THE SUBMERGED PRE-DROUWEN TRB SETTLEMENT SITE WETSINGERMAAR, C. 3500 CAL. BC (PROVINCE OF GRONINGEN, THE NETHERLANDS)

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ABSTRACT: This article presents the results of an extensive coring programme and a test excavation at Wetsingermaar (province of Groningen, the Netherlands). The corings made clear that the archaeological site spans over 1.5 ha and is located on the waterfront of a submerged Pleistocene ridge. The test excavation yielded ceramics, flints and other stone material, and archaeozoological remains. On the basis of its cultural remains it is concluded that Wetsingermaar constitutes an early site of the Funnel Beaker Culture (*Trichterbecherkultur*, *TRB*), predating the Horizon 1 of Drouwen TRB as defined by Brindley (1988b). This early phase is termed pre-Drouwen TRB (*cf*. Bakker, 1979: 115). The flint industry is similar to younger TRB assemblages, while the ceramic and archaeozoological evidence is difficult to interpret as a result of the fragmentary condition of the finds and the near absence of contemporaneous sites.

KEYWORDS: Northern Europe, the Netherlands, Neolithic, Neolithisation, Wetsingermaar, Swifterbant culture, TRB culture, pre-Drouwen TRB

1. INTRODUCTION (Raemaekers)

If one considers the transition to farming as one of the classical research themes of prehistoric archaeology, the Neolithisation of the North European Plain and southern Scandinavia through the genesis and development of the Funnel Beaker Culture (*Trichterbecherkultur, TRB*) is one of its classical areas of research. The area of origin of the TRB culture is generally sought in the North European Plain, with northern Germany and Poland commonly regarded as the source area (*e.g.* Hartz & Lübke, 2006; Midgley, 1992: 47–51). Owing to a lack of well-dated large assemblages in the Netherlands for the period of 4000-3400 cal. BC, the Dutch potential contribution to the study of TRB origins has been unclear (Raemaekers, 2005).

This paper presents the evidence from a new site (Wetsingermaar) in the Netherlands which dates from c. 3500 cal BC, roughly a century before the 'official' start of the TRB culture in the Netherlands (*cf*. Lanting & Van der Plicht, 2002). On the basis of these new findings the role of the Dutch evidence in the genesis of the TRB is addressed. It has been unclear whether the sparse evidence we have from the period 4000-3400 cal. BC represents the Swifterbant culture in the centuries immediately before Horizon 1 of Drouwen TRB (*cf*. Lanting & Van der Plicht, 2002: 23) or a transitional phase between Swifterbant and TRB (*cf*. Ten Anscher *et al*., 1993; Ten Anscher, 2012: chapter 5), known as pre-Drouwen TRB (After: Bakker, 1979: 115–122).

The Wetsingermaar is a man-made canal running west of the villages of Sauwerd and Winsum in the province of Groningen, approximately 10 km north of the city of Groningen (fig. 1). In October 2000 a new pumping-station was built on the Wetsingermaar. H.-J. Streurman of the *Centrum voor Isotopen Onderzoek* (Centre for Isotope Research) of the University of Groningen collected charcoal, carbonized bones, sherds and flint from the side of the construction trench, at a depth of 2.5 m below the surface, *i.e.* 2.0 m below NAP (*Nieuw Amsterdams Peil*; Dutch Ordnance Datum). A piece of charcoal from the layer containing the artefacts provided a ^{14}C sample, which was dated to c. 3500 cal. BC (table 1). Because of the thick layer of Holocene marine sediments covering the remains, the site is not under threat. But for the construction of the pumping-station, the site would have remained undiscovered.

Raemaekers' overview of Late Swifterbant pottery (Raemaekers, 2005) prompted new interest in the site. The 2000 research indicated that the site dated from around the start of the TRB West Group in the northern part of the Netherlands, c. 3500 cal. BC or slightly later (Lanting & Van der Plicht, 2002: 67/68). The limited amount of remains at Wetsingermaar did not allow a definite cultural attribution: is it a Late Swifterbant and/or a TRB site? Because of the scarcity of settlement sites from both these periods and the location of the site far north of the dry mainland where the majority of the Dutch TRB sites are situated, additional fieldwork was necessary to assess the significance of the site. After the 2000 fieldwork, two issues remained unresolved. These were: 1. the

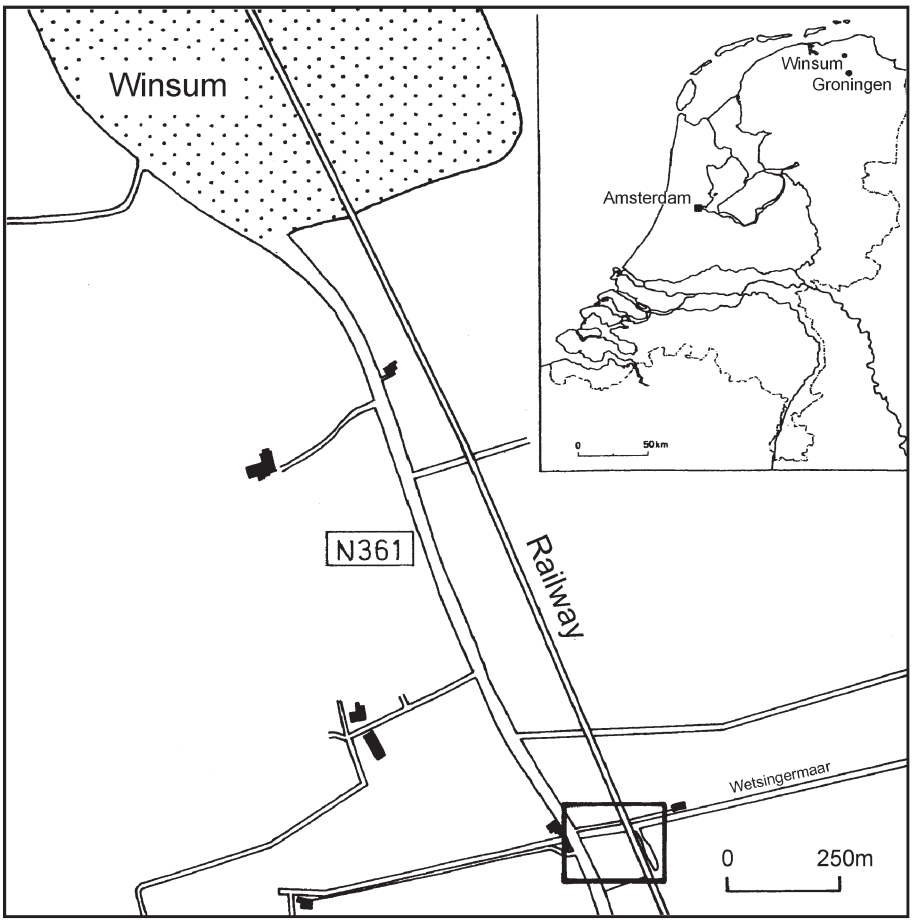

Fig. 1. Location of Wetsingermaar (Drawing J.H. Zwier, RUG/GIA).

Table 1. Available ^{14}C dates (After: Feiken, 2000).

Lab number	*Dated material*	*Date (BP)*
GrA-16659	Charcoal from section	4700 ± 40
GrN-26219	Peat	4480 ± 70
GrN-26218	Peat	4560 ± 60
GrN-26217	Peat	4710 ± 60
GrN-26216	Peat	4740 ± 50
GrN-26215	Peat	4850 ± 50
GrN-26214	Peat	4980 ± 70

extent of the site and its situation in the landscape; and 2. the age and cultural characteristics of the site. New fieldwork was carried out in 2005, which included extensive corings and a small-scale excavation. A final coring campaign was carried out in June 2011 to further investigate the geographical setting of the site.

2. THE 2000 INVESTIGATIONS (De Jong)

In November 2000 small-scale fieldwork was carried out by the Groningen Institute of Archaeology (GIA) of the University of Groningen. This fieldwork consisted of investigating the sections as exposed in the trench and a series of corings in the vicinity of the trench. In all corings the depth of the Pleistocene surface was recorded, to improve the existing Pleistocene depth model. A total of 27 corings were carried out – in two rows intersecting at a right angle (Feiken, 2000: 50/51). It was concluded that the site occupied the summit of a Pleistocene elevation. The decline from this height was very gradual; only to the southwest was the slope steeper. Core A1 (some 30 m south of the section) contained one flint artefact and some charcoal. Charcoal was also found in core A2, 5 m to the south. The finds came from the Pleistocene coversand. Core B25, taken east of the trench at a distance of approximately 300 m, contained a 35 cm thick peat layer. This peat layer was ^{14}C-dated (table 1). The samples were taken from core B25, where the peat layer was 41 cm thick. The resulting ^{14}C dates indicate that the peat layer is contemporaneous with the site; also pollen samples were extracted and analysed (unpublished).

In the section, burnt bone, flint artefacts and potsherds were found. The bone fragments were all small and difficult to determine (see section 3.6). The 33 potsherds were described as belonging to a single period assemblage, because there were no indications of multiple occupation periods at the site. The cultural attribution was difficult to establish because of the small size of the assemblage (see section 3.3). A total of 104 flint artefacts were recovered, 100 of them pieces of waste like blocks, flakes and

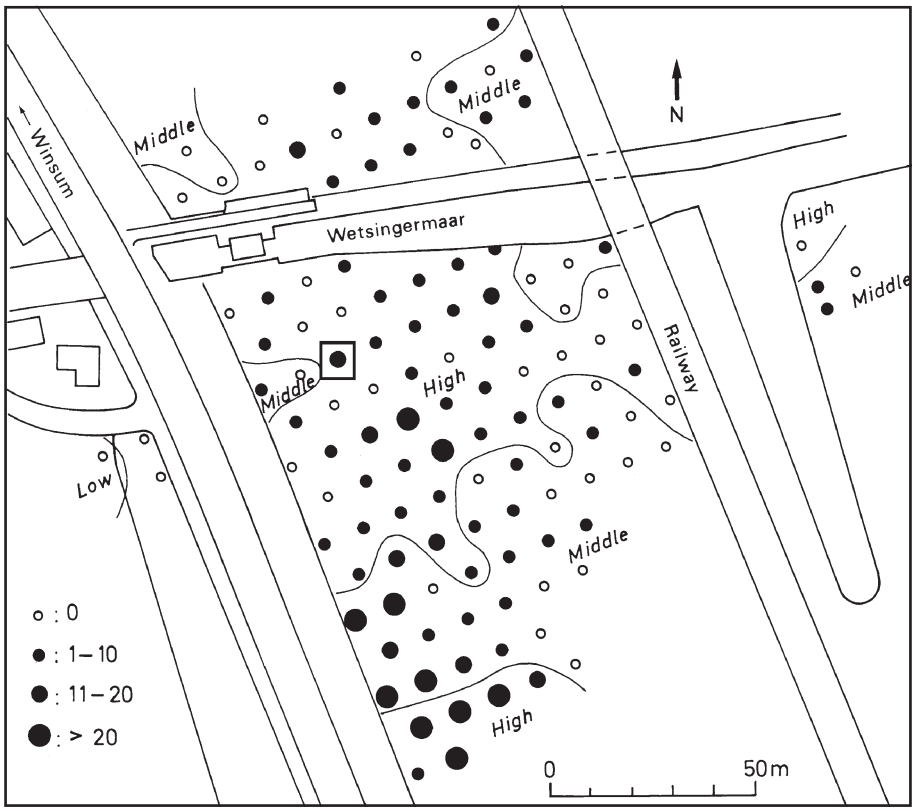

Fig. 2. General distribution of archaeological finds in the corings and reconstruction of the Pleistocene surface (Drawing J.H. Zwier, RUG/GIA). Open dot: coring without finds; black dot: coring with finds. High: higher than 2 m –NAP; middle: 2-2.5 m –NAP; low: below 2.5 m –NAP. The square indicates the position of the trench.

splinters. The four modified artefacts are a flake-scraper, a transverse arrowhead and two retouched flakes (Feiken *et al.,* 2001). On the basis of the flint characteristics it was concluded that the majority of the nodules originated from the Saalian boulderclay. The similarities between the worked and unworked flint indicated that the flint had been collected locally (Feiken *et al.*, 2001; section 3.4).

Diatom analysis was carried out on sherds and the clay sediment covering the site. It suggested that the pottery too was probably produced locally (De Wolf, 2001; Feiken *et al.*, 2001: 55/56). The main aim of this research was to gain insight into the drowning of the site. The analysis showed a gradual increase in marine influence (Feiken, 2000: 50). The depth of the Pleistocene surface, combined with the existing models of the relative sea-level rise (*e.g.* Van der Plassche, 1982) suggested that the site was covered with clay sediment from around 3700 BP (c. 2100 cal. BC).

