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

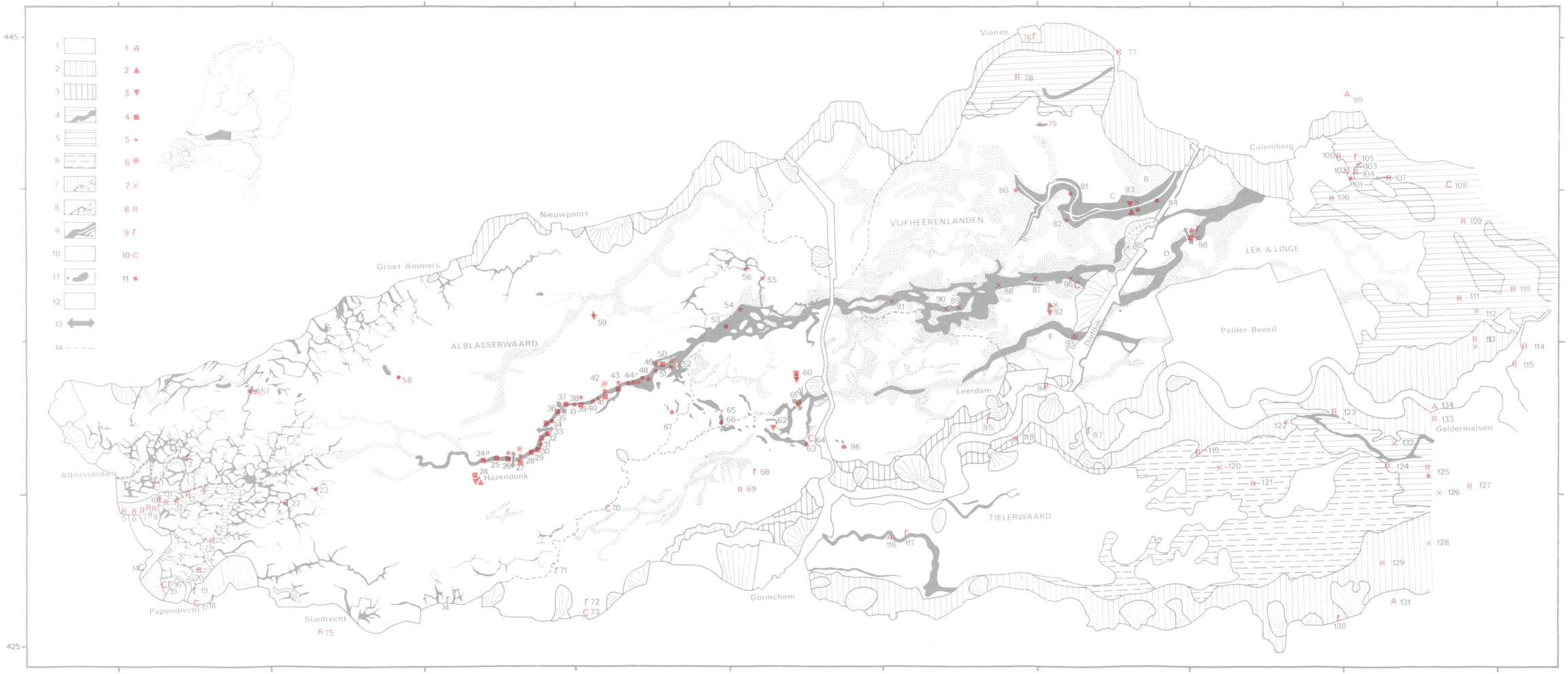

Fig. 18. Map of the Prehistoric and Roman occupation of the river clay/wood peat area, in relation to geology

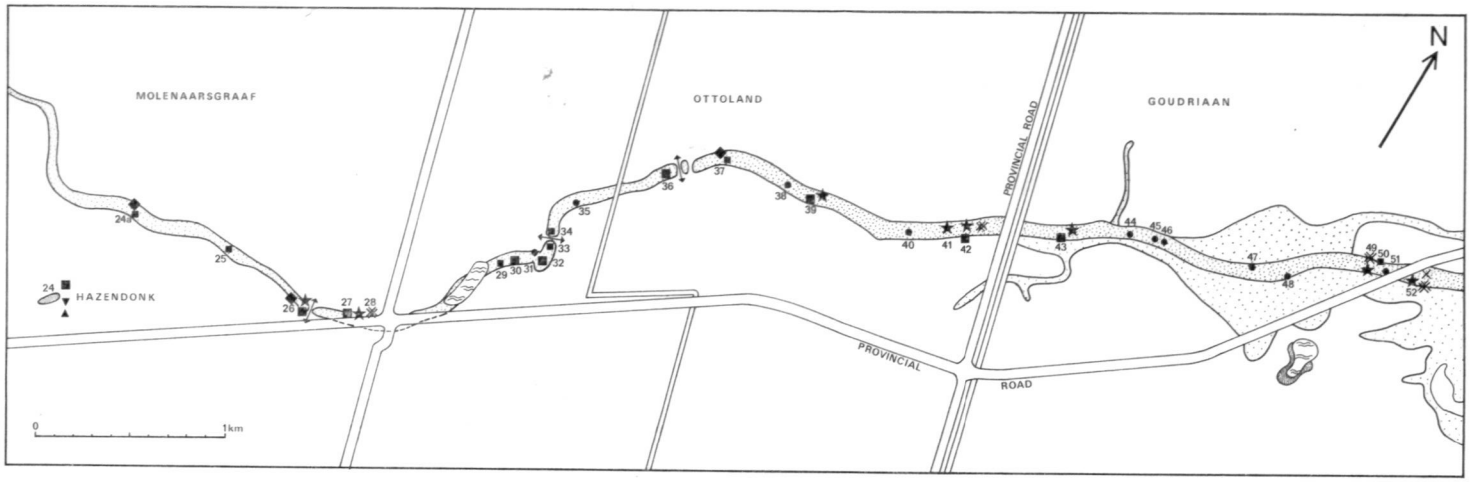

Fig. 19. Prehistoric sites on the Schoonrewoerd stream ridge between Molenaarsgraaf and Noordeloos. Scale 1:40,000. For the situation see fig. 18.

