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The domestic sphere of the Corded Ware Culture: a functional analysis of the domestic implements of three Dutch settlements

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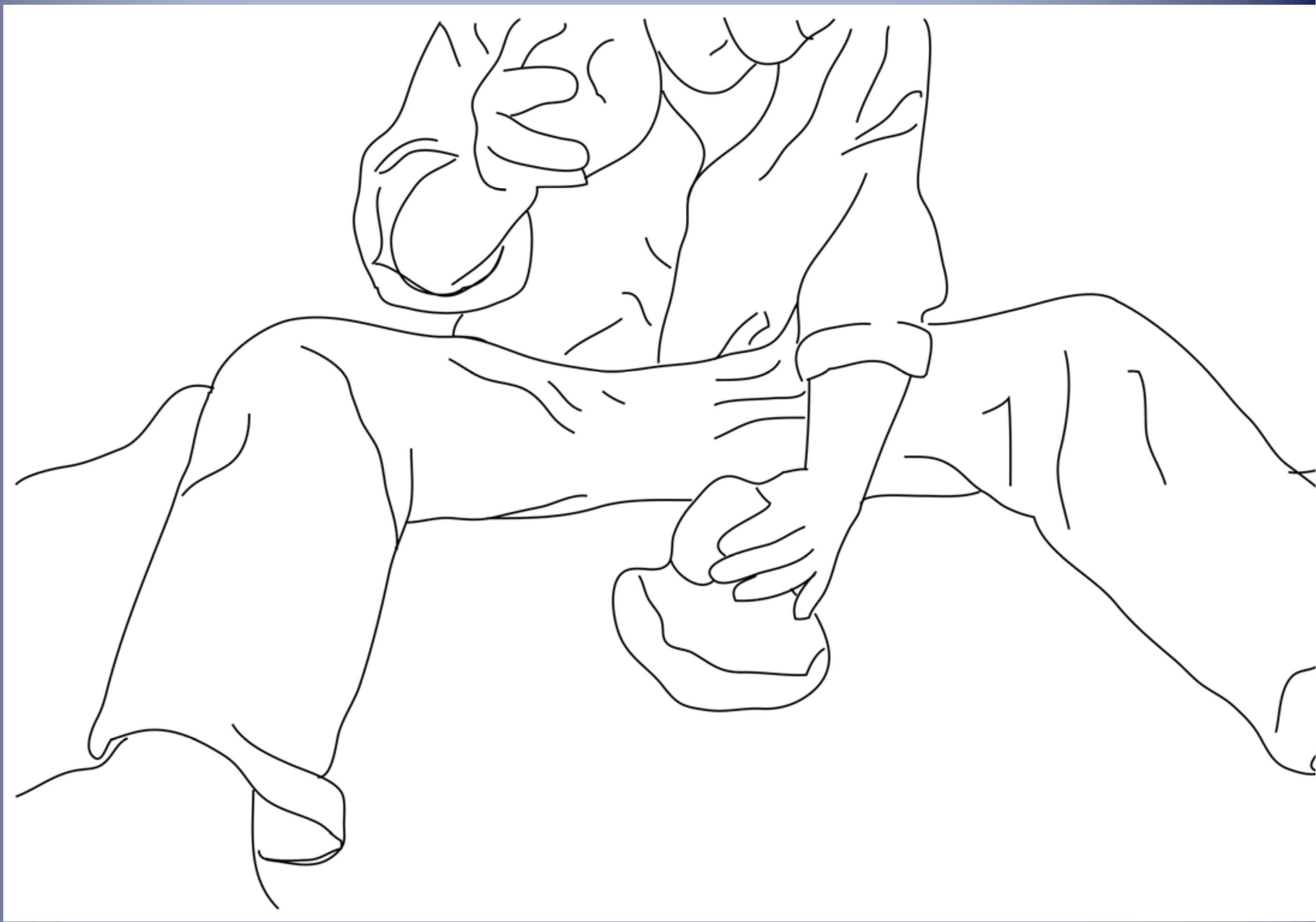

THE DOMESTIC SPHERE OF THE CORDED WARE CULTURE.

A functional analysis of the domestic implements of three Dutch settlements

Virginia García-Díaz

THE DOMESTIC SPHERE OF THE CORDED WARE CULTURE.

A functional analysis of the domestic implements of three Dutch settlements

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Contents

Chapter 1. The enigmatic Corded Ware Culture

1.1 The Corded Ware Culture: The state of affairs

The Corded Ware Culture (CWC) was a cultural phenomenon that extended from the Black Sea to the North Sea between 2900 and the 2400 cal BC, covering practically the same territory as their predecessors, the Funnelbeaker (*Trechterbekercultuur* or *TRB* in Dutch) groups. The traditional definition of the CWC distinguished an early horizon, the A-horizon, characterized by homogeneity in material culture, from a second phase characterized by cultural variability (Siemen 1997). It was because of this variability, that the CWC received different names in different regions (Furholt 2014; see Chapter 2). In the case of the Netherlands, it was defined variously as Single Grave Culture, Battle Axe Culture (as in the case of Denmark and northern Germany), and/or Protruding Foot Beaker Culture (Lanting 1973; see Chapter 2). In this thesis, the term Corded Ware Culture (CWC) will be used.

Both the Corded Ware and the Single Grave Culture are mainly known by their funerary architecture and ritual. The typology of burials is very similar across Europe; however, the quantity and distribution of burials differ, from isolated graves to concentration of barrows or proper Corded Ware cemeteries (Rudnicki and Włodarczak 2007; Włodarczak 2004). Barrows and single graves are found all across Europe with similar burial rituals, such as the burial of bodies with at least one vessel and three or four objects. The culture was named after the type of decoration found on pots in the graves, or after the battle-axes found on the male graves. The vessels were decorated with impressions of cords, usually located on the neck of the beaker. Experiments have shown that the cord was made of a bast-fibre, maybe flax, and it was impressed on the pot when the clay was still fresh, before firing (Grömer and Kern 2010). Males were mainly buried with battle-axes, arrowheads and flint daggers while female graves were characterized by the presence of ornaments and pottery (Vandkile in Westermann 2007). Men were buried with their head to the west, lying on their right side and facing south. Women were placed with their head to the east, on their left side, also facing south. Men's graves are more frequent than women's burials and children's graves are a minority (Butrimas 1990; Furholt 2014; Lohof 1994; Mischka 2011; Rudnicki and Włodarczak 2007).

The origin of the CWC was traditionally linked with assumed migrations from the east, bringing new traditions and the Indo-European language. The battle-axes deposited mostly in male burials were interpreted as the symbol of a warrior society based mostly on agricultural practices, where males formed a warrior aristocracy within a patriarchal structure (Childe 1958). However, the theories related to the CWC started to change in parallel with a major archaeological paradigm change: the arrival of the New Archaeology from the early 1960s onwards. A group of young Anglo-Saxon researchers tried to develop a new archaeology, different from the European historicism. The researchers were influenced mainly by anthropology and sociology, but also by psychology and diverse branches of natural sciences. In addition, the new theories were backed up by several technical improvements, such as the first computer systems and more reliable dating methods. A scientific method was used, and instead of a pure descriptive analysis a deductive approach was employed. Settlements, activity areas and the social networks started to be researched. And finally, cultural diffusion started to be questioned and evolutionary perspective became more popular. The conception of the European Neolithic would be strongly influenced by Processual archaeology (see Trigger 1989 and Johnson 1999 for a more detailed discussion of the subject).

The new way of research and the new data available produced several changes to the perception of the CWC. First, the role of the previous TRB groups in the formation of the CWC was taken into consideration. Migration theories started to be abandoned and the first papers proposing a local origin of the CWC, or at least an important role of the TRB groups, were published (Lanting and van der Waals 1976). However, there are some exceptions to this, and the migration factor was still considered in the 1990s (Kristiansen 1991) and even in the twenty-first century (Czebreszuk 2003; Haak *et al*. 2008). The violent character and the patriarchal organization of the groups were also reviewed. Battle-axes were starting to be considered as symbols instead of actual weapons (Malmer 1992) and the idea of the Indo-European origin was abandoned. Finally, the evolutionary ideas were the basis of one of the main theories of the late 1980s. The emergence of the "*Secondary Product Revolution*", characterized by the use of the plough but also with the emergence of some milk-derivative products and of wool (Sherratt 1983, 1986), dominated the economic approaches to the CWC groups. New discoveries and ^{14}C dates suggested that the plough was already known in the IV millennium (Halstead and Isaakidou 2011; Sherratt 2006). However, burials and settlements have always been studied separately and an extended comparison between settlements and burials on terms of material culture is still lacking. Although some articles centred on the social interpretation of settlements have appeared (Hecht 2007; Hogestijn 1992, 1998; Müller 2003), the main publications and topics discussed at congresses and scientific meetings are still centred on burials.

In recent decades, significant advances have been made through the application of new techniques. Skeletal remains have been studied to understand pathologies, sex, diet and genetic affiliation (Włodarczak 2008); the ritual and ideological identity of the groups has begun to be questioned from diverse points of view, such as: the relation of the bodies with the objects (Van der Linden 2003, 2012), the spatial distribution of the burials and barrows (Bourgeois 2013) and their meaning in the landscape (Doorenbosch 2013); flint and stone have also been analysed from the point of view of networking, technology and use (Van Gijn 2010; Wentink 2006, *in preparation;* Wentink and Van Gijn 2008). However, the main advances produced during the last 15 years are related to the construction of a better chronological sequence (Beckerman 2012a; Fokkens 2012; Furholt 2003a, 2003b, 2014; Włodarczak 2006, 2009). The conception of cultural uniformity, which defined cultural phenomena until then, has lost ground in favour of the diversity generated by local traditions and groups (Furholt 2014).

1.2 The European Corded Ware society: General characteristics

Despite obvious regional variations, research in recent decades has provided a general interpretation of CWC societies:

a) The CWC society was based on nuclear, familial groups, an interpretation supported by evidence of the small settlements with houses and structures of less than 10m in length (Hecht 2007). Furthermore, the genetic analysis of the skeletons from the Eulau burial revealed the existence of nuclear families, as inferred from the genetic link between the male skeletons (Haak *et al.* 2008; Meyer *et al.* 2009).

b) The CWC groups based their subsistence on a '*mixed economy*'. Although the economic diversity of the groups varied from region to region and from site to site, there were some common traits for the economy of the groups, which was based on cereal production, husbandry, fishing, fowling and the collection of shells, wild fruits and plants.

The production and consumption of cereals in these groups is proven by the presence of archaeobotanical remains and pollen samples, and shown by the presence of cereal processing tools. Additionally, some of the settlements were partially established on rich agricultural soils (Hecht 2007). Naked barley, wheat and emmer are the best represented botanical remains, along with wild fruits such as raspberry, flax and apples (Herbig and Maier 2011; Kadrow 2008; Klassen 2005; Kirleis *et al.* 2012; Witkowska 2006). Pollen analyses also show a high level of deforestation in Europe during the third millennium BC, suggesting that forests were cleared to produce land for pasture. Faunal remains at several domestic sites provide evidence for the importance of animal husbandry. Pigs, cattle, sheep/goat and occasionally dogs are the most numerous zoo-archaeological remains found at the settlements (Kolář *et al*. 2012; Müller *et al.* 2009; Zeiler 1989a, 1997; Zeiler and Brinkhuizen 2012, 2013). In addition, anthropological analyses of skeletons have confirmed a diet rich in animal proteins (Hecht 2007; Kolář *et* *al.* 2012). Finally, traces on some skeletons from burial contexts show pathologies related to work as herdsmen (Hecht 2007).