3. THE 2005 INVESTIGATIONS

3.1. Methods (Molthof)

Corings

As a first step in the fieldwork, 134 corings were made. Two types of coring were performed. The first type are the so-called ‘landscape corings’. These were placed in a triangular grid with intervals of 20 m. These corings were made with a screw auger with a 7 cm diameter (the first metre) and a 4 cm diameter core auger. The purpose of these landscape corings was to map the buried Pleistocene topography. The second type of coring were the ‘archaeological corings’, which were placed in a triangular grid with intervals of 10 m. These corings were made with a screw auger 10 cm in diameter. The archaeological corings produced samples from the top of the Pleistocene sediment, which were wet-sieved on a 3 mm mesh. The archaeological finds in the residues were then plotted on a map. The presence of archaeological finds in a core would prompt the coring of the nearest grid points. The location of the excavation was decided on the basis of this map.

Test pit

One test pit was opened at coring location no. 8 (fig. 2). Because the Pleistocene deposits lie some 2.5 m below the present surface, the test pit was created in two phases. First, a mechanical digger removed the top 1.2 m in a square of 6x6 m. This depth corresponds to that of the water table. Then a 3x3 m surface within this square was taken down to the top of the archaeological layer. This test pit was then divided into nine squares measuring 1x1 m. In each square two spits of 10 cm thickness were removed in their entirety to be wet-sieved on a 5 mm and a 2 mm mesh. The NAP level was recorded for both spits. It was essential to work quickly and efficiently, since the floor of the trench was situated well below the water table and started to flood immediately upon excavation. In all, the trench was open for just four hours.

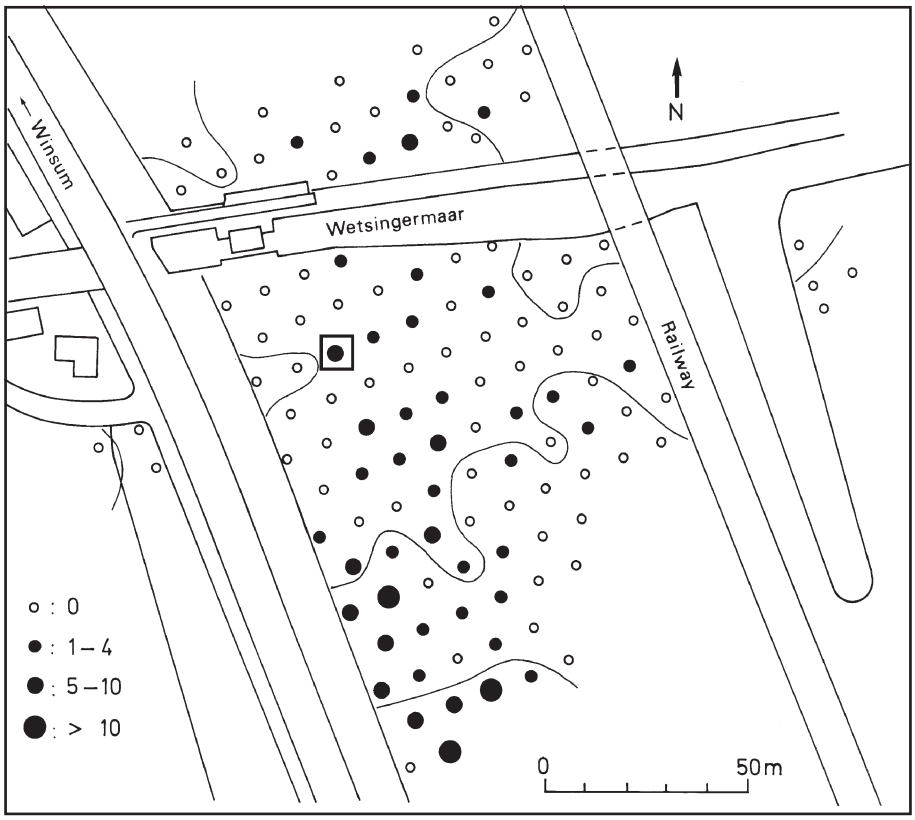

Fig. 3. Distribution of pottery in the corings and reconstruction of the Pleistocene surface (Drawing J.H. Zwier, RUG/GIA). Open dot: coring without finds; black dot: coring with finds. High: higher than 2 m – NAP; middle: 2-2.5 m –NAP; low: below 2.5 m –NAP. The square indicates the position of the trench.

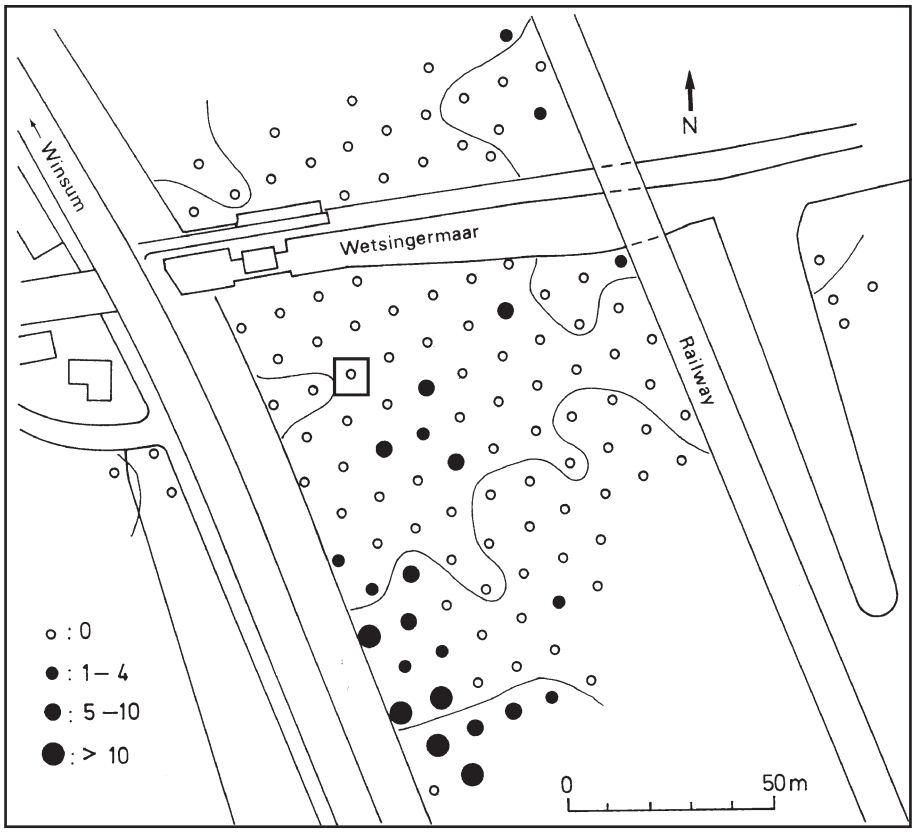

Fig. 4. Distribution of bone in the corings and reconstruction of the Pleistocene surface (Drawing J.H. Zwier, RUG/GIA). Open dot: coring without finds; black dot: coring with finds. High: higher than 2 m – NAP; middle: 2-2.5 m –NAP; low: below 2.5 m –NAP. The square indicates the position of the trench

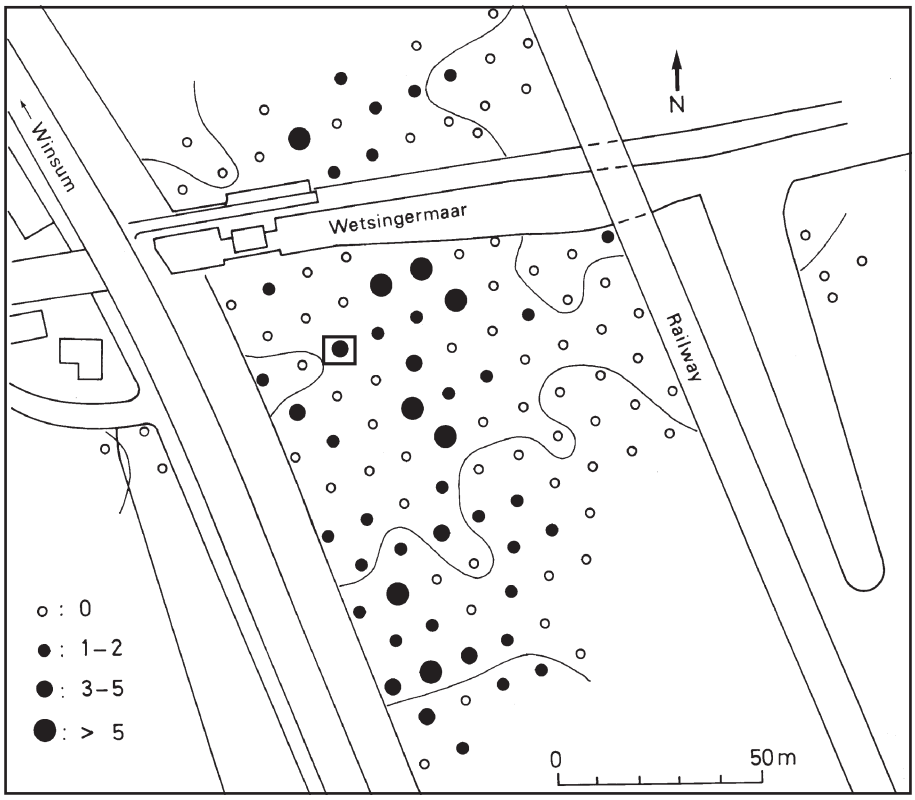

Fig. 5. Distribution of charcoal in the corings and reconstruction of the Pleistocene surface (Drawing J.H. Zwier, RUG/GIA). Open dot: coring without finds; black dot: coring with finds. High: higher than 2 m below NAP; middle: 2 to 2.5 m below NAP; low: more than 2.5 m below NAP. The square indicates the position of the trench.

3.2. Geology and site extent (Van der Wal, Huisman, Devriendt, Niekus and Raemaekers)

The Pleistocene surface in the province of Groningen is the northern continuation of the Drenthe Plateau. The *Hondsrug* is part of the northeastern ridge of this Plateau and forms its highest part. At the end of the Saalian glacial, meltwater caused erosion on the lowest part of the Hondsrug, between Groningen and Sauwerd. The area filled with water and formed a lake. The area to the north of the lake became a boulderclay island, known as *Het Hoog van Winsum* (The Winsum High). During the Weichselian glacial, aeolian coversands covered the island, which, according to Roeleveld (1974: 29–34), remained an island at least until 3950-3650 BP. The depression between Groningen and Sauwerd then slowly filled with marine sediments as the sea level rose, and the Pleistocene island was eventually covered as well.

The top layer is a c. 2.5 m thick layer of marine clay. The clay has a blue-greyish colour. The presence of peppery-furrow shells (*Scrobicularia plana)* underlines the interpretation of the clay as a marine deposit (determined by W. Prummel). These shells are common in the silt of the Wadden Sea area, south of the present salt-marsh zone. In some corings a thin layer of humic clay (on average 5 cm thick) formed the basis of this layer.

At a depth of 2.5 metres below the present-day surface there is a layer of bouldersand approximately 10 cm thick, which gradually merges into the underlying unweathered, calcareous boulderclay. The latter was deposited during the Saalian glaciation, approximately 150,000 years ago. The bouldersand is a weathered residue of the Saalian boulderclay, which largely developed during the Eemian interglacial and the Weichselian glacial as a result of the washing and leaching out of loam and finer sand particles. The coarser and heavier fractions remained.

The bouldersand is rich in small glacial erratics. In the northern slope of the 2000 trench it was clearly visible that the build-up of the layer was rather chaotic.

Because the excavated soil from the 2000 trench had been dumped on the adjacent meadow, the composition of the glacial erratics could easily be assessed. A large number of Palaeozoic limestones and crystalline erratics were gathered. The former are characterized by greenish-grey to blue Silurian Beyrichia limestones, fragments of skeletons of stromatoporoid sponges, and Ordovician limestone types. Among the crystalline erratics, reddish rapakivi granites and their variants were dominant. A count according to the Hesemann method resulted in a score of 10,000, which indicates that the collected indicator boulders all originated from the northeastern Baltic Sea and the Gulf of Bothnia. The numerous rapakivi erratics, and especially their composition, make it clear that at Wetsingermaar only eastern Baltic boulderclay was deposited.

