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Hunting beneath the waves. Bone and antler points from North Sea Doggerland off the Dutch coast

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Abstract
Bone and antler barbed points form one of the most common categories of finds from the submerged prehistoric landscape of the North sea, also known as 'Doggerland'. They are usually found in redeposited sediments from the off-shore coastal zone. Some 30 years ago a first analysis of these hunting weapons was published, based on more than 400 finds. Meanwhile their numbers have doubled and verge on 1000, making them one of the larger artefact groups from this relatively unknown area. Also the number of sites from which these points derive has increased due to coastal reinforcement and the extension of Rotterdam harbour. Gradually more information is becoming available that these points can contribute to inter-site distinctions and different subgroups. While there is a need for further dating and chronological control, this find group, in combination with for instance characteristic lithic finds and human remains, might in the future provide a better grip on the communities of hunter-gatherers that inhabited this area. This is of particular importance since within the spectrum of finds there are two size groups. The smaller points, of a length of up to 88.5 mm, appear to form a separate group of points in the find spectrum of Western and Northern Europe.

1 Introduction

Bone and antler points are increasingly becoming an interesting topic of research in the Low Countries. Almost every other week a new one is found. This is remarkable since much of the current land surface in the Netherlands and across the border into Belgium is not very conducive to the preservation of artefacts of organic material (Amkreutz 2013). Most finds therefore derive from waterlogged sediments situated at or in front of the current coastline. These sediments predate the final inundation of the North Sea basin in the sixth millennium BC (Peeters/Momber 2014; Weninger et al. 2008) and as such contain the remains of activities and camps dating to the Mesolithic, belonging to what is currently known as 'Doggerland' (Coles 1998). These aggregate sediments were and are extracted and used in an industrial manner, predominantly in the construction of harbours and the consolidation of beaches in coastal protection measures (Moree/Sier 2015; Peeters/Momber 2014). As such they have become accessible to the public, both professional and amateur. These sediments not only provide faunal and geological specimens, but have also contributed to a dramatic increase in the number of archaeological finds. Amongst these are now several hundreds of bone and antler points.

An initial study of these was conducted by L. B. M. Verhart in the 1980s (Verhart 1986; 1988). A total of 434 points was analysed, all deriving from the Maasvlakte 1 area southwest of Rotterdam. Almost thirty years later new infrastructural works led to new large-scale extractions in tandem with ongoing beach consolidations. These have yielded hundreds of additional points so far. Counting now more than 1000 points from a larger number of sites justifies a renewed look at this corpus of finds. In a recent study (Spithoven 2016) these were analysed in detail. Here we present the results of this research, focusing in particular on the differences and similarities between sites, typological issues, dating, and avenues for future research. Our aim is to provide an increased understanding of this particular group of bone and antler points, especially since it appears to assume a distinct position in the corpus of bone and antler points in Western and Northern Europe. First, however, we sketch part of the historical background of this research.

2 History of research and the importance of North Sea archaeology

The study of bone and antler points is not a given topic for the Low Countries. In contrast to other northwest European sites with elaborate finds of barbed points, such as Star Carr in the United Kingdom (UK) (Elliott/Milner 2010), the Scandinavian Maglemose sites (Blankholm 2008), or German sites such as Hohen Viecheln (Schuldt 1961), Duvensee (Bokelmann 1971), or Friesack (Gramsch 2016), evidence is overall very scarce. The reason for this may be found in the fact that decalcified loess soils and acidic sandy soils characterise much of the area, making much of prehistory a very lithic story (Amkreutz 2013). In the west and part of the north of the country chances are better. Peat and clay sediments are present there, and they have yielded a number of high quality sites of Mesolithic and Neolithic age that produced rich faunal finds as well as organic artefacts (e.g. Louwe Kooijmans 2003; 2005; Koot et al. 2008). Unfortunately, most of these sites are situated at a considerable depth, often below the groundwater table, or have been covered up by younger sediments, making archaeological investigation a rare and costly exercise. Moreover, none of these sites yielded bone or antler barbed points. This indicates that they are either too young (the earliest dates for the Hardinxveld sites are around 5500 BC [Louwe Kooijmans 2003]), or that the tradition of making bone and antler barbed points was not practiced here. Unfortunately, even when older Middle Mesolithic sites in the area, such as at Rotterdam-Beverwaard (Zijl et al. 2011) were uncovered, they did not have the right conditions of preservation, leaving open the functional, chronological, or cultural questions to the absence of these artefacts.

This leaves us with a very barren record for studying bone and antler points as only isolated finds remain, such as the barbed point from Emmererfscheidenveen, which was probably found in a bog in the east of the country (Louwe Kooijmans 1971, 58–59). The appearance of dozens of bone and antler points from the Maasvlakte 1 area in the 1970s (Louwe Kooijmans 1971) formed a welcome addition. In the 1980s the number of finds drastically decreased, but the development of a second harbour extension in recent years (Maasvlakte 2), beach reinforcements and geo-ecological projects such as the 'Zandmotor' (meaning: the 'sand engine') again led to a sharp increase in finds, in particular because a large group of amateur palaeontologists and archaeologists actively search the beaches in order to find palaeontological specimens and artefacts (e.g. Amkreutz et al. 2016; Peeters/Momber 2014). These finds mainly derive from a number of sites located several miles off the coast and are therefore also distinctly related to the Mesolithic occupation of Doggerland. This clearly demonstrates the importance of the North Sea for understanding the material (and other) aspects of the hunter-gatherer occupation, not only of the Low Countries, but for northwest Europe in general. This deserves some further elaboration.

For the Netherlands systematic research into the archaeology of the drowned land under the North Sea is a fairly recent endeavour. In 1971 L. P. Louwe Kooijmans published an overview of worked pieces

of bone and antler, mainly dating from the Mesolithic (Louwe Kooijmans 1971). These finds originated mostly from fishing nets or dredging. The development of the Maasvlakte 1 area subsequently yielded a lot of archaeological remains as argued above.

While attention for North Sea archaeology afterwards became less intensive in the Netherlands, the definition of and attention for Doggerland in the UK (Coles 1998; Gaffney et al. 2009; Peeters/Momber 2014) and the increase in industrial and economic activities in and around the North Sea again yielded increasing numbers of finds, in fishing nets, in the aggregates industry, and in beach filling measures. For the Palaeolithic the large haul of Neanderthal artefacts including numerous handaxes off the coast of Great Yarmouth and the find of a frontal bone of a Neanderthal individual off the Dutch Zeeland coast formed important discoveries (Hublin et al. 2009; Tizzard et al. 2014). Simultaneously large parts of the southern North Sea basin were mapped using corings and other information (e.g. Gaffney et al. 2009; Hijma et al. 2012). This information is gradually providing a geomorphological and ecological context for human occupation, both during the Pleistocene and the Holocene, as well as with regard to the characteristics of inundation (Hijma/Cohen 2010; Weninger et al. 2008). The development of this context is still in its early days, but in view of the increasing number of finds it is of considerable importance. These finds mainly derive from the new infrastructural projects mentioned above. Apart from the Maasvlakte 2 area and the Zandmotor (see Fig. 1) these also include the reinforcement of beaches along the Dutch coast for which 20,000,000 m^3 of sediments are extracted every year. The sediments yield many finds of Palaeolithic and Mesolithic age. These include large quantities of faunal material, but also many lithic and organic artefacts amongst which are hundreds of bone and antler points and dozens of human remains. Most dating evidence for these finds points to the Mesolithic (e.g. Meiklejohn et al. 2015; van der Plicht et al. 2016). As argued earlier, most quarrying locations are situated several miles off the coast. Because of this a number of factors should be mentioned that are of importance when dealing with these finds and interpreting bone and antler points.