Hunting, fowling, fishing and shell collection complemented the Corded Ware Culture's diet. Wild animals, fish, birds, and shells are present at the settlements. Some arrowheads have been found in settlement contexts probably related to hunting. Wild animals and fish were probably also exploited to obtain skins, teeth and bones. Skins could be used to produce several types of clothes, while the use of bone and teeth to produce tools and ornaments has been documented in several wetland settlement sites (Pétrequin 1989; Van Heeringen and Theunissen 2001; see Chapters 4, 5 and 6).

c) The CWC society had a high degree of social inequality affecting the structure of the group. This social inequality implied a division of labour based on gender, sex and age, explored in the following paragraphs. The main consequences for the society were the existence of elites that occupied a preferential position within the groups and the CWC society.

Variation in the percentage of male and female burials has been interpreted as indicating a predominant role of male individuals in the society. However, and without denying the possibility that the CWC society was stratified by gender, it is also necessary to take into account several other possibilities. First, barrows and single graves could perhaps have coexisted with other burial practices. This possibility is supported, in the first place, by the occasional reuse of TRB megaliths by the CWC communities and, secondly, by the ethnographic documentation of burial rites that do not leave material traces. The archaeological interpretation of the preserved burials must also be considered. Gender classification has not always been determined by the anthropological analysis of the skeletons, but by the associated grave goods. When objects, traditionally associated with males, were present in the grave the burial was classified as a male grave (Drenth 1992). However, in recent decades, some archaeologists have proposed that the existence of two genders is a modern concept that follows a patriarchal conception of the society, and have argued that the existence of a third gender and its role within the groups should be considered (Sofaer and Stig Sorensen 2013).

The discrimination related to age is mainly based on two observations: the low number of infants and elderly people present in the graves. Infant burials make up less than 8% of the total number of burials from the CWC (Drenth 1992); however, the identification of child burials was not always based on the study of the skeletal remains (Drenth 1992). Ethnographic studies show several examples of children buried in different places from the rest of the community. These differences were usually related to a different concept of the position of infants within the society (see Kamp 2001 and Baxter 2008 for an extended review). When settlement contexts are analysed, children are usually underrepresented and the case of the CWC is no exception. Their role both in the formation of the archaeological record and in their community is undervalued. However, since the 1980s the role of children in prehistoric societies has been discussed from diverse perspectives in archaeology (Baxter 2005, 2008; Kamp 2001; Lally and Moore 2011). In addition, the economic tasks performed by children should not be forgotten. They played an active role in small agricultural communities where they were responsible for simple tasks: water supplying and herding are among the ethnographically documented activities performed by children (Kamp 2001).

The low percentage of elderly people buried in the graves is contradictory. While elders had traditionally played an important role in theories of social group composition in prehistory (Kertzer *et al.* 1984; Welinder 2001), they are underrepresented in the human remains. Beside the diversity of burial practices discussed earlier, other possibilities have been suggested. The mobility associated with the CWC groups would be an impediment to older people following the group (Van der Linden 1992). Consequently, elderly and diseased individuals would be abandoned or would voluntarily leave the community (as documented in Inuit communities).

According to this view, a new social inequality based on the existence of an elite within the society would eventually develop. This premise is supported by two main arguments, the first of which is related to the demography of these groups and the percentage of the population represented in the burials. It seems clear that only a small percentage of the society had access to the ritual of burial in barrows and Single Graves. The time and energy needed to build the barrows and the graves and to acquire the grave goods would have required communal effort by a large group, even though the end-result, that is the construction of the barrows and graves, was only enjoyed by, or directed towards, a small percentage of the society.

CWC groups have traditionally been interpreted as violent populations, and their material assemblages were always linked to different kinds of violence: first through the idea of Indo-European populations imposing their culture on the more peaceful TRB people (Childe 1958; Kristiansen 1989); and secondly by giving the grave goods a functional interpretation related to violence. For instance, battle-axes and daggers were interpreted as warriors' weapons. The popularity of this image of a violent population has decreased during recent decades (Westermann 2007), and some authors have proposed an alternative explanation for the group structure of the CWC (Vander Linden 2003, 2007, 2012). However, lately some archaeological analysis has pointed out the importance of violence in these communities. Some earlier authors contemplated the existence of a '*secret society*' consisting of a male elite distinguished by the material culture (Czebreszuk 2003: 21). A violent episode in the lives of these CWC inhabitants was inferred from the analysis of the data obtained from the multiple burial of Eulau. However, the issue of whether violence was a general aspect of life or whether Eulau is an isolated episode is still being discussed (Haak 2008; Meyer *et al.* 2009).

The general characteristics of the CWC are still under debate and, therefore, the study of domestic assemblages permits a better comprehension of the daily organization of the groups. Current knowledge of the social composition of the CWC is mainly based on the study of burials and depositions, and the number of settlement studies is still low. In this context, in 2009 the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) project '*Unlocking Noord-Holland's Late Neolithic Treasure Chest*' started. The analysis of three settlements from the Dutch wetlands was a point of departure to compare the social interpretations of burials and depositions with those acquired from domestic contexts.

1.3. The NWO-Odyssee project: Unlocking Noord-Holland's Late Neolithic Treasure Chest

1.3.1 Introduction

In the second half of the past century, and largely between the late 1970s and the early 1990s, several settlements dated to the CWC were discovered and excavated in the Noord-Holland province (Van Heeringen and Theunissen 2001). The excavations revealed the exceptional quality of the sites, especially due to the good preservation of the organic materials. In an inventory published in 2001, 37 sites were listed, most of which were dated to the CWC (Van Heeringen and Theunissen 2001). Some of these sites, such as Keinsmerbrug, Zeewijk, Kolhorn, Mienakker, Aartswoud and Zeewijk, were considered *unique* (Van Heeringen and Theunissen 2001). However, the analysis of the excavation data and finds was uneven; a lot of the finds were never studied in detail, and very few international publications were available, so the relevance of the excavated settlements was not known to the larger scientific community.

1.3.2 Aims of the project, sample, methodology, the team and research questions

The aims of the project were threefold: to generate a new corpus of data in order to expand current knowledge about the domestic life of the CWC in the Noord-Holland province; to test and develop models of CWC subsistence and settlement variability; and to provide a basis for the development of management approaches to and public appreciation of the CWC heritage (Theunissen *et al.* 2012, 2013, 2014). In order to achieve these goals, three settlements were selected using several criteria: the accessibility to the excavation documentation; the availability and quality of the materials and the representativity of the excavated area; and the settlement size and/or type. Originally, the selected sites were Keinsmerbrug, as an example of a small site without structures; Mienakker, as an example of a medium-size settlement with one house structure; and Kolhorn, as an example of a large site with several dwellings/domestic structures. However, during the analysis of Kolhorn, several anomalies related to the data storage impeded a proper analysis and the site had to be excluded from the study. In order to follow the original idea of the project, Zeewijk, a domestic site with similar characteristics, was selected to replace Kolhorn.

The project was arranged around three main aspects: settlement variability, landscape use and material culture. The study of settlement variability focused on the identification of differences between sites. For this, it was necessary to characterize the settlement size, the intra-site spatial organization and the functional variability, as well as the duration of occupation (permanent versus seasonal). The study of landscape use focused on the ways CWC people exploited natural resources and structured the landscape, and the study of the use and role of material culture was directed towards the identification of the production processes of the objects. This study required an integral approach to the Single Grave material culture *chaîne opératoire* (see Chapter 3).

For this purpose, a team was formed, composed of different research specialists from Leiden University and Groningen University, several archaeological companies (Kenaz Consult, BIAX CONSULT, Archaeobone) and the Cultural Heritage Agency of the Netherlands. Five main research areas were formed:

1) spatial analysis, which began with the digitalization of the excavation plans. Afterwards, Nobles (2012a, 2012b, 2013a, 2013b, 2014a, 2014b) performed the spatial analysis of the excavated areas, following the analysis of the material culture. The combination of the different results obtained could answer some questions related to the formation of the sites, the internal organization of the space and the functionality of some of the structures interpreted at the settlements;

2) archaeobotanical studies performed by Oudemans and Kubiak-Martens (2012, 2013, 2014), Brinkkemper and Van den Hof (2014) and Van Haaster (2012) analysed and published both the data already available and new samples. The results of this analysis were crucial to understanding the relation of the groups with their natural environment, and to reconstruct the diet of the CWC in the Noord-Holland province.

3) archaeozoological studies directed by Zeiler and Brinkhuizen (2012, 2013, 2014) analysed all taxa of the three selected sites, and provided information about subsistence patterns and settlement variability;

4) pottery analysis was performed by Beckermans (2012b, 2013, 2014, 2015) and focused on the functional and chronological differentiation of the assemblage. In addition, the analysis of organic residues allowed the team to infer the function of vessels and provided new insights towards the reconstruction of the diet of the CWC inhabitants (Kubiak-Martens and Oudemans 2012, 2013, 2014); and, finally,

5) the analysis of flint, stone and bone implements is the subject of this thesis (García-Díaz 2012, 2013, 2014a), while the amber ornaments from Zeewijk were analysed by Van Gijn (2014a). The results of these analyses contributed to the discussions on site formation, as well as settlement function, group composition, settlement variability, resource exploitation and the social and ideological significance of objects.

The main research questions addressed by the project were (Kleijne *et al.* 2013; Smit *et al*. 2012; Theunissen *et al.* 2014):

1. What is the spatial extent of settlement areas and how can any intra-site differentiation be characterized?
2. What is the functional nature of structures and features?
3. What indicators exist for occupation length and seasonality?
4. Which activities are represented in the artefact assemblages?
5. What variability exists in the '*cultural biography*' of objects?
6. What is the possible origin of inorganic resources?
7. Which activities are represented in the archaeozoological and archaeobotanical remains?
8. Which ecological zones are represented in the archaeozoological and archaeobotanical assemblage?
9. What evidence exists for group composition?
10. How do the characteristics of the CWC settlements in Noord-Holland compare to Corded Ware phenomena in the wider geographical setting?

The results of the analysis were published in three site monographs (Kleijne *et al*. 2013; Smit *et al*. 2012; Theunissen *et al*. 2014), and also comprise the core of three doctoral dissertations including the current thesis (Beckerman 2015; Nobles 2016; see this volume).

1.3.3 Research questions of the current thesis

The main objective of this research is to understand the domestic life of the Corded Ware inhabitants of the North-Holland province and the social implications of the actions and decisions of these groups. The domestic implements of the CWC communities are considered to be the practical reflection of their social actions (Dobres 1994, 2009; Miller 2009) and are therefore an essential source of information on the social composition of the archaeological groups. The research presented in this thesis combines raw material, technological and use-wear analysis of CWC artefacts (flint, stone and bone implements and amber ornaments). Departing from this methodological approach, some specific questions can be examined:

1. What is the relationship between the CWC Groups and their landscape? What are the strategies used by the inhabitants of each site to obtain their raw materials? Which raw materials are selected for tool production? Is it possible to observe exchange networks based on analysis of the raw material acquisition?

2. What is the character of the technology employed by the inhabitants of the three sites? How can this technology be interpreted? Does this technology show a pattern related to a seasonal pattern of habitation or to a permanently occupied site?