	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

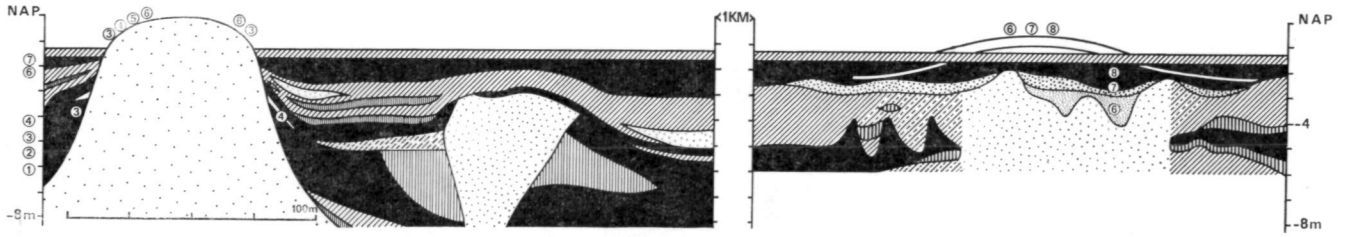

Fig. 20. Section across the Hazendonk and the Schoonrewoerd stream ridge (through the break-through channel of Molenaarsgraaf). Generalisation of figs. 34, 36 and 61. Horizontal scale 1:3000, vertical exaggeration : 10×.

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).

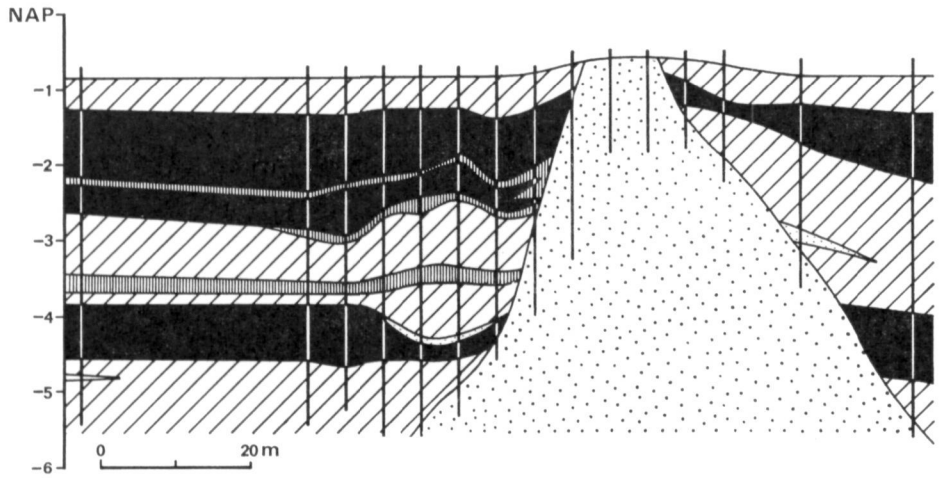

Fig. 21. W-E section across a very small *donk* near Hoog Blokland (site no. 60). At the left the clay wedge of the Schaik stream ridge between —3 and —4 m. On the top of the *donk* VL Culture and Late Beaker sherds were found. Horizontal scale 1:1000, vertical exaggeration : 10×. Legend as fig. 34.

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:

