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NEOLITHIC DISC WHEELS IN THE NETHERLANDS

with a note on the Early Iron Age Disc Wheels from Ezinge

(Pl. XXVII–XXXIV, Figs 22–29)

Introduction

In 1838 peat-cutters found a one-piece disc wheel the very clumsiness of which roused the curiosity of journalists and authorities, so that it was saved from destruction. Eventually the well known Leiden antiquarian L. J. F. Janssen (1848, pp. 94–97) examined and commented upon this wheel. Its close resemblance to what was known of the *tympana* of the Roman *plaustra*, coupled with a fallacious chain of tempting arguments, led him to the misconception that this wheel (and a second one of different type) was of Roman origin. Once labelled they were labelled forever; and in so far as they were not thought to represent giant lids or even table tops (Pleyte, 1882, p. 32), these wheels and the more recent comparable finds continued to be considered of Roman origin.

It was only in 1955, when still another wheel of the same type turned up in direct connection with a Neolithic trackway at Nieuw-Dordrecht (then under excavation), that Dr. W. van Zeist came to the conclusion that at least this wheel was to be considered of Neolithic origin. Even so, it remained questionable whether all wheels of this type were of Neolithic age, or whether these spanned a much longer period. Since 1955 five more one-piece disc wheels have been found in the peat. On the basis of the palynological evidence (dealt with by Mrs. M. R. van der Spoel-Walvius in the following paper) and C 14 measurements, the wheels all proved to be contemporary with the Nieuw-Dordrecht wheel. This was inducement enough to study the whole group of one-piece oak disc wheels found in the Northern Provinces of the Netherlands, and to collect as much information on these finds as possible.

We now know that a total of ten finds, comprising in all thirteen one-piece disc wheels of the same type, have been recovered from the peat deposits of the provinces of Groningen, Drenthe and Overijssel; of these ten finds, six could be dated, with the help of C 14 measurements and pollen analysis, to the end of the third millennium B.C. No comparable finds are known from other regions in the Netherlands.



Fig. 22. Find spots of disc wheels in the northern provinces of the Netherlands (numbers refer to the catalogue, part A).

This paper deals with the cultural aspects of the wheel finds and their implications. Some later bi- and tripartite disc wheel finds are also discussed, notably those from the excavations at Ezinge in the years 1924–1934 (graciously made available for publication by their excavator, Prof. Dr. A. E. van Giffen). The paper concludes with a complete catalogue of Dutch disc wheel finds.

The writer is indebted to many persons for actual help and valuable advice¹. But it is only due to the natural sciences that the wheels were given the place in prehistory that they deserve. The following paper, by Mrs. M. R. van der Spoel-Walvius, was accordingly the inducement to the present study. The writer wishes to express his special gratitude to Mrs. van der Spoel, and also to Dr. J. C. Vogel and Dr. W. van Zeist. Without their results he would never have set to work; without their help he never would have been able to bring this study to fruition.

General description of the Neolithic one-piece disc wheels

In reading the description of the wheels in general (and in detail, cf. the catalogue at the end), the reader should be aware that the state of conservation of six of the eleven disc wheels that are preserved was already quite poor when first seen by the writer. As is the case with all wood preserved in peat, the wheels look astonishingly fresh when found, even though the colour has turned to a dark brown and the wood has become quite soft. However, as soon as the wood is left to dry and starts to harden, many cracks appear, and in the end the wheel may be completely split and disfigured and, owing to stronger contraction in the direction perpendicular to the grain, become more oval than round. (The Gasselterboerveen wheel, no. 1, illustrates this to the point of caricature). Even when not heavily distorted the wheel will at least be diminished in size, and the surface will lose its original fresh appearance. Only the wheel of Midlaren (cat. A: 10) has survived the natural drying process reasonably well (Pl. XXVII, bottom). Attempts to preserve the fresh appearance and shape of the recent wheel finds have not been very successful².

Each of the wheels under consideration consists of one solid disc-shaped piece of oak (cat. A: 10–11 by way of exception of alder) cut from the tree-trunk longitudinally³ in such a way as to avoid the heart of the tree, so as to reduce the danger of bursting⁴. The size varies from 0.55 to 0.90 m in diameter. The discs tend to be slightly thicker towards the centre, and the cylindrical axle hole is surrounded by a strongly projecting circular ridge, cut out of the same piece of wood and thus forming a fixed nave. This projecting nave is found intact or as a surviving fragment on both faces of most of the wheels (nos. 1, 3, 4, 5B, 7, and 10–11). Other wheels which have preserved this nave only on one face show a slight discoloration which proves that the nave once was present (nos. 1 and 8, cf. Pl. XXIX). Only in the case of the wheel from Nieuw-Dordrecht (no. 6) could doubts arise as to whether there ever was a projecting nave on both faces; but even here a very shallow depression in the centre of the face where no nave can be seen, seems to indicate the place where it was broken off. Consequently, a fixed nave projecting from both faces apparently was characteristic of this type⁵.

In most cases the tread is flat and square at the end of the grain, but at the edges parallel with the grain it tends to be rounded, which could be an indication of usage and wear. Only in the case of the de Eese wheel (no. 7) was the tread found to be about equally flat and square all around. This was on the whole in accordance with the new and unused impression it made.

On the de Eese wheel, adze marks were also still clearly visible on the faces as long as they retained their fresh appearance (Pl. XXVIII).

The wheels of Midlaren (cat. A: 10–11) differ from the others in two respects. Firstly, like a disc wheel of different character found at Beckdorf (Germany; Cas-

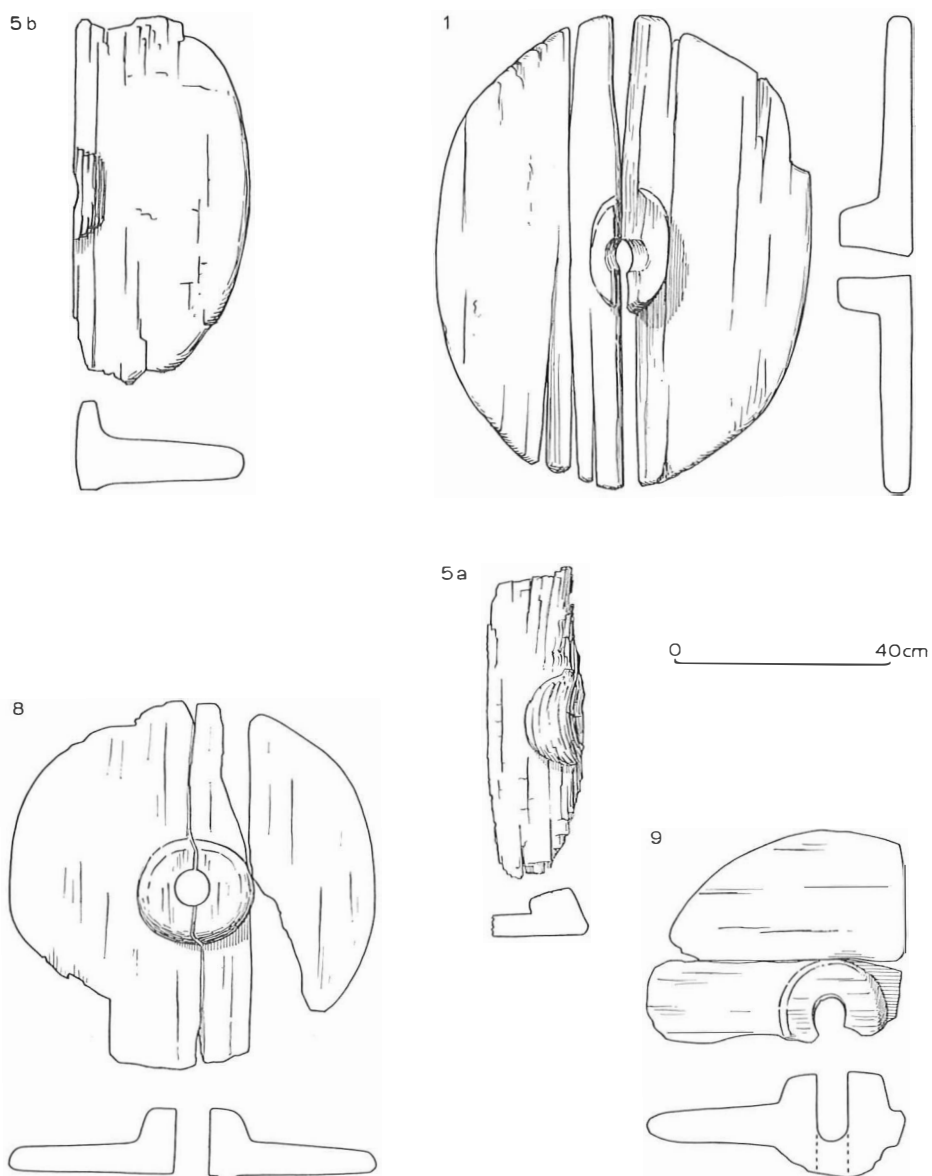


Fig. 23a. Neolithic one-piece disc wheels from the Netherlands (numbers refer to the catalogue, part A, and to fig. 22; for A: 10, cf. fig. 28).

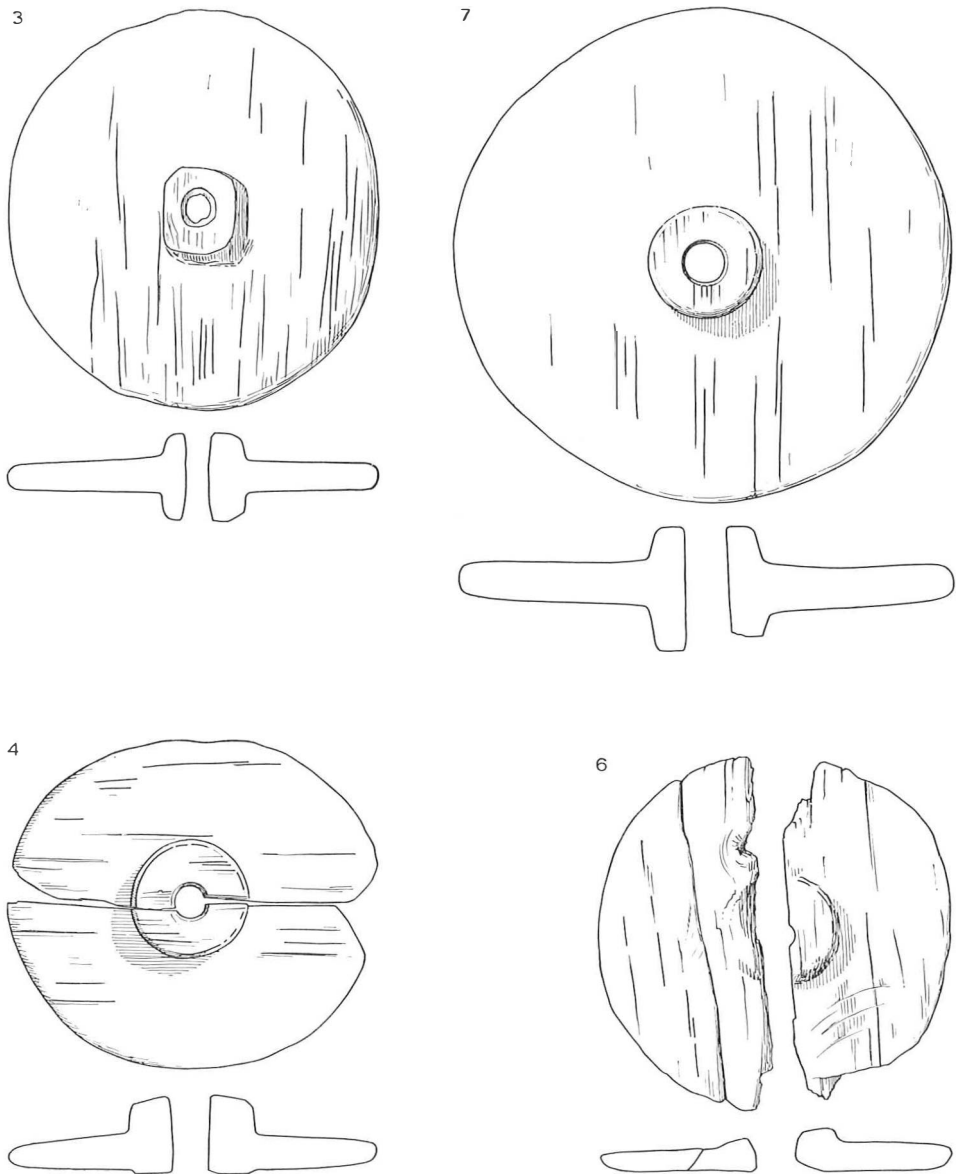


Fig. 23*b*. Neolithic one-piece disc wheels from the Netherlands (numbers refer to the catalogue, part A, and to fig. 22; for A: 10, cf. fig. 28).

sau, 1938), they are made of alder and not of oak, and secondly they are unfinished, the axle holes never having been made.

Character of the deposits

The fact in itself, that all the wheels under consideration were found in peat, is not surprising; otherwise the wood could hardly have survived. What is surprising, however, is that a relatively short period at the end of the third millennium B.C. should be represented by thirteen wheels (nine beyond doubt, four in all probability; cf. next paragraph); whereas, in the whole of subsequent prehistory only two more finds of disc wheels from the peat are attested: the wheels from Valthe and Weerdinge (cf. the next to the last paragraph, and the catalogue, part B). One can hardly account for this phenomenon by the assumption that disc wheels went out of use again only to reappear in the pre-Roman Iron Age. Even though the many prehistoric phenomena that at present seem to require the explanation of being 'ritual' should put the prehistorian on his guard, one is inclined to consider these Neolithic disc wheels as most probable votive or ritual deposits in the peat. In this context, the following facts must also be taken into account.

At least four of the eleven wheels preserved (nos. 3, 7, 10–11) must have been in excellent condition when deposited. In the case of the de Eese and Midlaren wheels (no. 7, 10–11), which were placed in peat deposits of very limited extent (cf. following paper by Mrs. van der Spoel, pp. 147–50) and which in all probability were as yet unused, the deposits could have been of a purely functional character (preservation, or watering of the fresh wood). In the case of the Smeulveen wheel (no. 3), such a functional deposition seems to be out of question: even at the time of deposition the distance to the edge of the peat, and thereby to the nearest possible settlement, must have been at least 1 km. Moreover, conditions for watering the wood would have been more favourable in the wet border zone of the raised bog.

Other wheels were most probably already damaged beyond repair when deposited. Assuming that it was possible to drive a cart or waggon over the frozen raised bog in winter time, the wheels could simply have been thrown away after a breakdown, a possibility, in fact, suggested by van Zeist (1956, p. 317) in the case of the Nieuw-Dordrecht wheel (no. 6), which was found in pieces (broken in antiquity?, cf. catalogue, part A, no. 6) at the side of the wooden trackway. But even broken wheels (if not broken for the purpose) can have served as votive deposits, and in the Nieuw-Dordrecht case one should realize that the trackway itself is suspected of being of ritual character. In the first place, this trackway (as is true of other trackways) almost certainly led nowhere, and simply ended in the bog (cf. catalogue, *l.c.*)⁶. Secondly, underneath the balks of the small area of this trackway that has been archaeologically excavated, two beautifully worked wooden objects, essen-

tially undamaged at the time of deposition, have been found: the adze shaft (dealt with in the next paragraph; van Zeist, 1957, pp. 13–15), and a long club-like object, somewhat resembling a thin hockey stick (as yet unpublished). These objects can only have been intentionally deposited under the trackway.

On three occasions (in Gasselterboerveen, nos. 1–2; in Dertienhuizen, nos. 8–9; and in Midlaren, nos. 10–11) the wheels were found in pairs. In neither case are remnants of a cart reported, and in Gasselterboerveen the difference in the size of the two wheels was noteworthy (the wheels of Dertienhuizen and Midlaren were about similar in size). Certainly in Gasselterboerveen, the fact that two wheels were found together was not due to the possibility that both wheels had served the same cart. Therefore, this find appears to have had the character of a small ‘hoard’ of wheels (the same might be true of the wheels of Schönsee, Poland; cf. p. 119).

Votive deposition in the raised bogs was practiced in the Northern parts of the Netherlands, as it was in Northern Germany and Southern Scandinavia, from Early Neolithic times onward by the people of the TRB Culture⁷ (Becker, 1947; Bakker, 1959). There is, however, at least a probability that this practice was taken over by the people of the PF Beaker Culture (and possibly also by those of the hybrid PF Beaker—Bell Beaker groups)⁷ since some of the later deposits containing thick-buttled axes registered in the province of Drenthe appear to consist entirely or partly of axes of the ‘rough’ workmanship that is held to be characteristic of the *Einzelgrabkultur* in Denmark and Northern Germany (cf. next paragraph). In the hoard found near the river Reest⁸ (Achterop, 1960, p. 180, fig. 1), an axe of Lindø-type and a long finely polished chisel, both apparently of TRB affinities, were found together with a short two-sided chisel, a flint scraper, and four flint axes of the Single Grave type just mentioned. In the hoard of Holsloot (Achterop, 1960, p. 184, Pl. IV: top), a stone axe of the type often found in graves of the PF Beaker Culture was found with an enormous flint blade and three flint axes, also exhibiting the same ‘rough’ workmanship. In this context, it should be noted that in Sweden Malmér (1962, p. 486) could show that TRB offering practices such as the deposition of single objects or hoards, were taken over by people of the Boat Axe Culture (the Swedish equivalent to the PF Beaker Culture). Therefore, we do not think that our suggestion (cf. next paragraph) that the wheels belong to the PF Beaker Culture or with the hybrid groups is incompatible with the idea that they represent depositions of votive character.