3. What is the function of the tools in the three study sites? Which economic activities are practiced in the sites and how are these tools incorporated in the economic activities? Are these activities different from site to site? Are the imported materials being used for the same activities? Following the actual interpretation of the sites, do the smaller sites represent specialized camps? What is the functionality of the structures identified during the excavations and the new analysis? How is the space used? Is it possible to identify activity areas?

The results of this analysis will also be used to understand the relationship between the CWC and other groups previously occupying the region, such as the TRB, and the Vlaardingen group. Although it is commonly accepted that the CWC had strong ties with the TRB communities (Fokkens 1986; Van Gijn and Bakker 2005; Van der Waals 1964, 1984), an association between the material culture of both groups has not yet been identified. Tools used in daily activities play an important role in understanding the processes that resulted in the evolution from the TRB to the CWC. Secondly, the relationship between the Single Culture group and other contemporary groups such as the Vlaardingen group is still not well defined. Although the two groups coexisted for at least 400 years, a clear correlation between both groups is based mainly on the study of the pottery assemblage (Beckerman 2012a). The study of the domestic implements of the CWC and their comparison with the Vlaardingen communities could be the key to understanding the main relationships between both groups and the role that Vlaardingen communities played in the formation of the CWC. Finally, the results will be placed in a wider context: a comparison will be made between other CWC settlements in the Noord-Holland province and the results obtained from the study of CWC graves, barrows and depositions found in the Netherlands. In addition, the settlements under study will be considered in their European context.

1.3.4 The structure of the thesis

Although the study of Corded Ware settlements is still limited, information is available about several European contexts in the international literature. A comparison between the data available within Europe would permit a better understanding of the economic and social practices of the groups, and their social composition. In **Chapter 2**, an overview of the domestic contexts and implements from other Dutch and European Corded Ware sites is presented.

To understand the importance of the analysis of the CWC domestic implements, it is necessary to understand the social implications that the implements had for Neolithic societies. In **Chapter 3** presents the theoretical and methodological framework adopted in this analysis. Tools are understood not only as products of an economic system, but also as the reflection of choices made by the groups in relation to their landscape and the available resources. Therefore, to understand the role of the implements within a community, the production processes of the assemblages have to be studied in their totality. The analysis of archaeological implements should deal, then, with the study of the *chaîne opératoire* of the different implements: the raw material acquisition, the technological approaches used to produce the tool, its use and its final discard.

Chapter 4 deals with the analysis and the interpretation of the artefacts found at Keinsmerbrug. The assemblage studied was small and mainly consisted of flint implements. In addition, a small number of stone implements and amber ornaments were also studied. The small assemblage permitted a complete analysis of the material, and methodologically, it served as a test model for bigger sites, such as Mienakker and Zeewijk. During the spatial analysis of the archaeological features identified during excavation, several of these were interpreted as house structures (Nobles 2012b). Thanks to the integration of the spatial analysis and the use-wear analysis of flint and stone artefacts, interesting intra-site information was obtained that helped the team to understand the specific activities performed at the site.

Chapter 5 presents the analysis of the assemblage from Mienakker, consisting of flint, stone, amber and bone artefacts. This is considerably larger than the assemblage from Keinsmerbrug. However, during the analysis of the materials, some issues occurred. In the first place, the number of flint implements available for the current study did not match the number documented in a previous study (Peeters 2001a). During the previous analysis 1218 flint implements were recorded (Peeters 2001a: 522), among which various implements made from non-local raw material, such as Grand-Pressigny and Rijckholt flint. However, during the current analysis, it was noted that, most of the Grand Pressigny flint was missing. And, despite the efforts, it was not possible to locate the missing material. Secondly, Bulten (2001) published a study of the amber beads and pendants, but the materials were also missing, and only the splinters and the production waste were available for the current study. Finally, even though the collection of bone materials was almost complete, the preservation of the implements was not as good as expected. Bone is a soft and delicate material, and post-depositional alterations damaged the surface of several implements. Spatial analysis of the features and structures documented during the excavations led to the identification of the remains of a new structure (Nobles 2013b). Spatial analysis was, in this case, less productive than in Keinsmerbrug. Although no activity areas could be inferred, the distribution of the material culture provided information about the site formation, and about the function of the identified structures.

Chapter 6 is dedicated to the analysis of the assemblage from Zeewijk, which consists of a large amount of flint implements (more than 10,000), stone and bone. All the implements were analysed typologically and technologically. However, due to the large quantity of the available material, a sample was selected for use-wear analysis, using the expertise gained during the study of the previous sites. In addition, numerous amber ornaments were collected and studied at Zeewijk. The data obtained from the analysis, performed by Van Gijn (2014a), is introduced and discussed in this chapter. Unfortunately, while conducting the analysis of the assemblage, some difficulties arose and the spatial analysis of the flint and stone implements could not be performed. The lack of materials in the selected areas made analysis impossible and limited the interpretation of the potential activity areas present at the site.

Chapter 7 presents the main conclusions derived from the analysis presented in the previous chapters, and places these results within their broader Dutch and European context.

In **Chapter 8**, a synthesis of the results reached through the analysis of TRB and Vlaardingen settlements is presented. The chapter focuses on the information obtained from the analysis of the material culture obtained from both old and new excavations around the Netherlands. Emphasis is placed on the results from the technological and use-wear analyses of the material culture.

Finally, in **Chapter 9** the main conclusions of this book are summarized.

Chapter 2. The domestic Corded Ware Culture in Europe and the Netherlands: An overview

2.1 Introduction

The European CWC and the SGC are mostly known by their funerary architecture and the depositions of goods, and the Netherlands is no exception. Archaeological excavations of settlements are a recent phenomenon, and the number of excavated sites is still low. In this chapter, a brief introduction to the history of research in the Netherlands and Europe is offered, after which the main characteristics of the Dutch CWC settlements will be presented. The objective of this chapter is to sketch a context for the three case studies which will be discussed in Chapters 4, 5 and 6. Therefore, the settlements excavated until 2013 are the main subject of this chapter, although the fundamental characteristics of burials and depositions are also briefly discussed.

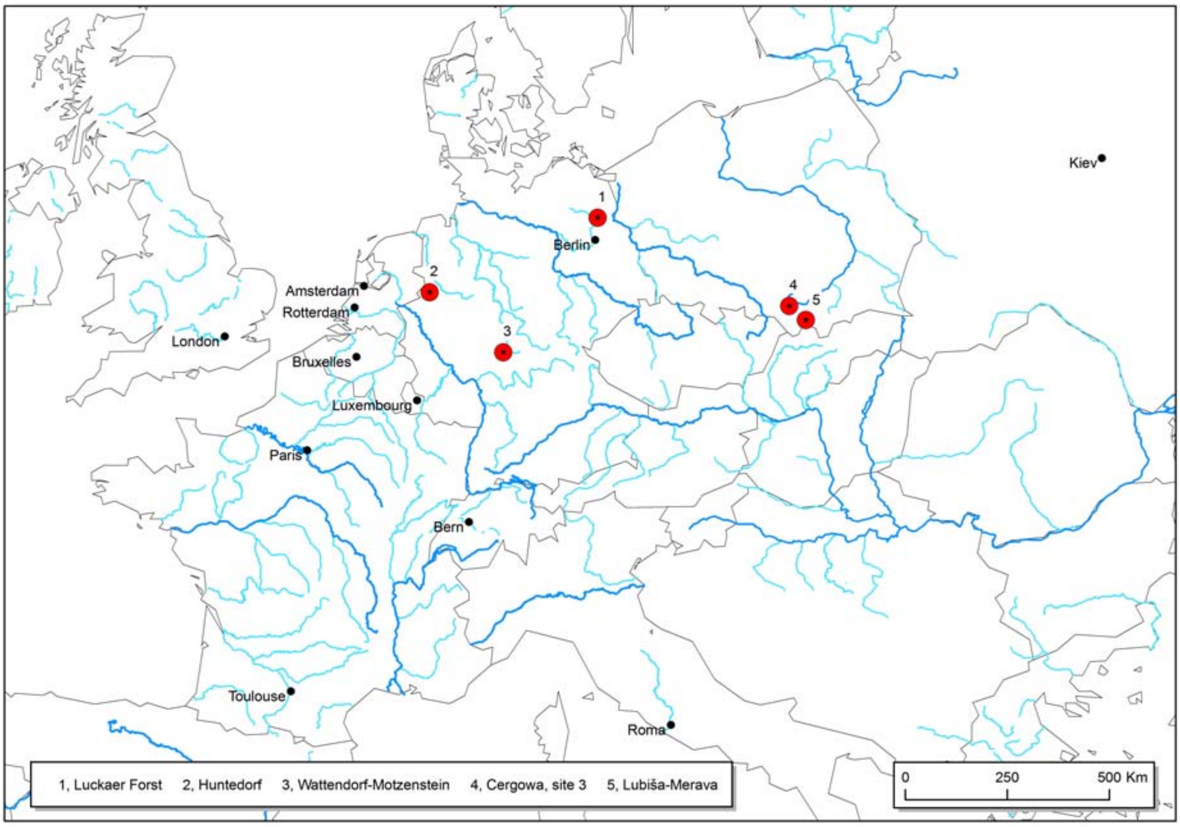


Figure 2.1. Map with the European Corded Ware Culture settlements cited on the text. 1:Luckaer Forst; 2: Huntedorf; 3: Wattendorf-Motzenstein; 4: Cergowa, site 3; 5: Lubiša-Merava Image courtesy of Mar Escalante Fernández).

2.2 Domestic contexts in European Corded Ware Culture

With some exceptions, Corded Ware settlements in Europe started to be excavated during the late 1970s. The available information is uneven and diverse, depending on the country and the region. Although publications about settlements are still infrequent, some remarks could be made for the main distribution areas of the CWC[1].

Central Europe

Several domestic sites are known from Central Europe. In a recent dissertation, Hecht (2007) compiled a synthesis of 226 settlements in a study area covering Southern Germany, France and East Switzerland, including the lake settlements in the region of Zurich. Hecht described three different types of settlements: villages, hamlets and farmsteads. Villages were recorded mainly in Switzerland, although the German settlements of Luckaer Forst, Hunterdorf 1, Dümmer and Succase were also considered villages (Hecht 2007; Loewe 1957). Hamlets and farmsteads were the more characteristic settlements, but a typical Corded Ware house could not be distinguished. According to Hecht (2007: 101-192) the following characteristics of the settlements were described: houses were usually small (no more than 10m in length), except in the case of CWC structures, where houses tended to be slightly larger; the inner space was divided into two or three spaces and fireplaces and hearths were located within the domestic spaces. It was suggested that small groups lived in the houses and performed several activities within the domestic space: the results obtained from the analysis of the faunal and botanical remains suggest that subsistence strategies were based on a mixed economy (Hecht 2007: 244-246). Agriculture and pasturing were of growing importance and were combined with gathering, hunting and fishing.

Results of the recent excavations of a small Central German hamlet, Wattendorf-Motzenstein, dated to 2660-2470 cal BC, were published in 2008 and 2009 (Müller 2009; Seregély 2008) and provided new insight into the domestic organization of the CWC. The uniqueness of Wattendorf-Motzenstein is not only due to the presence of several Corded Ware domestic structures, but also to their association with a ritual place on a rocky outcrop nearby. Although the settlement was only partially excavated, at least four domestic huts were identified during the excavation and several activity areas were interpreted inside one of the excavated huts. A cooking area and a living area were distinguished from a waste deposit area. Finally, a workshop for the production of grinding tools was found. Grinding and cereal processing tools were an important part of

[1] For the Netherlands, the settlements will be discussed in section 2.3.

the site, playing not only an economic but also a ritual role, as inferred from the deposition of three querns and a grinding stone in the ritual area (Müller 2009; Seregély 2008). Other stone implements, such as blades and scrapers of local flint and stone adzes, were also produced at Wattendorf-Motzenstein. Local flint coexisted with better-quality flint implements and stone axes imported from the Czech Republic and Poland.