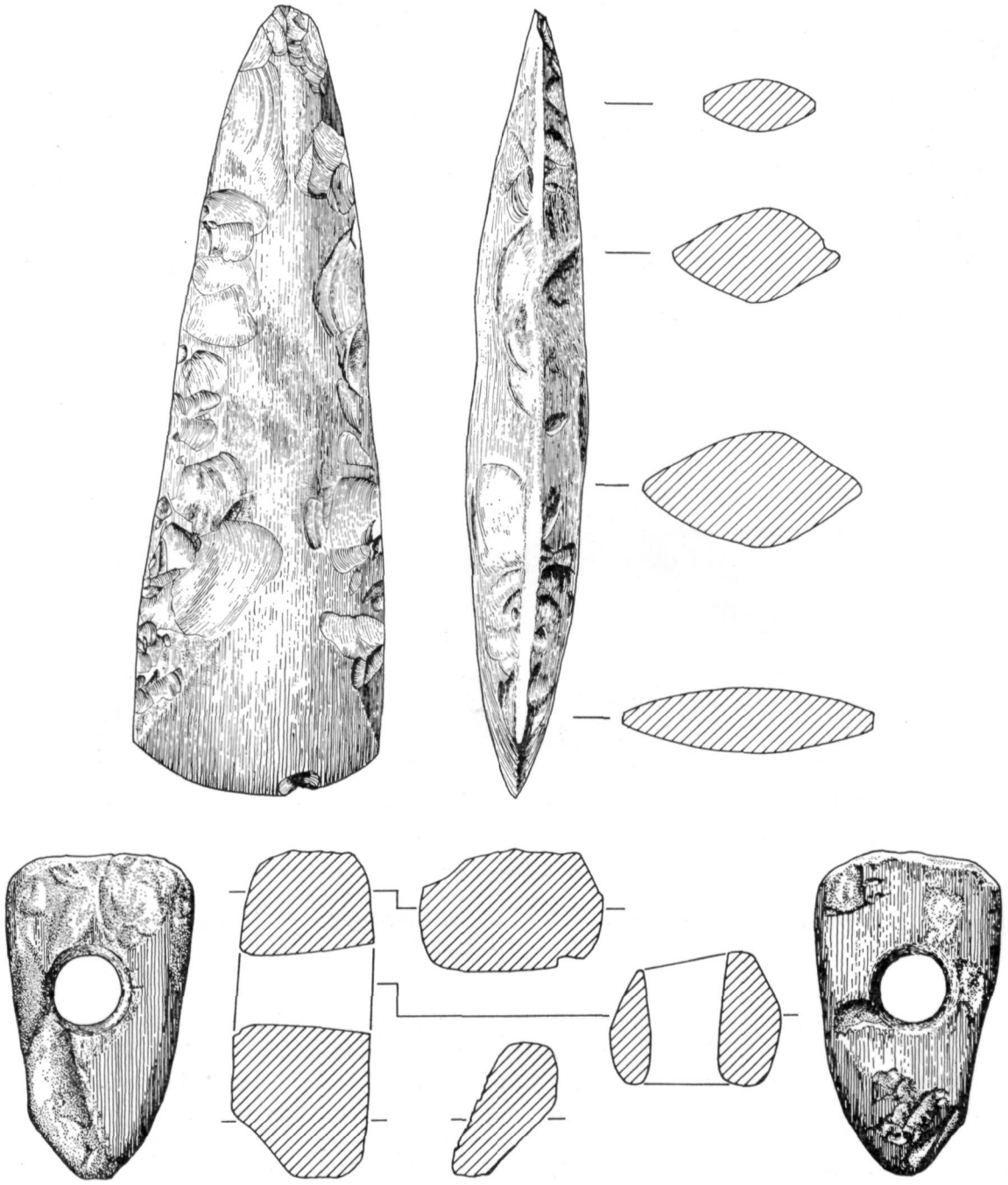

Fig. 22. Two stone axes from the river clay/wood peat area. Scale 1:2.

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,

[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.

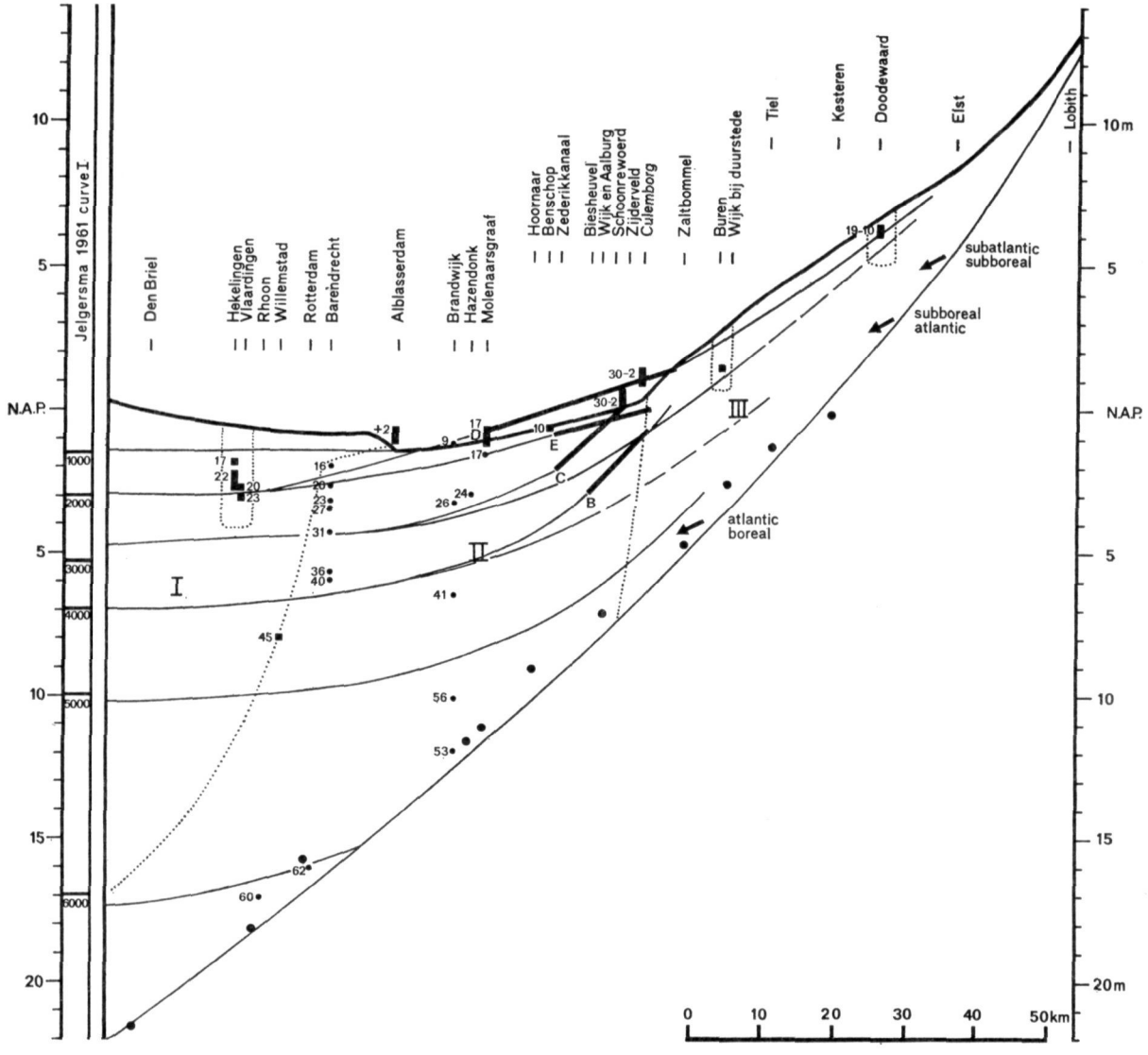

Fig. 23. Schematic west-east section through the Netherlands, from the coast at Den Briel through the river clay area to the German border at Lobith.
Horizontal scale 1:1000,000. Vertical exaggeration : 4000×.

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.

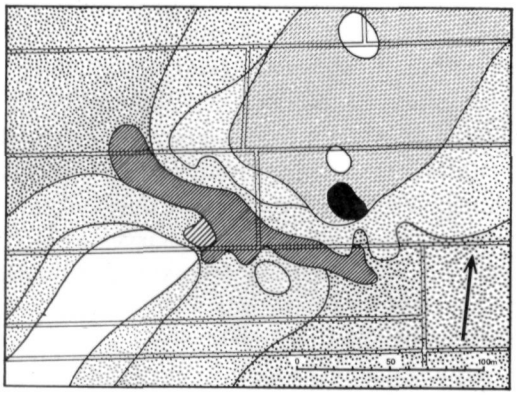

Fig. 24. Physiographic map of site no. 61, "Hoog Blokland-Nieuwvlietje", showing part of the Schaik stream ridge, a break-through channel and a BB settlement, discovered during the soil survey in 1953-'55. Based on 125 borings of 1.20-2.60 m. Scale 1:4000.