Date and cultural relationship of the wheels; the adze shaft of Nieuw-Dordrecht

The dating of the wheels largely depends on C 14 and palynological evidence (cf. the following paper by Mrs. van der Spoel, pp. 147–56). The C 14 dates for all of the seven wheels that were tested (cat. A: 1, 5B, 6–9, 11) fall within the limits

C 14 CHRONOLOGY OF DISC WHEELS AND NEOLITHIC CULTURES

Each symbol refers to one or more radiocarbon dates of a specific find, site, or site period. The hatched area represents the statistical error of the measurements. The probability that the true age lies within any chosen segment of the symbol is proportional to the relative area of this segment. The total length of the symbol is three times the normally quoted statistical error, so that there is a 99 % probability that the true age lies within this range. The central horizontal line gives the most probable age. In a number of cases, the mean is used of more than one determination of the same object. These cases are indicated by a square in the centre of the symbol; the mean value of each measurement being shown by a round dot. A triangle on the central line indicates that the date concerned provides a *terminus ante quem* (t.a.q.). The ages indicated on the table are in radiocarbon years B.C.

DISC WHEELS. All particulars are given in the catalogue, part A.

TRB CULTURE. *Odoorn*: 2640 ± 80 B.C. (GrN 2226, charcoal from flat grave, containing two Funnel Beakers beneath the mound of Megalithic Tomb D 32; Groningen IV, 177; *Helinium* I, 1961, 42); *Anlo*: 2510 ± 55 B.C. (GrN 1824, charcoal from a pit containing remains of the Havelte stage of TRB; *Palaeohistoria* VIII, 1960, 83; Groningen IV, 180); *Angelslo*: 2350 ± 60 B.C.; average of two determinations referring to youngest phase of Dutch TRB (2195 ± 100 B.C., GrN 2370, charcoal from flat grave containing cremation and pottery; Groningen IV, 179; 2430 ± 75 B.C., GrN 4201, charcoal from dwelling pit).

PFB CULTURE. *Anlo*: 2470 ± 55 B.C. (GrN 1855), charcoal from flat grave containing PF Beaker of early type; *Palaeohistoria* VIII, 1960, 75; Groningen IV, 180); *Vlaardingen*: 2350 ± 40 B.C.; average of the C14 dates of three samples from the main occupation layer of the Vlaardingen Culture, which also contained fragments of battle axes (type A) of the pan-European phase of the Battle Axe Cultures (2300 ± 75 B.C., GrN 2304; 2380 ± 60 B.C., GrN 2303; 2330 ± 100 B.C., GrN 2487; *Helinium* II, 1962, 103, 216, 224 ff.; Groningen IV, 178); *Ede*: 2245 ± 120 (GrN 330, charcoal from central grave of tumulus containing PF Beaker of early type, faceted battle axe and flint blade; *Ber. v. d. Rijksdienst v. h. Oudheidk. Bodemonderz.* V, 1954, 43; Groningen II, 135); *Emmen*: 2235 ± 140 B.C. (GrN 428, peat sample from a level in the raised bog characterized by increase of *Plantago lanceolata*, attributed to the landnam of the PFB; *Palaeohistoria* IV, 1955, 117; Groningen II, 132).

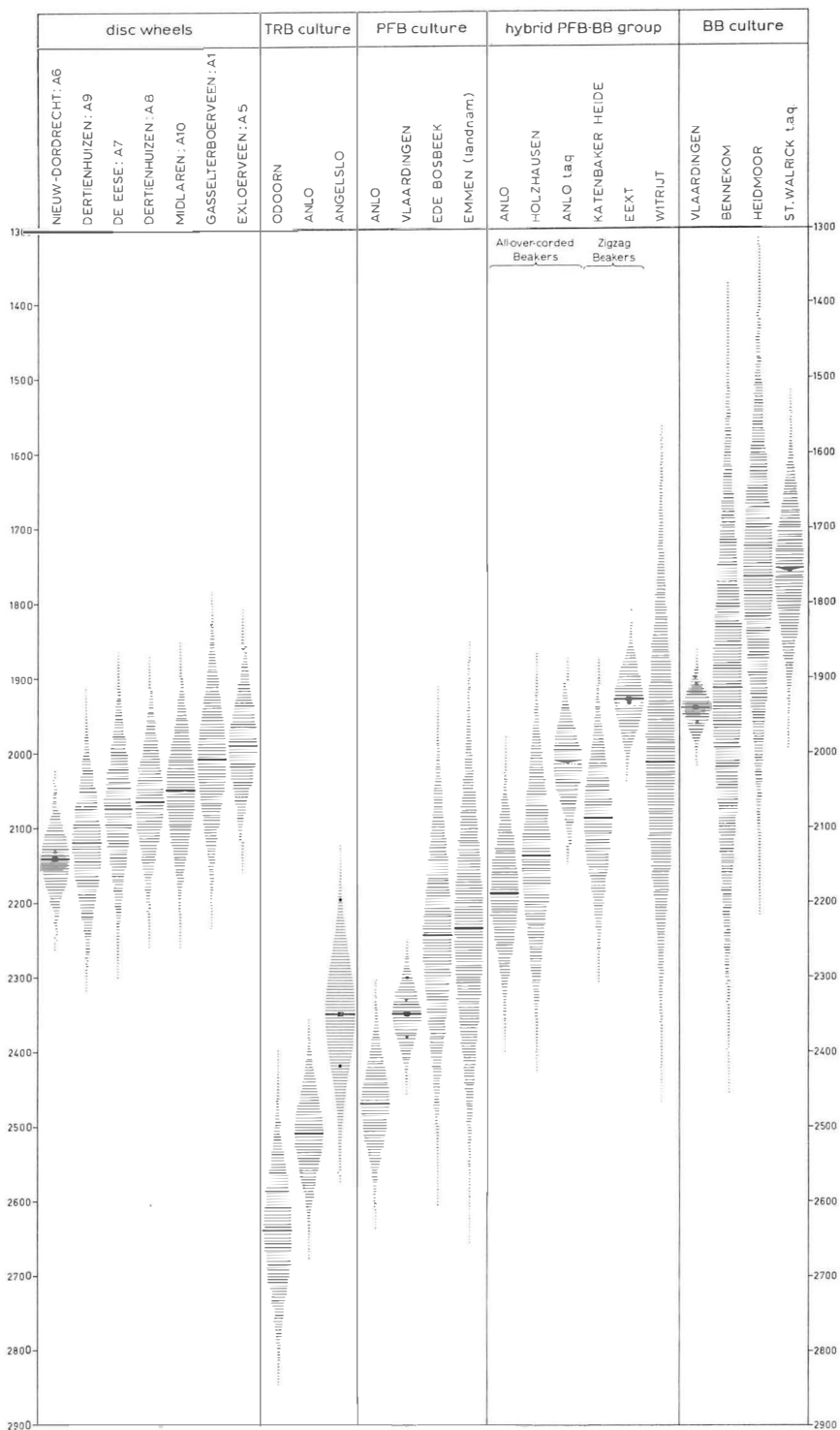
HYBRID PFB – BELL BEAKER GROUP. *Anlo*: 2190 ± 70 B.C. (GrN 851, charcoal from flat grave containing two All-over-corded Beakers; *Palaeohistoria* VIII, 1960, 75; Groningen IV, 180); *Holzhausen*: 2140 ± 100 B.C. (Heidelberg, charcoal from 3rd-period grave in barrow, containing All-over-corded Beaker; *Nachr. aus Niedersachsens Urgesch.* 27, 1959, 3–13); *Anlo*: 2015 ± 50 B.C. (GrN 1976, charcoal from pit, dug into flat grave containing All-over-corded Beaker; *Palaeohistoria* VIII, 1960, 75; Groningen IV, 180); *Katenbäker Heide*: 2090 ± 80 B.C. (GrN 4058, charcoal from grave beneath barrow containing two Zigzag Beakers, 9 flint implements and battle axe; *Oldenb. Jahrb.* 54, 1954, 3–26; Groningen V, in press); *Exnt*: 1930 ± 40 B.C., average of two measurements of charcoal covering central grave beneath barrow, containing Zigzag Beaker, battle axe and Grand Pressigny flint dagger (1935 ± 65, GrN 939; 1930 ± 50, GrN 946; Groningen II, 135); *Witrijt*: 2015 ± 150 B.C. (GrN 381, charcoal from foundation trench around central grave beneath barrow, containing hybrid Beaker and Grand Pressigny flint dagger (Groningen II, 135).

BELL BEAKER CULTURE. *Vlaardingen*: 1940 ± 25 B.C., average of four determinations of charcoal and wood from the Maritime Bell Beaker settlement layer (1960 ± 100 B.C. GrN 2419; 1900 ± 50 B.C., GrN 3097; 1960 ± 30 B.C., GrN 2159; 1910 ± 110 B.C., GrN 2481; *Helinium* II, 1962, 232 ff.; Groningen IV, 177–8); *Bemekom*: 1915 ± 180 B.C. (GrN 326, charcoal from central grave beneath barrow containing two Bell Beakers of Veluwe type; Groningen II, 135, Groningen IV, 182); *Heidmoor*: 1770 ± 150 B.C. (H27–25, charred wood from layer with Bell Beaker remains; *Germania* 36, 1958, 142); *St. Walrick*: 1775 ± 80 B.C. (GrN 2996, charcoal from youngest grave in three period barrow; t.a.q. for Bell Beaker of Veluwe type in first grave and Unëitice ornament in second grave, Groningen IV, 182).

Groningen II: H. de Vries, G.W. Barendsen, H.T. Waterbolk, Groningen Radiocarbon Dates II, *Science* 1958, 129–37.

Groningen IV: J. C. Vogel and H. T. Waterbolk, Groningen Radiocarbon Dates IV, *Radiocarbon* V, 1963, 163–202.

Neolithic Disc Wheels in the Netherlands



4090 \pm 40 B.P. (A: 6, Nieuw-Dordrecht) and 3960 \pm 80 B.P. (A: 1, Gasselterboerveen). For the associated wheels (A: 2, 10) similar dates apply. Thus, nine of the thirteen wheels, representing six of the ten finds, are dated within the limits stated. In this light and considering the similarity in shape of the wheels, it is quite safe to accept a corresponding date for the four remaining wheels, and thus for the group as a whole.

For both dating and the cultural attribution of the group it is of importance that the Musselkanaal, Nieuw-Dordrecht and Midlaren wheels were deposited in the peat at a level where the activities of people of the PF Beaker Culture are clearly expressed in the pollen diagram. This is in agreement with the C 14 dating results (see below). As to the question of their cultural attribution, one must clearly understand that the pollenanalysis shows that people of the PF Beaker Culture were living in the neighbourhood when the wheels were deposited, but not necessarily that they are the ones to be held responsible for the deposition.

A comparison of the C 14 dates of the wheels with those available for the Neolithic cultures represented in the area is instructive (cf. table, p. 110-1).

As to the dates of the TRB Culture, it should be noted that the youngest one, from Angelslo, represents the end phase of that culture⁹. On the base of the C 14 dates, the likelihood of a connection of the wheels with the TRB Culture as a whole is extremely slight. A connection with the Angelslo phase of the culture cannot, however, be altogether excluded. But it would require a phase of considerable duration, well beyond the age indicated by the C 14 dates at present available.

As for the dates of the PF Beaker Culture⁷, one must realize that all C 14 dates so far available (except the one from Emmen, which refers to a peat sample of a level where PF Beaker *Landnam* was clearly detectible in the pollen spectrum; van Zeist, 1955, p. 117, Pl. XXX) refer to finds that on typological grounds must be equated with the early 'pan-European' phase of that culture. On the basis of these C 14 dates, a connection of the wheels with the earlier phases of the PF Beaker Culture is unlikely, but a connection with a more advanced phase of that Culture would by no means be difficult. That a later phase of the culture must in fact have been contemporary with the wheels is indirectly clear from the C 14 dates of the mixed PF Beaker—Bell Beaker groups. In the grave from Eext, which yields the youngest date of these groups, PF Beaker Culture elements are well represented (battle axe of H type, on the Beaker the undecorated lower part), and in fact, graves with similar Beakers in Northern Germany are listed with the Single Grave Culture and dated *spätuntergrabzeitlich* and later (Struve, 1955, p. 49).

The C 14 dates clearly open the possibility that the wheels are to be connected with the mixed PF Beaker—Bell Beaker groups⁷.

The contemporaneity with the mixed groups leaves open the possibility of a con-

nection with the Bell Beaker Culture⁷, though all C 14 dates so far available of the Bell Beaker Culture, notably those of the *typo maritimo* Bell Beaker layer at Vlaardingén, do not favour such a connection. It is, however, possible that the earliest arrival of Bell Beakers of maritime type has not yet been recorded in C 14 dates, and this is in fact suggested by the earlier dates of the mixed groups, a fact otherwise unaccounted for.

Summarizing, one could state that the C 14 dates make out a case for connecting the wheels with a developed phase of the PF Beaker Culture or with the hybrid PF Beaker—Bell Beaker groups. The possibility of their dependence on the late TRB or early Bell Beaker Cultures cannot, however, be altogether excluded.

In the previous section we suggested that the wheels represent votive deposits, and we pointed to the fact that the votive deposition, though a long standing practice of the TRB Culture, was adopted by PF Beaker people. It is worth while to reconsider our C 14 conclusions in this light.

If the wheels finally prove to be offerings made by the last TRB people, their dates in the last century and a half of the third millennium B.C. could be taken to represent the introduction of the wheel into this region. It would be difficult to imagine why people amongst whom the practice of placing offerings in the peat was a long standing tradition would not have made offerings of wheels before, if they had had any.

Assuming a connection with a later phase of the PF Beaker Culture, the dates of the wheels could be taken to represent the moment of taking over the practice of votive deposition by PF Beaker people. It would not be difficult to imagine that the early PF Beaker immigrants had already had wheels, which only their descendants learned to deposit in the peat. In fact, as we shall see in the next section, the PF Beaker immigrants are the most likely agents for the introduction of wheels (if they were not the introducers, the wheels were most likely distributed by diffusion rather than by migration).

It would be more difficult to think of this in connection with the Bell Beaker Culture and to conceive these wheels as representing offerings of the earliest Bell Beaker 'prospectors'. This would imply that newcomers, unfamiliar with the conception of votive deposition, at once took to placing offerings in the peat, for which they only used wheels (no other votive depositions of the Bell Beaker Culture being known), and shortly afterwards abandoned this practice altogether, long before the culture was extinguished.

The only archaeological evidence for the dating, and at the same time, for the cultural relation of one of the wheels, is from Nieuw-Dordrecht. On stratigraphical and palynological grounds, the wheel which was found near the trackway and the trackway itself can safely be taken as belonging together (cf. Mrs. van der Spoel, pp.

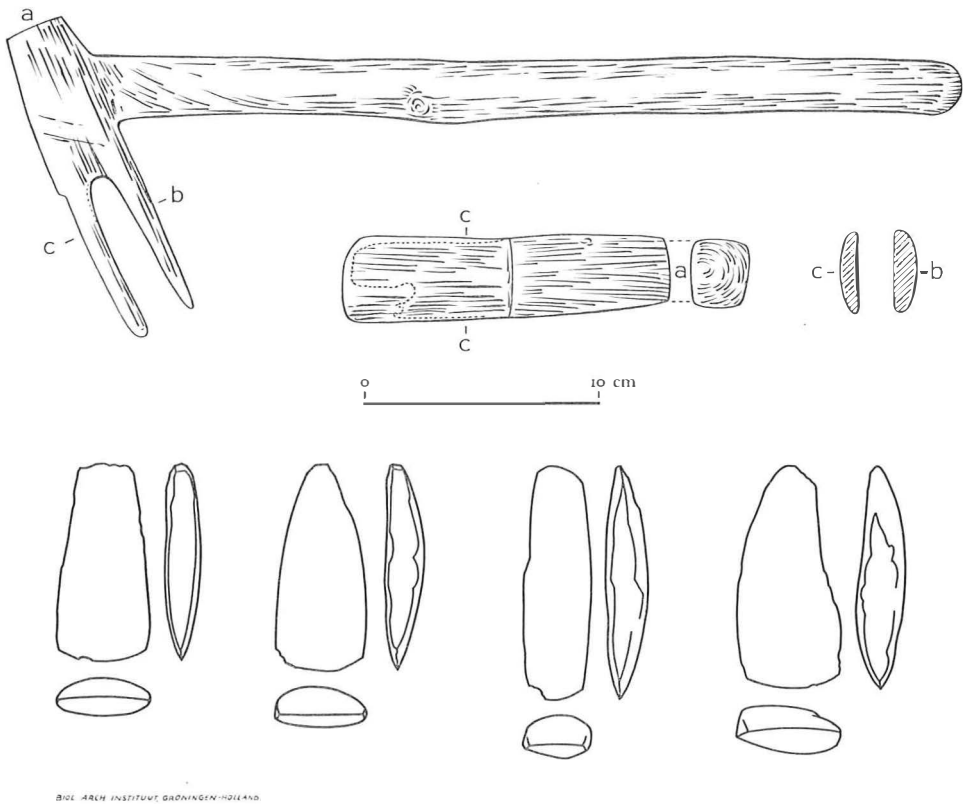


Fig. 24. The adze shaft of Nieuw-Dordrecht (above) and some flint adzes that fit the shaft (bottom; l.t.r. Eext, cf. note 11; Fochtelloo, gem. Ooststellingwerf; chisel from the hoard from the Reest, cf. p. 109; Weende, gem. Vlachtwedde).

145-7). Underneath the wood of the trackway a wooden shaft for a stone axe was found (fig. 24). Although the stone axeblade for which had been made the shaft was not present, its shape can be deduced with some certainty from the shape of the slot in the shaft. According to van Zeist (1956, p. 317; 1957, p. 15), a thin-butted axe would have fitted the shaft. We do not agree with this opinion, and as Van Zeist also realized, there is room for discussion on this point. In view of the fact that the axes in the Netherlands have never been studied adequately, only a provisional estimation can be given on the basis of the old 'impressionistic' criteria¹⁰.