In Poland, most of the Corded Ware remains are barrows and graves (Jázéwski 1969; Włodarczak 2006, 2008), but a compilation of Southeastern Poland and Western Ukraine settlements is available (Kadrow 2008; Witkowska 2006) including both open-air contexts and caves, the former also used as deposition places. Although most of the settlements were interpreted as campsites, Cergowa, site 3, Brestov-Dielňa and Lubiša-Merava were interpreted as '*homestead flint processing places*' (Kadrow 2008: 244). Flint was worked in specialized places, and the final stage of the tools was performed at the settlements (Witkowska 2006). The CWC in Poland is linked with the preceding TRB groups. Where TRB groups were present, the CWC developed the traditional economic system of the previous inhabitants. Pollen analyses show the importance of cereal production within an economy based on cattle and sheep herding, whereas in mountainous areas, where TRB groups were less prevalent, the economic patterns changed. Pollen diagrams show that '*the indicators of human activities are absent or very modest*' (Kadrow 2008: 246). It has been argued that the exploitation of the mountainous areas during the CWC was linked not only to herding but also to the use of new economic resources, such as salt mines (Pelisiak 2008: 56). In general, the Corded Ware society in this region has been interpreted as mobile, nomadic, and composed of small groups of herders. Settlements were occupied for a short time and were strongly related to the location of burial sites, mostly during the first stages of the CWC (Witkowska 2006).

Estonia, Finland and Latvia

In the Baltic countries, as in the rest of Europe, burial finds predominate over the domestic structures. However, some information about domestic structures, their tools and their economy is available. In addition to axe depositions and burials, a total of 58 settlements have been documented in Estonia (50 inland and eight on the main Estonian islands) (Kriista 2000). The sample is not homogeneous and the research has not been systematic. Most of the archaeological finds belonging to the CWC are pottery sherds, but most of the settlements have several occupation layers and the undecorated pottery sherds are sometimes mixed and misplaced among other archaeological deposits. At Estonian Corded Ware settlements, flint and stone are rare and flaked implements are almost never present. Besides the axes, flint implements are found at a low percentage of sites, generally in the form of triangular and heart-shaped flint arrowheads, chisels and scrapers (Kriista 2000). The study of the settlement patterns in Estonia showed a change in mobility and location. Even though recent research (Kriista 2000) concluded that cereals started to be cultivated in Estonia during the previous Neolithic phase, the Combed Ware Culture, the agricultural practices determined the location of the settlements during the CWC. The quality of arable lands and pastures for cattle were the main characteristics sought by the inhabitants of Estonia, but hunting and fishing were still important (Kriista 2000). A similar pattern is suggested for Corded Ware settlements in Finland and Latvia. Possibly, small groups were moving around the territory founding different settlements with habitations of different duration (Kriista 2000).

Remains of 17 habitation sites containing Corded Ware pottery have been investigated in Latvia (Loze 1992). Most of the sites were located on the inland zone, in Lubana Lake depression. Beakers, household pots and amphora were the main types of vessels obtained from domestic contexts, and blades, axes, scrapers and arrowheads make up domestic flint assemblage. Stone boat-axes were found in a high quantity (more than 150 implements). Thanks to the good preservation of organic materials several bone spears and chisels were documented. Bones were also used for an ornamental purpose and tablets with toothed, ribbon-shaped ends were common, not only in domestic contexts but also in burials. Further, several beads and pendants of Baltic amber were found at the sites, with different shape and typology (Loze 1992).

Finally, several sites with Corded Ware pottery were documented in Finland. The settlements were located on slopes where sandy soil changed into clay soil, near running water but not on the coastline. The settlements provided a high number of pottery fragments but a small amount of flaked stone and flint (Edgren 1984 in Kriista 2000; Kriista 2000; Larsson 2007/2008).

Scandinavia

Settlements were almost unknown in Sweden until the 1970s, when digging machines were incorporated into archaeological excavations. The first archaeological excavation performed with this new methodology revealed several houses from different periods, but publications did not appear until the late 1980s and the beginning of the 1990s. Several Neolithic houses, including Corded Ware structures, were found. The longhouses consisted of two aisled structures, and occasional evidence of a sunken floor was found. The amount of finds found inside the houses was low. In a recent publication by Larsson (2007/2008), an estimation of less than 200g of pottery and between 100g and four kilograms of stone was documented. Bone remains were unequally preserved at the settlements. Several occupations of Corded Ware houses have been documented in a number of cases, suggesting a reiterated use of the space by later communities (Larsson 2007/2008).

In Denmark, Jutland has been the centre of Single Grave research. There, during the 1980s, a large number of settlements were excavated. The sites were characterized by long houses associated with small assemblages containing amber, flint, stone and pottery (Liversage 1987). The origin of the SGC in Jutland was interpreted by Kristiansen (1991) as the result of the influence of several migrations, but Damm (1991) proposed that the SGC had local roots and originated in the previous TRB groups. The early Neolithic population in Denmark evolved differently during the TRB period: while in eastern Denmark the groups tended to stress their collective identity by using collective megaliths to bury their ancestors, in western Denmark individual graves predominated and the use of megaliths coexisted with the stone packing graves. During the Late TRB, the differences between both groups grew, and a deep change of the material culture, and a different group, the SGC, originated (Damm 1991). Excavated settlements in Denmark have provided house plans, pottery remains, a low quantity of flint and stone and fragments of amber ornaments. Finally, some pollen and zoo-archaeological remains were analysed in the late 1980s and early 1990s (Damm 1991; Kristiansen 1991; Larsson 1991; Liversage 1987; Robinson and Kempfner 1987).

In Norway, the SGC is interpreted as the arrival of a sudden and deep economic and political change (Liversage 1987). The pollen diagrams show the disappearance of the forest and the development of a landscape covered by grasses. The clearance of the forest has been interpreted as a reflection of the new economy of the groups. The settlements of the SGC were small with self-sufficient households. Subsistence strategies were dominated by herding and small scale cereal cultivation, but fruit gathering, hunting and fishing would complete the economy of the groups (Liversage 1987). In the region of Thy, settlements were interpreted as summerhouses where specialized activities were carried out by nomadic people. The Single Grave groups moved around the territory due to hard weather conditions during winter in this area of the country (Liversage 1987; Vandkilde 2005).

2.3 The Corded Ware Culture in the Netherlands

2.3.1 The chronology of the Corded Ware Culture in the Netherlands and the history of the research

Research into the CWC started during the late years of the 18th century (Fokkens 2005). Barrows were clearly visible in the landscape, and these structures soon caught the attention of the first Dutch scholars, but also of the first treasure hunters; unfortunately, some of the barrows were plundered and the context of the found materials destroyed. The excavations of Holwerda in the first decade of the twentieth century are considered the first systematic archaeological excavations accomplished in the Netherlands. The descriptions of the barrows and their associated archaeological materials were published, and Holwerda's work was followed and continued during the 1930s and 1940s by Van Giffen and several of his students, such as Van der Waals, Glasbergen and Waterbolk (Fokkens 2005). The first typo-chronology accepted by these Dutch scholars for the period was proposed and published in 1955 (Van der Waals and Glasbergen 1955), based on the typology of the thin-walled pottery associated with the excavated barrows and extended in 1965/66 (Anonymous 1965/1966). This typo-chronology remained in use until Lanting and Van der Waals (1976) proposed a continuity between the pottery of the CWC and that of the Bell Beaker period. A year later, this typology was reinforced with the publication of a series of radiocarbon dates for the prehistory of the Netherlands (Lanting and Mook 1977). Some new revisions were published during the 1990s (Drenth and Lanting 1990; Drenth and Hogestijn 1999) and the first decade of the current century (Lanting 2007/2008; Lanting and Van der Plicht 1990/2000). The publication by Drenth and Lanting (1990) was the first attempt to generate a typo-chronology based on a material culture different from pottery. The hammer axes found in the barrows of Drenthe were the basis to create a material distinction between the four phases of the CWC (Drenth and Lanting 1990). The articles opened a new debate on the last phase of the CWC, that is until now unresolved (for a further discussion see Beckerman 2012a).

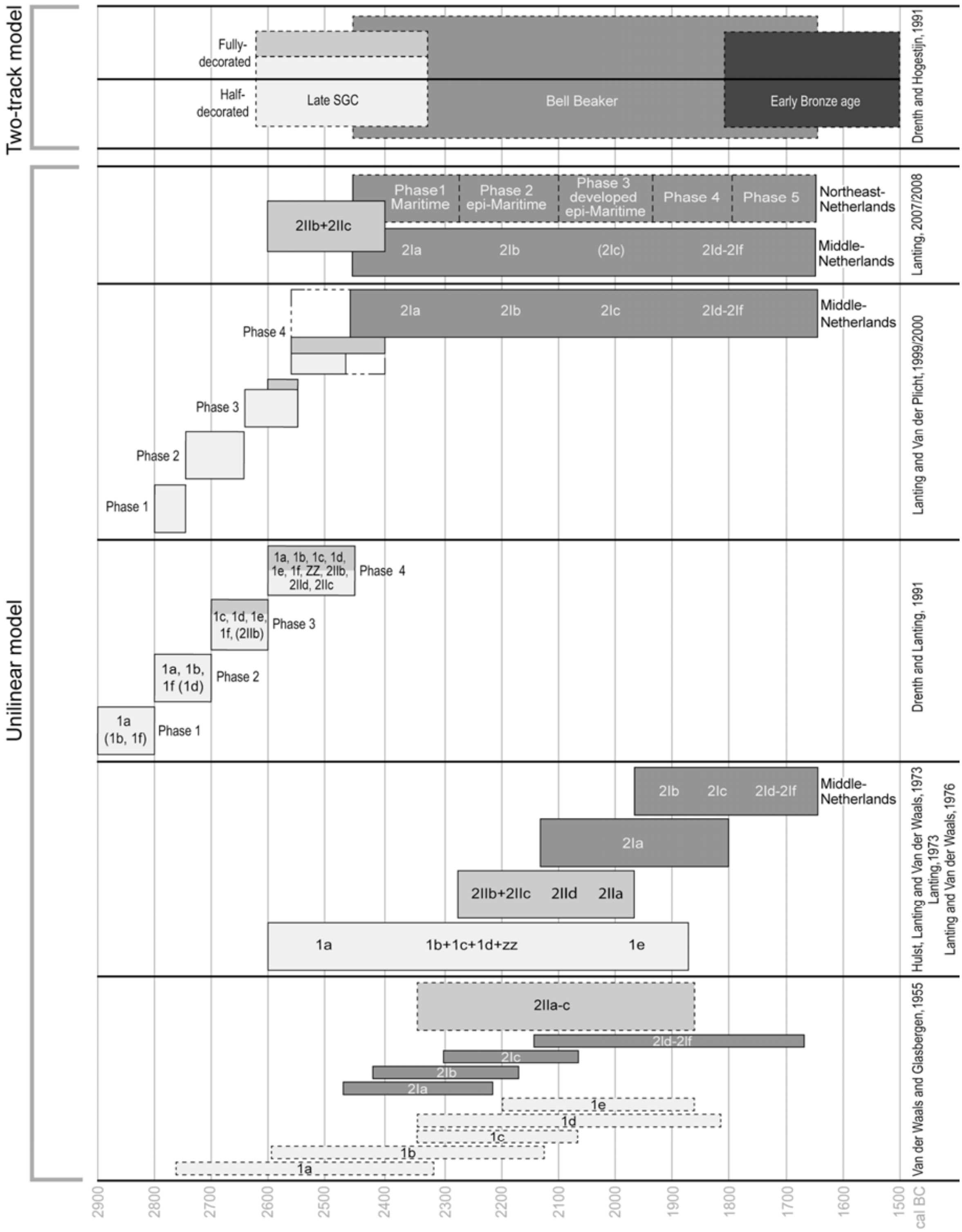
According to Drenth and Lanting (1990) and to Lanting and Van der Plicht (1990/2000), the CWC is divided into four phases (Drenth and Lanting 1990; Lanting and Van der Plicht 1990/2000):

a) Drenth and Lanting (1990) proposed a first phase starting with a chronology around 2900/2850 BC. However, Lanting and Van der Plicht (1990/2000) suggested a later beginning for phase 1, around 2800/2759 BC. In addition, Furholt (2003a) compiled several ^{14}C dating for northwestern Germany and the Netherlands, showing that the CWC in that area started around 2900 BC. The first phase is characterized by the presence of type A1-2 hammers, type 1a beakers without cord impressions and maybe type 1b and type 1f beakers with groove-lines decoration. At the end of this phase and at the beginning of phase 2, type 1a beaker with cord and fishbone impression emerged along with type A-3 hammers. In addition, amphora and waveband beakers occurred since the first phase and lasted until the fourth phase.

