villa Nova de São Pedro (do Paço & Sangmeister 1956), Zambujal (Sangmeister & Schubart 1971) are left out of consideration here. They form a separate chapter in building traditions. It is difficult to establish whether they influenced the common building traditions, and if so to what degree.

Conclusion

When we venture to summarize these scanty data, the first noteworthy point is the lack of houses during the whole Beaker period in North-western Europe. At the end fairly large round oval houses appear to occur at various places, in addition to the scattered finds of small huts. Does this form develop from suggested tents of the preceding Beaker groups, or has it developed from the small round huts of the Mediterranean area?

In our country the large Elp type, much better suited to wood construction, developed quickly, but it is limited to the districts along the North Sea coast of Holland to Denmark. In Great Britain the development took an entirely different course, towards a type of round hut [107], which also came to be used in the Southern Netherlands during the Middle Bronze Age. In Central Europe the small, rectangular, two-aisled house of the Late Neolithic remained in use during the Early Bronze Age.

4.9.2.3. *The pits*

The small round pits are a common feature of (Late) Beaker settlement sites, although they are not restricted to settlements of this period. Pits of this type were found for instance at Anlo and Schipborg (BWB) [108]. At Elp (MBA) [109] similar pits occur inside the houses. Although these pits seem to have played a certain role in the settlement, their function is unclear.

A second type of pit, associated with beaker settlements (but also not restricted to these) are the wide horseshoe-shaped depressions. These were found at Anlo, Angelsloo, Schipborg, Eeserveld and Haps [110], but also in the Bandceramic cemetery of Elsloo [111]. About function and origin of these pits there is still much discussion. Modderman suggested that they might mark the places of uprooted trees.

4.9.3. The Settlement Finds

4.9.3.1. *The Bell Beaker pottery*

The typology and the relations of the Bell Beaker Culture in this country have already been described several times and *in extenso*, particularly by Van der Waals [112]. Here we propose to make only a few remarks and for the rest to refer the reader to these publications.

Between about 2000 and 1700 B.C. the important local group of Veluwe Bell Beakers developed and flourished in the central Netherlands. Elsewhere, especially in the province of Drenthe, the evolution was less spectacular and led to another local group with forms and decoration of a more simple appearance.

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[107] For example: Itford Hill (Burstow & Holleyman 1957), Thorny Down (Stone 1941); Fox 1964, 86 f.

[108] Waterbolk 1960, 72-74; Van der Waals 1962, figs. 16, 30.

[109] Waterbolk 1964, for instance the houses 5 and 12.

[110] Waterbolk 1960, 89; Van der Waals 1965[a], [b], 1962, 242 f.; Van Zeist 1968, 60; Verwers 1972, 11-12.

[111] Modderman 1970, 72-73.

[112] Bursch 1933, Van der Waals & Glasbergen 1955, 1959, Van der Waals 1964[a], Butler & Van der Waals 1966.

Thin- and thick-walled BB pottery can be distinguished. Verlinde [113] fixed the dividing line at about 5 mm. Most grave pottery is thin-walled. Thick-walled pottery is rarely found in more or less complete pieces. It probably comes from larger beakers (*e.g.* the Drouwen beaker) [114]. In settlements such as at Meerlo Heath it is much more common. We have not made this distinction, but both sorts occur at Molenaarsgraaf [115].

A group of "Hybrid Beakers" combines the characteristics of Bell Beakers and the older Protruding Foot Beakers (PFB). Although they were originally considered to be a mixed form and were placed later than the Maritime Bell Beakers, ^{14}C-dates now prove an older age. The idea that they are forerunners of the Maritime Bell Beakers and even intermediate between these and Protruding Foot Beakers seems now to have much reason.

Sherds of Protruding Foot Beakers are entirely lacking in the find group at Molenaarsgraaf, as is the case with the All Over Cord Beaker (Van der Waals type 2^{IIb}). There are, however, a few sherds which may come from 2^{IIa} beakers and from Maritime Bell Beakers [116]. The fragmentary character of the material, however, does not permit of any certainty in such an attribution. The sherds could just as well have formed part of the decorative motifs of later Bell Beakers. Moreover, the presence of a few typologically early sherds does not prove an early occupation, since some archaic clements can always occur in later domestic assemblages [117]. Although occupation in Molenaarsgraaf in the said period (about 2100-1900 B.C. in ^{14}C-years) is unlikely for geological reasons, we cannot entirely exclude this in view of the fragmentary character of the pottery [118].

It is clear from the variety of motifs used that the material is chiefly from late Bell Beakers. We can point out a few sherds that must have come from real Veluwe Bell Beakers, both among the settlement terrain finds and those from the pit fillings [119], so that the designation "Veluwe Bell Beaker association" is justified. This is confirmed by two facts.

First, the Veluwe Bell Beakers are distributed over a wider area than merely the Veluwe district. In any case we must include in it the "Rijk van Nijmegen" hills (Nijmegen, Wijchen, St.-Walrick), North Limburg (Meerlo), the northern part of North Brabant (Cuyk, Haps, Oss), the Utrecht hills (Rhenen, Leersum, Maarsbergen, Het Gooi) and the coastal area (Monster, Mijnsherenland) [120]. The geographical position therefore justifies our assumption of a VBB association. Second, the beaker from grave I is a genuine Veluwe Bell Beaker (*cf.* p. 301).

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[113] Verlinde 1971.

[114] Modderman 1971.

[115] For instance fig. 77, no. 305/307 (thick), no. 210 (thin-walled).

[116] For instance fig. 81, 1st row nos. 2 and 6 from the left, 3rd row nos. 1 and 5 from the left. Fig. 86, base sherd no. 194 and no. 338.

[117] Clarke 1966, 181, 183.

[118] At any rate the settlement has a *terminus post quem* of about 2000 B.C. for geological reasons (*cf.* p. 97).

[119] For instance fig. 81, 1st row the third from the left and the rim and base sherd in the 2nd row. Fig. 86 nos. 210 and 305/307.

[120] *Cf.* map in Van der Waals 1964[a] (fig. 13).

Nijmegen	Louwe Kooijmans 1973.
Wijchen	Bursch 1933, *Taf.* II-2, III-12, 13, 15, 16.
St.-Walrik	Groenman-van Waateringe 1966[a].
Meerlo	Verwers 1964.
Cuyk	Bogaers 1967.

To summarize, we propose that the Bell Beaker pottery at Molenaarsgraaf may be called a Veluwe Bell Beaker association and that early Bell Beaker elements cannot be demonstrated on account of the fragmentary character of the material.

4.9.3.2. *Barbed Wire Beaker pottery*

The Barbed Wire Beaker pottery was first comprehensively described by Modderman [121], after his finds on the Margijnen Enk near Deventer. In recent years it has aroused especial interest, as can be seen from the publications of Waterbolk, Bloemers, Lanting and Verlinde [122]. In view of these studies there is no point in dealing at length with BWB pottery here. We confine ourselves to a résumé and a few additions to points discussed in the above-mentioned publications.

Considerable confusion prevails about the correct terminology of the various decorative techniques which led to BW ornamentation. Unfortunately the original and most accurate description by Modderman (*viz.*: thread-wound stamp decorated beaker pottery) has never been taken into general use, but has been replaced by a simpler, but less sharply defined designation.

The most important characteristics of the BWB pottery are here described:

— Decoration with a thread-wound stamp, predominantly with a rigid core, sometimes combined with fingertip impressions (in V-motif, vertical or horizontal), rarely with cord impressions, grooves or impressions of a dentated spatula.

— The dominating motif is the horizontal or slightly oblique line running round the pot. Surrounding bands of one or a few zigzag lines, sometimes with vertical impressions, are common. Two-thirds or the whole of the pot is decorated.

— Peculiarities which occur are: cordoned rims, perforations below the rim and very rarely a big ear (only with small beakers) or decoration on the innerside of the rim. A number of beakers have channeled decoration instead of BW impressions, although in all other respects they are identical, particularly in the motifs used, the combination with fingertip impressions, the workmanship and the variation in forms.

— A distinction must be made between small beakers and large pots. The latter often have a heavy foot with a bowl-shaped (concave) inner profile. The large pots often have a high belly and an accentuated neck bend.

Haps	Verwers 1972.
Oss	Bursch 1937.
Rhenen	Van der Waals & Glasbergen 1959, fig. 20; Lanting & Van der Waals 1971, note 16.
Leersum	Reusink 1963, 1967.
Maarsbergen	Lanting & Van der Waals 1971.
Het Gooi (Hilversum)	Remouchamps 1928, Bursch 1935.
Monster	Stuurman 1965, Glasbergen & Addink Samplonius 1965.
Mijnsherenland	Verwers 1968.

In Germany Veluwe Bell Beakers are found as far as the Neuwied Basin. *Cf.* W. Kersten 1938, note 11. An additional find: Piepers 1972 (Bornheim).

[121] Modderman 1955[b]; see also Modderman 1954, 1959[b], 1959[c].

[122] Waterbolk 1959, 1960, 73-74; 1964[a]; Bloemers 1968, Lanting 1969[a], Verlinde 1971; see also I. F. Smith 1955 esp. 9-10; Van der Waals 1962, Clarke 1970, esp. map fig. X at p. 136.

— The workmanship is significantly inferior to that of the preceding beaker types. For tempering stone grit (pounded granite) is most often used.

— It is possible to distinguish a typological sequence in which carefully decorated pieces, with closely wound stamps, are the oldest, and carelessly decorated pottery, with widely wound stamps, the latest. The youngest appears to be the group of horizontal or oblique stamp impressions in vertical rows.

The BWB pottery was dated by Modderman to the Early Bronze Age as a direct successor of the pottery of the "true Beaker Cultures" (*i.e.* the Protruding Foot Beaker and Bell Beaker Cultures). This dating was confirmed by new evidence, published by Waterbolk. Lanting recently summarized the available dating information and claimed that it showed a dating between 1800 and 1400 B.C. [123]. This implies an overlapping of the Bell Beaker Culture on the one hand and the Early Hilversum Culture on the other. The lack of closed finds and find-associations is a formidable handicap for a good dating.

The best argument for the contact with the Bell Beakers is the existence of a group of of small beakers occupying an intermediate position by their form and the decoration techniques employed [124]. The contact with the Hilversum pots is illustrated best by the pot from Vorstenbosch, dated by a bronze pin to the beginning of the Middle Bronze Age [125].

In connection with his excavations on the Meerlo Heath, Verlinde examined 13 domestic assemblages in which Bell Beaker sherds occur. Only in two cases do BWB sherds appear to be "structurally" missing (*i.e.* in spite of sufficient sherds). He concluded from this that closely wound BWB pottery (of which his finds appeared in the main to consist) and the Late Bell Beakers were contemporary [126]. Some caution appears to be necessary here, however, for more than half of the studied find-groups are old amateur collections. It is precisely the most recent, carefully excavated find-groups that indicate that the BB and BWB elements do not generally go together [127].

A small find-group at Vlaardingen consisted exclusively of early (M)BB material. At Oostwoud MBB and VBB occurred together, Dodewaard and Haps revealed only VBB sherds, a deposit at Velsen and a group of round pits at Anlo only BWB sherds [128]. It is obvious that in any case we are concerned with both a pure VBB period and a period in which widely wound barbed wire was used exclusively. Both might be separated by a period in which late Bell Beakers and closely wound Barbed Wire decoration go together. In this respect we agree with Verlinde that the identical distribution patterns of the BB, BWB (all closely wound, with one exception) and Pot Beaker sherds in the excavation on the Meerlo Heath supports

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123 Modderman 1955[b], esp. 42; Waterbolk 1960, J. N. Lanting 1969.

124 We name the beakers from Diever, Emmen, Drijber (Modderman 1955[a], PL II), Querenstede, Kr. Ammerland (Zoller 1963), Heek, Kr. Ahaus (Voss 1967, *Taf.* 17.10; Albrecht 1934, 135, *Taf.* 19.2), Obereinzingen, Kr. Fallingbostel (Asmus 1954).

125 Modderman 1959[c]. Other finds of BW-decoration on HVS pots are: Wijchen (Glasbergen 1954, fig. 63.3), Vogelenzang (Groenman-van Waateringe 1966[b] and own observations).

126 Verlinde 1971, 40-41.

127 We must realize that the old amateur collections are insufficiently documented, especially as far as the find spot is concerned. One "site" might include material from various settlements.

128 *Cf.* p. 293 and the lit. cited there.

the contemporaneity of these three groups of pottery there. But to what extent have preservation conditions influenced the present distribution?

What is the typological and chronological position of the BWB pottery of Molenaarsgraaf?

In the settlement site widely wound stamps predominate, although closely wound stamps are occasionally found [129], but there is no trace of the vertical rows of horizontal impressions. The last BWB phase is therefore absent and the middle phase dominates. The closely wound impressions represent either an occupation between phase 1 and phase 2, contemporary with the cemetery (!), or they form an archaic element during phase 2.

The BWB sherds from the gully all have impressions from widely wound stamps. The BWB association forming phase 2 is therefore contemporary with the BWB layer at Velsen and the small round pits at Anlo. Certainly, when we add a number of BWB sherds from the settlement site, it appears to be a characteristic find-group of this period in which all typological elements are present.

4.8.3.3. *Pot Beakers*

Pot Beakers are up to 50 cm. in height, relatively thin-walled (7-11 mm.), richly decorated pots, with a characteristically more or less pronounced zoning of the decoration [130]. Two form-types can be distinguished: the Necked Pot Beaker with a pronounced neck bend and a type with an S-profile, which Lehmann divides into two types on decorative grounds: the Trumpet Pot Beaker and the Belted Pot Beaker, The dating of the Pot Beakers must be determined by typological arguments and by open associations, as closed finds with Pot Beakers are very rare [131]. Verlinde [132] recently and justifiably disputed Lehmann's datings; producing ample arguments he proposed that we should assign all Pot Beakers to the period of the Veluwe Bell Beaker. The relationship between the Necked Pot Beaker and the Veluwe Bell Beaker cannot be denied. The S-profiled Pot Beaker shows, however, a number of points of similarity to the large BWB pots: the form, the small foot, the holes under the rim and the decoration pattern. We would draw attention to the vague boundary between Necked and S-profiled Pot Beakers. In fact, a continuous typological series can be proposed, of which the Pot Beakers of Velp and Huinen on the one hand, and those of Driesche Berg and Ede on the other, are the extremes [133].

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[129] *Cf.* note 28.

[130] Lehmann 1965 gave a review of the Dutch Pot Beakers; later finds are published by Lehmann 1964, 1967[a], [b],[c], Hulst 1965/'66, 1970, Louwe Kooijmans 1967, 1973. For a detailed characteristic of Pot Beakers see Lehmann 1965, further Modderman 1955[b], Verlinde 1971 and the literature cited there.

[131] One closed find is the Nijmegen Pot Beaker (Louwe Kooijmans 1973). All other associations are less closed, with the exception of the central grave of a barrow at Ede. The Pot Beaker (Lehmann 1965, no. 3; Bursch 1933, 58) found there lay outside the barrow, but the Veluwe Bell Beaker in the central grave contained a sherd from another Pot Beaker. The Pot Beaker found below the barrow at Hanendorp near Vaassen (Lehmann 1965, no. 1; Holwerda & Evelein 1911, 22, *afb.* 27-28) has no direct association with the clumsy beaker (with BW impressions!) found in the centre. This beaker most probably belongs to a secondary grave and so forms a *terminus ante quem.*

[132] Verlinde 1971, 38.

[133] Velp: Hulst 1965/'66, 1970; Huinen: Lehmann 1965, no. 10; Driesche Berg: Lehmann 1967[c]; Ede: Lehmann 1965, no. 3. Intermediate forms between the Necked and the S-profiled Pot Beakers are in our opinion the Pot Beakers Lehmann 1965 nos. 4, 5 and 17 and the specimen from Speulde (Lehmann 1964).

Pot Beakers are the show pieces of the domestic pottery. That we possess such a large number (about 15) of more or less complete examples of these large pots is because they were deliberately buried. If the find circumstances are well documented, they appear to have been buried reverted. The frequent absence of bottoms agrees with this [134]. Moreover, whole pots or large pieces of pots are regularly found in or near burial mounds or graves [135]. Not only by their external appearance or form, but also because of these find circumstances [136], Pot Beakers, *Riesenbecher*, and large BWB pots form one group, which we can name together "Beaker Pots" [137]. By their concentration on the Veluwe the Pot Beakers form a regional group which can be linked with the Veluwe Bell Beakers. As is the case with the Veluwe Bell Beakers, they occur, however, in small numbers (also as sherds in domestic assemblages) in a much larger area [138].

The purpose of the first type of burial (with reverted pots) is illustrated by the find of

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[134] This is the case with the Pot Beakers from the Uddelermeer (Holwerda 1909, p. 39 and *afb.* XIV, *in situ* photograph in the RMO archive), Driesche Berg (Lehmann 1967[c], Hulst 1970), Ermelo (Louwe Kooijmans 1967[a], Hulst 1970) and Velp (Hulst 1965/'66, 1970).

[135] Pot Beakers near, under or in barrows:

Ede	(Bursch 1933, 56, Pl. V. 6; Lehmann 1965, no. 3).
Hanendorp	(Holwerda & Evelein 1911, 22, *afb.* 28; Lehmann 1965, no. 1).
Uddelermeer	(Holwerda 1909, 39, *afb.* XIV; Lehmann 1965, no. 11).
Driesche Berg	(Lehmann 1967).
Nijmegen	(Louwe Kooijmans 1973).

[136] Large BW pots buried upside down:

De Vledders:	Waterbolk 1959, 199-210.
Übach-Palenberg:	Bonner Jahrbücher 167, 1967, 418-419.

Large BW pots associated with barrows:

Stegerense Veld, Ommen:	Bursch 1933, 50, *Taf.* V. 2; Modderman 1955, fig. 1.
Ermelose Heide, barrow II (also V and XVI):	Modderman 1954, 39.

Riesenbecher buried upside down:

Leusder Hei:	Modderman 1955[c], 40.
Aalden:	Modderman 1957.
Echt:	Bloemers 1971.

See also the notes 139, 142, 144.

[137] We must also include in this group of "Beaker Pots": the English large "rusticated" Beaker vessels (Clarke 1970, figs. 113, 123-126, 129, 230, 366, 367, 915, 916); the large Early Bronze Age pots from Denmark (Glob 1952, nos 566-573; Magnusson 1948/'49) and the large beakers from the Rhine district (Sangmeister 1951, 80 and *Taf.* I. 16; Köster 1965/'66, *Taf.* 16.2, 16.4; Riquet *et al.* 1963, fig. 19.4, 20.3; Zumstein 1966, 132 (sherds only). The Dutch Pot Beakers form a (remarkable) part of this group.

[138] We must stress here that the map by Lehmann (1965) only gives the distribution of the more or less complete Pot Beakers and so of the habit to bury these for a special reason. But this habit has had a wider distribution: outside this country a few complete true Pot Beakers were found: in Belgium, along the Lower Rhine and in East England:
Lommel: Marien 1952, fig. 134.7.
Winnekendonk, Geldern: Geschwent 1960, *Taf.* 9 & frontispiece; also Bonner Jahrbuch 145, 1940, 218 and *Taf.* 47.2.
Bebra: Uenze 1961, no. 1, *Taf.* 1.
Neustadt, Kr. Frizlar: Uenze 1961, *Abb.* 1, *Taf.* 3[a/b].
Preist, Kr. Bitburg: Nachrichtenblatt für Deutsche Vorzeit 15, 1939, 254, *Taf.* 65.1.
Gütersloh: Lange 1959.
Erle, Kr. Recklinghausen: Günther 1960, *Bild* 36.
England: Lehmann 1967[a], Clarke 1970.

a large undecorated pot at Metzendorf/Woxdorf[139]. The pot, in its form identical with the large BWB pots, was placed over a dish with BW decoration[140]. The enclosed room was intact as a cavity, in which a skull lying on the dish was perfectly preserved. A comparable interment of a skull with a large pot related to the BWB pottery is known to us from the other extremity of the distribution area (Llancaichisaf, Glamorgan, Wales)[141]. We do not know, however, whether the pot was placed beside or over the skull. In a flint mine shaft at Findon, Sussex, a large pot with cordened rim and BWB impressions in zones was inverted over a cremation[142]. This appears to occur more frequently in England. Soon afterwards it became a very common type of interment[143]. A burial comparable with those at Findon and Woxdorf is the cremation in a late *Schnurkeramik* beaker, protected by an inverted undecorated *Riesenbecher*, from the "Neolithic urnfield" at Sande[144]. Pot Beakers, therefore, might have been buried upside-down as a protection of partial interments, *e.g.* only the skull or other parts of the body (see also p. 312).

As Pot Beakers may bear over much of their surface a fairly loose and unzoned decoration, it is not easy to make a percentage estimate of the proportion of Pot Beakers in domestic assemblages. The dimensions of the sherds also play a part in this.

Only a few sherds from Molenaarsgraaf can be atributed to Pot Beakers by reason of their decoration. These are some sherds bearing decoration type E[145]. That Pot Beaker sherds also occur in K, G and I seems likely, but cannot be proved. Only one sherd[146], found together with a few others from the same pot, shows a Necked Pot Beaker-like profile. The decoration, however, is too careless and the wall too thick for a genuine Pot Beaker. The finds from the pits are so scanty that the lack of Pot Beakers need not arouse surprise, but their absence in the gully filling seems to us to be significant. Pot Beakers apparently do not (any longer) belong to this BWB association. The small number of Pot Beaker sherds at Molenaarsgraaf is probably the result of the preponderance of material from phases 2 and 3.

4.9.3.4. *Domestic pottery*

The largest part of the Molenaarsgraaf pottery does not belong to any of the previously described groups. The sherds are those of pots which we know, in their complete forms, as *Riesenbecher* and small rusticated beakers, but mainly as sherds from domestic assemblages. Much less attention has been devoted to the latter than to grave pottery. In recent years, however, this attitude has changed and a few find-groups, accounts of some of which are published, have become available for comparative study. We have utilized some of these findings in our discussion above.

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139 Wegewitz 1960.

140 Not recognized as such by the excavator, but clearly recognizable from the drawings.

141 Griffiths 1957, fig. 7.1, with literature; Clarke 1970 fig. 359 (cat. no. 1857).

142 Jessup 1970, 79; Clark 1970, cat. no. 993.

143 I. F. Smith 1961, 117 for Wessex biconical and collared urns.

144 Schwantes 1936, Struve 1955, 53, *Taf.* 18, also I. F. Smith 1955, 12; comparable finds are those from Mannhagen (Kersten 1966) and Oldesloe-Blumendorf (Schwantes 1936, 82, *Taf.* 4.1). Clarke 1966, 191 stated: "Some of these larger (*viz.* Barbed Wire) vessels have been found inverted over cremation burials in Britain and on the continent."

145 Fig. 82 type E, esp. 2nd. row, both sherds at the left.

146 Fig. 84, esp. upper row, the central sherd.

— At Oostwoud (North Holland) [147] sherds of Maritime and Veluwe Bell Beakers occur together with pottery decorated with channelling and finger-tip impressions in V-motifs. Genuine Pot Beaker sherds are not included in the small find-group.

— At Haps (North Brabant) [148] two small concentrations of sherds were found, dated by sherds of Veluwe Bell Beakers. In one concentration lay a burial pit and the remains of the grave inventory, namely a Veluwe Bell Beaker with fingertip impressions on the lower part. 70 sherds (61%) are decorated. Of these, 20% are decorated with a dentated spatula, theo thers for the most part with fingertip impressions, particularly in V-motifs. Spatula impressions and groove lines occur on occasional sherds. At least one (rim) sherd belongs to a genuine Pot Beaker.

— At Dodewaard (Gelderland) [149] a concentration of Bell Beaker pottery was found in a Middle Bronze Age settlement. Of 359 sherds 103 (about 30%) are decorated, of which 31 came from (Veluwe) Bell Beakers. There are no Maritime Bell Beakers. In the remainder of the decorated pottery fingertip impressions in various motifs comparable with those of Molenaarsgraaf predominated. The V-motif is rare, however, as is channeled decoration. Genuine Pot Beakers are certainly represented.

— At Schipborg (Drenthe) [150] BWB pottery was almost the only datable element: widely wound stamps were mostly used. Sherds from undecorated pots and with fingertip, nail and spatula impressions as a decoration are of somewhat different workmanship, but have the same distribution. All the facts support the contemporaneity of both types of pottery. A third type, decorated with channeling is poorly represented. A large pot with spatula impressions in horizontal rows and a cordoned rim was found in the immediate vicinity and is certainly contemporaneous with the settlement finds. The pot shows great similarity to the large pot from Molenaarsgraaf. Only in the shape of the bottom there is a considerable difference.

— At Monster (South Holland) [151] domestic Beaker pottery included MBB (?), VBB and BWB sherds. The rest of the pottery shows channelling, fingertip and nail impressions (also in V-motif). Genuine Pot Beakers are well represented.

— The settlement on the Meerlo Heath [152] also yielded BB sherds (no MBB, some VBB) and (closely wound) BWB sherds, which are here probably contemporaneous. Of about 435 sherds about 30% is decorated. Of these BB (10%) and BWB (14%) are about equally represented. The remaining 76% shows mainly fingertip impressions, but also channelling. A few sherds come from genuine Pot Beakers. The BB pottery is primarily thin-walled. The BWB and especially the remainder of the decorated pottery is predominantly thick-walled.

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147 Van Giffen 1961, 1962, 1966, De Weerd 1966; see also Verlinde 1971, 39.

148 Verwers 1973, 9, *Abb.* 8.

149 We thank Mr R. S. Hulst, Amersfoort, for the information on the Bell Beaker finds of Dodewaard. In the numbers 150 undecorated sherds are not taken into consideration; although they are different from the HVS/DKS ware their attribution to the BB material is not certain.

150 Van der Waals 1962.

151 Glasbergen & Addink Samplonius 1965, Stuurman 1965.

152 Verlinde 1971.

	type elements				Molenaars graaf	other sites
1400	HVS					Velsen (2nd layer)
1500	HVS	BWB2			(3)	Vogelenzang, Wijchen, (Vorstenbosch)
1600		BWB2			2	Velsen (1st layer), Anlo (pits)
1700		BWB1	VBB		1/2	Meerlo Heath
1800			VBB		1	Dodewaard, Haps
1900			VBB	MBB	?	Oostwoud
2000				MBB		Vlaardingen

Fig. 122. Schematic representation of the chronological relationships of some well-documented settlement sites of the period 2000-1400 B.C. in the Netherlands.

If we compare these data, and refer to those of Molenaarsgraaf, it appears that only a few very general conclusions may be drawn. In fact beaker settlements do not yield enough pottery and the find material is not homogeneous enough.

— The percentage of decorated pottery varies from 30% (Dodewaard, Meerlo Heath) to 60% (Haps). Together with the Molenaarsgraaf finds (table 19) it seems that a great variation in the ratio of decorated to undecorated pottery occurs. Moreover, there is no regularity nor evolution to be recognized.

— The percentage of genuine BB sherds of the total of decorated sherds is low: 30% (Dodewaard), 20% (Haps), 10% (Meerlo Heath). The relatively high percentages at Dodewaard and Haps correspond with phase 1 at Molenaarsgraaf, for, reckoned over the total quantity from the settlement terrain, it is about 10%. For phase 1 it must, therefore, be some times higher.

— VBB and BWB pottery both appear to be associated almost exclusively with pottery decorated with fingertip impressions. The V-motif predominates; channeled decoration occurs in both in small quantities. As far as BWB pottery is concerned this agrees with the existence of complete beakers, whith channeled decoration, which are closely related to the real BW beakers. The association BB-channelling in phase 1 at Molenaarsgraaf is to some extent exceptional.

— Molenaarsgraaf reveals a number of elements not to be found in any recorded find-group: the frequent cordoned rims, the perforations under the rim, the impressions on the rim and the heavy feet. these are all elements characteristic of BWB pottery and at Molenaarsgraaf are found in this group and on undecorated pottery, which we placed in phase 3. The absence of these elements in the named find-groups supports this dating.

— There is a remarkable similarity between the percentage division of the pottery into the various categories at Molenaarsgraaf and at Meerlo Heath. Is this fortuitous ? Does it mean that Meerlo Heath covers the same period, or is it the consequence of the chronological position of Meerlo Heath, "half-way" to Molenaarsgraaf ? We do not know.

— Finally, we repeat that real Pot Beakers are very poorly represented at Molenaarsgraaf. This cannot be the result of regional factors, in view of their occurrence at Monster and also

at Ottoland [153], nor can it be caused by too little material. The real cause is likely to be the preponderance of pottery from phases 2 and 3 in the settlement terrain.

Our final conclusion must be that the domestic assemblage (in fact the domestic assemblages) at Molenaarsgraaf corresponds reasonably well with the discoveries at a few other well documented terrains of the same period.

4.9.3.5. *Some final remarks on the pottery*

The largest part of the settlement pottery at Molenaarsgraaf probably originates from *Riesenbecher* and related smaller pottery. The *Riesenbecher* are typologically the continuation of the series which we named when discussing the Pot Beakers [154]. As a residual group they are in the first place defined by negative characteristics, the absence of dentated spatula or BW impressions and of zoned decoration. They have a loosely arranged decoration of simple impressions carried out with the fingertip (often V-motif), nail, plain spatula or a broken-off pointed object such as a twig or a bone. The pot may be entirely or only two-thirds decorated. Sometimes they are wholly undecorated. They have an S-profile of divergent forms, seldom is it angular. The bottom can be small and heavy and concave inside, or broad and flat. Cordoned rims occur frequently; much less common is a row of perforations below the rim [155].

The dating of these pots rests mainly on typological arguments supported by a few (open) associations: the Drouwen pot [156] might belong to the Bell Beaker sherds there, that of Schalkholz [157] to a small Bell Beaker, the undecorated Metzendorf pot [158] belongs to a BW-decorated dish, and the Aalden pot [159] to the Early Bronze Age.

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[153] *Cf.* note 151 (Monster); Ottoland: data of the author.

[154] *Cf.* Verlinde 1971, 37. Pot Beakers were also seen as a regional group of the *Riesenbecher* by Stampfuss 1929, 89 and Gatermann 1943. BW pots were included in the *Riesenbecher* by Struve 1955, 43, 131-132. Remarkably the few Dutch *Riesenbecher* are all found outside the Veluwe. To us the following more or less complete *Riesenbecher* are known: Schipborg (Van der Waals 1962), Drouwen (Modderman 1971), Aalden (Modderman 1957), Rhenen (pers. comm Mr J. Ypey, Amersfoort), Echt (pers. comm. Mr J. H. F. Bloemers, Amersfoort). The fragmentary Rhenen pot (height c. 40 cm.) was found together with sherds of HVS/DKS pots in "grave 519" of the Merovingian cemetery there. It is over all decorated with A-fingertip impressions and has a profile like most large BW pots: everted rim, high belly and small heavy bottom with protruding foot. The Echt pot (Bloemers 1971, now in the Maastricht museum) is 51.5 cm. high and shows a close similarity to some BW pots (esp. Modderman 1955, fig. 1, no. 4) in profile and arrangement of decoration. It has an everted rim with a row of perforations and a cordon below, and a narrow, heavy base. The decoration consists of slightly oblique long grooves, alternating with rows of vertical fingertip impressions. Both are *Riesenbecher* that on typological grounds must be dated to the BWB Culture. Especially the Echt pot shows a strong relationship to the Molenaarsgraaf pot with reed impressions and might be called a *Riesenbecher* of Bentheim type.

[155] The principal literature on *Riesenbecher* (and sherds in domestic assemblages): Stampfuss 1929 (esp. *Taf.* XII), 1940; W. Kersten 1938, Stieren 1950 (no. 956), Stegen 1954, Struve 1955 (esp. 43, 131-132 and *Taf.* 24), Wegewitz 1960, Uenze 1961, Voelkel 1963, 1968. Lehmann (1965, 27) argues against the differentiation of the *Riesenbecher* in the Bentheim and "Moislingen" type. In our opinion the Bentheim type is well defined, while the Moislingen type is merely a heterogeneous residual group.

[156] Modderman 1971.

[157] K. Kersten 1951, Struve 1955, *Taf.* 21.10 & 11, also *Taf.* 15 (Kat. nos. 372-373). The upper part is decorated with a two-toothed spatula. The profile is angular like some Pot Beakers. The association with a small Bell Beaker is not entirely certain.

[158] *Cf.* notes 139, 140.

[159] Modderman 1957.

It seems to us that the careful analysis of domestic assemblages may also contribute considerably to dating. *Riesenbecher* of the "Bentheim type" are in this way dated by the BWB association from the gully filling at Molenaarsgraaf, where all the characteristics of this type occur. Also the pot with reed impressions, which typologically accords perfectly with the sherds from the gully, may be called a *Riesenbecher* of the Bentheim type. It forms a good parallel to the well-known pot from Esperke, Kr. Neustadt [160]. Only the decoration with reed impressions is exceptional. Comparable impressions by means of a reed, broken bone or other cylindrical object are known, however, on beakers of very divergent form [161], which at least partly originate from the same period. As we have already suggested the pot shows a strong relationship to the large BW pots not only by its form but also by the arrangement of its decoration.

The undecorated pottery from the gully filling includes two interesting elements. First, in the little pin an indication of the presence of handled beakers. Handled beakers are very rare in this country and are exclusively known from the BWB phase. Second, the outward bent rim (fig. 88, upper left) and a bottom sherd (fig. 89, right) demonstrate the presence of beakers with the form of the "intermediate BB-BWB type", like those mentioned in note 124.

Finally, a comment on phase 3 at Molenaarsgraaf and on the preponderance of undecorated pottery there. In the Central and Southern Netherlands the first Hilversum urns occur in the course of the Early Bronze Age. The lack of Hilversum pot sherds indicates that phase 3 must have ended earlier, certainly, therefore, before 1500 B.C. The ^{14}C date 1400 B.C. of the hearth no. 29 and the evidence of the pollen diagram confirms this. On the other hand we know that BW decoration occurs certainly up to the occurrence of the first Hilversum pots. In fact we find that nearly all the decorative motifs of the Molenaarsgraaf BWB association (phase 2) recur on Hilversum pots. It is one of the reasons why we think the HVS Culture cannot represent a pure immigration as Glasbergen suggests, but bears a strong autochthonous stamp [162]. The HVS Culture is the logical successor of the BWB Culture around the southern North Sea, but with a much more regional character. In both cultures, however, intensive contacts across the North Sea must have existed.

So at Molenaarsgraaf the HVS phase was not attained; only an impoverishment of decoration occurs. This can be a local phenomenon or the characteristic of the phase directly before the HVS urns. In any case we must assume that some of the decorated pottery, including that with BW decoration, from the settlement site belongs to this last phase. The disappearance of the decoration in the course of the Early Bronze Age, moreover, conforms logically to the general tendency in this country which develops into the completely undecorated pottery of the Middle Bronze Age: in the north the *Kümmerkeramik* of the Elp Culture, in the south the Drakenstein urns.

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[160] Jacob Friesen 1959, *Abb.* 151; Struve 1955, *Taf.* 24.4.

[161] Beakers with impressions of reeds or comparable cylindrical objects: see Elzinga 1964, Louwe Kooijmans 1973. Further: Waterbolk 1958, fig. 6.2; Van der Waals & Glasbergen 1954, Pl II.2, VIII.23; Clarke 1970, fig. 56. Outside the Netherlands: Sangmeister 1951. 80, *Taf.* I.16; Köster 1965/'66, *Taf.* 25.5; Riquet *et al.* 1963, fig. 4.4, 9.4, 20.3; Struve 1955, *Abb.* 12; Clarke 1970 figs. 57, 263, 909, 912, 1086.

[162] Glasbergen 1969.

4.9.3.6. *The flint*

Unfortunately much less attention has been paid to neolithic flint than to the pottery or the Palaeo- and Mesolithic flint. Meerlo Heath is, in fact, the only more or less fully documented flint complex of the Beaker Cultures in this country and its surroundings [163].

The divergences from Meerlo Heath find an explanation in the different geographical situation. Meerlo lies on the river Meuse, with natural flint supplies in the form of gravel in its direct environs. Molenaarsgraaf lies in the middle of a peat region, about 30 km. away from the nearest natural flint supplies (river gravel and erratics). On both sites local flint-working took place. The differences in the quality of treatment are not noticeable. On both sites a few large artifacts were found, in addition to the products of the somewhat poor local flint industry. We must assume that the large blades were not made at the sites, but imported into the settlement, so that the presence elsewhere of specialized flint workers must be considered. Such large blades do not appear to occur at Schipborg.

The most important difference between Molenaarsgraaf and Meerlo Heath is the absence of arrow-heads, *Pfrieme* (awls) and *Dolchspitze* (dagger points) at Molenaarsgraaf. This can be related to the small importance attached to hunting as was proved by the bone refuse. At Ottoland-Oosteind and Ottoland-Kromme Elleboog also only one damaged arrow-head was found on both places [164]. Arrow-heads are, however, not typical settlement finds, and it seems to us characteristic that most arrow heads at Meerlo were found by amateurs in the topsoil before the excavation.

At Molenaarsgraaf the piece shown at fig. 90 c is related to the *Pfrieme*. The *Dolchspitze* seem to me related to the blades with retouche.

The percentage of artifacts confirms that of Meerlo (19%). A high percentage of scrapers is found there also (60%), as at Schipborg. In both places core scrapers occur [165], and a few scrapers with superficial retouche. Scrapers at Schipborg attributed to the TRB Culture accord, however, also very well with the Molenaarsgraaf typology, as well as the few scrapers found at Monster. Two of them can be directly correlated to the BB Culture. The same applies to the scrapers from Velsen (BWB) and Vogelenzang (HVS). The simple, non-typical forms therefore appear to have had a long life. Various kinds of arrow-heads, if of less carefully shaped forms, also occur at Vogelenzang (HVS) [166].

The almond-shaped artifacts (fig. 90 e) appear to be characteristic of this period. A specimen with retouche on one side was among the grave goods of the VBB grave at the Mottenkuil. A few with retouche on both sides were found at Schipborg among BWB domestic refuse. From a barrow at the Weekromse Zand comes an almond-shaped artifact with retouche on both sides

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[163] Verlinde 1971, 33, 43 (Meerlo Heath), Van der Waals 1962, 230, 242 (Schipborg). We will not try to compare with Beaker flint complexes outside the Netherlands, such as Belle Tout, Sussex (Radley 1970). This seems not very significant in this state of research.

[164] *Cf.* App. I, nos. III-11 and III-26 (= App. III, nos. 36 and 42). Type as Verlinde 1971, fig. 6, 2nd row, 4th from the left and Van der Waals 1962, fig. 28, no. 50.

[165] For instance Van der Waals 1962, fig. 29, no. 68.

[166] Groenman-van Waateringe 1966[b], fig. 46, Glasbergen 1969, fig. 13 (Vogelenzang), own observations (Velsen), Glasbergen & Addink Samplonius 1965, fig. 13.4 (Monster).

and a handled groove-decorated beaker. Their possible association is, however, not established [168].

A parallel for the triangular borers was found by us at Goudriaan [169]. It has, on the same geological grounds as are valid for Molenaarsgraaf, a *terminus qost quem* of 2000 B.C.

Sickle fragments were not found at Molenaarsgraaf, nor at Ottoland, Schipborg or Meerlo Heath. They also appear to be absent in Middle Bronze Age settlements. In the Alblasserwaard, on the other hand, we know of a few Late Bronze Age and/or Early Iron Age terrains, where sickle fragments occur. All this confirms such a late dating of sickles in this country, as opposed to that made, for example, in Denmark [170].

The fragment of the flint axe (fig. 87 s) forms one of the few indications of the type of flint axe used in our country during the BB Culture and the Early Bronze Age. We know only the grave finds at Lunteren [171], among which were two flint axes. They are of the type of rough workmanship (if not even rougher) which is generally found in PFB Culture graves [172]. Our axe fragment is, however, a part of one of a much more carefully made type.

The flint material is in clear contrast to that of the Vlaardingen Culture by the absence of axe-flakes and transverse arrow-heads. The scrapers from Molenaarsgraaf appear to be of finer workmanship and to possess other l/b/h ratios. Large blades with retouche have not been recorded at VL Culture sites [173].

4.9.3.7. *The worked stone*

Recently J. N. Lanting distinguished two related types of perforated axes (the types "Emmen" and "Zuidvelde"), that are found in Bell Beaker and Early Bronze Age graves. Both have a long lozenge shaped outline [174]. But in general we can say that only very rarely do perforated axes or fragments of them occur in Late Bell Beaker or Early Bronze Age context [175]. The Molenaarsgraaf fragment with its straight sides and modest size gives only very little information. We only can say that it is not impossible that it is the fragment of a perforated stone axe of Emmen type.

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168 Mottenkuil: Van der Waals 1964[a], fig. 12; Schipborg: Van der Waals 1962, fig. 28, nos. 68, 40; Weekromse Zand: RMO e 1936/1.26 and 24, Modderman 1955[b], fig. 4. 11.

169 RMO inv. no. h 1971/1. 32; App. III, no. 46.

170 *Cf.* for instance Groenman-van Waateringe 1966[b],—& Van Regteren Altena 1961. The bronze sickle in the Heiloo depot, commented on exhaustively by Brunsting (1962), can be preferably considered in our opinion as a product of the Dutch Late Bronze Age bronze industry.

171 Butler & Van der Waals 1966, 125f., figs. 13[b], 45, 46. From Great Britain, Clarke (1970, 448) mentions only 4 flint axes. Since stone axes are also unknown as grave goods in Bell Beaker graves, we are very ill-informed about all Bell Beaker axes. A domestic pit at Schipborg (Van der Waals 1962, 235, 250) gives the single association in this country.

172 Van der Waals 1964[a], 22, 49.

173 *Cf.* Van Regteren Altena *et al.* 1962/'63, 1962 30, fig. 8; Glasbergen *et al.* 1966, fig. 26; Glasbergen *et al.* 1967, 23.

174 Pers. comm. J. N. Lanting, Groningen.

175 See for example: Van der Waals 1962, fig. 29, Bloemers 1968, figs. 4 and 5, Bell and Hoffmann 1940, *Taf* 16, no. 7.

The arrow-straightener [176] is a very characteristic implement for this period. These implements were frequently discovered in graves and form a characteristic item of Bell Beaker Culture archery equipment that probably remained in use in the Early Bronze Age. We mention here the finds at Meerlo (VBB) [177], Haps (VBB) [178], Uddelermeer (late VBB or BWB) [179] and Toterfout (HVS) [180] in this country. In Northern Germany [181], England [182] and especially in Southern Scandinavia [183] they occur commonly in the Beaker milieu and in the Early Bronze Age. They are also known, however, in other periods: in our country specimens were found in Bandceramic settlements at Sittard and Caberg [184], and in the Baltic area in the Pitted Ware Culture [185].

The ball-shaped polyhedrons are a much more common type of artifact than would appear from publications. They are not very spectacular and consequently only incidentally reported. One example was found in a barrow at Vaassen [186], possibly belonging to Middle Bronze Age pottery. At Zwaagdijk [187] (Middle Bronze Age) fragments of similar stones were found, as also at Elst [188] (end of Middle Bronze Age). We know of three examples from the Veenenburg estate between Lisse and Hillegom [189], where BB Culture, Early and Middle Bronze Age finds were made. Another specimen was found, together with an undecorated Hilversum urn, at Wijchen [190]. In the IJsselmeer polders [191] a few examples are known. The relatively late dating on grounds of distribution at Molenaarsgraaf (phase 2/3, *cf.* p. 236) is confirmed by these finds. The function of the ball-shaped polyhedrons is, however, still unclarified. They are certainly not stones used for beating [192], but rather for some kind of rubbing or smoothing work. Are they perhaps whetstones for bronze implements?