As to the shape of the axe for which the shaft was intended, the negative of the slot suggests a moderately thick-butted specimen of the four-sided Northern type with approximately parallel faces. It would have been comparatively small, c. 10 or 11 cm in length and 2 cm in thickness.

One could ask whether the cross-hafting implies that the axe itself was shaped as an adze, i.e. asymmetrical with respect to its main axis. Childe (1950, p. 157)

points out that it is quite possible to haft a normal axe crosswise to use it as an adze (which, *vice versa*, is not true for an adze blade), so that one is not entitled to assume that only a stone adze blade could have fitted the shaft. Asymmetrically shaped axes, all with comparatively straight cutting edges, occur preponderantly in the 'rough workmanship' group of axes to be discussed presently but are also found in the group of smaller four-sided TRB (?) axes (fig. 24)¹¹.

Rectangular-sectioned axes of the series, typical for the TRB Culture in Southern Scandinavia (Becker, 1957), are frequently met with in the northern provinces of the Netherlands. They are the chief component of the hoards of (predominantly flint) axes found in the raised bogs (Bakker, 1959; Achterop, 1960). They are also found in small numbers as stray finds, and occasionally, in the *hunebedden* (megalithic tombs of the TRB Culture). On the basis of analogy they are attributed to the TRB Culture. Hardly any of these axes would satisfy the requirements just defined for the Nieuw-Dordrecht shaft. On their shape, only the moderately thick-butted axes of Bundso and Lindo type (Becker, 1957) would be qualified, but most of them would be too large. In the South Scandinavian system (Becker, 1954) axes of these types can be dated to Middle Neolithic III to V (Becker, 1957, p. 29), which can be equated with the *Untergrab-Obergrab* periods of the Single Grave Culture.

On the other hand, many of the flint axes of 'rough workmanship' which in North-Germany and in Denmark are considered typical of the Single Grave Culture (Struve, 1955, pp. 59–62; Glob, 1945, p. VIII), would meet the requirements quite well; this is especially true for Struve's thickbladed type *mit zerklüftetem Nacken*. Moreover, the average size of axes of this group is much smaller, and thereby closer to the axe that fitted the shaft. So far as associated, the axes of this group in this country also belong to the PF Beaker Culture (the Dutch equivalent of the Single Grave Culture) or to the hybrid PF Beaker—Bell Beaker groups¹².

However, a number of rectangular-sectioned thick-butted axes with moderately thick blades and almost parallel main sides are known from the *hunebedden* (e.g. van Giffen, 1928, Pl. 154) and as stray finds, which are difficult to classify according to the 'impressionistic' criteria, and which do not fit well into either of the groups mentioned. In average size they are about equal to the axes of 'rough workmanship', and some of them would certainly fit the Nieuw-Dordrecht shaft. The occurrence of the axes in the *hunebedden* naturally suggests their belonging to the TRB Culture but it is not a proof¹³ and one is inclined to see these axes as the everyday type of work axe of the local TRB Culture. On the basis of their thickbuttedness, one is inclined to assign a late Middle Neolithic dating to these axes (according to the South-Scandinavian system).

Practically all the four-sided axes of hard stone which have appeared in the Northern parts of the Netherlands are too thick to fit the shaft.

Our provisional conclusion is that the axe that fitted the Nieuw-Dordrecht shaft probably was a later Middle Neolithic axe (according to the South Scandinavian system). It could very well have been an axe belonging to the PF Beaker Culture (or to the hybrid groups), but the smallest axes of the as yet ill-defined group probably connected with the Dutch TRB Culture are also possibilities. It should be realized, however, that virtually nothing is known about the axes used by the Bell Beaker people. Thus, the axe evidence would allow an attribution of the Nieuw-Dordrecht wheel to both the TRB and PF Beaker Cultures, leaving the possibility of a Bell Beaker attribution apart.

If we combine the evidence based on C₁₄, palynology, character of the deposits, and archaeology the following can be said:

The uniformity of the wheels, the short period of their occurrence, and the fact that they all represent peat deposits, make it probable that we are dealing with a specific element of one culture. This may be true for the practice of wheel-deposition only, or for the wheels as such. The period of the deposits is at the very end or after the TRB Culture, in the period of a developed stage of the PF Beaker Culture, when the hybrid PF Beaker—Bell Beaker groups were already in existence. We also must reckon with the possibility of the presence, by then, of the Bell Beaker Culture. The possibility of an attribution to any of the last three exists, with the least probability in the case of the Bell Beaker Culture, in consequence of the probably votive character of the deposits. The evidence derived from C₁₄ dates and palynology and the axe evidence are consistent with attribution to the PF Beaker Culture.

Such an attribution would, as we suggest below, be in accordance with the character and origin of the PF Beaker Culture, the westernmost branch of the family of Battle Axe Cultures.

Parallels and origin of the Dutch disc wheels

To estimate the significance of the Dutch Neolithic wheels for prehistory and for the history of wheeled transport, we must establish their possible relationship to two other centres of wheeled transport in Europe of about the same period: the Middle Danube Basin and the Pontic Steppe area.

In the Middle Danube Basin, a model of a two-axled, four-wheeled waggon was found in grave 177 of the cemetery of the Baden Culture at Budakalász, usually dated to the period of 2200 to 1900 or 1800 B.C.¹⁴ (Banner, 1956, Pl. 120; Bóna, 1960, pp. 83–84, fig. 3: A). I. Bóna (1960) was then able to identify a series of clay wagon models, succeeding the Budakalász model, in the Middle Danubian Early and Middle Bronze Age. Until Bóna's identification the wagons had often been

taken to represent hanging boxes and the wheels had repeatedly been considered to represent spindle whorls, since these elements had become separated through the decay of the wooden or bone axles which originally connected them¹⁵. The wheels of the Budakalász and of some of the subsequent wagon models, which are undecorated, appear to represent massive, possibly one-piece, disc wheels with round axle holes and often (but not at Budakalász!) protruding naves. They may have been partly similar to the Dutch examples. Other model wheels may be decorated with painted patterns indicative of the structure of the original wooden wheel which served as the prototype, *e.g.* Near-Eastern and Indian clay wheel models (Childe, 1954, fig. 3, 7; Bóna, 1960, p. 90, fig. 4–5. Pl. LXV: 4, 10; LXVI: 1, 5; LXVIII: 4). But one cannot assume the reverse, that undecorated specimens like the wheels from Budakalász necessarily represent plain, structureless, one-piece disc wheels like the Dutch examples.

The question as to the possible similarity of the early Middle Danubian and Dutch wheels is, however, of secondary importance in view of the fact that hardly any direct connections are conceivable between the Baden Culture and the northern parts of the Netherlands. The Baden Culture is considered to be of Southern origin, with a strong Western Anatolian component (Banner, 1956; Bognár-Kutzián, 1961, p. 227; Kalicz, 1963). Yet, the Baden Culture made itself felt in Central Europe, where, for example, Salzmünde is believed to have developed out of Baalberg under strong Baden influences. Such influences would fall in a period contemporary with the beginning of the Scandinavian Middle Neolithic (*cf.* Driehaus, 1960, pp. 178–83), before the expansion of the Battle Axe Cultures. Elements familiar to the Baden Culture, like the wheels, might therefore have reached North-western Europe from the Danubian quarter by way of diffusion.

However, in the Danubian area, according to Bóna (1960, p. 102), the axles appear to have turned with the wheels, in contrast to the wheels of the Pontic Steppe area, which certainly revolved on the axle, as did the Dutch ones¹⁶.

In this and in other respects the Pontic Steppe area offers favourable prospects in respect to a possible relationship with the Netherlands. Wheels that appear to resemble the Dutch Neolithic disc wheels in all respects have been discovered by A. I. Terenožkin in graves of the Kurgan Pit Grave Culture (*drevneyamnaya, Grubengrabkultur*) at Storoževaya Mogila on the lower Dnieper near Nikopol and at Akkerman on the Molotchna in the Melitopol district.

In kurgan no. 7 of Storoževaya Mogila, the second of three shaft graves contained as the only grave furniture the remains of a wooden two-wheeled cart (Terenožkin, 1951*a*; 1951*b*). On a step around the shaft the two wheels were found on one side; on the other side were the remains of the body of the cart and the cartpole. The wheels (Pl. V) which measured only 0.48 m in diameter, are solid one-piece discs, cut lengthwise out of the tree, with round axle holes and projecting

naves. The similarity of these wheels to the Dutch ones is stressed by Merpert (*in litt.*)¹⁷. At Akkerman, the largest kurgan of the group, no. 8, had a shaft grave of similar shape, also containing remnants of a two-wheeled cart (Terenožkin, 1956). The wheels were of the same type, but slightly larger, measuring 0.62 m in diameter, thus being about similar in size to the wheel from Nieuw-Dordrecht, which is among the smallest of the Dutch finds.

Neither of the graves contained any datable objects. Nevertheless, the attribution to the Pit Grave Culture, proposed by Terenožkin on the basis of the form of the graves and the stratigraphically proved priority of this type of grave to those of the Catacomb Grave Culture in the same area, is generally accepted (Hančar, 1955, p. 118; Gimbutas, 1956, p. 78; Childe, 1957, p. 151; Mongait, 1959, p. 131; Merpert, 1961, p. 186).

Terenožkin suggested a date for the graves of Storoževaya Mogila and Akkerman as being in the second half of the third millennium B.C. The dating of the Pit Grave Culture, and especially of its initial phases, is still open to discussion (*e.g.* Gimbutas, 1961, *contra* Merpert, 1961). In view of the princely character of these graves, in which the carts are considered to serve as hearses in Sumerian fashion (Childe, 1957, p. 151), one could argue that they should fall in a more mature phase of the culture; in fact Merpert (*in litt.*) is inclined to assign them to the final phase. For our purpose it is, therefore, important that this final phase of the Pit Grave Culture, the fourth period in Merpert's (1961) system, offers the best points of contact for cross-dating, especially in the hammer-headed pins that are characteristic of the later part of this phase and of the subsequent Catacomb Grave period. Miložič (1955) taking the Kuban-Caucasus area as the center of distribution of these pins, points to the silver examples in the Alaca Hüyük graves in Anatolia (in which a Caucasian component is clearly represented). The youngest graves of Alaca Hüyük can be dated to about '2250 ± 50 B.C.' (this is not a C 14 date!). This date should, therefore, according to Miložič, also apply to the older Kuban-Caucasian pins. The same line is taken by Childe (1957, p. 157): 'If the Alaca pins are the luxury version of a Pontic type, their absolute date—certainly about 2000 B.C.—is a *terminus ante quem* for the creation of the type in Southern Russia', and consequently, for the end phase of the Pit Grave Culture. Merpert (1961, p. 185) and Gimbutas (1961, p. 194) hold similar opinions.

Excavations in recent years of settlement sites of the Pit Grave Culture, situated on the high banks along rivers, did show the inadequacy of the existing conceptions of the level and economic character of this culture (Merpert, 1961, pp. 185–186). Far from being the simple homesteads of only half-sedentary pastoralists, large settlements of long duration and, in the final phases, of elaborate architecture, testify to a fully sedentary population, to stockbreeding on an extensive scale, to agriculture, and ultimately, to the development of metallurgy. Under such circum-

stances, the exact dating of the Storoževaya and Akkerman graves is not conclusively decisive; the essential point is the proof they give that carts with wheels identical to the Dutch ones were known to this culture, which flourished at least as early as the period of occurrence of one piece disc wheels in the Netherlands.

In view of the suggested likelihood of a connection of the Dutch Neolithic wheels with the PF Beaker Culture (or the mixed PF Beaker—Bell Beaker groups), we must point to the connections between the Battle Axe Cultures (of which the PF Beaker Culture represents the westernmost branch) and the Pit Grave Culture. Since Childe (1927) suggested a south-eastern origin for the Battle Axe Cultures, a variety of theories have been suggested, taking for granted the existence of connections between these cultures to a greater or less extent (e.g. Childe, 1957, pp. 157, 173–4; Gimbutas, 1956; Glob, 1945, p. XIII; Merpert, 1961, p. 182; Miložević, 1953, Abb. 35; Struve, 1955, pp. 113–6). The writer is not in a position properly to evaluate these opinions, but it should be kept in mind that these opinions range from the acceptance of complete genetic affiliation of the Battle Axe Cultures to the Pit Grave Culture (Šturms, 1957) and the spread of cultural elements westward from the Pontic area by means of actual migrations (Sulimirski, 1955), to the allowance of influence to a limited degree and of cultural transmission (Brjussov, 1957, p. 258; 1962). Proof of trade connections at least of the Pontic Ochre Grave Cultures (the combined Pit Grave and Catacomb Grave Cultures) with Central and Northern Europe, in which the Battle Axe Cultures must have served as intermediaries, is to be found in the occasional occurrence of hammer-headed pins (Behrens, 1952). Certainly an important Pontic Pit Grave element taken over by Battle Axe people is the burial in single graves under barrows (Sulimirski, 1955, pp. 121–2; Piggott, 1962, p. 116), whether or not this points to migration from the Pontic area (Sulimirski, *l.c.*) or to cultural transmission (Childe, 1957, *l.c.*; Piggott, *l.c.*). The fact that contacts of Central and Northern Europe with the Pontic area were not limited to the period in which the Battle Axe culture in its pan-European phase spread over Europe, is indicated by the typologically late Beaker associated with the hammer-headed pin from Bleckendorf (Behrens, 1952), and by influences in the *Enkeltgrav* pottery of the *Obergrabzeit* in Denmark (Glob, 1952, p. 112).

In the light of these facts, it is tempting to see in the Dutch Neolithic wheels still another element of Pontic origin introduced into Northwestern Europe by Battle Axe people. A pair of wheels found in a bog at Schönsee near Braniewo in Poland (formerly Braunsberg, East Prussia; Gaerte, 1929, Abb. 94; Schneider 1952; our Pl. XXXI) appears to represent our type of one-piece disc wheel; if so, these certainly help bridge the long gap between the Pontic steppes and the Netherlands¹⁹.

A connection of this kind would be welcome to those who like to see the bearers of the Battle Axe Cultures as Indo-Europeans. As Gimbutas (1956, pp. 79–80) points out, the roots of the words for wheeled vehicle, and for wheel, axle, yoke,

pole, linchpin and nave (but *not* for the spoke), appear to agree in many Indo-European languages, so that if the Battle Axe people were Indo-Europeans, they should have known the disc wheel during their expansion. The suggested connection of our disc wheels with the Battle Axe Cultures would be in agreement with this supposition. Nor does the appearance of spoked wheels in Northern Europe by c. 1250 B.C. (Childe, 1954, p. 13) contradict such a view.

Enticing as such speculations may be, one must realize the possible unreliability of arguments based on only a few chance finds of perishable material. Instead of representing a cultural element spread westward in a definite cultural context (that of the Battle Axe Cultures), such a device as the wheeled vehicle might well have been diffused more independently over Europe. We are not convinced that the perforated stone discs of the South-Scandinavian TRB Culture (Glob, 1952, nos. 255–7), of which some 50 examples are known, and which usually are taken to represent discoid maces of the Middle Neolithic period, are really wheels of model vehicles as is suggested by Bóna (1960, p. 105, note 167). The material (hardstone) does not appear to favour this interpretation. But the enigmatic representations on the stone slabs of the portholed stone cist of Lohne-Züschen in Hessen (Uenze, 1956, Taf. 33–36; Kühn, 1935, pp. 259–260) are more difficult to account for. Recent re-investigation of the grave's contents led Schrickel (1962, p. 31) to date the building of this grave and of some other monuments of the same type to a horizon in between younger Rössen – TRB A/B – younger Chassey A and Michelsberg – older Chassey B; quite an early date for an *allée couverte* deriving from the West. If it is really wheeled carts that are being drawn by the pairs of oxen represented; and if, as Dr. Schrickel (*in litt.*)¹⁸ thinks most likely, the engravings are to be connected with the building of the monument (in which, however, sherds of Late Neolithic *Riesenbecher* of Bentheim type also occur), then the presence of the wheel in Hessen at least would be attested to before the spread of the Battle Axe Cultures. Dr. Schrickel (*in litt.*) stresses the similarity in style, already noticed by Breuil (1928), of the Lohne-Züschen representations to the Ligurian engravings of the Mont Bego. The oldest Mont Bego engravings (Phase I), which show pairs of oxen but no wheeled vehicles, are said by Anati (1960a, p. 707) to be connected with 'Cardial Ware which dates to the middle of the third millennium'. This could suggest an early origin for the Lohne-Züschen engravings, and open another possible way for the diffusion of the wheel: via the Mediterranean and Western Europe. We certainly do not think this a more likely way to account for the Dutch Neolithic disc wheels. It does suggest that our picture of the diffusion of wheeled transport towards Northwestern Europe in Neolithic times is as yet incomplete.

At present, however, the balance of existing evidence favours the probability that the wheel was introduced to Northwestern Europe by Battle Axe people from the Pontic steppe area.

Later bi- and tripartite disc wheels, notably from Ezinge

Fragments of six or seven tripartite disc wheels with lunate openings have been uncovered in the *terp* of Ezinge. The only two finds in the Netherlands of plank-built disc wheels outside Ezinge are both from the peat in Drenthe: one, of the Ezinge type, was found near Weerdinge and the other, of different though related shape, was found near Valthe.

The *terp* of Ezinge is one of the series of artificial dwelling mounds along the Southwest bank of the river Hunze in the province of Groningen (cf. fig. 22). Some of these mounds appear to date back to the earliest occupation of the marsh area, about 600–400 B.C. (Waterbolk, 1962, pp. 39–42, Abb. 27). Waterbolk identified the first settlers as being former inhabitants of the adjoining diluvial sand area and pointed to heavy sand-drifting in this period as a possible stimulus for the transmigration. He defined the culture, common to sand- and marsh area, as the Zeijen Culture, an earlier and a later phase of which are characterized by Ruinen-Wommels I and II pottery respectively. Ruinen-Wommels I pottery is datable to the transition Hallstatt D–La Tène A. Pottery of the Ruinen-Wommels I type has been identified in three of the *terpen* of the Ezinge group, but not, so far, at Ezinge itself (Waterbolk, 1962, Abb. 27).