First, the finds are discovered mainly on the beaches. This means they are found in secondary contexts and there is no necessary or even likely direct relation with the material that is found in their vicinity. The reason for this is the fact that the sediment is extracted by large vessels, so-called 'trailing suction hopper dredgers', from designated areas off the coast and subsequently sprayed ('rainbowed') onto the beaches. Material within the sediment is therefore firstly intensively mixed and then displaced. Larger pieces also often suffer damage. Secondly, object recovery depends on collectors and beach walkers. With a few notable exceptions (people who keep track of dates, wind direction, tides, etc.), there is often little (archaeological) system in where and when they walk and how this relates to erosional processes on the beach in particular areas. The location of finds on the beach is often noted with relative precision, but this mostly only allows an association with a quarry location. Moreover, over time one can envisage that repeated beach filling activities from different areas may overlap and sediments erode in a complex manner.

Thirdly, there has been little archaeological monitoring of the extraction activities. Occasionally an exception is made. For instance area 240, where many Neanderthal artefacts were found off the Great Yarmouth coast, was intensively researched and sampled, which led to further finds and the conclusion that submerged and buried areas with intact palaeo-landscapes had survived there. Similarly, geoarchaeological and palaeontological research was undertaken at the quarry area of Maasvlakte 2 which may in the future yield indications for relations between sediments on the beach and lithostratigraphic units in the extraction area (Kuitems et al. 2015). Overall, however, these are exceptions, and little to no archaeological surveying takes place in these areas. So, while there are perspectives for a better integration between extraction and find locations, this is at the moment only of limited use.

This means that for the particular set of bone and antler points discussed here most of the information available is strongly related to the objects themselves. While this provides certain obvious drawbacks,

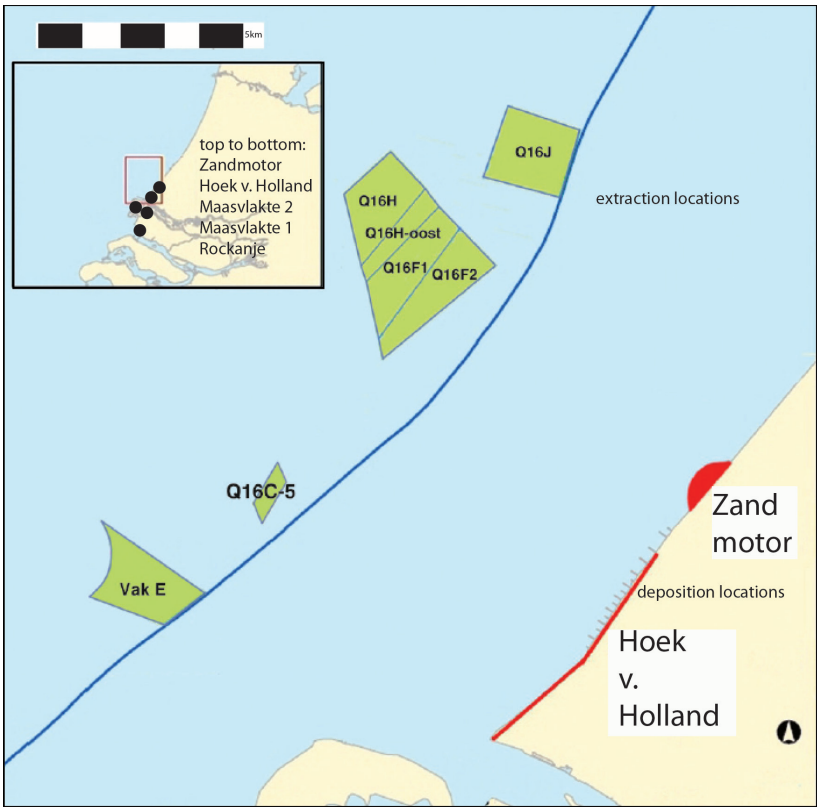


Fig. 1. Map of the Dutch coast (insert) with sites mentioned in the text. Larger map: Zandmotor and Hoek van Holland area and sand extraction sites (after Langeveld 2013).

much may still be learned from these artefacts. In this paper we will sketch the characteristics and dimensions of this find group. In incorporating the points that were found over the last years new possibilities come into existence regarding chrono-typological and functional aspects in relation to distribution. First we will provide the outlines of the research that was done in the 1980s.

3 The study by L. B. M. Verhart

In 1988 Verhart published a first study (Verhart 1988) of the characteristics of the barbed points found in the Netherlands (Fig. 2a). The absolute majority of these objects came from the Europoort area and were found on Maasvlakte 1. The sand for this project came from the North Sea, from sands recovered from what is now the Oostvoornse Meer, a lake situated just south of Maasvlakte 1. The majority of finds studied by Verhart were bone and antler barbed points from several collections (434 in total), most of them found between 1981 and 1983. Verhart provided an elaborate statistical analysis of the morphometric properties of the points and delved into their technological characteristics and fabrication techniques. From these characteristics he built a morpho-typology of the so-called 'Europoort group' as a whole and elaborated on aspects of dating and use. Finally he compared this group to other point groups in a Mesolithic northwest European context.

The statistical analysis of the metric properties of the complete points allowed for the distinction of two size groups (see Figs. 4–5). A group of 'small points' with a maximum length of 85 mm each, a simple cross-section, a mean barb length of c. 4 mm and a specific selection of barb types was distinguished from a group of 'large points' with a minimum length of 94 mm, a mean barb length of c. 13 mm, different barb types and predominantly sophisticated cross-sections (Verhart 1988, 187). The differences in barb types relate to the techniques used in their execution. The differences in cross-sections mainly refer to the degree to which the barbed area was prepared (i.e. thinned) by cutting and scraping, which lead to a pear-shaped cross-section. One bi-laterally barbed point found in the Maasvlakte 1 material still remains an exception. Within the group of small points a number of points remained plain and were used without barbs. Most points show four barbs that are placed rather close to the tip. In the group of large points there was one item that demonstrated a barb or notch qualifying it as a harpoon. Overall a number of points demonstrated

Fig. 2. Typical bone and antler points: a – previous finds (photo: National Museum of Antiquities); b–c – points found recently on the Maasvlakte 1 beach in the Netherlands (photos E. J. Spithoven). Not to scale.

evidence of intensive use and repair. Also of importance: Verhart determined that 70 % of the points were made of bone (metapodials and ribs) and about 25 % of antler. They were fabricated by splitting the metapodials, followed by the groove-and-splinter technique on both bone and antler (Verhart 1988, 171).

Verhart interpreted the points as deriving from hunting and fishing activities. The smaller points would have served as implements for arrows used in hunting (of mainly birds) or fishing with bow and arrow, while the bigger points were interpreted as resulting from fishing or hunting activities using a spear or a lance (Verhart 1988, 189). Verhart based this more or less on the absence of debris from other activities, lithics in particular. While this may be true from a functional perspective, the new finds described below are often found together with, although not any longer in association with, many other artefacts that represent a variety of activities. These include an elaborate corpus of lithic finds, mainly dating to the Mesolithic.