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176 Arrow shaft smoother or straightener; German: *Pfeil(schaft)strecker* (*glätter*).

177 Verwers 1964, fig. 4; a pair forming part of a grave inventory with Veluwe Bell Beaker.

178 Verwers 1972, *Abb.* 9, fragment, part of domestic refuse.

179 Holwerda 1911[a], *afb.* 4 a single piece forming part of a grave inventory with a small to BW Beakers related beaker (*cf.* note 242).

180 Glasbergen 1954, fig, 42[c], a single piece.

181 For instance: Radberg near Hülsten (Kroll 1938, a pair in Early Bronze Age (BWB) association); Marbeck Kr. Borken (Stieren 1950, no. 98, isolated find near BB and BWB sherds); Hohenhorster Bergen, Kr. Bocholt (Stieren 1950, no. 44, isolated find in urnfield, late beaker finds nearby); Stieren 1950, no. 334 (isolated find) and no. 1286 (fragment with Neolithic refuse); Voss 1967, *Taf.* 17.6: fragment, isolated find; Struve 1955: two pieces in Early Middle Bronze Age milieu at Norddorf.

182 Grimes 1938, fig. 4.2; Clark 1963, fig. 16; Annable & Simpson 1964, nos. 285-290 (Roundway), nos. 211-218 (Wilsford), nos. 382-389 (Collingbourne), all grave groups dating from the beginning of the Bronze Age. No arrow shaft smoothers are mentioned by Clarke 1970 (esp. 448).

183 Glob 1952, nos. 322, 539; Forssander 1933, *Abb.* 40, 42.

184 Both unpublished: RMO 1 1937/4.43 (Caberg), 1 1959/12.192 & 250 (Sittard). A parallel to the Caberg specimen is illustrated by Bailloud & Mieg de Boofzheim 1955, PL. VIII. 16.

185 *Cf.* note 183.

186 Holwerda & Evelein 1911, *afb.* 24.

187 Modderman 1964[a], esp. 35.

188 Hulst 1969, 277 and fig. 4.

189 RMO h 1930/7.20-23.

190 Museum Frans Bloemen, Wijchen, no. B1.0.67.

191 Comm. Mr G. D. van der Heide, Schokland. North-east Polder, parcel P14; East Flevoland Polder, parcel G 42 (BB culture?).

192 The ball-shaped polyhydrons show a supperficial resemblance to the *Kornquetscher*, regularly found in Iron

As for the concentration of stones no. 308, we would mention for purposes of comparison the collection of small pebble deposited in a pit (no. 69) at Meerlo Heath. Verlinde thinks of raw material for the tempering of pottery. At Molenaarsgraaf no quartz was included in the concentration while stone (*i.e.* quartz) tempering was not frequent. The problem of the function of these stones remains unsolved.

4.9.3.8. *The worked wood*

Both at Vlaardingen [193] and at Molenaarsgraaf oak, lime and elm are almost completely lacking in the determination lists. The alder is much more frequent at Molenaarsgraaf than was the case at Vlaardingen. This might be explained by the use and the measurements of the poles: at Vlaardingen these were heavier and were used for the building of houses.

The method of workmanship is fairly varied at Vlaardingen [194]. The house 10, on the western bank, had poles carefully trimmed all round to a point, with small facets. The poles on the eastern bank, often of split wood, were carelessly cut and usually after rough notching were broken through and not further treated. The way of cutting at Molenaarsgraaf differs from both these techniques. The poles there were pointed with a few powerful blows of an axe on one or two sides.

The fragment of the tenon, as used in a mortise and tenon construction, is well paralleled in the wooden temple at Bargeroosterveld [195]. The tenons there are bigger in all respects. They are thicker (10-15 cm.) and considerably longer (30-75 cm.) and have a wider flange. This small temple belongs to the Elp Culture. It is precisely this culture that may best be regarded as the continuation of what we have found at Molenaarsgraaf.

We know a few examples of poles knocked in the bottoms of gullies with shallow water on prehistoric sites in this country. In the bottom of the shallow gully at Culemborg [196] we did find a few poles, belonging to the adjoining Iron Age settlement. The gully, however, then had the character of a marshy depression rather than that of open water and the posts could easily be interpreted as the remains of fences. In the gully at Vlaardingen, besides the remains of nets and the famous osier weel (fish trap), a considerable number of enlined posts, closely set together were uncovered. The fishing expert Boddeke thought they were the remains of blockings, used in trapping the sturgeon, represented there with large quantities of its bone plates. Also the nets, with a mesh width of 13 cm. were probably used for sturgeon fishing [197].

Age milieu. Quartzites were also often used for these, but they have larger dimensions and show the beaten surfaces of pounding stones, the result of their use, *viz.* the beating and pounding of grain.

[193] Glasbergen *et al.* 1966, 61. Wood samples from the creek bank zone, trench 7:

alder	63	hawthorn	2
ash	38	elm	1
hazel	11	mountain-ash	1
maple	9	yew-tree	1

[194] Glasbergen *et al.* 1966, 56, 59.

[195] Waterbolk & van Zeist 1961; ^{14}C date: GrN 1552, 3240 $\pm$ 65 B.P. (1290 B.C.), Vogel & Waterbolk 1963.

[196] Data by the author.

[197] Boddeke 1971 and pers. comm. See also Glasbergen *et al.* 1966, 46; Van Regteren Altena *et al.* 1962/'63, 1963, 47-48.

In the Upper Rhine in some places poles have been found which were originally interpreted as *Flusspfahlbauten*, but which Clark [198] prefers to see as the remains of constructions for the catching of migratory fish as salmon. Since the sturgeon might have been present for ecological reasons on the Molenaarsgraaf gully (the salmon probably not), it is possible that the poles are the remains of similar structures as at Vlaardingen. They might have been used, however, for the setting up of traps (*e.g.* for eels) as is still done in the canals and waterways of the Netherlands. It is interesting that the osier weel, found at Vlaardingen, is of the same type as the Early Atlantic specimens from Denmark and the fish traps used until a few years ago in the Dutch Biesbosch area [199].

4.9.4. The Grave Goods

4.9.4.1. *The Veluwe Bell Beaker from grave I*

We can name the beaker from grave I a Veluwe Bell Beaker because of its angular profile, its decoration, which accentuates the form, and the width-height ratio [200].

We have already pointed out above (p. 249) that this beaker is not an outstanding specimen. A plain (not a dentated) spatula was used, the rim profile is very simple, the wall fairly thick, the surface not so well finished as with many other Bell Beakers, the decoration (especially the zigzag bands) rather careless and the form proportions not very balanced. As fine, first-rate Bell Beaker pottery does occur at Molenaarsgraaf [201] we must assume either that this is an exception to the rule of putting best-quality goods in the grave, or that the grave belongs to a period when this very fine Bell Beaker ware was no longer available in the settlement. We opt for this later possibility, as such a relatively late placing in the history of the settlement is supported by the ^{14}C date (1685 $\pm$ 35 B.C.) of the grave and by some typological considerations.

In the typological sequence of Van der Waals our beaker conforms most closely to the type 2^{Ie}, which is not necessarily in conflict with the very late dating. The dating of the 2^{If} beaker from St.-Walrick, well before 1710 $\pm$ 80 B.C. [202] combined with the Molenaarsgraaf beaker proves indeed that the end of the typological sequence might be of chronological value in only a very general sense or not at all.

The bands with surrounding zigzag lines form in our view an element that can be justifiably given a very late dating. We find the motif—but in a finer execution—on a large number of Veluwe Bell Beakers of various forms. We do not wish to speculate about the origin of this motif. It is a logical element among the various (Bell) Beaker motifs. It is, however, noticeable that the surrounding zigzag band, consisting of one to a maximum of four lines, is one of the few (and the most striking) decorative motifs of BWB pottery. This motif is also prominent in

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198 Clark 1948, 69.

199 Clark 1948, 55 (Ertebølle Culture); Clark 1965, 43-44 and PL. II.

200 Van der Waals & Glasbergen 1955, 24-25.

201 For instance fig. 86, nos. 210, 338; fig. 81 first 3 rows, the sherds at the left.

202 Groenman-van Waateringe 1966[a], Butler & Van der Waals 1966, 54.

the small group of beakers which occupies an intermediate position between the Bell Beakers and the BW Beakers [203]. The decoration with bands of bold horizontal zigzag lines seems to to be one of the few elements to survive the transition from the Neolithic to the Bronze Age. The typological intermediate form of the zigzag motif of our beaker, between that on Veluwe Bell Beakers and on the BW Beakers, may be explained by the chronological intermediate position.

4.9.4.2. *The domestic beaker from grave III*

The small beaker from grave III has the slightly accentuated shoulder and the funnel-shaped neck (and also the foot) that most conforms with some very early Protruding Foot Beakers in this country, such as those of Hees and Schipborg [204]. On geological and archaeological grounds such a dating (2500-2400 B.C.) is impossible. Moreover, the beaker is only decorated on its lower part ! A second choice is the BW Beakers, especially those which are carefully shaped, although they lack an accentuated shoulder. As domestic pottery was very rarely placed in beaker graves it is not surprising that we possess no exact counterparts, for complete pots of this kind are consequently rare. The fact that only the lower part of the Molenaarsgraaf beaker is decorated while the neck is undecorated, is remarkable for beaker ware.

The gift of a Bell Beaker of moderate quality in grave I at the end of the period covered by this culture, plus this simple domestic pot, given in grave III, suggest that the very late Bell Beaker graves are characterized by domestic or inferior pottery as grave gifts. It is the prelude to the complete disappearance of pottery in the graves and even of grave goods in general during the Early Bronze Age.

We will name here a few graves that have the same feature of a simple domestic pot as grave gift and that for various reasons might date from the same period. In a complicated barrow at Hülsten, Kr. Borken [205] a small round pit contained a small carelessly shaped beaker with S-profile, entirely decorated with fingertip impressions in V-motif. Only two bands were left blank (!). At Selm, Kr. Lüdighausen [206] a small beaker was found in a oval burial pit as a grave gift to a cremation. It is entirely decorated with Λ-motifs, with the exception of a narrow strip under the rim. In the Netherlands we consider the beaker from the second grave of barrow E, Uddelermeer [207], as belonging to the same group and phase, together with the small beaker with reed impressions from grave II in the Roman castra at Nijmegen [208].

4.9.4.3. *The large beaker with reed impressions*

The typological place and the dating of the pot with reed impressions has already been discussed above (p. 296). We also commented on the association of this pot with grave II and

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[203] *Cf.* note 124.

[204] Waterbolk 1958, fig. 4; Van der Waals 1964[a], fig. 6; Van der Waals 1962, fig. 20.

[205] Kroll 1938, Albrecht 1934, 129; Struve 1955, 130-131.

[206] Albrecht 1934, 139, *Abb.* 23.2; also I. F. Smith 1955[a], 10-11 (dating the beaker to the BW Beaker ware); Struve 1955, *Taf.* 24.8.

[207] Holwerda 1911[a], 5-9 and *afb.* 4-9, see also note 242.

[208] Louwe Kooijmans 1973.

on the find-circumstances of the "Beaker Pots" (*i.e.* the Pot Beaker-*Riesenbecher*-BW pots) in general (p. 291 f.).

4.9.4.4. *The fish-hooks*

Three bone or antler fish-hooks have been found in this country. A 7.6 cm. long antler specimen was found in the IJssel near Olst [209], a 9 cm. long hook in the North-east Polder [210] made of (elk ?) antler, and a 11.5 cm. long whale bone hook also in the North-east Polder [211]. In material and shape, and because of their barbs, they are very different from the Molenaarsgraaf hooks. None of them are dated.

The oldest fish-hooks of Northern Europe, those of the Danish Maglemose Culture [212], are of the same type and made with the same technique as those of Molenaarsgraaf. They are made of bone, V- or U-shaped and were often cut after a hole was bored in the bend of the hook. They have no barbs, but often a little knob or a notch to fasten a line. We know this type also from the Swiss bog settlements [213], from the so-called *Huntedorf* on the Dümmersee (TRB Culture) [214] and from a few cemeteries of the Pitted Ware Culture: Tangermünde [215] and Ostdorf [216]. This type of fish-hook has therefore had a very long life and seems to be restricted to environments with still fresh-water. This agrees well with the special function Clark [216] attributes to them: to hook on a living bait for the catching of pike. But we must realize that the Molenaarsgraaf hooks are among the smallest of this type (the Maglemose hooks are mostly 5-10 large) and the youngest in date. They are not necessarily used in the same way and Boddeke's experiments point indeed to another type of fishery at Molenaarsgraaf [217].

Fish-hooks, which are in any case rather uncommon, are rarely found in graves [218]. At Molenaarsgraaf the fish-hooks may best be regarded as the counterparts, the "wet version' of the customary archer's equipment [219] found in Bell Beaker graves on the sandy grounds. At Molenaarsgraaf hunting was unimportant: the fisherman's gear replaced hunting equipment.

4.9.4.5. *The antler hook*

Large antler hooks or hoes, like the specimen from grave II are hardly known in Bell

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209 Unpublished: RMO d 1928/12.1, bought from Mr Dul Fortmond, Olst; with one barb and grooves around the top.

210 Unpublished, found about 1950 and recently acquired by the Schokland museum. Round cross-section.

211 Boeles 1951, 197, fig. 42; Van der Heide 1955c, 110.

212 Clark 1948, 1936, 43; Clark 1965, 42-43, fig. 17, 18. Brøndsted 1960, 60-67, 84-85; Glob 1952, no. 533.

213 Clark 1948, 64, fig. 11; 1965, fig. 18; Wyss 1969, *Abb.* 8.13-16, barbless hooks 6-12 cm.

214 Jacob Friesen 1959, *Abb.* 126.

215 Tangermünde: Preuss 1953/'54; Ostdorf: Bastian 1961, Schuldt 1961. The coastal settlements (and cemeteries) as Västerbjers have other types of hooks, probably more suited to sea-fishing and sea-fishes (Stenberger *et al.* 1943, esp. 86-87).

216 Clark 1965, 42-43, fig. 17.

217 Described at p. 333; see also note 59.

218 Clark 1948, 66-67; *cf.* also note 215; Häusler names a few bone fish-hooks in graves of the Siberian Glazkovo Culture (Häusler 1962, 1155, *Taf.* IX.3 (Nockoj 3) and *Taf.* VIII.1 (Makarovo 2)). The Glazkovo Culture is dated to the 18-13th century B.C.

219 *Viz.* arrow-heads of different types, wristguards, arrow shaft smoothers.

Beaker or Barbed Wire Beaker context. Only in Great Britain were a few hooks found in graves [220].

For its original use we will name a few possibilities. First, the hook is very similar to the Neolithic flint miner's picks. These might have been used for cutting the chalk as well as for levering blocks of chalk out of the walls [221]. That they really are suited for heavy digging work was proved in the Overton Down experimental earth work [222]. The use as a miner's pick is, however, entirely out of the question at Molenaarsgraaf. There it might have been used as a ground working implement, while the rose might have been damaged in breaking up the clods [223]. For the much younger antler hooks from the *terp* mounds (after 600 B.C.) such a use is generally accepted. They show, however, an intensive polish on the working end, lacking on our hook.

Is it possible that the hook, like the fish-hooks, formed a part of the fisherman's equipment? It could have been a fishtrap lifter or dredge. Wooden hooks of very similar measurements and shape were until recently in use in Sweden to pull nets out of the water [224]. At Robenhausen certain wooden objects with short side-branches radiating at an oblique angle to the shafts were interpreted as such [225]. In the already mentioned cemeteries at Tangermünde and Ostdorf, used by a society with a comparable economy and living in a comparable environment, a few antler implements occur, if of another type [226]. They have a double point with a centrally bored hole in which was originally a shaft, thus making a kind of double pick axe. At Västerbjers [227], a coastal settlement, other types of fish-hook occur and the comparable antler implement is also different. It is an antler tine bored through at the base, as was done in the Maglemose culture. One piece shows clearly that it was originally provided with a shaft. On the point traces of wear are visible in the shape of longitudinal scratches. But the function of the implement is not clear: digging implement, net lifter or weapon?

It does not seem possible to determine with any certainty the way in which the antler hook was used. If we had to choose we would give preference to its use as a net lifter from the fairly deep and sometimes chilly waters of the gully. This explains the small wear and the scratches on the point. The rose would then have been damaged by its use as a hammer to drive into the gully bed the poles on which the traps and nets were fixed.

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[220] Clarke 1970, cat. nos. 221 (p. 440), 739 (p. 438), 817 (p. 441), 1083 (p. 446), 1366 (p. 441). Antler tine: no 135 (p. 441).

[221] Clark 1965, 175, also 48-49. Similar hooks were found at Spiennes and St. Geertruid in small numbers.

[222] Jewell 1963, esp. 51-52.

[223] In the Western Netherlands these implements are very scarce. One from Hillegom is reported (Van der Wal 1952, 108, PL. IIB). The implement is undated,

Dr H. H. Frese, Rockanje, informed me about the hoes, at present in use in Africa. These are rather primitive tools, unspecialized in form or function. The angle between blade and haft is always a sharp one, which is not the case with our antler hook. To us this seems not significant, however, since prehistoric people were not free to choose the most efficient angle, but had to work with a naturally grown form. For the African hoes see Baumann 1944.

[224] Such a wooden hook is in the Hamburgisches Museum für Völkerkunde, Cat. no. 27.102:22, length = 37.5 cm., length of hook = 20 cm. We thank Dr Wilhelm Bierhenke for his information on this implement.

[225] Clark 1948, 71.

[226] Bastian 1961, esp. 98-101 & *Abb.* 72[a]; Preuss 1953/'54, Tangermünde grave 21 (*Taf.* XXV. 4). A similar implement was found at the Dümmersee (Deichmüller 1969, *Abb.* 2).

[227] Stenberger *et al.* 1943, 87-89 and *Taf.* 20.7, 25, 28.

4.9.5. The Graves

4.9.5.1. *General remarks*

The Netherlands have a very rich tradition in the investigation of Beaker graves, especially barrows, but comparatively little order has been created among the large quantities of available data. A detailed survey lies, however, outside the range of this essay, and would only be possible after intensive study of field documentation and notes both of amateur and professional archaeologists [228]. Such a work is being undertaken by J. D. van der Waals, and J. N. and A. E. Lanting [229]. Here, however, we will confine ourselves to published data, which are not disputed in interpretation or dating, and data supplied by recent investigations. This is only a part of the available material, but it is the most important part and more than adequate for assessing the value of the Molenaarsgraaf data.

First, a few general remarks. Burial in cemeteries appears to have been common, but is mainly recognizable when barrows were raised over the graves. Large groups of barrows seem, in view of the grave goods, to have been in use for a long time. Bell Beaker graves join those of the Protruding Foot Beaker Culture. Small groups appear to represent shorter periods. But isolated barrows occur just as much [230].

Flat graves are less commonly known, but they were certainly as numerous as the barrows [231]. Especially during the large scale excavation of prehistoric settlements, the last few years, many flat graves of the Beaker Cultures were discovered. During the execution of public works it is, however, only a striking burial gift that leads to its discovery and most of them will be disturbed unnoticed. We must assume that a relatively large number of dead were buried in flat graves without noteworthy grave goods.

Little attention has been paid to the relationship between graves and settlements. It appears that the graves often lie in the immediate vicinity of the settlements during a period extending from the Protruding Foot Beaker Culture to the urnfields of the Late Bronze Age. This was at least the case in a number of extensive excavations, such as Anlo (PFB), Elp and Angelsloo (ELP). Also at Oostwoud (BB), Haps (VBB), and Nijmegen (VBB) [232] settlement remains and graves were found on one and the same terrain. The frequent occurrence of some beaker sherds or domestic pottery in and under barrows also indicates an adjacent dwelling

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[228] *E.g.* Van Giffen, Modderman, Waterbolk, Bursch, Remouchamps and Holwerda and amateurs like Bellen and Bezaan.

[229] We thank Prof. van der Waals and especially Mr J. N. Lanting for their help and information relating to the problems discussed in the subsequent paragraphs.

[230] A large barrow group is, for instance, that of the Ermelose Heide (Modderman 1954); small ones: those at Anlo (Waterbolk 1960), Swalmen (Groenman-van Waateringe & Van der Waals 1961) and St.-Walrick (Groenman-van Waateringe 1966[a]). As isolated barrows we name Meerlo (Verwers 1964) and Mol (Beex and Roossens 1962, 1963).

[231] *Cf.* Waterbolk 1958; Van Giffen 1937: Sleen, discovered by the finding of one rich grave; the others appeared to be poor in grave gifts. Recently at Hijken a grave field of 7 PFB Culture flat graves was discovered accidentally during large scale excavations of a Bronze Age settlement by the BAI, Groningen.

[232] Waterbolk 1960, 1964[a], Van der Waals 1965[b], 1966, 1967, Van Giffen 1961, 1962, 1966, Verwers 1972, Louwe Kooijmans 1973.

place. This fact therefore leaves the possibility open that the dead were in fact buried in the settlement during its occupation at Molenaarsgraaf, as the landscape made no other choice available.

Ring ditches or intermediary ditches with palisading (under the barrow, between the grave and the barrow's edge), and reinforced grave pits were in use in both the PFB and BB Culture[233]. As far as the latter is concerned we must, however, be careful with former interpretations of soil traces.

After having stressed above the uniformity of a few general aspects of burial customs, in what follows we discuss mainly the position of the bodies themselves and point out some differences between the various Beaker Cultures in this respect.

4.9.5.2. *Veluwe Bell Beaker graves*

In the phase of the Veluwe Bell Beaker Culture the graves are orientated predominantly in an E-W direction [234]. Of 26 graves dated predominantly by a beaker 21 appear to have an

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[233] Ring-ditches: PFB Culture *cf.* A. E. Lanting 1969, BB Culture *cf.* Lanting & Van der Waals 1971, note 15, Louwe Kooijmans 1973, esp. notes 66-68. I list some reliable observations of reinforced grave pits of the BB Culture:
— Mol (Beex & Roossens 1962, 1963), pit 330 ×200, reinforcement 220 × 100 cm.
— Wehm (Schlicht 1958), pit 220 = 150, reinforcement 150 × 100 cm.
— Schaaik (= Schayk) barrow 3 (Van Giffen 1949, 73), pit 278 × 245, reinforcement 195 × 95 cm.
— Emst (Van Giffen 1930[a], 75, *Abb.* 65), pit 350 × 175 with 250 × 70/45 cm. coffin.
— Vaassen, barrow 3 (Lanting & Van der Waals 1971, fig. 9) pit 150 × 130, reinforcement 120/100 × 60 cm. Cremation.
— Maarsbergen (Lanting & Van der Waals 1971, 118, fig. 13), pit 220 × 130, reinforcement 150 × 85 cm.
— Molenaarsgraaf, grave I (this paper p. 250) reinforcement: 130/135 × 80/95 cm.
— Cuyk (Bogaers 1967, 10), pit 160 × 110, reinforcement: 85 × 48 cm.

[234] The graves used are those mentioned in note 235 plus:

1. Wageningen, barrow 1, WSW-ENE, with one or two Bell Beakers. Remouchamps 1928.
2. Hilversum, barrow 10, E-W, with a copper dagger and flint arrow-heads. Remouchamps 1928.
3. Ede, E-W, with wristguard. Bursch 1933, *Abb.* 54.
4. Hilversum, barrow 1, WSW-ENE, with copper dagger (with one small rivet). Bursch 1935, 49, *afb.* 29, 39.
5. Oss, *c.* E-W, *cremation with Veluwe Bell Beaker.* Bursch 1937.
6. Diever, E-W, reinforced with stones, with very late Bell Beaker. Van Giffen 1930[a], *Abb.* 7 e-f; *cf.* Modderman 1955[b].
7. Emst, WSW-ENE, with wristguard. Van Giffen 1930[a], *Abb.* 65.
8. Exloo-Odoorn, WNW-ESE, with early type of Bell Beaker, copper dagger and awl, golden ornaments, flint flakes. Van Giffen 1947, *afb.* 7,8.
9. Lunteren (a), E-W, with two Veluwe Bell Beakers, a copper awl, 4 cushion stones, frag. wristguard, flint axe, 6 arrow heads. Butler & Van der Waals 1966, 123 f.
10. Lunteren (b), E-W, with wristguard, flint axe, 7 arrow-heads. Butler & Van der Waals 1966, 127 f.
11. Cuyk (a), E-W, with small Bell Beaker sherd. Small pit (160 × 110) with coffin (?) 85 × 48. Bogaers 1967[a], *10.
12. Cuyk (b), E-W, with 2[Id-e] Bell Beaker. Bogaers 1967[a] *10.
13. Wageningen, NE-SW, with 2[Id-e] Bell Beaker. Van Es 1964, 197, 255, PL. XLVIII.
14. Haps, WSW-ENE, with (fragmentary) Veluwe Bell Beaker. Verwers 1972, 7 f.
15. E(e)nerschans, NNW-SSE, five foot VBB bowl. Van Giffen 1946, *afb.* 7.
16. Driesche Berg, Speulde, ESE-WNW, Bell Beaker, upside down in filling of burial pit. Lehmann 1967[c].
17. Vaassen, barrow 2, NW-SE, with 2[Ic] beaker. Lanting & Van der Waals 1971, 107, fig. 7, 8.
18. Vaassen, barrow 3, NNW-SSE, with 2[Ic] beaker, copper knife, amber button and pendant. Lanting & Van der Waals 1971, 114, *figs.* 9 & 12.

For Early Bell Beaker graves see note 269. We realize, that there might be discussion why the Exloo-Odoorn grave is in

orientation between WNW-ESE and WSW-ENE. We know at the moment 8 more or less complete corpse-silhouettes and 4 cases in which only the position of the head is determined [235]. The silhouettes all show a crouched corpse, laid down on the left side with the head to the east and facing south. Five of them were defined as the graves of men because of the presence of wrist guards as grave goods. Of the presumed head-silhouettes two lie at the east end, but two at the west end of the grave pit. Both the latter observations are not, however, irrefutable proof that they are in fact head silhouettes, as no report was made about the enamel of the teeth. The find of amber beads and buttons near the neck of one of these two (Hilversum) forms no conclusive proof, for elsewhere (Harendermolen) these lay near the pelvis.

The child grave (III) at Molenaarsgraaf is the first indication that women were buried differently from men in the Dutch Bell Beaker province. That corpse-silhouettes on the right side have not yet been reported may be the result, for example, of a poverty of grave goods in the graves of women, or of the erection of barrows only (or predominantly) over the graves of men [236].

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this list, while the Elp and the De Eese graves are in the other. The Exloo-Odoorn grave is dated by the awl to Reineke Al (Butler & Van der Waals 1966, 61) while the beaker is typologically rather early. So the (not associated) early beakers from both other graves might also have been in use in the same period.

[235] These are:

1. Heerde, barrow 3. Orientation ENE-WSW, on the left side, facing south. Veluwe Bell Beaker near head. Remouchamps 1928.
2. Harendermolen. Orientation E-W, facing south. Wristguard, amber buttons (V-perforated) and beads, some flint. Van Giffen 1930[a], 40 f., *Abb.* 25-28.
3. Oostereng, Bennekom, barrow 12. Orientation E-W, on the left side, facing south. Veluwe Bell Beaker behind pelvis; arrow-heads, wristguard. Bursch 1933, *afb.* 50.
4. Schaaik (= Schayk) near Oss, barrow 3. Orientation E-W, on the left side, facing south. Bowl near forehead; two flint flakes. Van Giffen 1949, 71-74.
5. Elspeter Heide, barrow 5. Orientation E-W, on the left side, facing south. Veluwe Bell Beaker near lower legs; flint flake. Modderman 1954.
6. Maarsbergen. Orientation NE-SW, on the left side, facing SE. 2^{Ic} Bell Beaker near the feet; wristguard, reinforced burial pit. Lanting & Van der Waals 1971, 118 f.
7. Lunteren. Orientation ENE-WSW (silhouette E-W), on the left side, facing south. Veluwe Bell Beaker behind the head; wristguard, copper dagger, 8 arrow-heads, piece of flint, reinforced burial pit. Hulst 1972.
8. Nijmegen, barrow V. Orientation E-W, on the left side, facing south. Early (2^{Ib-c}) Bell Beaker before forehead; wristguard. Louwe Kooijmans 1973.
9. Speulde, barrow 9. Orientation E-W. "Head-silhouette" at the east end. Veluwe Bell Beaker in the west end. Bursch 1933, *Abb.* 45.
10. St.-Walrick, barrow 1, period 1. Orientation E-W. Head-silhouette with enamel of teeth at the east end. Veluwe Bell Beaker at the west end. Groenman-van Waateringe 1966[a], 72-80; pers. comm. Mr J. N. Lanting, Groningen.
11. Bennekom. Orientation NW-SE. "Head-silhouette" (no enamel recorded) in the west end. 2 Veluwe Bell Beakers at the SE side of the pit. Van Giffen 1954[a].
12. Hilversum, barrow 2. Orientation W-E. "Head-silhouette" (no enamel recorded) in the west end. 4 Amber beads at the presumed place of the neck. Remouchamps 1928.

Two graves of those listed above are relatively early (nos. 6 and 8, *cf.* note 270). Molenaarsgraaf grave I itself is not included in the list.

[236] In the Saale district men's graves are more frequent and richer in grave gifts than the women's graves. (Fischer 1956). The PFB Culture graves in the Netherlands show the same feature, men's corpse-silhouettes being much more frequent and accompanied by more grave goods of a higher quality (A. E. Lanting 1969).

The placing of grave goods seems to be fairly variable: the beaker stood five times near the legs (once near the feet, once behind the pelvis, once near the knees, twice not specified). Other grave goods lie behind the back (also wrist guards !) or in front of the chest.

4.9.5.3. *Barbed Wire Beaker graves*

For the BW Beaker Culture we have already remarked that our knowledge of burial customs is slight, owing to the lack of grave goods. Yet the few data warrant some conclusions. We considered eight graves which are associated more or less strongly with BWB pottery [237]. They lie, with one exception, in a NW-SE to N-S orientation. In four cases a corpse silhouette was observed [238], each with the head to the south, three of them on the left side, facing west and in one case with no details specified. What is very noticeable is the frequent occurrence of sherds or large pieces of BW decorated pots at the foot or on the surface of the barrow or on the former surface under the barrow, in the case of a primary grave. In most cases these sherds lead to attributing the mentioned graves to the BWB Culture. In only three cases there was a BW Beaker in the burial pit. A flint dagger of a Scandinavian type, a second undecorated beaker and a worked piece of flint are the few associated grave goods. The N-S orientated graves, not dated and without grave goods, might originate also from this period [339]. Otherwise, the first graves containing dead buried extended on their backs seem to occur during this time.

The barrow investigations at St.-Walrick provided particularly valuable data [240]. Within

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[237] The graves used are:

1. Gasteren. WNW-ESE, BW Beaker in filling of very shallow burial pit. Van Giffen 1941, *afb.* 31.
2. Emmerhout, barrow 3. NNE-SSW, with BW Beaker and flint dagger of Scandinavian type. J. N. Lanting 1969[b].
3. Ermelose Heide, barrow 2, period 2. SE-NW, with crouched corpse-silhouette on left side, head in SE, facing SW. BWB sherds in the barrow belong to the 2nd period. Modderman 1954, 22 f., Pl. XXXIII.
4. Ommen, Stegerense Veld, barrow 1, period 2. S-N, with crouched corpse-silhouette on left side, head south, facing W. Big fragment of BW pot at the barrow foot, probably dating this period. Reinforced burial pit. Bursch 1933, *cf.* also Modderman 1955[b].
5. Gasteren, barrow 43. N-S, BWB sherds in secondary position in the sand of the barrow. Harsema & De Ruiter 1966.
6. Emmerhout, barrow 1. NW-SE, some Neolithic sherds, the latest with BW decoration from the barrow and the surface below it. J. N. Lanting 1968, 164.
7. Oudemolen, barrow 12, period 1. SE-NW, with crouched corpse-silhouette, on the left side, facing SW, head south, and with one retouched flint flake. In the foot of the barrow, east of the grave, a concentration of many sherds of a big BW pot. Excavation BAI 1950, unpublished. Pers. comm. Mr J. N. Lanting, Groningen.
8. Querenstede, Kr. Ammerland. NNW-SSE, crouched corpse-silhouette on the left side, facing east, head south. In the north end two beakers, one with BW decoration, the other undecorated. Zoller 1963, 105-107.
9. Eext-Kerkweg, barrow 2. E-W, with small flint-knife. On the former surface and below the barrow the sherds of a BW Beaker. Lanting & Van der Waals 1971[a].

As early as 1955 Modderman (1955[b], 42) observed that the BWB graves in general deviate from the characteristic E-W Beaker orientation. The direction of the Hanendorp grave (Holwerda 1911, fig. 27, 28; *cf.* notes 131, 241) cannot be determined, (no north is indicated) while it is also dubious whether the BW beaker belongs to this grave. So this grave is not included in the list.

[238] The nos. 3, 4, 7, 8 in note 237.

[239] As for instance grave t2[1] at St. Walrick (note 240).

[240] Groenman-van Waateringe 1966[a]. We can establish the following typological grave sequence:

1. t1[1]. E-W grave, head silhouette (with enamel of teeth, facing south) in the east end. 2[1f]-Veluwe Bell Beaker in the west end.

a short period 8 building phases of three barrows were dated there. In the five burial pits found, some of them with traces of the bodies, the change from E-W orientated pits with a crouched body to NW-SE orientated pits with bodies extended on their backs and head to the south (sic !) can be observed. The oldest grave is dated by a 2^{If} Veluwe Bell Beaker, the youngest by a ^{14}C date 1710 $\pm$ 35 B.C. The typological grave sequence concurs largely with the palynologically determined sequence. Only grave 3^1 is typologically somewhat earlier than was supposed. The small cemetery at Molenaarsgraaf is contemporary with some of the graves at St.-Walrick, namely 3^1 and 1^2.

4.9.5.4. *The chronological-cultural position of the Molenaarsgraaf cemetery*

Grave I at Molenaarsgraaf appears to be a burial which is thoroughly in the tradition of the Veluwe Bell Beaker phase in this country, in spite of its very late dating.

Grave III conforms, by its E-W orientation and by the mere fact that a beaker was present, more to the VBB than to the BWB tradition. The burial on the right side might well be the typical manner of burying women. But the typological relationships of the beaker to the (early) BWB Culture gives the grave a transitional character. Only a few parallels for the placing of the pot in the filling of the burial pit are known [241].

Grave II has the characteristic BWB orientation, while the man's position, moreover, agrees with that of the known corpse-silhouettes. Under worse preservation conditions not many grave goods would have survived, but it would still have contained 4 pieces of flint. Did some grave goods disappear, however, in the disturbance caused by pit 199 ? Would arrowheads in place of fish-hooks have been given in the sandy regions ? To what extent is the direction of the grave influenced by the adjoining gully ? If we included in our reckoning a rotation of 90° with the clock the situation of the body is normal for the VBB Culture. The placing of the grave goods both behind the back and in front of the body is normal in VBB graves. A number of these arguments are, however, invalidated by the unmistakable connection with the reed-impressed pot. All the circumstances in which the sherd of this pot were found correspond, moreover, to similar finds in and near BWB barrows. In grave II, therefore, we may say that

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2. $t3^1$. E-W grave, crouched corpse-silhouette on the left side, head east, facing south. No grave goods.
3. $t2^1$. NW-SE grave, crouched corpse-silhouette on the left side, head SE, facing south. No grave goods.
4. $t1^2$. NW-SE grave, crouched corpse-silhouette on the left side, head SE, facing SW, *Schleifennadel* at the throat.
5. $t1^3$. NW-SE grave, corpse-silhouette, length 1.80 m., stretched on the back, head SE. ^{14}C date GrN 2996 3660 $\pm$ 35 B.P. (1710 B.C.). In the publication (p. 74) erroneously: SW-NE.

The palynological investigations gave as the most probable sequence of these five graves: 1^1, 2^1, 1^2, 3^1, 1^3. The typological sequence gives only an earlier position of 3^1, but is not in conflict with the stratigraphy. It is remarkable that in the typological sequence all primary graves are older than the secondary graves. We thank Mrs Dr Groenman-van Waateringe for the opportunity to examine the field drawings of the St.-Walrick barrows.

[241] We found in the Dutch literature:

— Onnen, Van Giffen 1930[a], *Abb.* 85: a "beeheeve-grave" with late Protruding Foot Beaker.

— Driesche Berg, Lehmann 1967[c]: Bell Beaker upside down in top of filling of a grave pit.

— Hanendorp, Emst, barrow 6, Holwerda & Evelein 1911, 22, *afb.* 27, 28: a BW Beaker, in the filling of a grave pit. It is possible that the beaker lay on the floor of an unrecognized secondary grave pit. *Cf.* also note 131.

— In a small, but deep, rectangular pit of a barrow at Ermelo one BW beaker was found at the bottom, the other half way up the filling. This is, however, probably not a grave. Modderman 1959[b].

the BWB elements dominate. Only the relatively richness of the grave goods might form a reminiscence of the VBB Culture.

In the three graves of the cemetery at Molenaarsgraaf we can see clearly exemplified the transition from VBB to BWB burial tradition. Grave I is still pure VBB, grave II has a modest BWB influence and grave II is a pure BWB grave. The spatial relationship between the graves and especially the almost identical ^{14}C dates of graves I and II indicate that the transition VBB-BWB came about very abruptly in burial ritual.

The phase occupied by these graves in the total Netherlands grave material locates the cemetery therefore in a transition period VBB-BWB. We showed above (p. 289) that the existence of a period in which VBB and (closely wound) BWB were in use together might have existed. This must have been exactly the period between phase 1 and phase 2 of Molenaarsgraaf, in which the cemetery already on other than typological grounds was placed. Within this period an abrupt change in burial ritual took place. This last fact is illustrated by the almost complete lack of transitional grave forms in our country [242].

4.9.5.5. *Beaker skeletons in the Netherlands*

For the information about the details of the body positions, provided by the skeletal material at Molenaarsgraaf, there is hardly any comparable material in the Netherlands. What there is has been preserved only in exceptional cases, as no bones remain preserved in the acid limeless sand on which most of the barrows lie. It has always been the low-lying parts of this country which have yielded bones and skeletal material [243], as now for the Bell Beaker Culture, thanks to the damp conditions there. This applies to the whole of prehistory and to early history. Only three finds are available for comparison: a grave near Nierssen, excavated by Holwerda in 1907, a grave near Oostwoud (1964) and a grave at Ottoland (1969).

The Oostwoud grave [244] forms an excellent parallel for grave I. In a grave pit, orientated E-W, the traces of the reinforcement of the sides were still clearly to be seen. A man of about 40, of robust build, was buried on his left side with his head to the east, facing south. Pelvis and shoulder-girdle were twisted somewhat backwards. The lie of the legs was identical with

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[242] As such E-W orientated BWB graves and N-S orientated (late) VBB graves might be considered. We name Eenerschans (note 234, no. 15) Gasteren and Eext (note 237, nos. 1 and 9). An interesting grave, in this respect, is the highest grave of barrow E, Uddelermeer. The orientation is E-W, a crouched silhouette on the left side, facing south was visible. The grave goods consisted of a simple beaker, an arrow-shaft smoother (*cf.* note 179) and some flint flakes. (Holwerda 1911[a], *afb.* 3, 4, 7; 1912, *afb.* 1). For typological reasons the beaker can be placed in the early BWB phase and at any rate not earlier than the group of beakers named in note 125.

[243] A general review of the skeletal remains is given by Mrs Constandse-Westermann (1968) and earlier by Huizinga (1959), On the Mesolithic skulls see Huizinga 1959 and the literature cited there and in Louwe Kooijmans 1970/'71. At Swifterbant Early Neolithic skeletons were found (see p. 163); at Oostwoud, Nierssen and Ottoland-Oosteind Bell Beaker skeletons (see notes 244-248), In West Frisia (Oostwoud, Grotebroek, Zwaagdijk) Middle Bronze Age remains were discovered (note 244, Van Giffen 1953, Modderman 1964[a]). At Rijswijk Roman skeletons (Bloemers 1969) at Katwijk a Merovingian cemetery (Sasse 1911). The finds in the *terpen* (Roman times and later) are discussed by Halbertsma 1954.

[244] De Weerd 1966, 1967; Glasbergen 1969 esp. photo fig. 1; see also Van Giffen 1961, 1962 (with excavation plan), 1966. We obtained more information from Prof. Van Giffen, Prof. Glasbergen and Miss Metz, all of whom I wish to thank for their friendly help.

that of Molenaarsgraaf grave I, the arms lay bent in front of the body, but in some details the position differed from that of grave I. The skull was round and broad, and perhaps is a planoccipital *Steilkopf*. The grave lay within the terrain of a BB settlement and below a barrow (barrow II), in which at least ten other graves, most of them with crouched skeletons, were found. The stratigraphic position was such that a BB age seemed acceptable for this grave, but could not be proved. But two flint flakes, found in the burial pit and perhaps grave goods, supported this supposition. The striking likeness to grave I at Molenaarsgraaf is a confirmation of this opinion [245].

At Nierssen [246] remains were found of two persons in one grave pit, directed WNW-ESE. One of them lay in a crouched position and exactly on its left side, its head to the east and facing south. The incomplete remains of the second body, especially the long bones, lay close behind the back of the first body. There were no grave goods which could permit a dating, but allocation to the Bell Beaker Culture is the most probable [247].

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[245] The stratigraphy at the site was: a grey occupation layer with Bell Beaker refuse, covered by a level with plough-marks, itself covered by the low barrow, which was thrown up in more than one phase. The grave discussed here was discovered during a rescue operation (1964) some years after the excavation (1956-'57) and was not observed at levels in or above the plough-marks. The presumed BB age of the grave was recently confirmed by a ^{14}C date: GrN 6650 1950 $\pm$ 55 B.C. The other graves were all dug in the barrow and situated above the phough marks. None of the graves contained datable grave gifts. Since cross-ploughed soils are dated to the Middle Bronze Age in a number of places in West Frisia the graves were generally considered to be Middle or Late Bronze Age in date, the more since crossed plough-marks also occurred below the nearby barrow I, which has a ^{14}C date: GrN 797 1075 $\pm$ 80 B.C. But the plough-marks below both barrows differ in appearance. Below barrow II we have one coarse crossed system and a system tangential to the barrow, below barrow I two crossed systems in different directions occurred. Van Giffen himself (letter of 29-7-1969) considered one of these systems to be of Bell Beaker age. We must conclude that we only can say that the ten graves are later than the (Early) Bell Beaker occupation layer.