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-

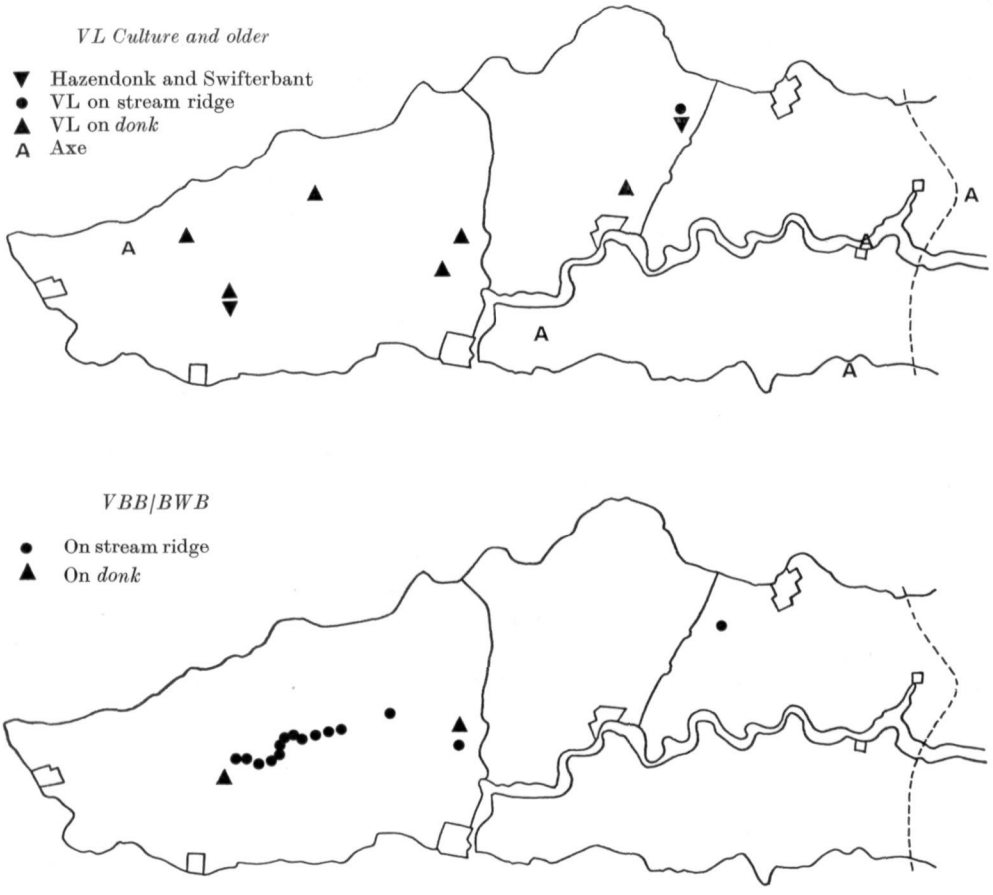

Fig. 25. Alblasserwaard, Vijfheerenlanden, Tielerwaard, Lek en Linge district.
Distribution of Neolithic finds and sites.

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.

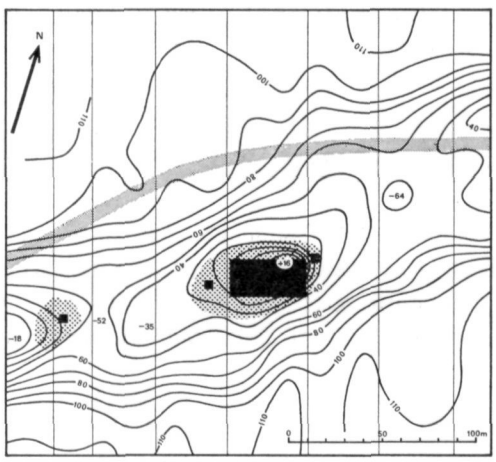

Fig. 26. Contour map of a part of the Schoonrewoerd stream ridge at Ottoland-Oosteind (site no. 42), showing a very high elevation, occupied (perhaps with interruptions) from 1800 (VBB) till 900 B.C. (Late Bronze Age).
Excavated area in black. Legend : see fig. 27. Scale 1:4000.

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.