b) The second phase of the CWC in the Netherlands is dated around 2750-2650 BC. The phase is characterized by type B/A hammers, type B hammers, and faceted type 1 hammers. Decorated and undecorated beakers are present. Type 1a and type 1b beakers with cord and fishbone impressions are found along with type 1f beakers. At the end of the phase 2, type C and type C/A hammers and type 1d beakers are also found.

c) The third phase is dated around 2650-2550 BC. This phase is characterized by type D and type E hammers, faceted type 2a hammers and type 1a, type 1b, type 1c, type 1d and type 1f beakers. At the end of the phase the first AOO-beakers and the first Grand-Pressigny daggers are found.

d) Lanting and Van der Plicht (1990/2000) proposed a chronology of 2550-2400 BC for the fourth CWC phase. This phase is characterized by type H, type P1 and type R/S hammers and faceted type 2b hammers. In addition, type F and type G hammers are found outside graves. Several Corded Ware Beakers (type 1b, type 1c, type 1e and type 1f) are found in the graves. In addition, type 1e beakers are occasionally found at settlements. Along with these CWC beakers, AOO-beakers and ZZ-Beakers are also found. Finally, Grand-Pressigny daggers are found in the graves.



For the Van der Waals and Glasbergen model the dates in the publication were calibrated with Intcal09. For the other models the calibrated dates in the publications were used.

Legend:
Boxes with dashed lines: dates are suggested by the authors as indication
Boxes with solid lines: dates are suggested by the authors as having some certainty

= PF Beakers
= AOO Beakers
= Bell Beakers
= Early Bronze age Beakers

Figure 2.2. Different chronological models proposed for the CWC (Beckerman 2012a).

Recently, Beckerman (2016) proposed a different chronology for the Dutch coastal CWC groups. The study was based on technological analysis of sherds from diferent settlements of the Noord-Holland province and its correlation with the 29 ^{14}C datings available for the region (Beckerman 2016: 167). Although absolute dates could not be exactly assigned to the groups, Beckerman classified the ceramics in two different groups: Group 1, or early Corded Ware, characterised by ceramics often tempered with stone grit and more often thick-walled, and with a decoration often consisting manily of spatula motifs, but with cord and fingertip decoration also present (Beckerman 2016: 173); and Group 2, or late Corded Ware (Beckerman 2016: 173), characterised by a lower use of stone grit as temper material and a higher number of thin-walled pottery (Beckerman 2016: 173). The decoration was often applied with cords and All Ornamented beakers are found more oftenly in this group. However, and due to the lack of technological data available for the rest of the country, it is still uncertain if the model is valid for the whole of the Netherlands.

2.3.2 The discovery of Corded Ware Culture settlements in the Netherlands

Corded Ware settlements known in the Netherlands are not numerous. The fact that most of the research conducted for this period has focused on the excavation and documentation of barrows and graves has probably underrepresented the domestic sites. The preservation of archaeological sites is also affecting the existing sample. First of all, the geology of the Netherlands plays an important role in the identification of the settlements. Organic remains are almost absent in the sandy regions, affecting the economic knowledge for the entire Neolithic period. Therefore, the good preservation of this type of remains in the wetlands is crucial for the understanding of the Dutch Neolithic. Secondly, in the Noord-Holland province, the archaeological remains of the CWC were located near the surface. Consequently, the preservation of the settlements was deeply affected by natural erosion and recent agrarian activities (Hogestijn 2005).

Before the Second World War only one settlement, Zandwerven, had been excavated. The excavation was started by Van Giffen in 1929 and continued by Van Regteren Altena in 1957 and 1958 (Van Regteren Altena and Bakker 1961), but it was not until the 1970s that the excavations of settlements became more common. There are several reasons for this new research interest. First, since 1961 a new law had protected the barrows and megaliths, considering them heritage monuments. The total protection of the monuments caused an almost complete suspension of excavations of graves and barrows and diverted research into settlements. Secondly, the development of New Archaeology generated an interest in the economy and the social aspects of the inhabitants of the past communities. This interest was evidenced by the development of new excavation techniques and methods such as the introduction of flotation techniques and the use of sieves. The technical and methodological developments of archaeology were parallel to an expansion of building and railway construction projects in the Netherlands. Most of the excavated settlements of the CWC were discovered and excavated during the development of large-scale infrastructure.

Flint, stone and bone artefacts coming from settlement contexts received little attention, although the study of some flint artefacts was published in some publications (Fokkens 1982; Peeters 2001c). Stone tools from Kolhorn were also published in one article by Drenth and Kars (1990a) and bones were partially published in several publications (Van Ginkel and Hogestijn 1997; Van Heeringen and Theunissen 2001; Van Wijngaarden-Bakker 1997). These articles contain mainly typological and technological analyses of the stone and flint material, with few exceptions (Scheurs in Van Heeringen and Theunissen 2001: 137-138; Van Gijn 1985). Systematic use-wear analysis was not applied to any assemblages until 2009. From 2009 onwards, use-wear analysis was applied to flint, stone and bone remains from three different sites in Noord-Holland: Keinsmerbrug, Mienakker and Zeewijk (García-Díaz 2012, 2013 and 2014a; see Chapters 4, 5 and 6). Along with these publications, one unpublished bachelor's thesis focused on the analysis of the lithic material of Steenendam, and use-wear analysis of 50 flint artefacts (Van Roozedaal 2011).

Before the beginning of the *NWO Odyssee* project, some overviews of CWC were published (Drenth 2005; Fokkens 2005; Hogestijn 2005; Van Heeringen and Theunissen 2001). Probably the most complete overview, taking into account the entire territory of the Netherlands, was published in 2008 (Drenth *et al*. 2008). Since then, few new discoveries concerning CWC settlements have been published. CWC archaeological remains can be found in four different geological areas (Drenth *et al*. 2008; Van Gijssel and Van der Valk 2005)(Figure 2.3):

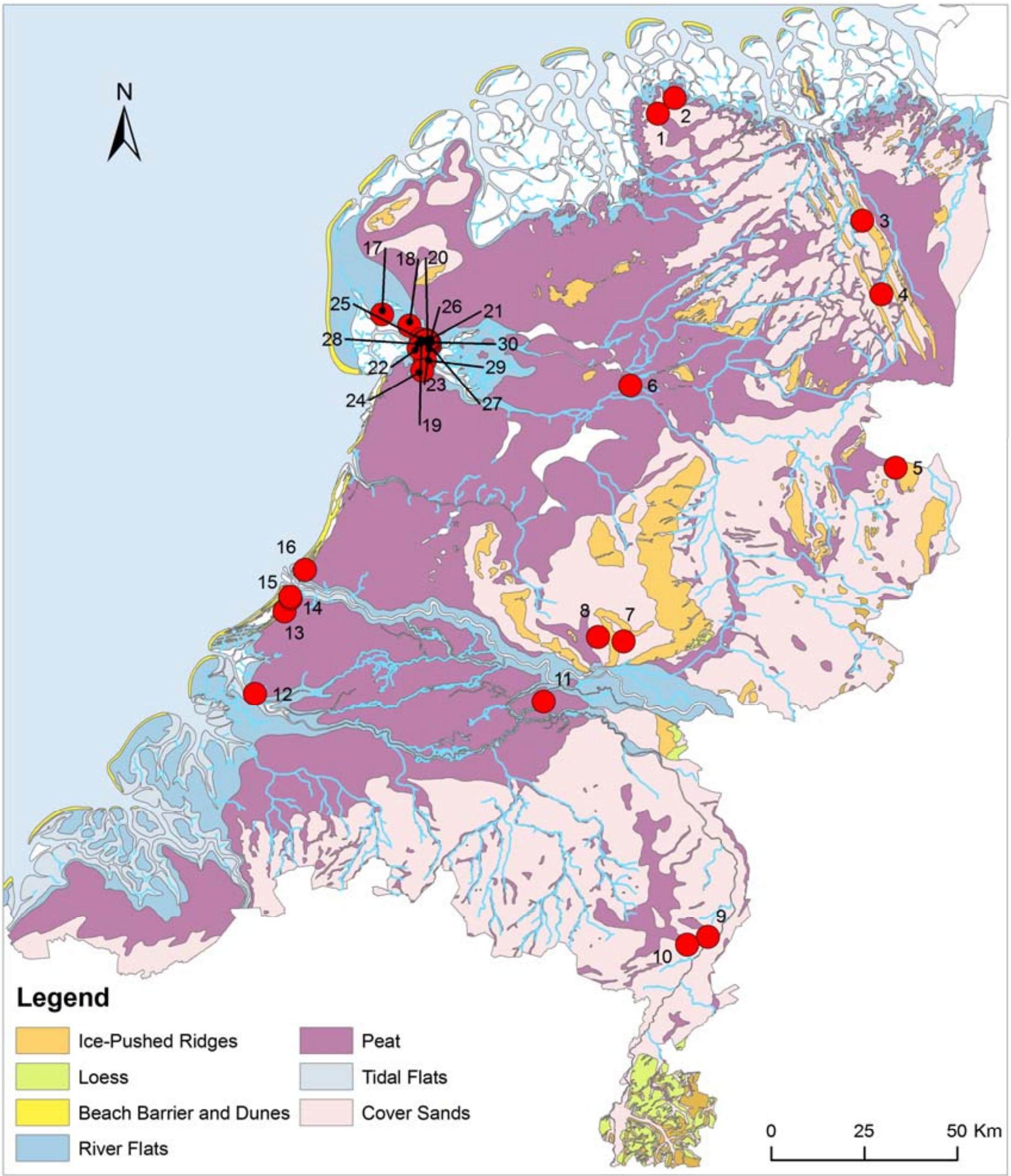
a) The coastal barriers and older dunes area: the coastal barriers were formed during the sea level rise during the first half of the Holocene. The increase in annual temperatures at the end of the last glaciation caused the melting of the glaciers and the polar ice caps. Holocene sedimentation started with the development of a thick peat layer in front of the estuaries. Water carried sediments that were deposited in front of the estuaries, which covered the peat deposits with clay (De Vries 2007). Finally, the low older dunes formed from drift sand blown onto the coastal barriers of the western Netherlands and were suitable for occupation from 4400 BC onwards.