The *terp* of Ezinge was excavated (1924–1934) by Professor van Giffen, who could discern a stratification divisible into six main periods (Van Giffen, 1936). Of these, the youngest period (period I) was datable to c. 400–1200 A.D.; periods II and III represented the Imperial Roman Period (resp. younger and older), period II being sealed by traces of burning which could be connected with the Anglo-Saxon migrations. Period IV was datable to the younger Pre-Roman Iron Age; period V, representing the settlement on top of the first artificial heightening, could be brought by Van Giffen in connection to the phase Jastorf-B. Period VI, the earliest, represents the first settlement, comprising probably two farmsteads which were built on the original level surface. Represented among the earliest pottery (some of which bears geometric decoration) is the Ruinen-Wommels II type (cf. van Giffen, 1936, *Beilage* 5, Abb. 1–2, nos. 1518a; 449). Since the wheels (to be described presently) already turn up in the rebuilding phase of the oldest settlement (per. VI; cf. catalogue C, nos. 3–3a), they may be safely considered as part of the material estate of the Zeijen Culture, even though only their occurrence with the younger phase of this culture is attested.

The wheels from Ezinge (on which details are given in the catalogue, part C; cf. also fig. 25) are all of the classic tripartite type with lunate openings which in recent years has repeatedly been discussed (e.g. Childe, 1954; Piggott, 1957; Clark, 1952, pp. 301–310). They each consist of three oak planks, connected to each other by four oak pegs and by two oak transverse laths. They are solid except for the two

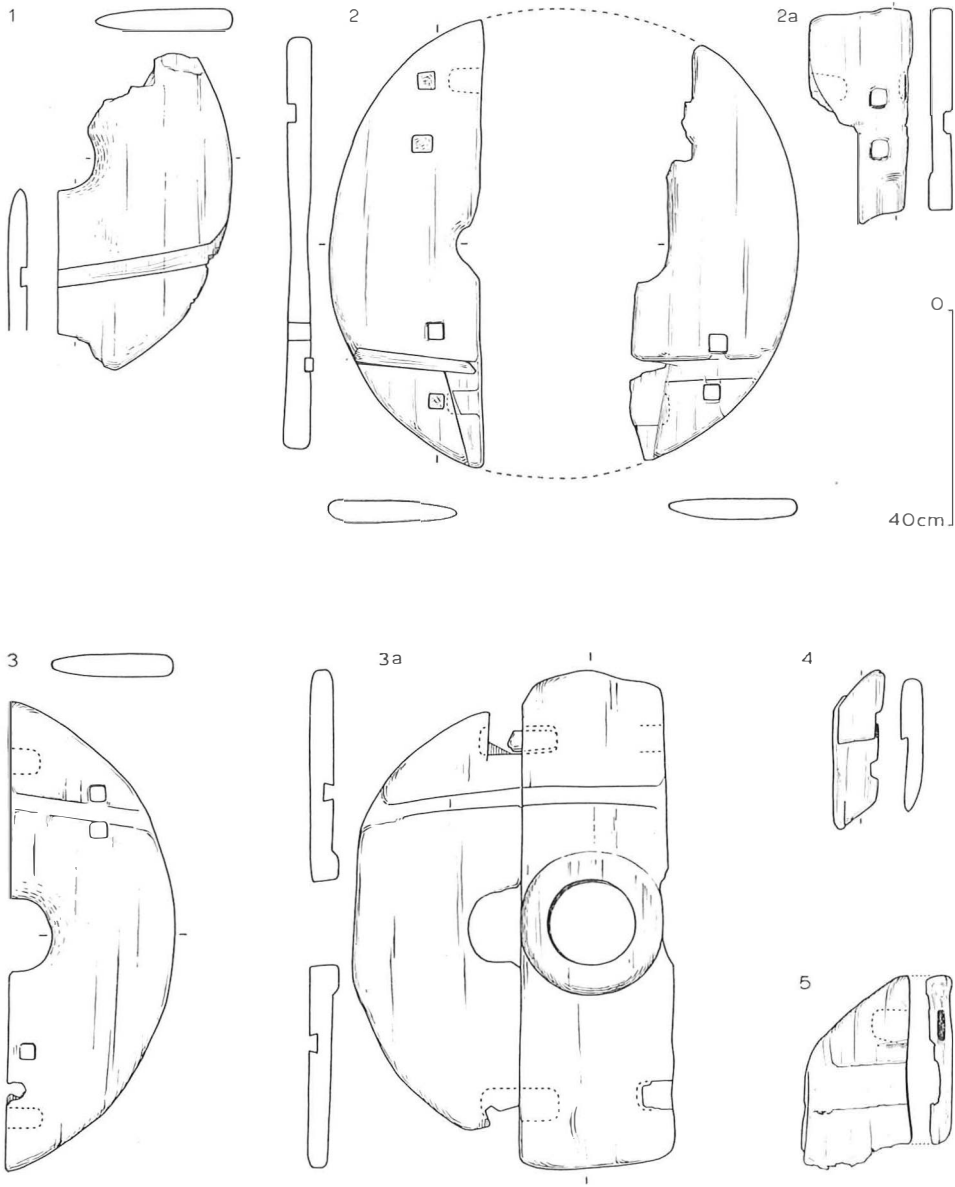


Fig. 25. Iron Age tripartite disc wheels from Ezinge (numbers refer to the catalogue, part C).

lunate openings in the lateral segments and the opening for the nave in the central part. The four pegs (two for each joint) fit into pegholes in the sides of the planks, so that they are invisible as long as the parts are joined together. The two transverse laths are tightly shoved into dovetailed grooves which slightly taper over the whole of their length. There is always one groove on each face of the wheel, and one on each half of the wheel. Thus, the wheels are identical in construction to those from Dystrup (Sophus Müller, 1907) and Buchau (Piggott, 1957, fig. 13, Pl. XXII*a*; the pegs are not indicated on fig. 13, but one of them is clearly visible in the joint on Pl. XXII) whereas on the wheel from Blair Drummond (Piggott, 1957, fig. 12, Pl. XXII*b*), the function of both pegs and transverse laths is taken over by two transverse rods passing through holes bored through all three parts on either side of the nave.

In addition to the elements just indicated, some of the Ezinge wheel fragments show still another structural feature of which the function is not quite clear and which, to our knowledge, is not paralleled elsewhere so far. On the fragments listed as 2, 3 and 4 (cf. catalogue, part C), rectangular perforations are found in pairs on both sides of the transverse grooves; apparently there were originally six pairs per wheel (two pairs per plank, three pairs per groove). In some of these perforations, plugs, rectangular in cross-section, are kept in place by clay which fills up the space around the plug (about half of the perforation). These oak plugs are now cut off level with the faces of the wheel, but it is not clear whether this was done originally and purposely, or only recently by the excavators' shovel.

As is clear from the diameter of the central openings (and from the wheels of Dystrup and Buchau), the hubs forming the naves were made separately (with the grain of the wood in the direction of the axle as with spoked wheels). In the Ezinge examples the central openings were reinforced on one face of the wheel (apparently the outer face) by a ring-shaped thickening, as is clear from the fragments listed under nos. 2*a* and 3*a* (cf. fig. 25). Curiously enough, none of the nave hubs from Ezinge survive.

As to the lunate openings, their function is not very clear. But it is striking that as a constant feature one face of the wheel slopes down toward the outer rim of these openings as if to form an easy grip for the hand when lifting of the cart might be necessary (cf. fig. 25; cross-sections).

Tripartite disc wheels of the type just described certainly represented skilful carpentry, but the construction had its weak points, as may be seen from the fractures of the Ezinge fragments. Missing parts of the wood over the pegholes or adjoining the dovetailed grooves (cf. Pl. XXXIV), show that time after time the pegs or strengthening laths broke out since the wheels were apparently subjected to strong forces. Consequently, practically all Ezinge fragments originate from broken wheels, which time and again seem to have collapsed in much the same way. This may be the

reason for the phenomenon, otherwise strange, that at two separate points fragments of different incomplete wheels were found lying together within a house (nos. 2-2a and 3-3a). Such fragments seem to represent refuse wood, ready to be burnt in the fire place, or to be re-used for different purposes.

The wheel fragments from Ezinge that could be identified in the excavation records or on the field drawings (nos. 1-3) are from periods VI, V, and III; the possibility that one of the fragments that could not be identified may have belonged to period II cannot, however, be ruled out (cf. nos. 4-5). Thus, tripartite disc wheels were in use at Ezinge from certainly before 400 B.C. to the earlier Roman Imperial Period, and possibly also in the later Roman Imperial Period. It should be realized that in the higher levels of the *terp* the chances of survival of organic substances are very much reduced, owing to the dryer soil conditions, so that the absence of tri-partite discs from period II-I in itself cannot be taken as proof that this type of wheel no longer existed.

It is worth while to examine, in this context, the earliest occurrence of the spoked wheel (of wood, for ordinary transport) at Ezinge and in the vicinity. Fragments of c. nine spoked wheels are among the Ezinge finds. Of these, only four could be identified in the excavation records and these all proved to represent period I. It is particularly regrettable that it was not possible to identify the find numbers 845 and 905 among the fragments that lost their labels since the excavation. According to the records, these numbers represented 'wheels' (without further indication as to their type), and refer to finds from period II (later Imperial Roman period). We would expect these to be spoked wheels. It is equally regrettable that we are not certain that find number 1792 of period V (representing the first heightening of the *terp*) refers to a disc wheel. It is not very likely that this number represents a spoked wheel. Among the Ezinge finds that have lost their labels which are candidates for these find numbers there are fragments of five spoked wheels and of two disc wheels (cf. Catalogue, part C, nos. 4-5). It is, therefore, only possible to state that no disc wheels could be identified from a later period than period III (earlier Imperial Roman period), and no spoked wheel from an older period than period I (c. 400 A.D. and later). It is interesting to note that at Feddersen Wierde, the well known dwelling mound in the marsh area of Northern Germany in which the earliest occupation dates back to the second half of the 1st century B.C. (Haarnagel, 1961, pp. 53-54), only (fragments of) spoked wheels have been found thus far (according to kind information by Dr. W. Haarnagel).

The earliest occurrence of spoked wheels in the province of Drenthe may be in the same period. At three sites (half finished fragments of) spoked wheels have been found in pits in small peat deposits, which apparently belonged to nearby settlements of the Roman Imperial period. In the Bolleveen near Zeijen (Gem. Vries), part of a felloe of a spoked wheel and other finds were recovered from a series of

ancient pits in the peat, which later were again overgrown. The pottery could be dated by van Giffen (1950, p. 91 afb. 2, 1922/V 1a-s) to the 2nd-4th centuries A.D. In the Bolleveen of Taarlo (Gem. Vries) too, such pits proved to be present. Fragments were found, in the course of peat-cutting, of unfinished felloes and nave hubs of spoked wheels, and also fragments of three pots, which could be dated to the earlier Roman Imperial period (Clason, 1963). However, on the strength of pollen analysis, Miss Clason points out that at least one of these pits was still open by c. 400 A.D.; therefore, the possibility of a date of the wheel fragments in the later Roman Imperial period cannot be excluded. Mr. W. A. van Es kindly informed me that in the border zone of the Looveen near Wijster (Gem. Beilen), just outside the large settlement of the Roman Imperial period, a pit was found dug into the peat which proved to contain several half finished wooden objects, possibly sunk in the peat for soaking. Among these objects were unfinished parts of felloes, and there was also a pot, tentatively datable to the Early Roman Imperial Period, and approximately contemporary with the first phase of settlement.

To return to the disc wheels: it is significant that in none of these peat pits of the Roman Imperial Period were fragments of plank built disc wheels found. Yet, two such wheels are known from Drenthe, both from the raised bog in the Emmen area (cf. fig. 22).

Two lateral fragments of a tripartite disc wheel with lunate openings of the type current at Ezinge (without rectangular openings at the sides of the transverse grooves) were found in 1913 in the Weerdingerveen (cf. catalogue, part B no. 2; fig. 29). There is no possibility of dating the find archaeologically, but with the help of small particles of peat still adhering to the wood, Mrs. Van der Spoel (cf. following paper) was able to date the wheel by pollen analysis to the beginning of the Subatlantic period (c. 800 B.C. to c. 200 A.D.), certainly before 200 A.D. It is thus about contemporary to the Ezinge wheels.

The second wheel, found in 1845 in the peat E. of Valthe, no longer survives, but it is known from the description and a drawing made by L. J. F. Janssen (cf. catalogue, part B no. 1; Pl. XXXII). This wheel was bipartite and had no lunate openings since the disc was solid. Nevertheless, it was close to the tripartite disc wheels in construction, the two halves being joined by the same transverse laths, and the nave being of the same type. Janssen saw the wheel only some time after its recovery when it had already suffered considerably due to drying and lack of care. The fact that he does not mention dowels to keep the halves together does not, therefore, necessarily imply that there cannot have been dowels. Anyway the most essential innovations of the Ezinge wheels as compared to the Neolithic ones are also present with the Valthe wheel; its construction out of more than one piece of wood, and the hub for the nave made separately, with the grain of the wood in the direction of the axle being the decisive factors. Consequently, the simpler charac-

ter of the Valthe wheel should not be taken too quickly as proof of an earlier dating. It certainly is a pity that no possibility is left of an objective dating of the Valthe wheel. We shall return to the question of typology and dating in the last paragraph.

In summary, it is possible to state that tripartite disc wheels with lunate openings were in use in this part of the Netherlands from at least c. 400 B.C. on into the Early Imperial Roman Period. By then, they apparently were replaced by the spoked wheel which, of course, for more special purposes, had been known even in barbarian Europe long since (Childe, 1954, pp. 13–14; Anati, 1960b).

Some technological aspects of the Dutch disc wheels; conclusion

The total number of disc wheels known from temperate Europe (reviewed repeatedly in recent years: Clark, 1952, pp. 307–309; Childe, 1954; Piggott, 1957) is reinforced substantially by the finds in the northern part of the Netherlands. Thirteen solid disc wheels of a type hitherto unknown outside Eastern Europe and of undoubted Neolithic age; some eight tripartite disc wheels in well dated Iron Age context; and a wheel of uncertain age could be added to the records. Such an accumulation of finds of a special character in a limited area clearly results from favourable circumstances (ritual deposition (?) in the bog, and preservation therein).

It is possible to arrange the disc wheels that came to light in temperate Europe in an order which seems to reflect some kind of typological development:

one-piece solid disc wheels with fixed naves: the Dutch examples dealt with in this paper; Neolithic; those from the Pontic area, Neolithic (Terenožkin, 1951a, 1951b, 1956); the wheel from Schönsee near Braniewo, Poland (formerly Kreis Braunschweig, East-Prussia), of unknown age (Gaerte, 1929, Abb. 94; Schneider, 1952)¹⁹; small wheel with nave on one side from the Stellerburg, Holstein, c. 900 A.D.²¹;

one-piece solid disc wheels with separate inserted naves: Beckdorf, Germany, possibly of Late Neolithic or Early Bronze Age date (Cassau, 1938; cf. the following paper, p. 151–2); six examples in the Oldenburg Museum, Germany, of unknown age (Cassau, 1938, p. 70, to be published by Mr. H. Hayen of Oldenburg); possibly the wheel from Glastonbury Lake Village, Pre-Roman Iron Age, c. 150 B.C. – 0 (but this wheel may have had no nave at all, the central opening being quite small; Bulleid & Gray, 1911, fig. 84); Aulendorf, Germany, wheel of uncertain construction²⁰, dated by pollen analysis to the transition of the Neolithic and the Early Bronze Age in Southern Germany, which implies that the wheel could even be of the same age as the Dutch one-piece disc wheels (von Tröltsch, 1902, p. 95; Mötefindt, 1918, pp. 43, 47, 49, Abb. 18; Schneider, 1952);

one-piece disc wheel with lunate openings and separate inserted nave: Tyndbaek, Denmark (suggested to be of Neolithic age on the base of inconclusive evidence; S. Müller, 1920; Brøndsted, 1957, p. 177);

bipartite solid disc wheel with separate inserted nave: Valthe, Netherlands (present paper, cat. B: 1);

bipartite disc wheel with lunate openings and separate inserted nave: Biskupin, Poland, Lausitz Culture, Early Iron Age, Hallstatt D (*Ill. London News* 8–VIII–1936);

tripartite disc wheels with lunate openings and separate inserted naves: Mercurago and Castione, Italy (Munro, 1890, p. 208; said to be Reinecke D—Peschiera by Childe, 1954); Wasserburg Buchau, Germany, Late Bronze Age, Hallstatt A–B (Piggott, 1957); Dystrup, Denmark (Müller, 1907; Danish Early Iron Age, c. 100 B.C.–100 A.D. according to Piggott, 1957); Blair Drummond, Scotland (Piggott, 1957); Weerdinge and Ezinge, Netherlands, Iron Age, c. 500 B.C.–200 A.D. (present paper, cat. B: 2; C: 1–5).

From the disorderly way in which the dated wheels figure in this series, it is clear that the typology has no precise dating value. But to some extent the series may represent stages in the technological development of the wheel in temperate Europe. In the Neolithic, only solid one-piece disc wheels might have been known. Already in the Early Bronze Age, the principle of the separate inserted nave may have been introduced (the wheels from Beckdorf and Aulendorf). By the end of the Bronze Age and in the Iron Age, bi- and tripartite wheels, with or without lunate openings, but always with separate inserted naves, came into use.