Some archaeological arguments are in favour of a Middle or Late Bronze Age date: at Grotebroek (Van Giffen 1953) a crouched skeleton was found in a secondary grave in barrow I, of which the primary grave has a ^{14}C date GrN 160 975 $\pm$ 40. In the Middle Bronze Age cemetery at Zwaagdijk (Modderman 1964) one of the dead was buried in a flexed position on its back. Flexed burials occur in the *terpen* of Groningen and Friesland, where they are later than 600 B.C. and most probably date from Roman times and later. Other arguments, however, favour an older, Bell Beaker, age. The orientation of the ten graves is either E-W (6x) or N-S (3x). In the E-W graves all skeletons lie with the head east, 5 facing south, 1 facing north. In the N-S graves two skeletons lie on the right side, head in the north end, facing west, one skeleton lies with the head in the south end. The burial ritual conforms therefore good (although not in every detail) whith the BB and BWB traditions (see p. 306 f.). We remark that north-facing inhumations are not found in the Netherlands until now, but some are known with AOC Beakers in Great Britain (*cf.* Lanting & Van der Waals 1972). An 11th grave (De Weerd 1967) contained a skeleton in not-anatomical position. This peculiar type of burial is demonstrated a few times for the Bell Beaker Culture in the Netherlands (see p. 312). One of the graves (no 222) at last contained the skull and other skeletal parts of a hare or rabbit, probably a grave gift. The solution of this problem of the age of the graves might ultimatily be given by future ^{14}C determinations of the skeletal material from the graves. If it might appear that we have to do with a Bell Beaker cemetery, it can be considered as a good parallel of Molenaarsgraaf. The absence of grave goods together with the occurrence of N-S directed graves would be consistent with a very late Bell Beaker date, approximately contemporaneous with Molenaarsgraaf. The discussed Bell Beaker grave might be the primary grave of the barrow in that case. When the ten graves appear to be of later date, this would mean a considerable continuity of the burial traditions into the Bronze Age.

[246] Holwerda 1908. Nierssen barrow G4. The photographs of the skeletal remains *in situ* (Pl.I la, 3) show their true position. The skeletons are preserved in a plaster mantle: it is a mirror image of the true position but also the most detailed and most reliable. The drawing (Pl. I.2) is in conflict with the analysis of the photograph and need not be preferred in our opinion.

[247] Huizinga (1959, 51-52) discussed the anatomical report by Nieuwenhuis 1908 and stated that the undisturbed

A burial comparable in many respects to the Nierssen grave was found in 1969 at Ottoland, lying on the Schoonrewoerd stream ridge and so dated after about 2000 B.C. for geological reasons. The grave pit was orientated NE-SW and contained a recently partly disturbed skeleton in a crouched position, lying exactly on its left side, its head to the east and facing south. In the western part of the pit lay the bones of a second person, particularly the long bones, in a heap. The skull was missing although this spot had not been disturbed. The lower jaw was present. An allocation to the Bell Beaker culture was confirmed by a ^{14}C date:

GrN 6384 3820 ± 45 B.P. (1870 B.C.)

Both the Nierssen and Ottoland graves [248] are the more interesting when we bring them in relation to the Pot Beaker burials. For there are indications that in that case we might have to do with the covers of burials of the skull only [249]. In our view we are concerned at Ottoland and Nierssen with an unusual type of grave goods: the bones (or part of them) of a second person. The named finds have in common the interest in and the practice of burying skeletal parts of fellow human beings in non-articulating positions with special attention to the skull. Must we attribute the disturbance of grave II at Molenaarsgraaf to this? It is one of the possible interpretations that there the removal of the remains of the dead person were indeed the purpose of the digging, although we have given some arguments against this [250].

Both graves at Nierssen and Ottoland show further that the position of bodies, exactly on their sides, was also in use during the Bell Beaker Culture and that the difference between grave I and grave II in this connection is of comparatively small importance.

4.9.6. The burial customs of the Netherlands Beaker Cultures in a wider context

4.9.6.1. *The Bell Beaker Culture*

The systematic E-W orientation established in the Netherlands is characteristic of the Bell Beaker graves. The most detailed data for comparison, also for comparing the position of the

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skeleton very probable has a skull of the planoccipital *Steilkopf* type and that the long bones are just as robust as the postcranial skeletons of this "Bell Beaker people" mostly are. So there is no argument supporting the decision that these are the remains of a woman, as Nieuwenhuis suggested. In view of the rules in burial customs of the Bell Beaker Culture in this country, discussed below, it is more probable that the skeleton is that of a man.

[248] Publication in preparation by the author. Two more graves can probably be added: the grave described by de Weerd (1967) from barrow II at Oostwoud (*cf.* note 245) and a partly disturbed grave discovered in 1972 on the Schoonrewoerd stream ridge at Molenaarsgraaf (Appendix III no. 24[a]). In the not disturbed part some skeletal remains (upper jaw, part of pelvis and shoulder blade, some long bones) lay in great disorder. This grave is not dated but very probably is of Bell Beaker Age.

[249] *Cf.* the discussion at p. 292, esp. of the Metzendorf-Woxdorf grave.

[250] The burial types mentioned here belong to a vast complex of partial, inarticulated and/or unintentional burials, that show many variations and cover almost the whole of the prehistoric and early historic period. A systematic study of these "aberrant" burials might reveal interesting data on matters as prehistoric religion and cannibalism. I am intended to discuss these things in more detail in the report on the Ottoland settlements and graves. I will be very grateful to anyone who can inform me on skull burials, inarticulated burials *etc.* from the Beaker period and the Early Bronze Age. Some examples are named for instance by Benninger 1931, Jankuhn 1939, Stone 1934, Timpel 1966, Frickhinger 1939, Maringer 1942/'45.

dead, come from the Saale region. The cultural relations of the Veluwe Bell Beaker phase in this direction make this region, in spite of its great distance away, remarkably suitable for comparison.

In the Saale region [251] the Bell Beaker graves lie in a N-S direction. Men were buried on their left sides with their heads to the north and women on their right sides with their heads to the south, all facing east. This means therefore a rotation of 90° in relation to the Netherlands. The dead lie strictly on their sides and sometimes even half on their bellies, with the hands in front of their faces, their legs drawn up into a right or sharp angle, one leg often more than the other. Pottery was always placed behind the back. Graves are generally flat graves, sometimes stone cists. These are all points of difference from practice in the Netherlands. Especially as far as the cemetery at Molenaarsgraaf is concerned it is interesting, however, that the same rules apply for children's graves as for adult graves, namely that they lie among the adult graves and that in general only a very simple pot was given as grave good, very rarely a decorated beaker. Furthermore, the graves often lie in small cemeteries of 4-10 graves, which often lie lengthwise in the length direction of the cemetery. All this applies exactly to Molenaarsgraaf also.

In addition to these detailed data other regions provide only supplementary information. In the whole eastern group [252], similar N-S directed flat graves, with the dead facing to the east, are the rule. In Bohemia and Moravia [253] there is, however, no differentiation between sexes: all the dead lie on their right sides with their heads to the south. Some N-S orientated BB graves are also known in Schleswig-Holstein and Northern Germany [254]. From the Lower Rhine region [255] and Hessen [256] we have no information. In the Upper Rhine region [257] there is a very great variety in the orientation of graves, but N-S and NE-SW appear to predominate. In Southern Bavaria [258] the direction is N-S, with a few exceptions (E-W).

The best information on (Bell) Beaker burial customs in Great Britain is given by Clarke[259]. After a first glance we get the impression of a complex tradition without strict rules. The best that can be said is that generally the orientation is NE-SW, with common variations to N-S and E-W and with a sex-bound differentiation: men have the head in the N to E and, women in the S to W end. But Clarke gives no information on the sides on which the dead were buried. When we study Clarke's data in more detail and plot them in compass-cards it becomes visible that the rules (or the absence of these) vary from group to group. The question arises, moreover, how reliable the sex determinations are and in which degree errors in these influence the patterns. The earliest beaker groups (AOC, E) show a preference for a N-S direction. The European beaker group has even a sex-bound differentiation in NW-SE male graves (head NW)

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[251] Fischer 1956, 161-169.

[252] Sangmeister 1964[a].

[253] Neustupný & Neustupný 1961, 79.

[254] Struve 1955, 70-71.

[255] Gatermann 1943 only remarks that the *Schnurkeramik* Culture has barrows, the Bell Beaker Culture flat graves and that sometimes the dead are buried in a crouched position.

[256] Sangmeister 1951, 62 and *Taf.* XIX. 1-5 mentions only graves of the "*Westdeutsche Bechergruppe*".

[257] Köster 1965/'66, 45-47.

[258] Ruckdeschel 1968.

[259] Clarke 1970, esp. 257 f., 455-456.

and SE-NW female graves (head SE). The N-S male graves are continued in the W/MR group. The "general rule", given above is valid for some later groups (N3, S1, in lesser extent S2) and perhaps also for N/MR, N4 and S3, on which not much information is available. The group N2 shows a polarization to N-S (S-N) and E-W (W-E) directions. Other groups (N/NR, N1/D) demonstrate a peculiar NW-SE orientation (head NW) for the female graves.

Lanting and Van der Waals demonstrated in their review article of Clarke's work [260], that after the first phase(s) of the Bell Beaker Culture (AOC, E) a regional differentiation of the grave orientation came into existence. This accounts to a large extent for the wide range of variation in the grave orientations. In Wessex the older N-S graves continue, the dead facing east (men on their left side, head N; women on their right side, head S). In Yorkshire and in the northern focus area the graves turn to a W-E direction, the dead facing south. At least in Yorkshire a sex-bound differentiation exists (men on their left side, head E; women on their right side, head W) and it seems that this might apply to the northern group as well.

When we try to summarize the mentioned data on the Bell Beaker burial ritual, especially the grave orientation, we can state first that two main traditions occur: the one of E-W graves (Yorkshire/Scotland, the Netherlands), the other with N-S graves (Saale region, Wessex, (Upper Rhine)). Sex-bound differences are the rule: the man on the left side, head N or E, the women on the right side, head S or W, both, therefore, facing in the same direction. The N-S orientation seems to be an older tradition, the E-W orientation seems to be introduced later in the regions involved. We will work this out further below.

4.9.6.2. *The Battle Axe Culture*

For an explanation of these differences from Netherlands practice, especially the difference between the Netherlands and the Saale region, we must consider the burial customs of the preceding Battle Axe Culture (= *Schnurkeramik*, Single Grave Culture, Protruding Foot Beaker Culture). In these there is a considerable uniformity throughout NW Europe. The burial pit is always orientated in an E-W direction and mostly covered with a barrow. This applies to Denmark [261], Northern Germany [262], the Saale region [263], Bohemia and Moravia [264], the Upper Rhine region and Southern Bavaria [265]. The often reinforced burial pit contains a crouched body facing south. It is interesting to know that at least in the Saale region the crouched bodies are often twisted backwards. Men lie on the right side, women on the left side. This applies also to the Netherlands, where we know 12 corpse-silhouettes, all showing a crouched person, facing south, 10 of them lying on the right side and two on the left side [266]. The first

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[260] Lanting & Van der Waals 1972.

[261] Glob 1944, 160 f. and fig. 97. Especially in the older phase the orientation is strictly E-W; later there is more variation until at last appear the first burials in which the dead are stretched on their back.

[262] Struve 1955, 68 f. *Cf.* also K. Kersten 1952, Henrich 1938, Deichmüller 1963.

[263] Fischer 1956, 109-110; Feustel *et al.* 1966. Fischer 1953 gives a short survey of the Neolithic grave orientations in the Saale district.

[264] As note 253; Buchvaldek & Koutecký 1970, esp. 190-193.

[265] As notes 257, 258.

[266] Since A. E. Lanting is preparing an exhaustive study on the burial practice of the Dutch PFB Culture,

have much richer grave goods; six have stone axes, and two also a battle axe, indicating that these are the graves of men. Beakers are usually placed near the knees (5 times) and sometimes near the pelvis (once) or the head (twice). Axes lie in front of the body (near the hands?; six times), or behind it (twice) The predominance of male graves can be explained in the same way as in the BB graves.

4.9.6.3. *The transition of the Battle Axe to the Bell Beaker Culture*

Everywhere where it can be determined the difference in burial ritual between the Single Grave Culture and the Bell Beaker Culture is clear. Fischer [267] emphasizes this for the Saale region: in the sequence *Kugelamphorenkultur—Schnurkeramik—Glockenbecherkultur—Únětice Kultur* the change in burial ritual in the first and last transition is fairly small, but in the middle one drastic, as will appear from the data given above. In this country, however,

based on about 100 graves, we do not think it relevant to give the list of 38 well-documented graves which we compiled in our general survey of the literature on the burial practice of the various Beaker Cultures. In the orientation there is a strong preference for E-W, but a deviation up to 45° is rather common (We think especially to a more SW-NE direction). Even N-S directed graves (as barrow 3, Noordse Veld, Zeijen, Van Giffen 1930[a], *Abb.* 88) might occur in rare instances. Round pits are not unusual. *Cf.* A. E. Lanting 1969.

PFB graves with corpse-silhouettes are:

1. Eext-Ketenberg. Orientation WSW-ENE, on the right side, facing S. Early beaker near pelvis, battle axe, axe, flint knife. Van Giffen 1930[a], *Abb.* 32-34.
2. Langedijk, barrow 3. Orientation WNW-ESE, on the right side, facing S. Beaker near the knees, axe, flint flakes, arrow-head. Van Giffen 1930[a], *Abb.* 94-95.
3. Vredenheim, flat grave below barrow 3. Orientation SW-NE, on the left side, facing SE. Early beaker near the knees. Van Giffen 1942, *afb.* 19; A. E. Lanting 1969, fig. 3.
4. De Eese. Round pit with NW-SE(?) orientated silhouette facing S. Early beaker near the head, two flint axes, one flint knife. Waterbolk 1964[b], 80 f., figs. 16, 20.
5. Anlo, barrow 1. Orientation W-E, on the right side facing S. Axe and flint flake. A. E. Lanting 1969, fig. 7.
6. Angelslo, "flat grave" (pit 10). Orientation SW-NE, on the right side, facing S. Axe and flint flake. A. E. Lanting 1969, fig. 6.
7. Angelslo, barrow 10. Orientation WSW-ENE, on the right side, facing S. Battle axe, flint axe, grinding stone. A. E. Lanting 1969, fig. 8.
8. Angelslo, flat grave pit 4. Orientation SW-NE, on the right side, facing SE. Battle axe, flint knife, arrow-head. Pers. comm. Mr J.N. Lanting, Groningen.
9. Eext, barrow Galgenveentje 1. Orientation E-W, on the left side, facing S. Beaker, flint knife. Lanting & Van der Waals 1971[a].
10. Heerde, barrow 1. Orientation E-W, on the left side, facing S. Early beaker near the feet, two flint flakes. Remouchaps 1928.
11. Ermelose Heide, barrow 3. Orientation W-E, on the right side facing S. Two late beakers near the head, flint knife. Modderman 1954, 22, Pl. XXXII, Pl. VIII. 2.
12. Putten. Orientation W-E, on the right side, facing S. "Zigzag"-beaker, Grand Pressigny dagger, battle axe, flint axe, Van Giffen *et al.* 1971.
13. Mander. Orientation E-W, with silhouette (no details mentioned). Battle axe type A, flint knife. Hijszeler 1959.
14. Swalmen, barrow 6, period I. Orientation WSW-ENE, on the right side, facing S. Late beaker near the knees. Groenman-van Waateringe & Van der Waals 1961, 48.
15. Swalmen, barrow 8, period I. Orientation SW-NE, on the right side, facing S. Beaker type 1[d] near the knees. Pers. comm. J. N. Lanting.

[267] Fischer 1956, 109-185.

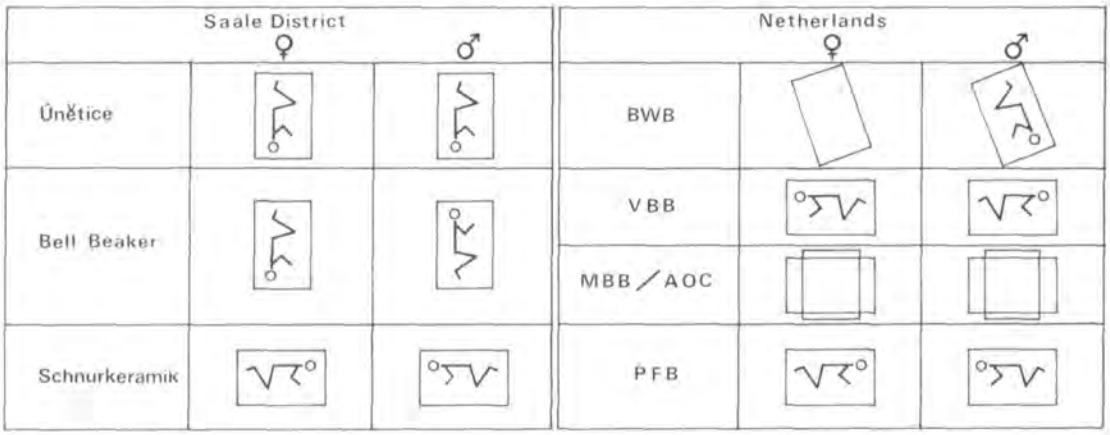

Fig. 123. Survey of the directions of the grave pits of the Beaker Cultures and the Early Bronze Age in the Saale district and the Netherlands.

the change consists only in a reversal of sexual differentiation and a greater liberty in the placing of grave goods, especially of the beaker. It is therefore all the more remarkable that in the comparatively small number of graves from the early phase of the Bell Beaker Culture in this country, which we have hitherto omitted to consider, a relatively frequent deviation of the E-W orientation occurs. This applies to the All Over Cord Beakers (2^{IIb}) [268], the Maritime Bell Beakers ($2^{Ia, b}$) [269] and the forerunners of the Veluwe Bell Beaker (2^{Ic}) [270]. In some cases

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[268] We listed with All Over Cord Beakers:

Anlo,	barrow B,	NW-SE. Waterbolk 1960.
Anlo,	barrow C,	NW-SE. Waterbolk 1960.
Swalmen,	barrow 6,	period 2, NW-SE (silhouette on the left side facing SW). Groenman-van Waateringe & Van der Waals 1961.
Garderen,	barrow 4,	W-E. Bursch 1933.
Emmen,	barrow 3,	WSW-ENE (head east?). Bursch 1936 (with Grand Pressigny dagger only).
Aalden,	barrow 3,	N-S. Van Giffen 1940, 203 f., *afb.* 27.
Roden,	barrow I,	W-E. Van Giffen 1935, 117, *afb.* 10.

[269]

1. De Eese, barrow 4, c. E-W, with Early Bell Beaker. Van Giffen 1930[a], *afb.* 100.
2. Elp, barrow 1 (A), WNW-ESE. Van Giffen 1934, 103, *afb.* 4.
3. Mol, NW-SE, with very vague corpse-silhouette, head NW (?), Maritime Bell Beaker, undecorated Beaker, bowl. Beex & Roossens 1962, 255; 1963.
4. Wehm, Kr. Aschendorf-Hümmling, WNW-ESE, with crouched corpse-silhouette on the right side, head west, facing south, Maritime Bell Beaker and undecorated beaker near the feet. Schlicht 1958.
5. Uddelermeer, barrow D, lower grave, NE-SW, probably belonging to the Maritime Bell Beaker. De Laet & Glasbergen 1959, Pl. 19; Holwerda 1911[a], 7 f., *afb.* 9, 11.

[270] Maarsbergen NW-SE, Lanting & Van der Waals 1971, 41, fig. 13[a], with reinforced grave pit. Emmen, barrow

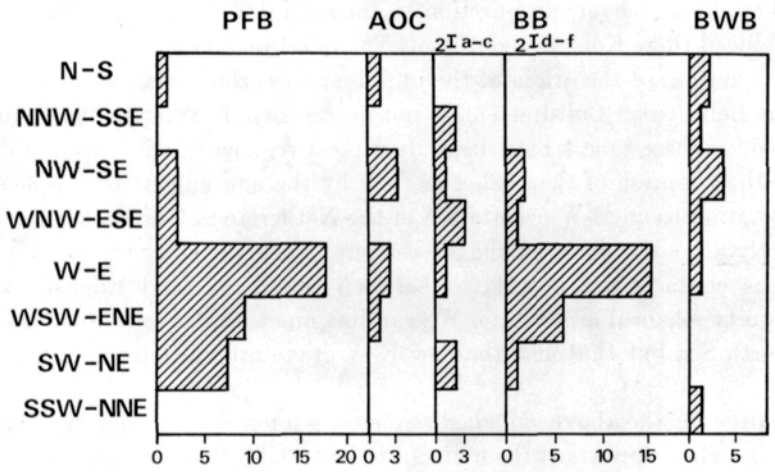

Fig. 124. Schematic representation of the directions of the grave pits of the various Beaker groups in the Netherlands. According to the data of notes 234, 235, 237, 266, 269.

a rotation of 90° seems to occur within one barrow or group of barrows [271]. With the exception of two 2Ic Beaker men's graves (which both follow VBB practice) there is no comment that can be made on a possible difference between male and female graves.

The sequence in the Netherlands can be explained by assuming the introduction of different burial customs when the first Bell Beakers (*i.e.* the All Over Cord Beakers) came into use and subsequently the adoption of the PFB burial ritual by the BB Culture, although this was not complete and some original characteristics were retained. The burial ritual introduced most probably had a 90° different orientation, an exactly opposite manner of burial of men and women to that of the PFB Culture and perhaps a different placing of the grave goods. If we regard the backward turning of the *Schnurkeramik* skeletons as applicable to the whole of the Single Grave Cultures then the placing of the body exactly on its side might have been introduced at the same time. The BB burial ritual in the Saale region conforms to all these customs. Moreover, it is quite clear that it cannot have been an autochthonous development there, but was introduced there from elsewhere. This makes the same supposition for the Netherlands much more acceptable. We said above that the same burial tradition seems to be reflected by the earliest (AOC, E) Beaker graves in Great Britain, which also show a preference for a N-S orientation and a sex-bound differentiation, like the Saale region has [272].

9, NNW-SSE, over E-W orientated grave. Bursch 1936, 64. Oudemolen, N-S, excavation BAI 1954, with 2Ic beaker, pers. comm. Mr J. N. Lanting; unpublished. Nijmegen, barrow V, E-W. Louwe Kooijmans 1973, with early type of Bell Beaker. See also note 234, nos. 17 and 18.

[271] For instance: Swalmen: Groenman-van Waateringe & Van der Waals 1961. Anlo: Waterbolk 1960. Emmen, barrow 9: Bursch 1936, 64.

[272] But in Great Britain, only the position of the head is known to us, not the side on which the dead were laid in the grave (*cf.* note 259). The one AOC burial, with the man facing NW (Lanting & Van der Waals 1972, fig. 1, AOC 730), demonstrates that this is not necessary always E or S.

In England there is, moreover, no question to the origin of the (Bell) Beaker Culture: it was certainly introduced there from the continent. The question where this grave ritual came from is equal to the question of the origin of the impulse and perhaps also the group of people that gave rise to the Bell Beaker Culture. This is not necessarily the same as the origin of the oldest Bell Beakers, since these might have been developed regionally out of preceding PF Beaker groups during the adoption of the beaker as such by the new culture or people [273].

The 90° rotation to an E-W orientation of the Netherlands Bell Beaker graves took place during or shortly after the phase of the 2^{IC} beakers. This is exactly the period, during which intense overseas contacts are postulated between the Dutch and English Beaker groups, based mainly on typological arguments. We can imagine that not only the decoration pattern crossed the North Sea but that also the new E-W grave orientation was introduced, at least in Yorkshire.

An alternative for the above-sketched sequence is a purely autochthonous development of the grave ritual, such as appears at the moment to be possible the case for the typological development of the beakers in this period. However, such a hypothesis is difficult to maintain in view of the explanations of the grave ritual outside this country, especially in the Saale region and Great Britain. It is, moreover, clear that when Bell Beakers were first made in this country, more occurred than a mere typological change in the beakers. We have already referred to the changes in grave ritual. Later we shall deal in more detail with the well-known physical-anthropological arguments for this country. The changes in the grave gifts, and especially the introduction of copper implements, have only been determined for the later phases of the BB Culture. This can easily be explained by the scarcity of the older materials.

4.9.6.4. *The transition of the Bell Beaker to the Early Bronze Age Cultures*

Changes in burial ritual were also confirmed in this country during the transition from the Veluwe Bell Beaker to the BW Beaker. Grave goods became scarce. The orientation of the burial pit was N-S instead of E-W and no particular structures are found below or around the barrows. Grave II at Molenaarsgraaf shows that this involves a clockwise rotation of 90° for male graves. No female graves are known.

Ruckdeschel [274] summarizes the grave ritual of the Early Bronze Age (Reinecke A phase) in Central Europe. The large area of the Únětice Culture has exclusively graves which are orientated in a N-S direction [275]. There is no sexual differentiation. Both men and women are buried on their right sides with the head to the south, facing east. These are the same rules that earlier applied in the Bell Beaker Culture in Bohemia and Moravia and in the Saale region only for the female graves. The sexual differentiation therefore disappears there. Outside the Únětice Culture we find other orientations and also sexual differentiation. In Moravia the graves are orientated NNW-SSE; the men lie on their right sides with their heads to the north, the

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[273] In our opinion uncertainty about the "Bell Beaker problem" has arisen by the confusion of these questions, which should be studied separately. We might even be concerned with beaker-less invaders adopting and subsequently developing this type of pottery. Professor Van der Waals in particular is developing very interesting and revolutionary ideas on the origin of the Bell Beaker; these ideas certainly influenced my thinking in this field of study.

[274] Ruckdeschel 1968.

[275] Fischer 1956. 170-185.

women on their left sides, with their heads to the south, both therefore facing west. In Southern Bavaria the graves are orientated NE-SW, the men lying on their left sides with their heads to the NE, and the women lying on their right sides with their heads to the SW, both therefore facing SE. In both regions there is accordingly a difference from the practice in the preceding period. In the Rhine region, as before, no rules can be determined. These seem to have varied in each cemetery [276].

We think the BWB grave ritual can simply be traced back to the preceding VBB phase, in close conformity to the cultural continuity which we saw existed at Molenaarsgraaf. At most we would ascribe the transition to the N-S orientation to influences from the east (Únětice Culture) or we would relate it to the introduction or development of the burials with inhumations extended on the back (which show a preference for SE-NW directions).

4.9.6.5. *The archaeological consequences of the anthropological data.*

The anthropological facts have always played an important part in interpreting the Bell Beaker Culture, especially after the detailed monograph devoted by Gerhardt to the skeletal material of the Bell Beaker Culture in Central and Western Germany [277]. He distinguished five main types of skulls:

— The *planoccipitale Steilkopf*, the most frequent type of skull. Before the Bell Beaker Culture it does not appear to have been found north of the Alps. People with such an unusual skull, hyperbrachycephal and with a flat *occiput* must be regarded as the core of the Bell Beaker people. Especially the men are fairly tall. Both male skeletons at Molenaarsgraaf conform well to the description given by Gerhardt of this type.

— An Alpine type (*curvo-occipitale Rundkopf*),

— A northern type (*dolichomorf*),

The alpine and the northern type form autochthonous elements. The last element may have originated from the Single Grave Culture [278].

— A Mediterranean type (*grazil dolichomorf*),

— A *Klötze* type; unusual.

In the Early Bronze Age we find in the Adlerberg Culture a similar assortment of skull types as was formerly found in the Bell Beaker Culture. The new type, the planoccipital *Steilkopf* is also present (though in small numbers) in other Early Bronze Age groups (particularly the Únětice Culture) [279]. The Molenaarsgraaf skeletons show a similar late presence of the typical Bell Beaker skull in the Netherlands.

The Bell Beaker skull type contrasts strongly with that of the preceding Single Grave

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[276] Ruckdeschel 1968, Köster 1965/'66.

[277] Gerhardt 1953, *cf.* also Gerhardt 1951, 1967; Bach 1965, 1966; Ulrich 1960. Older reports: Breitinger 1939, Otto 1950.

[278] Gerhardt 1953, 109.

[279] Köster 1965/'66, 61; Gerhardt 1953, 197; Gerhardt 1951[a], (1964); Riquet 1970, 187-196. The planoccipital *Steilkopf* or big brachycranic skull forms an important element at Adlerberg itself and also at Singen and Nähermenningen. Less so at Straubing and in Austria (for instance Gemeinlebarn), but with some exceptions as at Hainburg-Teichtal, where the type is well represented. In the Únětice Culture the type occurs in very modest numbers. Riquet says that the type apparently spread more to the south and west than to the east; but from where did it spread?

Culture. The fairly small number of *Schnurkeramik* skulls from South-western Germany (17, of which 12 adults) all belong to one extreme dolichocephalic type, called by Gerhardt *Archaisch Stenodolichomorf* [280]. In Bohemia also this type forms a significant, although not predominating, element in the *Schnurkeramik* [281]. In Central Germany the type is much more poorly represented although it can be recognized in a few older individuals. No *Schnurkeramik* sekeletal material is known in the Netherlands. As far as the post-cranial skeleton is concerned, the *Schnurkeramik* skeletons, those with planoccipital *Steilkopf* and the Early Bronze Age skeletons from Singen/Hohentwill are all similar in their robustness.

The important differences in cultural remains and grave ritual between Single Grave and Bell Beaker Culture are therefore accompanied by a clear anthropological change from a fairly homogeneous dolichomorphic people to a varied population with the (hyper)brachymorphic planoccipital *Steilkopf* as a leading element. The transition from Bell Beaker Culture to the Early Bronze Age Cultures is very gradual in every respect. We must therefore consider the appearance of the Bell Beaker Culture as a real immigration: the penetration of entirely new population elements with their own material culture, just as centuries earlier the bearers of the Battle Axe Culture penetrated Western and Central Europe. In this connection Gerhardt made a number of interesting remarks [282] about the constitution of the BB population. It consists of the fusion of a number of "races" without any clear intermixing. Of the men particularly the majority have the typical planoccipital *Steilkopf*, while the women are mainly responsible for the heterogeneous character of the whole. It looks as if a group of male foreigners frequently recruted women from an existing population. In one cemetery, in addition to the planoccipital *Steilkopf*, one other type of skull is clearly present in large numbers. In the four double graves of Gerhardt's "*Reine A*" (pure BB) group people of the same skull type were buried. He concludes that they were a group of newcomers who rapidly increased in numbers and mingled with the the existing population only to a limited extent.

The consequence of this anthropological model is not inevitably the assumption that the material culture of the Bell Beaker Culture as a whole was also imported from elsewhere. This might be the case with only a few (new) elements such as the wrist guard and the copper knife. We can imagine that the new people only imported and preserved a few recognizable cultural elements of their own and otherwise adopted many autochthonous elements. That is, we think a (partial) anthropological discontinuity might be combined with a largely continuous cultural development.

In this short study we will not deal with the origin of the planoccipital *Steilkopf* skull type (we refer the reader to Gerhardt [283]) although it might be the clue to the origin of the new elements in the Bell Beaker Culture. The above observations serve only to point out the consequences of the anthropological observations at Molenaarsgraaf, and to stress that the planoccipital *Steilkopf* has now also been established in the Veluwe Bell Beaker group [284].

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[280] Sangmeister & Gerhardt (1965), 197; Feustel *et al.* 1966, 117-146; Buchvaldek & Koutecký 1970, 275.

[281] Sangmeister & Gerhardt (1965), 112-113; Riquet 1970, 104 says that the extreme dolichocranic skulls of the *Schnurkeramik* are demonstrated to be very characteristic. In combination with a certain skeletal gracility he sees some resemblances to the old Bandceramic stock.

[282] Gerhardt 1953, 159 f.

[283] Gerhardt 1953, 163-182.

[284] I discovered the book of Riquet (1970) only after the writing of this section. The book gives a survey of the

4.9.7. The Ox Burial

4.9.7.1. *Neolithic animal burials in the Netherlands*

Apart from the *terp* finds, complete animal skeletons or their traces (corpse-silhouettes), from the pre-Roman period in the Netherlands are rare. For comparison with the ox burial at Molenaarsgraaf the following finds may be mentioned:

In the primary grave of a barrow at Emst (Veluwe) [285] were found— in addition to a 2^{IIb} (All Over Cord) Beaker, a second beaker and a Grand Pressigny flint dagger—the remains (teeth) of a "horse's" head. They were all grave goods for a dead person whose silhouette was

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Neolithic and Early Bronze Age skeletal remains of France and surrounding countries. The systematic treatment of the huge quantities of this widely dispersed and (for archaeologists) not easily accessible material, makes this study of the utmost importance. Riquet confirms the lines of the European anthropological evolution, as they were known, and gives specifications on many points.

One of the major themes, if not the central problem is again the sudden appearance during the "Chalcolithic" (*i.e.* the Beaker Period) of the robust people with the big brachycranic skulls, sharply contrasting to the gracile and dolichocranic "danubian complex" and the likewise dolichocranic *Schnurkeramik* people, living in Central Europe. He says (p. 109). "We see here one of the deepest breaks in the continuity of the European anthropological history". Riquet cannot see this as an immigration. At any rate this people came not from Spain, were brachycranic skulls are only very scarcely represented in and before the Chalcolithic. He believes (p. 184) that "we see in this the resurgence of the Mesolithic stock, which was temporarily eliminated mainly be the Early Neolithic and later by the Middle Neolithic colonists". In this connection he stresses the occurrence of brachycranic skulls in the Mesolithic (principally those of Offnet), besides the predominantly dolichocranic skulls (p. 34-35), that all differ considerably from the "danubian complex" (p. 55-56). He assumes a spontaneous "brachycranisation" or "dinarisation" of the original (Mesolithic) population in the two millennia before 2000 B.C. He rightly stress that our anthropological knowledge is restricted to relatively small areas and that data lack from long periods and vast countries.

We can, however, hardly accept Mesolithic survivals of considerable extent over a period of about 2000 year until 2000 B.C., unrecognized until now in archaeological and anthropological respect. The remarkable contemporeinity of the first occurrence of the planoccipital *Steilkopf* over a vast part of Europe (Czecoslovakia, Germany, Great Britain (Riquet p. 110, 196) and more sporadically in Spain and Southern France) is also difficult to explain in this theory. It is, however, interesting that brachycranic people occur in Northern France (SOM Culture) and along the Meuse in Belgium, although there are clear differences from the Bell Beaker people: their stature is smaller and the mean values of the *index cranicus* are considerably smaller (Riquet 1970, p. 143). Riquet gives also some references (p. 114, 183-184) to the Danish Neolithic skeletal remains, described in detail by Brøste and Jørgensen. Both the TRB people of the Danish Middle Neolithic and the people of the Dagger Period (Danish Late Neolithic, contemporaneous with the Bell Beaker Culture and the Dutch Early Bronze Age) had rather big mesocranic skulls (not brachycranic as Riquet says !) with a mean *index cranicus* of resp. 76.0 and 77.2 for the men. But there is a considerable variety and it is especially interesting in this context that there is quite a number of skulls with an *index cranicus* of over 79.0, and a rather flat occiput, Late Neolithic but also Middle Neolithic. We also note that there is a marked increase in mean body length of about 10 cm. between both periods, while the Neolithic TRB people was already tall and robust. The question of the possible anthropological relationship of all these brachycranic groups of is crucial archaeological importance. We are not competent to give an answer and just pose this question. Nor is this the place and moment to work out the consequences of the possible answers. One might led to a possible northerly origin of the BB people. This does, however not exclude that in the formation of the Bell Beaker *Culture* (*i.e.* the find association), contacts with remote countries, like the Iberian peninsula, played an essential role.

[285] Holwerda & Evelein 1911, 19 and *afb.* 20, 21. See also PZ 4 1912, 368-373; Behrens 1964, 48, 107; the grave (pit) itself is difficult to discern.

also visible. Van Giffen later declared that the jaws belonged to an ox [286]. It can no longer be determined whether a complete ox or only its head was buried in the grave.

In an eccentric position under barrow 3 on the Solsche Berg at Garderen the silhouette of a large animal was observed in a separate pit [287]. The barrow covered a bottom grave, which contained among other things a Grand Pressigny flint dagger. On the former surface lay a few sherds of a late Protruding Foot Beaker. The animal burial dates, therefore, from the same period as that of Emst.

In the WSW-ENE orientated primary grave of tumulus 1 at Zeijen [288] was found the silhouette of a large animal, apparently an ox, judging from the teeth which were preserved. The other grave goods were a thick-butted gneiss axe and a flint flake. No trace of any human interment was found, so that the ox may have been buried as a grave gift or simply as a primary burial. The date cannot be fixed more precisely than probably Protruding Foot Beaker Culture.

At Angelsloo [289] in the extensive excavation in 1966 an ox burial (silhouette with enamel of the teeth) was found close to a NE-SW orientated grave in which the dead person was buried in a crouched position on the left side with the head to the SW. In the grave a completely oxidized bronze or copper finger-ring was found. Even when we accept that the grave dates the ox burial, we can give no better date than Late Neolithic or Early Bronze Age.

In the centre of the settlement at Ottoland-Oosteind [290] (VBB to Late Bronze Age) the complete skeleton of a pig (a two year old domestic female) was found in an E-W orientated burial pit. For stratigraphic reasons the burial must be dated early in the occupation period (*i.e.* VBB/BWB). No human graves were found.

In the Vlaardingen Culture settlement at Leidschendam [291] the fairly complete skeleton of a pig, about 5 months old, was found.

In one of the graves of barrow II at Oostwoud (containing a crouched skeleton, on the right side, head north and facing west) the skull and other remains of rabbit or hare were found. The grave is not dated [292].

Finally, we must mention some finds in West Frisia: an ox skeleton from the Middle Bronze Age settlement at Zwaagdijk which, however, in view of the state of bone preservation,

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[286] Van Giffen 1930[a], 156-157. The "horse's head", RMO no. e 1911/8.8, could not be found in the museum to give it a re-examination.

[287] Bursch 1933, 69-71, *Abb.* 66, 77; see also Behrens 1964, 48, 107. Behrens doubted whether the original identification as a horse is right and suggests that it might also be an ox, as appeared to be the case in the Emst grave. Horse burials are very rare, while ox burials are the most common. Mr J. N. Lanting informed me that, according to a letter from Dr Bursch in 1971, a military veterinary surgeon from the nearby camp at Nieuw Millingen had identified the teeth as those of a horse. In our opinion this cannot remove the doubts.

[288] Van Giffen 1930[a], 57-59, *Taf.* 47, 48; Behrens 1954, 64, 48, 107. Although the grave pit seems to be very small to contain a complete animal, this was doubtless the case. Van Giffen (1930[a]) stated: "*Es war wie ein grosser Schatten an der Ostseite des Grabes erkenntlich*" and (1925/'26, 244) "a complete animal was placed" (in the grave).

[289] Van der Waals 1966, pers. comm. Mr J. N. Lanting. The animal lay on its right side, head NE, legs directed to NW.

[290] Preliminary report: Louwe Kooijmans 1969[b]. The animal lay on the southern slope of the pit, head east and on its back, the legs stretched upward.

[291] Glasbergen *et al.* 1967, 114. Mrs Dr W. Groenman-van Waateringe informed me that in this case a burial with a ritual purpose is unlikely. An interpretation as normal carcass refuse seems most probable.

[292] *Cf.* note 245.

TABLE 25

Survey of the Neolithic — Early Bronze Age animal burials in the Netherlands

Site	Animal	Cultural association	Situation	Lit. in note
Hanendorp-Emst	ox	AOC beaker	in a grave	285,286
Garderen	(ox)	AOC beaker	in a grave	287
Zeijen	ox	Late Neol. — EBA	in a grave	288
Angelsloo	ox	Late Neol. — EBA	near a grave	289
Molenaarsgraaf	ox	VBB—BWB	separate grave in settl. + cemetery	
Ottoland	pig	VBB—BWB	in settlement	290
Leidschendam	pig	VL—SVB	in settlement (carcass refuse)	291

is apparently a (sub)recent burial, and an ox skeleton from tumulus I at Oostwoud, also possibly a recent burial. In view of the new data described above both finds, in our view, merit a fresh study [293].

Animal burials are therefore a recurrent, but rare, phenomenon in the Beaker Cultures in the Netherlands. They are mostly related with human burials which may largely be explained by the excavation traditions. Only at Ottoland it is likely that a burial is related to a settlement. The find at Leidschendam seems to be a part of the normal domestic refuse rather than a ritual burial. The Molenaarsgraaf ox might, in view of these facts, form a part of the cemetery or, on the Ottoland analogy, belong to the settlement activities and might be interpreted then as an initiation sacrifice.

The lack of other animal burials (*e.g.* of the TRB Culture) is not significant, for in fact no Middle Neolithic skeletal material is known at all in this country. It is not permitted to state, therefore, that this custom was introduced by one of the Beaker Cultures.

4.9.7.2. *Neolithic animal burials in a wider context*

The monograph of Behrens [294] permits us to make a comparison of Netherlands data with those of the whole of the Old World. He collected 268 finds, which involve 459 complete animal skeletons. Of these the majority (414; 90.2%) come from domestic animals. As far as distribution in space and time is concerned, the picture is very strongly influenced by the state of the archaeological research, the burial customs (*e.g.* cemeteries as opposed to collective burials in megalithic graves and inhumation opposed to cremation) and by the conditions for preservation of the bones. That 75% of the finds show some relationship to human graves might be mainly due to the fact that excavations have concentrated upon cemeteries. On the other hand the fact that human graves have not been found does not mean that they were not present

[293] Modderman 1964, 32; Van Giffen 1962, excavation plan.

[294] Behrens 1964.

in the vicinity. With the preponderance of domestic animals (especially ox) and the relation to graves the Dutch animal burials do not occupy an unusual position.

Most animal burials belong to the *Kugelamphorenkultur* and to a somewhat lesser extent, to the Baden (Pécel) Culture and some TRB groups (Baalberg, Walternienburg) of Central Europe and the Central Danube region. Fairly many and large cemeteries with good skeletal material from these cultures have been found. We find there in every large cemetery a few animal burials, often those of oxen in pairs. The dog also plays an important role. A few finds have been made in the *Schnurkeramik* Culture, but younger animal burials do not appear to occur [295]. The Western European finds form a separate and later group; they consist of about 20 items in which one or more dogs (about 50) are buried as a grave gift, a custom occurring from Southern Sweden to the Iberian Peninsula [296] but in the Netherlands, curiously, it has never been reported. Occasionally a dog is buried in a settlement, as at Easton Down [297]. A second group is formed by the oxen, of which we have already discussed the finds in the Netherlands. Other animals are not mentioned by Behrens. The Ottoland pig is therefore exceptional. Outside the Netherlands the following finds have been made.

At Engers (Kr. Neuwied) [298] the skeleton of a large animal was found near a Bell Beaker grave. It is most probably an ox. From a grave at Wiesbaden *am Hebenkies* [299] a "horse's" skull was reported, dated as *Schnurkeramik*. An ox skeleton at Skendleby, Lincolnshire [300] was among settlement finds which included A-Beaker sherds. Directly in front of the entrance of the megalithic grave of the Boyne Culture at Bryn Celly Ddu, Anglesey [301], an ox was buried, and was either contemporary with or of later date than the monument. In the Tumulus St. Michel at Carnac, Brittany [302] (Early Bronze Age) alongside human burials two large ruminants (very probably oxen) were buried in stone cists. At Villa Nova São Pedro [303] an ox was carefully buried in a deep pit within the fortification. Halfway in the filling a large pot was found containing the bones of deer and pig. A second ox was buried in the immediate vicinity.

The strongly flexed position seems to be very exceptional. We found no example of it in Behrens' lists. The best parallels are both (Baalberg or Únětice) ox burials of Stemmern, but they lack the flexed neck. The certain establishment of the absence of the phalanges needs a careful excavation and a special attention to this phenomenon. A reliable example is the Early Bronze Age horse burial of Gleina, where all second and third phalanges were missing. But this too seems to be a rare practice [303a].

It is difficult to draw any other conclusion from these few, widely scattered finds than that ox burial especially in the Bell Beaker Culture, was no unusual practice. We have no indication as to where this custom originated. The interpretation of the purpose of the burial

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[295] Beherns 1964, 56.

[296] Behrens 1964, 71-74.

[297] Behrens 1964, 105; Stone 1958, photo 23.