b) The central river district was characterized by the confluence of a large number of rivers, including the Rhine and the Meuse. Geologically, the region was formed from the tops of former pre-Holocene river dunes located on peat and clay sediment deposits. In the surroundings, freshwater areas with plenty of wild animals and fish were available (Van Gijssel and Van der Valk 2005).

c) From a geological point of view, the northern, central and southern Dutch Pleistocene areas have remained unchanged during the last 10,000 years. The more humid conditions of the Holocene caused the expansion of a river system on sloping areas and the growth of extensive raised bogs on poorly drained flat areas (De Vries 2007: 309). Most of the Pleistocene soil was composed of sand, boulder clay and loess and, to a lesser extent, some areas of raised bog.

d) The tidal area in the province of Noord-Holland: this region is part of the marine and estuarine part of the Holocene Netherlands, and is characterized by tidal flats, salt marshes, levees and gullies. The large tidal basins of West-Friesland started to silt up between 4500 and 4000 BC as a result of sea level rise and became habitable around 2900-2800 BC (Smit 2012). At the beginning of the third millennium BC, extensive peat marshes started to form behind the coastal barrier (De Vries 2007: 305). The tidal branches caused several changes in the landscape, beginning between 4500 and 4300 BP (approx. 3200-2900 BC) when a lagoon formed and during the period 4300-3800 BP (approx. 2900-2250 BC) two tidal branches divided the territory and created a rich landscape, which was occupied by several Neolithic settlements. A brackish marsh environment connected to the Vecht and Ijssel rivers characterized the landscape. Finally, the eastern border was formed by broad peat bogs, whereas the northern border was marked by the Pleistocene outcrops of Wieringen and Texel (Smit 2012: 17).

Although information about settlements was obtained from different environmental contexts throughout the Netherlands, the knowledge available for the various areas is uneven. The best-known area is the province of Noord-Holland, where extensive surveys were conducted. In the rest of the country, materials dated to the CWC are scarce and usually come from test-pits or partial excavations. In the next section, a compilation of the information concerning the CWC settlements is presented. The aim of this section is to offer a comparative framework for the case studies presented in Chapters 4, 5 and 6. Therefore, special emphasis is placed on flint, stone, bone and amber assemblages.



SGC

1, Steenendam
2, Bornwird
3, Anloo
4, Odoorn Eeserveen
5, Vasse
6, P14
7, Ede-Ginkelse Heide
8, Ede-Frankeneng
9, Donk-Het Spookestraatje
10, Helden-Keuperheide
11, Geldermalsen-Middengeibied
12, Vlaardingen
13, Leidschendam
14, Voorschoten-Boschgeest
15, Voorschoten-De Donk
16, Warmond Park Klinkenberg

N-H

17, Keinsmerbrug
18, Kolhorn
19, Zeewijk
20, Molenkolk 1
21, Molenkolk 2
22, Mienakker
23, Aarstwoud I
24, Zandwerven
25, Land uit Zee
26, Rhomneyhut
27, Tweede beker
28, Flevo
29, De Veken
30, Maantjesland

Figure 2.3. CWC settlements in the Netherlands (after Vos and de Vries 2011).

2.3.3 Corded Ware settlements of the coastal barriers and older dunes areas

Remains from the CWC were found in four different sites: Leidschendam, Voorschoten-Boschgeest, Voorschoten-De Donk and Warmond-Park Klinkenberg. The four sites were characterized by the existence of a grey organic layer containing CWC remains. The four sites were only partially excavated and the exact dimensions of the settlements were not determined. For Voorschoten-De Donk a minimum dimension of 25x25m was calculated while Warmond Park Klinkenberg was estimated to be at least 50x30m (Drenth *et al.* 2008: 168). The discovery of CWC remains over an older Vlaardingen site complicated the dating of the pottery at Voorschoten-De Donk. This is also the situation at Leidschendam, a Vlaardingen settlement where only two clusters with CWC pottery were interpreted during the excavations. In addition, one axe fragment could also be attributed to the CWC period (Glasbergen *et al*. 1967). The palynological research shows two settlement phases, with the earliest phase dated to the CWC. Only two structures were found during the excavations of the four sites: two water pits in Warmond Park Klinkenberg (Bink 2006).

Warmond-Park Klinkenberg

The settlement, located close to the current shoreline, was partially excavated in 2005. Pottery remains were mainly associated with the habitation layer. The assemblage consisted of 951 sherds, characterized by their small size and usually very polished walls. Just 62 of the fragments were decorated. Based on this decoration, a CWC phase-4 occupation was proposed (Mooren 2006). The typo-chronology was supported by three ^{14}C samples[2] providing a chronological average between 2562 and 2307 BC, and an occupation of 150 years was proposed (Bink 2006). The botanical analysis indicated the predominance of wild plants such as tubers, blackberries, and elderberries, although the cultivation of barley nearby was also suggested (Van Beurden and Van Waijjen 2006). Additionally, hunting, fishing and pig herding activities completed the subsistence activities practised on the site (Peters 2006).

Stone and flint implements were found in low numbers during the excavation of Warmond Park Klinkenberg (Table 2.1 and 2.2). The stone assemblage consisted of 123 implements made from several raw materials (Table 2.2). Although the majority of the raw materials were locally collected, quartzite was interpreted as a possibly imported raw material (Dijkstra and Bink 2006). Manufacturing traces were present on a low percentage of the tools. Flakes were the most represented tool type. One fragmented

[2] UtC13795 4010±70; UtC13796 3887±47 and UtC13798 3946±45 (Bink 2006)

quartzite quern, three possible grinding tools and four hammer stones completed the sample. Finally, the excavations revealed several stones related to the production of ornaments. Fragments of amber, jet and lignite were recovered in low numbers, but no final products, such as beads or bracelets, were found (Dijkstra and Bink 2006) (Table 2.4).

The flint assemblage is small in number (Table 2.1). Although it was mostly related to the habitation layer, some of the implements were also found inside one of the watering pits. A preliminary study of the flint assemblage was published in 2006 (Dijkstra and Bink 2006). Flint implements were described in terms of raw material, typology and technological traits, but, unfortunately, no use-wear analysis was performed. The flint is characterized by its low quality and flint tools were mainly produced with local raw material. Rolled nodules of northern flint were selected as cores, although some flakes were produced from broken flint axes. Flint technology was directed towards flake production, and the main approaches used were bipolar and direct hard percussion. Due to the use of small rolled pebbles, the implements obtained were of small dimensions. Retouched tools were not numerous (Table 2.1), and the main tool types are unmodified flakes, scrapers, borers, retouched flakes and retouched knives. Scrapers were predominantly made out of flakes, while borers were made from flint fragments (Dijkstra and Bink 2006).

2.3.4 Corded Ware settlements of the central river district

Just two possible settlements were identified on the central river area and only one was excavated. The first site, Vlaardingen, was located on top of another Vlaardingen site, making the chronological attribution of the site complicated. Three pottery sherds with '*maritime*'-type decoration suggested a possible attribution to the CWC, but the sherds could not be definitively assigned to the late CWC phase, or to the early Bell Beaker Culture (Drenth *et al.* 2008). The second site, Geldermalsen-Middengebied, was partially excavated and some archaeological materials without a clear archaeological context were recovered (Drenth *et al.* 2008).

2.3.5 Corded Ware settlements of the northern, central and southern Dutch Pleistocene areas

The archaeological evidence available for this region is not plentiful. The Pleistocene areas only revealed a small number of implements, lacking a clear archaeological context. Based on the description provided by Drenth *et al.* (2008: 170-172) two groups of archaeological finds could be distinguished. The first type consisted of concentrations of finds (generally pottery sherds or flint implements) without a clear association to structures or habitation contexts. Helden-Keuperheide, Ede-Ginkelse Heide, Ede-Frankeneng and Donk-Het Spookestraatje are examples of this type. The assignment of the materials to the CWC is based on pottery decoration. Other implements such as flint arrowheads helped to form the chronological estimation of two settlements, Ede-Frankeneng and Donk-Het Spookestraatje (Drenth *et al.* 2008). The second type of evidence is characterized by the presence of other archaeological finds linking the materials with the CWC. Most of the finds are associated with burials, as in the case of Anloo[3] (Jager 1985; Waterbolk 1960), P14 (Gehasse 1995; Ten Anscher 2012) and Ordoorn-Eeserveld (Bakker 1973). Additionally, one possible house plan was found during the excavation of Vasse, but its chronological attribution is still under discussion (Drenth *et al.* 2008: 172; Hogestijn and Drenth 2000).

Bornwird

The excavation of Bornwird (Fokkens 1982) provided several types of pottery from TRB and CWC associated with three postholes and two pits. Stone and flint implements were also found during the excavation. The chronological attribution of the flint implements was complicated due to the limited tool type variability for the northern part of the Netherlands during the Late Neolithic cultures. This low variability is probably due to a continuity in technological traditions (see Chapters 7 and 8). In addition, it is also determined by the low number of possibilities that the most-used raw material (moraine flint) offered the flint knapper. In addition, a clear stratigraphic correlation between the implements and the archaeological layers could not be established, and the study of the material culture did not provide information about the internal organization of the site.

Flint implements were considered to '*resemble to a number of – vaguely described – TRB assemblages*' (Fokkens 1982: 104). Flint implements were produced with local moraine flint. The assemblage was composed mainly of waste (99%), while 1% was classified as '*used or further worked*' (Fokkens 1982: 102). The functional classification of the tools was based on the retouched edges of the implements, as no use-wear analysis was performed. Therefore, 201 retouched tools were classified typologically in five groups and a presumed function was assigned based on the shape of the retouched edge. The main types were blades and flakes showing a convex retouch and/or use retouch, used for scraping or cutting; blades, flakes and blocks with a notch or concave retouch and/or use retouch used for scraping; flakes and blades with a pointed projection and a retouch

[3] The interpretation of Anloo is still under debate. Although the main interpretation is that the remains found belonged to a cattle-kraal, several authors consider that the archaeological remains could be part of a settlement (Bakker 1979; Van Gijn and Bakker 2005; Voss 1982).

used for drilling; and flakes and blades typologically characterized as arrowheads due to their retouch. A trapezoidal arrowhead was classified as typical for the TRB groups, while a leaf-shaped point was considered to belong to the Late Havelte groups (Fokkens 1982: 102).

Steenendam

At Steenendam, an inventory of the 1972-1973 excavation generated a list of almost 12,500 flint implements (Fokkens 1980 in Van Roozedaal 2011). Recently, a selection of 127 flint implements (1.01% of the total assemblage) have been re-studied using the typo-technology classification system of the database of the Laboratory for Artefact Studies (Leiden University)(Van Roozedaal 2011). Although the number of implements studied was low, some relevant conclusions were obtained: the assemblage was characterized by the use of local flint; cores were flaked without a previous platform preparation, and the use of bipolar technology was extensive; flint cores were small and were exploited randomly, displaying two or more flaking platforms; and flint technology was oriented towards flake production, although a low number of blades were also documented. The number of retouched implements was small, and tool types were dominated by scrapers and retouched flakes (Table 2.1) (Van Roozedaal 2011).