What the different types of disc wheels really represent are different degrees of perfection in imitating the disc wheel as it had been developed long since to perfection in Mesopotamia. In Mesopotamia, bi- and tripartite disc wheels were already in use side by side in about the same period, as may be clear from the bipartite wheels shown on the famous 'royal standard' from Ur and the tripartite disc wheel represented on the fragmentary stele from Ur (references in Childe, 1954; cf. *e.g.* Frankfort, 1954, Pl. 33A, 36). The representations are strongly suggestive that all these wheels had separate inserted naves.

But as to the Neolithic one-piece wheels with fixed naves, one could imagine that these represent as it were the fossilized *Urform* of the disc wheel, that ought to have preceded the more sophisticated bi- and tripartite wheels with separate naves. It is, however, exactly the occurrence of this type of wheel in the Pontic Steppe area, in connection with burial rites of Mesopotamian origin, which makes it clear that these wheels also represent simplified imitations of Mesopotamian prototypes. It should be realized that the construction of a tripartite disc wheel with separate inserted nave not only requires high technical skill, but also well adapted metal tools—tools which would not yet have been available to the craftsmen of the Pit Grave Culture (by then on the verge of the Metal Age), and which certainly were undreamt of by Battle Axe people.

There is yet another reason to see in the one-piece wheels with fixed naves the

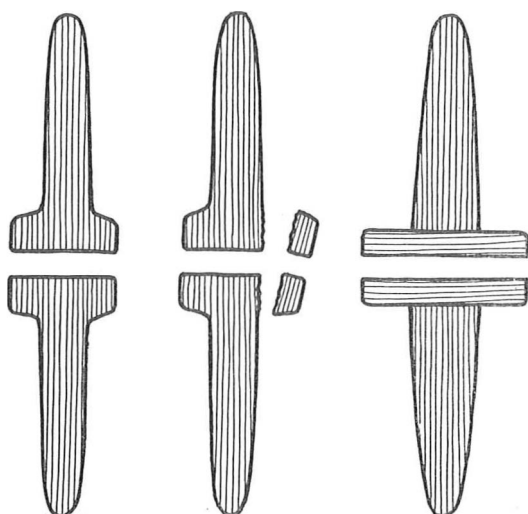


Fig. 26.
Schematic sections of one-piece and tripartite disc wheels, showing the significance of the direction of the grain of the wood for the strength of the nave.

imitation rather than the prototype of the wheel with separate inserted nave. The basic function of the nave is to keep the wheel in the right position, perpendicular to the axle. In doing so, the nave is subject to strong upward and downward pressure, especially at its extremities. The inserted nave successfully resists this pressure, owing to the direction of the grain of the wood. In this respect, these disc wheels anticipate the arrangement of the spoked wheel. But the one-piece disc wheels with fixed naves have the grain of the wood running parallel to the direction of pressure; and when the wheel gets a strong jolt, the projecting parts of the nave snap off (cf. fig. 26). That this often happened in fact can be seen on the Dutch wheels which are missing the nave on one of their faces. It is unlikely that a device so ill-adapted to its function would be a prototype. Among imitations, however, ill-adaptedness to function is conceivable.

It is, therefore, not surprising that despite all the variety in shape and elaboration they show, the later European disc wheels, firmly adhere to the principle of the separate inserted nave. It is this point which most markedly distinguishes the Neolithic one-piece wheels dealt with in this paper from all other European disc wheel finds.

NOTES

¹ The writer wishes to express his indebtedness to the many who have contributed in an essential way to this paper: Mr. Chr. Baas, *ze* Exloërmond, Mr. G. Barelds, Musselkanaal, Mr. N. Dubbelboer, Haren, Mr. J. Hendriks, Emmen, Mr. O. Hulshof, *ze* Exloërmond, Mr. K. Jonker, Musselkanaal, and Mr. J. Oosting, Norg, who were formerly concerned with the cutting of the peat and who, after so many years, went to much trouble in reconstructing

the circumstances under which some of the wheels were found; Mr. J. Broeker, doctor, Arnhem, and Mr. S. J. Snijder, secretary of the Oudheidkamer 'de Hondsrug', Emmen, who helped in identifying and locating a lost disc wheel find; Mr. D. G. J. Landweer, director of the N.V. Veenderij- en Turfstrooiselfabriek 'Klazienaveen' v.h. W. A. Scholten, Groningen, who kindly lent a disc wheel from the collection in his charge for study; to Mr. G. de Vries, overseer of the 'de Eese' estate, who reported the finding of the de Eese disc wheel; Mr. H. T. Katuin, master carpenter, Musselkanaal, Mr. H. J. J. ter Veen, bricklayer, Ter Apel, Mr. S. de Vries, police sergeant, Ter Apel, and Mr. A. Wams, inspector of building, Musselkanaal, who reported the finding of the wheels at Musselkanaal and helped in all possible ways to recover the essential information under the pressure of building having to go on. Our special gratitude is due to Mrs. R. de Jong-Butler and Dr. J. J. Butler, Groningen, who improved the English text of this paper; Mr. W. A. Casparie, Groningen, who gave much valuable information on questions regarding the raised bog and peat cutting; Mr. G. de Leeuw, assistant in the Assen Museum, who collected all information in the Exloërveen area, and Mr. A. Meijer, Mr. H. Praamstra and Prof. Dr. H. T. Waterbolk, who assisted in the identification of the Ezinge wheelfinds; the drawings are by Mr. B. Kuitert and Mr. H. Roelink, the photographs by the C.F.D., National University, Groningen (Pl. I (bottom), II, IV, VIII) and by Mr. J. Dijkstra (Pl. I, top). Miss M. Bierma and Miss J. Cazemier were kind enough to type the manuscript.

² The Nieuw-Dordrecht wheel was dried in a vacuum chamber in frozen condition. There has subsequently been no serious warping and distortion, but the surface has lost its original fresh appearance, and is now covered by countless minute cracks. The de Eese and Dertienhuizen wheels were treated over a long period to the point of saturation with a solution of methylcellulose. These wheels warped considerably, developed serious cracks, and lost the original fresh look of their surface. The conservation of the wheels from Smeulveen with tar and that from Weerdinge with linseed oil have certainly been more successful!

³ Not 'cut horizontally from a tree', as stated by Janssen (1848, p. 96) with reference to the Gasselterboerveen wheel.

⁴ We have to thank Ir. A. Govers of the Houtinstituut T.N.O., at Delft, for information on this question.

⁵ Some of the clay models referred to by Bóna (1960, p. 94, fig. 5 : 1) have the projecting nave only on one side of the wheel. Whether this feature represents a characteristic of the wooden prototype, or only a simplification of the clay model, is difficult to decide. The wheel of Aulendorf is also stated to have had a nave projecting on one side only; this nave is said to have been fixed on (not in) the wheel; cf. note 20.

⁶ The presence of the trackway has been verified for a distance of 1 km eastward from its beginning in the border zone of the raised bog. Then, over a distance of c. 0.5 km, the peat was already cut away before the investigation started. All round this area, standing sections of peat have been carefully investigated by Dr. W. van Zeist and W. A. Casparie (Aug. 1960) as to the presence of the trackway, but no continuation could be found. There is a slight possibility that it was missed by the investigators in consequence of the considerable irregularities in the peat cutting, but most probably the trackway ended c. 2 to 2.5 km from its starting point. It is to be regretted that the terminal point is no longer open to investigation.

⁷ TRB Culture (*Trichterbecherkultur*), abbreviation for Funnel Beaker Culture. PF Beaker Culture is here used to designate the culture represented by Beakers with Protruding Foot, the Dutch branch of the Corded Ware—Battle Axe Cultures, as defined by Glasbergen. For this culture, and for the Bell Beaker and the mixed PF Beaker—Bell Beaker groups, cf. Van der Waals & Glasbergen, 1955, 1959.

⁸ Since the publication of this hoard by Achterop (1960) the actual find spot and find circumstances could be registered thanks to the activities of Mr. H. H. Frieling, schoolmaster at Pieperij. The hoard was found c. 1930 near Pieperij, Gemeente Zuidwolde, near the eas-

tern shore of the river Reest, at the foot of a sand hill, on the sand, underneath peat (top. map coörd. 22153/51681). It has now been acquired by the Provinciaal Museum van Drenthe at Assen, inv. no. 1963/III 2-9.

⁹ Survey of the present state of knowledge concerning the TRB Culture is given by J. A. Bakker (*Helinium* II, 1962, pp. 219-224). For the final phase of the TRB Culture at Angelslo, a second C14 date will be available shortly.

¹⁰ The term is from Malmer (1962) who, in opposition to the 'impressionistic' approach to classification, advocates the mathematical approach, which is based on objective criteria such as size and proportion. We certainly do not wish to belittle the importance of classifications based on objective criteria, which have the advantage that they can be subjected to statistical analysis. We agree that in many fields of archaeological research the mathematical approach can bring considerable progress (as in the case of the flint axes under consideration). But we want to maintain, independently, the validity of the impressionistic approach, which often enables us to classify objects when objective criteria are as yet unknown; which often can provide insight into tendencies and essential moments of development when exact sub-classifications may be futile; and which leaves room for an interpretive element which is really essential. Classification should never become an end in itself.

¹¹ One example is associated with a Beaker of the mixed PF Beaker—Bell Beaker groups: Assen, 1936/VIII 1c, from Eext, Gemeente Anlo (*N.D.V.* 1957, fig. 16; Van der Waals & Glasbergen, 1959, fig. 25. In the drawing, the asymmetrical character of this adze blade is invisible; cf. our fig. 24).

¹² Associated with PF Beakers a.o.: Assen 1934/II 2b, from Ballo, Gemeente Rolde (Van der Waals & Glasbergen 1959, fig. 6); 1935/IX 1a, from Gieten, Gemeente Gieten; 1935/X 8a, from Peelo, Gemeente Assen; 1937/XI 7, from Ballo, Gemeente Rolde (ass. with beaker Van der Waals & Glasbergen 1955, Pl. IV, 9); 1956/X 7b-c, from De Eese, Gemeente Vledder (cf. the paper by Waterbolk in this volume); 1957/VII 4c, Hees, Gemeente Ruinen (*N.D.V.* 1958, pp. 13-14, fig. 4); Groningen, coll. B.A.I. 1918/VII 105 (*N.D.V.* 1957, fig. 16).

¹³ Sherds both of PF Beakers and of Bell Beakers are occasionally found in the *hunebedden*.

¹⁴ In view of the relative chronology and of available C14 dates such a dating looks much too low in our eyes (cf. p. 115, our table pp. 108-9, and Waterbolk, *Antiquity* XXXIV, 1960, pp. 15-16).

¹⁵ One of the 'caskets' has been found in a Wietenberg Culture context, which has been wrongly considered to be part of the Danubian Culture (Bóna, 1960, p. 86); hence the frequent mention of the use of wheeled vehicles by the Danubians in the literature.

¹⁶ Mötefindt (1918, p. 38) pointed to the fact that there is an essential difference between wheels turning *on* and wheels turning *with* the axle. According to him, wheels with a square central opening were fixed to the axle, with which they turned. Such is the case with the carts known as 'groaning carts' used in Mediterranean countries from antiquity to the present day. The inference of Bóna for the Danubian clay models is chiefly based on the shape of the axle holders attached to the waggon boxes. That the Dutch wheels revolved on the axle follows not only from the long tubular naves and round axle holes, which do not display any trace of a device to fix the wheel to the axle, but also from their close resemblance to the Pontic wheels, which are known to have revolved on the axle. In a letter (d.d. 8-1-1963) Mr. Dennis Britton of Oxford kindly gave his view on this point referring to models of Mongolian and Burmese carriages present in the Pitt-Rivers Museum at Oxford, and reaffirming generally our view.

¹⁷ We are extremely grateful to Mr. N. I. Merpert of Moscow and to Prof. A. I. Terenožkin of Kiev, who kindly gave their opinion on the Dutch wheels in letters (May, 1963).

¹⁸ We wish to thank Dr. W. Schrickel for her letter (dd. 22-IV-1963).

¹⁹ We are much indebted to Dr. O. F. Gandert (Berlin) and to Prof. Dr. W. LaBaume (Unter-Uhldingen) for informations on the Schönsee disc wheel. According to Prof. LaBaume (*in litt.*) two wheels were found (diam. c. 0.70 m; the size indicated by Gaerte, 1929,

Abb. 94 is a mistake), the conservation of which was excellent; but nothing is known as to the find circumstances.

²⁰ According to von Tröltsch (1902, p. 95) and Mötefindt (1918) this wheel was a bipartite disc wheel with separate nave. It was restored in 1930 at Tübingen, after which Dr. G. Schneider took notes of it in the Friedrichshafen museum in 1931. The description of the wheel was only published by Dr. Schneider in 1952 from these notes, long after the wheel itself had been destroyed during an air-raid in 1944. According to Dr. Schneider (1952), the wheel itself was a one-piece disc of maple, onto which a separate nave was attached *on* the outer face. But the drawing which serves to illustrate this description rather indicates a solid one-piece disc wheel with a projecting (not a separate) nave cut out of the same piece of wood! We are much indebted to Dr. S. Schiek of Tübingen, who kindly furnished a photo copy of the article by G. Schneider, otherwise inaccessible.

²¹ Prof. Dr. W. LaBaume drew our attention to this wheel in the *Landesmuseum* at Schloss Gottorp. We are much indebted to Dr. K. Struve for information and a drawing. This well dated oak wheel measures only 0.48 m in diam. The fixed nave is hemispherical, the axle hole close to 0.09 m in diam. One face of the wheel is completely flat.

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APPENDIX

CATALOGUE OF DISC WHEEL FINDS

For the general characteristics of the wheels, see the general description (pp. 105–8) of this paper. Dimensions of the disc wheels or parts of them, in so far as not mentioned in the catalogue, can be deduced from the drawings (fig. 23, 25).

When the depth of the find is given in relation to the surface of the peat, the reader should be aware that this surface needs not be the original surface (owing, *e.g.*, to such human activities as the burning of the top layer for the cultivation of buckwheat).

Details such as the names of finders and landowners are only mentioned in this catalogue when not so far published in the literature or easily accessible in the sources mentioned.

Veen is the Dutch word for peat; a *veenplaats* is a parcel of peat; names as Gasselterboerveen ('the peat of the farmers of Gasselte') or Smeulveen ('the smouldering peat') refer to certain well defined areas in the raised bogs.

The catalogue consists of three parts:

- A. Neolithic one-piece disc wheels
- B. Later bi- and tripartite disc wheels from raised bogs
- C. Iron Age Tripartite disc wheels from Ezinge.

Within these parts, the catalogue is arranged in the order of the dates of recovery of the wheels.

In the catalogue, the following abbreviations for Museums and Institutes are used:

- Assen = Provinciaal Museum van Drenthe at Assen
- B.A.I. = Biologisch-Archaeologisch Instituut, Rijksuniversiteit at Groningen
- Groningen = Groninger Museum voor Stad en Lande at Groningen.

A. NEOLITHIC ONE-PIECE DISC WHEELS

1–2. GASSELTERBOERVEEN, GEM. GASSELTE (fig. 23, Pl. XXX).

site and circumstances: Found in June, 1838, by peat-cutters in the peat at *veenplaats* no. 3 of the Gasselterboerveen, about above the underlying sand, and 1.50–2.00 m below the then surface of the peat. According to the *Staatscourant* a second wheel of similar shape, though smaller, was found in the vicinity, but was 'chopped to pieces by the peat-cutters in order to be able to continue the peat-cutting'.

description: Large wheel, split in three pieces (in antiquity or in the drying process?) and shrunken considerably especially in the direction perpendicular to the grain, to now oval shape, in drying. The disc, comparatively thin, is slightly thicker towards the centre. Heavy projecting nave on one side; on the corresponding place at the other side a clearly delimited discoloration is proof of the presence, at one time, of a projecting nave there too. Tread broad, flat and square at the end of the grain, more narrow and rounded at the edges parallel with the grain.

dimensions: The *Staatscourant* gives the impossible information that the diameter was (presumably before drying) 96 inches. Present dimensions (also represented on drawing and photograph): diam. 0.70–0.88 m; thickness of disc 0.05–0.065 m; nave projection 0.07 m; width of tread c. 0.03–0.035 m.

dating evidence: C₁₄ date (GRN 3238) 3960 ± 80 B.P.