[298] Gatermann 1943, 20, 40, 81 and *Abb.* 13, 31; Behrens 1964, 48, 98.

[299] Behrens 1964, 48 (note).

[300] Philips 1936, 67, 96 f. (= App. II); Behrens 1964, 106, 51-53.

[301] Hemp 1930, 194-196, 213 (= App. I); Behrens 1964, 105, 51-52; Piggott 1954, 200.

[302] Behrens 1964, 105, 51 and literature cited there.

[303] Do Paço & Sangmeister 1956, 219; Behrens 1964, 51-54. 113,

[303a] Behrens 1964, 102 (Stemmern), 99 (Gleina).

varies from find to find and is influenced by the find-circumstances. Behrens gives a full survey of all possibilities [304]. A very important distinction is the burial as a grave gift or the independent burial, sometimes itself even provided with grave goods. In this latter situation, which applies at Molenaarsgraaf, Behrens gives as the most important possibilities: a sacrifice, the burial of an animal that occupied a special place, a substitute for a dead person whose body was not available, or a profane purpose: the burial of a carrion. Only this last explanation do we consider inapplicable at Molenaarsgraaf.

4.9.8. Situation and Subsistence Economy

4.9.8.1. *The site*

We may wonder why the Bell Beaker people chose to make their settlements of all places on a small sand ridge in the middle of a peat region. There are a few indications that this was a deliberate choice and that there was a preference for low-lying (wet) sandy ground. Modderman [305] was able to show, by means of detailed data about the distribution of beakers in two important areas of the Veluwe, that the earliest (Protruding Foot) Beakers were closely connected with the courses of a few streams, and that in the course of the Beaker period (*i.e.* in the phase of the Veluwe Bell Beaker) the territory used was extended to drier and higher ground, possibly as a result of an increasing population. Although the distribution of the beakers (*i.e.* of the graves) does not necessarily correspond to that of the settlements, it does nevertheless indicate broadly the position of the settlements. Van Zeist and Verwers [306] also conclude that this preference for a wet milieu must have existed. The colonization of the Western Netherlands, and in particular the establishment of the settlement on the Schoonrewoerd stream ridge, may therefore be satisfactorily explained by the free choice of an attractive environment; we certainly do not need to assume that an emigration to "marginal milieus" took place as a result of increasing population pressure.

A second possible factor is of an economic-strategic nature. We have already indicated that one of the few possible contact routes between coast and hinterland may have followed the Schoonrewoerd stream ridge, and that the Molenaarsgraaf-Ottoland-Goudriaan settlement lay about half-way along this (mainly dry) communication road. This route was surely of regional importance. But we must realize that its importance may have been much greater in the light of the cultural ties and trade relations between the countries on both sides of the North Sea. Mainly typological arguments have been adduced in support of an expansion of the Netherlands Bell Beaker Culture in a relatively early phase (2^{Ic}) to the British Isles, especially to the east coast area of Yorkshire. In a subsequent phase the BWB Culture (in England possibly introduced from the continent) extended over the North German plains, the Netherlands and Southern England. In the same area we find, a few centuries later, the culturally closely related groups of the Wessex Biconical Urns and the Hilversum urns on either side of the North

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[304] Behrens 1964, 59-67.

[305] Modderman 1962/'63.

[306] Van Zeist 1963, Verwers 1972, 143.

Sea [307]. Within these cultural regions there existed in the Early Bronze Age a lively trade, which has been described in detail by Butler [308]. Not only did bronzes (axes, halberds) find their way from Southern England and Ireland to the regions east of this country, but the smiths themselves also crossed the North Sea. The bronze hoard at Wageningen is the most striking proof of this [309]. Moreover, the mutual import finds indicate that there must have existed in this period a North Sea traffic operating with seaworthy ships between Yorkshire and East Anglia on the one side and Jutland on the other. A similar trade sea route linking the Rhine estuary directly with England is considered by Butler to be very probable. Routes such as that on the Schoonrewoerd stream ridge (it is likely that it was not the only one) were probably used by merchants who, after landing on the coast, travelled inland (and deeper into Europe). The Molenaarsgraaf settlement was therefore less isolated than at first sight might be imagined.

4.9.8.2. *Reclamation*

Important information about reclamation techniques is yielded by the pollen spectra of the old surfaces under the burial monuments [310]. The pollen spectra under TRB burial monuments show a slight disturbance of the vegetation (*i.e.* of the timber) and low values for *Cerealia*, *Plantago lanceolata* and other track weeds. This type of spectrum may be explained by the type of *landnam*, according to Troels-Smith, in which only small clearings were deforested and the cattle were fed with foliage in enclosures or stalls near the settlement. The PFB barrows show spectra with very high *Plantago lanceolata* values, and higher values of *Gramineae* and other track weeds. The *Cerealia* values are, however, low. Such spectra indicate a *landnam* according to Iversen, in which large stretches of forest were cleared; these were subsequently only partly used for cultivation. Cattle grazed on the fallow fields.

These fundamental differences are also found in subsequent periods. Under the barrows of the Hybrid Beaker, Maritime and Veluwe Bell Beaker Cultures we find spectra like those under the TRB monuments. The BWB barrows show a continuation of the PFB tradition; the partly contemporaneous barrows with bank and ditch (HVS) in the Southern Netherlands have, on the other hand, spectra with low *Plantago lanceolata* values. These differences between the Northern Netherlands on the one hand and the Southern and Central Netherlands on the other continue, if in lesser degree, in the Middle Bronze Age.

The originally cultural (*i.e.* TRB-PFB) distinctions have therefore in the course of time acquired additionally a regional character. The data available to us are not sufficiently detailed to analyse this process more accurately. Almost certainly, however, it was connected with the concentration of the Late Bell Beaker Culture (VBB) in the Central Netherlands and its limited penetration into Drenthe, where PFB elements were long able to maintain themselves. The question whether and to what extent there existed any continuity of both traditions (PFB-BWB-ELP and TRB-Hybr.B-BB-HVS-DKS) will not be considered here.

That the above-named differences really were caused by agricultural techniques and were

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[307] Beakers: Clarke 1970, 159; BWB: *cf.* note 122 esp. Clarke 1970, 136.; HVS: Glasbergen 1969.

[308] Butler 1963[a], 201-211.

[309] Butler & Van der Waals 1968, esp. 81.

[310] *Cf.* Van Zeist 1967, Waterbolk 1954, 1956.

not or only partly the result of the situation of the graves in respect to the fields or the settlements appears from the important diagram V1 of the VL settlement at Voorschoten [311]. In the lower half of the diagram (pure Early VL occupation) only the alder carr of the shore flat was affected; the oak forest of the coastal barrier was disturbed only in very limited measure. After the coming of the PFB Culture we observe (in the upper part of the diagram) the great clearings, indicated by the decrease of *Quercus* and the increase of *Gramineae* which are characteristic of the PFB Culture. Both Waterbolk and Van Zeist [312] determined, moreover, that the barrow spectra closely correspond to the succession of human influence on the vegetation, which is visible in the raised bog diagrams.

The above fairly full account was necessary in order to assess correctly the Molenaarsgraaf data. From the beginning of zone 1 the diagram shows the picture of the PFB-BWB barrows and of the later (PFB/VL) phase of Voorschoten. This seems clearly to contradict our correlation of this zone with occupation phase 1 (VBB) of the settlement. We must, however, realize that the area of the stream ridge (and thus of the forest on it) was so limited that the clearing of a sufficiently large area of cultivable land (*cf.* p. 110) demanded the removal of a very considerable part of this forest. Moreover, natural pasture land was present on the clay wedges. In this situation the effect of both types of *landnam* on the pollen diagram will not, or will hardly, differ. The even more rigorous deforestation apparent in zone 2 (diagram II) is, however, perhaps the reflection of a difference in reclamation techniques during the VBB and BWB occupation phases.

Worthy of note are the very high values for *Cerealia* (up to 10%) and *Plantago lanceolata* (up to 25%) at Molenaarsgraaf. We find this also at Voorschoten (5% and 10% respectively) but not at Vlaardingen [313] (3% and 1% respectively), although both diagrams are fairly well situated in the settlement. We may conclude that the deforestation at Vlaardingen was much less rigorous and that the fields lay at some distance from the diagram and/or were of much less extent than at Voorschoten and Molenaarsgraaf. The latter conclusion would mean that the entire farming activity (cattle raising and land cultivation) at Vlaardingen was of less importance than in both the other settlements. The situation on the narrow, clayey, estuarine creek levee makes this in every way comprehensible.

4.9.8.3. *The fields and their working*

At Molenaarsgraaf we possess no other information about the fields than that they must have lain on the ridge, some of them next to the gully. It is, however, problematic whether a full investigation of the presumed arable land could supply us with more information. For many centuries, between occupation and covering, the terrain was disturbed by animal and plant

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311 Groenman-van Waateringe *et al.* 1968.

312 Waterbolk 1956, 48; Van Zeist 1967, 51.

313 Voorschoten: Groenman-van Waateringe *et al.* 1968; Vlaardingen: Groenman-van Waateringe & Jansma 1969. We must take into account that *Alnus* is included in the pollen-sum of the Voorschoten diagram. Consequently the values for *Plantago lanceolata* and *Cerealia* are relatively lower (about two times) in this diagram in comparison to Molenaarsgraaf and Vlaardingen. This means a better correspondence of Voorschoten and Molenaarsgraaf. The low values in the Vlaardingen diagram must be partly caused by the slightly longer distance between the diagram and the fields, than was the case at Voorschoten and Molenaarsgraaf.

activity, so that all shallow traces have disappeared. At Kromme Elleboog the investigation extended far beyond the settlement itself, yet no traces of arable land were found. Nor were any plough marks of the *ard* found, although we kept a particular watch for these.

Nevertheless it may be assumed that the arable fields were worked with the *ard* as this was generally used in the Early Bronze Age, as appears from the now fairly large number of plough traces which have been dated to this period. A few older datings show that the *ard* goes back to (much ?) earlier times. Observations of this in the Netherlands have been made, at Zandwerven (PFB), Bornwird (PFB), Oostwoud (BB (?), MBA), Velsen (BWB, HVS), Monster (HVS and later) and Gasteren 2× (both BWB). In West Frisia crossed systems of plough traces are a common feature in Middle Bronze Age settlements [314].

If the antler hook from grave II was also used as an agricultural hoe, this would mean that it was a tool used side by side with the *ard*.

4.9.8.4. *The cultivated crops*

The pollen diagrams tell us no more than that grain was cultivated. Fuller information about the nature of the cultivated crops is given by the impressions of seeds in pottery, or the finds of charred seeds. In spite of our special attention to these categories of finds the sole result of the excavation was the above- mentioned doubtful impression of *Einkorn* wheat (*Triticum monococcum*) in a sherd [315].

Recently Van Zeist [316] published an exhaustive article on the Dutch charred seed finds. Neolithic material in this country appears to be still very scarce. An example from Vlaardingen (VL Culture) contains mainly Bread Wheat (*Triticum aestivum*), little *Emmer* Wheat (*Triticum dicoccum*) and only very little Hulled six-row Barley (*Hordeum vulgare*). In three PFB settlements of slightly later date the dominating grains are the Naked six-row Barley (*Hordeum vulgare, var. nudum*) with 50-100% over *Emmer* wheat (7-27%). In the Middle Bronze Age *Emmer* wheat and both above-named barley types occur together, but it cannot be said that one of the two predominates. Because of the frequently occurring great homogeneity of single examples, quantitative conclusions based on charred seed samples are, however,

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[314]

Zandwerven: Van Regteren Altena & Bakker 1966, 37-38.

Bornwird: Pers comm. Prof Dr J. D. van der Waals.

Oostwoud: Van Giffen 1961, 1962, 1966 and pers. comm. One system of plough-marks might belong to the Bell Beaker occupation (*cf.* note 245).

Velsen: Vons 1969 and pers. comm.

Monster: Glasbergen & Addink-Samplonius 1965, Stuurman 1965.

Gasteren: Van Giffen 1941, 29-31; Harsema & De Ruiter 1966.

Middle Bronze Age: Van Giffen 1944, Modderman 1964[a], Bakker & Metz 1967, H. H. van Regteren Altena & Bakker 1968, 202.

From outside the Netherlands we name two recently published finds. The one of plough traces below a Mont. II barrow and over a flat grave of the late Single Grave Culture in Denmark (Thrane 1967, esp. 41, 57). The other, dated extraordinary early, below a long barrow at South Street, Wilts, and belonging to Neolithic occupation, ^{14}C dated BM 356 2810 ± 130 (Evans in Simpson (ed.) 1970, fig. 10).

[315] *Cf.* p. 277.

[316] Van Zeist 1968, esp. 153, tab. 63.

difficult to draw. More helpful in this respect are impressions in pottery. It is noteworthy that *Einkorn* wheat (*Triticum monoccum*) has only been identified in a few impressions on Neolithic pottery (Bandceramic, TRB Culture) but neither in later impressions nor from samples of charred grain.

We may briefly compare the data of the Netherlands with those of pottery impressions from a few other areas. Matthias and Schultze-Motel [317] studied grain impressions in Central Germany. On Bell Beakers they found only one impression (barley). *Schnurkeramik*, on the other hand, yielded plentiful data: of 173 impressions 46 were of barley, 82 of wheat (40 *Emmer*, 18 *Einkorn*, 24 unidentified), 2 of oats and 43 of unidentified grain. Únětice Culture impressions were much less numerous: 5 of barley, 7 of wheat (1 *Emmer*, 2 *Einkorn*, 4 unidentified) and 1 unidentified grain impression. For Denmark Helbaek [318] shows that in three important TRB settlements wheat (primarily *Emmer*) occurred much more frequently than barley (primarily Naked Barley). Jankuhn [319] came to the same conclusion. He shows, moreover, that in the Late Bronze Age the roles were reversed: 83 impressions of barley, 7 *Emmer* and one or two *Einkorn*. For Southern England Helbaek [320] determined that before the Bell Beaker Culture (particularly at Windmill Hill) wheat was the main crop, and that the Bell Beaker Culture introduced a notable change: the main crop then became barley. In the course of the Bronze Age the proportion of wheat increased somewhat (from 1:10 to 2:3). In the Late Bronze Age Hulled Barley gained predominance over Naked Barley: the proportions changed from 3:7 to 7:3.) He mentions that he also established a preponderance of Barley impressions on the Dutch beakers.

What can we deduce from these data ? First, that after the cultivation of primarily wheat (mostly *Emmer*, also *Einkorn*) during the entire Neolithic a change occurred during the Protruding Foot Beaker Culture (*Schnurkeramik*) in favour of the (particularly Naked) six-row barley. During the Late PFB Culture in the Netherlands and also during the Bell Beaker Culture in England this change had already taken place. In the course of the Bronze Age this change appears to have been reduced to some extent (but not in Denmark), while at the end of the Bronze Age Hulled six-row Barley replaces Naked Barley. This means for Molenaarsgraaf that probably Naked six-row Barley was the main crop, whith some *Emmer* and *Einkorn* wheat. Second, the occurrence of an impression of *Einkorn* wheat at Molenaarsgraaf seems to be less unusual than would appear from the Netherlands data alone. From the numerous impressions of flax seed in a beaker from Handley Down [321] it appears that the Bell Beaker people grew flax there too. In our view we may regard this as relevant to the Netherlands also.

4.9.8.5. *The domestic animals*

No contemporaneous material is available in this country as a basis for comparison with the Molenaarsgraaf bone spectrum, but we know of material from various older and younger settlements, all in the Western Netherlands, especially Vlaardingen and Hekelingen (VL

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317 Matthias & Schultze-Motel 1967, 1971.

318 Helbaek 1952, 198.

319 Jankuhn 1969, 147; see also Clark 1965, 108 on the wheat: barley ratio.

320 Helbaek 1952.

321 Helbaek 1952, 205; Clarke 1970, no. 191. Flax was grown since the Windmill Hill Culture.

TABLE 26

Carcass refuse of Late Neolithic and Early Bronze Age sites in the Western Netherlands

	VL-estuarine			VL-coastal barriers		VBB/BWB	HVS
	Vlaardingen [1]	Hekelingen [1]	Zandwerven [1]	Voorschoten [2]	Leidschendam [2]	Molenaarsgraaf	Vogelenzang [1]
Bos taurus	334	113	44	254 [6]	200	213	67
Sus domesticus	123 [3]	43 [4]	1	51	177	33	18
Capra/Ovis	16	8 [5]	2	30	32	14	6
Equus caballus	—	2	—	—	—	2	6
Canis familiaris	12	—	—	8	—	—	—
Cervus elaphus	788	162	—	40	28	4	—
Capreolus capreolus	25	30	—	24	22	—	—
Sus scrofa	218 [3]	23 [4]	—	5	—	1	—
Alces alces	—	—	—	—	—	3	—
Bos primigenius	—	—	—	4 [6]	—	—	—
Ursus arctos	4	1	—	1	—	1	—
Castor fiber	218	40	—	—	1	8	—
small predators	81	19	—	—	1	—	—
Halichoerus gryphus	3	—	—	1	2	—	5
Cetaceae	15	1	—	1	—	—	—
Avis sp.	129	4	14	5	9	3	—
Acipenser sturio	c. 2000	+	—	200	2	1	2
Esox lucius	+	+	—	—	—	+	—
Piscis sp.	+	+	—	—	—	1	1

[1] After Clason 1967.
[2] After Groenman-van Waateringe *et al.* 1968.
[3] Sus scrofa/domesticus : 532.
[4] Sus scrofa/domesticus : 64.
[5] Canis familiaris/lupus : 2.
[6] *Bos taurus/primigenius* : 10.

Culture, estuarine region), Voorschoten and Leidschendam (VL Culture, coastal barriers) and Vogelenzang (HVS Culture *s.s.*, coastal barriers) [322]. In any comparison, therefore, variations in age, culture and environment must be borne in mind.

[322] *Clason* 1967.

The kinds of livestock showed no great variations in the settlements named. Cattle were everywhere in the majority, followed by pigs, but the ratio of both animals in the various settlements varied considerably. Sheep and goats came third, in limited numbers. In the Middle Bronze and Iron Age settlements in the Western Netherlands pigs were usually of less importance than sheep or goats [323]. That there are no traces of dogs at Molenaarsgraaf may be the consequence of the limited amount of bone material. Moreover, the dog, because of its nature (it is not a meat-producer), was probably treated differently from the stock kept for slaughter. The occurrence at Vlaardingen and the occurrence of dog-burials in the Beaker Cultures [324] make it very probable that there were also dogs at Molenaarsgraaf.

Of the greatest importance are the closely dated remains of the domestic horse at Molenaarsgraaf. They are among the oldest in this country. Mrs Van Wijngaarden-Bakker recently gave a summary of these [325].

The oldest dated horsebones are a third phalanx and a molar found in the VL settlement at Hekelingen [326]. It was assumed that these were the remains of domestic horses because the marshy environment was not suited for the wild horse, but recently the possibility was considered that these might be the relics of wild animals shot elsewhere (in the sandy district) and brought to the settlement [327]. In the BB occupation layer under the Oostwoud barrow [328] one molar of a horse was found among other carcass refuse. The attribution to the BB Culture seems to be accurate, although the terrain was also used in the Middle Bronze Age. From a level with Bell Beaker sherds near Velsen three horse's jaws were recovered [329]. The dating of the comparatively abundant remains of horses at Langeveld [330] as "aeneolithic", or to the beginning of the Early Bronze Age, must be regarded as unreliable. The horse remains at Vogelenzang [331] can be confidently associated with HVS material from the second half of the Early Bronze Age (1600-1400 B.C.). All these finds, combined with the lack of the remains of horses in the VL settlements, indicate that the domestic horse was introduced into the Netherlands between about 2100 and 1800, *i.e.* during the Bell Beaker Culture.

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[323] Clason 1967, 14-21 (sites F-N), 203-204. Additional remarks in: Clason 1970, 302. In the river district new data have come available: at Zijderveld (MBA (+ Iron Age ?)) pigs outnumbered the small ruminants, at Dodewaard (MBA) and Culemborg (Iron Age) the numbers of bones of both are about equal. In the European Neolithic (the Balkan excluded) either the pig or the sheep/goat are second on the list after the cattle. In fact the geographical position, the cultural tradition and the environment are determinating factors for the way of farming practised in a certain settlement.

[324] Behrens 1964.

[325] Van Wijngaarden-Bakker (in press).

[326] Modderman 1953[a], 25; Clason 1967, 11. There has been some doubt to the reliability of the association of both horse bones. (the phalanx and molar) to the VL remains, since later BWB occupation ocurred on the site. There is, however, no reason for this. BWB finds were made exclusively in excavation pit A. According to the excavation reports the molar (find no. 102) was found in pit C between level II and III, *i.e.* between —2.20 m. and c. —2.40 m. NAP., in the top of the VL refuse layer. The phalanx has no number, but is the same as illustrated in Modderman 1953, PL III. 7 and described by Mr van der Feen in no. 103. This number contains the finds from the same excavation pit, but from a slightly deeper level.

[327] Groenman-van Waateringe 1970, 6.

[328] Clason 1967,16.

[329] Van Wijngaarden -Bakker (in press).

[330] Clason 1967, 13.

[331] Groenman-van Waateringe 1966[b], Glasbergen 1969, Clason 1967, 13.

Apparently the horse was also domesticated in other parts of Europe at this time. Mrs van Wijngaarden-Bakker names as the oldest find phases Orce (Spain), Avignon (Southern France) and New Grange (Ireland), all Bell Beaker Culture [332]. In the Central German *Schnurkeramik* Culture the horse had not yet made its appearance [333]. In various general surveys similar datings are mentioned, as in works by Zeuner, Isaac and Jankuhn [334]. Behrens remarks that horse burials first occurred right at the end of the periods discussed by him, *i.e.* in the Early Bronze Age (Únětice Culture). It was much later that horse burials became more general, however [335]. Nobis [336] says that the wild and domestic horse are very difficult to distinguish, which must be borne in mind particularly when considering regions which were favoured by wild horses. From the Mesolithic and the Neolithic only the remains of wild horses are familiar to him. In Boessneck [337] we find, however, a report on the domestic horse in the settlements of the Altheimer Culture, Altenerding and Pestenacker, *i.e.* in the (Dutch) Middle Neolithic. At Altenerding there is possibly some pollution with Bronze Age material, however, and at Altheim itself the horse does not occur. The domestication characteristics are not clear. The author speaks of "horses in the process of domestication".

In a recent monograph Nobis discussed the problem of horse domestication anew [338]. He found in the measurements of the horse bones from the Dnjepr-Donetz settlement at Derejevska (or Dereivska) strong indications that horse domestication took place in the South Russian plains in the second half of the fourth millennium B.C. (the site is dated with some Tripolye pottery). An additional centre of domestication in Central Europe (*i.e.* at the river Dümmer) is still unproved. Nobis describes further the presence of domestic horses in the Early Bronze Age (Bell Beaker and Nagyrév Culture) settlement at Csepel Háros near Budapest.

We summarize that it appears that the horse was domesticated in the Ukraine before 3000 B.C. and that it seems that the domestic horse did not spread over Central and Western Europe until Bell Beaker times.

4.9.8.6. *The hunt*

As we have already stated when discussing the material (p. 241) Molenaarsgraaf presents a contrast to the VL settlements along the estuarine creeks (Vaardingen, Hekelingen) and corresponds closely to those on the coastal barriers (Voorschoten, Leidschendam), as far as the proportion of livestock breeding to hunting is concerned, but at Molenaarsgraaf the hunt was of still less significance. We find the same at Vogelenzang, where the remains of hunted animals are even entirely absent. The difference in this respect might therefore not have been caused only by a difference in milieu, but also by a chronological/cultural difference. We should remem-

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[332] Boessneck 1967, 100-101.

[333] Clason 1971.

[334] Nobis 1955, 223; Boessneck 1956, 25 f.; Zeuner 1963, 324 f.; Jankuhn 1969, 39, 252 f.; Drower 1969, Isaac 1970, 29 f. We must be on our guard that ^{14}C dates are not used together with historical dates, when data from prehistoric Europe and the Near East are compared.

[335] Behrens 1964, 58 and 48 note 27: two horse skulls found in a Bell Beaker grave in Czechoslovakia.

[336] Nobis 1955.

[337] Boessneck 1956, 27.

[338] Nobis 1971, esp. 68, 75-76.

ber that the abundance of wild animals on the broad coastal barries must certainly have been greater than on the narrow Schoonrewoerd ridge, large areas of which were fully cultivated.

Clason has given a survey of the ratio of hunting and stockbreeding in the whole of Europe during the Neolithic [339]. She concluded that there is no overall geographical or cultural pattern to be distinguished. The most important factors were the physiographical situation and the environment of the site, which gave rise to remarkable variations in this respect (the source of animal protein) within certain prehistoric cultures. The above-mentioned variations in the Western Netherlands are a good example of this.

Among the remains of wild animals at Molenaarsgraaf the relatively large proportion of those of beavers is noteworthy. We find the same in Vlaardingen and Hekelingen. The elk bones are the earliest dated remains in the Western Netherlands. This may mean that the animal was very rare and only occasionally penetrated further west.

4.9.8.7. *Fishing*

During our discussion of the pointed wooden poles and the fish hooks (pp. 300 and 303) we made a few comments on fishing methods at Molenaarsgraaf and on the fish caught. The following are some complementary observations.

The occurrence in widely differing quantities of sturgeon bone plates on various Neolithic sites in the Western Netherlands is remarkable: at Vlaardingen and Voorschoten (early phase) they are most abundant, while at Hekelingen and Molenaarsgraaf they are almost entirely absent [340]. We think that these differences are not necessarily of basic importance. They may be connected with the proximity of the fishing water and the place where the fish was cleaned. If this was not the case in the settlement, no fish remains are to be expected. The place used to throw fish remains must also be considered. At Molenaarsgraaf the environment was perhaps not ideal for sturgeon [341].

Pike remains have been found at Vlaardingen, Hekelingen, Leidschendam and Vogelenzang, and are only absent at Voorschoten [342]. The pike is the most common fish in prehistoric findplaces in fresh water environment. This may be partly the consequence of the dimensions of the remains and problems of determination. Remains of smaller fish quickly decay, are less easily found and are difficult to classify.

We discussed with Dr R. Boddeke [343] the various ways in which the Molenaarsgraaf fish hooks might have been used. There are three possibilities. First, the method named by Clark[344], that the hooks were used for affixing the living bait in pike fishing. Although the larger Maglemose hooks might have been used in this way, this is unlikely for the small and more fragile

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339 Clason 1967, 188-202.

340 Clason 1967, 10-13; Groenman-van Waateringe 1968. But *cf.* Van der Feen and Kortenbout van der Sluijs in Modderman 1953[a], 25: "... and also many fragments of the bone skin plates of this species (*i.e.* the sturgeon)", in contradiction to Clason 1967, 11.

341 The sturgeon needs flowing water with access to both the sea and the rivers. Until recently the sturgeon lived in the Dutch estuarine Biesbosch district.

342 As note 339.

343 *Cf.* note 59.

344 As said earlier at p. 303; Clark 1965, 42-43 and fig. 17.

Molenaarsgraaf hooks. Dr Boddeke says that it is impossible to land a pike with them. Second, there is a well-known and old fishing technique for perch with a short rod from the bank of the water. This type of fishing was certainly in use, for instance, in the 17th century, as appears from a drawing by Rembrandt. Boddeke tested this way of fishing with bone copies of the hooks, but with a negative result: the perch managed to swim free before they could be lifted from the water. A third possibility is eel fishing with a long multi-hooked line (the "bob" or *peur* in Dutch). We must wait to test this type of eel fishing until the right season (the spring), but a better result than with the perch experiment is expected. This will not prove that the hooks were used for eel fishing, but only demonstrate that it is possible and very likely that this type of fishing was practised.

4.9.8.8. *Conclusions*

When we come to summarize the foregoing observations, we must first draw attention to the remarkable correspondences between Molenaarsgraaf and the VL settlements on the coastal barriers. In a similar landscape situation (although different genetically) the subsistence economy was largely the same. The narrow sand ridge and narrow strip of pasture land on the clay wedges in the peat region had to be subjected, however, to maximum exploitation, while the coastal ridges and coastal flats offered much more room.

In such cases of very small landscape units it is difficult to distinguish the two types of *landnam*. Settlement in the wet milieu has a logical connection with a preference, determined elsewhere, for low, wet, sandy ground. It is certainly unnecessary to consider that there was any shift to a marginal environment due to, for example, increasing population pressure. On the contrary, it seems likely that there was a conscious choice of a very attractive situation, which means a settlement shortly after the Schoonrewoerd ridge became available—*i.e.* after it was formed.

The small importance of hunting may be due to the landscape situation and/or the cultural tradition. The nature of the live-stock was "normal" for a Neolithic settlement in this country. The domestic horse seems to have been introduced in this period (2100-1800) during (or by) the Bell Beaker Culture into the Netherlands and possibly throughout all Western Europe. By its accurate dating the Molenaarsgraaf find is therefore an important piece of evidence. We may supplement the picture of the settlement with the dog, the use of the *ard*, and the cultivated crops: mainly barley, followed by *Emmer* and some *Einkorn* wheat and perhaps also flax.

Needless to say, we got the picture of a settled community at Molenaarsgraaf and that, in our view, this picture is also applicable to the other VBB and BWB communities in the Netherlands. The unusual position of the settlement appeared to offer no worse (perhaps even better) facilities for a normal Neolithic economy, in which only fishing was allotted a supplementary role.

It has not yet been proved that these people were not tradesmen or prospectors, as the traditional view of the Bell Beaker Culture holds, or held until recently. For such activities are difficult to ascertain by settlement research. It is, moreover, logical that a culture (perhaps originally consisting of colonists), which in a later phase separates into clearly regional groups, possessed, during that phase, thoroughly agrarian settlements. All this, moreover, tells us nothing about the first phase of the Bell Beaker Culture. We again (*cf.* p. 282) draw attention

to the difference between the course of events at Molenaarsgraaf and the very brief stay of a group of MBB people at Vlaardingen. This remarkable difference may well be of fundamental importance, revealing a characteristic difference in the way of life between the first and the far advanced phase of the BB Culture. It is interesting in this respect to make a comparison with the Battle Axe Culture. The traditionally accepted nomadic character of this culture has been rightly refuted in recent years by various writers [345], in favour of a settled farmers' culture. However, in spite of this, the character of the earliest phase, which spread so quickly over a large part of Europe, was not necessarily the same. This may be explained, in our view, by studying such an initial phase (if possible only in its first generation) separately from the later development. This is, however, a much more difficult task.

4.9.9. The ^{14}C Dates

For comparison with the ^{14}C dates at Molenaarsgraaf we give the following dates for the BB and BWB Cultures in the Netherlands (table 27).

TABLE 27

Bell Beaker and Barked Wire Beaker ^{14}C dates (B.C.)

MBB			
Vlaardingen	— —	1940 ± 25	mean of 4 measurements. Refuse layer with sherds. Van Regteren Altena *et al.* 1962/'63, 1962, 233; Vogel & Waterbolk 1963, 178.
Mol	— —	1995 ± 40	mean of 2 measurements : GrN 6646 1945 ± 45 and GrN 3641 2055 ± 60. Pers. comm. Mr J. N. Lanting, Groningen.
VBB			
Bennekom	GrN 326	1915 ± 180	grave with two Veluwe Bell Beakers. Van Giffen 1954, Van der Waals 1964[a], 52; Vogel & Waterbolk 1963, 182.
—	GrN 6155	1870 ± 35	pers. comm. Mr J. N. Lanting, Groningen. new dating of the GrN 326 sample.
St. Walrick *t.a.q.*	GrN 2996	1755 ± 80	Groenman-van Waateringe 1966 (*addenda* p. 158). Vogel & Waterbolk 1963, 182. *t.a.q.* of 2[1f] Beaker. Short chronological distance.
Haarlem	GrN 4635	1730 ± 40	Jelgersma *et al.* 1970, 120, 138. peat layer with Pot Beaker sherds.
BWB			
Anlo	GrN 852	1670 ± 65	Waterbolk 1960, 74; 1964, 119; Vogel & Waterbolk 1963, 180.
	GrN 1977	1645 ± 85	refuse pits with BWB sherds.
Angelsloo	GrN 5187	1525 ± 35	Vogel & Waterbolk 1972, 90. refuse pit with BWB sherds.
Velsen	GrN 5975	1540 ± 35	pers. comm. Mr J. F. van Regteren Altena, Amersfoort.
	GrN 5974	1670 ± 35	top and base of peat layer, to be correlated with BWB refuse.
Noordsleen *t.a.q.*	GrN 3036	1310 ± 70	Waterbolk 1964, 119; Lanting 1969, 199; Vogel & Waterbolk 1963. *t.a.q.* of refuse layer with BWB sherds below barrow.

[345] Van Zeist 1967, 59; Feustel in Feustel *et al.* 1966, 111-117; Jankuhn 1969, 33-35.

The ^{14}C dates at Molenaarsgraaf are in no respect in conflict with these dates. They provide valuable data for a more accurate marking of the boundary between the VBB and the BWB Cultures. The dating GrN 5132 1830 $\pm$ 50 can without difficulty be connected with the VBB Culture.

There also appears to be no overlap in the ^{14}C dates of both cultures, but there is a sharp division, just like we could determine this on various grounds in the Molenaarsgraaf data and could make this acceptable when we discussed the burial customs of these cultures in this country. What is noteworthy, however, is the absence of any ^{14}C dates for Veluwe Bell Beakers in the 18th century. This may be because of the scanty data. Both datings in the 19th century (Bennekom, St.-Walrick) are however, those of fully developed Bell Beakers, while the ^{14}C date of St. Walrick relates to a SE-NW grave with a corpse-silhouette, stretched on the back—a very early date for this type of burial [346]. A possible explanation is that we must postulate, between the pure VBB and BWB phases, a phase in the 18th century (or in a part of it) in which a devolution of the Veluwe Bell Beaker came about. The types of beakers occurring in the graves at Molenaarsgraaf, and the above-named parallels for them, might be placed in this intermediate phase, as might the above-named intermediate forms of BB and BWB pottery [347]. The BWB dates all fall in the 17th and 16th centuries.

The oldest dates for the HVS Culture *s.s.* do not extend far into the 16th century [348]. The lack of HVS pottery at Molenaarsgraaf means that these dates form a *terminus ante quem* for the settlement. It means a closer fixing of the *terminus ante quem* already afforded by the small hearth no. 29.

The earliest dates of the Elp Culture lie in the 15th and the beginning of the 14th centuries [349]. The ^{14}C date of the hearth conforms to the oldest Middle Bronze Age dates.

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[346] *Cf.* note 240. The ^{14}C date might be rather early: the double standard deviation gives an upper margin about 1640, which is still an early date, but premits a date for the 2[1f] Veluwe Bell Beaker in the early 17th century,

[347] *Cf.* p. 289, 302 and the notes 124, 242.

[348] Early HVS dates are:

Toterfout	GrN 50	1500 $\pm$ 100 B.C.
	GrN 1828	1470 $\pm$ 45
	GrN 1053	1530 $\pm$ 65
	GrN 1029	1380 $\pm$ 40
Eersel	GrN 5350	1510 $\pm$ 35

Vogel & Waterbolk 1963, 1972, 89; Waterbolk 1964, 119; Glasbergen 1969, 15.

It is a pity that the ^{14}C datings of two settlements gave disappointing and unreliable results (*cf.* Groenman-van Waateringe 1966[b], esp. 158):

Vogelenzang	GrN 2997	1190 $\pm$ 70 B.C.
Den Haag	GrN 2421	2270 $\pm$ 75

[349] Early DKS dates are:

Zijderveld	GrN 5376	1420 $\pm$ 80
De Treek, barrow I	GrN 2968	1380 $\pm$ 70

The earliest dates of some ELP settlements:

Elp	GrN 4171	1280 $\pm$ 80
Emmerhout	GrN 5588	1370 $\pm$ 60
Angelsloo	GrN 5183	1455 $\pm$ 35

Vogel & Waterbolk 1963, 1967, 1972.

4.10. REVIEW

In the foregoing we have reported our investigation of the VBB/BWB settlement at Molenaarsgraaf. A choice was then made for the separation of, on the one hand, the description of the enquiry itself (*i.e.* the finds, observations, analyses and the conclusions drawn form these), on the other hand, the definition of the geographical-geological and cultural-archaeological context of the community under investigation.

The descriptive part includes sections 4.1 to 4.7. In section 4.8 a synthesis is given and an attempt made to reconstruct as well as possible in words a picture of the settlement. The geographical-geological position of the settlement was sketched in Part II and in a more general sense in Part I. It is unnecessary to repeat a summary of all this. We must now only evaluate Molenaarsgraaf in the light of the cultural-prehistoric information about the most important aspects of the enquiry, which we assembled in 4.9.

In general it appears from the foregoing that the facts ascertained and the conclusions we formulated for Molenaarsgraaf were nowhere in conflict, and mostly agreed closely, with this information. Molenaarsgraaf often provided a confirmation, and in some cases a closer definition, of the existing knowledge. As such Molenaarsgraaf has therefore not only confirmed the picture we had of the relevant period, but also supplemented and enriched it. We summarize here what we consider the most important data.

Both the rather unusual house plans at Molenaarsgraaf may be considered as predecessors of the Elp type. Whether there is any relationship with the houses of the VL Culture, and if so what, is much less clear. The fairly large, oval type of house seems to have been built in various parts of Western Europe (Provence, the Hebrides) during the Bell Beaker time. In addition small, generally round huts also occur.

As far as the material remains are concerned, the pottery and the chronological sequence of VBB-BWB-undecorated ware seem to be representative of the period between Neolithic and Bronze Age in this country. The site lies within the VBB area which subsequently formed part of the BWB Culture area. The HVS Culture *s.s.* did not reach the site. The domestic assemblage, especially the BWB association, is very representative for the period and corresponds reasonably well with other domestic groups of this phase. The site gives a dating for the *Bentheimer Riesenbecher* in the very Early Bronze Age.

The flint contrasts with that of the VL Culture, and is very similar to the flint associated with BB, BWB and HVS pottery. The stone material seems representative for the phase. The dating of the ball-shaped polyhedrons to the end of the occupation gains credibility through other associations.

The grave ritual at Molenaarsgraaf is consistent with data known from this country. The transition from E-W to N-S oriented graves, both with the corpse in a crouching position, appears to be one of the characteristics of the transition from BB to BWB Cultures. This transition is very closely dated in Molenaarsgraaf. The BB grave ritual in the Netherlands seems to have been almost entirely borrowed from the PFB Culture. Only in the sex-bound differentiation has an inversion taken place. With this naturally the repertory of grave goods is largely different.

From a European point of view, the E-W orientation is peculiar. The occurrence of this

in England was either an insular development or was introduced from the Netherlands. Originally the BB people must have buried their dead in N-S oriented graves. In many parts of Europe a change in the grave orientation and/or burial ritual seems to have occurred in the beginning of the Bronze Age.

The skeletal material provides us with the first exact anthropological data for the Neolithic in the Netherlands. The presence of the typical Bell Beaker skull, the planoccipital *Steilkopf*, is now confirmed also for the Veluwe Bell Beaker group.

The ox burial conforms to a tradition (scarcely documented) of animal burials in the whole of Western Europe during the Beaker Cultures. The relatively large number in the Netherlands may be attributed to the intensity of research.

By means of the internal chronology of the settlement with the separate occupation phases, the position of the small cemetery, the pollen zones and ^{14}C dates, the prehistoric chronology of the period concerned, 1800-1500 B.C., is more closely defined. The results of the examination of the gully filling form an important basis for the study of the history of the inhabitation of the river clay/wood peat area.

The choice of the settlement terrain would appear to have been very deliberate. Together with landscape factors, apparently trade-strategic factors also played a part. The subsistence economy is very similar to that of the VL and HVS settlements on the coastal ridges. It implies an optimum use of the landscape, which offered similar opportunities. The live-stock was not different from that elsewhere in the Neolithic of the Western Netherlands. The well-dated remains of the domestic horse would appear to be of great importance.

The continuity of occupation in the Molenaarsgraaf-Ottoland-Goudriaan settlement during the transition from the VBB to the BWB Cultures (the crossing of the Neolithic-Bronze Age boundary) offers material for more general considerations on the concepts of continuity and discontinuity in prehistoric times. In our opinion we must make a clear distinction between anthropological, cultural and inhabitation continuity. Within a given culture this applies to its various aspects: aesthetic, technical, economic, religious and social traditions, at least in so far as they are capable of definition. In so doing we cannot escape a subjective choice of what we mean by continuous and discontinuous. An important reason for this is the imprecision of our datings, which puts our view of prehistoric events, as far as the time factor is concerned, out of focus. Neither can we avoid some subjectivity in our definition of a culture: for we must rate a large number of culture elements at their true value and esteem their relative importance. Traditionally, compelled to do so by the material, we have to use primarily flint/pottery/metal implements and ornaments as exponents of the technical and aesthetical traditions, and of burial customs as a religious exponent. That we can only have available a part (of the material part) of a culture, we leave out of consideration.

To what extent is the transition from VBB to the BWB Culture characterized by (dis) continuity ? The frequent occurrence of VBB and BWB sherds on one terrain shows that the inhabitation continuity noticed by us is apparently fairly general. The cultural changes caused no changes in the settlement pattern. It is rather a change which is brought about within or by an established community. The few anthropological data do not permit any pronouncement on this subject. We only remarked that Gerhardt encountered all the elements of the preceding Bell Beaker Culture in the Early Bronze Age cemeteries in the Upper Rhine region and in

the Únětice Culture. In Molenaarsgraaf we found the planoccipital *Steilkopf* in grave II: we dated it to the beginning of the BWB Culture.

This continuity of inhabitation and (hypothetically) of skull types is in contradiction to the changes in the transition from the PFB to the BB Cultures. As far as we can make out it happens only rarely that PFB and BB sherds are found on one terrain. The skull types of both cultures are very different.

The fact that we distinguish two (VBB and BWB) Cultures indicates, however, that in fact a number of culture elements changed more or less at the same time. We have already discussed the burial ritual: it became more simple (no surrounding structures, no grave gifts) and the grave orientation was different. The absence of grave gifts in the BWB graves is one of the reasons for our very incomplete knowledge of the material culture. The absence of a number of elements such as the wrist-guard, the copper dagger, the V-perforated buttons and the tanged-and-barbed arrow-heads, does not indicate that these were (no longer) in use. Only minor changes occur in the flint. Arrow-shaft smoothers are known in the BB Culture as well as in the Early Bronze Age. Both houses at Molenaarsgraaf reveal the same tradition. As new elements may be named the flint dagger of Scandinavian type and the bone ring pendant which, associated with BWB sherds, was found at Velsen [350]. The most striking are the changes in the pottery, in workmanship, form and decoration. In order to understand its origins better it is necessary, however, to have fuller knowledge of the end of the BB Culture. We may mention further the difference in reclamation methods (*landnam*) as a part of the subsistence economy. The difference in food production was, however, not so great that farming at Molenaarsgraaf could not be continued in a similar manner.

There occur therefore a number of changes which are more or less contemporaneous during the transition from the Late Neolithic to the Early Bronze Age. Because an easily recognizable difference exists in comparison with the preceding phase it appears to us justifiable to speak of a new culture. The changes were probably the result of new cultural impulses and contacts in an area stretching from Wales to Southern Sweden. The trade in metal (bronze, gold, tin) from Great Britain to Denmark may have played a part in this process. On the other hand the flint dagger is a Scandinavian element forcing its way westwards. In the Netherlands the beginning of the BWB Culture are best explained by the assimilation of a number of new elements by the existing Late BB Culture. A deeper insight into this process is hindered by the lack of find associations.