The research area measures approximately 160 m from north to south and 90 m from west to east. The size of the site remains undetermined because no distinct limits were discovered. Nevertheless, some remarks on find density may be made (figs. 2-5). The amount of archaeological

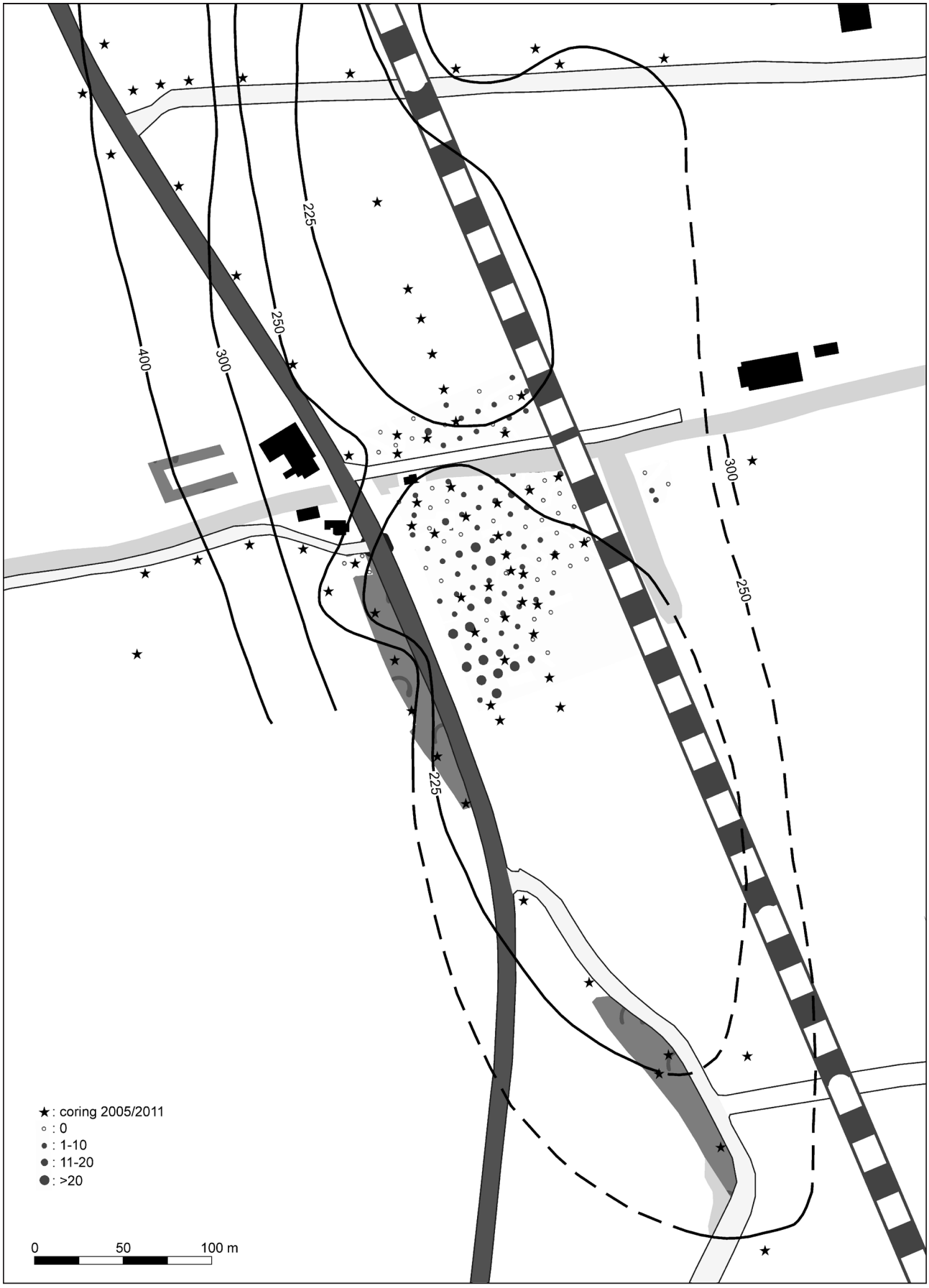

Fig. 6. Geographical setting of Wetsingermaar, based on corings (Drawing E. Bolhuis, RUG/GIA).

material decreases towards the northern and eastern sides of the research area, while the highest concentration of finds is in the west of the research area. The total amount of archaeological material per coring reveals a second concentration in the middle of the area. This is the result of the amount of charcoal in those corings (fig. 5).

These distribution patterns might suggest that the settlement was situated in the southwestern corner of the research area, on high ground. The depression north of it might then be a dump; all find categories are found there, especially flint and bone. The northern part of the research area would then be outside the settlement proper. A second plausible interpretation is that the difference in numbers of finds per coring results from differences in preservation. Better preservation in the southwestern part might be deduced from the presence of red-surface sherds (see 3.3) and a higher density of bone finds (fig. 4).

The 2011 coring campaign consisted of several series of corings at increasing distances from the site (fig. 6). As a result it has now become clear that the western slope is steep, while the three other sides slope more gradually. While our corings on the western slope revealed no indication of erosion, it is thought that this part of the Pleistocene outcrop bordered a river, probably the prehistoric equivalent of the Drentse Aa. Along this river, contact both with the Drenthe hinterland (the area with most TRB remains in the Netherlands) and with the North Sea coast could be maintained.

3.3. Pottery (Beckerman and Raemaekers)

In describing the pottery, the description system by Raemaekers (1999: appendix 1) was used. The decorations found at Wetsingermaar necessitated a new classification, as proposed below. We first present an overview of the characteristics of the sherds found in the 2005 trench. Then the time depth of the site is assessed by joining up the sherds from the 2000 campaign with those from the 2005 corings. Finally, the pottery will be compared with earlier, contemporaneous and later assemblages.

The 2005 trench

Forty-eight sherds with a weight of 5 g or more were described. All but one of the sherds are tempered with stone grit. Only 14 sherds contain a single tempering agent (11x red granite and 3x white granite); the most common combination of tempering agents is red granite and quartz (26x). Plant (13x) and grog temper (5x) are found as admixtures. The pottery was made by the coiling technique; joins are visible on 25% of the sherds. Evidence of the Hb technique is visible on 11 sherds and of the U technique on 1 sherd (terminology *cf.* Stilborg & Bergenstråhle, 2000).[1] The average wall thickness is 7.6 mm (mean 7 mm).

Decoration was found on eleven of the described sherds and on nine sherds omitted from the technological description for weighing less than 5 g. The twenty decorated sherds indicate that decoration was varied (fig. 7). Six types are distinguished:

- Type 1. (7x) Seven sherds were decorated with a spatula in a pattern of short, parallel vertical lines or impressions. The decoration may occur on the belly (1x), on the transition from neck to belly (2x) or on the rim of the pot (4x);
- Type 2. Groove lines (5x): parallel vertical lines, probably made with a spatula. The decoration is placed on the belly zone of the pot;
- Type 3. Zigzags (3x): spatula impressions. The decoration is located on the transition from neck to belly (1x) or on an unknown area of the vessel (2x);
- Type 4. Stab-and-drag (2x): The pattern consists of parallel vertical lines located on the belly zone;
- Type 5. Twisted cord (1x): decoration on the belly made with a cord twisted round a stick;
- Type 6. Impressions (1x): spatula or fingertip impressions. The pattern consists of almond-shaped impressions just 1 cm wide, placed in a vertical line on the belly zone.

Since only small sherds where found, there is little information on pottery morphology. One sherd is a base fragment and indicates that the first coils were placed around a small clay disc. A last wall sherd shows that the pottery had lugs (fig. 6).

Comparing the sub-assemblages

The sherds described above, from the 2005 excavation, were compared with the ceramic finds from the 2005 coring campaign and the 2000 investigation (unpublished data, Raemaekers) in order to gain insight into the time depth of the site's occupation (table 2). The general idea being that if these three assemblages were homogeneous, this would be indicative of a short occupation period. With the exception of the proportion of white granite temper, the pottery from the 2000 and 2005 campaigns is similar. The strong similarities between the three Wetsingermaar assemblages suggest that they are the remnants of a single, relatively short occupation, encompassing the entire 1.4 ha research area.

Cultural affiliation

The ceramic tradition of the Swifterbant culture starts around 5000 cal. BC. Traditionally, the Swifterbant culture is thought to continue until the start of the TRB West Group around 3400 cal. BC (*e.g.* Lanting & Van der Plicht, 2002; Raemaekers, 2005). In this perspective, the Swifterbant culture is divided into a ceramic Late Mesolithic early phase (5000-4700 cal. BC), a Neolithic middle phase (4700-3900 cal. BC) and a Neolithic late phase (3900-3400 cal. BC). New research (especially Ten Anscher, 2012) indicates that around 4000 cal. BC major developments in terms of ceramic characteristics occurred and Late Swifterbant should be rethought as Early TRB (*contra* Lanting & Van der Plicht, 2002; Raemaekers,

Table 2. Comparison of the three Wetsingermaar pottery assemblages. Figures in brackets refer to numbers of described sherds (>5 g).

	2005 Trench	*2005 Corings*	*2000 Research*
Number of sherds > 5 gr	48	7	32
Tempering agents (%)			
Red granite	90	86	78
White granite	63	14	22
Plant	27	24	25
Grog	10	10	0
Joins (%)	25	0	38
H-joins	17		17
N-joins	75		58
Z-joins	8		25
Average wall thickness (mm)	7.6	7.6	8.3
Wall decoration (%)	13	0	6
Number of decorated sherds			
Spatula lines	7 (2)		
Groove lines	5 (1)		
Zig-zag	3 (2)		
Stab-and-drag	1 (0)	1 (0)	
Twisted cord	1 (1)		
Spatula/fingertip impressions	1 (0)		2 (1)

2005). What might the Wetsingermaar ceramics contribute to resolving this difference in interpretation?

To shed light on this problem, the Wetsingermaar ceramics will first be compared with the pottery of the type-site Swifterbant S3 (4300-4000 cal. BC), after which the focus will turn to the few contemporaneous assemblages (4000-3400 cal. BC) and to Drouwen and Havelte TRB pottery (3400-2850 cal. BC).

A comparison with Swifterbant pottery

Swifterbant pottery in the narrow sense is not found in the vicinity of Wetsingermaar. The nearest findspot is Bronneger (province of Drenthe; Kroezenga *et al.,* 1991), some 50 km to the south. It yielded a single pot, dated c. 4800-4600 cal. BC (Lanting, 1992). This pot, some 1300-1100 years older than the Wetsingermaar sherds, is clearly less suited for comparison than the major assemblages in the province of Flevoland, dating to 4300-4000 cal. BC. The largest ceramic assemblage, from site S3, comprises more than 10,000 sherds. The S3 pottery is mostly tempered with plant matter, often in combination with stone grit. The pottery is rather coarse with an average wall thickness of 10 mm. It is built from coils joined with U joins. Decoration is limited to a row of parallel spatula impressions on the shoulder and/or the rim zone. Specific for the Swifterbant pottery of this period is a series of parallel spatula impressions on the inside of the rim (Raemaekers, 1999: 31–3; De Roever, 2004).

A comparison with contemporaneous pottery

Very few archaeological remains dating from the period 4000-3400 cal. BC have been found in the northern part of the Netherlands (Raemaekers, 2005). Known sites are Urk-E4, Emmeloord-J97, Schokkerhaven-E170 and Schokland-P14, all located in the Noordoostpolder, and Swifterbant-S25 in the neighbouring Flevopolder (prov. of Flevoland). The ceramics from Urk-E4 and Emmeloord-J97 are dated to this period by ^{14}C dating of burnt residue on pottery. These dates are too old, owing to the reservoir effect (Raemaekers, 2005: fig. 3), while the pottery from Schokkerhaven-E170 derives from an unpublished excavation whose documentation is partly missing. According to Ten Anscher (2012, appendix D), this pottery has a large time-depth (contra Raemaekers, 2005), and does not all stem from the period of relevance here. The relatively heterogeneous character of the pottery leads us to agree with Ten Anscher. Swifterbant-S25 was excavated in 2009-2010. Its small pottery assemblage derives from a creek infill that certainly covers a relatively long time span. The oldest sherds are contemporary with the Swifterbant-S3 material, while the youngest date to around 3900-3700 cal. BC. Intriguingly, the younger material seems to be more often tempered with granite, is relatively thin-walled and lacks the typical Swifterbant decoration schemes (Scheele, 2011).