One of the aspects of Verhart's study is formed by a comparison with other assemblages of bone and antler points in Europe. Based on morphological comparisons and 14C-datings Verhart defined a new typology building from Clark's (1936) original outline. Based on this there are good comparisons for the group of uni-laterally barbed points, with either widely spaced or fine-toothed barbs as well as for the single bi-lateral point. Most evidence indicates a chronological position in the Early Mesolithic, roughly between 9950–9700 uncal. BP (1950), with some chronological and geographical differences (Verhart 1988, 183). In a later publication Verhart (1995) published a broader range (9950–8060 uncal. BP [1950]). A footnote in the earlier publication already points out that the rather large group of small points poses a problem with respect to chronology. Then, only one date was available to Verhart for the small points (RMO inv. no.: h 1982/6.25; Ua-643: 6160±35 uncal. BP), and with a calibrated date of 5096±165 cal. BC, this is rather too young when compared to the inundation of the last part of the North Sea basin, following the draining of Lake Agassiz and events such as the Storrega slide (Hijma/Cohen 2010; 2011; Peeters/Momber 2014;

Weninger et al. 2008). Possibly the sample was contaminated, but this still leaves us in the dark regarding the chronological position of the group of small points. This is of particular importance since it has turned out that while the large points in either their fine-toothed variant or with widely spaced barbs may 'fit' the northwest European range of postglacial bone and antler points, the small points do not. Rather, it appears that the latter group is distinct to the southern North Sea area and has so far only been found at (secondary) sites in the Netherlands. Given the recent infrastructural works introduced above and the subsequent increase in the number of points it is time to have a more detailed look at both the smaller and larger barbed points from this area. In the following we will present the morphological characteristics of this expanded corpus of finds and provide an idea of its chronological, functional, and typological characteristics.

4 New research

For the new research (conducted by M. Spithoven; see Spithoven 2016) a total of 789 organic projectile points were investigated and 389 new points were documented (Fig. 2b–c). Currently 811 points have been documented in total, and it is expected that up to or even more than a thousand have meanwhile been found. They derive from several locations in Zuid-Holland in the Netherlands, mainly from beaches. The most important discovery sites are 'Maasvlakte 1', 'Rockanje', 'Hoek van Holland', and 'de Zandmotor' (see Fig. 1). The points are mainly found and kept by collectors who search the beaches for fossils and archaeological remains (Langeveld 2013). A number of these collectors have been contacted, and their points have been studied and documented in a number of house visits or during 'open days' where people could bring in finds. Recent reclamation areas such as 'Maasvlakte 2' (see Moree/Sier 2015), together with the popularity of fossil hunting at these locations in combination with the benefits of social media and even websites where finds can be discussed (see www.oervondstchecker.nl), partially explain this new boost in finds.

The sites or beach filling areas where most points are found are associated with specific sand extraction areas off-shore. The aim of the research was to specify whether significant differences between these different areas could be detected and what that would mean. Thereby the focus was on a number of topics:

- What are the different production methods for these projectile points?
- What different types of projectile points were found?
- Are there different projectile points for different weapons?
- Are there different projectile points used for different types of hunting?
- What types of projectile points were found at the main sites?

Information on the points was documented in a new database, including metrical and formal characteristics and photos. Similar data as those collected by Verhart (1988) were registered, as well as additional variables. Apart from discovery date, site, and a photograph, these included measurements of the length, width, thickness of the point and of the barbstrip as well as the weight and furthermore the state of preservation, cross-section, material (antler or bone), number of barbs, regularity of the barbs and the shape of the incisions of the barbs. Also the presence of a worked base, the presence of a binding barb (for harpoons), and the presence of binding traces and working traces were recorded.

The data have subsequently been analysed with the statistics program SPSS. This resulted in different associations and patterning for the numeric as well as the categorial data, offering the basis for a new typological classification.

In the following we aim to outline the results of this new analysis. While conclusive answers are still missing, partly in relation to dating issues and a lack of information on the original findspots, it is possible to make a first synthesis. We hope to present an overview of the diversity regarding the Dutch corpus of bone and antler points and as such offer a basis for comparison with other regions in Europe.

5 Primary and secondary sites

For this research the four most important sites are studied (Table 1). Most points were found at Maasvlakte 1, followed by Rockanje and Hoek van Holland. The fourth site is the Zandmotor, but this particular site has a different composition of points compared to the adjacent beach, Hoek van Holland. Furthermore, there are some smaller sites further inland. The sand there originates from the Eurogeul or the Maasmond (the shipping route into Rotterdam Harbour and its direct approach, the area where the Rivers Maas and Rhine flow into the North Sea).

The main sand source for Maasvlakte 1 is the Oostvoornse Meer. Partially sand also originates from the location itself, because deep canals and a harbour were built there. The sand from both sources is part of the old Rijnmond region, the deltaic estuary of the Rivers Rhine and Meuse that characterised the Mesolithic period here. The points from Maasvlakte 1 are typo-chronologically dated to the end of the Palaeolithic until the beginning of the Mesolithic. During this period the primary site saw a number of different landscapes as the sea gradually approached (e.g. van Kolfschoten/Vervoort-Kerkhoff 1986, 13; 64). At the beach of Rockanje four areas were filled in the autumn of 2004 and the spring of 2005. The sand for this supplementation originated from the sand extraction site 'Bollen van Goeree'. One of the notable things about Rockanje is the high number of flint flakes and tools, including microliths, found there. The artefacts are dated to the Palaeolithic and Mesolithic. Also other items of worked bone and antler are found quite frequently at this site.

The beaches of Hoek van Holland and the Zandmotor are both intended to reinforce the Dutch coast. The Zandmotor ('sand engine'), which measures about a square kilometre, is in fact an experiment of managing dynamic coastlines. The supplemented sand is supposed to form a reservoir for the subsequent natural replenishment of the beaches by wave action and deposition. Apart from several bone and

Table 1. Number of points per site in combination with primary location of extraction.

Count	Secondary Site	Primary Site
416	Maasvlakte 1	Oostvoornse Meer and Maasvlakte 1
241	Rockanje	Bollen van Goeree
104	Hoek van Holland	Sand extraction sites Q16C-5 and Vak E
23	Zandmotor	Sand extraction sites Q16F, Q16H, Q16J
18	Maasvlakte 2	Two sand extractions sites near the Eurogeul
8	Pijnacker	Eurogeul
3	Berkel en Rodenrijs	Sea sand
2	Anlaeg 2e Beneluxtracé	Eurogeul
2	Zanddepot Waalhaven	Maasmond or Maasvlakte 1
1	Arendsduin	Sea sand
1	Barendrecht	Sea sand
1	Capelle aan den IJssel	Sea sand
1	Capelle nabij Koperwiek (winkelcentrum)	Sea sand
1	Kethel	Sea sand
1	Onbekend	Unknown
1	Rockanje/Oosvoorne	Bollen van Goeree, or unknown
1	Vlugterburg	Sea sand
1	Zanddepot Stormvloedkering	Sea sand
1	Zandpartij Den Hoorn	Sea sand
1	Zevenhuizerplas	Zevenhuizerplas