We do not want to enlarge on this theme here. We merely wished to suggest that Molenaarsgraaf not only makes possible the reconstruction of a Late Beaker community, but also that data of the kind revealed by Molenaarsgraaf are indispensable for the unravelling of the relationships between the various Beaker Cultures.

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[350] App. I, no. III-34.

APPENDIX I

PREHISTORIC SITES AND FINDS IN THE WESTERN NETHERLANDS, MAPPED IN THE FIGS. 2, 5, 7, 8.

All terrains indicated on the maps are named and arranged according the map legends. The find-places are continuously numbered in each map. References are coded as II-81 (= map II, no. 18), IV-2 (= map IV, no. 2), etc.

Further, the mostly used place-names are given, The description includes as far as possible a short indication of the nature and age of the finds, of the find circumstances and relationships to the geology. The necessarily cursory treatment here means, however, that the descriptions cannot be complete.

In the bibliography reference is made as far as possible (with current periodicals) directly to the publication and page. Sometimes, however, it was shorter or simpler to refer to the bibliography via the author and year of publication. If no references are given the information is from the author's own documentation or observations. No attempt at completeness has been made in the literature mentioned. In particular publications in which an object has been illustrated are named. From "Archeologisch Nieuws" only a selection has been taken and announcements in the "Chronicles" of "Helinium" have generally not been used at all. As far as the terrains in the North-east Polder and the Flevoland Polder are concerned we have generally confined ourselves to a reference to Van der Heide 1965/66.

The find-places in the river clay/wood peat area are complete and fully documented in Appendix III. On the maps of the Western Netherlands, the maps I-IV, only the most importants are given. For various reasons, however, a few important terrains could not be included, namely nos. 39, 43 (VBB, DKS) and 55, 56 (DKS) of App. III.

We have attempted completeness in the list of finds and find-places discovered before 1972, while recent finds have been included as much as possible. When the number of a site is given in brackets, this means that the site is not indicated on the map, but was inserted after the closing of this part of the manuscript.

Nearly all finds are reliable. If the find was made in a secondary position, or its report is unreliable, this is stated. We again draw attention to the fact that a large group of finds which have reached the museums via art dealers has been left out of account, as have most stone and antler axes. A commentary on the contents of the various maps is given in the text (p. 13 f.).

It was only after we finished this part of the investigation, that we got some ideas about

the Late Bronze Age domestic pottery. The sites which may have been occupied in the Late Bronze Age are therefore not indicated as such on the map.

These are:

Westfrisia:	Enkhuizen	— AN 1971 *116-117
	Hoogkarspel	no. IV—31
	Medemblik	no. IV —30
coastal barriers:	Schoorl	no. IV —29
	Velsen-Van Lenneplaan	— Jelgersma *et al.* 1970, 140
	Velsen-PEN, Noorderweg	— idem.
	Velsen-Noordzeekanaal	— idem.
	Langeveld	no. III—48
river clay/	Molenaarsgraaf	— This publication, App. III, nos. 27-28
wood peat area:	Ottoland-Oosteind	no. III —11
	Noordeloos	no. III —20
	Schaik, Leerdam	— This publication, App. III, no. 93

I — Palaeolithic, Mesolithic, Early and Middle Neolithic, before c. 2500 B.C.

Fig. 2

Palaeolithic

1. Cadzand — Some flint artifacts, probably Mousterian and Tjongerian, found on the beach.
AN 1965 *85; Wh 18 1969 233; Wh 19 1970 118-119, 211-212; Wh 20 1971 111-117, 229-236.

2. Ellewoutsdijk — Levalloisian flake, fished up from the Western Scheldt sea arm.
BROB 9 1960 284.

3. Ellewoutsdijk — Worked reindeer antler (Lyngby axe ?), dredged up from the Western Scheldt sea arm.
Wh 9 1960 102-107.

4. Ramspol — Worked reindeer antler, perhaps unfinished Lyngby axe, dredged up north of Kampereiland.
Wh 9 1960 105.

5. Schokland — Tjongerian point and some other flint artifacts from outcropping boulder clay at the NW of the former island of Schokland.
Van der Heide 1955[c] 12 and fig. 10.

Mesolithic

6. Brown Bank, North Sea — Axes, one a perforated *Spitzhacke* (shaft-hole pick), made out of aurochs bones, fished up from a depth of c. 40 m. Early Mesolithic.
BROB 20/21 1970/'71 27-45.

7. Cadzand — Three worked flints, one an A-point, the others perhaps Late Palaeolithic.
Wh 17 1968 78-79; Wh 19 1970 211-212.

8. Colijnsplaat — Basal part of red deer antler showing working in the "groove and splinter" technique, fished up from the Eastern Scheldt sea arm. Early Mesolithic.
BROB 20/21 1970/'71 46-50.

9. Maasvlakte, Europoort — Barbed points (two complete specimens and a fragment), an antler sleeve, a wild boar's tusk chisel, a worked antler and a bone needle(?), found in dredged-up sands. From—25/22 m. NAP. Early Mesolithic.
BROB 20/21 1970/'71 48-53.

10. Volkerak, Willemstad — Small oakwood statuette, found during the building of a dock in the Volkerak at —8 m. NAP in a peat layer and on the underlying coversand.
Van Es 1968; Van Es & Casparie 1968.

11. Schoonrewoerd Donk, Leerdam — Some probably Mesolithic flint artifacts on the top of an outcropping Early Holocene dune. VL and DKS pottery.
Wh 14 1965 119-123 (no. 12).

12. Vianen — Skull with the characteristics of the Mesolithic Téviec type. From the river Lek.
Huizinga 1959 52-56.

13. Koegras, Julianadorp — Some flint flakes on the top of an Early Holocene dune at —4.25 m. NAP, covered with younger sediments. Mesolithic or Early Neolithic.
Du Burck 1959 63; Jelgersma 1961 29.

14. Texel — Flint scraper, Early Mesolithic or Late Palaeolithic, on outcropping Pleistocene.
Wh 19 1970 101.

15. Kuinre — Elk antler shaft-hole adze found before 1957 during digging works.
BROB 20/21 1970/'71 55-57.

16. Spoolde near Zwolle — A very large number (c. 350) of antler axes and other worked antlers. One is the fragment of an elk antler adze (Mesolithic), another a red deer antler T-shaped axe. In the immediate neighbourhood some TRB, VBB and BWB sherds. One sherd of a Pot Beaker or of a pot, related to the Swifterbant ware.
Van der Heide 1962; Hamming *et al.* 1965; BROB 20/21 1970/'71 57.

17. Koerhuisbeek, Deventer — A number of bone and antler implements, found 1968 during dredging works. A socketed adze, made out of an aurochs radius, a fragmentary antler T-shaped axe, four antler axes and a number of pieces with traces of working.
AN 1968 *66, BROB 20/21 1970/'71 53-55.

Early and Middle Neolithic settlements and pottery finds.

18. Zijderveld — Settlement site on the Late Atlantic river course named "Zijderveld stream ridge" beside the former stream channel with main occupation in the Middle Bronze Age (DKS) with numerous plans of round huts, and in the Iron Age with plans of rectangular houses. Some VL finds and indication of earlier occupation (c. 3000 B.C.) in the pollen diagram.
AN 1965 *107 *138; AN 1966 *93; BROB 18 1968 117-129; BROB 20/21 1970/'71 75-88; Vogel & Waterbolk 1972.

19. Hazendonk, Molenaarsgraaf — Top of an Early Holocene dune with finds of the Middle Neolithic (c. 3000 B.C.), VL Culture and the PFB (?), Hybr. B, MBB, VBB and BWB groups. Indication in the pollen diagram of further occupation about 3400 and 4100 (?).
Wh 1965 119-123 (no. 5); AN 1967 *114; This paper part III.

(19a.) Waardhuizen — *Cf.* II-14.

20. Schiedam — Early Neolithic sherd, the round bottom of a pot, tempered with organic material (plant remains), found during the construction of a dock at the shipyard Wilton Feyenoord at a depth of c. 8 m.
Wh 1955 30; Hel 2 1962 19-20; RMO h 1969/1.1.

21. Swifterbant-parcel H 46 — Early Neolithic settlement (hearth places, flint, pottery) and graves on the top of an Early Holocene dune between —5.00 and —5.75 m. NAP. Three comparable sites in the neighbourhood on parcels H 4, H 34 and H 128.
Van der Heide 1965/'66 no. 8; Van der Waals 1972; Ente 1971.

22. Swifterbant-parcel G 41/42 — Early Neolithic settlement and graves on the natural levees of a former river course between —5.50 and —5.75 m. NAP. Covered with circa 40 cm. clay upon which Bell Beaker sherds and a pointed-butted stone adze with oval cross-section (*cf.* Brandt T 24.4 but somewhat smaller) in secondary position. A comparable Early Neolithic site on parcels G 39/44.
Van der Heide 1965/'66 no. 10; Van der Waals 1972; Ente 1971.

23. De Gaste, Meppel — Early Neolithic domestic refuse on the top of an Early Holocene dune.
Van der Waals 1972; comm. Mr O. H. Harsema, Groningen.

Perforated "Breitkeile"

24. Megen	Big perforated *Breitkeil* with conical shaft-hole, from the ground of a newly dug ditch. RMO k 1968/3.1; Van der Waals 1972, no. NBr 2.
25. Spijk	Small, heavely worn, perforated *Breitkeil* with conical shaft-hole, found in 1964 at a big sandpit on the crossing of a Subatlantic former river course and a Gorkum II (= Calais II) stream ridge. Found when digging away the covering sediments. RMO e 1970/2.1; Van der Waals 1972, no. G. 8.
26. Gewande	Characteristic perforated *Breitkeil*, found in 1837, now lost. Van der Waals 1972, no. NBr 3.

Axes

27. Schalkwijk, Heemstede	Carefully formed, pointed-butted axe with straight sides and oval cross-section, sandstone containing feldspar, cf. Brandt T 24.3, but no angle between side and cutting-edge. Found on the oldest coastal barrier (of Spaarnwoude), under the overlying peat. AN 1969 *112; RMO g 1968/12.1.

Antler T-shaped axes.

28. North-east Polder	Antler T-shaped axe, found near the former island of Urk, during dredging work on behalf of the construction of the new polder. RMO g 1938/12.1.
29. Spoolde	*Cf.* I-16.
30. Windesheim	Two antler T-shaped axes among a number of antler implements, dredged up during construction works in 1968. AN 1968 *67.
31. Zandweert, Deventer	Big antler T-shaped axe, collected by the late Mr J. Butter, Deventer, 25 november 1939, together with a number of animal bones (some of these worked) from dredged-up sand. Geologie en Mijnbouw N.S. 3 267.
32. Koerhuisbeek, Deventer	*Cf.* I-17
(33.) North-east Polder	Antler T-shaped axe. Jaarverslag 1970 van de Musea voor de IJsselmeerpolders gevestigd te Schokland en te Ketelhaven, Internal Report no. 299 of the Rijksdienst voor de IJsselmeerpolders, photo at p. 10.

II — First part of the Late Neolithic, c. 2500-2000 B.C.

Fig. 5

VL Culture, settlements and pottery finds

1. De Brabers, Haamstede	VL settlement with house plans on a remnant of a coastal barrier. Trimpe Burger 1958, 1960, 1960/61; Hel 2 1962 20-22.
2. Hekelingen I	VL settlement on the natural levee of a fresh water creek. After covering with Dunkirk O clay: BWB occupation. BROB 4 1953 1-26; Hel 2 1962 13-19; Palaeoh 13 1967 11.
2a. Hekelingen II	VL settlement, discovered during the construction of a gas pipe line 1970, c. 500 m. to the west of Hekelingen I. pers. comm. Mr H. Sarfatij, Amersfoort.
3. Vlaardingen	VL settlement on the natural levees of a brackish tidal creek (Calais IVa). Imported PFB pottery and an A-battle axe. After or during a change in the "régime" of the creek a very short MBB occupation. Wh 7 1958 107-111; Wh 8 1959 106-117; Wh 10 1961 117-123; Hel 2/3 1962/63; Voetspoor 41-65; Hel 9 1969 105-117; Palaeoh 13 1967 10.

4. Voorburg — VL pottery on innermost (oldest) coastal barrier.
Wh 14 1965 174-175; AN 1966 *6, *101.

5. Leidschendam — VL/PFB settlement on the innermost (oldest) coastal barrier.
Hel 7 1967 97-120; Hel 8 1968 105-130.

6. Voorschoten — VL/PFB settlement with stratified deposits. Hybr. B and MBB pottery. On the innermost (oldest) coastal barrier.
Hel 7 1967 3-31; Hel 8 1968 105-130.

7. Zandwerven — VL/PFB settlement on remnant of coastal barrier.
Butter 1935; Van Giffen 1930 160; Wh 5 1965 99-103; Hel 2 1962 7-13, 224-231; Voetspoor 33-40; Palaeoh. 13 1967 12.

8. Hazendonk — *Cf.* I-19.

9. Goudriaan — Flint (among others fragments of polished axes) and VL pottery on the top of an Early Holocene dune.
Wh 14 1965 119-123 (no. 7).

10. Hoog Blokland-site I — VL and to BWB related pottery on the top of an Early Holocene dune.
Wh 14 1965 119-123 (no. 10).

11. Hoog Blokland-site II — Flint and VL pottery on the top of an Early Holocene dune.
Wh 10 1961 128 ("Sliedrecht"); Wh 14 1965 119-123 (no. 10).

12. Schoonrewoerd Donk — *Cf.* I-11.

13. Zijderveld — *Cf.* I-18.

14. Waardhuizen, Almkerk — Top of an Early Holocene dune with finds of the VL Culture (pottery and flint, both phases), PFB (pottery and flint axe fragment), Hybr. B (?) and VBB Beaker groups. One or two sherds might belong to the "Swifterbant" and "Hazendonk" wares.
AN 1968 *124.

(14a.) Bommelse Loo, Bommelerwaard — Some (early) VL sherds, found during building activities in 1972.
Pers. comm. Mr R. S. Hulst, Amersfoort. AN 1973 *28.

PFB and "Hybr. B". settlements and pottery finds

15. Waardhuizen — *Cf.* II-14.

16. Hazendonk — *Cf.* I-19.

17. Vlaardingen — *Cf.* II-3.

18. Leidschendam — *Cf.* II-5.

19. Voorschoten — *Cf.* II-6.

20. Voorschoten — Sherds of a Hybr. B. (Zigzag Beaker) in disturbed situation, but in sand of local origin.
AN 1967 *36.

21. Zandwerven — *Cf.* II-7.

22. Aartswoud — PFB (and other Late Neolithic ?) pottery, on the "Old Land", near the SE corner of the Wieringermeer Polder.
Pers. comm. Dr J. A. Bakker, Amsterdam.

23. Gawijsend — Hybr. B., complete beaker found under a Mediaeval well.
OML 13 1932 46; Wh 4 1955 58-72.

24. Westfriese Sluis — PFB, complete beaker, early type, found in the filling of a prehistoric pit, measuring 40 × 100 cm, and on a depth of c. 1 m.
Wh 4 1955 58-72; Voetspoor 38.

Artifacts, other than axes

25. The Hague, Congress Building — Four-sided portable grinding stone, found on the slope of a coastal barrier and under the overlying peat in a building pit. Probably PFB Culture.
Jelgersma *et al.* 1970 137.

26. Voorschoten — Long scraper, Grand Pressigny flint, on the innermost (oldest) coastal barrier.
Wh 2 1953 45-46; AN 1956 *140.

27. Leiden-De Burcht — Fragment of a *Spandolch* from the old surface under the Mediaeval *Motte*, probably in secondary position.
AN 1969 *5.

Battle axes

28. Linge — Battle axe, type P-2, found in 1885.
Hel 8 1968 233 (no. 9).

29. Oud Zuilen — Facetted battle axe, found about 1923 in the natural levee deposits of the river Vecht.
J. A. Bakker 1958; Hel 8 1968 226.

30. Katwijk aan de Rijn — Battle axe, type P-1, found during sand dredging.
Braat 1953.

31. Vogelenzang-Bekslaan — During extensive sand digging in the Old Dunes between 1895 and 1900, the following objects were found in a restricted area. It is not very probable that they form a hoard or a closed find.
a. battle axe, type K-6,
b. flint dagger of Early Bronze Age type,
c. bronze low-flanged axe,
d. red deer antler beam,
e. a globular and a disk-shaped stone (quartzite),
f. two pieces of amber,
g. sherd of DKS pottery.
Wh 6 1957 95-98; Hel 3 1963 243; Palaeoh. 12 1966/67 108 (no. 43); Palaeoh. 9 1963 43; Voetspoor 89; BROB 18 1968 51 and 95 (no. F 6).

32. Hoogwoud — Battle axe, type P-1, found in 1946 when cleaning a ditch.
Wh 3 1954 94; Voetspoor 39 (note).

33. Koggenrandweg — Battle axe, fragment, found on the surface.
Wh 4 1955 102; Wh 5 1956 6 (no. 13).

34. Gawijsend — Battle axe, fragment.
Wh 5 1956 6 (no. 12).

(34a.) Wieringerwerf — Battle axe, type H, fragment, found in 1966 in agricultural refuse.
AN 1971 *129.

35. Den Burg, Texel — Battle axe, fragment, found on the Hoge Berg, a Pleistocene outcrop.
BROB 8 1957/58 99.

36. North-east Polder parcel E 171 — *Cf.* II-53 (c).

Flint axes

37. Terneuzen — Thin-butted flint axe with oval cross-section, found in 1903 during the construction of a sluice in a peat layer at a depth of —2.50 m. NAP.
Van der Feen 1952; Wh 1 1952 13; Trimpe Burger 1960 686-691.

38. Schonenburgse Heuvel, Nieuw Lekkerland — Pointed-butted flint axe with oval cross-section, found on the top of an Early Holocene dune near the site of the former 14th cent. castle Schonenburg.
Wh. 11 1962 33; Wh 14 1965 119-123 (no 1).

39. Buren — Thin-butted flint axe with oval cross-section, found during drainage work at a depth of about 1 m.
Hel 3 1963 24.

40. The Hague-centre — Thin-butted flint axe with oval cross-section, found in the shore flat west of the oldest coastal barrier.
Wh 9 1960 107-110; Wh 12 1963 62-64.

41. Vronestein, Voorburg — Thin-butted flint axe with oval cross-section, found on the innermost (oldest) coastal barrier.
Wh 9 1960 107-110

42. Rodenburg, Leiden — Small, asymmetrical, roughly formed flint axe, said to be found on the site of the Roman castle.

RMO h 1969/8.1.

42[a]. Voorhout — Small flint adze found in 1954 on the eastern slope of the second coastal barrier.
Data by the author.

43. Lisse — Short flint axe of the "plump VL type". found on the innermost (oldest) coastal barrier, on the landward slope.
Hel 3 1963 101 (note 51).

43[a]. Abbenes — Small flint axe found in 1969 by a farmer when ploughing his field on the top of the Calais III sediments of the Haarlemmermeer Polder.
Data by the author.

(43[b].) Haarlemmermeer — The cutting edge of an axe of a coarse flint or quartzite. Found during the construction of the polder in 1853.
RMO no. JvL 43.

44. Venhuizen — Fragment (cutting-edge) of a flint axe, most probably in secondary position.
AN 1961 *4; Hel 3 1963 101 (note 53).

45. Hoornse burg — Pointed-butted flint axe with oval cross-section and flattened sides.
Wh 5 1956 4 (no. 1); WFO 5 1962 190.

46. Wieringermeer-parcel H 33 — Asymmetrical, thin-butted flint axe with oval cross-section and flattened sides.
Wh 5 1956 4 (no. 2); WFO 5 1962 190.

47. Wieringermeer-parcel H 42 — Three axes, found near a small Pleistocene outcrop:
a. small flint axe with roughly worked sides,
b. broad-butted stone axe with oval cross-section,
c. small stone axe with rectangular cross-section.
Wh 5 1956 2-7 (nos. 3, 8, 9); WFO 5 1962 190.

48. Robbenoordse bos — Somewhat asymmetrical, roughly formed small flint axe. Only cutting-edge polished.
WFO 8 1965 169; AN 1965 *52.

49. North-east Polder section E — Thin-butted flint axe with oval cross-section, found on heavily eroded Early Holocene dunes, west of the former island of Schokland, near the small harbour, together with some pieces of loam and some flint.
Van der Heide 1965/66 no. 2.

50. North-east Polder parcel 0 98 — Thin-butted flint axe with oval cross-section, found near the Bomenweg.
AN 1958 *107.

(51.) North-east Polder — Thin-butted flint axe with oval cross-section and some Pot Beaker sherds, found (probably dredged up) before the construction of the North-east Polder.
RMO d 1938/12.1-2.

Finds attributable to the TRB Culture

52. Wieringen — Big fragment of a half finished *Knaufhammeraxt*, found on Pleistocene outcrop.
AN 1969 *113.

53. North-east Polder parcel E 171 — Three axes found in 1969 on the surface of a Pleistocene outcrop:
a. small, pointed-butted axe with round cross-section, *cf.* Brandt *Taf.* 23.9 but somewhat smaller,
b. flint axe, thick-butted, rectangular cross-section, TRB Culture,
c. battle axe, Glob type K-1.
Pers. comm. Mr G. D. van der Heide, Schokland.

54. North-east Polder parcel P 14 — Pleistocene outcrop near the NE corner of the former island of Schokland with the following finds:
a. pointed-butted stone axe with oval cross-section,
b. TRB sherd and a transverse arrow-head,
c. typical VBB and BWB pottery and Beaker ware with channel-ornament, finger imprints in V-motif, rim cordon and protruding foot,

d. one sherd, richly tempered with pounded quartz showing the construction in broad clay bands; possibly Swifterbant ware.
e. plough marks.
Van der Heide 1965/66 no. 5.

55. Spoolde — *Cf.* I-16.

III — Second part of the Late Neolithic and beginning of the Early Bronze Age. c. 2000-1600 B.C.

Fig. 7

MBB, settlements and pottery finds

1. Hazendonk — *Cf.* I-19.
2. Vlaardingen — *Cf.* II-3.
3. Het Geestje, Monster — Finds of MBB (?), VBB, BWB, HVS and Iron Age pottery, originally stratified, but almost completely disturbed. Plough marks on different levels.
Hel 5 1965 97-117; Wh 14 1965 34-79.
4. Voorschoten — *Cf.* II-6.
5. Oostwoud — Bell Beaker settlement (MBB and VBB) and Middle Bronze Age barrows. At least one grave with well preserved skeleton attributable to the Bell Beaker Culture. Situated on Calais IV^b-sediments.
Hel 1 1961 223-228; WFO 5 1962 194-209; Voetspoor 174; AN 1967 *31; Palaeoh 13 1967 16; Glasbergen 1969 fig. 1.

VBB, settlements and pottery finds

6. Dodewaard — Concentration of VBB sherds within a MBA settlement with two types of houses: long, three-aisled houses and round huts. Situated on a "levee splay"-deposit. One of many comparable MBA sites, discoverd during soil surveys.
AN 1967 *64; BROB 18 1968 117-129; Havinga 1969.
7. Rossum/Alem — Some VBB sherds, dredged up from the river.
AN 1958 *134.
8. Kerkwijk — Two small VBB sherds, isolated finds on the surface amidst Roman and later finds on a complex of different stream ridges.
Modderman 1949^c (no. 44).
9. Waardhuizen — *Cf.* II-14.
10. Hoog Blokland-Nieuwvlietje — Some settlement sites on branches of the former river course named Schaik stream ridge. One, near a break-through channel, with VBB pottery (now lost).
TAG 1955 32; Wh 14 1965 119-123 (no. 12C).
11. Ottoland-Oosteind — Settlement with VBB, BWB, DKS and LBA pottery on a high point of the Schoonrewoerd stream ridge. Fragmentary house plans. Skeleton of a pig (as an offer) buried in a pit (VBB/BWB).
12. Ottoland-De Put — Two settlement sites. One beside a break-through channel through the Schoonrewoerd stream ridge. Some VBB sherds out of test pits.
Wh 14 1965 119-123 (no. 6).
13. Molenaarsgraaf — VBB/BWB settlement with two house plans, three graves and an ox burial. Situated besides a break-through channel trough the Schoonrewoerd stream ridge. Another site, occupied until the LBA in the neighbourhood.
AN 1966 *123; AN 1967 *114; This paper part IV.
14. Hazendonk — *Cf.* I-19
15. Mijnsherenland — VBB sherd dredged up from the river Oude Maas.
Wh 17 1968 80-85.
16. Het Geestje — *Cf.* III-3

17. Veenenburg, Lisse/Hillegom — Former state with extensive sand diggings in the years around 1930. Numerous finds
a. Complete Bell Beaker.
OML 10 1929 *Abb.* 9; OML 14 1933 *Taf.* IV:10; Wh 1 1952 106-107.
b. Flint tanged and barbed arrow-head, BB Culture.
Wh 3 1954 65-68.
c. Flint dagger of Early Bronze Age type and some BWB sherds.
OML 10 1929 8; BROB 18 1968 53 and 94 (no. F 5).
d. HVS sherds.
Glasbergen 1954 fig. 62[e]; Byvanck 1942 *afb.* 16; OML 14 1933 *Taf.* V: 7.
e. Hoard consisting of Ha A 1 bronzes and possibly also a stone axe with oval cross-section and broad, thick butt. A high-flanged axe probably do not belong to the hoard.
Pleyte 1877-1903, Westfriesland P1 VII and p. 19; Butler 1959 134-136.
f. Stone axe, pointed-butted and with oval cross-section, quartzite.
g. Half a perforated axe, gneiss, mapped as a hammer axe, but probably a late type battle axe.
h. A number of antler artifacts.
i. A number of stone artifacts: facetted globular stones, axe fragments used as hammer stones, axes.
b-i. RMO h 1930/7.1-54.
j. Stone axe with rectangular cross-section and broad butt, facetted globular stone and bone awl.
Wh 1 1952 106-107.

(17[a].) Haarlem-Schoterweg — Some Pot Beaker sherds in a humic former surface in the Older Dune sands. ^{14}C date GrN 4635 1730 $\pm$ 40 B.C.
Jelgersma *et al.* 1970 138.

(17[b].) Velsen — Stratified dune deposits, including one layer with both BB and HVS sherds.
Wh 19 1970 304.

18. Oostwoud — *Cf.* III-5.

19. Swifterbant — *Cf.* I-22.

20. North-east Polder parcel C 103 — VBB sherd, decorated with plain spatula, found in *detritus* deposits, which means a secondary position.
Van der Heide 1965/66 *afb.* 1 below, 1955[a] 15; 1955[c] 17.

(20[a].) North-east Polder — *Cf.* II-51.

21. North-east Polder parcel P 14 — *Cf.* II-54.

22. Spoolde — *Cf.* I-16.

BWB settlements and pottery finds

23. Culemborg-Den Heuvel — Two BWB sherds and an Early Bronze Age flint artifact from the sandy filling of a break-through channel through the Schoonrewoerd stream ridge. Extensive Iron Age settlement, DKS pottery as isolated finds.
AN 1966 *61.

24. Hoog Blokland — *Cf.* II-10.

25. Ottoland — *Cf.* III-11

26. Ottoland-Kromme Elleboog — BWB settlement beside a break-through channel through the Schoonrewoerd stream ridge. In a short distance a BB grave with the remains of two individuals.
AN 1969 *70.

27. Molenaarsgraaf — *Cf.* III-13.

28. Hazendonk — *Cf.* I-19.

29. Hekelingen I — Cf. II-2.

30. Botlek — BWB sherd in ground, originating from the 3rd petrol harbour.
Hel 2 1962 18 (note 14).

31. Het Geestje — *Cf.* III-3.

32. Veenenburg — *Cf.* III-17 (c).
33. Vogelenzang-Tweede Doodweg — HVS settlement on coastal barrier of De Zilk. One sherd bears BW impressions.
Hel 3 1963 242; Voetspoor 81-92; Palaeoh 13 1967 13; Glasbergen 1969.
34. Velsen-*Noordzeekanaal* — Finds of BWB, HVS, DKS and LBA or Iron Age pottery in stratification. Bone artifacts and *plough marks, both BWB and later.*
Wh 18 1969 106; 19 1970 34-35, 109; 21 1972 19-22, 78; Jelgersma *et al.* 1970 138-139.
35. Spanbroek — Some very small BWB sherds on Westfrisian I deposits (Calais IV[b]) and covered by Dunkirk O (?) deposits.
AN 1969 *63.
36. North-east Polder section H — Big BWB sherd, found "in the Unio clay (= Calais IV[b]) near Tollebeek". Dating of clay, however, not certain.
Van der Heide 1965/66 *afb.* 1, 1955[a] fig. 8.
37. North-east Polder parcels J 77/78 and J 110/111 — Early Bronze Age settlement on levee of former river course near the Nageler Weg. Flint, antler, BWB pottery. Somewhat disturbed by later erosion.
Van der Heide 1965/66 no. 3.
38. North-east Polder parcel P 14 — *Cf.* II-54.
39. Spoolde — *Cf.* I-16.

Flint arrow-heads

40. Cadzand — Short-tanged arrow-head, found on the beach.
AN 1962 *166.
41. Haamstede, Schouwen — Objects from the Old Dune Lanscape, found by J. A. Hubregtse, now in the Middelburg Museum:
a. Two flint arrow-heads, one leaf shaped, the other tanged.
b. Bronze spearhead and a bronze socketed arrow-head. Not dated.
c. Middle Bronze Age side-looped pin.
Wh 7 1958 14-18; Palaeoh 5 1956 73-76.
d. Late Bronze Age fibula.
Trimpe Burger 1958, 1960/61; Van der Feen 1952 and Van der Feen in: Bennema & Van der Meer 1952.
42. Kesteren — Hollow-based arrow-head and some flint flakes, found at a depth of more than 1 m.
AN 1969 *5.
43. Vechten — Tanged and barbed arrow-head, found during the excavation of the Roman fortress.
Wh 3 1954 65-68; RMO VF 866.
44. Scheveningen — Tanged and barbed arrow-head, found in 1923 on the 4th coastal barrier.
Wh 3 1954 65-68.
45. Katwijk — Broad-tanged arrow-head found in 1951 during sand digging in the dunes.
Wh 3 1954 65-68.
46. Katwijk Binnen — Arrow-head with long tang and short barbs, found in 1854 in sand, containing shells.
Pleyte 1877-1903, Batavia Pl. X 10; Wh 3 1954 65-68.
47. Veenenburg — *Cf.* III-17 (b).
48. *Langeveld*, Noordwijkerhout — *Extensive sand digging on one of the younger coastal barriers with finds of different periods,* originally partly in stratified deposits:
a. Sögel type arrow-head.
Wh 8 1959 25-29; Hel 3 1963 244.
b. Bone material, Early Bronze Age?
Palaeoh 13 1967 13.
c. Perforated antler axe.
Wh 8 1959 36-37.
d. Flint sickle blade (fragment).
Wh 7 1958 72-73.

e. DKS, "Hoogkarspel", and Iron Age pottery.
Wh 8 1959 25-29, 75-79; Wh 15 1966 30-49, *cf.* WFO 11 1966 214 (note 18).

49. Schalkwijk, Heemstede — Tanged and barbed arrow-head. HVS Culture.
Wh 15 1966 116.

50. Andijk — Tanged arrow-head.
Van Giffen 1944 188 (note); Wh 3 1954 65-68.

51. Medemblik — Sögel type arrow-head, found in the neighbourhood of MBA settlement.
AN 1968 *138.

52. Zwaagdijk — Sögel type arrow-head, surface find.
AN 1970 *44.

Various artifacts

53. Biesheuvel — Late Neolithic (Bell Beaker?) flint artifacts and DKS pottery on the Babyloniënbroek stream ridge.
AN 1967 *113.

(54.) disposed

55. Voorhout — Flint dagger of Early Bronze Age type.
BROB 18 1968 (no. Ia 16).

(56.) De Zilk — *Cf.* IV-42 (a).

57. Lisse — Wrist guard.
Collection IPP, Amsterdam.

58. Veenenburg — *Cf.* III-17 (c).

59. Vogelenzang — *Cf.* II-31 (b).

(59[a].) Heemstede — Oval flint knife, worked at two sides in a superficial retouche. Found in 1971 in ground of a small harbour at the east slope of the coastal barrier.
Data of the author.

60. Andijk — Flint dagger of Early Bronze Age type (?).
BROB 18 1968 101 (no. Z1).

61. Opperdoes — Flint dagger of Early Bronze Age type (?).
BROB 18 1968 104 (no. Z 14).

62. North-east Polder parcel M 131/132 — Flint dagger together with some flint flakes on a Pleistocene outcrop.
Van der Heide 1965/66 (no. 1); BROB 18 1968 78 (no. II 10).

IV — Bronze Age, with the exception of the BWB Culture. 1600-700 B.C.

Fig. 8

HVS settlements and pottery finds

1. Het Geestje — *Cf.* III-3.

2. Kijkduin, The Hague — Stratified occurrence of some HVS sherds below deposits with Iron Age remains on coastal barrier.
Wh 5 1956 10-12; Hel 1 1961 141-146; Voetspoor 81-92.

3. Veenenburg — *Cf.* III-17 (d).

4. Vogelenzang — *Cf.* III-33.

(4[a].) Velsen — *Cf.* III-17[b].

5. Velsen — *Cf.* III-34.

MBA settlements and pottery finds

5[a]. Ewijk — Two MBA settlements on clay covered with natural levee deposits, at a depth of 50-60 cm.
AN 1970 *90-91: 1971 *2.

6. Dodewaard — *Cf.* III-6.

7. Opheusden	MBA pottery on an old surface at a depth of 60-70 cm. AN 1960 *267.
8. Kesteren	MBA pottery on an old surface below a Roman settlement (*woerd*). *A second site with MBA pottery at a depth of 75 cm.* Modderman 1955[d] 31-32; AN 1971 *36.
9. Maurik	MBA occupation level at a depth of 50-55 cm. AN 1967 *102.
10. Zoelen	MBA pottery and later finds (La Tène glass armring fragments, Roman pottery) on the site Op de Beldert. AN 1969 *122.
11. Meteren	Some MBA sherds found on the Roman settlement site in the centre of the village. Data by the author.
12. Culemborg	*Cf.* III-23.
13. Zijderveld	*Cf.* I-18.
14. Overboeicop	DKS and Iron Age pottery finds (settlement) on the Zijderveld stream ridge, beside the former channel. Data by the author.
15. Mariahoeve, Hei- en Boeicop	DKS settlement on the Zijderveld stream ridge. Data by the author.
16. *Hei- en Boeicop*	*DKS settlement on the Zijderveld stream ridge beside two former stream-channels.* AN 1964 *310.
17. Schoonrewoerd Donk	*Cf.* I-11.
18. Hoge Woerd-Genderen, Wijk en Aalburg	DKS settlement beside a small gully on the Babylonënbroek stream ridge. AN 1967 *103.
19. Biesheuvel	*Cf.* III-53.
20. Noordeloos	DKS, LBA and Iron Age settlement(s) on a high point of the Schoonrewoerd stream ridge. Data by the author.
21. Ottoland	*Cf.* III-11.
22. Molenaarsgraaf	*Cf.* III-13.
23. Benschop	MBA occupation on the Blokland stream ridge beside a break-through channel. Data by the author.
24. Kijkduin, The Hague	DKS pottery on coastal barrier. Wh 5 1956 10-12, 18-23, 34-39; Wh 10 1961 73-76.
25. Langeveld	*Cf.* III-48 (e).
26. Vogelenzang	*Cf.* II-31 (g).
27. Haarlem	DKS sherds (?), flint, Iron Age pottery and iron slag in a building pit at the Jansstraat. Wh 11 1962 121-122; Hel 4 144 (no. 57).
28. Velsen	*Cf.* III-34.
29. Schoorl	Stone-gritted, probably MBA-LBA pottery on "*plek* II". Wh 6 1957 2-5; Wh 13 1964 42-46, 69-74, 149-150; pers. comm. Mr A. Schermer, Schoorl.
30. Medemblik	MBA settlement with house plans, plough marks and a barrow. AN 1968 *77 and *137, 1970 *4.
31. Hoogkarspel	Extensive settlement area with house plans, plough marks and barrows. MBA until the beginning of the Iron Age. WFO 9 1966 168-224; WFO 10 1967 202-226; WFO 11 1968 193-199; Voetspoor 103-109.
32. Zwaagdijk, Wevershoof	Settlement, barrows and flat graves, MBA. *Van Giffen 1944; WFO 1961 52-96; Voetspoor* 98-102 (barrows); WFO 7 1964 205-258; BROB 14 1964 27-35; Palaeoh 13 1967 14-15 (settlement and flat graves).

Middle Bronze Age barrows

33. Oostwoud — *Cf.* III-5.
34. Medemblik — *Cf.* IV-30.
35. Hoogkarspel — *Cf.* IV-31.
36. Zwaagdijk — *Cf.* IV-32.
37. Grotebroek — MBA barrows
WFO 2 1959 148-154; Van Giffen 1953.
38. Enkhuizen — Two Bronze Age barrows.
WFO 6 1963 234.

Bronzes, Early Bronze Age

39. Loosduinen — Bronze *Vollgriffdolch*, now in the Museum für Früh- und Vorgeschichte, Berlin, found in a peat layer under 3-4 m. sand.
Pers. comm. Dr W. H. Zimmermann, Wilhelmshaven.
40. Wassenaar — High-flanged axe with low stop-ridge. Irish import.
OML 10 1929 6; Holwerda 1925 *afb.* 25.
41. Veenenburg — *Cf.* III-17 (e).
42. De Zilk, Noordwijkerhout — Extensive sand digging on a relatively young coastal barrier, from where the following finds:
a. Wooden bow, Early Bronze Age.
Wh 1 1952 74-77; BROB 3 1952 43; PPS 29 1963 50-98 esp. 68 and 92; Glasbergen 1969 29.
b. Bronze spearhead, Early Bronze Age.
Hel 3 1963 241-245.
c. Hoard consisting of a spearhead and a palstave, Late Middle Bronze Age.
OML 10 1929 16; Wh 1 1952 74-77; Hel 3 1963 241-245.
d. Perforated mace head (?), quern stone and perforated antler sleeve.
Wh 1 1952 106-109.
43. Vogelenzang — *Cf.* II-31 (c).
44. North-east Polder — Flat axe, found on Pleistocene outcrop.
Van der Heide 1955[a] 22, 1965/66 200-214.

Bronzes, Middle Bronze Age

45. Haamstede — *Cf.* III-41.
46. Dreischor, Schouwen — Palstave, out of a collection old metal, collected by a farmer from his land.
Wh 15 1966 54.
47. Augustapolder, Bergen op Zoom — Palstave, found during the digging of an anti-tank-ditch in 1943.
Pers. comm. Dr J. J. Butler, Groningen.
48. Bodegraven — Looped spearhead identical to the spearhead from Oudenaarde, English import, dredged up from the river Oude Rijn during World War II.
Pers. comm. Prof Dr W. Glasbergen; see also Glasbergen & De Laet 1959 Pl. 31.
49. Liesbos, Jutphaas — Ceremonial sword of type Ommerschans-Plougrescant, but smaller than these.
BROB 20/21 1970/'71. 301-309.
50. Eimeren, Elst (Gld.) — Palstave, found during deep-ploughing.
AN 1968 *53.
51. The Hague — Palstave, found at the De Savorin Lohman Plantsoen.
Wh 16 1967 125; Wh 17 1968 203 and 211.
52. The Hague — Palstave, found at the Nieboerweg.
Wh 13 1964 3; Wh 17 1968 212.
53. Scheveningen — Palstave, found on the 4th. coastal barrier in or before 1926.
Wh 13 1964 2-7, fig. 1.

54. Voorhout — Hoard, consisting of 17 palstaves, a high-flanged axe and a lugged chisel.
OML OR 2 1908 45-46; OML 10 1929 17; Butler 1959 131-134; Palaeoh 9 1963 52.

55. Noordwijkerhout — Pin with disc head from the sandpit Guldenmond.
Hel 3 1963 244 (h) [*N.B.* h) and g) are interchanged on the map].

56. De Zilk — *Cf.* IV-42 (e).

57. Veenenburg — *Cf.* III-17 (e).

58. Heilo — Hoard, consisting of one bronze and four flint sickle blades, found on the coastal barrier SW of Heilo. Dating uncertain.
OML 43 1962 107-115.

59. Wieringermeer-parcel H 21 — Palstave.
Van der Heide 1955[a] 22; WFO 5 1962 192.

60. Marken — Spearhead, probably MBA, dredged up 12 km. east of the island Marken.
Modderman 1945 19; Van der Heide 1955[a] 22.

61. North-east Polder parcel F 39 — Palstave, found near the village Bant.
Pers. comm. Mr G. D. van der Heide, Schokland.

Bronzes, Late Bronze Age.

62. Elst — Late Bronze Age pin (Ha A2), found at the excavation of the Roman temples under the church.
Bogaers 1955 42 and Pl. 38.4.

63. Elst — Socketed axe, found in 1949 in digging at the banks of the river Linge at a depth of 1.40 m.
Bogaers 1955 42.

64. Elst — Mid-winged axe.
Mus. Arnhem BH 123; Pers. comm. Dr J. J. Butler, Groningen.

65. Bemmel — Socketed axe of the Hunze/Eems bronze industry, undecorated.
NDV 79 1961 199-233. Mus. Arnhem GAS 35.

66. Herveld — Socketed axe of the Hunze/Eems bronze industry and flint sickle blade.
Pleyte 1877-1903, Batavia Pl V; Wh 6 1957 32; NDV 79 1961 199-233.

67. Opheusden — At least two Ha A bronzes (razor and pin), found in 1911 in digging clay, together with Roman coins and two Merovingian pots.
BROB 12/13 1962/'63 187-191.

67[a]. Diefdijk — Socketed axe of the Hunze/Eems bronze industry, said to be found during ground work near the Diefdijk, west of Geldermalsen. Find-circumstances not very reliable.
RMO e 1937/7.1.

(67[b].) Haringvliet — Spearhead, found in 1972 during construction works.
Pers. comm. Mr H. Sarfatij, Amersfoort.

68. Monster — Socketed axe, western import, found near the watertower.
Wh 3 1954 91; Palaeoh 9 1963 89; Wh 13 1964 4.

69. The Hague — Socketed axe with *lappen*-decoration.
Wh 13 1964 5

70. The Hague — Socketed axe with *lappen*-decoration.
Wh. 13 1964 5.

71. Scheveningen — Socketed axe, found in 1884 when a channel was dug, "lying under a peat layer".
Wh 8 1960 110.

72. Voorschoten — Socketed knife, found on the oldest coastal barrier.
Wh 13 1964 5.

(72[a].) Katwijk — Small spearhead found in november 1972 on the beach, south of Katwijk.
Data by the author.

73. Noordwijkerhout — Small socketed axe of the Hunze/Eems bronze industry, found near the house Druivestein at the Zilk.
RMO h 1956/6.1.

74. Velsen — Socketed axe of the Hunze/Eems bronze industry, dredged up.
Data of the author.

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75. Diemen — Mid-winged axe, most probably dredged up in the IJsselmeer near Diemen.
AN 1967 *36.