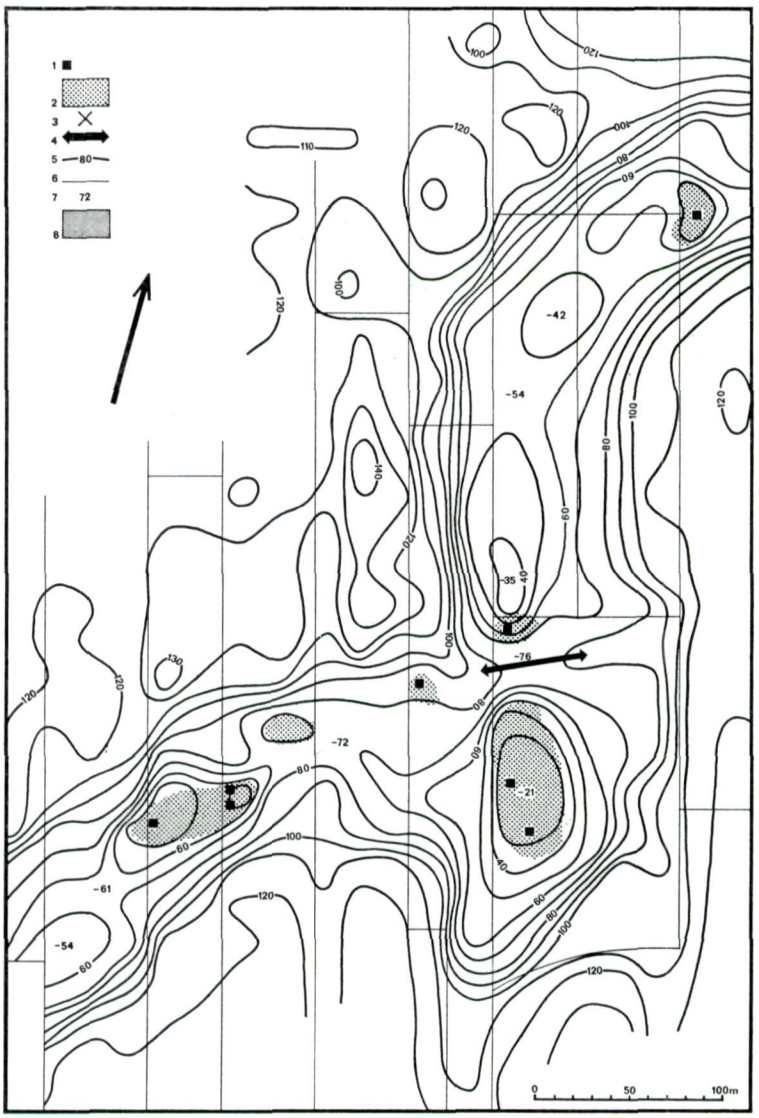

Fig. 27. Contour map of a part of the Schoonrewoerd stream ridge with the break-through channel at Ottoland-De Put. The contour lines are based on measurements in a system of 20 m. squares. Indicated are the sites nos. 29-35. Scale 1:4000.

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

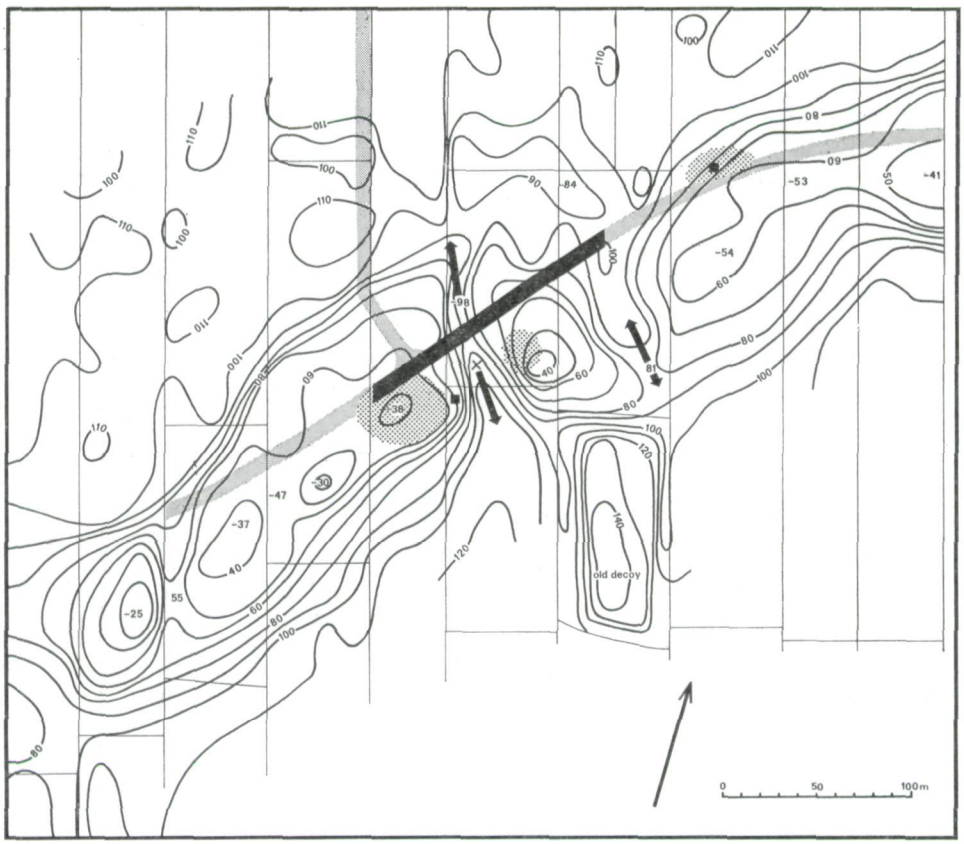

Fig. 28. Contour map of a part of the Schoonrewoerd stream ridge with the double break-through channel at "Ottoland-Kromme Elleboog". Indicated are the sites nos. 36 and 37.
Excavated part of road under construction in black. Legend : see fig. 27. Scale 1:4000.

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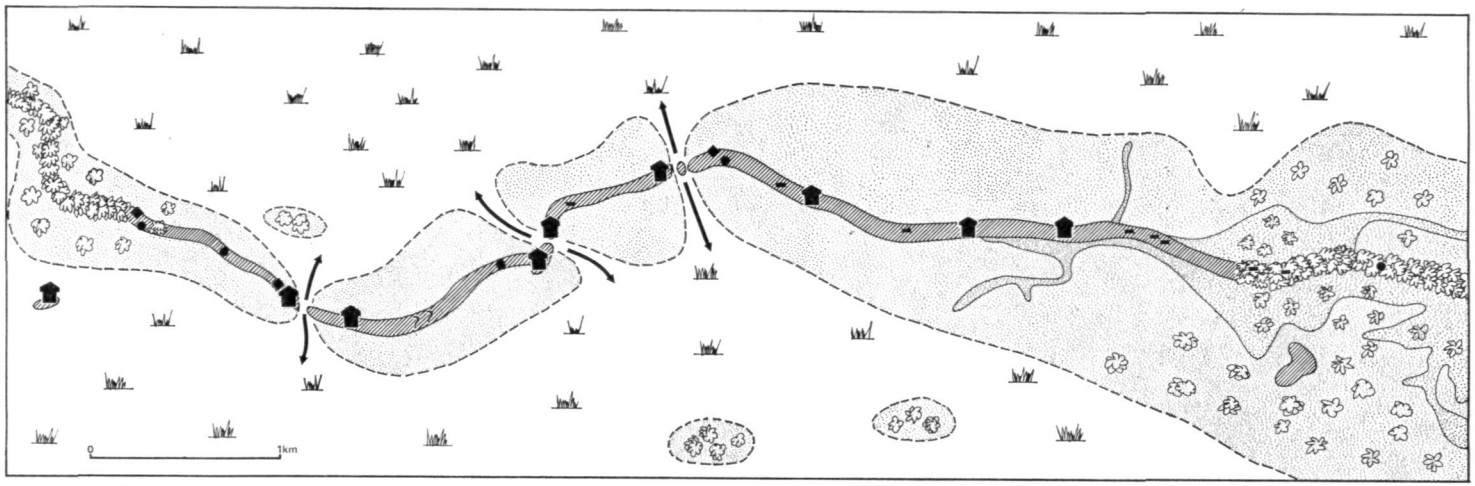
[74] *Cf.* for instance Waterbolk 1964[a] on the Middle Bronze Age settlement at Elp. We must bear in mind that a new farm-yard might not have been erected at or near the site of the old one, but farther away.