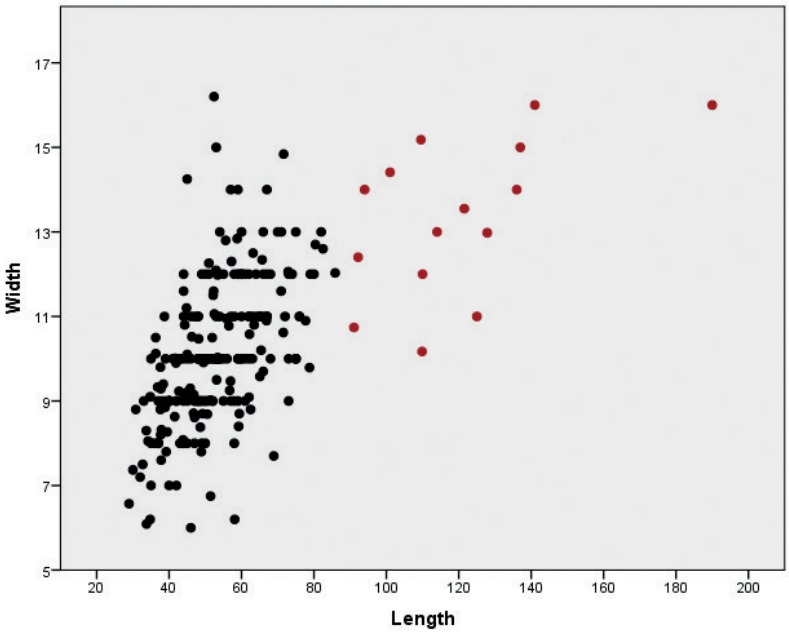


Fig. 3. Scatterplot of the width versus the length of all complete points incorporated in this research. Black dots: small points; red dots: large points.

antler artefacts and a number of points this site also yields large numbers of Palaeolithic and Mesolithic flint artefacts. A number of decades ago Verhart (1988, 187; 1995, 298) still argued that find locations from the Europoort area lacked finds that could be related to a more domestic occupation. The recent finds from beach filling areas seem to argue that part of this may have been related to research intensity and awareness among beach combers as more and more flint is found now.

Both Hoek van Holland and the Zandmotor are connected, yet they have different sand extraction areas and are therefore seen as different sites. At the beach of Hoek van Holland the last supplementation was in 2007 on the southern part and in 2009 on the northern part. At the Zandmotor the most recent sand filling took place in 2008 and 2009.

6 Numerical and categorial analysis

Based on measurements and visual inspection of the points gathered in the database an analysis of a number of numerical and categorial characteristics was conducted (Fig. 3). In order to prevent bias, only complete points were used for the analysis of numerical data. Two groups can be distinguished: the first one consisting of small points (Fig. 3: black dots) and the second one consisting of larger points (Fig. 3: red dots). The small points have a length between 28.9–85.9 mm and a width between 6–14.8 mm. The larger points have a length between 91.1–144.7 mm and a width between 10.1–16 mm. Verhart (1988) stated that small points have a maximum length of 85 mm and larger points a minimum length of 94 mm. This research now states a new maximum length for the small points as well as a new minimum length for the larger points. In this research the distinction line between these two groups lies at a length of 88.5 mm. This size is the average between the maximum length of the small points and the minimum length of the larger points. In reality the length and width ranges of the two groups will partly overlap.

6.1 Categorial data

A subdivision of the categorial data (barb shape, point shape, barb placement, etc.) is made by using frequency tables. On the basis of cross tables all categorial data were plotted against each other and discussed per site (see Spithoven 2016 for exact counts and information).

The shape of the barb incisions is one of the most important features used to distinguish the different types of points. From all researched points 38.5 % were made with incisions of type 2 (see Fig. 7 and

Verhart 1988, fig. 15), followed by 7.2 % with incisions of type 6, and 6.8 % with incisions of type 4. It should be noted that 26.1 % of the points were undeterminable in this aspect due to weathering.

Other categorial features are the chosen raw material (bone or antler) and the worked or unworked base and cross-section. These three features show differences between the Maasvlakte 1 sites and the other main sites. Most points found at the latter sites were made of bone (81.4 %), but the Maasvlakte 1 site has 22.9 % antler points in contrast to the other sites (Rockanje: 4.1 %; Hoek van Holland: 3.4 %; Zandmotor: 6.7 %).

Also, the base of a point was often modified to fit better on, or in the shaft. However, from the 789 points documented from the Netherlands only 60.8 % have a worked base. From the Maasvlakte 1 site the percentage is even lower (55.9 %). The cross-section of a point can either be simple (not worked any further) or sophisticated. A sophisticated cross-section means that the barbstrip is narrowed. The narrowing of the barbstrips seems to be meant as a way to make points more efficient. This modification has mostly been done on the outer part of the bone, probably to make the natural rounding more flat. At the Maasvlakte 1 site there is a vast portion of 70.1 % of points with a simple cross-section. This is in contrast to the other sites, where most points have a sophisticated cross-section.

6.2 Point types

In order to compare the four most important sites different types of points have been identified in a new typological classification based predominantly on numerical and categorial aspects (see Figs. 4–5 for a general impression and Fig. 6 for the categories). The points are divided into point types: arrowhead, spearhead, and harpoon. The former two are distinguished by length, with an arrowhead measuring less than 88.5 mm and a spearhead more than 88.5 mm (see above). The functional distinction will also be discussed further on.

Thereafter the points are divided into groups and subgroups. These subgroups or subtypes are predominantly based on an increase in the number of barbs. There was also a small number of simple points (points without barbs; see classification after Verhart 1988, fig. 24), but since these may be finished points, blanks or perhaps other tools, such as awls, these have been excluded from this typology. The different types of points will now be discussed in more detail.

Arrowheads with an oval base
An arrowhead with an oval base sometimes has a 'belly', which is a widening of the base at the side of the barbs. The barbs of this type of arrowhead are often made with one oblique incision, in the typology of Verhart (1988) this is incision type 2 (see Fig. 7). The number of barbs may be two, three, four, or five (subtypes 1, 2, 3 and 4).

Arrowheads with long barbs
This arrowhead type has characteristic barbs which are long and curved. The barbs are made by deep incisions in the shape of one or multiple crosses: incision types 5 and 6 (Verhart 1988). These arrowheads mostly have a worked base, and the number of barbs may be two, three, or four (subtypes 1, 2 and 3).

Arrowheads with a square base
The arrowheads with a square base differ from the ones with an oval base in the shape and execution of the base. The base of the square based arrowhead is produced by cutting grooves. The barbs of this arrowhead type are often produced with incision type 2, with one oblique incision. There may be three, four, or five barbs (subtypes 1, 2 and 3).