Use-wear analysis was performed on 45 flint implements, predominantly unmodified flakes and blades (Table 2.1). The number of artefacts showing use-wear is low and no general conclusion can be made, but the results show a predominance of the use of flint implements to process vegetal resources (Van Roozedaal 2011) (Table 2.5).

2.3.6 Corded Ware settlements of the tidal area: the province of Noord-Holland

In the Noord-Holland province several archaeological interventions were performed from the late 1970s until the late 1990s, and a large number of archaeological settlements dated to the CWC were documented (Figure 2.4). The archaeological settlements were concentrated in the higher parts of the tidal areas, relatively close to fresh water sources and to the sea line. The presence of several ecological niches in the area provided a rich environment to be exploited by Neolithic communities, and archaeological settlements started to flourish during that period. Due to the good preservation of the organic remains, the Noord-Holland province is the region with the highest number of documented CWC settlements. This region provided the most complete information about habitation patterns and economic strategies in the entire country (Van Heeringen and Theunissen 2001).

The settlement classification was performed on the basis of different archaeological finds, and therefore the category '*settlement*' encompasses a wide variety of sites. In the first place, some of the settlements consisted of isolated finds, as in the case of Rhomneyhut and Tweede Bejker (Van Heeringen and Theunissen 2001); some were discovered thanks to several drilling campaigns performed in 1989, although few materials were recovered (van Heeringen and Theunissen 2001) (Table 2.2); some sites (Land uit Zee) were considered as possible settlements after initial analysis, but they were never excavated (Van Heeringen and Theunissen 2001); and, finally, other settlements, such as Aarstwoud I, Molenkolk 1 and Molenkolk 2, Zandwerven, Zeewijk and Kolhorn, were subjected to large-scale excavations, although only two settlements, Keinsmerbrug and Mienakker, were excavated completely.

Hogestijn (1992, 1998, 2001, 2005) divided the sites into two groups on the basis of their size and form. Group 1 was composed of settlements larger than 3,000 m^2, situated close to open water, with a large assemblage. These types of settlements were interpreted as permanent residential settlements occupied by relatively large groups. Group 2 settlements were smaller and not situated close to open water, and the material culture associated was less extensive. The settlements from this group were interpreted as seasonal camps occupied by small groups performing specific activities (Hogestijn 1992, 2001, 2005). Subsistence activities were also different in the two types of settlements: while fishing and fowling are largely represented at Group 2 settlements, the presence of ard marks mostly at Group 1 settlements indicates that agricultural activities were principally performed on larger settlements (Hogestijn 2005).

Before the beginning of the NWO *Odyssee* project, the typo-chronology of the Noord-Holland settlements showed a small number of settlements during the early phase of the CWC period, a dense concentration of settlements during the main phases of the CWC, a continuation during the Bell Beaker period, and a change of settlement patterns during the Bronze Age with the reduction of the number of settlements in the area. However, during the NWO *Odyssee* project Beckerman (2016) re-analysed pottery sherds from several Noord-Holland settlements and suggested that the differences observed between the two distinguished pottery groups could be chronological (Beckerman 2016: 173; see section 2.3.1). Following Beckerman (2016: 173), Group 1 consists of the top layers at Zandwerven, Zeewijk-Oost, the northern part of Zeewijk-West, Aartswoud and Keinsmerbrug, while Group 2 consists of the southern part of Zeewijk-West, Mienakker and De Venken. Although most of the calibrated dates available for the region fall within 2880-2200 BC, Beckerman points out that actually Group 1 does contain the oldest dates of the region (Zandwerven and the northern part of Zeewijk-West).

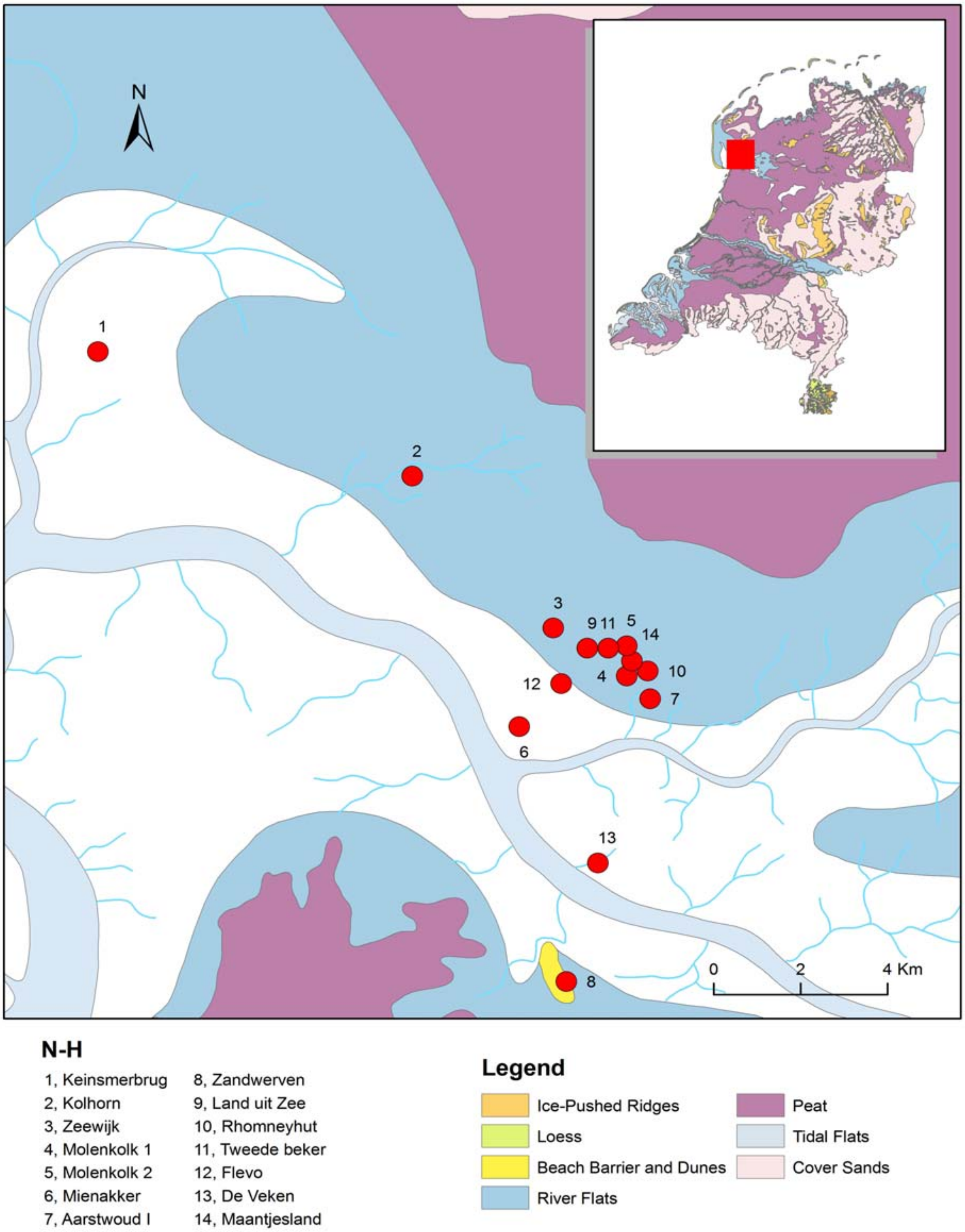


Figure 2.4. Corded Ware Culture settlements in the North-Holland province (after Vos and de Vries 2011).

Flint

The study of flint implements shows a predominant use of local material. Flint was collected from the Pleistocene deposits of Texel and Wieringen, and carried to the settlements where tools were produced (Peeters 2001b, 2001c; Van Iterson Scholten and De Vries-Metz 1981). In addition, some imported flint was used. This can be inferred from the use of low percentages of flint from the Maas-Rijn deposits at Aarstwoud (Van Iterson Scholten and De Vries-Metz 1981), Molenkok 2, De Veken and Maantjesland (Peeters 2001c), the use of Spiennes flint to produce a polished axe at Molenkok 2, and the documentation of eight implements coming from France, possibly Grand-Pressigny flint (Delcourt-Vlaeminck quoted in Van Heeringen and Theunissen 2001) at Aarstwoud.

Flint technology was determined by the physical characteristics of the northern raw materials. The hammer and anvil technique was predominantly used to exploit the rolled flint nodules, although other flaking techniques such as unidirectional and multidirectional approaches were also documented at several sites (Peeters 2001c; Van Gijn 1985). Flint production was focused on flakes, and blades were rare. Retouched implements were not numerous, and the diversity of tool types was small. These implements were mostly flake-scrapers, retouched flakes and blades, *pièces esquillées* and borers (Table 2.1), but other tool types such as arrowheads, wedges and hammers were documented, although less frequently (Peeters 2001c).

Table 2.1. Flint tool types and number of implements found at the settlements cited on the text.

	Flakes	Blades	Retouched Blades	Cores	Scrapers	Borers	Wedges	Arrowheads	Sickle	Hammer	Burins	Retouched Flake	GP dagger	Axe	Retouched general	Flint general
Warmond Park	107	12	2	9	12	2	-	-	-	-	-	11	-	-	2	186
P 14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bornwird	-	10	-	-	-	1	-	2	-	-	-	201	-	-	-	-
Steenendam	*	-	-	7	*	-	-	-	-	-	-	-	-	-	36	12.429
Aarstwoud	-	-	-	-	57	3	2	8	1	-	-	-	-	-	-	8156
Molenk 1	170	4	-	1	6	-	-	1	-	-	-	2	-	-	1	221
Molenk 2	293	2	2	2	3	-	-	1	-	1	-	-	-	-	1	349
Portwelw	43	-	-	-	2	-	-	-	-	-	-	3	-	-	-	63
De Veken	192	1	-	5	8	1	-	-	-	-	1	6	-	-	-	239
De Vrij 1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flevo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*
Poolland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Mees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gouwe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*
Maantij	*	1	-	*	2	-	-		-	-	-	3	1	-	-	146
Westfr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*
Stridham	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tweede B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zaandwerven	-	-	-	-	*	-	-	-	-	-	-	-	-	-	*	-
Kolhorn	*	-	-	-	*	*	-	1	-	-	-	*	-	1	-	10.000
Texel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-
Anloo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

When the tool types or the material are mentioned but the number is not specified, an asterisk is used (GP: Grand-Pressigny).

Use-wear analysis was performed on two assemblages, Kolhorn and Aarstwoud. At Aarstwoud, use-wear analysis was performed on nine tools interpreted as a '*possible deposition*' (Scheurs in Van Heeringen and Theunissen 2001: 137-138). The implements, seven scrapers and two flakes, were found while taking new samples for an internal report of the predecessors of the Cultural Heritage Agency, the State Service for Archaeological Investigations (Rijksdienst voor het Oudheidkundig Bodemonderzoek, ROB) in 1999 (Scheurs in Van Heeringen and Theunissen 2001: 137-138). Although the preservation of the tools was not good, some results were obtained from use-wear analysis. Seven implements, six scrapers and one unmodified flake were probably used to scrape hide; one flake, with bifacial retouch, was possibly used to cut an undetermined hard material; and one scraper showed some polish that could be interpreted as hafting traces (Table 2.2).

At Kolhorn, a pilot study was performed on a random selection of 29 scrapers (Van Gijn 1985). Only seven scrapers displayed possible traces of use, and in only three of these cases the contact material could be interpreted. One scraper may have been used to work an indeterminate plant material, while two scrapers were used for hide scraping (Table 2.2).