Bronzes, not dated

76. Enkhuizen — Spearhead, found in the polder Grootslag near the Mijndersloot.
Wh 7 1958 74; WFO 2 1959 147.

77. Bovenkarspel — Spearhead.
Pers. comm. Dr J. J. Butler, Groningen.

78. Venhuizen — Spearhead, found near the Kerkbuurt.
Wh 12 1963 104.

79. North-east Polder parcel J 122 — Spearhead, found during the digging-up of potatoes, near the Nageler weg.
AN 1958 *183; Van der Heide 1965/66 200/214.

Hammer axes

80. St. Maartensdijk — Hammer axe.
Hel 4 1964 68 (no. 70).

81. Brouwershaven — Hammer axe, "lydite-like "stone.
AN 1962 *163.

82. Rockanje — Hammer axe, made of gabbro, originating from the Strijpse Dijk and there in secondary position.
Wh 10 1961 55-59.

83. Noordwijkerhout — Top fragment of a hammer axe (type Muntendam ?), on coastal barrier near Ruigenhoek.
Wh 13 1964 160-161.

84. Veenenburg — *Cf.* III-17 (g).

85. Hillegom — Hammer axe, made of "hornblend-diorite", found in 1910.
Wh 4 1955 12-14.

86. Uitgeest — Hammer axe.
OML 10 1929 16.

(86a.) Limmen — Fragment of perforated stone axe.
Cordfunke 1969.

87. Sijbekarspel — Hammer axe, type Muntendam.
WFO 3 1960 129-132; Hel 1 1961 132-134.

88. Wieringermeer — Hammer axe, type Muntendam, exact findspot unknown.
Wh 5 1956 6 (no. 11); WFO 5 1962 190.

89. Texel — Fragment of perforated axe, found on a Pleistocene outcrop named De Hooge Berg.
AN 1964 *331.

90. Enkhuizen — Hammer axe, found in secondary position, 400 m. west of Gelderse Hoek, north of Enkhuizen.
AN 1970 *45.

91. North-east Polder Urk — Half-finished, big hammer axe, found north of the former island Urk.
Van der Heide 1955a 14.

92. North-east Polder Urk — Fragment (cutting-edge) of a hammer axe, found north of the former island Urk.
Van der Heide 1955a 14, 1955c 15.

93. North-east Polder De Voorst — Hammer axe, type Muntendam.
Van der Heide 1955a 15, 1955c 14.

APPENDIX II

DATA USED IN THE DIAGRAM AT FIGURE 11

No.	No. App. I	Site	Finds/Lit.	Dates	Underlying deposits	Meaning of the depths	Depths (m. below NAP)	Compaction (estimated, cms.)
1	I-10	Volkerak, Willemstad	Wooden statuette Van Es & Casparie 1968	GrN 4922 4450 ± 85	Pleistocene cover sands	depth of find	— 8	none
2	I-21	Swifterbant-parcel H46	1) Early Neolithic settlement and graves	(before 3300)	Early Holocene dune	top of dune and lower limit of settlement traces	— 5.00/— 5.75	none
			2) peat sample Van der Heide 1965/66. Ente 1971. Vogel & Waterbolk 1972	GrN 5067 3660 ± 60	slope of Early Holocene dune	depth of sample	— 6.15	none
3	I-22	Swifterbant-parcel G41/42	Early Neolithic settlement and graves Van der Heide 1965/66. Ente 1971. Vogel & Waterbolk 1972	GrN 5443 3350 ± 40 5606 3590 ± 65	estuarine creek levee (C II)	depth of occupation level	— 5.30	some
4	I-13	Koegras, Julianadorp	1) Some flint flakes	(before 2800)	Early Holocene cover sand hill	top of the hill	— 4.25	none
			2) Peat sample Du Burck 1959 Jelgersma 1961	GrN 467 2975 ± 210	slope of Early Holocene cover sand hill	depth of sample	— 4.70	none
5	II-3	Vlaardingen	1) VL Culture settlement, PFB finds	GrN 4948 2180 ± 40 2480 2240 ± 70 2304 2300 ± 75 2487 2330 ± 100 2303 2380 ± 60 2306 2460 ± 100 4114 2470 ± 120	natural levees of estuarine creek (C IV[a])	depth of occupation level: highest point and limit of peaty gully deposits wood preserved at house sites	— 3.00/— 3.20	likely (30)
			2) MBB occupation of very short duration Van Regteren Altena *et al.*, 1962/63. Vogel & Waterbolk 1972	— — 1940 ± 25 (mean of four measurements)	natural levees of estuarine creek (C IV[b])	occupation level wood preserved	— 2.80	likely (30)

No.	No. App. I	Site	Finds/Lit.	Dates	Underlying deposits	Meaning of the depths	Depths (m. below NAP)	Compaction (estimated, cms.)
6[a]	II-2	Hekelingen	1) VL Culture settlement	GrN 254 2250 ± 120 684 2120 ± 85	natural levees of estuarine creek (C IV[a])	depth of occupation level; highest point and limit of peaty gully deposits	—2.10/—2.80	likely (30)
			2) BWB occupation	(1700-1600)	clayey deposit overlying the VL settlement (C IV[b])	occupation level	—1.90	likely (30)
			Modderman 1953					
6[b]	II-2[a]	Hekelingen II	VL Culture settlement	(2200)	natural levees of estuarine creek (C IV[a])	occupation level	—2.70/—2.90	likely
			Pers. comm. Dr J. A. Bakker, Amsterdam					
7	II-5	Leidschendam	VL Culture settlement, PFB finds	GrN 5027 1710 ± 60 5028 1860 ± 60 5029 1710 ± 80	Older Dunes on coastal barrier (C III)	occupation level	—0.90/—1.10	none
			pollen diagram L3	(VL Culture)	shore flat	two depths with human influence on the vegatation (*Cerealia*, *Plantago*)	—2.85 —3.15	none
			Glasbergen *et al.* 1967 Groenman-van Waateringe *et al.* 1968					
8	II-6	Voorschoten-cutting 17	Peat-filled depression with stratified VL Culture remains	GrN 4908 2030 ± 60 (a) 4907 2130 ± 70(b) 5031 2080 ± 40(c) 4906 2140 ± 50(d)	Older dunes on coastal barrier (C III)	charcoal from layer no : 10 (a), 8 (b), 4 (c), 2 (d)	—0.90 —1.10 — —1.40	none
			Glasbergen *et al.* 1967 Groenman-van Waateringe *et al.* 1968					
9	II-7	Zandwerven	VL Culture settlement, PFB finds	GrN 2221 2040 ± 65 1583 2710 ± 55	Sandy coastal barrier (top at —2.50) covered with low dunes (C III)	occupation levels : — 1929 excavation — 1957/58 excavation	—1.00/—1.50 —2.30 —1.30/—1.70	none
			Van Giffen 1930 Van Regteren Altena *et al.* 1962/63					
10	I-19	Hazendonk, Molenaarsgraaf	Weathered surface in the peat deposits; correlation with VL Culture This paper, part III	GrN 5175 2340 ± 40	slope of Early Holocene dune	depth of dated surface at "juncture" to the dune slope	—2.90/—3.10	none
11	II-37	Terneuzen	Flint axe of "Vlaardingen type", found 1903 Van der Feen 1952	(2400-2000)	in a peat layer	depth of find	—2.50	some

No.	No. App. I	Site	Finds/Lit.	Dates	Underlying deposits	Meaning of the depths	Depths (m. below NAP)	Compaction (estimated, cms.)
12	—	Bornwird	Settlement with VL - like pottery and PFB sherds Pers. comm. Prof. Dr. Van der Waals, Groningen Vogel & Waterbolk 1972	(2300-2000) before GrN 5295 1980 ± 50	Late Glacial deposits	occupation level, plough marks	— 0.70/— 1.20	none
13	III-5	Oostwoud	1) BB settlement and grave	(1900-1700)	sandy creek ridge, West-frisian deposits I (C IV^b)	occupation level	— 1.50/— 1.70	about 80
			2) MBA barrows Van Giffen 1961, 1962, 1966	GrN 797 1075 ± 80	*id.*	base level	— 1.50/— 1.70	about 80
14	III-12	Molenaarsgraaf	1) VBB/BWB settlement and graves	GrN 5132 1830 ± 50 5176 1690 ± 30 5705 1685 ± 60 5131 1685 ± 40 5566 1680 ± 40	sandy stream ridge (C IV^b)	occupation level : highest point and "juncture" to gully deposits	— 0.80/— 1.60	none
			2) MBA occupation This paper : part IV	GrN 5177 1400 ± 35		*id.*	— 0.80/— 1.40	none
15	IV-23	Benschop	MBA occupation unpublished	GrN 5356 1010 ± 60	sandy stream ridge undated	highest point of occupation level	— 0.70	none
16	IV-20	Noordeloos	settlement site MBA - Iron Age unpublished	(at least 1200-600)	sandy stream ridge (C IV^b)	highest point of occupation level	— 0.60	none
17	IV-53	Biesheuvel	BB and MBA settlement site unpublished	GrN 5357 1175 ± 40	sandy stream ridge undated	highest point of occupation level	+ 0.10	none
18	IV-18	Wijk en Aalburg	MBA refuse in small gully unpublished	(1400-1000)	sandy stream ridge undated	highest point of occupation level	+ 0.60	none
19	I-13	Zijderveld	1) MBA settlement	GrN 5376 1420 ± 80 5220 1315 ± 60 5219 930 ± 35	sandy stream ridge (C III)	occupation level : highest point and "juncture" to gully deposits	+ 0.20/+ 0.75	some ?
			2) Iron Age settlement Pers. comm. Mr. R.S. Hulst, Amersfoort J. de Jong 1970/71 Vogel & Waterbolk 1972	GrN 5574 715 ± 80 5351 665 ± 100 5573 450 ± 65 5352 200 ± 90 5218 310 ± 30		*id.*	+ 0.15/+ 0.40	some ?

No.	No. App. I	Site	Finds/Lit.	Dates	Underlying deposits	Meaning of the depths	Depths (m. below NAP)	Compaction (estimated, cms.)
20	III-16	Dodewaard	1) VBB domestic refuse	(1800)	"levee splay" deposit in back swamp. Probably C IV^b	occupation level	+ 6.20/+ 6.30	very little
			2) MBA settlement	(*c.* 1200)	*id.*	occupation level	+ 6.30/+ 6.20	very little
			Pers. comm. Mr. R. S. Hulst, Amersfoort					
21	IV-32	Zwaagdijk	MBA settlement and barrows	GrN 4243 1250 ± 60 2359 1065 ± 35 2168 1015 ± 45	sandy creek ridge, Westfrisian II deposits (D O)	base levels of barrows	— 1.60/— 1.75	about 80
			Van Giffen 1944 Modderman 1964			occupation level	— 1.40/— 1.60	
22	IV-37	Grotebroek*	MBA barrows	GrN 160 975 ± 40	sandy creek ridge, Westfrisian II deposits (D O)	base level of barrows	— 1.50/— 1.70	about 80
			Van Giffen 1953					
23	IV-31	Hoogkarspel site D	1) MBA barrows nos. II, III** on ploughed soil	GrN 5050 1070 ± 40	sandy creek ridge, Westfrisian II deposits (D O)	preh. ploughed soil (base) *id.* (top)	— 1.03/— 1.25 — 0.80/— 1.05	about 80
			2) LBA-Iron Age settlement on the barrows	GrN 5051 730 ± 50 5048 700 ± 45				
			Bakker & Brandt 1966					
24	IV-31	Hoogkarspel - site F	LBA-Iron Age settlement	(750-600)	Westfrisian II deposits (D O)	preh. ploughed soil (base) *id.* (top) present surface (top)	— 1.20/— 1.60 — 1.00/— 1.40 — 0.70	about 80
			Bakker & Metz 1967					
25	—	Ezinge	Artificial *terp* mound Early Iron Age till recent	(600 B.C./recent)	bank of tidal creek in salt marsh deposits	occupation level on salt marsh 600 B.C. top of first artif. mound	— 0.20 + 1.20	some (20) some
			Van Giffen 1936, 1954, 229					
26	—	Escamppolder, Loosduinen	Iron Age settlement (R-W III)	(400-200)	peat landscape with rests of coastal barriers	"juncture" of inhabited surface to sandy heights	— 0.75	none
			Bennema 1954, 45 Modderman 1955					

No.	No. App. I	Site	Finds/Lit.	Dates	Underlying deposits	Meaning of the depths	Depths (m. below NAP)	Compaction (estimated, cms.)
27	—	Leiden, Bosch en Gasthuis Polder	Iron Age settlement (R-W II, III) Bennema 1954, 45	(500-200)	deposits of small estuarine creeks	highest points of occupation level	— 0.50	some (20)
28	III-23	Culemborg	Iron Age settlement Unpublished	GrN 5001 260 ± 50 4945 650 ± 70 4946 670 ± 50 4947 410 ± 75	sandy stream ridge (C IV[b])	highest point of occupation level limit peaty gully deposits	+ 1.40 0.00/+ 0.20	none none
29	—	Valkenburg	Roman fortress, 6 phases, artificial elevation Van Giffen 1921, 1954, 1954[a]	A.D. 32-240	natural levee of the river Rhine	occupation level of phase: 1:A.D. 42/ 44 3:A.D. 47/ 69 6:A.D.210/240	— 0.30/ 0.00 + 0.60/+ 1.00 + 1.75	some
30	—	Arentsburg	Roman settlement Van Giffen, 1921, 1954	A.D. 85 - middle 3rd cent.	coastal barrier	highest point occupation level top of synchronous clay wood preserved below	+ 1.00 — 0.10 — 0.47	none
31	—	Rijswijk	Roman settlement Bloemers 1968, 1969, 1970	mid. 1st-begin 3rd cent.	thin clay deposit over a sandy height	highest point of occupation level (begin-end of occupation)	— 0.15/+ 0.15	none
32	—	Tuinster Wierden, Leens	young artificial mound Bennema 1954, 53-54 Van Giffen 1940	A.D. 650-recent	levee deposits in young salt marsh	base level artificial mound	+ 0.80/+ 1.00	some ?
33	—	Godlinze	cemetery Bennema 1954, 53-54	begin 7th cent.	young salt marsh deposits, near a ridge	original surface level	+ 0.85/+ 1.05	none ?
34	IV-30	Medemblik	1) MBA barrow 2) Carolingian occupation H. H. van Regteren Altena & J. A Bakker 1968	(1200-1000) 8th-9th cent.	Westfrisian deposits peaty clay	base level height of "juncture" of peaty clay to barrow	— 1.30 — 0.90	about 80 ? about 80 ?

* Van Giffen (1954, 227) mentions erroneously 1.20 — N.N.

** Tumulus I (Bakker 1959) has its base at — 1.50 (base of plough marks at — 1.74). This barrow is situated at some distance from the barrows II and III.

APPENDIX III

LIST OF PREHISTORIC AND ROMAN SITES AND FINDS IN THE RIVER CLAY/WOOD PEAT AREA, MAPPED IN FIG. 18

In the following list all sites are briefly described under the following headings:

a: municipality and name
b: physiographic situation
c: finds
b: find circumstances
e: literature

The list contains all sites and finds of the Roman Age and earlier. The observations and data of the author are supplemented by documentation of Stiboka, ROB and RMO and by some data of the Municipal Museum at Arnhem, the BAI and the Royal Coin Cabinet in The Hague. As will be seen most sites are discovered during soil surveys and by AWN members, that is by the work-group Lek en Merwestreek, lead by Mr. H. A. de Kok from Hardinxveld.

When the number of a site is given in brackets, this means that the site is not indicated on the map, because of the unreliable find report or because it was inserted in the list after closing of this part of the manuscript.

The finds are, with a few exceptions, in the RMO, Leiden.

ALBLASSERWAARD

1 a *Alblasserdam—Souburg*
b Natural levee of the Alblas stream.
c Among numerous sherds of mediaeval pottery (11th - 14th cent.) one small Roman sherd (grey varnished ware).
d Site of a former castle. Grassland. Collected by AWN-members about 1966.

(1a) a *Alblasserdam—Souburg*
b Natural levee of the Alblas stream.
c Six roman coins covering the period from the birth of Christ till about 270 A.D. (Germanicus, Claudius, Hadrian, Gordian, Claudius Gothicus, Gallienus).
d According to a note in the BAI archives the coins were part of the collection of Mr G. van der Lee from Oudewater. They were said to have been found at this site in 1938. We owe this information to Mr G. J. van den Beemt. The find is considered by us as unreliable.

2 a *Oud Alblas—Noordzijde*
b Natural levee of the Alblas stream.
c One small Roman sherd (grey varnished ware) among sherds of mediaevel pottery (11th-14th cent.).
d Arable land beside a farm. Collected from the surface by Mr G. van den Beemt, Alblasserdam.

3 a *Oud Alblas—Kooiwijk*
b Natural levee of the Alblas stream.
c One small Roman sherd (grey varnished ware) among sherds of mediaeval pottery (11th-14th cent.).
d Small artificial mound. Collected by AWN-members during diggings on behalf of construction works in 1967.
e AN 1967, *90-*91.

4 a *Oud Alblas—village*
b Natural levee of the Alblas stream.
c Some small, possibly Roman, terra nigra-like sherds.
d Collected by AWN-members during diggings on behalf of house building in 1968.

5 a *Alblasserdam—site 2 (Cable Factory)*
b Alblasserdam creek ridge, below a c. 60 cm. clay cover.
c Roman settlement yielding numerous finds (2nd cent.).
d Discovered during the soil survey 1954. Small rescue excavation by AWN-members during construction works 1964.
e Wh 10, 1961, 125-126; Wh 11, 1962, 61, 123-124; Van den Beemt 1967.

6 a *Alblasserdam—site 1 (Cable Factory)*
b Alblasserdam creek ridge, below a c. 80 cm. clay cover.
c Roman settlement yielding numerous finds (late 1st-beginning 3rd cent.).
d Small rescue excavation by AWN-members during construction works 1962.
e See No. 5; Wh 13, 1964, 47-48.

7 a *Alblasserdam—site 3a*
b Alblasserdam creek ridge, below a c. 60 cm. clay cover.
c Roman settlement yielding many finds (2nd-3rd cent.).
d Discovered by AWN-members. Finds collected from the surface (arable land) and from a test pit 1965.
e Van den Beemt 1967.

8 a *Alblasserdam—site 3b*
b Alblasserdam creek ridge, below a 50-60 cm. clay cover.
c Roman settlement yielding numerous sherds.
d Collected by Mr G. van den Beemt from a trench, dug on behalf of the water works 1972.

9 a *Alblasserdam—site 4*
b Alblasserdam creek ridge, below a c. 40 cm. clay cover.
c Roman settlement site.
d Discovered by the late Mr H. Voogd, Giessen, and Mr H. A. de Kok, Hardinxveld, 1961. Finds also collected from the surface and from a test pit by Mr G. van den Beemt, Alblasserdam, 1966.
e Van den Beemt 1967.

10 a *Alblasserdam—site 5*
b Alblasserdam creek ridge.
c Some Roman sherds.
d Parcel disturbed by sand digging. Collected from the surface (arable land) by Mr G. van den Beemt, Alblasserdam, 1967.
e Van den Beemt 1967.

11 a *Oud Alblas—site 6*
b Alblasserdam creek ridge, below a c. 80 cm. clay cover.
c Roman settlement site.
d From the surface (arable land) and from a testpit by Mr G. van den Beemt 1966. This pit apparently touched a mediaeval (12th cent.) refuse pit.
e Van den Beemt 1967.

12 a *Oud Alblas—site 7*
b Alblasserdam creek ridge.
s Roman settlement site.
d Discovered during the soil survey 1954 (only two sherds, now lost). Finds collected from the surface (arable land) by Mr G. van den Beemt 1971.

13 a *Oud Alblas—Zuidzijde*
b Alblasserdam creek ridge.
c sherds of Roman and mediaeval (12th-15th. cent.) pottery.
d Found in ground, excavated from this parcel and used at road construction works at some distance. Discovered during the soil survey 1954. Now grassland. No finds made during field control by the author 1968. A small undisturbed part of this settlement has been discovered at the southern margin of the parcel by Mr G. van den Beemt, Alblasserdam, 1971.

(13[a]) a *Oud Alblas*
b High parcel of land.
c Big bronze coin (*sestertius* ?) of Trajan.
d Found in 1843 by a farmer.
e Janssen 1846, 390

14 a *Papendrecht*
b In the body of the modern dike.
c Roman coin, an *as* of Vespasian.
d Found during construction works, 1964.

15 a *Papendrecht*
b Papendrecht creek ridge.
c Roman coin, a *sestertius* of Commodus.
d Found by Mr P. van der Sluis, Papendrecht, 1966.

16 a *Papendrecht—Bethlehem church*
b Papendrecht creek ridge.
c Two small Roman sherds among numerous sherds of mediaeval pottery (11th-12th cent.).
d Site discovered during the soil survey 1954. Roman finds made by Mr G. van den Beemt, Alblasserdam, 1966.

17 a *Papendrecht*
b Bank of the Merwede river.
c Roman coin, a *denarius* of Quintus Metellus.
d Found by Mr C. van der Esch, Papendrecht, 1965.

18 a *Papendrecht*
b Bank of the Merwede river.
c A rim sherd of a Roman pot.
d Found by Mr G. van den Beemt, Alblasserdam, about 1970.

19 a *Papendrecht*
b Small creek belonging to the Papendrecht creek ridge.
c A Roman sherd.
d Found by Mr G. van den Beemt, Alblasserdam, 1968.

20 a *Papendrecht—Swimming-pool*
b Papendrecht creek ridge, below a c. 60 cm. clay cover.
c Roman settlement yielding numerous finds (2nd half 1st-2nd cent.). Mediaeval pits (11th-14th cent.) had been dug from a higher level, very probably half-way the clay cover.
d Found by AWN-members during road construction works and the construction of the swimming-pool 1967-1968.

21 a *Oud Alblas*
b Papendrecht creek ridge.
c Some Roman sherds.
d Found at the surface (arable land) by Mr G. van den Beemt, Alblasserdam, 1967.

22 a *Bleskensgraaf—Provincial road*
b Small creek belonging to the Alblasserdam-Papendrecht system, below a 30-60 cm. clay cover.
c Roman settlement yielding a moderate number of finds (3rd cent.).
d Grassland. Finds collected from a newly dug ditch by Mr G. van den Beemt, Alblasserdam, 1969.

23 a *Bleskensgraaf*
b Small creek belonging to the Alblasserdam-Papendrecht system, below a 30-60 cm. clay cover.
c Small flint flake.
d Grassland. From a depth of 60 cm., in a boring made by Mr M. J. de Haan, Bleskensgraaf, about 1968.

24 a *Molenaarsgraaf—Hazendonk*
b Isolated *donk*. Top not covered with clay.
c "Hazendonk-", Vlaardingen- and Beaker pottery. Pollen diagram showing human occupation about 4100(?), 3400, 3000, 2500/2300 and 1700 B.C.
d Grassland. Discovered (test pits) by AWN-members 1963. Test excavation by the author 1967.
e This paper part III.

24[a] a *Molenaarsgraaf*
b Schoonrewoerd stram ridge, below a c. 40 cm. clay cover.
c A partly disturbed grave pit, which contained the remains of a disarticulated skeleton. A few beaker-like sherds and flint flakes in the surroundings.
d Discovered by Mr S. Kooistra from Molenaarsgraaf in the side of a newly dug ditch, bordering the re-allotment road, 1972.

25 a *Molenaarsgraaf—parcel Mr A. L. Korevaar*
b Schoonrewoerd stream ridge, below a c. 40 cm. clay cover.
c A few beaker-like sherds, some flint flakes and a scraper.
d Grassland. From two test pits by AWN-members 1966. Site disturbed by extensive sand digging.

26 a *Molenaarsgraaf—parcel Mr A. Boon*
b Schoonrewoerd stream ridge. At the bank of a break-through channel, below a 30-40 cm. clay cover.
c VBB/BWB settlement and graves; some MBA finds (^{14}C dates about 1830-1680, 1400 B.C.).
d Grassland. Discovered (test pits) by AWN-members 1966. Excavation by the author 1966-1967.
e This paper part IV.

27 a *Molenaarsgraaf—parcel Mr J. A. Baan*
b Schoonrewoerd stream ridge, below a 40 cm. clay cover.
c Sherds of domestic pottery of the VBB/BWB period,; some flint.
d From three test pits by AWN-members 1967.
e This paper fig. 59. On the maps combined with No. 28.

28 a *Molenaarsgraaf*
b Schoonrewoerd stream ridge, below a 40 cm. clay cover. Grassland.
c/d— Sherds of DKS and LBA pottery, a retouched flint flake. From a shallow sand pit, during the soil survey 1954.
— The grip of a flint dagger, some sherds, one of them with a BW impression, some flint. From a test pit by AWN-members 1964.
e This paper fig. 59. On the maps combined with No. 27.

29 a *Ottoland—De Put, site 3*
b Schoonrewoerd stream ridge, below a clay cover.
c Five sherds, one decorated by channeling, probably beaker pottery.
d Grassland. From a test pit by AWN-members 1964.

30 a *Ottoland—De Put, site 4*
b Schoonrewoerd stream ridge, below a clay cover.
c Some sherds, one with BW-decoration and a retouched flint flake.
d Grassland. From three test pits by AWN-members 1967.

31 a *Ottoland—De Put, site 5*
b Schoonrewoerd stream ridge, below a clay cover.
c Some very small sherds and pieces of loam.
d Grassland. From a test pit by AWN-members 1964.

32 a *Ottoland-De Put, site 7*
b Schoonrewoerd stream ridge, below a clay cover.
c Sherds, decorated with grooves and fingertip impressions (V-motif), one VBB sherd, some flint.
d Grassland. From a test pit by AWN-members 1964.

33 a *Ottoland-De Put, site 6*
b Schoonrewoerd stream ridge, below a clay cover. At the bank of a break-through channel.
c Seven small sherds, probably beaker pottery.
d Grassland. From a test pit by AWN-members 1964.

34 a *Ottoland—De Put, site 8*
b Schoonrewoerd stream ridge, below a clay cover. At the bank of a break-through channel.
c Small sherds, probably beaker pottery; some flint.
d Grassland. From two test pits by AWN-members and the author 1966.

35 a *Ottoland—De Put, site 9*
b Schoonrewoerd stream ridge, below a clay cover.
c Small sherds, beaker pottery ?, some flint.
d Grassland. From a test pit by AWN-members and the author 1966.

36 a *Ottoland—Kromme Elleboog, No. 1*
b Schoonrewoerd stream ridge. Near a complex break-through channel, below a 30 cm. clay cover.
c Domestic beaker pottery; at least one sherd with BW-decoration; flint. ^{14}C date 1845 $\pm$ 55 B.C.
d Discovered 1966 by AWN-members and the author. Rescue excavation by the author 1969, forced by road construction.
e AN 1969, *70-71.

37 a *Ottoland—Kromme Elleboog, No. 2*
b Schoonrewoerd stream ridge, below a 40 cm. clay cover.
c Grave with the remains of two persons: one normal inhumation, the other not in anatomical position and the skull missing. ^{14}C date 1870 $\pm$ 45 B.C. Nearby a small pit with charcoal (^{14}C date 460 $\pm$ 35 B.C.; probably too young) and with a few small sherds, tempered with granite grit.
d Found by AWN-members and the author during the survey of a newly dug ditch, bordering the new reallotment road 1970.

38 a *Ottoland*
b Schoonrewoerd stream ridge, below a clay cover.
c Some small sherds and pieces of loam.
d Found by AWN-members and the author during the survey of a newly dug ditch, bordering the new re-allotment road 1969-1970.

39 a *Ottoland—"behind the church"*
b Schoonrewoerd stream ridge, below a clay cover.
c Sherds, decorated with grooves, lines and fingertip impressions, Two VBB-sherds, MBA sherds, some flint.
d Found by AWN-members, the author and Mr A. Verrips, Ottoland, during the survey of a newly dug ditch bordering the new re-allotment road 1969, 1970 and 1971.

40 a *Ottoland*
b Schoonrewoerd stream ridge, below a clay cover.
c Some sherds, beaker pottery?
d Found by AWN-members and the author during the survey of a newly dug ditch, bordering the new re-allotment road 1969.

41 a *Ottoland—Oosteind, No. 2*
b Schoonrewoerd stream ridge, below a clay cover.
c Sherds of MBA pottery, pieces of loam, some flint. Remains of a probably recent ox (?) skeleton at a depth of 50 cm.
d From two test pits by AWN-members 1968.

42 a *Ottoland—Oosteind, No. 1*
b Schoonrewoerd stream ridge. Very high elevation, below a 20-30 cm. clay cover.
c Settlement site, dated by sherds of BB, BWB, DKS and LBA pottery. Skeleton of a domesticated pig (BB/BWB phase). Two ^{14}C dates: about 1700 and 850 B.C.
d Discovered by AWN-members 1965. Excavation by the author 1969.
e AN 1969, *70-71.

43 a *Goudriaan—Smoutjesvliet*
b Schoonrewoerd stream ridge, below a clay cover.
c Some beaker-like sherds, DKS pottery, some flint.
d Grassland. From two test pits by ANW-members 1968 and the survey of a newly dug ditch 1970.

44 a *Goudriaan*
b Schoonrewoerd stream ridge, below a 40 cm. clay cover.
c "Ancient settlement soil" with charcoal.
d Grassland. Reported by AWN-members 1968.

45 a *Goudriaan*
b Schoonrewoerd stream ridge, below a clay cover.
c Some pieces of loam.
d Found by AWN-members and the author during the survey of the dug-out strectch of a new re-allotment road 1969.

46 a *Goudriaan*
b Schoonrewoerd stream ridge, below a clay cover.
c A triangular flint artifact (*cf.* fig. 95 p) and some pieces of loam.
d Found by AWN-members and the author during the survey of the dug-out stretch of a new re-allotment road 1969.

47 a *Goudriaan*
b Schoonrewoerd stream ridge, below a clay cover.
c Some pieces of loam.
d Grassland. From a test pit by AWN-members and the author 1968.

48 a *Goudriaan*
b Schoonrewoerd stream ridge, below a clay cover.
c One sherd tempered with quartz grit; one flint flake. Finds not preserved.
d From a test pit by AWN-members and the author 1968.

49 a *Goudriaan—Nieuw Goudriaan*
b Schoonrewoerd stream ridge, below a clay cover.
c Many sherds of DKS and (probably) LBA pottery; some flint flakes.
d Grassland. From various test pits by AWN-members 1963, 1964, 1968 and during the survey of a stretch of a new re-allotment road 1969, 1970,

50 a *Goudriaan*
b Schoonrewoerd stream ridge, below a clay cover.
c Some sherds, one decorated with grooves, probably beaker pottery; one flint flake.
d Grassland. From a test pit by AWN-members 1968 and during the survey of a stretch of a new re-allotment road 1969.

51 a *Goudriaan*
b Schoonrewoerd stream ridge, below a clay cover.
c Two sherds tempered with quartz grit, two flint flakes.
d Found by AWN-members 1963-1968 and by Mr H. Bliekendaal, Molenaarsgraaf, 1967 in a small sandpit.

52 a *Noordeloos—terrain Mr K. Roozendaal*
b Schoonrewoerd stream ridge. Very high elevation, below a 20-30 cm. clay cover.
c Many sherds of DKS and LBA pottery; some deliberately roughened sherds (Iron Age !). Six flint flakes, one scraper, one sickle fragment. Probably also some beaker sherds, one showing BW-impressions.
d Arable land. Discovered during the soil survey 1954. Finds collected by AWN-members and the author from the surface and a test pit 1967-1969.

53 a *Noordeloos*
b Schoonrewoerd stream ridge, below a clay cover.
c Some small pieces of loam.
d Test pit by Mr H. A. de Kok, Hardinxveld, 1966.

54 a *Noordeloos*
b Schoonrewoerd stream ridge.
c/d Three sherds of DKS pottery. From the section of a newly dug ditch, during a survey by Mr H. A. de Kok, Hardinxveld, 1968. During the soil survey 1954 a few sites with "ancient settlement soil" were mapped in the stretch of the Schoonrewoerd stream ridge, east of this site.

55 a *Meerkerk—Tienhoven polder, no. 1*
b A small but clearly visible side creek of the Schoonrewoerd stream ridge, below a clay cover.
c Mainly sherds of DKS pottery, some undatable pottery, one flint flake.
d From the section of a newly cut ditch along a new re-allotment road, by AWN-members and the author 1968.

56 a *Meerkerk—Tienhoven polder, no. 2*
b A small but clearly visible side creek of the Schoonrewoerd stream ridge. A remarkably high elevation.
c Sherds of DKS pottery, some flint.
d Grassland. From the section of a newly cut ditch along a new re-allotment road, during a survey by AWN-members and the author 1969.

57 a *Nieuw Lekkerland—Schonenburgse Heuvel*
b Very high and extensive *donk*, not covered with clay. Grassland.
c/d — Flint axe.
Found in 1952 by the farmer's son Mr G. Terlouw in a shallow sand pit
— Big lump of flint.
Found by Mr G. van den Beemt, Alblasserdam, about 1966.
— Hearth places with some calcinated flint.
Observed by AWN-members 1967 in a small sand pit.
— Site of the former castle of Schonenburg. Some bricks and mediaeval pottery (13th-14th cent.) have been found.
e This paper fig. 22; Wh 11, 1962, 33; Wh 14, 1963, 119-123 (No. 1). All on the flint axe.

58 a *Brandwijk—Het Kerkhof*
b Small *donk*, covered with clay.
c One sherd, tempered with broken quartz, possibly VL Culture.
d Orchard. From a test pit by Mr H. Bliekendaal, Molenaarsgraaf, 1966.

59 a *Goudriaan—Donk Goudriaan*
b Isolated *donk*.
c VL pottery and flint flakes, some of them showing polished facets (axe flakes).
d Grassland. From a small sand pit, found by AWN-members 1963-1965.

60 a *Hoog Blokland—Den Beemt, site I*
b Very small *donk*.
c Late VL pottery, sherds of a small beaker decorated with impressions of a broken bone or small stick, some flint.
d Grassland. From an extensive test pit by AWN-members 1963.
e This paper fig. 21.

61 a *Hoog Blokland—Nieuwlietje*
b Schaik stream ridge, near a break-through channel, below a 35-50 cm. clay cover.
c Bell Beaker settlement site.
d Discovered during the soil survey 1954. A test pit yielded Bell Beaker pottery, now lost. From some other points in the vicinity "ancient settlement soil" was reported by Stiboka. Ir. J. van der Linde personally pointed me out that this is the site where the test pit was dug and not one of the others, as was reported previously.
e This paper fig. 24 and p. 98 note 62.

62 a *Hoog Blokland—Den Beemt, site II*
b A *donk* belonging to a group of *donken*.
c One pot base tempered with quartz grit, VL Culture; three flint flakes, one scraper. Also mediaeval pottery (11th-12th cent.).
d Grassland. Found in a sand pit by AWN-members, 1963.

63 a *Arkel*
b An extensive *donk*, near the eastern end.
c Some small, probably DKS sherds.
d Found by AWN-members in ground, dredged out of a ditch, 1962.

64 a *Arkel*
b Unknown.
c Roman coin, an *as* of Trajan.
d Documentation Royal Dutch Coin Cabinet, The Hague.

65 a *Hoornaar*
b *Donk*.
c Some small Roman sherds, one of them grey varnished ware, many sherds of mediaeval pottery (13th-16th cent.), one flint flake.
d Gardens. Found at the surface by Mr M. J. de Haan, Bleskengraaf, 1967.

66 a *Hoornaar*
b *Donk*.
c A small prehistoric sherd and a flint flake.
d From a small pit, containing some charcoal, at the site of a demolished farm, by Mr H. A. de Kok, Hardinxveld, 1964.

67 a *Noordeloos—Slingeland Donk*
b *Donk*.
c Five small sherds, one tempered with quartz grit. Now lost.
d Grassland. Found in a sand pit by Mr H. A. de Kok, Hardinxveld, 1963.

68 a *Hoog Blokland—Kort Scheiwijk*
b Unknown.
c Some Roman sherds, now lost.
d Found during the soil survey 1954. Pers. comm. Ir. J. van der Linde.

69 a *Gorinchem—Land der Zes Molens*
b "At a depth of about 60 cm., below the clay cover and on the peat".
c Many sherds of Roman pottery, 82 rim and base sherds preserved.
d Found in 1941 during the construction of the four-way road. Reported by the late Mr H. van Hoogdalem. Controlled by Dr F. C. Bursch, Leiden. Field control by the author and AWN-members yielded no finds at all. The site might be completely destroyed or buried below the viaduct.

(69[a]) a *Arkel—Onderweg*
b Natural levee of the river Linge
c A modest number of sherds of Roman and mediaeval pottery (11th-15th cent.).
d Collected from the surface 10-3-1973 by the author and a group of amateur archaeologists. The site is situated halfway Arkel and Gorinchem.

70 a *Giessenburg—Postkade*
b Unknown.
c Romain coin, *denarius* of Vespasian.
d Found at the Postkade by a certain Mr A. v. W., according to a newspaper of the period 1880-1905, preserved in the RMO.
e Verslagen Rijksverzamelingen van Geschiedenis en Kunst 21 (1889), 76.

71 a *Giessenburg—Duvelsheultje*
b Natural levee of the Giessen stream.
c Some Roman sherds, one of them the rim of a terra sigillata mortarium. Not preserved.
d Found in ground, dredged out of a ditch, during the soil survey 1954. Pers. comm. Ir. J. van der Linde; also mentioned in the documentation of the ROB.

72 a *Hardinxveld—Buldersteeg*
b Unknown
c Some Roman sherds, now lost.
d Found at the surface, during the soil survey 1954.

73 a *Hardinxveld—Buldersteeg*
b Unknown.
c A Roman coin, a *sestertius* of Livia.
d Found by Mr J. C. Coenrads on his terrain. Reported by the late Mr H. van Hoogdalem, 1952 to ROB and RMO.

74 a *Hardinxveld—Giessendam*
b Natural levee of the Giessen stream.
c A Roman sherd, terra sigillata, now lost.
d Found during the soil survey 1954. Pers. comm. Ir. J. van der Linde.

75 a *Sliedrecht—Ronduit Polder*
b In the so-called Sliedrecht Biesbosch. Pre-Roman deposits, covered by thick sub-recent sediments.
c Numerous sherds of Roman pottery and other domestic refuse. Only a few sherds of native pottery. (2nd-1st half of 3rd cent.).
d Collected by Mr C. van der Esch, Papendrecht, out of dredged-up ground, deposited around a new harbour under construction. The original position of the finds was below a 1.80-2.40 cm. thick clay layer.
e Van der Esch 1965.

(75[a]) a *Papendrecht-Ketelhaven*
b In the river foreland of the river Merwede
c Fragment of a thin-walled Roman amphora, sherd of a thick-walled Roman amphora, rim-fragment of a Pingsdorf jug. Some undated bronze and iron objects.
d Found in 1960 during dredging operations during the construction of the harbour Ketelhaven east of Papendrecht at "Oosteind". Acquired by the RMO Leiden from the Rijkswaterstaat (Water Control and Public Works Department).
e Verslagen Rijksverzamelingen van Geschiedenis en Kunst 83, 1961, 176.

VIJFHEERENLANDEN

76 a *Vianen-centre*
b Natural deposits of the river Lek.
c Some sherds of native and Roman pottery
d Collected by AWN-members in 1967 in ground used in a garden at Brandwijk and said to have been transported to there from the sports-fields near the church in the centre of Vianen. No finds were made during field control by the author at this site.

77 a *Vianen—Hagestein, barrage*
b River foreland of the Lek, crossing here the Hagestein stream ridge.
c — A 75 cm. high Roman amphora, with graffito GAP.
— Some native and Roman sherds and five net wieghts, made from Roman roof tiles.
d Dredged up during construction works on behalf of the barrage from a depth of about —3 m. NAP, 1955 and 1957.
e Verslagen Rijksverzamelingen van Geschiedenis en Kunst 78, 1956, 158 and 81, 1959, 185.

78 a *Vianen—De Loog*
b Hagestein stream ridge.
c Some sherds of Roman and native pottery. One *Badorf* (Carolingian) sherd.
d Collected by the author about 1967 in disturbed position from an extensive sand pit, made on behalf of the road construction works. Also found in sand from this site, transported to minor works some kms. to the south.

79 a *Vianen—Autena Donk*
b *Donk*, situated isolated. Grassland, osiers.
c/d — Sherds of Iron Age and mediaeval (13th-14th cent.) pottery. Collected during the soil survey 1950.
— Sherds of Iron Age and other prehistoric pottery. From a test pit by AWN-members 1964.
e Pons 1951, 1961, de Kok 1965.

80 a *Hei- en Boeicop—terrain Mr den Besten*
b Zijderveld stream ridge. Three slight elevations near the former stream channel. Below a c. 40 cm. clay cover.
c MBA settlement, yielding many sherds of DKS pottery and other domestic refuse.
d Grassland. From a number of test pits made by Mr H. den Besten and AWN-members 1964.
e AN 1964, *310; this paper fig. 30.

81 a *Schoonrewoerd—Mariahoeve*
b At the side (clay-mantle) of the Zijderveld stream ridge. A flat terrain with three slight elevations, probably corresponding with occupation centres. Below a c. 50 cm. clay cover.
c MBA settlement, yielding many pieces of loam and some sherds of DKS pottery.
d Grassland. From a test pit by AWN-members and borings by the author 1965.

82 a *Schoonrewoerd—Overboeicop, terrain Mr Wink*
b Zijderveld stream ridge near some small rest gullies and on a relatively high and sandy point. Below a c. 50 cm. clay cover.
c Sherds of Iron Age pottery (at c. 45 cm.) above a level with sherds of DKS pottery at 45-85 cm. below the surface.
d Grassland. Collected during the soil survey and from test pits by AWN-members 1965.
e Pons 1951, 1961.

83 a *Everdingen—Zijderveld*
b Zijderveld stream ridge, near the former stream channel. Below a clay cover.
c Extensive MBA settlement and Iron Age settlement at a slightly higher level, both yielding numerous finds and house plans. Evidence of earlier occupation in a pollen diagram: slight before c. 2670 B.C., stronger between 2670 and c. 1550 B.C. (VL Culture?). Some probably VL Culture finds in the immediate vicinity.
d Discovered bij AWN-members 1965. Extensive rescue excavation by Mr R. S. Hulst, Amersfoort. Now for the greater part destroyed by a sand dredging pit.
e AN 1965, *107, *138; AN 1966, *93; Beex & Hulst 1968, J. de Jong 1970/'71, Vogel & Waterbolk 1972.

84 a *Everdingen—Zijderveld no. 2*
b Zijderveld stream ridge.
c "Ancient settlement soil" with some small pieces of loam.
d Grassland. Reported by Mr H. den Besten, Hei- en Boeicop and Mr G. van den Beemt, Alblasserdam,1965. Established by means of some borings.

85 a *Schoonrewoerd—De Waai*
b Dike breach deposit (30-50 cm.) on a thin clay layer on one of the branches of the Schoonrewoerd stream ridge.
c Some sherds of Iron Age pottery.
d Orchard. From below the surface in a test pit made during the soil survey 1950 (now lost) and from the surface collected by Mr H. den Besten, Hei- en Boeicop, 1965.
e Modderman 1951, Pons 1951, 1961.

86 a *Schoonrewoerd—centre*
b Artificially raised elevation on the Schoonrewoerd stream ridge, on which the present village is situated.
c/d — A Roman coin of Nerva
Found during digging works on behalf of the water works, between the church and the churchyard about 1946. Reported by the late Mr H. van Hoogdalem, Gorinchem.
— Some sherds of "native" or Iron Age pottery, now lost.
At the fringes of the artificial elevation. Collected from the surface during the soil survey 1950.
e Modderman 1951, Pons 1951, 1961.