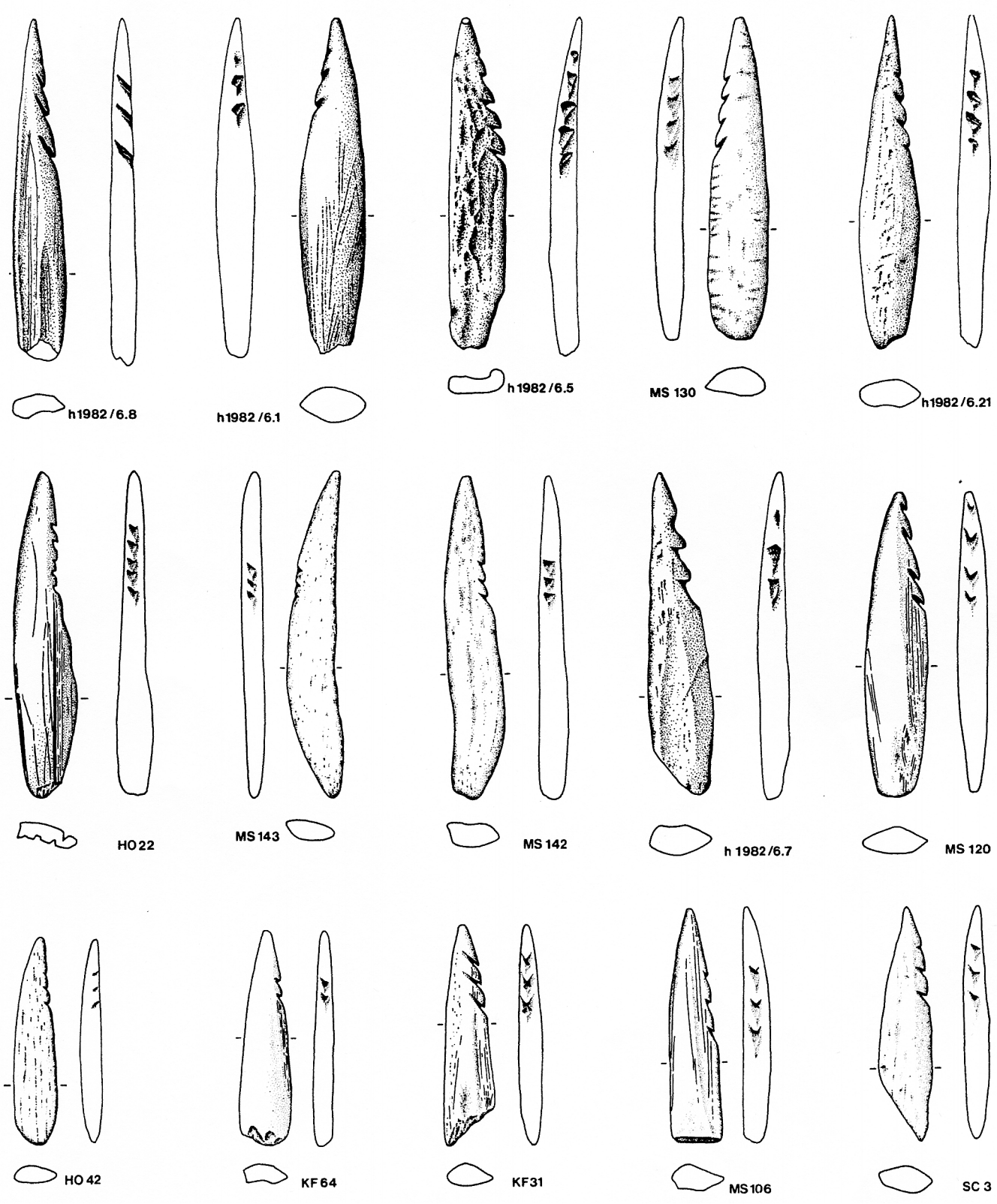


Fig. 4. Examples of the different types of smaller points (after VERHART 1988; scale 1:1).

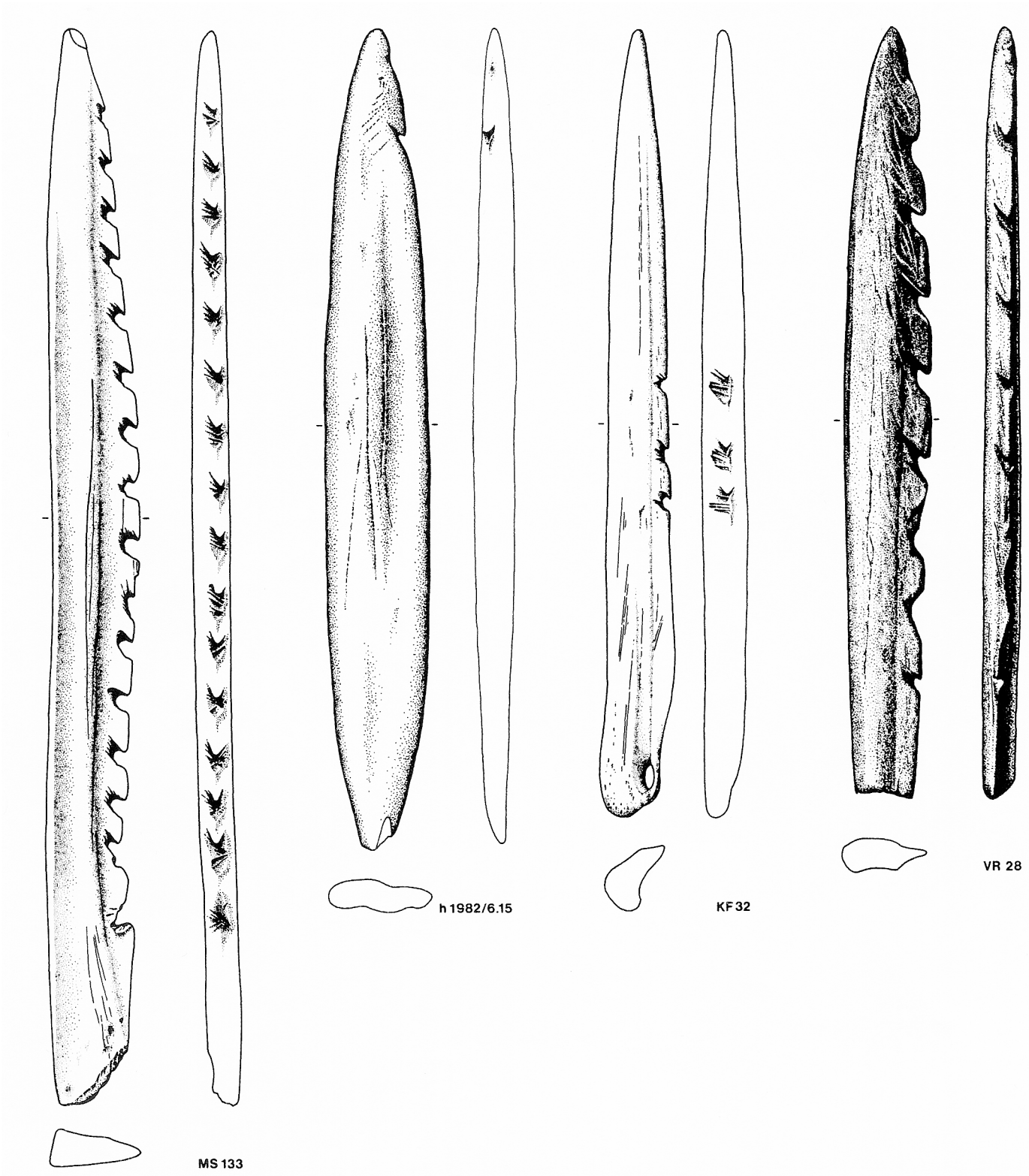


Fig. 5. Examples of the different types of larger points (after Verhart 1988; scale 1:1).

Fig. 6. Different point types as based on categorial and numerical data: a – arrowhead with oval base; b – arrowhead with long barbs; c – arrowhead with square base; d–g – spearhead types 1, 2, 3, 4.