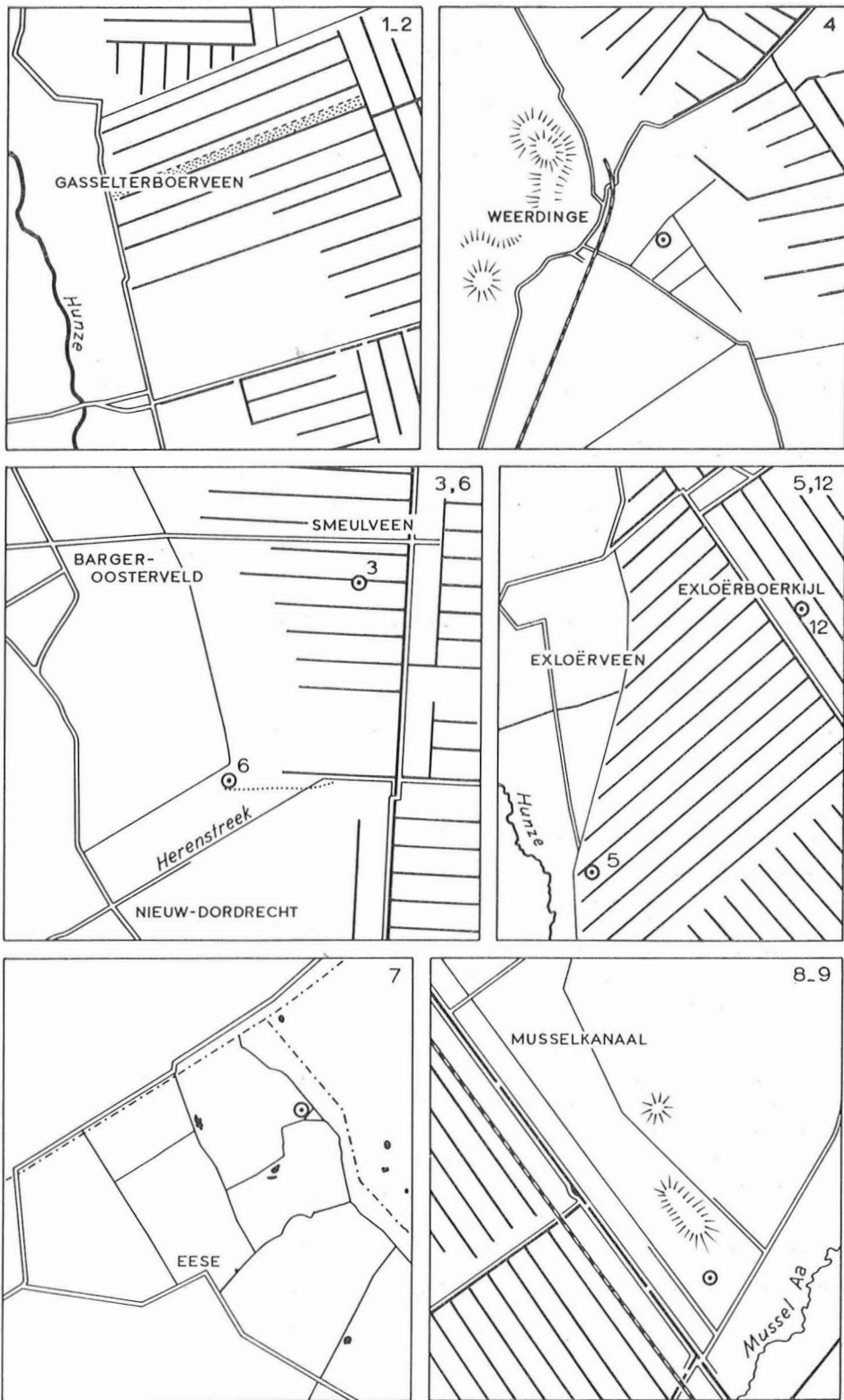


Fig. 27. Detailed maps of find spots of Neolithic disc wheels (scale 1:50.000).
The dotted line near nr.6 indicates the position of the trackway of Nieuw-Dordrecht.

documentation: *Staatscourant* (= Official Gazette) 1838, 21 July, no. 171; *Provinciale Groninger Courant*, 1838, 17 July, no. 57; L. J. F. Janssen, *Drentsche Oudheden*, Utrecht 1848, pp. 94–97; W. Pleyte, *Nederlandsche Oudheden, Drenthe*, Leiden 1882, p. 41.

collection: Assen 1844/1.3.

3. SMEULVEEN, GEM. EMMEN (fig. 23, Pl. XXX).

site and circumstances: Found in June, 1923, by the peat-cutters Piet de Jong and Egbert Snijder in the peat at *veenplaats* 51 of the Smeulveen, close to the canal forming the northern limit of the *veenplaats*, at a distance of about 350 m. from the centre of the Scholtenskanaal, in the 'black peat' (presumably the dark coloured highly humified Older Sphagnum peat) at a depth of about 2 m below the then surface of the uncut peat.

description: Disc wheel, apparently well preserved (due to its treatment with tar not long after the finding, the tar possibly concealing a number of invisible cracks) and little distorted. Drawing and photograph represent its condition in 1962. Disc almost flat; projecting nave, cylindrical, of sub-rectangular cross-section, well preserved on both faces; axle-hole hourglass shaped; tread broad, flat and square at the end of the grain, more narrow and rounded at the edges parallel with the grain.

dimensions (in the 1962 condition): diam. 0.73–0.78 m; thickness of disc 0.05–0.075 m; nave projection 0.05 m; width of tread 0.03–0.04 m.

documentation: label with the wheel.

collection: Groningen, N.V. Veenderij- en Turfstrooiselfabriek 'Klazienaveen' v.h. W.A. Scholten.

4. WEERDINGE, GEM. EMMEN (fig. 23, Pl. XXX).

site and circumstances: Found (May, 1927) by H. Hendriks, Emmen, in the course of peat-cutting, at a distance of 200–300 m from the W. edge of the peat on the slope of the Hondsrug, near the Pottenstreek near Weerdinge, (according to J. Hendriks) at a depth of c. 1.50 m under the then surface of the peat, in the lowermost spit, almost on the sand.

description: Disc wheel, quite well preserved and only little distorted (due to its treatment with joiners' glue water shortly after the finding?), broken into halves with marginal damage due to the peat-cutting. Description, drawing and photograph represent its condition in 1962. Heavy disc, slightly thicker towards the centre; heavy and outwardly conically shaped projecting nave, well preserved on one face, partly broken off (its base only subsisting) on the other. Axle hole purely cylindrical and smooth; tread slightly more square and broad at the end of the grain. The wheel gives the impression of having been quite fresh at the time of its deposition in the peat.

dimensions in present condition (between brackets: shortly after the finding according to the museum register): diam. 0.60–0.695 m (0.670–0.690 m); thickness of disc 0.04–0.07 m (0.030–0.060 m); diam. axle hole 0.07 m; projection nave 0.075 m; width of tread 0.03–0.04 m.

documentation: entry in the museum register; letters of G. J. Overbeek, then assistant in the Assen Museum, to Prof. Dr. A. E. van Giffen (19 and 24–V–1927); oral communication from J. Hendriks, Emmen (younger brother of H. Hendriks †), who was also present when the wheel was found, to G. de Leeuw and J. D. van der Waals (6–XII–1962).

collection: Assen, 1927/V. 4.

5. EXLOËRVEEN, GEM. ODOORN (fig. 23, Pl. XXX).

site and circumstances: Found (summer 1928 or 1929) by the peat-cutters Chr. Baas and the brothers J., H. and R. Oosting in the peat at *veenplaats* 9 of the Exloërveen, at distances of about 250–300 m E. of the Drift and about 30 m S. of the northern boundary and 55 m N. of the southern border of the *veenplaats*, at a depth of about 1.50 m below the then surface, in the *darg* (= fen peat) underneath about 0.75 m *turf* (= highly humified Older Sphagnum peat) and 0.75 m *grauw veen* (= fresh Younger Sphagnum peat). When found, a piece of wood was still in the axle hole; but this was burnt up in the peat-cutting steam engine. In *veenplaats* 8, adjoining *veenplaats* 9 to the S., a wooden trackway, running more or less parallel to the *veenplaatsen*, was partly uncovered year by year by the peat-cutters. About the age and construction of this trackway, nothing is known. In *veenplaats* 7, the side rail of a waggon (length c. 4 m) was found.

subsequent history: The wheel was acquired from the peat-cutters by Mr. J. Broeker (then doctor of the district), who presented it to the B.A.I. and who witnessed the wheel being immersed in a basin in the Institute. Upon enquiry in the Institute early in 1962, nothing was known of this wheel. Two unlabelled fragments (of which only one with certainty represents part of a disc wheel of our type; see below), were recovered on this occasion in the cellars of the Institute, one of the two possibly represent what survives of this find. Nothing is known about the origin of the other fragment.

description: That the Exloërveen disc wheel actually was a disc wheel of the type under consideration was confirmed by Mr. Broeker, who, upon receiving a photograph and description of the de Eese wheel (no. 7), wrote that the latter, 'because of its resemblance to the Exloërveen wheel, could have belonged to the same vehicle'. This similarity has also been stressed by the peat-cutters Chr. Baas and J. Oosting. The two unlabelled fragments, recovered in the Institute in 1962, cannot have belonged to the same disc wheel, owing to their considerable difference in thickness. These fragments are:

A. poorly preserved fragment, probably representing the middle section with part of a protruding nave on one side of a disc wheel of our type. Of the tread, nothing survives. If the fragment had belonged to a tripartite disc wheel, crosswise grooves should have been present;

B. approximately half a disc wheel, undoubtedly of the type under consideration, the other half of which must have been broken off recently, judging by the fresh appearance and colour of the fracture. Surface of one face in poor condition owing to the uncontrolled drying (description, dimensions, drawing and photograph represent the present condition). Heavy disc, notably thicker towards the centre. The corresponding parts of the projecting nave preserved to full height on one face, only the very base surviving on the other face. Tread, quite well preserved at the edge parallel to the grain, flat, apparently but little worn, rounded only towards one face. The wheel could have been in quite fresh condition when deposited in the peat.

dimensions: A. length 0.570 m; thickness disc 0.04 m; (part of?) nave projection 0.04 m; B. diameter of the wheel c. 0.70–0.72 m; thickness of disc at the base of the nave 0.088 m, near the edge 0.055 m; nave projection 0.08 m; width of tread c. 0.035–0.04 m.

dating evidence: C 14-date (of no. 5B; GRN 4155) 3940 ± 60 B.P., *i.e.* 1990 ± 60 B.C.

documentation: Letter of Mr. S. J. Snijder, Emmen, to Prof. Dr. H. T. Waterbolk (B.A.I., 19–XII–1960); letter of Mr. J. Broeker, Arnhem to J. D. van der Waals (B.A.I., 18–I–1961); oral communications (28–V–1962 and 27–XI–1962) from Chr. Baas, J. Oosting and K. Jonker (peat-cutters and concessionaire of *veenplaats* 9 in 1928–1929) and from G. Barelds (peat-cutter in the *veenplaatsen* 7 and 8) to Mr. G. de Leeuw, assistant in the Assen Museum.

collection: The fragments mentioned have been transferred to the Assen Museum, 1962/XI 1–2.

6. NIEUW-DORDRECHT, GEM. EMMEN (fig. 23, Pl. XXVII).

site and circumstances: The wheel was found (end of Sept., 1955) by peat-cutters, immediately preceding the excavation of part of the wooden trackway of Nieuw-Dordrecht by Dr. W. van Zeist. The findspot was c. 5–10 m N. of the trackway, near the starting point of the latter on the slope of the Hondsrug, and at about the same level in the peat as the trackway. Only one of the outer fragments of the wheel was still in situ when Dr. Van Zeist visited the site—the other fragments had been thrown away by the peat-cutters. Only after careful examination of the dug-away peat could the other fragments (except central part) be recovered. It is unfortunately impossible to make sure whether the wheel had been broken in antiquity or only recently. Dr. Van Zeist is inclined to believe the former, as the fractures were slightly battered at the edges. It can now safely be assumed that the trackway simply ended in the peat, without any apparant goal. Its total length would have been c. 1 km. It was too long for its only function to have been the bridging of the wet border zone of the bog. It has been twice excavated: in 1955 (Van Zeist, 1956) and in 1960 (unpublished). On both occasions a beautifully worked, almost undamaged wooden implement was found directly under the wood of the trackway; in 1955 the hue shaft of a stone adze (p. 114, fig. 24; Van Zeist 1956; 1957), and in 1960 a long clublike object, not unlike a thin hockey stick (unpublished).

description (in present slightly shrunken condition, after drying in a vacuum chamber in frozen condition. The drawing represents the same condition, but the photograph, Pl. XXVII, represents its condition before drying): Three reasonably well preserved sections of a comparatively small disc-wheel, the central section of which (with almost the entire axle hole, diam. c. 0.06 m) is missing, cut out of a plank of gradually diminishing thickness, containing a knot. A comparatively low projecting nave is preserved on one face only; at the corresponding place on the other face a very shallow depression in the surface of the disc possibly indicates the place where once the projecting nave was broken off. Tread broad, flat and square at the end of the grain, more narrow and rounded at the best preserved of the edges parallel with the grain.

dimensions in present condition (between brackets before the drying): diam. in the direction of the grain 0.610–diam. perpendicular to the grain 0.610 m (0.645 m); thickness of the disc 0.33–0.52 m.

dating evidence: C₁₄-date of the wooden trackway nearby (GRN 1087) 4080 ± 55 B.P.; for this and the palynological evidence, pointing to the period of the PF Beaker people, cf. the following paper (pp. 147–9). The fact that underlying the wood of the trackway the wooden shaft of a stone adze was found furnishes further evidence for the Neolithic dating of trackway and wheel, cf. pp. 114–6. A second C₁₄ date of the wooden trackway (GRN 2986) gave 4100 ± 55 B.P., *i.e.* 2150 ± 55 B.C.; average of the two dates: 2140 ± 40 B.C.

documentation: W. van Zeist, *De veenbrug van Nieuw-Dordrecht, N.D.V.* 1956, p. 317, afb. 3; *Twee neolithische veenvondsten te Nieuw-Dordrecht, N.D.V.* 1957, pp. 12–13, Pl. VI; H. T. Waterbolk, *De prehistorie van Nederland in absolute getallen, Honderd Eeuwen Nederland*, = *Antiquity and Survival* II, 5–6, 1959, p. 12, fig. 9; Photo in S. J. de Laet & W. Glasbergen, *De voorgeschiedenis der Lage Landen*, Groningen 1959, Pl. 14, top. Oral information by Dr. W. van Zeist and Mr. W. A. Casparie.

collection: Assen, 1955/X 1a.

7. DE EESE, GEM. STEENWIJKERWOLD (fig. 23, Pl. XXVIII).

site and circumstances: Found (end of July, 1960) in the peat of a natural pool on the heath belonging to the estate de Eese, ca 350 m W. of boundary post 4 of the provincial boundary

between the provinces of Overijssel and Drenthe, on occasion of the conversion of the pool into a swimming pool. The wheel was lying on the sandy subsoil, which, in view of the palynological interpretation of the peat, implies that a hole had been dug in the peat for its deposition (cf. the following paper, p. 149).

description: undamaged and little or never used disc wheel of considerable dimensions (which, alas, suffered badly in the course of the drying process, notwithstanding continuous treatment with methylcellulose. Description, photographs and drawing refer to the wheel in its original state). Disc almost flat; projecting nave, cylindrical, preserved on both faces; axle hole slightly conical; tread, of about equal width all round, flat and square.

dimensions (before transformation due to the drying): diam. 0.91–0.92 m; thickness disc 0.07–0.09 m; nave projection 0.07–0.08 m; diam. nave at the base 0.22 m; diam. axle hole 0.075–0.085 m.

dating evidence: C 14-date (GRN 2368) 4025 ± 75 B.P.

documentation: oral communication to the writer from A. Meijer and Dr. W. van Zeist (B.A.I.), who visited the site shortly after the finding on 28-VII-1960, after a telephone call by Mr. G. de Vries, superintendent of the de Eese estate; H. T. Waterbolk, *Nieuwsbulletin K.N.O.B.* 6e Ser. XIII, 1960, column 247.

collection: Leiden, Rijksmuseum van Oudheden, d 1961/12. 1.

8–9. DERTIENHUIZEN (MUSSELKANAAL), GEM. ONSTWEDDE (fig. 23, Pl. XXIX).

site and circumstances: no. 8 was found (7-X-1960) by workmen digging foundation trenches for new houses in the quarter Dertienhuizen of the village of Musselkanaal, in the foundation trench of the house Begoneastraat 35. The wheel was recovered by one of the workmen, H. J. J. ter Veen of Ter Apel, who through the kind offices of the Ter Apel police gave notice to the B.A.I. Whether it was already broken before the finding is unknown. No 9 was found (10-X-1960) directly beneath the place where no. 8 was found, upon inspection of the findspot by G. Delger, A. Meijer and J. D. van der Waals (B.A.I.). Part of the wheel had already been cut away, and the remainder, though still in situ, was broken. Whether this was an ancient or a recent fracture is difficult to say. For the stratigraphical position of the wheels in the peat, cf. Pl. XXXVII, following paper. The wheels were lying in a peat layer with many natural fragments of wood. Next to the wheels, however, a vertical pole of oakwood, which had been worked to an angular cross-section (diam. c. 0.20–0.25 m), was found standing in the peat. This pole could not be extracted from the peat, for fear of damaging the newly laid foundation of the houses under construction. On top of the uppermost wheel an oak tree was lying, branches and all. The wheels were found near the NW edge of a SW–NE gully in between the *horsten* (= isolated coversand ridges in the raised bog). The wheels could thus have been thrown into the gully from the edge.

description (description, drawing and photographs represent the wheels before the drying process, which distorted them severely, despite continuous treatment with methylcellulose (no. 8)). Three pieces, representing the major part of a disc wheel. Disc only slightly thicker near the centre; projecting nave comparatively short, preserved completely on one face, on the other face only represented by a small remnant to prove its original presence; axle hole cylindrical; (no. 9) Two pieces representing c. $\frac{1}{3}$ of a disc wheel (plus two additional pieces which may belong to the same wheel). Disc slightly thicker near the centre; projecting nave comparatively short, preserved on one face, partly broken off on the other face; axle hole cylindrical.

dimensions (before drying): no. 8, diam. 0.67–0.685 m; thickness nave 0.04–0.06 m; diam. nave at the base 0.21 m; diam. axle hole 0.065 m; nave projection 0.065 m. No. 9, diam. about 0.67–0.70 m; thickness disc 0.05–0.075 m; diam. nave at the base 0.20 m; diam. axle hole 0.06 m.

dating evidence: C¹⁴-dates (no. 8, GRN 2878) 4015 ± 65 B.P.; (no. 9, GRN 2879) 4070 ± 70 B.P.; for these dates and for the palynological evidence, pointing to the period in which the PF Beaker people were present, cf. the following paper (pp. 150–1).

documentation: reports of the visits to the find spot by W.A. Casparie, M.R. Walvius and J. D. van der Waals (B.A.I.; 10 and 12–X–1960); J. D. van der Waals, *Nieuwsbulletin K.N.O.B.* 6e Ser. XIII, 1960, column 247; *Verslag van de toestand van het Groninger Museum voor Stad en Lande* voor het jaar 1960, pp. 14–15.

collection: Groningen, (no. 8) 1960/X 1a; (no. 9) 1960/X 1b.