This leaves us with Schokland-P14. The large-scale excavations at this site in the period 1982-1990 did spark a series of publications (Ten Anscher, 2000/01, 2012; Ten Anscher & Gehasse, 1993; Ten Anscher, Gehasse & Bakker, 1993; Gehasse, 1995; Gotjé, 1993), but the lack of a publication on the site's topography, stratigraphy and ceramic remains (and the relations between these three topics) has so far hindered any meaningful reference to this site. Ten Anscher's long-awaited PhD thesis (2012) provides important and well-argued evidence from the ceramic remains of the period 4000-3400 cal. BC. On the

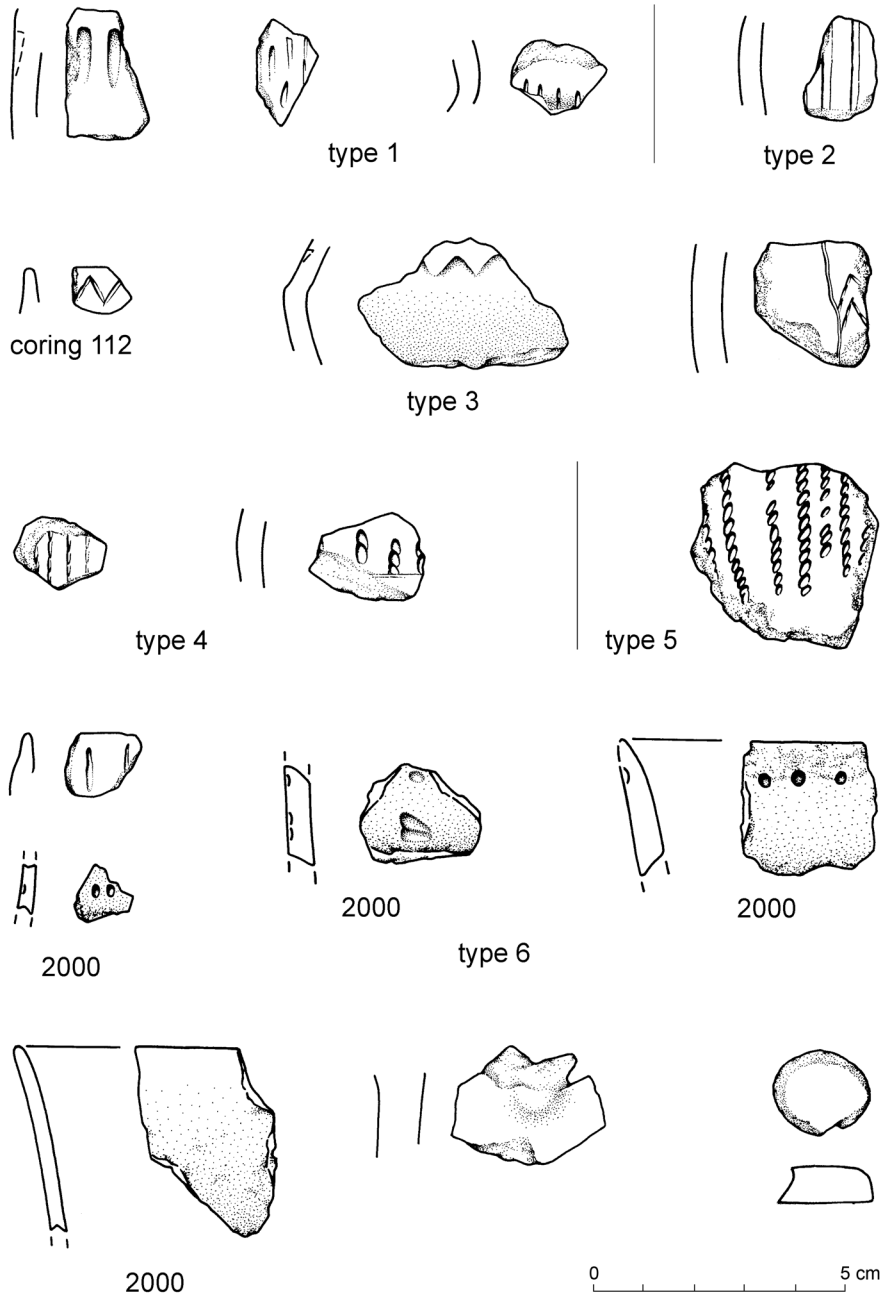

Fig. 7. Diagnostic sherds from Wetsingermaar (Drawing M.A. Los-Weijns, RUG/GIA). Decoration types are explained in the text.

basis of the slowly deposited infill of a creek, he argues in favour of a gradual transition from the Swifterbant culture to Drouwen TRB. The ceramic material from the creek infill reveals evolving trends in several characteristics: temper, coiling techniques, base morphology and decoration. A large number of ^{14}C dates from food crusts make it tempting to interpret these patterns in terms of chronology (Ten Anscher, 2012: 41–130). Nevertheless, as Ten Anscher rightly notes (2012: 114/115), the proposed stratigraphy is not absolute: the date of individual sherds is difficult to prove on the basis of depth alone. As a result, the pre-Drouwen TRB as described by Ten Anscher is defined by material whose decoration sets it apart from the older Swifterbant ceramics and its younger TRB counterparts. The typical decoration is the twisted-rope motif, applied to produce parallel, horizontal or vertical lines or arc-like patterns. The average wall thickness is 8 mm. Most sherds are tempered with granite; some also include plant temper. All visible coils indicate the use of the Hb technique. All these characteristics are found in the Wetsingermaar ceramics.

Parallels for the simple zigzags, groove lines and especially the twisted-cord impressions of Wetsingermaar are also found in the pottery from Hüde I and Osterwick (fig. 8). While the stratigraphy of Hüde I, located on lake Dümmer (Lower Saxony), is problematic (Kampffmeyer, 1991; Lanting & Van der Plicht, 2002: 23–5; Raemaekers, 1999: 72–91), its find catalogue provides intriguing parallels, as twisted-cord impressions are present at Hüde I as well (*e.g.* Kampffmeyer, 1991: *Taf.* 3:391, 28231,

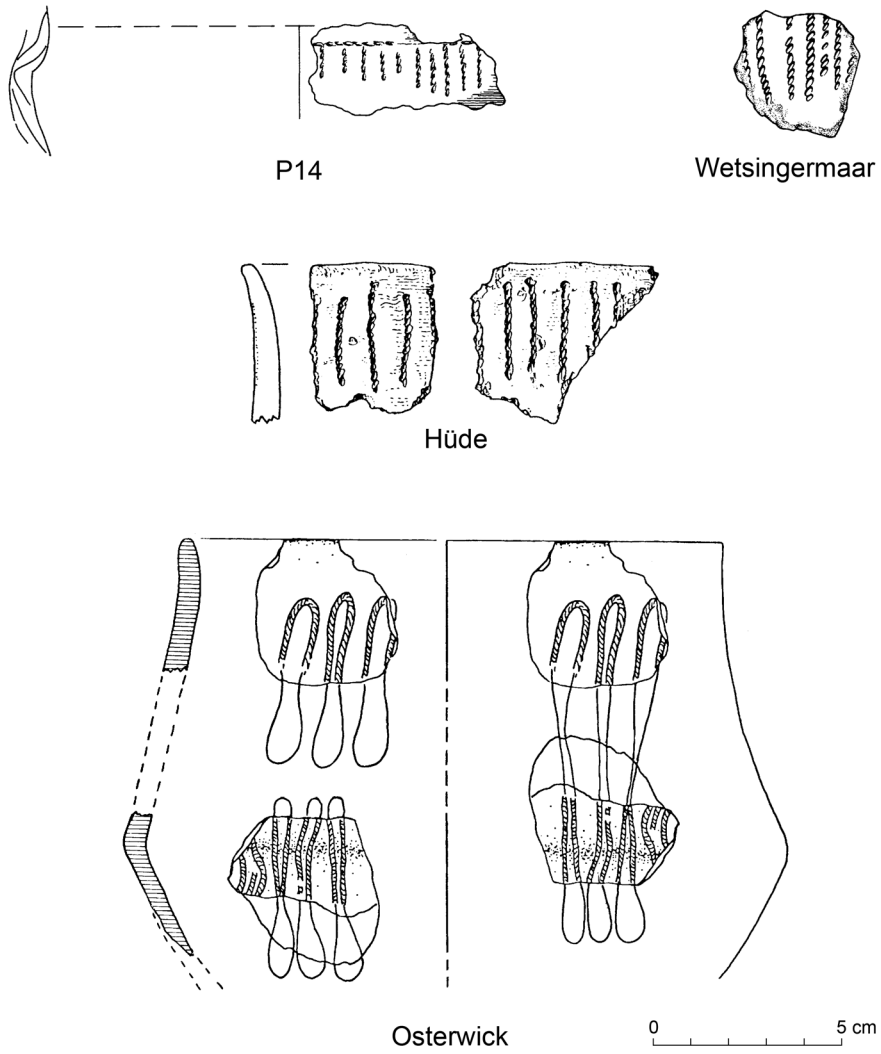

Fig. 8. Sherds with cord impression from Wetsingermaar, P14 (Ten Anscher *et al.,* 1993: fig. 2), Hüde I (Kampffmeyer, 1991: *Taf.* 3) and Osterwick (Willms, 1982: *Taf.* 25) (Drawing M.A. Los-Weijns, RUG/GIA).

22790). At the site of Osterwick (Westphalia), four sherds with twisted-cord decoration were found as surface finds in a settlement of the Michelsberg culture (Willms, 1982: *Taf.* 25:b-e). The last-mentioned find is even more intriguing when the ceramic form is taken into account: its biconical shape is similar to that of contemporaneous undecorated pottery from Emmeloord (Raemaekers, 2005: fig. 6.7) and Swifterbant S61 (De Roever, 2004: fig. 24a).

A comparison of the Wetsingermaar pottery with a large catalogue of Early Neolithic TRB pots from Denmark is of relevance because this pottery predates Brindley's Horizon 1 of the TRB West Group. Koch's Early Neolithic types 0-IV (Koch, 1998) include vessels with twisted-cord decoration and with stab-and-drag and spatula techniques. Often far more complex decorative schemes occur than on the pottery from Wetsingermaar. Most pottery was tempered with granite, sometimes in combination with feldspar. Flint, grog, white quartz and sandstone were less often used as tempering agents (Koch, 1998: 229). The preference for stone grit (granite) and the addition of plant material and grog corresponds with the tempering agents used at Wetsingermaar. Another similarity is found in the use of the Hb technique (Koch, 1998: 124–7).

A comparison with Drouwen TRB pottery

The typochronology of Drouwen and Havelte TRB pottery is relatively well-developed, thanks to the detailed analysis of several major assemblages from the megalithic tombs. The most recent scheme comprises seven horizons of which Horizons 1-4 constitute the Drouwen phase and Horizons 5-7 the Havelte phase (Brindley, 1988b). In the study of this pottery little attention was given to technological details, which is certainly due to the abundant stylistic information available in the assemblages from megalithic tombs. The following is therefore an impression rather than the result of detailed research. In general, it may be concluded that TRB pottery was tempered with granite, was coil-built using the Hb technique and varied strongly in terms of wall thickness. This variation is related to the wide variety in ceramic forms. Because of the research tradition, the comparison necessarily focuses on the decoration. Some of the decoration techniques of

Drouwen TRB pottery are in a general sense comparable to those used on the Wetsingermaar pottery: groove lines, twisted-cord decoration and spatula impressions. But, as a rule, the decoration of the Drouwen TRB pottery is far more complex in pattern and range of techniques used than the Wetsingermaar pottery (*e.g.* Brindley, 1988b).

Conclusion

Judging by the variables described above, the Wetsingermaar pottery assemblage is very homogeneous. This suggests that we are dealing with a site of at least 1.4 ha, occupied intensively (many finds in the corings) during a relatively short period (perhaps a few centuries?). The Wetsingermaar pottery is more similar to pre-Drouwen TRB ceramics than to the Swifterbant pottery or to the only slightly younger Drouwen TRB pottery. These similarities are found in the strong preference for stone grit temper, the wall thicknesses, the coils joined with the Hb technique and the decoration techniques. The Wetsingermaar pottery differs strongly from the Swifterbant S3 ceramics in terms of tempering agents, wall thickness, coiling technique and several types of decoration. A comparison in terms of technical characteristics with the pottery from the subsequent Drouwen TRB pottery is difficult, since there is little available information from the latter. TRB-Westgroup pots are also mostly tempered with stone grit and built with coils joined by the Hb technique, but a striking difference is that the decoration on the Drouwen TRB pottery is generally far more complex in pattern and range of techniques used on individual pots.