Spearheads, type 1
This first type of spearheads often has regular barbs mostly produced with incision type 6 (Verhart 1988): incisions in the shape of multiple crosses. Incision type 6 in combination with another incision type is also possible. The space between the barbs is often round in shape. Sometimes (though rarely) such a point was used as a harpoon tip. To make this possible a hole was drilled into the base of the point to secure the line of the harpoon.

Spearheads, type 2
The spearheads of type 2 have four or five regular barbs. These spearheads have a sophisticated cross-section which means that the barbstrip is narrowed as well as barbed. The barbs are made with incision type 6.

Spearheads, type 3
The spearheads of type 3 are characterised by the fact that the barbs are only present in the middle section of the point. Because of this, the length of the barbstrip in relation to the length of the point is relatively short.

Spearheads, type 4
The spearheads of type 4 have an extra side (because of the rounded shape of the selected area of the bone), and the barbs are located only there.

Harpoons
It is not clear how many larger points are actually harpoon tips. Only one point could clearly be defined as a harpoon tip, because of the binding barb that seems to be present there in combination with the other barbs.

6.3 A visual comparison

For each site the composition of points has been studied (see Fig. 9). For Maasvlakte 1, however, there were not enough points identified by type at the time the research was conducted in order to draw conclusions for some aspects.

For Rockanje it is notable that there are more arrowheads than spearheads. The arrowheads found there are mostly arrowheads with an oval base and two or three barbs (subtypes 1 and 2). Among the spearheads, spearhead type 1 is the most common. In the histogram of Hoek van Holland it is also notable that more arrowheads than spearheads have been found, and only arrowheads with an oval base have been detected. Arrowheads with an oval base and three barbs (subtype 2) are the most common finds. Among the spearheads, types 1 and 2 are the most common. For the Zandmotor it is shown that more arrowheads than spearheads have been found there.

Spearheads of type 5 (not listed above) were found only after this contribution had already been written. This type of spearhead has only been found on the Zandmotor so far. Specimens have three barbs on top of the point made with incisions in the form of single or multiple crosses (incision types 5 and 6). Among the arrowheads, the ones with an oval base and three barbs are most common. No incision type 4 barbs were documented, although of course the number of finds at this site is still pretty low.

Although more sites and finds need to be studied, some characteristics may already be determined from this comparison. These include the fact that on most sites the number of arrowheads is larger than the number of spearheads, and that there are distinct differences in point types. Clearly arrowheads with an oval base are most common everywhere, but the absence of arrowheads with a square base at Hoek

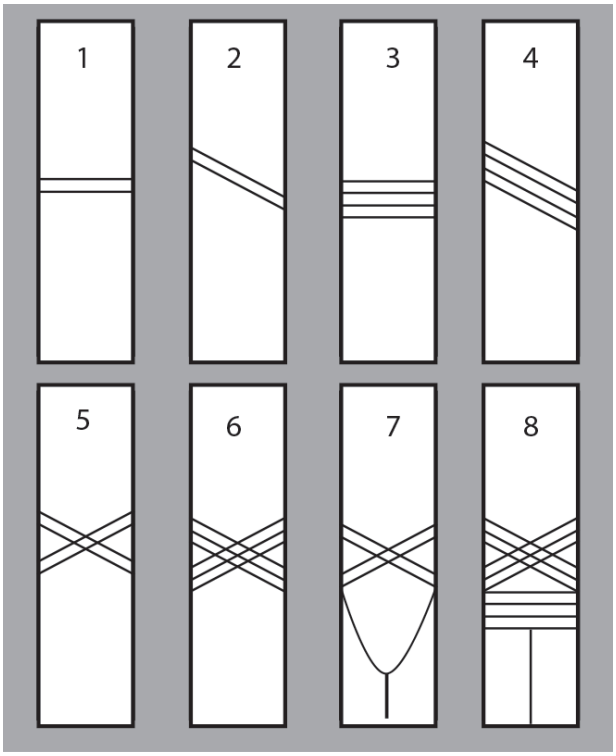


Fig. 7. Shape/type of incisions according to Verhart; combinations of two types are described thus: the lowest number will come first (for example '12' means types 1 and 2), '0' is put behind a number when only a single shape type is used (for example '20' means shape type 2) (adapted from Verhart 1988, 167).

van Holland and the absence of type 4 barbs at the Zandmotor are quite distinctive. It is felt that when the number of points increases, the patterning may become more distinct. Another important division is formed by the difference in raw material use. At Maasvlakte 1 there was obviously a preference for antler, and also the technological sophistication of the points was of a simpler character, with most points having a straightforward simple cross-section (see Spithoven 2016). The question is what are we looking at? We will return to this at the end of this contribution.

7 Additional aspects

7.1 Using the points

Typologically, we have looked at smaller and larger points and harpoon tips. The small points have been defined as points with a length less than 88.5 mm, the large points as those with a length of more than 88.5 mm. The smaller points are suggested to be arrowheads and the larger points spearheads. According to the study by Verhart (1988, 185–187), the morphological similarities between spearheads and harpoons and some finds of associated shafts argue for their use in spears. As such they will have been used for hunting large land mammals such as brown bear, elk, red deer, and boar. The spearheads may also have been part of implements such as leisters. The small points must have had a different function. The fact that they have in most cases distinctly different dimensions forms an argument in favour of this and so for their interpretation as arrowheads for shooting small game, birds and fish. Weight (see Gramsch 2000) is another factor in this. Experimental research conducted with replicas of these smaller bone points also indicated their use as projectile implements (Tsiopelas 2010), whereas numerous studies (e.g. Clark 1952) have pointed out the diversity existing in arrowhead use and raw materials. One could also argue that the larger numbers of small points argue in favour of their use in projectile weapons as more of these would have been lost. In the earlier study only one harpoon was identified, indicating that this is a fairly rare type of hunting weapon. The new assemblage also yielded one potential candidate, based on the presence of a possible binding barb (another option would be a perforation), that secured the implement to the shaft. Harpoons may have been used in the hunting of large (sea) mammals and fish.

Fig. 8. Evidence of binding traces (a) and tar or pitch residue (b; detail).

7.2 Hafting the points

Within the new assemblage some points yielded evidence of their hafting (see Fig. 8). This seems to have been done by attaching them to an (arrow) shaft by means of bindings, probably from organic material such as sinew or plant fibres. In the soft bone or antler material this may have left 'impact' traces on the point. As was already noted by Verhart (1988, 183) these traces often appear on just one side of the point, indicating they were attached to a bevelled rather than a split shaft. The new points still seem to confirm this procedure and choice. Also, two points with remains of possible pitch or tar residues were found at the beach of Rockanje. One point with remains of possible pitch or tar residues has been found in Pijnacker. The residues are found on the base of each point and may have extended to both sides. These residues will have been used to further secure the points to the shaft. Further research into the composition of these adhesives is currently being conducted at Leiden University (Spithoven 2018, 78-79).