[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.



stream ridge or *donk*, deforested, arable land.

clay wedge, perhaps suited for agriculture.

clay wedge, pasture land.

wooded stream ridge.

clay wedge with alder carr.

swampy marsh.

break-through channels with open flowing water.

occupation centres (house sites).

occupation centres, dubious.

modest, perhaps VBB/BWB, finds.

grave(s).

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.

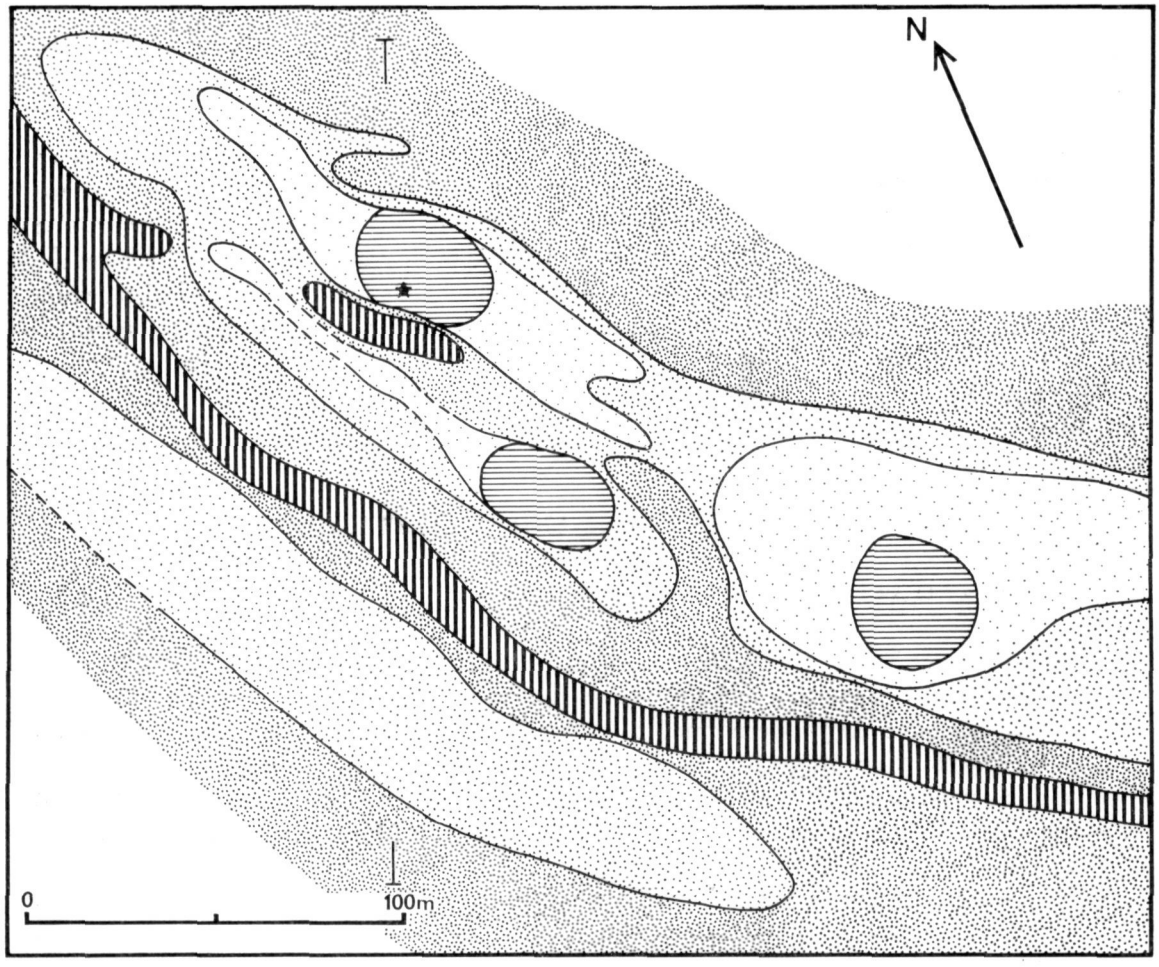

Fig. 30[a]. The Middle Bronze Age settlement on the Zijderveld stream ridge near Hei- en Boeicop (site no. 80). Physiographic map. Scale 1:2000.

Legend :

- "occupation layer" 30 cm. (settlement sites)
- <75 cm.
- 75-125 cm.
- >125 cm.