87 a *Leerdam—Overheicop*
b Schoonrewoerd stream ridge. Broad and high. Below a c. 40 cm. clay cover.
c Some sherds of Iron Age pottery.
d Orchard. Collected by AWN-members and the author during drainage works about 1966.

88 a *Leerdam—Hoogeind*
b Schoonrewoerd stream ridge.
c Some sherds of Iron Age pottery. Now lost.
d Collected during the soil survey 1950.
e Pons 1951, 1961.

89 a *Leerbroek—Kerkweg no. 1*
b Schoonrewoerd stream ridge. Very high elevation, not covered with clay.
c Sherds of Iron Age pottery.
d Collected during the soil survey 1950.
e Pons 1961.

90 a *Leerbroek—Kerkweg no. 2*
b Schoonrewoerd stream ridge. Very high and broad elevation. Not covered with clay.
c One Iron Age sherd.
d Orchard. Found at the surface by Mr H. den Besten, Hei- en Boeicop, 1964.

91 a *Leerbroek—Weverwijk, 't Hoog*
b Schoonrewoerd stream ridge, below a c. 35 cm. clay cover.
c Iron Age settlement yielding a moderate number of sherds.
d Grassland and arable land. Collected from a test pit during the soil survey 1950. Now lost. From borings, a test pit and from the surface by AWN-members and the author 1965.
e Modderman 1951, Pons 1951, 1961.

92 a *Leerdam—Schoonrewoerd donk*
b *Donk*, situated isolated.
c Sherds of VL, DKS and Iron Age pottery. Some flint, one probable a Mesolithic or Early Neolithic trapeze.

d Grassland with farmer's sand pits. Collected by AWN-members from the sand pits and a small test pit 1964; by the author during a small test excavation 1965; by the owner of the land, Mr den Besten, Schoonrewoerd, from the sand pits 1967.
e De Kok 1965.

93 a *Leerdam—Schaik*
b Schaik stream ridge, showing a small, relatively high elevation. Below a c. 40 cm. clay cover.
c Late Bronze Age settlement, yielding many sherds and two flint sickle fragments.
d Grassland. From a test pit by AWN-members 1965.

94 a *Leerdam—Uiterwaard*
b River foreland of the Linge river.
c A Roman jug, 1st half 1st cent. A.D., and some sherds (now lost).
d Found by Mr J. Fledderus, Leerdam, during digging works on behalf of the deposition of glass refuse of the glass factory, about 1935.

95 a *Kedichem—Oosterwijk*
b Natural levee of the Linge river.
c Two Roman sherds among numerous sherds of mediaeval pottery (11th-14th cent.).
d Collected during the soil survey 1950. The Roman sherds are probably not on their original place, but washed over a short distance from (a) site(s) farther upstream.
e Modderman 1951, Pons 1951, 1961.

96 a *Arkel —Rietveld donken*
b One of a group of small *donken*. Below a c. 50 cm. clay cover.
c One flint flake, charcoal.
d Grassland. From a test pit by AWN-members 1965 .

LEK EN LINGE DISTRICT

97 a *Beesd—Acquoy, Kerkweg*
b Natural levee of the Linge river.
c A few sherds of Roman pottery, one *Badorf* (Carolingian) sherd.
d Arable land. Collected from the surface by the author 1967. Discovered during the soil survey 1965.

98 a *Culemborg—Den Heuvel*
b Schoonrewoerd stream ridge. An extensive and high elevation near a break-through channel. No or only a thin clay cover. Arable land (originally).
c Early—Late Iron Age settlement yielding numerous finds. Some sherds of BWB, DKS and Roman pottery. Mediaeval pottery (11th-12th cent.) and soil traces.
d Discovered by AWN-members 1965. Finds in the removed topsoil near a sand dredging pit. Rescue excavation of the undisturbed part by the author 1966.
e AN 1966, *61-62.

99 a *Culemborg—De Bol*
b River foreland of the Lek river.
c Two antler axes. One the base of an antler and perforated parallel to the cutting edge. The other has its cutting edge made from the main beam, the eye-time used as the handle.
d Found by Mr G. Abels, Utrecht, at an extension plan of the city of Utrecht in sand derived from this spot.

100 a *Culemborg—De Hond polder*
b —
c A Roman jug.
d Arable land. Found during diggings on behalf of the water works at a depth of about 1 m. about 1951.

101 a *Culemborg*
b High terrain on a natural levee below a clay cover.
c Sherds of DKS pottery.
d From a prehistoric pit and a dark level, a former sufrace. Found during the work on behalf of the extension of Culemborg by Mr A. Molenaar, Culemborg, 1971.

102/ a *Culemborg*
103 b High terrain on a natural levee below a clay cover.
c Sherds of Iron Age pottery.
d From a dark level, a former surface. Found during the work on behalf of the extension of Culemborg by Mr A. Molenaar, Culemborg, 1971.

104 a *Culemborg*
b High terrain on a natural levee below a clay cover.
c Sherds of (predominantly) Roman and some native pottery.
d From a clearly visible dark level, containing phosphates.

105 a *Beusichem—Voorkoopstraat*
b Natural levee deposits covered by 60 cm. clay. Conspicuous elevation.
c A few sherds of Roman and native pottery among many sherds of mediaeval pottery (12th-15th cent.).
d Arable land. Collected from the surface by the author 1967. Discovered during the soil survey 1965.

106 a *Culemborg—Veldzicht*
b Natural levee of a former river course. A relatively high elevation, not or only slightly covered with clay.
c Roman settlement (2nd. cent.) yielding many sherds. Roman and native pottery represented equally. Some sherds of later (14th-17th cent.) pottery.
b Arable land. Collected from the surface by the author in 1967. Discovered during the soil survey 1965. Finds made by Mr. A. Molenaar, Culemborg 1968-1970, in the environment of this site.

107 a *Beusichem—Ringelpoel*
b Natural levee of a former river course. Below a c. 65 cm. clay cover. A slight elevation only.
c Roman settlement yielding only a few sherds. No sherds of native pottery.
d Grassland and arable land. Collected from the surface by the author 1967. Discovered during the soil survey 1965. More finds made by Mr R. S. Hulst, Amersfoort 3-12-1968 in a newly dug ditch.

108 a *Beusichem*
b Unknown.
c *As* of Caligula, "the third Roman coin found in Beusichem in a short time".
d Found during digging works on behalf of the illumination of the vanity fair by Mr D. van Alphen, 1953.

109 a *Beusichem—Engelrode*
b Natural levee of a former river course, only slightly covered with clay (less than 25 cm.).
c Roman settlement yielding many sherds, only a few of them of native pottery. A bronze fibula at a depth of 20 cm. in a boring. 2nd cent.
d Arable land. Collected from the surface by the author 1967. Discovered during the soil survey 1965. The site was known already in 1851 by the find of a jug and a small terra sigillata cup at or near this place by Mrs D. C. D. van Rijnbeek van der Veer, now in the collection of the Municipal Museum Arnhem.

110 a *Buren—Hofkamp*
b Natural levee of a former river course. Extensive elevation. Only slightly covered with clay (less than 40 cm.).
b Roman settlement yielding a modest number of sherds. The native pottery froms a minority. 2nd-3rd cent.
c Orchard, grassland and arable land. Collected from the surface by the author 1967. Discovered during the soil survey 1965.

111 a *Buurmalsen—De Treef*
b Natural levee of a former river course. Extensive elevation. Not covered with clay.
c Roman settlement yielding many finds. Only a few sherds of native pottery. End of 1st till first half of 3rd cent.
d Arable land. Collected from the surface by the author 1967. Discovered during the soil survey 1965.

112 a *Buurmalsen—Huize Voorzorg*
b Natural levee of a former river course. Extensive elevation near a remarkable depression, probably a former stream channel.
c Some "native" or Iron Age sherds. No Roman import ware.
d Orchard, grassland. Collected from the surface by the author 1967. Discovered during the soil survey 1965.

113 a *Buurmalsen—Nieuwe Steeg*
b Two natural levee deposits, c. 50 cm. each, separated by a dark grey clay layer of 20 cm. and resting on peat.
c From the uppermost levee deposit: sherds of Roman pottery, 2nd cent. From the dark grey clay: sherds of "native" or Iron Age pottery.
d Discovered by the State Geological Service. Test excavation by A. du Saar, A. Verbraeck and J. Trimpe Burger 1960. Some Roman sherds collected from the surface during field control by the author 1967.

114 a *Buren—Den Hulster*
b Natural levee deposits. No elevation.
c Roman settlement yielding only a few sherds of both Roman and native pottery, c. 2nd cent.
d Grassland with a few parcels arable land. Collected from the surface during the soil survey 1947. Identification Prof Dr P. J. R. Modderman.
e Modderman 1949, no. 139.

115 a *Buren—De Woerd*
b Natural levee deposit. A slight elevation near a former stream channel.
c Roman settlement yielding only a few sherds of both Roman and native pottery, c. 2nd cent.
d Arable land. Collected from the surface during the soil survey 1947. Identification Prof Dr P. J. R. Modderman.
e *Modderman 1949, no. 138.*

(115[a])a *Beesd*
b River foreland.
c Bronze spearhead.
d Found about 1968 by Mr D. Rombout, Geldermalsen, dredged up from the river Linge. Exact find-spot unknown. Pers. comm. Mr R. S. Hulst, Amersfoort.

(115[b])a *Geldermalsen—Diefdijk*
b Unknown.
c Bronze socketed axe with *lappen* decoration.
d Acquired by the RMO, Leiden from an art-dealer in 1937. Said to be found during ground work for a new road near the Diefdijk. Exact find-spot unknown. Unreliable find.

TIELERWAARD

116 a *Spijk—Spijkse Veld*
b Spijk stream ridge (Dunkirk I ?) crossing an older (the Calais II Gorkum stream ridge) in the deeper subsoil.
c Small and heavely worn perforated *Breitkeil* with conical shaft-hole.
d During the exploitation of an extensive sand dredging pit here, Mr H. Teeuw, Vuren, found the axe in the load of a truck, mainly carrying off the topsoil, 1964. Reported by Mr A. Verbraeck, State Geological Service, and Mr H. A. de Kok, Hardinxveld.
e This paper fig. 22.

117 a *Spijk—Spijkse Veld*
b Spijk stream ridge
c Some sherds of native pottery of the Roman period, among others an outward curved facetted rim sherd.
d Found by Mr de Boer, Gorinchem, in the removed topsoil near the extensive sand dredging pit, about 1968.

118 a *Vuren—Heukelom*
b Natural levee deposits of the Linge river, covered by a clay layer.
c Some sherds of Roman (c. 2nd cent.) and late mediaeval (14th-15th cent.) pottery.
d Collected from the surface during the soil survey 1955-'56. Identification Prof Dr P. J. R. Modderman.

119 a *Deil—Wordensteeg*
b Natural levee deposits covered with clay.
c Sherds of Roman and native pottery (c. 2nd cent.) both represented equally.
d Collected from the surface during the soil survey 1955-'56 Identification Prof Dr P. J. R. Modderman. During field control by the author 1967 unfavourable find circumstances (grassland). Only a few sherds in ground, dredged out off a ditch.

120 a *Deil—Rumpt, Bouwerblok*
b Natural levee deposit. Below a 40 cm. clay cover.
c "Native" pottery.
d Reported by Ir. J. N. B. Poelman to the ROB 1961. Identification Prof Dr P. J. R. Modderman.

121 a *Deil—Oudwijkse Blok*
b Natural levee deposit. Below a c. 40 cm. clay cover, at some distance below two clay layers, both 60 cm. thick.
c Roman settlement yielding many sherds of Roman and native (c. 25%) pottery. 1st-2nd cent.
d Collected from the surface during the soil survey 1955-'56 (grassland) and during a field control by the author 1967 (arable land).

122 a *Deil—Enspijk*
b In a black clay separating two natural levee deposits, the uppermost about 70 cm.
c Many sherds of (probably Late) Iron Age pottery. One small sherd of Roman pottery (grey varnished ware) at the present surface.
d Discovered by the State Geological Service. Finds collected also during a field control by the author 1967 from the banks of a lake that fills a former sand dredging pit.

123 a *Deil—Oude Wetering*
b Natural levee of a former river course. Below a c. 50 cm. clay cover. A small but remarkable elevation.
c Roman settlement yielding a modest number of sherds.
d Orchard. Collected by the author 1967. Discovered during the soil survey 1955-'56.

124 a *Geldermalsen—Voetakker*
b Natural levee of a former river course covered by clay, near a badly visible former stream channel.
c A few sherds of Roman pottery.
d Grassland, bad find circumstances. Collected by the author 1967. Discovered during the soil survey 1955-'56.

125 a *Geldermalsen—Meteren centre*
b Natural levee deposit of a former tiver course, probably formerly covered by a clay layer. Topsoil now deeply disturbed. A remarkable NW-SE running ridge.
c Sherds of Roman and native (the majority) pottery among the sherds of mediaeval pottery (from the 12th cent. onwards). Two DKS sherds.
d Collected from the surface and from two test pits by AWN-members and the author, 1965.

126 a *Geldermalsen—Meteren, Middenblik*
b On coarse sand with gravel, either a Pleistocene outcrop or a natural levee deposit. Below a 40-100 cm. clay cover.
c (Probably Late) Iron Age settlement yielding many sherds and other domestic refuse.

d Collected during the soil survey 1955-'56, during road construction works 1957, 1964 and during field control by the author 1967.
e AN 1967, *52, *108; AN 1964, *220,

127 a *Geldermalsen—Meteren, Bergakker*
b probably river levee deposits
c Sherds of Roman and native pottery (predominantly Roman import ware). 2nd half 1st-2nd cent.
d Found in the dug-out ground of a sand dredging pit by Mr R. S. Hulst, Amersfoort, 1968.

128 a *Waardenburg—Oud Snellenstein*
b Unknown
c Sherds of "native" pottery
d Discovered by the State Geological Service, 1958.

129 a *Waardenburg—De Vergt*
b Natural levee deposits of a former river course.
c Roman settlement yielding many sherds of native and Roman pottery. 2nd cent.
d Orchard and arable land. Collected from the surface during the soil survey 1955-'56. Identification Prof Dr P. J. R. Modderman.

130 a *Haaften—Tuil, Nieuw Klingelenberg*
b Natural levee deposits of the Waal river.
c A few possibly Roman sherds among sherds of Late Mediaeval pottery (14th-15th cent.).
d Orchard and a small field of arable land. Collected from the surface during the soil survey 1955-'56. Identification Prof Dr P. J. R. Modderman. No Roman sherds found during field control by the author 1967.

131 a *Waardenburg—uiterwaard*
b river foreland of the river Waal.
c Axe made of the base of a red deer antler beam.
d Found by Mr T. Zijlker, Waardenburg and reported by Mr G. Elzinga, Leeuwarden, to the ROB.

132 a *Geldermalsen—Mr Dr Kolffschool*
b natural levee of the river Linge.
c Sherds of "native" pottery.
d Arable land. Found by Dr W. C. Braat, Leiden, 1939, during a visit.

133 a *Geldermalsen—Bottesteyn*
b Natural levee deposits of the river Linge on older levees ot the same river.
c The grave goods of some extraordinary rich Roman graves, from the 2nd half of the 1st century A. D., comprising 61 pieces of pottery, 11 bronzes and 15 glasses. Merovingian (6-7th), Carolingian, *Badorf, Kugeltopf* and *Pingsdorf* pottery sherds are said to have been found on the same terrain.
d Dug up by Mr G. Murman, then the inhabitant of the house Bottesteyn, in the orchard near his house in 1905 and the following years.
e Stuart 1968.

(133[a])a *Geldermalsen—Hangwaard I.*
b River levee deposits or out cropping Pleistocene sand.
c — Sherd with fine parallel cord impressions, part of an All Over Cord (2[1b]) Beaker.
— Sherd with horizontal rows of herring-bone impressions, part of a (late) Protruding Foot Beaker.
— Triangular flint arrow-head.
— Two flint flakes.
d Discovered 5-8-1972 by the AWN work-group West-Betuwe in the sides of a newly dug ditch, bordering a road under construction about 750 m south of Bottesteyn (= no. 133).
e AN 1973, *28.

(133[b])a *Geldermalsen—Hangwaard II*
b River levee deposits or outcropping Pleistocene sand.
c Sherds of Roman and Iron Age pottery.
d Discovered 16-8-1972 by the AWN work-group West-Betuwe in the dug-out stretch of a road under construction, about 100 m. south-east of site 133[a].

134 a *Geldermalsen—uiterwaard*
b River foreland of the river Linge. On a local sand deposit.
c A polished stone axe.
d Found at the surface by Mr H. Th. Spit, Geldermalsen, 1958.

APPENDIX IV

RADIOCARBON DATES, ESTABLISHED ON BEHALF OF THIS PUBLICATION

List of ^{14}C dates of samples from archaeological sites in the river clay/wood peat area, determined on behalf on the present study

	sample	No.	B.P.	B.C.	
Molenaarsgraaf-Hazendonk					
Section A-B, boring 1967-3 — 330 cm. NAP	peat	GrN 5175	4290 ± 40	(2340)	*
Section H-J, boring 1969-1 — 250/260 cm. NAP	peat	GrN 6212	3630 ± 35	(1680)	
Section H-J, boring 1969-1 — 370/380 cm. NAP	peat	GrN 6213	4480 ± 40	(2530)	
Section H-J, boring 1969-1 — 465/475 cm. NAP	peat	GrN 6214	4935 ± 40	(2985)	
Section H-J, boring 1969-1 — 545/555 cm. NAP	peat	GrN 6215	5320 ± 40	(3370)	
Molenaarsgraaf-Bell Beaker Settlement					
Grave I, femur of skeleton	bone	GrN 5131	3635 ± 40	(1685)	*
Grave II, femur of skeleton	bone	GrN 5566	3630 ± 40	(1680)	*
Ox grave, metacarpals of skeleton	bone	GrN 6218	4385 ± 105	(2435)	
Pit 210, charcoal in primary position	charcoal	GrN 5705	3635 ± 60	(1685)	*
Pit 199, charcoal in secondary position	charcoal	GrN 5132	3780 ± 50	(1830)	*
No. 58, concentration of sherds and charcoal, gully bank	charcoal	GrN 5176	3640 ± 30	(1690)	*
No. 29, Middle Bronze Age hearth place	charcoal	GrN 5177	3350 ± 35	(1400)	*
Pollen diagram I, North Section C8, — 170 cm. NAP	peat	GrN 5264	2710 ± 35	(760)	*
Ottoland-Oosteind					
Pit complex, poor in finds, no. 48	charcoal	GrN 6217	3655 ± 55	(1705)	
Small pit with Late Bronze Age sherds, no. 60	charcoal	GrN 6252	2815 ± 55	(865)	
Ottoland-Kromme Elleboog					
Excavation, sample no. 1, from a small pit	charcoal	GrN 6216	3795 ± 55	(1845)	
Grave site, sample from a small pit	charcoal	GrN 6253	2410 ± 35	(460)	
Grave site, long bone of non-articulated skeleton	bone	GrN 6384	3820 ± 45	(1870)	
Benschop					
Middle Bronze Age settlement site, from test pit	charcoal	GrN 5356	2960 ± 60	(1010)	*
Biesheuvel					
Middle Bronze Age settlement site, prehistoric pit	charcoal	GrN 5357	3125 ± 40	(1175)	*
Culemborg-Den Heuvel					
Small pit (no. 101) probably contemporary with GrN 4946	charcoal	GrN 4945	2600 ± 70	(650)	*
Big pit (no. 93) with numerous finds; early in occupation	charcoal	GrN 4946	2620 ± 50	(670)	*
Complex of pits (nos. 210-214) with Early Iron Age finds	charcoal	GrN 4947	2360 ± 75	(410)	*
Refuse layer in gully, Late Iron Age finds	wood	GrN 5001	2210 ± 50	(260)	*
Avezaath-Roman ship					
Wood from presumed Roman ship fragment	wood	GrN 5646	1820 ± 30	(A.D. 130)	*

* Published in Vogel & Waterbolk 1972.

APPENDIX V

LATE NEOLITHIC SKELETON FINDS FROM MOLENAARSGRAAF (Z.H.)

by

AGATHA S. KNIP *

Contents

Introduction

In October 1966 we received human skeletal parts, described later, which had come to light during investigations at Molenaarsgraaf, South Holland, conducted by the National Museum of Antiquities

At three different places, about 15 m from each other, human remains were found in the settlement terrain which originates from the transition period from Neolithic to Bronze Age. One of the graves contained a funeral gift consisting of a late Veluwe Bell Beaker. Two of the graves are dated by means of ^{14}C dates at about 1700 B.C. In the thesis of Mr L. P. Louwe Kooijmans further particulars about the finds—circumstances, dating, etc.—are given.

The material consists of the following 'find numbers':

Mgr. I 38: incomplete skeleton, including skull;
Mgr. II 37: incomplete skeleton, including skull;
Mgr. III 36: incomplete skeleton, including skull.

Description of the finds

A detailed description of each of the skeletal parts found may be omitted here. We shall only mention data (or resume them in tables) which may be of importance to any later comparative study.

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* Institute of Human Biology, Utrecht, Director: Prof Dr J. Huizinga. This report was written in 1967. It is published here in a unrevised form.

a) *Skeleton Mgr. I 38.* (Plate XIII)

The skull is light brown in colour and slightly deformed on the left side after death. A part of the os occipitale, the left os zygomaticum and a great part of the face are missing. Both ossa temporalia, a part of the maxilla and various parts of the base of the skull are separate; because of the post mortem deformation, however, any reconstruction of the skull is unreliable.

Norma facialis: the forehead gives a moderately high and fairly broad impression. The tubera frontalia are pronounced; the transverse curvature is regular and flat. The face is moderately high and fairly broad. The naso-frontal suture is convex. The nose appears to be moderately high and fairly broad; at the right underside of the nasal aperture there is a sulcus prenasalis. The orbit gives a moderately high and fairly broad impression; the shape is practically rectangular with a transversal axis running from upper medial to lower lateral. Left and right a clear frontal notch is present in the orbital roof. The superciliary arches are hardly developed; the supraorbital trigonae are fairly flat.

Norma lateralis: the face gives a moderately long and fairly high impression in relation to the skull. The glabella is very weakly developed (Broca I); the superciliary arches are not very prominent either. The sagittal outline shows a fairly steep and prounced vaulting of the frontal bone; a fairly pronounced curvature of the parietal bone; an almost flat curve 1.5 cm above lambda to 3 cm below lambda (planoccipitaly) and from there on a regular vaulting of the occipital bone. The external occipital protuberance is hardly visible. The temporal lines are little developed. The mastoid processes are fairly robust. A paramastoid process is present on the left.

The post auricular part of the skull consists of a little more than 1/3 of the total length. The external auditory meatus is elliptical with a longitudinal axis, which runs from the upper front to the lower rear. The nasion lies in the same flat area as the lower part of the frontal bone. The face is probably orthognathous. The mandible does not appear to be very robust. The ramus is fairly broad in relation to the height; the mandibular angle is not large; the coronoid process is somewhat higher than the condyloid process. The corners of the jaw are slightly turned inwards; the lower edge of the mandible is convex in shape. The square chin protrudes markedly. The mental protuberance and the mental tubercles are well developed. The two mental foramina to the right (the diameter of one is smaller than that of the other) lie at the height of P_1 9 mm from the lower edge of the mandible; the left mental foramen lies 12.5 mm from the lower edge under P_1.

Norma verticalis: the skull is sphenoid in form without any clear post orbital constriction. The greatest breadth lies somewhat behind the transition from the posterior to the middle third part of the length of the skull. The tubera parietalia are particularly well developed; the tubera frontalia are somewhat less clearly accentuated. A parietal foramen is present on both sides of the skull.

Norma occipitalis: The skull gives a moderately high and very broad impression. The transversal curvature is not very pronounced; both side walls of the ossa parietalia run fairly steep downwards from the tubera parietalia. Five wormian bones have been found in the suture between the ossa parietalia and the os occipitale. The bony ridges round the occipital foramen

are clearly accentuated. The eurya lie on the lowest part of the parietal bones. The palate is bordered by a parabolic dental arch. The right I^2 and M^2 were lost after death. The right M^3 is nearly erupted; the left M^3 is present but separately. The elements show no reduction. Wear is limited. The shape of the mandibular dental arch is paraboloid. Both M_3's are not erupted. The right M_1 shows a Y-pattern, Both M_1's and the incisors show slight wear. Inside the lower jaw the attachment points for the chewing muscles are well developed; there is an indication of a mental spine.

Most probably we are dealing with an individual of the male sex. All skull sutures are still open; also the fusion of the sphenooccipital suture has not occurred. The apparent age of this person is 15 years.

The following parts of the post cranial skeleton are preserved:

Extremitas superior: both scapulae (damaged); right (damaged) and left clavicle; both humeri, ulnae and radii; 16 carpal bones (some damaged); 10 metacarpalia and 28 phalanges.

Extremitas inferior: both ossa coxae; both femora, tibiae, fibulae and patellae; 14 damaged tarsalia, 9 metatarsalia and 14 phalanges.

Truncus: damaged sternum, 23 costae, 21 vertebrae and 5 segments of the sacrum.
Most epiphyses are present.
Neither the right nor the left humerus is very robust. The left humerus has a somewhat rounder diaphysis cross-section than the right humerus. The deltoideal tuberositas in both humeri is not strongly developed. The left humerus shows a perforation of the humeral septum; in the right humerus a post mortem perforation of the humeral septum is visible. Both humeri show a clear torsion.

The radii and ulnae are gracile in shape.

The sciatic notches of the ossa coxae are J-shaped (a male feature). The maximum length and width of the ossa coxae correspond well with each other as do the measurements of the left and right acetabulum.

The femora show a clear flattening in antero-posterior direction. The robusticity index indicates that also these long bones are not very robust. The left femur shows a clearly developed pilaster; a trochanter tertius is present. The torsion of this femur is somewhat indefinite.

The tibiae are not very robust. They show no transverse flattening. The right tibia is slightly twisted. On the ventral side of both distal epiphyses a squatting facet is present. The fibulae appear to be somewhat gracile.

The astragali are fairly broad and not very high in relation to the length. The trochleae are broad and not very long in relation to the astragalus measurements. On the left and right collum tali there is a lateral squatting facet. The calcanei are fairly narrow and moderately high. The tubera calcanei are fairly broad in relation to the height.

The ventral wall of the left foramen transversarium of the atlas consists of two bone rings.

An estimation of the stature, based on the length of various long bones, according to both Manouvrier and Pearson (Martin, 1928), is as follows:

Stature of skeleton Mgr. I 38 (♂)

Calculated from:	*Manouvrier*	*Paerson*
Femur d	161.2	—
" s	155.2	156.3
Tibia d	164.2	163.5
" s	164.8	163.9
Radius d	165.4	164.1
" s	166.6	165.4

The stature was approximately 162-163 cm.

b) *Skeleton Mgr. II 37.* (Plates XIV-XVI)

The skull is light to dark brown in colour and has considerable post mortem deformation on its right side. On the right side large parts of the os parietale, os frontale, os temporale and maxilla are missing. The zygomatic bone is also missing on the right side. The mandible has lost its right coronoid process and part of the chin on the right side.

Norma facialis: The forehead gives a moderately high and moderately broad impression. The transverse curvature is not marked and the tubera frontalia are moderately developed. The face is fairly tall and narrow. The nose is fairly high and moderately broad. The naso-frontal suture is convex. At the left inferior edge of the nasal aparture a sulcus praenasalis is present. The moderately large orbit is quadrilateral in shape with a transversal axis running from upper medial to lower lateral. In the left and right orbital roof a frontal notch has been found, above which, a small distance away laterally, a supraorbital foramen is visible. The superciliary arches are moderately developed; the supraorbital trigonae are fairly flat. The remnant of a metopic suture which is about 25 mm long is present above the naso-frontal suture.

Norma lateralis: The face gives a fairly tall and moderately long impression in relation to the posterior part of the skull. The glabella is weakly developed (Broca II), and the superciliary arches are also little accentuated. The median sagittal outline shows a fairly marked vaulting of the frontal bone, a less marked curvature of the parietal bone, an almost flat curvature 2 cm above lambda to 4 cm below lambda (planoccipitaly) and thence a regular vaulting of the occipital bone. The mastoid process is fairly robust and on both sides divided into three.

The post auricular part of the skull consists of somewhat less than 1/3 of the total length. The external auditory meatus is elliptical in shape with a longitudinal axis running from upper front to lower rear. The supra meatic spine is well pronounced. The course of the suture at the left pterion shows the picture of the stenokrotaphia. The bony ridges for the attachment of the musc. temporalis are well developed. The face is orthognathous.

The nasion is not deep; the nasal bones protrude.

The mandible gives a fairly robust impression. The mandibular ramus is broad and fairly tall; the mandible angle is not large; the condyloid process is lower than the coronoid process. The corners of the jaws are somewhat turned outwards; the lower edge of the mandible is

concave in shape. The square chin sticks out; to the left there is a mental tubercle. The muscle attachments are very clearly developed. The left mental foramen lies 12 mm from the lower edge of the mandible under P_2; on the right it lies 11 mm from the lower edge under P_2.

Norma verticalis: The skull is sphenoid in shape without marked post orbital constriction. The greatest breadth lies somewhat in front of the transition from the posterior middle third part of the length of the skull. The tubera parietalia are more distinct than the tubera frontalia. A left foramen parietale is present.

Norma occipitalis: The skull gives a moderately tall and fairly broad impression. Both parietal bones meet under an obtuse angle (slight lophocephalia); the transverse curvature is not very pronounced and both sides fall almost vertically downwards and inwards. Seven wormian bones are present in the suture between the ossa parietalia and os occipitale. The external occipital protuberance is hardly visible; the external occipital crest is clearly developed. The muscle attachments round the occipital foramen are plainly accentuated. The eurya lie on the lowest part of the parietal bones.

Norma basalis: The occipital foramen is almost round in shape. The mastoid notches are fairly deep; the left and right glenoid fossa are fairly deep. The dental arch of the maxilla is paraboloid in shape. All dental elements are erupted; the right I^1 was lost after death. The I^2 is clearly reduced on both sides; the left C is fairly small. The elements show considerable wear, which is most pronounced in the M^1's .The palate gives a high impression.

The form of the dental arch of the mandible is paraboloid. Of the elements P_1, C, I_1 and I_2 on the right and C and I_2 on the left were lost after death. On the right M_2 there is a Y-pattern. The elements clearly show wear, especially both M_1's. However, the M_3's also show wear in its early stages.

This skull appears to be that of a male person. In view of the fusion pattern of the skull sutures (S^3 is closed) and the dental wear this man apparently died at the age of 30 years.

The following parts of the post cranial skeleton are preserved:

Extremitas superior: both scapulae (incomplete), both clavicles (damaged), both humeri (one incomplete), the right ulna (damaged), the right radius (incomplete), the 8 left carpalia (damaged), the five left metacarpalia, 10 left phalanges.

Extremitas inferior: both ossa coxae (incomplete), both femora (one incomplete), the right patella, both tibiae (one incomplete), both fibulae (one incomplete), the 14 tarsalia, the 10 metatarsalia, 23 phalanges.

Truncus: 24 damaged costae, 23 damaged vertebrae, 1 fragment of the sacrum, 3 parts of the sternum.

The right humerus does not give a very robust impression. It shows a clear torsion and is flattened off. The deltoideal tuberositas is moderately developed; the radial fossa is shallow.

The radius and the ulna are not very robust in shape.

The left half of the pelvis is about 17 mm shorter than the right half. The left acetabulum

is markedly shorter and very shallow in comparison with the right acetabulum. The sciatic notches are J-shaped on both sides (a male feature).

The right femur shows a strong flattening in antero-posterior direction. The robusticity index indicates that this bone is not very robust. No trochanter tertius is present. The linea aspera is not pronounced. The left caput femoris gives a somewhat shorter impression than the right caput; it is not, however, flattened off.

The facies articularis medialis of the right patella shows a practically right-angled bend to the ventral.

The right tibia is moderately robust in shape. It shows no lateral flattening. The corpus in the proximal part makes a convex bend to the ventral. The distal part of the tibia is clearly positively twisted in relation to the proximal part. On the ventral side of the lower epiphyseal end there is a small articular surface. The right fibula makes a sharp concave bend in a lateral direction. It does not appear to be very robust.

The astragali are rather low and moderately broad in relation to the length; the trochleae are fairly broad and long in relation to the astragalus measurements. On the collum of the right astragalus a lateral squatting facet can be seen. The calcanei are moderately broad and moderately high. The tubera calcanei are moderately broad in relation to the height.

The sternum consists of three unossified parts

Stature of skeleton Mgr. II 37 (♂)

Calculated from	*Manouvrier*	*Pearson*
Femur d	165.4	164.9
Tibia d	166.6	165.8
Humerus d	159.5	159.4

The stature must have been about 163-164 cm.

c) *Skeleton Mgr. III 36*

These skeletal remains are very probably those of a female person of about 1½ years. The condition of preservation made it impossible to make reliable measurements for a comparative investigation of this material.

Amidst the skeletal remains of Mgr. II 37 a fragment of an epiphysis was found that did not belong to Mgr. I 38 or Mgr. III 36. Together with the unossified sternum of Mgr. II 37 this could indicate the presence of a fourth person.

Comparisons and conclusions (see tables 1 and 2)

The index cranicus gives for Mgr. I 38 a value of 95.6 and for Mgr. II 37 a value of 84.5. Both skulls are clearly brachycranic.

The difference between both indices is chiefly caused by the large skull breadth of Mgr. I 38.

Both from the relationship between the height and the length and from that between the height and the width it appears that Mgr. II 37 is clearly tall (hypsi-acrocrania); the indices

are 83.0 and 98.2, respectively. The length-auricular index (67.0) indicates a high (hypsicrania) skull. The same indices* show that Mgr. I 38 is averagely tall (orthocrania) in relation to the length (this is supported by the length-auricular index: 61.8) and fairly low in relation to the breadth (tapeinocrania); the indices are 72.6 and 75.9, respectively. The sagittal-frontal index is in both skulls smaller than 90, which supports the impression gained during inspection that the foreheads are clearly domed and fairly steep. The sagittal-parietal index of Mgr. II 37 has a value of 90.2 and of Mgr. I 38 a value of 87.5; from this is appears that Mgr. I 38 (see also figure 1) has a somewhat more pronounced parietal bend.

From the transversal fronto parietal indices it appears that Mgr. I 38 shows a slight stenometopia and that Mgr. II 37 must be included in the metriometopic class (indices 64.2 and 66.8 respectively). The orbits of Mgr. II 37 are moderately high (mesoconchia; orbital index: 81.2). Judging from the upper facial index and the facial index (67.2 and 115.2) Mgr. II 37 has a fairly narrow and fairly tall upper face (hyperleptenia) and face (hyperleptoprosopia). Apparently Mgr. I 38 has a narrow and tall upper face (leptenia) and face (leptoprosopia) the indices being 58.3 and 95.3*, respectively.

The nose of Mgr. II 37 is fairly narrow and high (lephtorrinia; nasal index 45.7). From the gnathic index (89.5) it appears that Mgr. II 37 is clearly orthognatous.

Further similarities and differences may appear from tables 1 and 2. The great similarity in shape is chiefly expressed in the comparison of the median sagittal outlines; these are orientated in such a way that the lines along which the greatest length was measured and the points in the middle of these lines (M) coincide (see figure 1).

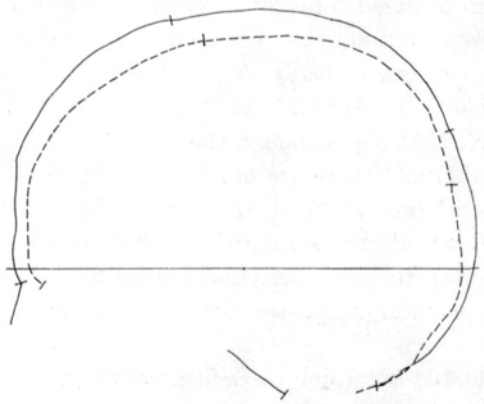

Fig. 1. The outline of Molenaarsgraaf I (— — —) compared with the outline of Molenaarsgraaf II (———).

The similarity of both skulls, particularly as far as the planoccipital region is concerned is striking; the small variations are the normal variations of morphological characteristics which occur within a group.

* It must be noted that the indices have been calculated from inexact measurements.

The post-cranial skeleton (see table 3) of both persons does not give a very robust impression. The femora show a clear flattening (platymeria) as appears from the values of the platymeric index.

The tibiae show no flattening (eury- to mesocnemia). Both right humeri show platybrachia; the left humerus of Mgr. I 38 is rounder in shape. The perforation of the humeral septum is no rarity in Neolithic man (Martin, 1928; Schinz, 1922; Glanville, 1967).

The left os coxae of Mgr. II 37 is clearly pathologically deformed (see Plate XV); yet no obvious abnormalities which might be related to this were found in the femora and tibiae. Closer investigation showed that this os coxae certainly belongs to skeleton Mgr. II 37.

The sternum found amongst the remains of Mgr. II 37 consists of three parts not yet fused. According to Krogman (1962) the ossification of the sternum is completed after the 25th year. It cannot be ruled out that this sternum came from another individual.

Stature calculated according to Manouvrier and Pearson gives an average length of 163-164 cm for Mgr. II 37 and 162-163 for Mgr. I 38. The last mentioned person was not yet fully grown so that his length when adult, bearing in mind the late adolescent acceleration in growth, would certainly have been more than 163 cm.

The male 'planoccipitale Steilköpfe' from Middle and West Germany, described by Gerhardt (1953), have been chosen for comparison with these two planoccipital, brachymorphic skulls. The averages and ranges of this group have been tabulated by Bach (1964-65). From table 5 it appears that some measurements of Mgr. II 37 lie just on or immediately below the lowest variation limit. Namely the biauricular breadth, the length of the face, the condylar breadth and the bizygomatic breadth. The low value of the bizygomatic breadth of Mgr. II 37 is striking; it explains the values lying above the upper variation limit of the upper facial and the facial index. The length-height index, breadth-height index, nasal breadth and nasal height differ only slightly from the uppermost variation limit. A large individual variability should be taken into account, which in view of the typologically very heterogeneous make-up of the Bell Beaker people is not so remarkable (Bach 1964-65; Gerhardt, 1953). Mgr. II 37 strongly resembles the Mühlhausen skull (Bach 1964-65), although the face of Mgr. II 37 is higher and narrower.

In Gerhardt's material (1953) there are only 7 young persons. As comparative material for Mgr. I 38 only Braunsdorf (no. 41 *), ♂, 18 years) and Kleinvahlberg B (no. 60 *), ♂, 18 years) may serve. Table 6 reveals the similarities and differences between the three skulls. Gerhardt (1953) remarks that the juvenile persons are undoubtedly brachymorphous with a clear tendency towards planoccipitaly, in contrast to the very young persons who have a fairly long skull shape.

Average stature (calculated according to Breitinger) of all male Bell Beaker people of the series of Gerhardt (1953) is 169.4 cm (n = 20, min.-max. = 160-178 cm). The Bell Beaker people had a fairly long stature in comparison to other Neolithic groups (Bach, 1964-65; Grimm, 1959; Vallois, 1943).

The measurements and indices of Mühlhausen, Weimar 79, Weimar 81a and Weimar 82 (Bach 1964-65) may serve as a comparison for the measurements of the extremities of skeleton Mgr II 37 (see table 4).

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* Numbering according to Gerhardt (1953).

Few human remains from the Neolithic period have been found in the Netherlands in association with the Bell Beaker Culture. The only human remains so far described come from Nierssen, near Vaassen on the Veluwe (Nieuwenhuis, 1908). The findings of this skull material—dolichocrania, an abnormal forehead and heavy eyebrow arches—are questioned by Huizinga (1959). Basing his reasoning on the coarse character of the skeleton, Huizinga reaches the conclusion that these skeletal remains belong very probably to the 'planoccipitale Steilkopf', the typical central figure in the Bell Beaker people (Gerhardt, 1953).

In 1953 Gerhardt wrote a monograph on the Bell Beaker people in Central and West Germany. According to him this very heterogeneous people consist chiefly of alpine-dinaric types, in which the planoccipital brachymorphous type predominates, especially in the men. This observation is supported by Hemmer's allometric study (1967).

The important basic group of the Bell Beaker people: The 'planoccipitale Steilkopf' is characterized as follows by Gerhardt: the skeleton is very coarse and heavy; the occiput is especially flat and steep, the nose protrudes markedly.

In addition to Germany other countries have also yielded examples of 'planoccipitale Steilköpfe' in association with the Bell Beaker Culture; among others Italy (Graziosi, 1947), Poland (Wiercinsky, 1967) Roumania (Necrasov and Cristescu, 1965), Spain (Fusté, 1956. 1961, 1964) and Czechoslovakia (Jelinek, 1964 and 1967).

We still have no knowledge of the origin of this type. In earlier Neolithic periods the type has been encountered outside the Bell Beaker period (Alcobé et al., 1967). Apparently the Bell Beaker people entered our country via the east (Bohemia and Moravia), although an invasion from the south, namely the Spanish peninsula, cannot be discounted. (Childe, 1957, 1964; Constandse-Westermann, 1968; Fusté 1956, Jelinek, 1967; v.d. Waals 1964).

Summary

During an excavation by the National Museum of Antiquities (Leiden, Netherlands) at Molenaarsgraaf (province South-Holland) human skeletal remains buried in graves were found belonging to people who lived there at the transition from the Neolithic to the Bronze Age, during the end phase of the Bell Beaker Culture (see Louwe Kooijmans 1974).

The skulls and long bones of two skeletons could be investigated after more or less successful reconstruction.

The two planoccipital brachycranic skulls show a close relationship to the main type of the Bell Beaker folk of Central- and West Germany as described by Gerhardt (1953).

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TABLE 1

MEASUREMENTS OF THE SKULL (ACCORDING TO MARTIN, 1928)

Measurement		Mgr. I 38 ♂	Mgr. II 37 ♂
Greatest length	M. 1	161.0	171.5
Glabella-lambda length	M. 3	159.0	168.0
Nasion-basion length	M. 5	80.0*	105.0
Greatest breadth	M. 8	154.0	145.0
Frontal breadth (min.)	M. 9	99.0	97.0
Frontal breadth (max.)	M. 10	127.0	—
Biauricular breadth	M. 11	125.0*	121.0
Asterion breadth	M. 12	118.0*	110.0
Basion-bregma height	M. 17	117.0*	142.5
Auricular-bregma height	M. 20	99.5*	115.0
Sagittal frontal arc	M. 26	127.0	127.0
Sagittal parietal arc	M. 27	120.0	123.0
Sagittal occipital arc	M. 28	106.0*	111.0
Sagittal frontal chord	M. 29	109.0	112.0
Sagittal parietal chord	M. 30	105.0	111.0
Sagittal occipital chord	M. 31	88.0*	98.0
Frontal angle	M. 32^5	125°	131.5°
Basion-prosthion distance	M. 40	93.0*	94.0
Upper facial breadth	M. 43	102.0*	105.0
Bizygomatic breadth	M. 45	108.0*	105.0*
Maxillary breadth	M. 46	—	100.0*
Nasion-gnathion distance	M. 47	103.0*	121.0*
Nasion-prosthion distance	M. 48	63.0*	71.0
Anterior interorbital breadth	M. 50	—	25.0
Orbital breadth	M. 51	40.0*	40.0
Orbital height	M. 52	33.0*	32.5
Nasal breadth	M. 54	—	27.0*
Nasal height	M. 55	—	59.0
Palate breadth	M. 63	41.0*	37.0
Maxillo alveolar breadth	M. 61	61.0*	59.0
Bicondylar width	M. 65	116.0	118.0*
Length of base	M. 68	73.0	90.0*
Mandibular height	M. 69^2	L. 22.3 R. 22.0	L. 29.0 R. 30.0
Mandibular height	M. 69^3	L. 24.1 R. 23.5	L. 31.0 R. 32.5
Ramus length	M. 70	51.0	64.0*
Ramus breadth	M. 71	L. 38.5 R. 39.0	L. 45.2 R. —
Min. breadth of mandibular ramus	M. 71^a	L. 30.2 R. 31.0	L. 34.0 R. —
Gonial angle	M. 79	124°	115°
Length of premolar-molar row (mandible)	M. 80^2	L. 35.2 R. 35.0	L. 37.0 R. 37.2
Length of molar row (mandible)	M. 80^3	L. 20.6 R. 20.9	L. 30.0 R. 31.0
Length of premolar-molar row (maxilla)	M. 80^2	L. — R. 33.0	L. 38.0 R. 38.0
Length of molar row (maxilla)	M. 80^3	L. — R. 20.0	L. 27.0 R. 27.0

* Approximate values.