7.3 Dating and comparing the points

The comparison of the Dutch assemblages of these points on a European scale remains difficult. Verhart (1988, 179–183) distinguished between larger points with smoothly spaced barbs, roughly dating between 10,000 and 8000 BP and with a wide geographical distribution including Scandinavia, Eastern Europe and the UK, and those with wider spaced barbs that already occur in the Late Glacial, but gradually become less important during the Late Glacial in favour of the so-called Star Carr-type (Clark 1954). Since then there have been many site and region based as well as technological studies of points from different European sites (e.g. David 2006; Elliott/Milner 2010; Gramsch 2000; Verhart 2000), and these confirm the existence of a wide range of regionally varying barbed point types. The ones from the Netherlands fall within this range. The variety of small points, however, poses a problem. While there are perhaps individual points on a European scale that may fall into the statistical category of small points (see for instance some of the points from Friesack 4; Gramsch 2000), the assemblages from the Dutch coast in themselves stand out rather distinctly. It appears that nowhere else the contribution of small points to the spectrum is so distinct. This of course brings to the fore the question whether this is a chronological or a regional phenomenon, or perhaps both. While there seems to be convincing evidence for a regionally distinct group, further research regarding the validity of the length categories and for instance more confirmation on the particular use of these implements is necessary to define whether they are really distinct. Nevertheless, the regional argument is plausible since the Dutch points are in fact finds from a now completely drowned area (Doggerland; see Coles 1998), of which we only see indirect evidence.

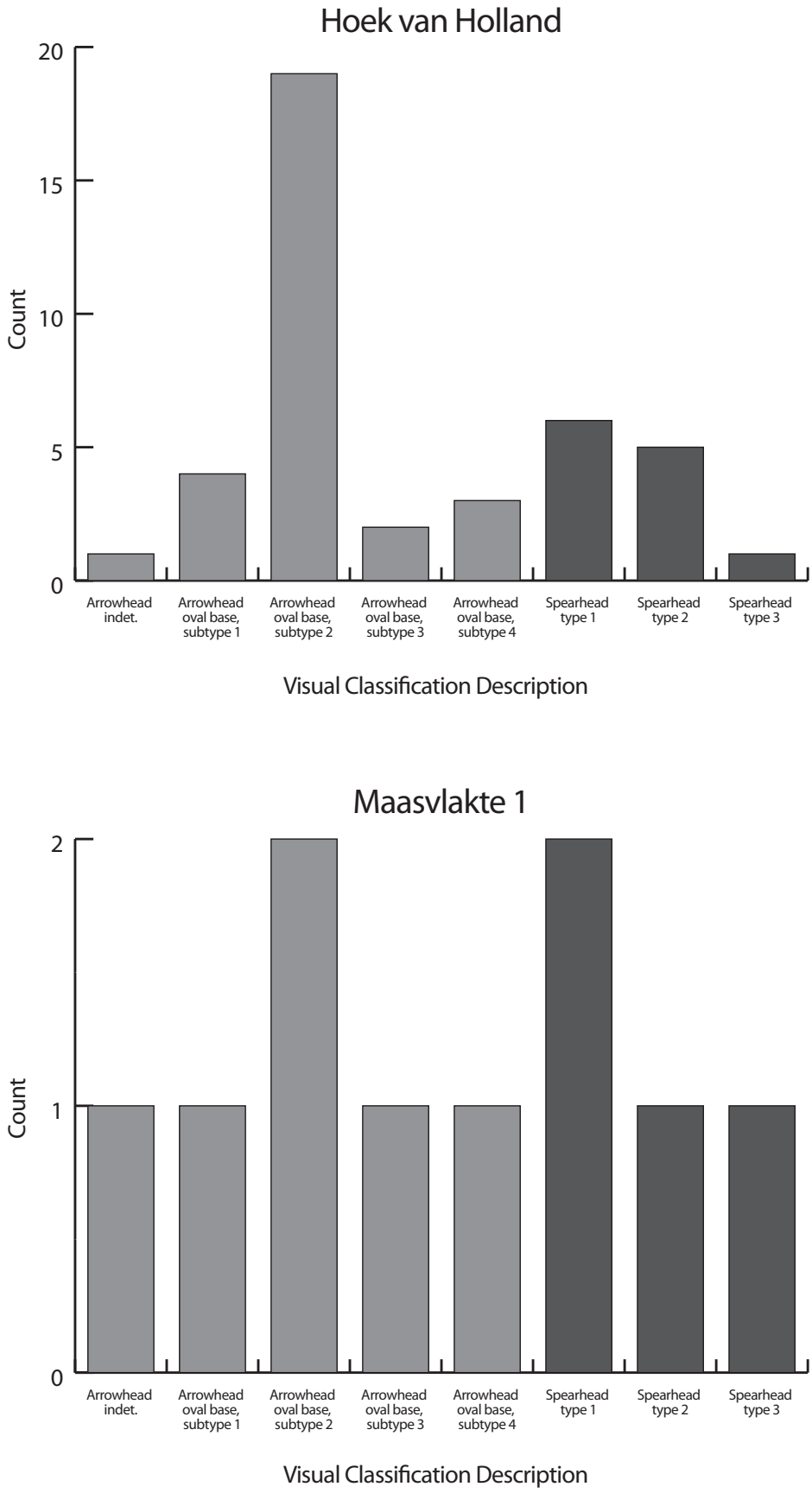
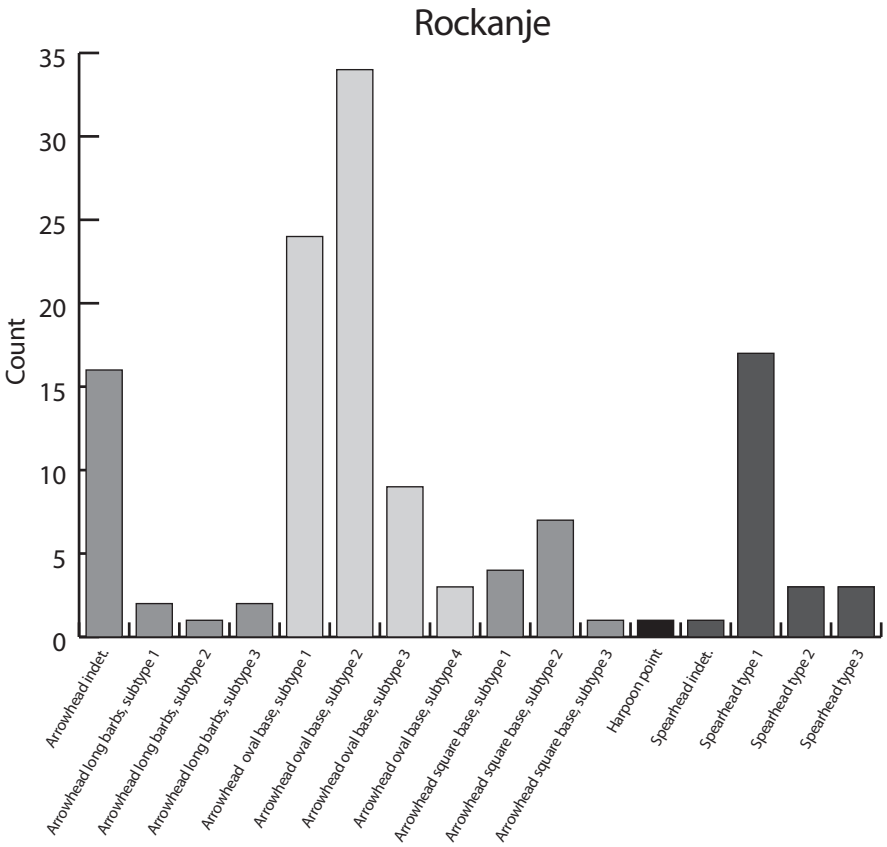


Fig. 9. Point types for the individual sites: Hoek van Holland, Maasvlakte 1, Rockanje, Zandmotor.