} depth of the top of the stream ridge

- >100 cm. peat on the sand (stream channels)

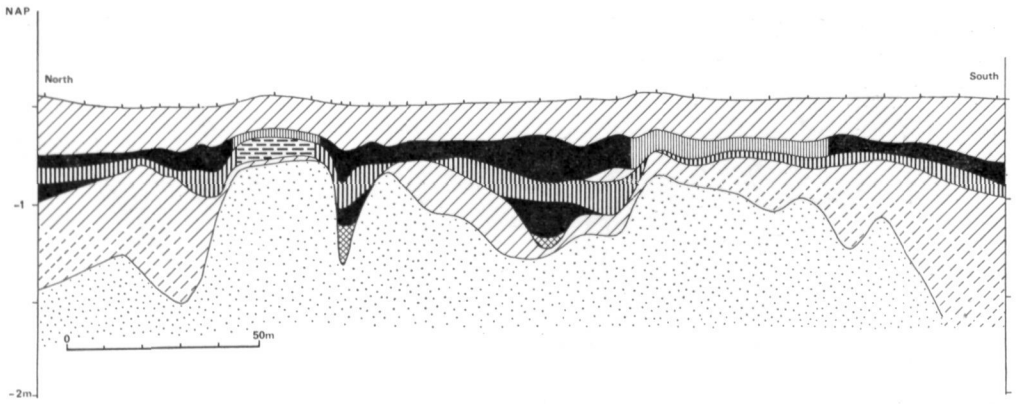

Fig. 30[b]. Hei- en Boeicop (site no. 80), N-S section across the residual stream channels and one of the occupation centres. Horizontal scale 1:2000, vertical exaggeration : 25×.

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.

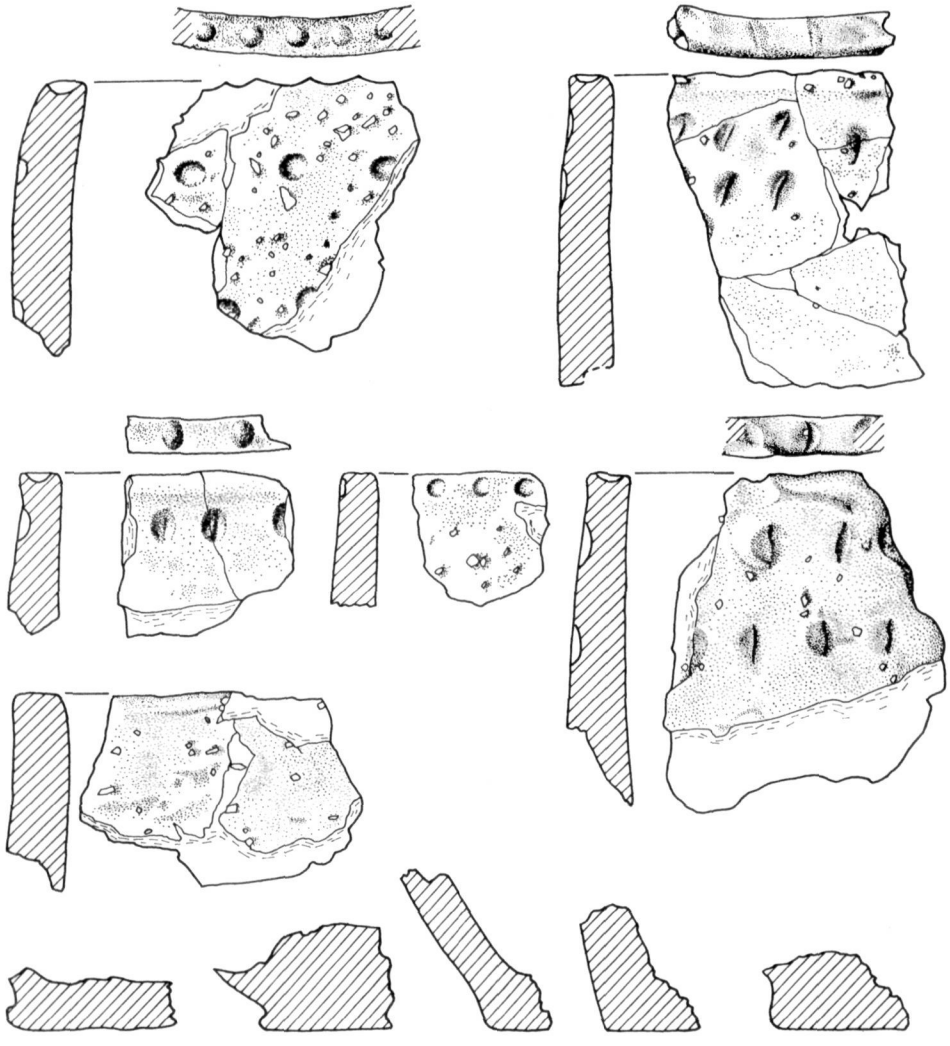

Fig. 30c. Hei- en Boeicop (site no. 80), pottery from the test pits (star in fig. 30a). Scale 1:2.

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.).