3.4. Flint artefacts (Niekus, Devriendt and Aalders)

The following description is based mainly on artefacts recovered during the 2005 coring campaign (n=67) and the 2005 test trench (n=817). In addition, the finds from 2000 (Feiken *et al.*, 2001) are included (n=104). Since only a small part of the site was excavated, and consequently a relatively small number of artefacts was uncovered, we have refrained from detailed typo-technological analyses. Descriptions of the artefacts are kept to a minimum.[2] As was noted earlier *(ibid.),* the site seems to represent a single-component habitation, which means that there are no indications of an admixture of artefacts dating to the Late Upper Palaeolithic, Mesolithic or post-TRB periods (see below). After a description of the lithic finds, the assemblage will be compared with assemblages attributed to the Swifterbant culture and the Drouwen TRB culture. As no pre-Drouwen TRB flint assemblages have been published, the Wetsingermaar assemblage

Table 3. Classification of the flint artefact assemblage from Wetsingermaar. The numbers include fragments.

	2000	*Corings*	*Excavation*	***Total***	*Percentage*	*Burnt (number)*
Debitage						
Chips (≤ 10 mm)	20	27	403	**450**	45.5%	60
Flakes	58	29	352	**439**	44.4%	62
Blades	5	2	15	**22**	2.2%	2
Blocks	7	2	11	**20**	2.0%	14
Cores	7	-	4	**11**	1.1%	1
Core-preparation pcs.	-	2	7	**9**	0.9%	-
Core-rejuvenation pcs.	2	2	-	**4**	0.4%	-
Resharpening flakes	-	-	4	**4**	0.4%	
Potlids	-	1	2	**3**	0.3%	2
'Micro-burins'	-	-	2	**2**	0.2%	-
Nodule	1	-	-	**1**	0.1%	1
Subtotal	*100*	*65*	*800*	***965***	*97. 7%*	*142*
Retouched tools	*4*	*2*	*17*	***23***	*2.3%*	-
Total	*104*	*67*	*817*	***988***	***100.0%***	*142 (=14.4%)*
Retouched tools						
Retouched pieces	1	2	8	**11**	-	-
Scrapers	1	-	4	**5**	-	-
Transverse points	2	-	3	**5**	-	-
Borers	-	-	2	**2**	-	-
Subtotal	*4*	*2*	*17*	***23***	-	-

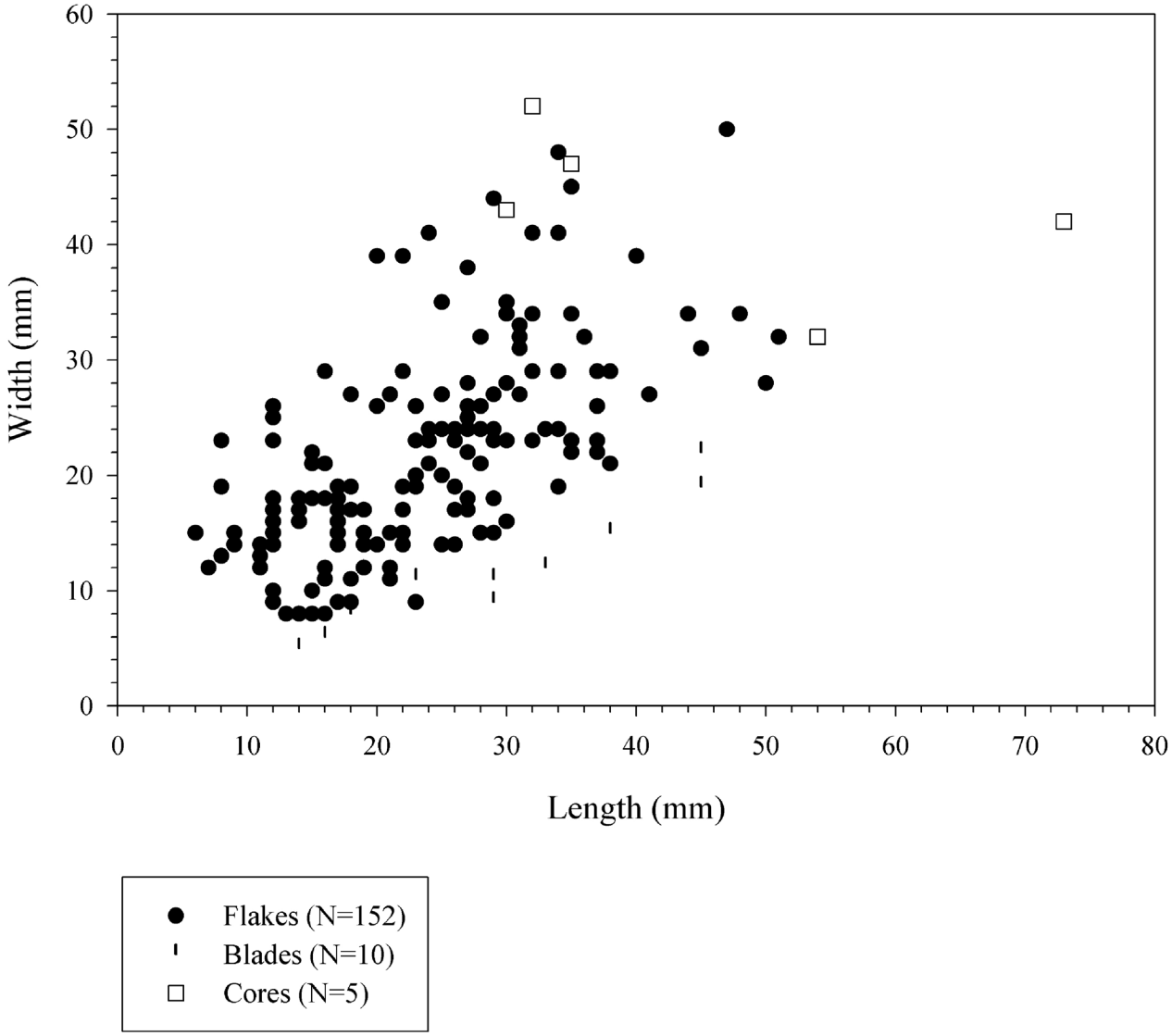

Fig. 9. Scatter diagram showing the length and width in mm of the complete flakes (n=152), blades (n=10) and cores (n=5) (Graph M.J.L.Th. Niekus, RUG/GIA).

Table 4. Descriptive statistics of the complete flakes (n=152), blades (n=10) and cores (n=5) in mm.

	Flakes	*Blades*	*Cores*
Number	152	10	5
Length			
Range	6-51	14-45	30-73
Average	23.3	29.0	44.8
St.dev.	9.59	11.35	18.43
Width			
Range	8-50	5-22	32-52
Average	21.7	11.8	43.2
St.dev.	9.03	5.47	7.40
Thickness			
Range	1-15	2-7	17-40
Average	5.0	3.8	31.0
St.dev.	2.59	1.81	9.49

cannot be compared with assemblages whose ceramic affinities are considered the most relevant.

Technology and raw material

In total, nearly 1000 flint artefacts are present, with a total weight of 1435.3 g. The classification of the assemblage, subdivided according to find context, is presented in table 3. Most of the assemblage consists of small chips (unretouched artefacts < 1 cm) and simple flakes, while regular blades (length at least twice the width of the artefact with parallel sides) are relatively rare. All cores are classified as flake-cores, and in fact the assemblage as a whole can be characterized as flake-oriented (fig. 9). As far as could be established, all artefacts (excluding chips and burnt artefacts) were made from erratic flint. Several pieces display *Bryozoa*, characteristic for flint of a primarily northern (Baltic) origin. No artefacts on imported

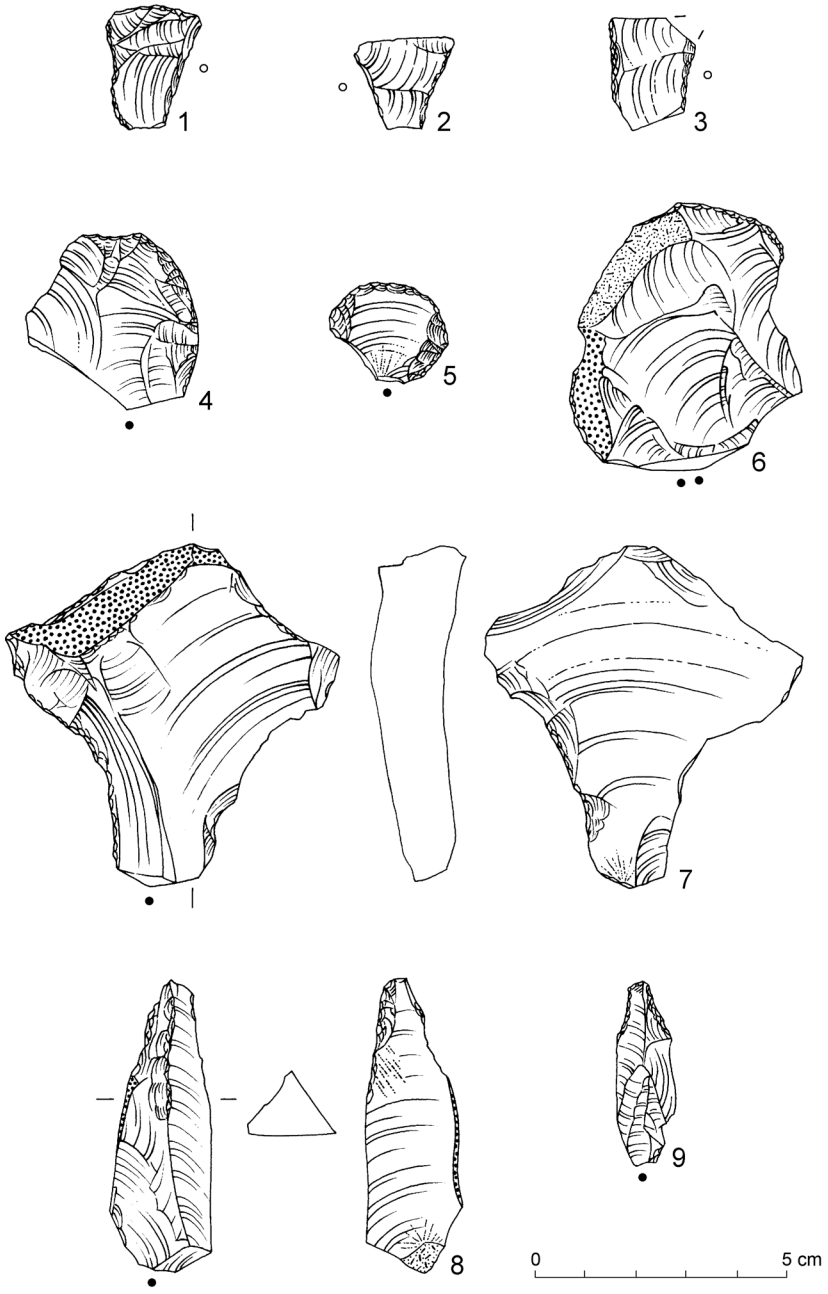

Fig. 10. A sample of the retouched flint tools from Wetsingermaar (Drawing M.A. Los-Weijns, RUG/GIA). 1-3: transverse points; 4-5: scrapers; 6-7: retouched pieces (flakes); 8-9: borers. Infilled circle: point of percussion present; open circle: point of percussion no longer present; irregular stippling: remnants of cortex; regular stippling: remnants of old frost-split faces.

flint were identified. The flint itself is relatively fine-grained, although a few coarse-grained pieces do occur.

The geological setting suggests that raw material may have been collected locally or in the immediate surroundings of the site. At first sight, the quality of the raw material seems to be good but on closer inspection quite a few pieces display frost-cracks, not uncommon for flint nodules in bouldersand deposits. Several pieces display a fresh, chalky cortex, pointing to an origin from boulder-clay deposits, as is evident all over the site. On average the artefacts appear fresh, although several pieces display post-depositional surface modifications such as slight gloss and patination – mostly brown patina, but a few pieces with a blackish discoloration occur as well. The latter is sometimes referred to as 'underwater' patina and occurs frequently when artefacts are situated in anaerobic situations, for example under clay deposits (Stoel, 1999; Johansen *et al*., 2009). A slight white patination was observed in a few cases as well. Some basic descriptive statistics of the complete flakes, blades and cores are presented in table 4.