TABLE 2

INDICES OF THE SKULL (ACCORDING TO MARTIN, 1928)

		Mgr. I 38 ♂	Mgr. II 37 ♂
Length-breadth index	M. 8: 1	95.6	84.5
Length-height index	M. 17: 1	72.6*	83.0
Breadth-height index	M. 17: 8	75.9*	98.2
Length-auricular index	M. 20: 1	61.8*	67.0
Transversal frontal index	M. 9:10	77.9	—
Transversal fronto-parietal index	M. 9:8	64.2	66.8
Sagittal fronto-parietal index	M. 27:26	94.4	96.8
Sagittal frontal index	M. 29:26	85.8	88.1
Sagittal parietal index	M. 30:27	87.5	90.2
Sagittal occipital index	M. 31:28	88.2	88.2
Orbital index	M. 52:51	—	81.2
Nasal index	M. 54:55	—	45.7*
Mandibular ramus index	M. 71:70	L. 75.4 R. 76.4	L. 70.6 R. —
Gnathic index	M. 40:5	—	89.5
Facial index	M. 47:45	95.3*	115.2*
Upper facial index	M. 48:45	58.3*	67.2*
Longitudinal cranio-facial index	M. 40:1	57.7*	54.8
Vertical cranio-facial index	M. 48:18	53.7*	49.6

* Approximate values.

TABLE 3

MEASUREMENTS AND INDICES OF THE POST-CRANIAL SKELETON
(ACCORDING TO MARTIN, 1928)

Measurement		Mgr. I 38 ♂		Mgr. II 37 ♂	
Os coxae					
Maximal length	M. 1	L. 190.0	R. 189.0	L. 198.0	R. 215.0
Maximal breadth	M. 2	L. 133.0	R. 133.0	L. —	R. —
Pubic length	M. 17	L. 67.0	R. 68.5	L. —	R. —
Ischial length	M. 16	L. 74.0	R. 78.0	L. —	R. —
Breadth of the sciatic notch	M. 31	L. —	R. —	L. —	R. —
Length of the sciatic notch	M. 32	L. —	R. —	L. —	R. —
Vertical diameter acetabulum	M. 22	L. 48.0	R. 51.5	L. —	R. 52.0
Horizontal diameter acetabulum	M. 22	L. 45.5	R. 47.0	L. —	R. —
Coxal index	M. 2:1	L. 70.0	R. 70.3	L. —	R. —
Ischium-pubis index	M. 17:16	L. 90.5	R. 87.8	L. —	R. —
Femur					
Maximal length	M. 1	L. 399.0	R. —	L. —	R. 445.0
Physiological length	M. 2	L. 398.0	R. 419.0	L. —	R. 440.0
Trochanter-condylus length	M. 3	L. —	R. —	L. —	R. 425.0
Physiological trochanter length	M. 4	L. —	R. —	L. —	R. 411.0
Sagittal diameter of middle of diaphysis	M. 6	L. 24.0	R. 23.0	L. —	R. 27.0
Transverse diameter of middle of diaphysis	M. 7	L. 21.0	R. 22.0	L. —	R. 25.0
Circumference of middle of diaphysis	M. 8	L. 70.0	R. 70.0	L. —	R. 81.0
Transverse diameter of upper part of diaphysis	M. 9	L. 29.0	R. 28.0	L. —	R. 31.0
Sagittal diameter of upper part of diaphysis	M. 10	L. 21.0	R. 21.0	L. —	R. 22.0
Length-thickness index	M. 8:2	L. 16.7	R. 17.5	L. —	R. 18.4
Robusticity index	M. 6+7:2	L. 10.7	R. 11.3	L. —	R. 11.8
Pilasteric index	M. 6:7	L. 104.5	R. 114.2	L. —	R. 108.0
Meric index	M. 10:9	L. 75.0	R. 72.4	L. —	R. 70.9
Tibia					
Maximal length	M. 1	L. 359.0	R. 356.0	L. —	R. 367.0
Length	M. 1[b]	L. 353.0	R. 352.0	L. —	R. 362.0*
Maximal diameter at for nutr. (middle of diaphysis)	M. 8[a]	L. 29.3	R. 31.4	L. —	R. 33.0
Transverse diameter at for nutr. (middle of diaphysis)	M. 9[a]	L. 22.0	R. 21.2	L. —	R. 22.0
Minimal circumference of diaphysis	M. 10[b]	L. 65.0	R. 67.0	L. —	R. 77.0*
Length-thickness index	M. 10[b]:1	L. 18.1	R. 18.8	L. —	R. 20.9
Cnemic index	M. 9[a]:8[a]	L. 75.0	R. 67.5	L. —	R. 66.6
Astragalus					
Length	M. 1	L. 50.5	R. 51.0	L. 58.0	R. 56.3
Breadth	M. 2	L. 43.0	R. 41.0	L. 43.5	R. 43.8
Height	M. 3	L. 29.2	R. —	L. 32.3	R. 33.7
Trochlea length	M. 4	L. 30.0*	R. —	L. 35.8	R. 34.4
Trochlea breadth	M. 5	L. 31.0	R. 31.0	L. 33.4	R. 33.6

* Approximate values.

TABLE 3 (CONTINUED)

Measurement		Mgr. I 38 ♂		Mgr. II 37 ♂	
Length-breadth index	M. 2:1	L. 85.1	R. 80.3	L. 75.0	R. 77.7
Length-height index	M. 3:1	L. 57.8	R. —	L. 55.6	R. 59.8
Trochlea length index	M. 4:1	L. 59.4	R. —	L. 61.7	R. 61.1
Talus-trochlea breadth index	M. 5:2	L. 72.3	R. 75.6	L. 76.7	R. 76.7
Trochlea index	M. 5:4	L. 103.3	R. —	L. 93.2	R. 97.6
Calcaneus					
Length	M. 1	L. 78.0*	R. 76.0*	L. 78.0*	R. 76.2
Breadth	M. 2	L. —	R. 37.0	L. 41.0	R. 42.5
Minimal breadth corpus	M. 3	L. —	R. 23.0	L. —	R. 24.0
Height	M. 4	L. 36.0	R. 36.0	L. 39.0	R. 41.0
Length	M. 5	L. 52.0*	R. 52.5	L. 49.0*	R. 51.8
Tuber height	M. 7	L. 42.0*	R. 43.0*	L. 52.5	R. 54.8
Tuber breadth	M. 8	L. 28.0*	R. 28.0*	L. 30.0*	R. 31.0
Length-breadth index	M. 2:1	L. —	R. 48.6*	L. 51.2*	R. 55.0
Corpus length index	M. 5:1	L. 66.6*	R. 69.0*	L. 62.8*	R. 67.9
Tuber index	M. 8:7	L. 66.6*	R. 65.1*	L. 57.1*	R. 56.5
Tuber index	M. 7:1	L. 53.8*	R. 56.5*	L. 67.3*	R. 71.9
Humerus					
Maximal length	M. 1	L. —	R. —	L. —	R. 307.0
Total length	M. 2	L. 296.0	R. 304.0	L. —	R. 301.0
Max. diameter of middle of diaphysis	M. 5	L. 18.2	R. 19.5	L. —	R. 22.0*
Min. diameter of middle of diaphysis	M. 6	L. 14.6	R. 15.0	L. —	R. 16.0
Min. circumference of diaphysis	M. 7	L. 50.0	R. 54.0	L. —	R. 59.0
Diaphysis cross-section index	M. 6:5	L. 80.2	R. 76.9	L. —	R. 72.7*
Robusticity index	M. 7:1	L. —	R. —	L. —	R. 19.2
Ulna					
Physiological length	M. 2	L. 230.0	R. 228.0	L. —	R. —
Circumference	M. 3	L. 31.0	R. 31.0	L. —	R. 37.0
Length-thickness index	M. 3:2	L. 13.4	R. 13.5	L. —	R. —
Radius					
Maximal length	M. 1	L. 243.0	R. 239.0	L. —	R. —
Physiological length	M. 2	L. 231.0	R. 228.0	L. —	R. —
Circumference	M. 3	L. 38.0	R. 38.0	L. —	R. —
Length-thickness index	M. 3:2	L. 16.4	R. 16.6	L. —	R. —

* Approximate values.

TABLE 4

COMPARATIVE DATA ON THE LONG BONE DIMENSIONS

Measurement		Mgr. II 37 ♂	Muhlhausen ♂	W 79 ♂	W 81[a] ♂	W 82
Humerus		L/R	L/R	L/R	L/R	L/R
Maximal length	M. 1	—/307	—/347	—/—	—/(320)	345/—
Total length	M. 2	—/301	—/341	331/—	—/313	343/—
Min. circumference of diaphysis	M. 7	—/59	—/65	67/—	—/70	70/70
Radius						
Maximal length	M. 1	—/—	—/—	—/259	—/—	—/267
Physiological length	M. 2	—/—	—/—	—/242	—/—	253/253
Circumference	M. 3	—/—	42/—	—/43	—/—	45/44
Ulna						
Physiological length	M. 2	—/—	247/—	246/—	—/—	254/—
Circumference	M. 3	—/37	35/—	42/—	—/—	40/40
Femur						
Maximal length	M. 1	—/445	—/482	—/—	433/—	491/491
Physiological length	M. 2	—/440	—/479	—/—	432/—	490/489
Sagittal diameter of middle of diaphysis	M. 6	—/27	30/28	—/—	27/—	33/32
Transverse diameter of middle of diaphysis	M. 7	—/25	31/29	—/—	29/—	30/31
Circumference of middle of diaphysis	M. 8	—/81	92/—	—/—	85/—	108/108
Transverse diameter of upper part of diaphysis	M. 9	—/31	38/37	36/—	35/—	36/38
Sagittal diameter of upper part of diaphysis	M. 10	—/22	26/25	27/—	25/—	28/28
Tibia						
Maximal length	M. 1	—/367	386/(384)	—/—	—/—	415/—
Length	M. 1[b]	—/362	384/(377)	—/—	350/—	411/—
Maximal diameter at for nutr. (middle of diaphysis)	M. 8[a]	—/33	35/35	—/—	34/—	41/40
Transverse diameter at for nutr. (middle of diaphysis)	M. 9[a]	—/22	23/24	—/—	23/—	25/25
Robusticity index humerus	M. 7:1	—/19	—/18.7	—/—	—/21.9	20.3/—
Length-thickness index radius	M. 3:2	—/—	—/—	—/17.8	—/—	17.4/17.8
Length-thickness index ulna	M. 3:2	—/—	—/14.2	17.1/—	—/—	15.7/—
Robusticity index femur	M. 6+7:2	—/11.8	—/11.9	—/—	13.0/—	12.9/12.9
Pilasteric index femur	M. 6:7	—/108	96.8/96.5	—/—	93.1/—	110.0/103.2
Meric index femur	M. 10:9	—/70.9	68.4/67.6	75.0/—	71.4/—	77.8/73.7
Length-thickness index femur	M. 8:2	—/18.4	19.2/—	—/—	19.7/—	22.0/22.1
Cnemic index tibia	M. 9[a]:8[a]	—/66	65.7/68.5	—/—	67.7/—	61.0/62.5

TABLE 5

COMPARATIVE DATA ON THE SKULL DIMENSIONS

Measurement		Mgr. II 37	"Planoccipitale Steilkopf"		
		♂	n	x	♂ min.—max.
Greatest length	M. 1	171.5	12	176.7	170 — 183
Nasion-basion length	M. 5	105.0	2	—	105 —(112)
Greatest breadth	M. 8	145.0	11	148.5	140 — 156
Frontal breadth (min.)	M. 9	97.0	11	100.7	97 —(106)
Frontal breadth (max.)	M. 10	—	4	128.2	124 — 132
Biauricular breadth	M. 11	121.0	2	—	125 — 127
Asterion breadth	M. 12	110.0	2	—	106 — 115
Basion-bregma height	M. 17	142.5	3	140.3	137 —(144)
Auricular-bregma height	M. 20	115.0	9	120.9	(114) —(125)
Length-breadth index	M. 8:1	84.5	10	84.3	80.4 —(89.6)
Length-height index	M. 17: 1	83.0	3	78.0	75.7 — 79.7
Breadth-height index	M. 17: 8	98.2	3	94.6	93.8 — 95.2
Length-auricular index	M. 20: 1	67.0	8	68.1	65.4 — 72.7
Transversal-frontal index	M. 9:10	—	4	78.1	77.8 — 78.8
Transversal fronto-parietal index	M. 9:8	66.8	9	67.3	(63.2)— 71.2
Basion-prosthion distance	M. 40	94.0	3	96.3	(95) — 97
Upper facial breadth	M. 43	105.0	4	109.7	105 — 112
Bizygomatic breadth	M. 45	105.0*	2	—	122 —(135)
Nasion-gnathion distance	M. 47	121.0*	6	125.0	121 — 129
Nasion-prosthion distance	M. 48	71.0	5	73.3	70 — 76
Orbital breadth	M. 51	40.0	6	42.0	40 — 44
Orbital height	M. 52	32.5	6	33.7	31 — 36
Nasal breadth	M. 54	27.0*	4	24.7	22 — 26
Nasal height	M. 55	59.0	6	51.8	50 — 54
Bicondylar width	M. 65	118.0*	1	—	121 —
Mandibular symphysis height	M. 69	30.7	9	35.2	(28)— 40
Facial index	M. 47:45	115.2*	2	—	(95.6)— 99.2
Upper facial index	M. 48:45	67.2*	2	—	(56.3)— 57.3
Orbital index	M. 52:51	81.2	6	80.1	(75.6 — 83.7
Nasal index	M. 54:55	45.7*	4	47.3	(42.3)— 50.0

* Approximate values.

TABLE 6

COMPARATIVE DATA ON THE SKULL DIMENSIONS

		Mgr. I 38 ♂	Braunsdorf no. 41 ♂	Kleinvahlberg B no. 60 ♂
Greatest length	M. 1	161.0	—	184.0
Nasion-basion length	M. 5	80.0*	—	—
Greatest breadth	M. 8	154.0	—	157.0
Frontal breadth (min.)	M. 9	99.0	—	106.0
Frontal breadth (max.)	M. 10	127.0	—	—
Biauricular breadth	M. 11	125.0*	—	—
Asterion breadth	M. 12	118.0*	—	—
Basion-bregma height	M. 17	117.0*	—	—
Auricular-bregma height	M. 20	99.5*	120.0	120.0
Length-breadth index	M. 8:1	95.6	—	85.4
Length-height index	M. 17:1	72.6*	—	—
Breadth-height index	M. 17:8	75.9*	—	—
Length-auricular index	M. 20:1	61.8*	—	65.2
Transversal-frontal index	M. 9:10	77.9	—	—
Transversal fronto-parietal index	M. 9: 8	64.2	—	67.5
Basion-prosthion distance	M. 40	93.0*	—	—
Upper-facial breadth	M. 43	102.0*	106.0	108.0
Bizygomatic breadth	M. 45	108.0*	133.0	—
Nasion-gnathion distance	M. 47	103.0*	112.0	106.0
Nasion-prosthion distance	M. 48	63.0*	66.0	63.0
Orbital breadth	M. 51	40.0*	40.0	39.0
Orbital height	M. 52	33.0*	32.0	30.0
Nasal breadth	M. 54	—	24.0	23.0
Nasal height	M. 55	—	49.0	49.0
Bicondylar width	M. 65	116.0	—	—
Mandibular symphysis height	M. 69	23.1	32.0	(28.0)
Facial index	M. 47:45	95.3*	84.2	—
Upper facial index	M. 48:45	58.3*	49.5	—
Orbital index	M. 52:51	—	80.0	76.9
Nasal index	M. 54:55	—	48.9	47.1

* Approximate values.

SAMENVATTING

(Dutch Summary)

Vóór 1950 was het westelijke rivierengebied, het gebied tussen Tiel en Alblasserdam, in archeologisch opzicht terra incognita : een wit gebied op de verspreidingskaarten. In de volgende jaren werden vooral bij de bodemkarteringen wel enkele ontdekkingen gedaan, maar de oprichting van de AWN werkgroep "Lek en Merwestreek" in 1962 markeert pas het moment, waarop er van een systematische exploratie sprake gaat zijn. Onder de bezielende leiding van H. A. de Kok worden vele tientallen archeologische terreinen, daterende van de Vlaardingen-cultuur tot de Middeleeuwen, ontdekt. Zij zijn gelegen op de afzettingen van voormalige rivierlopen en kreeksystemen en op de toppen van Oudholocene duinen. Er vond over deze vondsten intensieve correspondentie plaats met Professor Modderman.

Verschillende oorzaken zijn er aan te voeren, waardoor de schrijver in 1965 haast onontkoombaar met deze materie werd geconfronteerd en zich daarin ging verdiepen: de noodzaak van een inventarisatie en waardering van deze vondsten, die het bewoningsbeeld van West-Nederland aanmerkelijk beïnvloedden; de dreiging van een ruilverkaveling, welke inmiddels in uitvoering is; de noodzakelijke begeleiding van de werkgroep en niet in het minst de interesse van de auteur voor de interrelatie van geologie en archeologie en de mogelijkhed de studie van het desbetreffende gebied als promotie-onderzoek te beginnen.

In de loop van de jaren heeft het onderwerp van de studie uitbreidingen ondergaan en heeft het accent zich enigszins verplaatst. Spoedig waren wij al tot de conclusieg ekomen, dat voor de gestelde doeleinden een aantal opgravingen noodzakelijk was. In de gemeente Molenaarsgraaf werd in 1967 op de "Hazendonk" een oriënterend onderzoek ingesteld. Het terrein "Molenaarsgraaf" werd in 1966 en 1967 vrijwel volledig opgegraven. Drie andere opgravingen werden uitgevoerd wegens bedreiging door grondwerkzaamheden: in 1966 een ijzertijd-nederzetting nabij Culemborg en in 1969 twee terreinen in Ottoland: het terrain Oosteind (VBB-LBA) en Kromme Elleboog (VBB/BWB). Beide opgravingen in Molenaarsgraaf leverden zoveel informatie, dat het uitwerken daarvan een aanzienlijk deel van de tijd in beslag zou nemen. Over de drie andere onderzoekingen zal later worden gerapporteerd.

Tegelijkertijd bleek het wenselijk de bijeen gebrachte gegevens in een wijder kader, dat van geheel West-Nederland, te plaatsen. Hieruit is Deel I van deze bundel voort gekomen. Daarin wordt een overzicht gegeven over de bewoningsgeschiedenis van West-Nederland, vooral wat betreft de periode voor 700 v. Chr. De relatie tot de geologische ontwikkeling van het gebied, gedomineerd door de transgressie/regressie-cycli staat daarbij centraal.

Wij werden tevens geboeid door de gegevens welke de archeologische terreinen leveren voor de constructie van een curve voor de zeespiegelstijging, temeer daar de Alblasserwaard

een bij uitstek geschikt gebied bleek te zijn voor waarnemingen betreffende voormalige waterniveaus.

Het oorspronkelijke onderwerp heeft zijn beslag gekregen in Deel II. Wij behandelen daarin de bewoningsgeschiedenis en de geologische ontwikkeling van het westelijke rivierengebied. De archeologie kan zonder de geologie niet begrepen worden. Anderzijds levert zij de dateringen voor verschillende afzettingen, met name voor de stroomruggen. Deel II vormt een eerste ontwerp van een archeologische diagram van de streek.

De beide laatste delen zijn de verslagen van de twee opgravingen in Molenaarsgraaf.

Op de Hazendonk (Deel III), de top van een Oud-Holoceen duin, werd bewoning vastgesteld omstreeks 4100 (?), 3400, 3000, 2400, en 1700 v.Chr. Een nieuwe groep aardewerk, voorlopig "Hazendonk aardewerk" genoemd, werd omstreeks 3000 v. Chr. gedateerd. De andere bewoningsfasen zijn te verbinden met "Swifterbant", de Vlaardingen-cultuur en de fase van late klokbekercultuur en de cultuur van de wikkeldraadbekers. De bewoningsfasen vallen samen met de geologische regressiefasen en zijn gescheiden door perioden zonder bewoning.

Te Molenaarsgraaf (Deel IV) bevond zich op de Schoonrewoerdse stroomrug en gelegen aan een doorbraakgeul een kleine nederzetting uit de overgangsperiode Neolithicum-Bronstijd (VBB/BWB, 1800-1500 v. Chr.). Het is één van een aantal vergelijkbare kernen op deze stroomrug, die tezamen een klein, langgerekt gehucht hebben gevormd. In de nederzetting werden twee opeenvolgende huisplattegronden vastgesteld. De geulvulling leverde informatie over de voedsel-economie en het milieu (slachtafval, pollendiagrammen, houten palen). Het boerenbedrijf steunde op akkerbouw (graan) en veeteelt (vooral rund). De jacht was onbelangrijk, in tegenstelling tot de visserij. Drie menselijke graven en een rundergraf bevatten goed geconserveerde skeletten, voor Nederland een zeer bijzondere situatie. Het was mogelijk een gedetailleerd chronologisch diagram van de nederzetting te ontwerpen. De overgang Neolithicum-Bronstijd blijkt te worden gekenmerkt door een grote mate van culturele continuïteit. De culturele relaties van huisplattegronden, vondsten en graven worden in een afzonderlijke paragraaf besproken.

De vier delen zijn zo geschreven, dat elk deel afzonderlijk gelezen kan worden. De gegevens van beide opgravingen (deel III en IV) zijn verwerkt in de overzichten (deel I en II). In deel I is tevens gebruik gemaakt van de conclusies van deel II.

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INDEX OF FIND-SPOTS

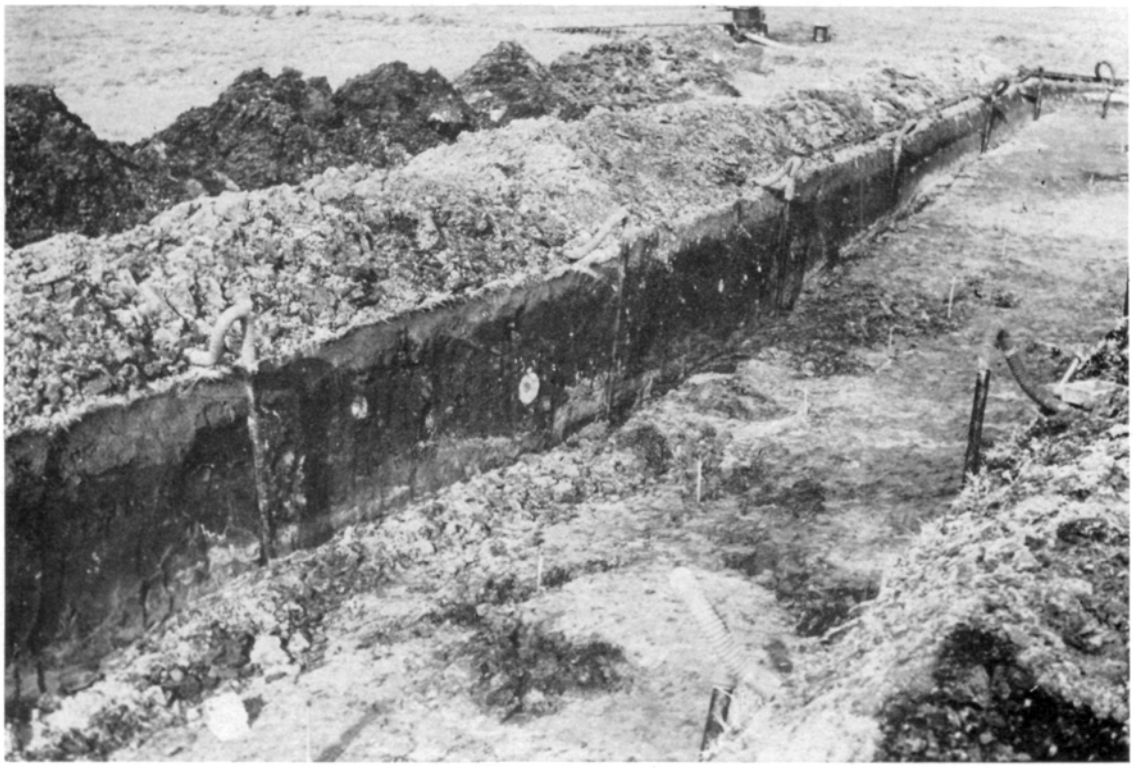
NETHERLANDS

OTHER COUNTRIES

The site Molenaarsgraaf seen from the north. We are standing on the peat-covered clay wedge of the Schoonrewoerd stream ridge, within the reach of the "sand lobe". The ridge itself can be seen best, where it is crossed by the N-S running ditch in the centre of the picture. The ditch gets an irregular course where it crosses the loose sand of the ridge; the higher banks are also clearly visible. At the right the excavation is in progress in the pits Z8-11 (the photo is made during the second operation in 1967). To the left of the ditch both sheds are situated on the place of the pits B6-8. To the left of the sheds one can see the depression where the break-through channel lies.

Molenaarsgraaf. The eastern part of pit A8, seen from the NW. Post holes, a round pit and disturbances by roots.

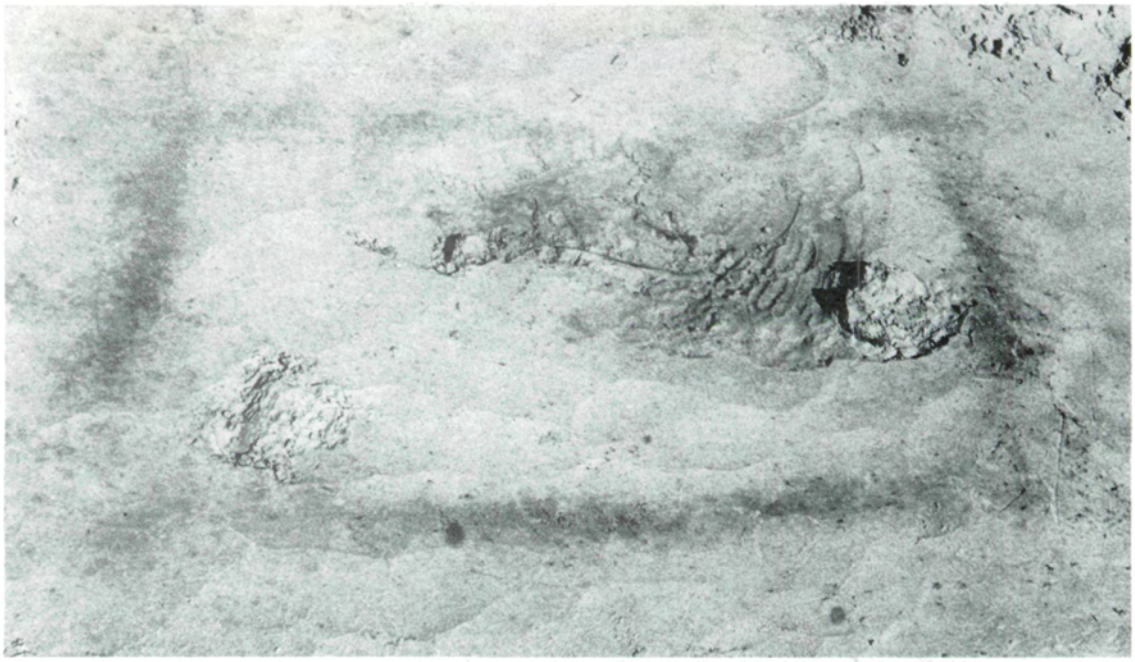
Molenaarsgraaf. Section through a post hole. Visible are the brown clay cover, the grey occupation layer and the post hole in the yellow sand below.



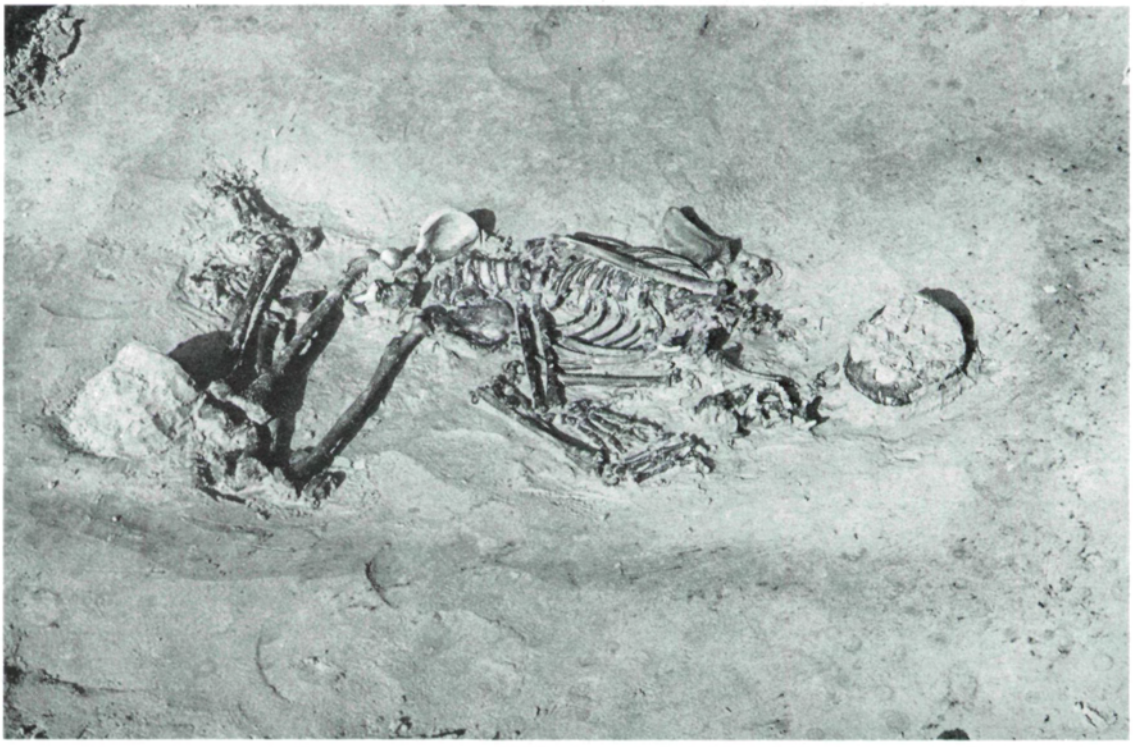
Molenaarsgraaf. General view of pit C8 during the excavation.

Molenaarsgraaf. Detail of the north section of pit C8, showing the roots of an alder carr on the east bank of the residual channel.

Molenaarsgraaf. Grave I, vertical photograph.



Molenaarsgraaf. Grave I at -1.50 m NAP, showing the traces of the timber casing and the position of the skull, pelvis and beaker.



Molenaarsgraaf. Grave I, oblique view from the south.

Molenaarsgraaf. Grave I, detail, showing the position of the skull, lower jaw and fin ray (indicated with a match).

Molenaarsgraaf. Grave I, detail showing the position of arms and hands.

Molenaarsgraaf. Bell beaker from grave I.

Molenaarsgraaf. Fin ray from grave I, 6 × natural size.

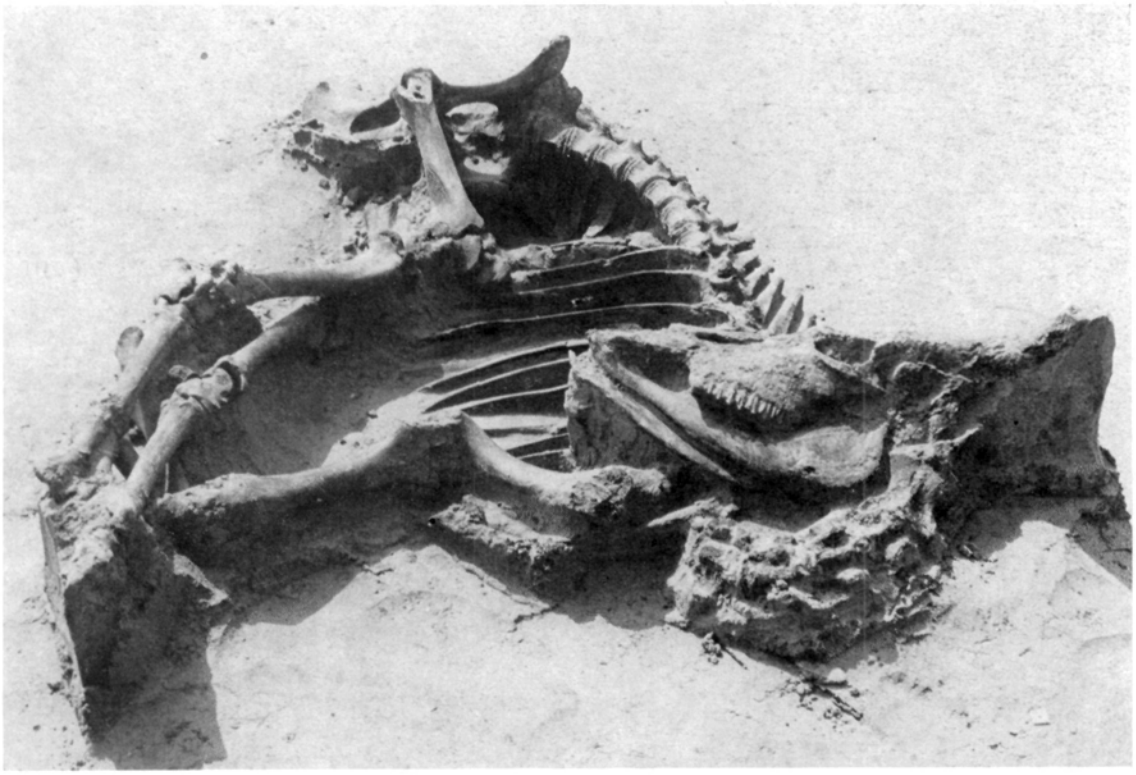
Molenaarsgraaf. Grave II, vertical photograph.

Molenaarsgraaf. Grave II and surroundings, showing the pit no. 199, intersecting the grave. Vertical photograph.

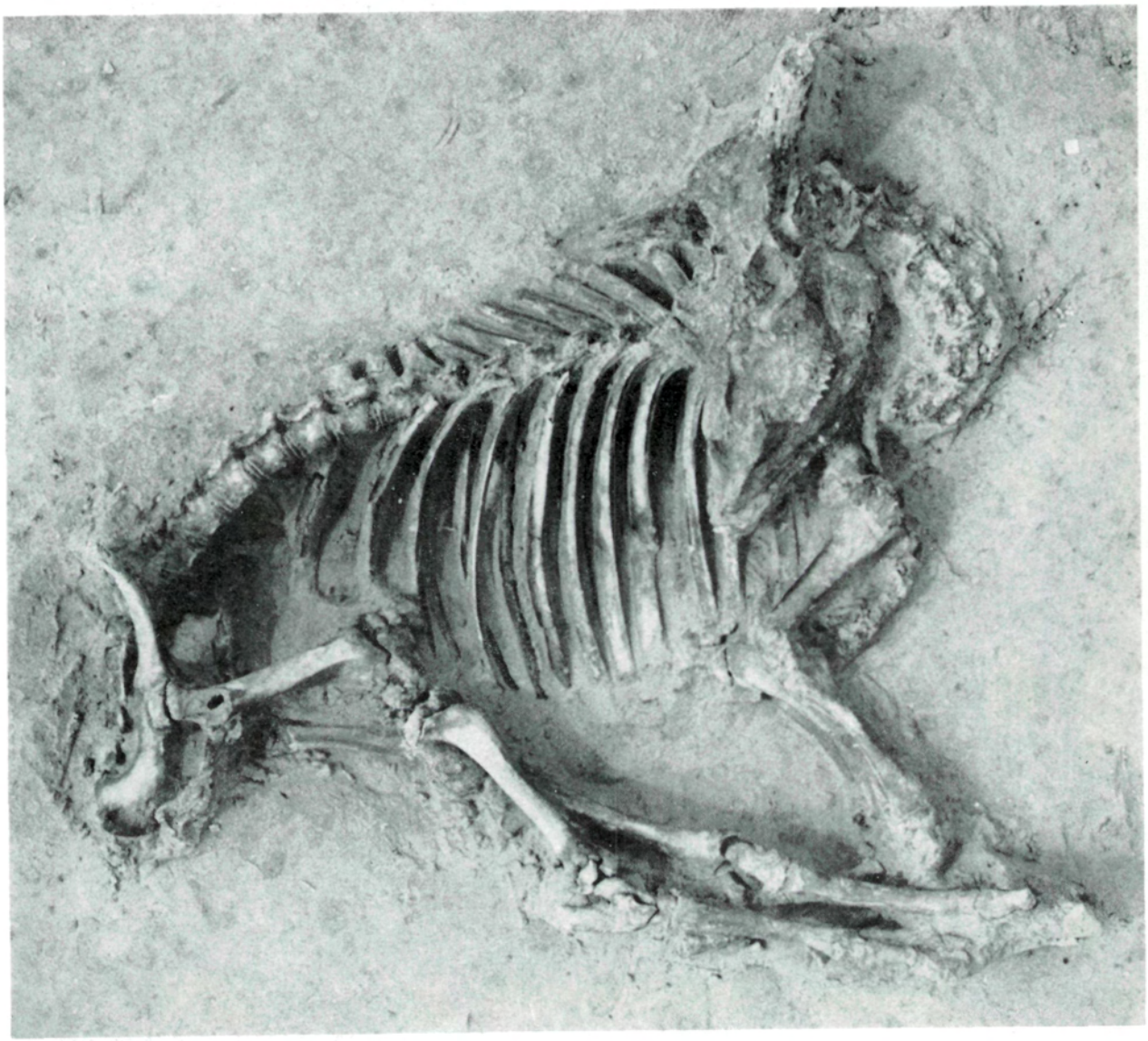
Molenaarsgraaf. The fish-hooks from grave II, 3/2 × natural size.

Molenaarsgraaf. Grave III, vertical photograph.

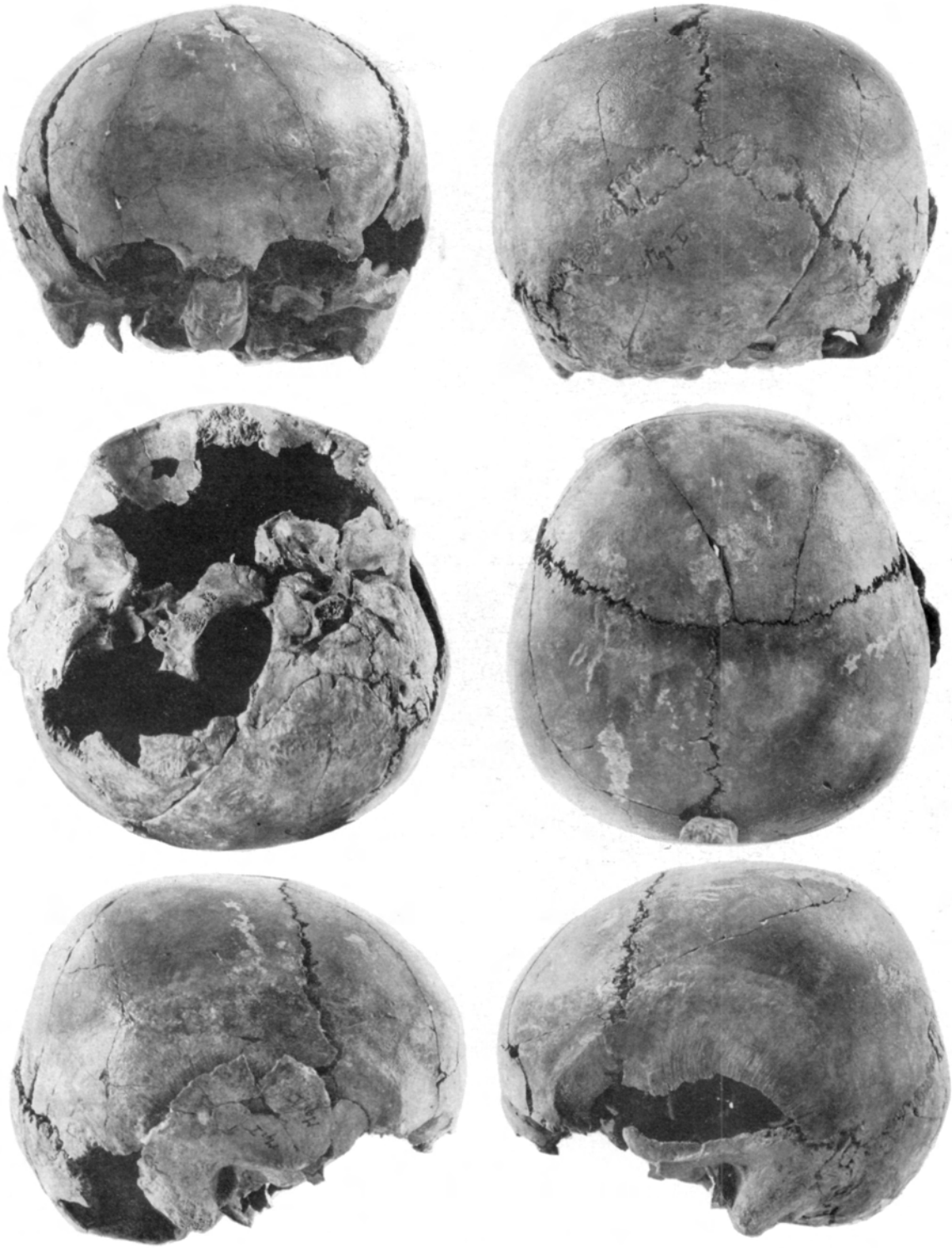
Molenaarsgraaf. Grave III, oblique view from the south, showing the deformation of the skull.



Molenaarsgraaf. Ox burial, oblique view from the north.



Molenaarsgraaf. Ox burial, vertical photograph.



Molenaarsgraaf. Grave I, skull.

Molenaarsgraaf. Grave II, skull and both *radii*. The diaphysis of the upper (left) *radius* was found in pit 199, the diaphysis of the lower (right) *radius* in the infilling of the gully (deposit 1). Both articular ends come from the grave. Skull and *radii* on different scales.

Molenaarsgraaf. Grave II, skull and both *ossa coxae*. The left *os coxae* (at the left) shows considerable deformation. Skull and *ossa coxae* on different scales.

Molenaarsgraaf. Grave II, skull.

Hazendonk, municipality Molenaarsgraaf. The *donk* during the excavation seen from the south.