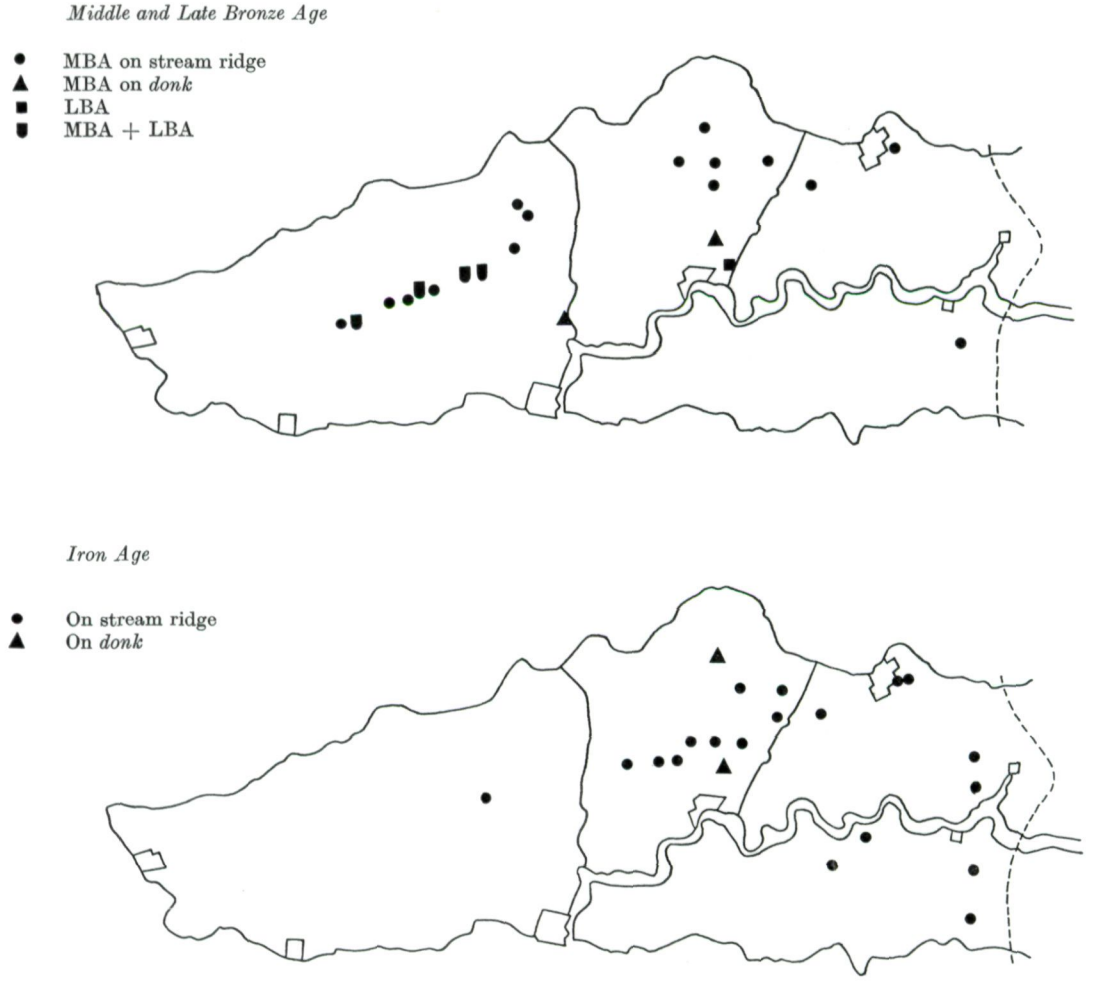

Fig. 31. Alblasserwaard, Vijfheerenlanden, Tielerwaard, Lek en Linge district.
Distribution of Bronze Age and Iron Age finds and sites.

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.

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[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.

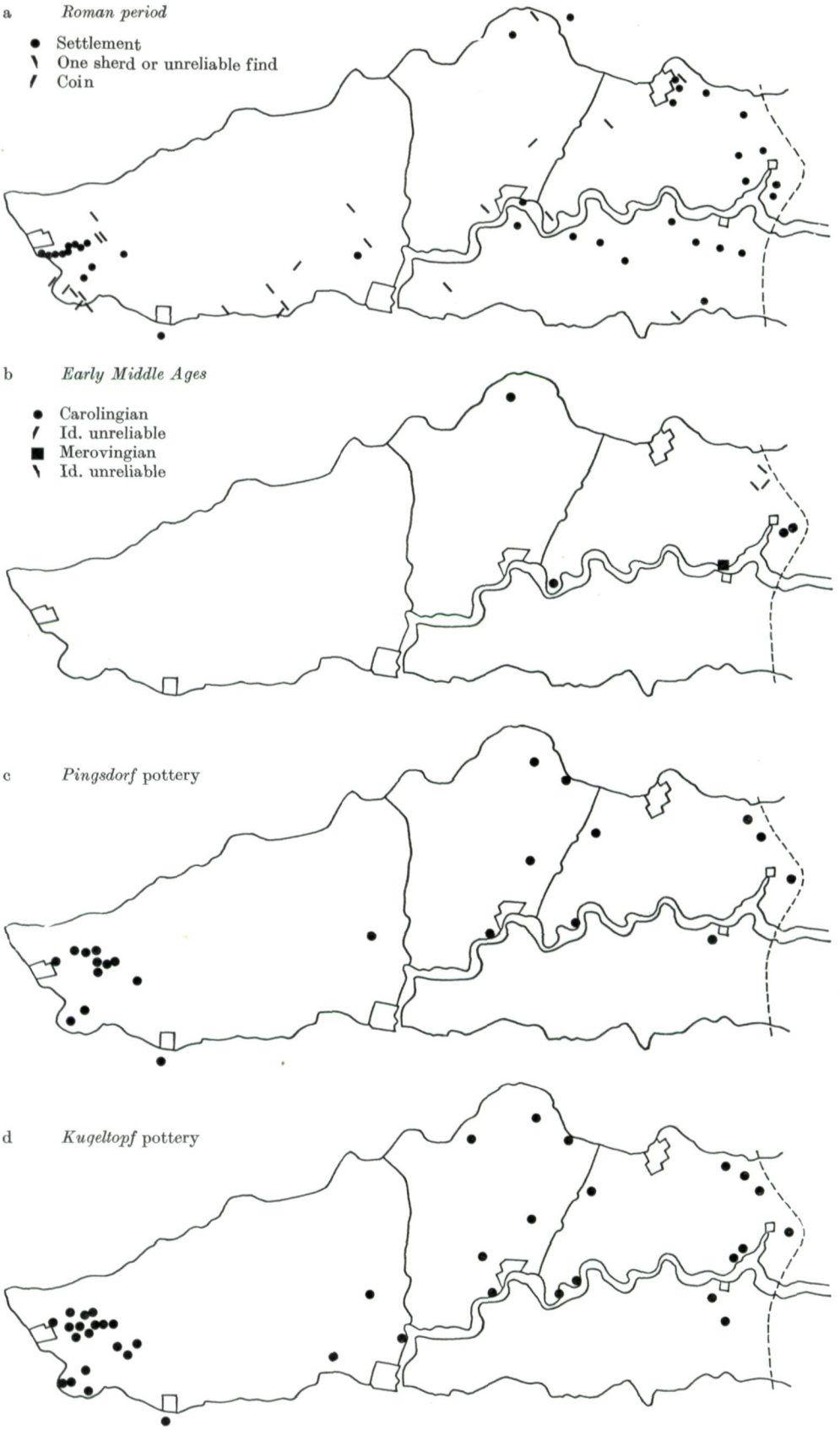

Fig. 32. Alblasserwaard, Vijfheerenlanden, Tielerwaard, Lek en Linge district.
Finds and sites of the Roman period till the 12th century A.D.

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.