Retouched tools

There are 23 retouched tools or tool fragments in the assemblage (2.3%; fig. 10). Simple retouched pieces (mainly flakes and blades) are the most numerous (n=11), followed by scrapers (n=5) and transverse points (n=5). In addition, one borer and a tip of a borer are also present. Among the retouched pieces there is one obliquely blunted blade and a fragment of a truncated blade or blade-like

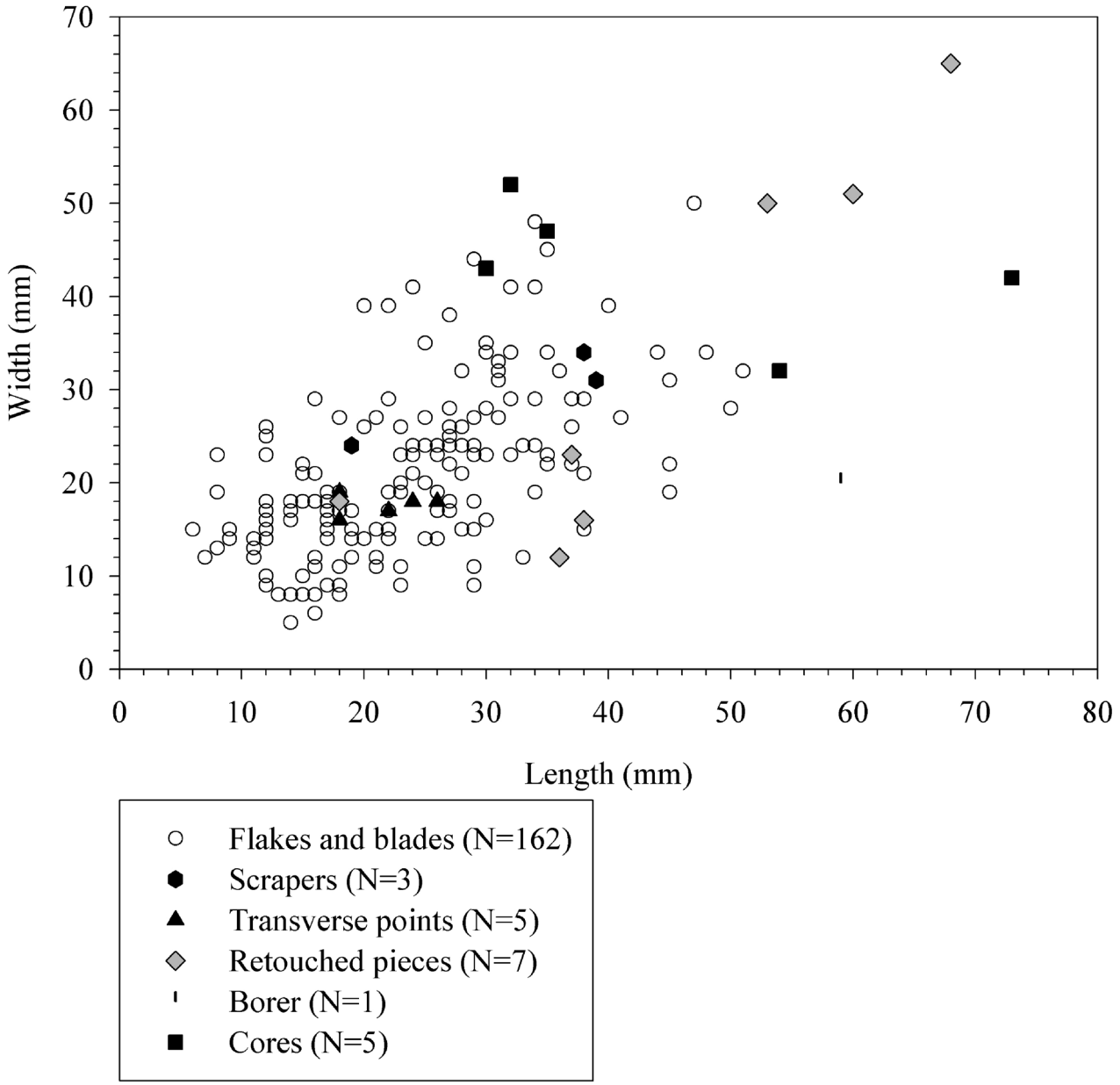

Fig. 11. Scatter diagram showing the length and width in mm of the complete retouched tools in relation to the measurements of the complete flakes and blades (n=162) and cores (n=5) (Graph M.J.L.Th. Niekus, RUG/GIA).

flake, possibly a preform of a transverse point. Another possible preform was published by Feiken *et al.* (2001: fig. 3.3). Furthermore, a flake with marginal retouch along the side is present, but it is not clear whether the retouch is the result of use. Two of the retouched pieces are preparation or rejuvenation pieces, one of which is a large flake (68x65x21 mm) combining retouch along the side with a notch. Two chips with retouch have also been included in this category but whether the retouching was intentional is uncertain.

All five scrapers were made on flakes; four of them may be described as end scrapers. One scraper depicted in Feiken *et al.* (2001: fig. 3.1) may be defined as a combination of side and end scraper. The smallest scraper measures 16x16x6 mm, the largest 39x31x11 mm. One scraper was made on a core-rejuvenation flake. Although strictly speaking they are waste products, four resharpening flakes, possibly from scrapers, are mentioned here.

The five transverse points were all made from flakes. Four are complete; one lacks a small part of the cutting edge as a result of shooting. One of the transverse points displays a small patch of black material on the ventral side, possibly a remnant of hafting material. The two micro-burins of the Krukowski type are quite common finds from Late Upper Palaeolithic and especially Mesolithic assemblages, and are considered to be related to the production of points on the basis of blade technology. These two micro-burins are probably to be

interpreted as evidence of earlier activities. Their recovery certainly results from the sieving and they may be more common than previously thought. As mentioned earlier, at least two possible preforms are also present, and in combination with the 'micro-burins' these point to the on-site manufacture of hunting equipment.

The borer is a heavy specimen made from a thick core-preparation blade or blade-like flake, measuring 59x20x15 mm. The working tip is heavily abraded and damaged. According to D. Stapert (pers. comm.), who microscopically examined the artefact, it is not a strike-a-light since the characteristic rounding in combination with scratches and gloss is absent (Stapert & Johansen, 1999). Most probably it is a heavy-duty borer, possibly for piercing a hard material such as pottery or relatively soft stone. Similar tools were found at, amongst others, the Middle Neolithic site of Schipluiden (Van Gijn *et al.*, 2006) and Late Neolithic/Bronze Age sites (*e.g.* Van Gijn & Niekus, 2001). Fragments of polished axes and strike-a-lights, which are common on sites of the Drouwen TRB culture, were not found.

In the scatter diagram (fig. 11) the lengths and widths of the complete retouched tools and of specific waste products are shown in relation to the measurements of the complete flakes and blades and the cores. Although the numbers are low, it is interesting to see that all five transverse points are situated close together in this graph, probably because of specific size requirements for hunting equipment. Half of the retouched pieces are considerably larger than the unretouched flakes, so it appears that the larger blanks were selected.

A comparison with Swifterbant flint

At the various creek bank sites of Swifterbant (4300-4000 cal. BC), the flint technology was clearly aimed at the production of blades, while trapezes and a few transverse points furnished the hunting equipment (Deckers, 1979; Devriendt, in prep.). If we compare Wetsingermaar with these Swifterbant sites (*e.g.* S2, S4 and S51), it is clear that the Swifterbant assemblages are more blade-oriented. Depending on the data used, the percentage of blades ranges from 27% to nearly 35% (Deckers, 1979) or 12-14% (Devriendt, in prep.), while only little over 2% of the Wetsingermaar assemblage consists of blades. The average length-width ratios for the unretouched flints (flakes and blades) measured by Devriendt for the Swifterbant sites S2 and S3 are 1.46 (n=28) and 1.48 (n=2167) respectively, while the similar figure for Wetsingermaar is 1.24 (n-162).

A comparison with Drouwen TRB flint

Similar low percentages of blades for Drouwen TRB sites have been reported for example by Deckers (1981), Vosselman (2008) and Deunhouwer (1983). At Helpermaar (Fens *et al*., 2010) only four or five (retouched) blades were found, probably sickle-blades, and also at Slootdorp-Bouwlust there is no indication of systematic blade production (Peeters, 2001). The absence of a significant blade component is also reflected in the average length-width ratio for the unretouched flakes and blades. At Wetsingermaar the average ratio is 1.24, while for Helpermaar (n=37) an average of 1.12 was calculated. Based on a histogram of length-width ratios (Deunhouwer, 1983: 34, fig. 13) the average ratio for *hunebed* D19-Drouwen could be determined as 1.16 (n=118).

For 81 complete flakes and blades from Groningen-De Wijert-Zuid, Deckers (1981) calculated an average length-width ratio of 1.14. It should be mentioned that in this case Deckers distinguished two major habitation phases, a TRB and a Single Grave component, each with different ratios. According to Deckers, the artefacts dating to the SGC have ratios ranging between 0.5 and 1.0, while for TRB flints in general an average length-width ratio of 1.5 seems normal (*ibid*.: 200). However, we cannot rule out that the mixing of different occupation phases produced a relatively high average ratio. Obviously, more research is necessary in this respect. On the basis of these ratios the Wetsingermaar assemblage compares better to the Drouwen TRB assemblages than to the Swifterbant flints.

Transverse points

The cultural affinities of the Wetsingermaar assemblage were also addressed by looking at the length-width ratio of the transverse points. For the Mesolithic it is commonly assumed that narrow trapezes were gradually replaced by broad specimens, and that in the Swifterbant culture transverse points occurred more frequently than before (see Niekus, 2009). During the period of the Drouwen and Havelte TRB culture, nearly all points were of the transverse type. To investigate the chronological position of the Wetsingermaar assemblage, the length-width ratio of the points was calculated and compared with those of samples from the Swifterbant creek bank sites (based on measurements by Devriendt, in prep.; and Deckers, 1979) and a number of TRB assemblages (fig. 12).[3] The latter comprised 20 transverse points from the Drouwen TRB site Groningen-AZG (Brindley Horizons 1, 2 and possibly 3; Overeem, 2005; Kortekaas, 2002) and a sample of transverse points from megalithic grave D19-Drouwen in Drenthe (Deunhouwer, 1983). According to A.L. Brindley (pers. comm.), the pottery from this tomb dates mainly to Horizon 3. In addition, four transverse points found in an SGC grave from Borger in the province of Drenthe were included.[4] Even though the numbers are very low for Wetsingermaar and the SGC grave from Borger, a clear development can be seen with respect to the length-width ratio.

Most of the Swifterbant projectiles have ratios larger than 1.0 and should be described as trapezes (fig. 11, number 1). But, as mentioned earlier, a few transverse points do occur. During the TRB period (numbers 3 and 4) there are obviously more transverse points, even though a few pieces might be better described

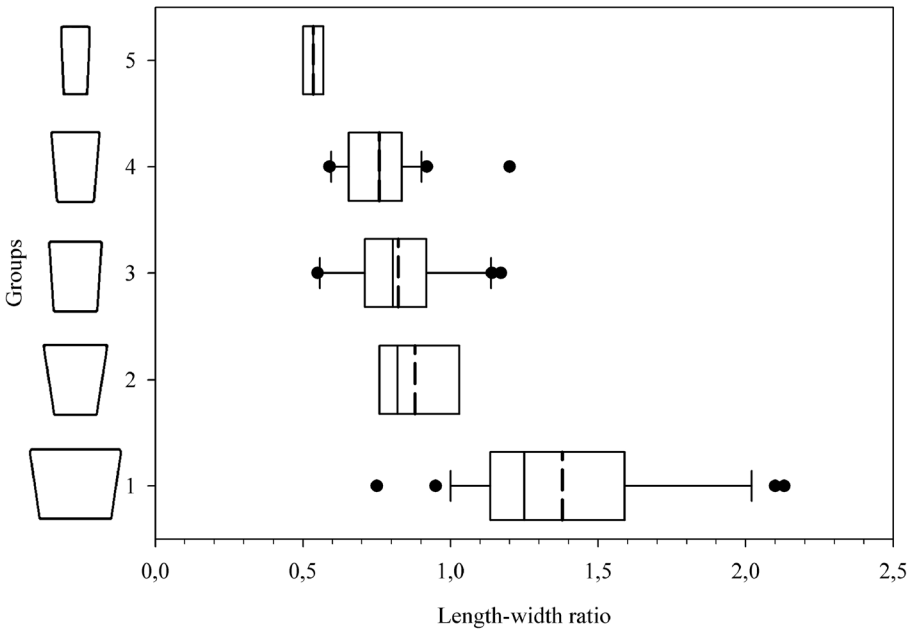

Fig. 12. Boxplots showing the length-width ratios of trapezes and transverse points for: 1. Swifterbant (n=37); 2. Wetsingermaar (n=5); 3. AZG (n=20); 4. Hunebed D-19 (n=25); and 5. SGC-grave from Borger (n=4) (Graph M.J.L.Th. Niekus, RUG/GIA). The most 'classic' specimen from each group is depicted. In this boxplot, the 25th percentile is represented by the boundary of the boxes closest to zero while the boundary furthest from zero indicates the 75th percentile. The whiskers indicate the 90th and 10th percentiles. The median is indicated by the closed line, the average by the dashed line.

as trapezes. It is clear that also in terms of the morphology of the points, Wetsingermaar is more similar to the TRB assemblages than to the Swifterbant sites. Whether the observed decrease in the ratio from Wetsingermaar through Groningen-AZG, megalithic grave D19-Drouwen and finally to the SGC-grave from Borger represents a chronological development is difficult to assess. First of all, the numbers for Wetsingermaar and Borger are very low. Secondly, most megalithic tombs contain a mixture of artefacts from different horizons (*cf.* Brindley, 1988a) which prevents more detailed chronological analysis.[5] Another possibility that deserves mention is that there might be a difference in size between transverse points from settlements (Wetsingermaar and Groningen-AZG) and points from (megalithic) graves, such as D19-Drouwen and Borger. This idea is not new but was put forward by Deckers (1985) when he stated that "Almost 95% of the TRB trapezes come from graves and very few from settlements. Nevertheless, it is notable that trapezes coming from settlements are smaller in size. In part three I will suggest that trapezes were used as status indicators in graves and as tools in settlements" (Ibid.: 155). Unfortunately, his study of TRB artefacts was never published.