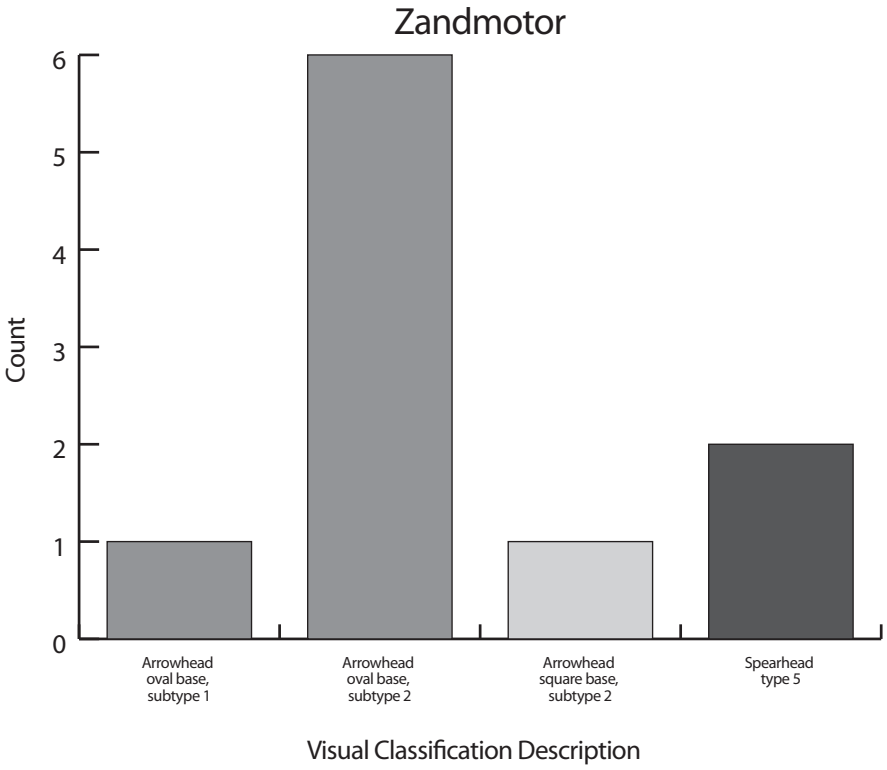


Fig. 9 continued.

Concerning the chronological question not much can be said. Only a small number of points from the corpus of many hundreds have so far been dated (see below; see also Verhart 1988):

- h 1982/6.25 (small barbed point, finely toothed), Ua-643: 6160±135 BP; 5096±165 cal. BC (CalPal),
- h 1982/6.5 (large barbed point, with spaced barbs), Ua-642: 9945±115 BP; 9539±195 cal. BC (CalPal),
- MS 139 (bi-laterally barbed point), Ua-644: 9690±125 BP; 9061±184 cal. BC (CalPal), and
- Langendoen, no. 4 (large barbed point), Maasvlakte 2, GrA 59743: 8860±55 BP; 8023±184 cal. BC (CalPal).

While the large points and the bi-lateral point fall within an Early Mesolithic range, the small barbed point appears to be too young for its location and may have been contaminated (see Verhart 1988, 179–181). It could be argued that the smaller points are maybe a younger phenomenon since they appear to be less common on earlier Mesolithic sites across Europe, but it is clear that many more dates are needed before any distinct explanation may be given, and that for now any speculations on the chronological time-frame of their occurrence are preliminary.

8 Conclusions and future research

The current state of research with an almost doubled number of analysed points forms an interesting addition to the analyses and interpretations from the 1980s. Verhart (1988, 189) at that time distinguished between small (plain and barbed) and large points, as well as harpoons and bi-lateral points. The current study based on the work by Spithoven (2016) confirms this distinction, albeit with slightly different dimensions regarding the distinction between 'small' and 'large'. Furthermore it adds an additional dimension to the finds. While previously most finds derived from the Maasvlakte 1 area in general, there are now more individual sites. Some of these have yielded larger quantities of finds, others fewer. Nevertheless, among these finds there now appear inter-site distinctions. These are based on the occurrence of a number of certain types, based on the numerical and categorial factors that were measured. There appear to be several interesting differences that relate to the type-composition of the individual sites and indirectly to their extraction areas. The major difference is that between the Maasvlakte 1 site and the other locations. At the former site (also see Spithoven 2016, 76–78) more points were made of antler, which is easier to work and more flexible, but suffers more from weathering. 70 % of identified points there are characterised by a simple cross-section, not a sophisticated one made by thinning the barb-section. Also for instance most of the barbs found there are of incision type 2, whereas for instance at Rockanje this is only the case for 25 % of them. Apart from this distinctions there appear to be a number of more subtle ones between the different locations that have been studied, but these are in need of further quantification when more points are analysed.

The question is: what do these differences mean? That, however, is difficult to assess. Clearly technological and typological choices are never just that. They are part of learned traditions and sometimes deliberate or subconscious ways to express affiliation or group identity, as was for instance identified for points of the Pritzerbe type in northeastern Germany (Cziesla 2006; see also Iversen 2016; Löhr 1994; Wiessner 1983). However, in order to be able to make inferences regarding the presence of different groups or technological communities, more and other data are required. To some extent there is hope for that.

At the time of the earlier research there was a distinct dearth of lithic finds. Due to their lack Verhart indicated that the finds of bone and antler points and their source locations in the Europoort area most probably pointed to lost hunting gear: 'The absence of imperishable settlement debris like flint artefacts, microliths, burins, scrapers, axes and other stone implements, together with larger artefacts of bone and antler as documented from the North Sea and Denmark, are indications that the Europoort area

was not primarily inhabited. It must have been an area exploited mainly for hunting and fishing.' (Verhart 1988, 187). It cannot be denied that most evidence points to the importance of fishing and hunting, but meanwhile many of the locations have also yielded large quantities of lithic artefacts that cover a range of tools and much production waste (see also Amkreutz et al. 2016). These objects even include artefacts such as scrapers or knives with tar residue still attached. Building from that, it is clear that we are also dealing with locations that were more than just a hunting stand and may have encompassed settlement areas. The problem of course is that it remains difficult to provide exact archaeological context information. Nevertheless, as has been demonstrated for other aspects of 'Doggerland-occupation' (van der Plicht et al. 2016), there is still much information to be gleaned from these less contextualised bulk finds of artefacts, too. For the study of bone and antler points a number of research targets have therefore been defined for the future. Spithoven, apart from continuing with the inventory, has pursued work on these points focusing on microwear analysis and experimental archaeology (Spithoven 2018). This sheds more light on the fabrication steps of these points as well as their use, and also provides information regarding different fabrication traditions and hunting techniques. Additionally, more points will be 14C-dated in order to add a chronological perspective, in particular for the small ones. Also Zooarchaeology by Mass Spectrometry (ZooMS) analysis may shed light on whether a specific range of animals was targeted for point production (see van Doorn 2014). The possible glue, or tar remains will be further analysed in a project at Leiden University (Spithoven 2018, 78–79).

In conclusion, the research presented here is very much work in progress. It is hoped that future research will unravel the position of the 'Doggerland-points' in the overall European framework of organic point production as well as shed more light on the ways of life of the past inhabitants of this enormous drowned European heartland.

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