10–11. MIDLAREN, GEM. ZUIDLAREN (fig. 28, Pl. XXVII).

site and circumstances: Found in November, 1962, in the peat of the *Bolleveen*, a small and deep depression on the *Hondsrug* (the main, sand-covered boulder clay ridge running about SSE–NNW from Emmen to the town of Groningen), north of the hamlet of Midlaren. Two wheels were brought to the surface by a mechanical excavator, digging a pit in the peat to create a water reservoir on behalf of the nearby skating-rink of Midlaren. Hence, nothing definite is known as to the precise stratigraphical position of the find. It is, however, known that c. 30 years ago 2 m of peat was dug away over practically the whole surface of the *Bolleveen*, so that the wheels must have been lying at a depth of at least 2 m below the surface of c. 1930. The wheels were rescued from a heap of rubbish wood that had been extracted from the peat by the machine as being remarkable objects by the farmer M. de Swart of Midlaren, and were taken by him to his farm house. Only upon a visit to the Provincial Museum of Drenthe at Assen in July, 1963 did Mr. de Swart realize their real significance; a message was then sent to the museum. By then, only one of the wheels survived undamaged.

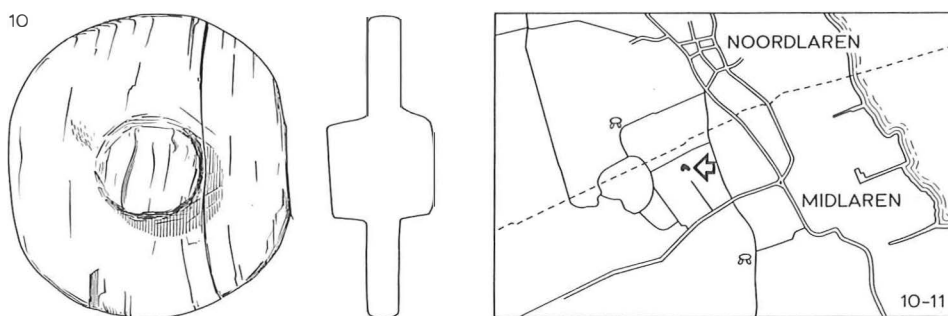


Fig. 28. One of the unfinished Neolithic one-piece disc wheels from Midlaren (cat. A: 10), scale 1:14, and the find spot of the Midlaren wheels.

In the immediate vicinity, on a cover sand hillock directly west of the *Bolleveen*, traces of a settlement were destroyed, unnoticed by science, in the course of sand digging a few years earlier. On the basis of sherds, preserved by Mr. de Swart, this settlement can be ascribed to an early phase of the Funnel Beaker Culture (TRB; the phase of the vertical band decoration with ladder motives, cf. Kaelas, 1955, pp. 57, 59). In view of the results of pollen analysis and C 14 measurement it is, however, highly unlikely that the wheels are to be brought into connection with this TRB settlement.

description (referring to the wheels in their condition in July, after half a year of sojourn in the open air near the farm house. This exposure, however, affected at least wheel no. 10 remarkably little; wheel no. 11 had, by then, been consumed in the stove, except for its central part) No. 10: small wheel, unfinished, of alder (determination by Miss A. M. van Helsing, B.A.I.), which in all other respects conforms to the general type. Wheel of moderate size, split recently into two parts, but still in reasonable condition, cut from an eccentric tangential part of the tree trunk, with parts of the bark still adhering in a cleft in one of the hubs. The wood displays irregularities, due to heavy knots, especially in the external hub. Flat disc, not thicker towards the centre. The cylindrical nave projections are well preserved on both sides. The wheel is unfinished, there being no axle hole. Tread and nave hubs are angular, and look freshly hewn; No. 11: wheel, of which only the central part with the nave survives, but which according to the de Swart family, was originally of the same size and aspect as the wheel no. 10. The shapelessness of the surviving fragment hardly allows for the verification of this similarity.

dimensions: (no. 10) diam. 0.54–0.56 m; thickness of disc up to 0.065 m; nave projection up to c. 0.07 m; width of tread c. 0.06 m.

dating evidence: C 14-date (GRN 4154) 4000 ± 70 B.P.; 2050 ± 70 B.C., referring to a sample taken from the most eccentric wood, close to the bark, of wheel no. 11. This date, and also the palynological evidence from peat still adhering in a cleft of wheel no. 10 (cf. the following paper, pp. 151–3), points to the period of the PF Beaker people.

documentation: oral information from M. de Swart and his father B. de Swart to Miss A. T. Clason, J. D. van der Waals, and H. T. Waterbolk (25–VII and 6–VIII 1963).

collection: Assen, 1963/X 1–2.

12. EXLOERBOERKIJL, GEM. ODOORN.

site and circumstances: Found c. 1910 in the peat of *veenplaats* 77 of the Zuider Boerplaatsen near Exloërboerkijl, at a distance of c. 800 to 1000 m from Tweede Exloërmond. The wheel was lying almost on the sand of a local sandridge under the peat, at a depth of only 1.50 to 1.75 m below the then surface of the peat. The wheel was left to decay on the spot without becoming known to science.

description: The wheel was described by Mr. O. Hulshof as an one-piece disc (of which one small segment had been broken off along the grain) with a diameter of c. 0.80 m and a central opening of c. 0.05 to 0.10 m; it was probably made of oak. Mr. Hulshof could remember nothing as to the presence of a fixed or inset projecting nave. Notwithstanding this, we think it possible that this wheel was an one-piece Neolithic disc wheel. The fact that the central opening is described as having been quite small seems to preclude the possibility of a one-piece solid disc wheel with separate inset nave, like *e.g.* the wheel from Beckdorf, Kreis Stade (Cassau, 1938).

documentation: oral information by Mr. O. Hulshof of 2e Exloërmond, who, at the time of the finding of the wheel, was working nearby on the same *veenplaats*, and who was interested in the find (22-VII-1963 to J. D. van der Waals and 16-IX-1963 to G. de Leeuw, following information given by his son, a student in Amsterdam, to Mrs. M. R. van der Spoel-Walvius).

B. LATER BI- AND TRIPARTITE DISC WHEELS FROM THE RAISED BOGS

1. VALTHE, GEM. ODOORN (Pl. XXXII).

site and circumstances: A bi-partite disc wheel (since lost) was found in May, 1845, by a farmer named Hebers in the 'Langehiets Landen', situated in the border zone of the raised bog, c. 1.5 km E. of Valthe. The wheel turned up when Hebers was ploughing a field situated on top of the peat, which had already been dug away in part (*in een deels afgeveenden en beploegden akker*, Janssen, 1848, p. 91), at a depth of 0.75 *el* under the surface (= c. 0.50 m; whether the then surface or the original peat surface is meant is uncertain). In the same field the Leiden antiquarian L. J. F. Janssen discovered shortly afterwards a W.-E. row of pointed rectangular stakes standing in the peat extending for a distance of about 80 m (120 *el*). Some were standing in twos next to each other at a mutual distance of c. 0.35 m (0.5 *el*). It was at a distance of hardly 0.70 m (1 *el*) from one of these stakes that the wheel had been found. Janssen thought of a possible connection of the stakes with the well known Valtherbrug which, for various reasons, is unlikely (Van Zeist, 1958, p. 40). But the stakes can have been remnants of a different trackway, possibly of the type found at Weerdingerhout and Emmererscheidenveen (Van Zeist, 1958, pp. 39-41).

description: Bi-partite solid disc wheel of oak, which has not been preserved and is only known to us from the description and a drawing made by Janssen. The two halves were held together by two transverse laths in dovetailed grooves, in the same manner as with the tripartite wheels (cf. general description, pp. 121-2). Apart from these laths, no pegs or peg-holes are mentioned. The absence of nails is stressed. A separate tubular nave was fitted tightly in the centre.

dimensions (metric equivalents to the size units used by Janssen are probably: 1 *el* = 0.688 m; 1 *duim* = 0.025 m; cf. Pl. XXXII): diameter c. 0.65 m; thickness c. 0.03-0.035 m; width of nave externally c. 0.10 m (?); length of nave c. 0.30 m.

documentation: L. J. F. Janssen, 1848, pp. 91-92; manuscript with drawing, now in the University Library at Leiden, no. B.P.L. 944 III/V-Z (cf. Pl. XXXII).

2. WEERDINGERVEEN, GEM. EMMEN (fig. 29).

site and circumstances: A tripartite disc wheel with lunate openings was found in May, 1913, by the peat-cutters of the concessionaire A. Smook Azn. of Nieuw-Weerdinge in the peat of *veenplaats* 35, blok 7, of the Weerdingerveen, at a depth of 0.60 m below the then surface, in a concentration of tree remains (which can be accounted for by the fact that the findspot is not far from an old stream in the peat, the Mussel A). At the same place and level, a standing row of pointed stakes (length c. 0.40 m, diam. c. 0.09 m) was observed in the peat, and a plank was found (thickness c. 0.03 m, breadth 0.15 m) which had a hole coarsely hewn in one of the ends. The stakes and plank might suggest the presence of a wooden footpath of the type known from Weerdingerhout and from Emmererscheidenveen, both Gem. Emmen (Van Zeist, 1958, pp. 39-40). The findspot is said to be at a distance of about 100 m from the place where, in June 1940, two bog bodies were uncovered, which

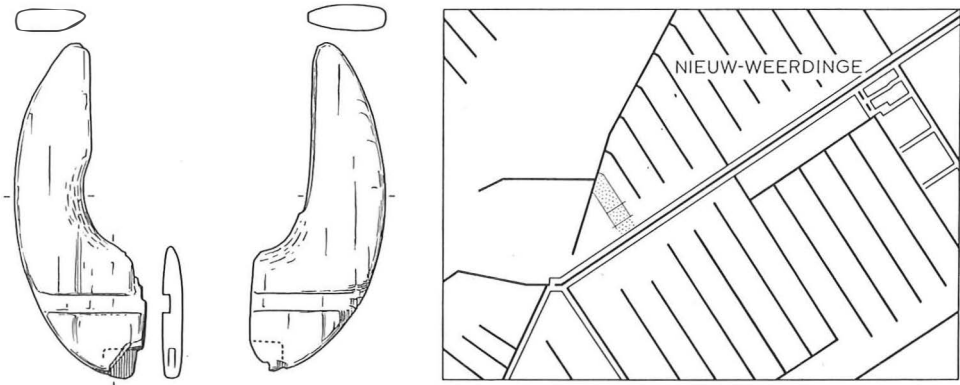


Fig. 29. The fragmentary tripartite disc wheel from Weerdinge (cat. B: 2), scale 1:14, and its find spot.

on palynological grounds could be dated to the period between c. 200–500 A.D. (Van Zeist, 1956, pp. 201–203).

description: Two fragmentary lateral segments of a tripartite disc wheel of oak with lunate openings of the Ezinge type (cf. the general description, pp. 121–2), but without rectangular perforations at the sides of the transverse grooves. (Traces of) both transverse dovetailed grooves and two pegholes survive. The fragments suggest an oval wheel in consequence of irregular shrinking in the course of drying.

dimensions: diam. of the wheel c. 0.70 m; thickness 0.04–0.05 m.

dating evidence: On palynological grounds a dating is suggested about the beginning of our era, and certainly before 200 A.D. (cf. the following paper by Mrs. Van der Spoel, p. 154).

documentation: Letter of Mr. A. Smook Azn., Nieuw-Weerdinge, to the Assen Museum (22-V-1913).

collection: Assen, 1913/V 2, 2a.

C. IRON AGE TRIPARTITE DISC WHEELS FROM EZINGE

For information on the *terp* of Ezinge and for the general description of the wheels, cf. pp. 121–2.

Indications of find spots and levels are according to the system used in the definite publication of the Ezinge excavations in preparation, and referred to as *Atlas*.

1. (fig. 25, Pl. XXXIV).

find spot and circumstances: The fragment was found within a house (1926 campaign, Van Giffen, 1928, fig. 11: X, compartment E/F-16; that is in compartment F¹-9, in between levels M and N, according to the *Atlas*), which can be attributed to period IV (Van Giffen, 1936).

description: Major part of the lateral fragment of a tripartite disc wheel with lunate openings. Thin disc, (recently?) warped considerably. Parts of both grooves for transverse laths and the narrowest part of one peghole survive. There were no rectangular perforations on either side of the transverse grooves. According to the photographs, the fragment was found broken. One piece broke off over the peghole.

dimensions (1962 condition): diam. of the wheel c. 0.85 m; thickness of fragment 0.032–0.044 m.

dating evidence: Period IV, earlier Imperial Roman period, 1st.–2nd. cent. A.D.

documentation: The fragment was unlabelled and there was no entry in the excavation records, but it could be identified beyond doubt with the help of the field drawing and the photographs (1926, nos. 114, 117); cf. also Van Giffen, 1928, fig. 11; X, compartment E/F–16. It has now been registered under no. 189a, 189 representing the nearest by find number of the same level.

collection: Groningen.

2–2a. (fig. 25; Pl. XXXIII–XXXIV).

find spot and circumstances: According to the field drawing and a photograph, two lateral segments and, in all probability, (parts of) a central section of tripartite disc wheels were found in the 1932 campaign lying next to and upon each other, together with other pieces of worked wood, in the central bay of the southernmost farmhouse of the nuclear *terp*, period V (compartment F 13–10; at 1.10 m N.A.P.).

description: Two lateral segments belonging to one tripartite disc wheel (which could be identified with certainty as belonging to this find) and parts of the central section of the same or a second wheel (which probably also belongs to this find). According to the drawing of the fragments in their present condition (fig. 25), the central part appears to belong to a wheel of slightly greater size, but this could also be due to differential shrinking of the fragments. Tripartite disc wheel(s) with small lunate openings. Remnant of a ring-shaped strengthening round the central hole for the nave on the outer face. Tread worn and rounded on the edges parallel to the grain (lateral segments), more flat and square on the edges at the end of the grain (central part). Of the six pairs of rectangular perforations on both sides of the transverse laths five pairs survive; on one of the lateral segments there is as much as 0.02 to 0.05 m distance between laths and perforations. In four of the perforations, plugs of rectangular cross-section survive which do not, however, protrude beyond the face of the wheel(s); whether they have been cut off level with the faces of the wheel(s) in antiquity or recently, in the course of the excavation, is uncertain. The plugs fit the perforations only in one direction, in the other direction, about twice the space is available. On one face of one of the lateral segments part of the transverse lath is still in place. None of the wooden pegs which keep the three parts together are preserved. In at least two places parts of the lateral segments have splintered off in antiquity thus exposing the pegholes (Pl. XXXIV).

dimensions: diam. of the wheels approximately 0.85–0.90 m; thickness 0.038–0.051 m.

dating evidence: period V of the *terp* of Ezinge.

documentation: drawings and register of the 1932 excavations; photograph 1932 no. 159 (Pl. XXXIII). The fragments were registered under no. 1178, but no description other than 'wooden wheel' was given.

collection: Groningen.

3-3a. (fig. 25).

find spot and circumstances: Two lateral segments of two disc wheels and the central part of one of these wheels were found (in the 1933 excavations) lying together, not far from the hearth of the farmhouse of the second phase of the first period, VI', underneath the *terp*, which represents the settlement in the open field before the first heightening took place (compartment F8-9/923; at 0.19-0.47 m + N.A.P.).

description: (3) Lateral segment of a tripartite disc wheel with lunate openings and two pairs of rectangular perforations on both sides of the dovetailed transverse grooves. One plug of sub-rectangular cross-section preserved. Tread rounded. When found, the segment was still in good condition with parts of the transverse laths (now missing) still in position. Only a chip between one of the rectangular perforations and one of the pegholes had been broken out (apparently in antiquity). (3a) Lateral segment and central part (now broken into eight pieces, but still substantially whole when found, with parts of the transverse laths (now missing) in position) of a tri-partite disc wheel with lunate openings and ring-shaped strengthening on the outer face around the central hole for the nave. Tread worn and rounded on all edges. No rectangular perforations on the sides of the markedly dovetailed transverse grooves. Extreme lateral edge broken off in antiquity. Of the four wooden pegs keeping the parts together, two are preserved, half filling the pegholes, broken in antiquity. Ancient fractures at three places which disclose the pegholes.

dimensions: (3) diam. of the wheel c. 0.92 m; thickness of fragment 0.038-0.042 m. (3a) Diam. of the wheel c. 0.92 m; thickness of the fragments 0.038-0.044 m, over the central ring 0.054 m.

dating evidence: Period VI'; Zeijen Culture, transitional period Hallstatt D-LaTène A (Waterbolk 1962).

documentation: Drawings and register of the 1933 excavations; photograph 1933 no. 255a-b. The fragments were registered under no. 1495 (3) and 1502-1503 (3a).

collection: Groningen.

4. (fig. 25, Pl. XXXIV).

site and circumstances: in all probability an Ezinge find, as the fragment was found lying with the other wooden objects from Ezinge. Label and identity of the fragment are lost. In the records of the Ezinge excavations (fragments of) 'wheels' that could not be identified among the wooden objects preserved are registered under nos. 845 (campaign 1932, period II, compartment H¹²-8¹⁷, at 2.35 + N.A.P.); 905 (campaign 1932, period II-III, compartment H²⁰-8²¹, at 0.90 + N.A.P.) and 1792 (campaign 1934, period VI, section Z 1b). These numbers could refer to spoked wheels, since nothing is recorded as to their shapes. Nevertheless, the fragment no. 4 could represent one of these finds.

description: Fragment of the lateral segment of an (in all probability) tripartite disc wheel with lunate openings. Smallest of all Ezinge wheels preserved. Part of the (worn and rounded) tread, part of a lunate opening, part of a dovetailed groove for (missing) transverse lath, and the halves of two rectangular openings on both sides of the grooves are preserved.

dimensions: diam. of the wheel approximately 0.70 m; thickness of fragment 0.044 m.

documentation: absent (see above).

collection: Groningen.

5. (fig. 25; Pl. XXXIV).

site and circumstances: cf. no. 4.