Conclusion

The flint assemblage from Wetsingermaar is characterised as a flake-based industry, and with respect to the length-width ratio of the debitage and characteristics of the cores the site is closely comparable to the subsequent Drouwen TRB assemblages. No clear affinities to the Swifterbant culture were found: blades are rare and all points are classified as transverse points. As with later TRB settlements, the tool-kit is characterised by the dominance of simple retouched pieces and scrapers, and to a lesser extent by transverse points, borers and 'notched' pieces. Furthermore, measurements of the transverse points suggest that the site is more similar to the TRB assemblages than to known Swifterbant assemblages. Indeed it should be kept in mind that the Swifterbant assemblages are some 600 years older than Wetsingermaar, while the TRB assemblages are more similar in age.

The absence of strike-a-lights and fragments of polished flint axes, so characteristic of TRB sites, may simply be due to the small excavated proportion of the site. Another explanation for the absence of these tools could be that the site may not have been inhabited year-round but was a spot where people returned on a regular basis, for specific purposes. A similar explanation was put forward by Hingst (1990) for the TRB site of Hobbersdorf (Germany) where, despite a large number of flint artefacts, polished axes and fragments of the same are extremely rare. Hingst suggested that the site might have been used for hunting and was occupied on a seasonal basis only.

In an earlier publication (Feiken *et al.*, 2001) it was suggested that the site was primarily used for collecting raw materials and for the first stages of flint working. Yet, the finds from the 2005 excavation have clearly shown that an interpretation as a settlement is more likely, since a normal range of tools (scrapers, points, borers etc.) is present.

3.5. Stone tools (Devriendt and Niekus)

In section 3.2 it was pointed out that the Pleistocene subsoil in the immediate surroundings of the site is rich in glacial erratics. The bouldersand and boulderclay are characterised by an abundance of flint and stone pebbles, cobbles and boulders, ready to be picked up and

used for any purpose. During the excavation hundreds of cobbles were collected, but only a handful is possibly of any archaeological relevance. During the excavation, no formal tools such as hammer stones or grinding stones were found. Ten small fragments of granite and one quartizitic sandstone (total weight 41.2 g) are characterised by rough, crater-like planes of fracture. Even though there is no visible discoloration it is possible that these fractured as a result of burning.

Furthermore, there are six other, larger, pieces of granite (total weight 308.8 g) with relatively fresh planes of fracture and impact traces, which all were found in close proximity to each other and presumably are part of the same boulder. They could be refitted into two groups of three. Since there are no indications of human percussion such as clear flake scars or bulbs of percussion, it is likely that the fragmentation of the boulder is due to natural processes such as frost splitting. The impact traces may very well result from the collision of stones during cryoturbation of the soil. Similar traces occur frequently on stones (including flint) from glacial sediments. In view of the fact that the pottery is tempered with stone grit, it is tempting to explain the fragmentation of the granite boulder as an early step in procuring temper material, but this cannot be substantiated.

3.6. Zoological remains (Prummel and Brinkhuizen)

In the analysis of the zoological material the two available sub-assemblages will be presented separately. First to be presented are the as yet unpublished finds from the 2000 research. Second, the zoological material from the 2005 test trench is discussed. These remains were recovered by wet-sieving the excavated soil from the 1x1 m squares (about 1.5 m^3) over 5 mm and 2 mm mesh sieves. The two fractions are discussed as separate find groups.

The animal bones recovered in 2000

Three burnt bones with a total weight of 4.1 g were recovered by H.-J. Streurman when he discovered the site. These are a part of a thoracic vertebra of a domestic or a wild pig (*Sus domesticus* or *S. scrofa*), part of a long bone of a large mammal and part of a bone of a mammal of unknown size. Twenty burnt bone fragments with a total weight of 1.4 g were also found. These include two bird bone fragments, seventeen mammal bone fragments and an unidentified bone fragment.

The 5 mm mesh sieve fraction

A total of 360 animal remains with a total weight of 94.5 g were recovered from the 5 mm mesh sieve. The bones are heavily fragmented and weathered. Only 33 bones with a total weight of 12.0 g could be identified to species, genus or family. The remaining 327 remains, with a total weight of 82.5 g, are unidentified mammal, bird and fish bone fragments (table 5).

The identified remains represent domestic pig, cattle, mallard, flounder/plaice/dab and three or four marine mollusc species (mussel, peppery furrow shell and lagoon cockle (and perhaps cockle)). The pig and cattle bones are identified as domestic because of their small size. Even if we reckon with 10% shrinkage of the burnt pig bones and the sole cattle bone (see below), the fragments are too small to come from wild boar or aurochs (Lyman, 1994, 386–7). The marine mollusc shell fragments probably came from the clay sediment covering the site.

A total of 86 of the animal remains (24%) in the 5 mm sieve fraction are calcined. These bones were burnt at temperatures of at least 700 °C. These are bones from pig (1x), unidentified birds (2x), mammal of cattle/horse size (1x) and unidentified mammals (82x). Another 41 bone fragments (11%) were burnt at temperatures between 500 and 700 °C; they show black patches or are completely black (Lyman, 1994: 384–392). These are bones of pig (6x), cattle (1x), an unidentified bird (1x), unidentified mammals (31x) and flounder/plaice/dab (2x).

Eight of the twelve pig bones are upper and lower tooth fragments. This high proportion of dental elements will be the result of their high recognisability and of the durability of these elements. Three pig tooth fragments represent infantile or juvenile pigs, the others are from subadult or adult pigs. The four non-dental pig bones are a petrosum, which is the most stable part of the skull, a small part of a tibia, a phalanx 2 of a young pig and a sesamoid. The cattle bone fragment is a *processus articularis* of a mandible. The only bird bone that could be identified is part of a scapula of a mallard. The five bones of Pleuronectidae, more precisely flounder/plaice/dab, are part of a basioccipitale, two precaudal vertebrae, a caudal vertebra and part of an os anale (table 6).

The 2 mm mesh sieve fraction

A total of 266 animal bone and mollusc shell fragments, with a total weight of 3.5 g, were recovered from the 2 mm mesh sieve. Most bones in this fraction are heavily fragmented and weathered as well. A total of 100, with a total weight of 0.5 g, could be identified to species, genus or family. The remaining 166 remains are very small fragments of mammal, bird and fish bones (table 5).

The identified remains only represent wild species: three (or four) wild mammal species (stoat, root vole and common vole and/or field vole), three fish species (eel, flounder (and perhaps other Pleuronectidae) and presumably sea bass), three marine mollusc species (laver spire shell, rough periwinkle and a cockle species) and a freshwater mollusc species (button ramshorn snail).

Twenty-nine of the bone fragments recovered from the 2 mm mesh sieve are burnt (11%). Half of them (6%) are calcined; the others (5%) are black. The calcined bones are the two flounder bones, a flatfish bone, an unidentified fish bone and eight mammal bone fragments. All black-burnt bones are mammal bone fragments.

Table 5. Animal remains from the 2005 excavation at Wetsingermaar. N: numbers of identified remains; W: weight of bones/shells in g.

	5 mm mesh sieve		*2 mm mesh sieve*	
	N	W	N	W
Domestic mammals				
Sus domesticus, pig	12	5.4		
Bos taurus, cattle	1	4.6		
Wild mammals				
Mustela erminea, stoat			3	0.0
Microtus oeconomus, root vole			28	0.2
Microtus agrestis or *M. arvalis*, field vole or common vole			1	0.0
Microtus sp.[1]			41	0.0
Mouse, unidentified			2	0.0
Wild birds				
Anas platyrhynchos, mallard	1	0.4		
Fishes				
Anguilla anguilla, eel			1	0.0
Pleuronectidae, *in casu* flounder / plaice / dab	5	0.1	8	0.0
Platichthys flesus, flounder			2	0.0
cf. *Dicenthrarchus labrax*, cf. see bass			3	0.2
Marine molluscs				
Hydrobia ulvae, laver spire shell			1	0.0
Littorina saxatilis, rough periwinkle			1	0.0
Mytilus edulis, mussel	1	0.0		
Scrobicularia plana, peppery furrow shell	1	0.2		
Cerastoderma lamarcki, lagoon cockle	2	0.6		
Cerastoderma lamarcki or *C. edule*, cockle	10	0.7	1	0.1
Freshwater molluscs				
Anisus leucostoma, button ramshorn snail			1	0.0
Unidentified remains				
Mammal of cattle/horse size	3	13.2		
Mammalia, mammals	308	68.3	143	2.8
Aves, birds	16	1.0	23	0.2
Pisces, fish			7	0.0
Total	360	94.5	266	3.5
total identified	33	12.0	100	0.5

[1] 2 of the 41 Microtus sp. bones are cf. root vole

Fig. 13. The lower left and lower right first molars and the lower right canine from presumably the same adult stoat, *Mustela erminea* (W. Prummel, RUG/GIA).

The three stoat bones are the lower left and the lower right first molars and the lower right canine from presumably the same adult stoat (fig. 13). The root vole is represented by three lower left first molars and 25 incisors from the upper and the lower jaw. A right upper first molar and a right upper second molar listed as 'vole' (*Microtus* sp.) may in fact be root vole molars. A lower left first molar is from a field vole or a common vole. The 39-41 remains identified as 'vole' are upper or lower molars and incisors. The bones from one or two unidentified mouse species are a femur and a long bone.

Vertebrae predominate among the fish remains. Other parts of the skeleton that are represented are vomer (two

Table 6. Distribution of the mammal, bird and fish remains over the skeleton.

5 mm sieve: mammals and birds

	pig	*cattle*	*mallard*
Cranium	1		
Maxilla	1		
Mandibula	4	1	
Maxilla/mandibula	3		
Scapula			1
Tibia	1		
Phalanx 2	1		
Ossa sesamoidea	1		
Total	12	1	1

5 mm sieve: fishes

	flounder/plaice/dab
Cranium (basioccipitale)	1
Vertebra praecaudalis	2
Vertebra caudalis	1
Os anale	1
Total	5

2 mm sieve: mammals and birds

	stoat	*root vole*	*field/common vole*	Microtus sp.	mouse
Maxilla (teeth)				9	
Mandibula (teeth)	3	3	1	2	
Maxilla/mandibula (incisors)		25		30	
Femur					1
Long bone					1
Total	3	28	1	41	2

2 mm sieve: fishes

	eel	*flounder*	*flounder/plaice/dab*	*cf. sea bass*	*fish*
Vomer		2			
Supracleithrale			1		
Vertebra praecaudalis	1		3	2	
Vertebra caudalis			3	1	
Vertebra (undefined)					2
Unidentified element			1		5
Total	1	2	8	3	7

specimens) and supracleithrale (table 6). Both vomer specimens were identified as flounder. One is from a flounder which had both eyes on the right side of the body and the other is from an individual with both eyes on the left side.[6] Flounder belongs to the family of the Pleuronectidae (right-eyed flatfishes). All species from this family have both eyes on the right side of the body. However, reversed individuals, with both eyes on the left side, are quite common in flounder, less common in plaice and dab, and relatively rare in other Pleuronectidae (Wheeler, 1978). According to Nijssen and De Groot (1987), a flounder population may include 5-10% of left-eyed individuals.