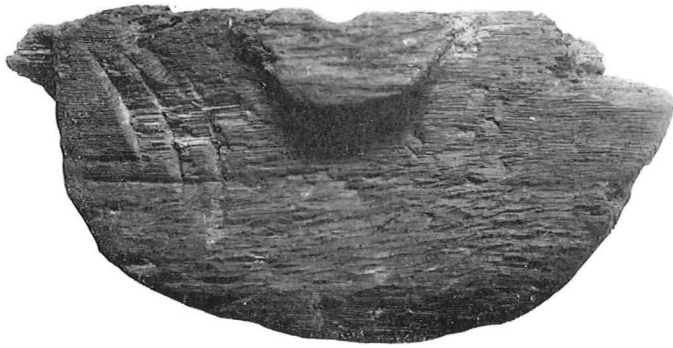
description: Partly burnt fragment of the lateral segment of a tripartite disc wheel (nothing of the lunate openings survives). One peghole and part of a transverse groove, which has been widened by the splitting-off of an adjoining piece of wood in antiquity, are preserved. There do not seem to have been rectangular perforations at the sides of the transverse grooves. Tread worn and rounded.

dimensions: diam. wheel approximately 0.90–1.00 m; thickness fragment 0.040–0.047 m.

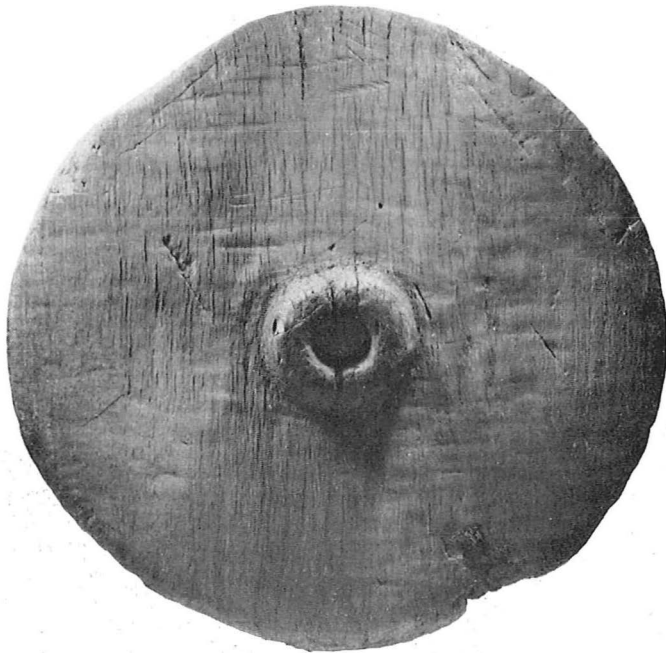
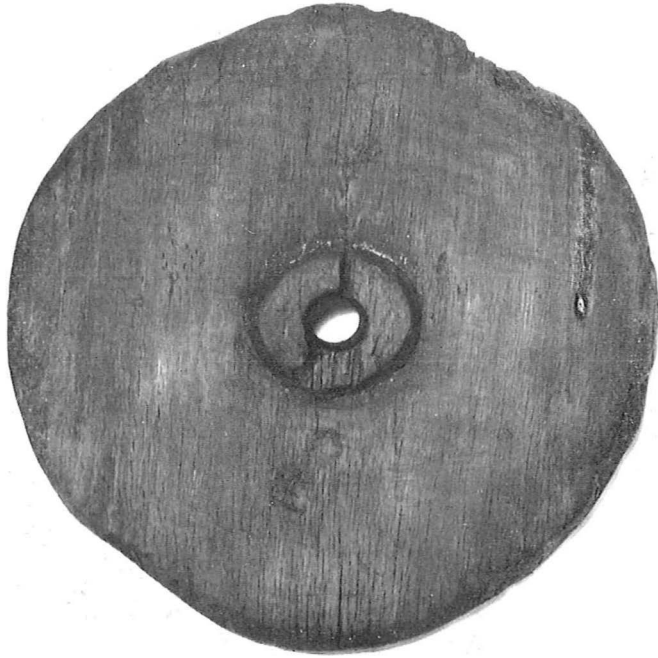
documentation: none.

collection: Groningen.

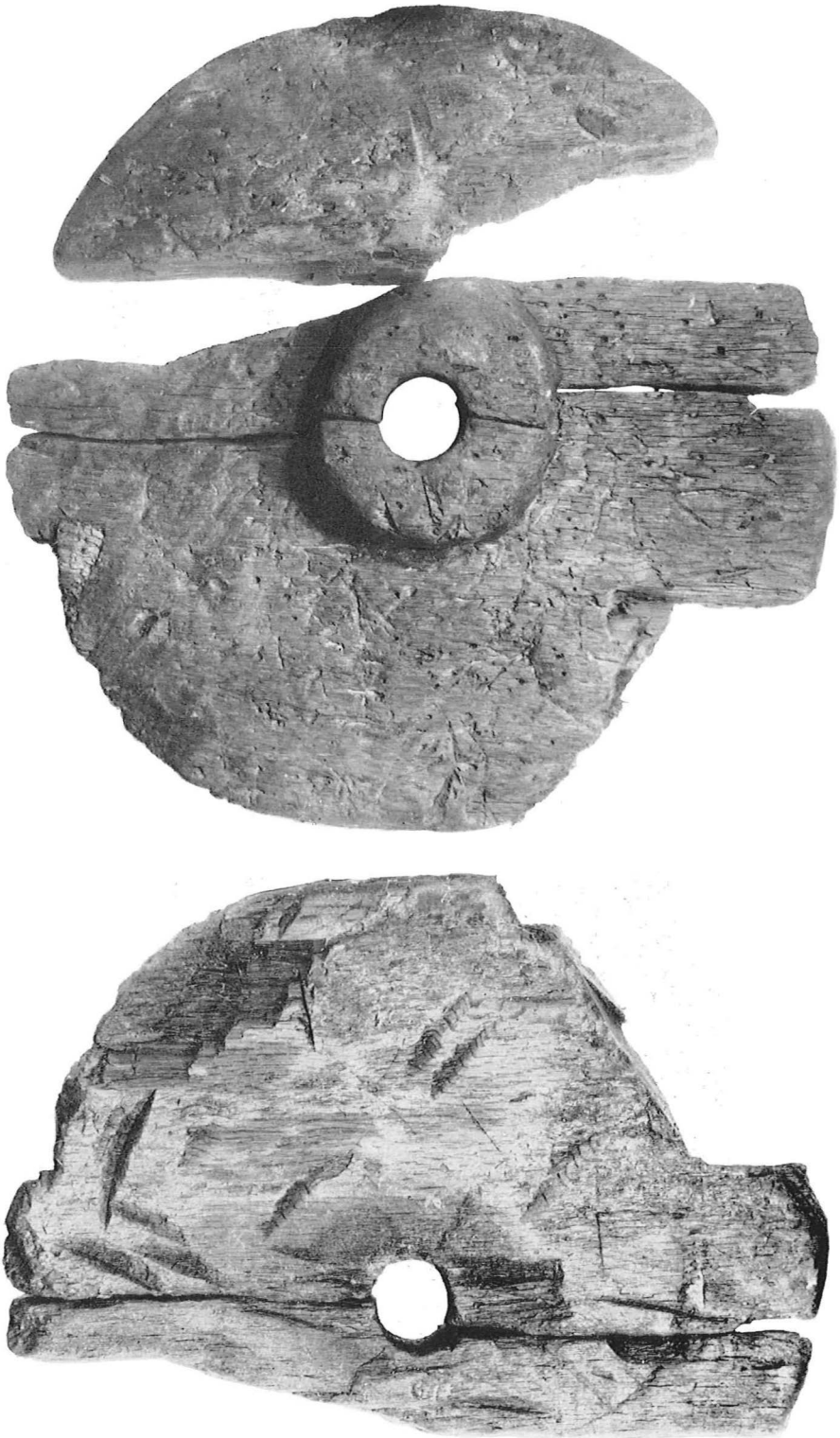
N.B. This paper will appear separately with a more extended description of the cultural setting of the Dutch disc wheel finds.



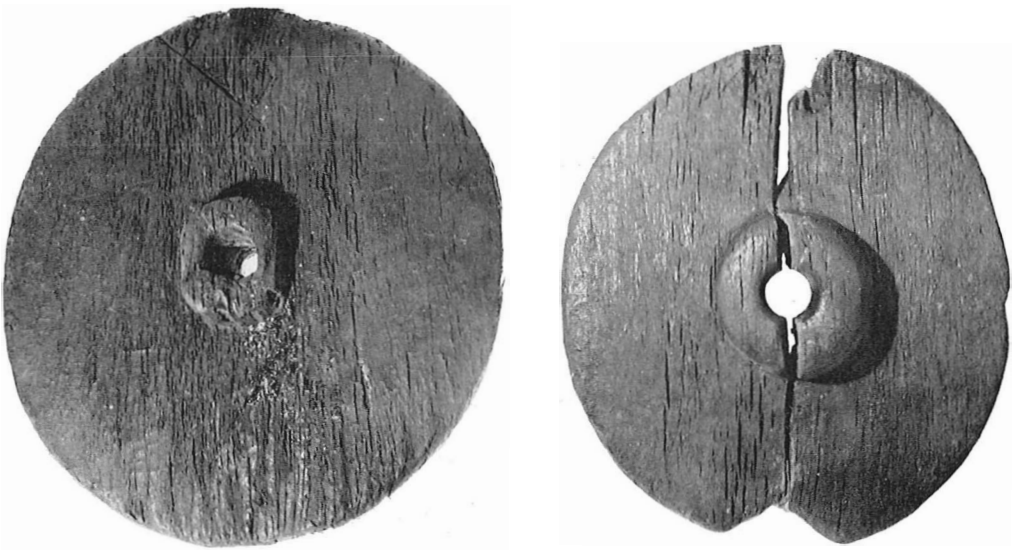
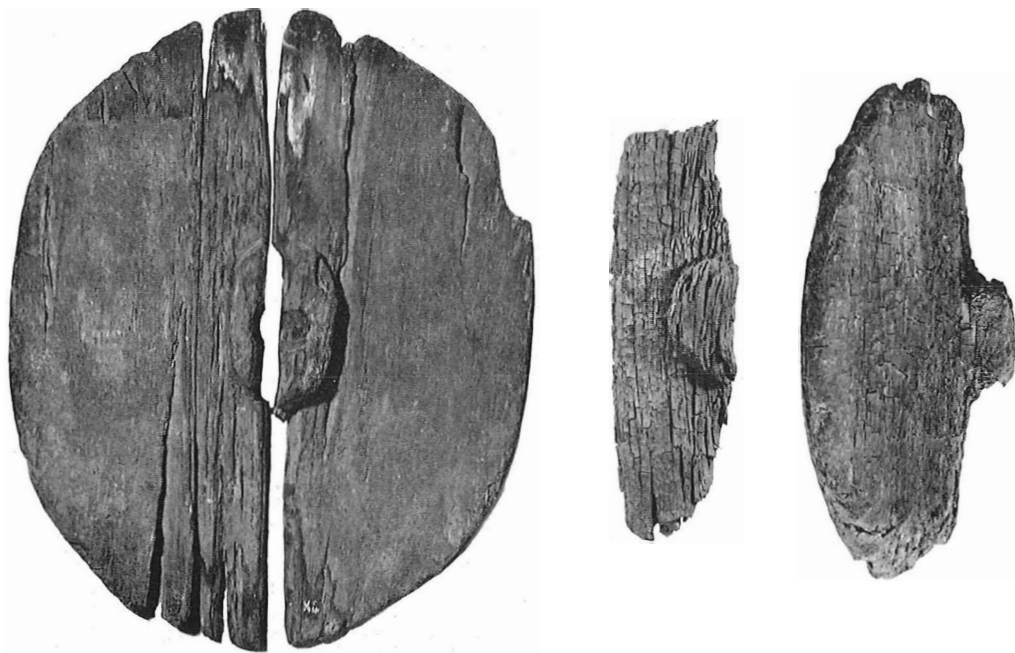
Neolithic disc wheels from Nieuw-Dordrecht and Midlaren (cat. A: 6, 10).



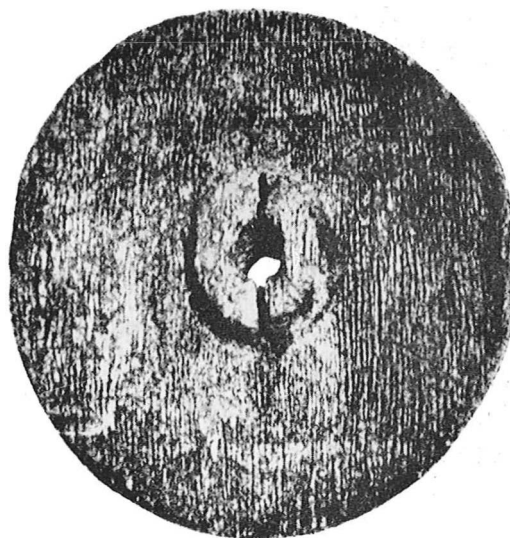
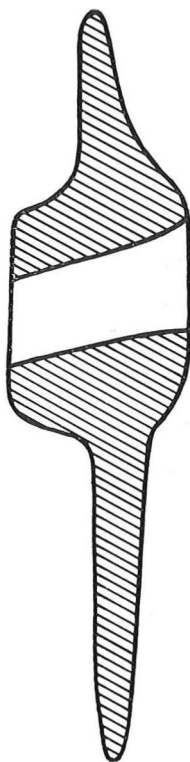
Neolithic disc wheel from De Eese (cat. A: 7).



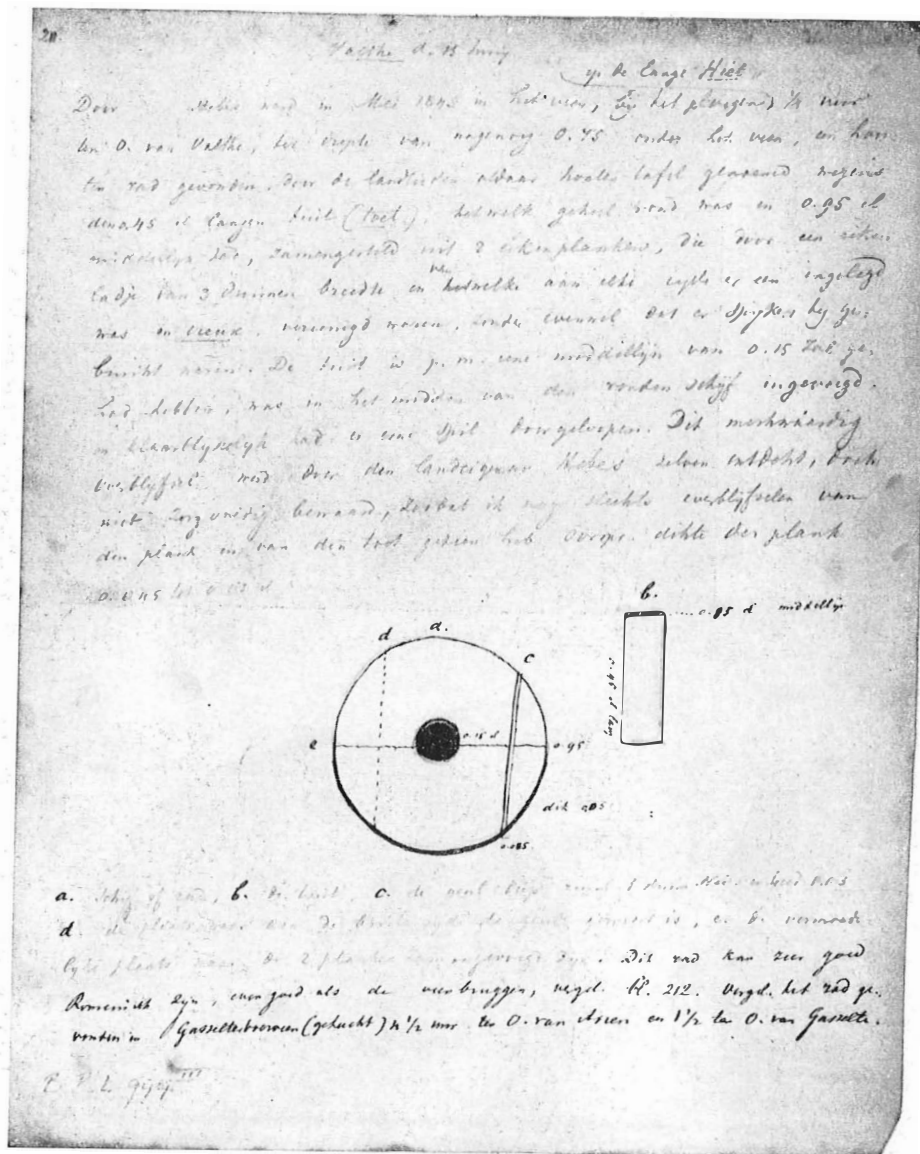
Neolithic disc wheel from Dertienhuizen (cat. A: 8).



Neolithic disc wheels or their fragments from Gasselterboerveen, Exloërveen, Smeulveen, and Weerdinge (cat. A: 1, 5A-B, 3, and 4).



Neolithic disc wheel from Storoževaja Mogila, kurgan no. 7 (top; after Terenožkin); disc wheel from Schönsee near Braunsberg/Braniewo (bottom; after Schneider).



Notes with sketch of 1845 concerning the bipartite disc wheel from Valthe (cat. B: 1) by L. J. F. Janssen (Leiden, University Library, B.P.L. 944 III).



Ezinge, 1932. Fragments of two Iron Age disc wheels (cat. C: 2a-b) *in situ* in the central bay of a farmhouse of period VI (youngest sub-phase).



Ezinge. Fragments of Iron Age tripartite disc wheels (cat. C: 2, reverse; 2; 4; 5; 1.