Discussion

The heavy fragmentation and weathering of the mammal, bird and fish bones demonstrates that the bones were trampled by man and animals while lying on the site. This weathering happened in the period between the deposition of the bones at the site and the sedimentation of the clay sealing the site. As a result of weathering, an unknown number of unburnt bones may have completely disintegrated.

The domestic pig and cattle bones represent the livestock. Despite the low numbers, the proportion in which their remains were recovered (12:1) matches the predominance of pig and the poor representation of sheep/goat at the sites of the Swifterbant culture in the basins of the rivers IJssel and Vecht in the province of Flevoland. For instance, at the Swifterbant site S2, excavation 2004 (sieved material) yielded 11 pig bones, 1 cattle bone and 2 pig/wild boar bones. The RIJP excavation at the same site (hand-collected material) produced 6 pig bones, 1 cattle bone, 5 pig/wild boar bones and 5 sheep/goat bones. The BAI excavation at S2 (hand-collected and sieved material) uncovered 10 cattle bones, 108 pig bones and 156 bones of pig/wild boar. At the Swifterbant site S3 (hand-collected material) 321 cattle bones, 936 pig bones and 9 sheep/goat bones were found. At the site of P14 (Layers A-C) 83 cattle bones were recovered, 329 bones of pig/wild boar and 4 bones of sheep/goat (Bakels & Zeiler, 2005: table 14.2; Gehasse, 1995; Lauwerier *et al.*, 2005; Prummel *et al.,* 2009; Zeiler, 1997). At the same time, most Swifterbant sites in the Rhine-Meuse area of the Netherlands have a higher representation of cattle and sheep/goat remains than do the Swifterbant sites of Flevoland (Oversteegen *et al.*, 2001; Robeerst, 1995; Zeiler, 1997).

Because most Drouwen and Havelte TRB sites in the Netherlands are situated on sandy soils with poor preservation conditions, we are poorly informed on the animal husbandry practised by their occupants. So far, the only TRB site at which bones have been found in great numbers is that of Slootdorp-Bouwlust (province of North-Holland) (date c. 3000 cal. BC). Its inhabitants kept dogs (30 bones), pigs (47 bones of pig or wild boar) and sheep and/or goats (57 remains), and perhaps cattle (83 bones of cattle or aurochs). Game hunting was as important as animal husbandry. The inhabitants of Slootdorp-Bouwlust were also involved in fowling (46,211 bones) and fishing (790 bones) (Lauwerier, 2001; Schnitger, 1991). Cattle bones often predominate over pig and sheep/goat bones in German and Danish TRB sites (Benecke, 1994: *Abb*. 53; Gehasse, 1995: table 9.8). At the German early TRB site of Siggeneben-Süd, dated from c. 3800 cal. BC onwards (Hartz *et al.*, 2007: 584), cattle (22 bones) outnumbered pigs (17 bones) and sheep/goat (3 bones). Dogs are represented by 7 bones (Nobis, 1983). In spite of the very small number of identified animal remains at Wetsingermaar, the predominance of pig bones over cattle bones and the absence of sheep/goat remains suggest a form of animal husbandry like that practised by Swifterbant people in the province of Flevoland rather than the cattle-dominated husbandry known from the northern TRB groups.

The three stoat teeth, presumably from one animal, are the only indication for game hunting. The stoat was hunted for its fur. It prefers coniferous and mixed forests to live in, but can also be found in hedgerows at the boundaries of fields and meadows, on scrubby riverbanks and on lake shores. Because its food mainly consists of rodents, it often occurs in habitats rich in rodents (Pulliainen, 1999). The Pleistocene island on which the Wetsingermaar site was situated must have been rich in voles (table 5). Fowling was done at least for mallard, which will have lived on freshwater pools on the island and along the coast of the island.

We assume that the occupants caught their fish near to the site. The gullies and the adjacent tidal flats that surrounded the island were most suitable for catching fish. The fishing gears used for catching eel were most probably a wickerwork fish trap of the kind that has been found at various Mesolithic and Neolithic sites in the Netherlands, such as Hardinxveld-Giessendam De Bruin (Louwe Kooijmans *et al.*, 2001), Hoge Vaart (Hamburg *et al.*, 2001), Bergschenhoek (Louwe Kooijmans, 1986) and Emmeloord (Bulten *et al.*, 2002) or the leister. Flounder was actively caught by 'flounder treading', with spears or leisters, and passively with an osier hurdle (a weir) that was permanently erected on the tidal flats. Besides flatfish, species such as bass and grey mullet too may have been trapped behind such hurdles at low tide and collected for consumption.

Although it is not impossible that the site's inhabitants consumed mussel (*Mytilus edulis*), lagoon cockle (*Cerastoderma lamarcki*) and perhaps common cockle (*Cerastoderma edule*), it is more likely that these shell fragments originate from the clay sediments covering the site, since most of them were found in the upper spit of the site. The same holds for the other finds of seashells (table 5). The lagoon cockle shells confirm that stagnant brackish to salt water prevailed during the period of clay sedimentation on the site (Prummel & Heinrich, 2005: 69; Prummel *et al.*, 2007).

The finds of the root vole demonstrate that moist to wet vegetations with high plant coverage were available in the area. This vole species may have found a suitable freshwater habitat on the shore of the island or in wet grassland on the island itself (Van Apeldoorn, 1999). Dutch Neolithic finds of the root vole, which is a western relic of the original /Europe-wide population, are known from the northern part of the province of North-Holland (Prummel & Heinrich, 2005: fig. 2; Zeiler, 1998) and from the province of South-Holland (Zeiler, 2006). The species was also recovered at the *terp* site of Englum (early Roman period) in the province of Groningen (Prummel 2007: table 8.4) and in the *terp* sites of Wijnaldum (Roman period - Early Middle Ages) and Oosterbeintum

(Migration Period and Early Middle Ages) in the province of Friesland (Prummel & Heinrich, 2005: fig. 2).

The field vole lives in moist habitats with a rich grass cover. It may have found this type of habitat in woodland, marsh and wet meadows on the lower parts of the island (Zima, 1999a). The common vole prefers open cultivated farmland, grazed pasture and short meadow grass (Zima, 1999b). This type of habitat was perhaps present on the highest parts of the island. The island will have contained biotopes suited for both types of vole.

The biotope of the only freshwater mollusc recovered at the site, the button ramshorn snail, is freshwater marshland and small or tiny freshwater bodies that dry out periodically. The minimum pH is 5.4. The species may live in slightly brackish biotopes, up to 8.4‰ salinity (Gittenberger *et al.*, 1998: 147/148). The presence of a shell of this species suggests that alkaline, fresh water was present on the boulderclay island. The alkaline conditions may have favoured the bone preservation.

Conclusion

The animal remains from the site of Wetsingermaar show that the inhabitants of the site kept domestic pigs and cattle. They hunted for stoat and mallard. These domestic and wild animals will have lived on the Pleistocene island on which the site was situated. The root vole, the field vole and/or the common vole, and the button ramshorn snail lived in wet areas on the island. The inhabitants caught fish in the gullies and on the tidal flats near the island.

4. SYNTHESIS (Raemaekers)

The 2005 investigations yielded important insights into the research questions presented in the Introduction. Regarding the first research question on site size and local topography, the extensive coring programme indicated that Wetsingermaar is a site of at least 1.4 ha, occupying a Pleistocene coastal island. The pottery analysis showed that the material across the site is fairly homogeneous. This suggests that the site may have been occupied intensively during a comparatively short period of time (a few centuries?). If this assumption holds true, Wetsingermaar is remarkable. In the Dutch Neolithic, large settlement sites consisting of multiple contemporaneously occupied farmsteads are little known, apart from Bandceramic sites. The best parallel is Schipluiden near The Hague, dated around 3600-3400 cal. BC, *i.e.* almost contemporary. This site covered some 0.5 ha, divided into four farmsteads and occupied continuously for c. 130-370 years (Louwe Kooijmans & Jongste, 2006).

The density of archaeological finds in the corings at both sites is comparable in terms of flints and pottery.[7] At Schipluiden, the corings (having a similar diameter) on average yielded 1.6 and 0.3 finds of flint and pottery respectively (Deunhouwer, 2003: 48–50). These figures for Wetsingermaar are 1.1 and 1.5. If site density is similar and Wetsingermaar is at least three times the size of Schipluiden, what kind of site is this? If the occupation period is indeed short, a hamlet-like settlement might be envisaged, but of course a doubling of the occupation period would reduce the settlement size by half. The fact that its limits were not determined hampers a proper interpretation of the site. The available data suggest that it occupies a fairly flat Pleistocene surface, to the west bordered by a stream that connected the inhabitants to both the coastal area and the sandy interior. One might surmise that large boulders were collected along this stream and built into one or several megalithic tombs.

The small-scale investigation prohibits a lengthy discussion of site function. While it may be that the presence of boulderclay flint at a mere depth of some 10 cm was a reason to settle here, one might also presume that the agricultural potential of this flat area was the primary attraction. The use of local flint was proposed on the basis of the characteristics of the assemblages from both the 2000 (Feiken *et al.*, 2001) and the 2005 research; cultivation of cereals cannot be proven owing to the absence of charred remains. The list of attested or assumed activities is short. Diatom analysis carried out in 2000 suggested that the pottery was produced locally, while flint working is likely as well. The flint tools also point to several activities. These are hunting and the working of various materials. The zoological remains indicate that domestic animals, mostly pigs, wild mammals, birds and fishes were exploited. All in all, the finds suggest that Wetsingermaar was a settlement site.

The second research question pertains to the age of the archaeological remains and their cultural attribution. This question was not addressed by ^{14}C dating, because of the unproven association between dated charcoal and the archaeological finds. The charcoal date does suggest human activity around 3500 cal. BC. Is this a date that can be underpinned with the available archaeological evidence? This research question was addressed by means of comparing the potsherds and flint artefacts with known assemblages. The comparison was troubled by the relatively meagre insights into the technological characteristics of Dutch TRB pottery, the lack of published contemporaneous flint assemblages and the near absence of subsequent TRB flint assemblages from settlement sites. Taking these problems into account, cultural attribution must be carried out with caution.

It is important to underline the similarities of the Wetsingermaar sherds and those from P14 (Ten Anscher, 2012: chapter 5) and Swifterbant S25 (Raemaekers & Geuverink, 2009; Raemaekers, 2011), which are both interpreted as pre-Drouwen TRB. These similarities are found in terms of temper, coiling technique and decoration. The Wetsingermaar flint artefacts occupy an intermediary position between the Swifterbant flints and the TRB assemblages, but fit the TRB data best. Though

the Swifterbant S25 flint artefacts have not been studied extensively, the impression is that they represent a flake technology. The Wetsingermaar ceramics and flints show that around or shortly after 4000 cal. BC a relatively swift change in material culture occurred. The outcome of this change is quite similar to the material culture of early TRB sites in northern Germany and Denmark. The distribution of the domestic mammal remains fits more with Swifterbant sites than with TRB sites, but the Wetsingermaar number of remains is small. On the basis of these similarities, it seems justified to propose that Wetsingermaar represents an early TRB group on the western margin of the North European Plain.

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6. NOTES

1. In Dutch terminology: N-/Z-joins and H-joins, respectively (see Stilborg & Bergenstråhle, 2000).
2. The following metric and non-metric parameters were recorded: find number, type and subtype of artefact, length, width, thickness, weight, burnt or unburnt condition, completeness, type and percentage of cortex or other old surfaces and post-depositional surface modifications.
3. The length and width of trapezes and transverse points refer to the length and width of the blank ('technological length [and width?]') and not necessarily the maximum dimension of the artefact or the direction in which the objects were hafted.
4. Drawings of the transverse points from the unpublished SGC grave at Borger were made available to us by J.N. Lanting (GIA).
5. It is interesting to note that the length-width ratios that were determined for transverse points from a number of other megalithic graves (not depicted) are very similar to those from D19-Drouwen.
6. The skull of a Pleuronectide is asymmetrical. Morphologically, the elements of the left side of the skull match those of the right side. However, they are not each other's mirror image. Also the unpaired elements, such as vomer and parasphenoid, are asymmetrical.
7. The density of bone finds is considerably less at Wetsingermaar (17.8 *vs*. 1.6 finds per coring). This is probably the result of the poorer preservation at Wetsingermaar.

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