		Aarstwoud	Steenendam	Kolhorn	Total
	Hide	7	1	2	10
Animal	Hard Uns	-	1	-	1
	Soft Uns	-	1	-	1
	Plant Uns	-	1	1	2
Plant	Hard Plant	-	3	-	3
	Reed	-	1	-	1
	Siliceous Plant Uns	-	2	-	2
Plant/Hide	-	-	1	-	1
Hafting traces	Unknown	1	-	-	1
Undetermined	Hard	1	3	-	4
Unsure/Unknown	-	-	2	-	2

Table 2.2. Results of the use-wear analysis performed to flint implements of three CWC settlements in the Noord-Holland province (Uns: unspecified).

Stone

Although some analysis was performed on the stone assemblages from Aarstwoud I (Van Iterson Scholten 1981), De Vrijheid 1 and De Vrijheid 2 (Van Heeringen and Theunissen 2001), the only settlement that was systematically analysed was Kolhorn (Drenth and Kars 1990b). At Kolhorn, stone implements were predominantly produced using local raw material, which was collected, as in the case of flint, from the nearby areas of Texel and Wieringen (Drenth and Kars 1990b) and from the east coast of the Ijsselmeer (Van Iterson Scholten and De Vries-Metz 1981: 131). Imported materials were also used to produce stone artefacts, as corroborated by the fragment of a gabbro hammer-axe, the 63 pieces of Meuse River gravel and the two pieces of red sandstone documented at Aarstwoud I (Van Iterson Scholten and De Vries-Metz 1981). Grinding stones and querns are the best-represented tool types, but other tool types, such as rubbers, whetstones, pounders, battle-axes, cubic stones and hammer stones, were also recovered (Table 2.3). A selection of raw materials to produce some implements was inferred at Aarstwoud I and Kolhorn. At both settlements, querns were mainly produced using granite (granite and gneiss in the case of Kolhorn, and granite in the case of Aarstwoud I), while quartzite and sandstone were chosen to produce hammer stones (Drenth and Kars 1990b; Van Iterson Scholten and De Vries-Metz 1981). Several production traces were documented on handstones, querns and grinding stones from Kolhorn. Querns and grinding stones usually displayed negatives of flake removals, the result of flaking used to sharpen or shape the implements. Additionally, some handstones showed traces of percussion along their lateral perimeters, indicating that the tools were hammered to obtain the desired shape (Drenth and Kars 1990b). Use-wear analysis was not performed on the stone assemblages, but some functional inferences were made for the implements from Kolhorn. Processing cereals, polishing bone tools, grinding amber and cracking hazelnuts were some of the uses proposed by the researchers (Drenth and Kars 1990b). Unfortunately, until use-wear is performed, the exact function of these tools will remain unknown.

	Flake	Quern	Grinding tools	Hammerstones	Rubbing topol	Whetstones	Pounder	Battle Axe	Weight	Cubic stones	Stones general
Warmond Park	*	1	3	4	-	-	-	-	-	-	123
P 14	-	-	-	-	-	-	-	-	-	-	-
Bornwird	-	-	1	7	-	-	-	-	-	-	-
Steenendam	-	-	-	-	-	-	-	-	-	-	-
Aarstwoud	-	*	*	*	*	*	*	1	-	-	7471
Molenk 1	-	-	-	-	-	-	-	-	-	-	-
Molenk 2	-	-	-	-	-	-	-	-	-	-	-
Portwelw	-	1	-	-	-	-	-	-	-	-	-
De Veken	-	-	-	-	-	-	-	-	-	-	-
De Vrij 1 and 2	-	-	1	-	-	1	-	3	-	1	-
Flevo	-	-	1	-	-	-	-	-	-	-	-
Poolland	-	-	-	-	-	-	-	-	-	-	-
Mees	-	-	-	-	-	-	-	-	-	-	-
Gouwe	-	-	-	-	-	-	-	-	-	-	-
Maantij	-	-	2	1	-	-	1	-	1	-	*
Westfr	-	-	-	-	-	-	-	-	-	-	-
Stridham	-	-	-	-	-	-	-	8	-	4	*
Tweede B	-	-	-	-	-	-	-	-	-	-	-
Zaandwerven	-	-	-	-	-	-	-	1	-	-	-
Kolhorn	-	38	9	25	9		*	4	-	7	150
Texel	-	-	-	-	-	-	-	-	-	-	*
Anloo	-	-	-	-	-	-	-	-	-	-	-
Total	-	40	17	37	9	1	1	17	1	12	

Table 2.3. Stone tool types and number of implements found at the settlements cited in the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Bone

Although one of the characteristics of the Noord-Holland province is the good preservation of the organic implements, only the bone assemblage from Aarstwoud I has been studied. Bone awls and pins from the 1972 excavation were published in 1981 (Van Iterson Scholten and De Vries-Metz 1981). Additionally, two '*hamerknop*' needles[4] were published in 2001 (Van Heeringen and Theunissen 2001). A preliminary study of 174 bone implements was carried out in 1994 (Cavallaro in Drenth *et al* 2008). Most of the worked bone assemblage at Aarstwoud I consisted '*primarily of needles and awls, but also included spatulas, ornaments, weights, scrapers, axes and retouchoirs*' (Drenth *et al*. 2008: 164)(Table 2.4). Other animal products were also used to produce ornaments (Table 2.35). Three perforated teeth (from a dog, a pig and a deer) were recovered during the excavation. In addition, some isolated bone implements were also studied and published, such as the bones interpreted as possible flutes made out of bird bones at De Vrijheid 1 and 2 (Table 2.4).

[4] These types of needles could be defined as pins with a flat, square, broad end.

	Awls	Pins	Needles	Spatulas	Ornaments	Weights	Scrapers	Axes	Retuchoirs	Flutes	General
Warmond Park	-	-	-	-	-	-	-	-	-	-	-
P 14	-	-	-	-	-	-	-	-	-	-	-
Bornwird	-	-	-	-	-	-	-	-	-	-	-
Steenendam	-	-	-	-	-	-	-	-	-	-	-
Aarstwoud	*	*	2	*	3	*	*	*	*	*	174
Molenk 1	-	-	-	-	-	-	-	-	-	-	-
Molenk 2	-	-	-	-	-	-	-	-	-	-	-
Portwelw	-	-	-	-	-	-	-	-	-	-	-
De Veken	-	-	-	-	-	-	-	-	-	-	-
De Vrij 1 and 2	-	-	-	-	-	-	-	-	-	1	3
Flevo	-	-	-	-	-	-	-	-	-	-	-
Poolland	-	-	-	-	-	-	-	-	-	-	-
Mees	-	-	-	-	-	-	-	-	-	-	-
Gouwe	-	-	-	-	-	-	-	-	-	-	-
Maantij	-	-	-	-	-	-	-	-	-	-	-
Westfr	-	-	-	-	-	-	-	-	-	-	-
Stridham	-	-	-	-	-	-	-	-	-	-	-
Tweede B	-	-	-	-	-	-	-	-	-	-	-
Zaandwerven	-	-	-	-	-	-	-	-	-	-	-
Kolhorn	-	-	-	-	-	-	-	-	-	-	-
Texel	-	-	-	-	-	-	-	-	-	-	-
Anloo	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	2	-	3	-	-	-	-	1	

Table 2.4. Bone tool types and number of implements found at the settlements cited in the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Ornaments

At Aarstwoud I, amber, shell and ceramic beads and pendants were produced. Piena and Drenth (2001) studied almost 200 fragments of amber (Table 2.4) indicating the local production of amber beads. Small nodules of amber were collected from nearby seashores. Flint borers were used to produce amber beads with a conical perforation, while bone borers were probably used to produce beads with a long and cylindrical perforation. Flint borers are likely to have been hafted with wood or bone, and used together with ceramic discs (Piena and Drenth 2001). Unfortunately, no evidence of these borers was found during the analysis of the bird remains (Van Wijngaarden-Bakker 1997). The local production of amber beads and ornaments was inferred from the presence of splinters, flakes and core fragments recovered during sieving. Shell and ceramic beads were probably produced locally (Table 2.5). The ceramic beads were produced with clay tempered with chamotte[5]. Two clay beads, one disc-shaped and the other ball-shaped, were discovered during the excavation. Clay was also used to produce a small female figurine interpreted as a statue of a mother-goddess (Van Heeringen and Theunissen 2001). Finally, three disc-shaped shell beads with a central perforation were

[5] *Chamotte:* fragments of crushed pottery and/or fired clay added to a clay body as a temper (Rice 1987).

also recovered (Table 2.5). The beads were produced with a plaque of an oyster shell and were perforated. On two examples the perforations had an hourglass shape, while the third implement showed a conical perforation.

		Amber		Jet	Lignite	Shells	Ceramic beads
	Fragments	Beads/pendants	Amber general				
Warmond Park	3	-	-	1	32	3	2
P 14	-	-	-	-	-	-	-
Bornwird		-		-	-		
Steenendam		-		-	-		
Aarstwoud	*	35	200	-	-	3	2
Molenk 1	-	1	-	-	-	-	-
Molenk 2	3	-	-	-	-	-	-
Portwelw	-	-	-	-	-	-	-
De Veken	-	-	-	-	-	-	-
De Vrij 1 and 2	-	-	-	-	-	-	-
Flevo	-	-	-	-	-	-	-
Poolland	-	-	-	-	-	-	-
Mees	-	-	-	-	-	-	-
Gouwe	-	-	-	-	-	-	-
Maantij	-	-	-	-	-	-	-
Westfr	-	-	-	-	-	-	-
Stridham	-	-	-	-	-	-	-
Tweede B	-	-	-	-	-	-	-
Zaandwerven	-	-	-	-	-	-	-
Kolhorn	*	*	150	*			
Texel	-	-	-	-	-	-	-
Anloo	-	-	-	-	-	-	-
Total	6	36	350	1	32	6	4

Table 2.5. Ornament types and number of implements found at the settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

2.3.7 Depositions in the Netherlands

The first evidence of depositions in the Netherlands dates to the Late Mesolithic, although depositional practices would not become more common until the Middle Neolithic. These practices continued during the Late Neolithic, the Bronze Age and the Iron Age (Fontijn 2002; Wentink 2006; Wentink *et al.* 2011).

A deposition could be defined as an implement, or a group of objects, deliberately placed in a spot. CWC depositions were made up of one or more objects, mostly axes (flint axes, stone axes or battle axes), flint blades and pottery vessels. Depositions consisting of one-piece wooden wheels are also typical of the CWC (Van der Waals 1964). The first evidence of wooden wheels in the Netherlands is dated to the first half of the 19^{th} century and, although it was not until more than a century later that a second example appeared at the excavation of the Neolithic track-way of Nieuwe-Dordrecht, since 1955 a total of 13 disc wheels have been recovered from the peat deposits of the provinces of Drenthe, Groningen and Overrijssel (Van der Waals 1964). Wooden wheels were produced from one single piece of oak wood and have similar dimensions. Disc wheel depositions were interpreted as ritual implements due to the connection between the wheels and the track-way. The hoards were considered as a reflection of the importance of networking and communication in the symbolic world of Late Neolithic communities. Finally, Drenth *et al.* (2008) argued that some bone remains found in connection with burials or barrows should also be considered intentional depositions.

Flint and stone depositions have been found in the Netherlands in the form of multiple or single object hoards. Ter Wal (1996) conducted an extended compilation of flint depositions in 1996. In addition, Wentink (2006) and Van Gijn (2010a) analysed twelve CWC depositions from the north of the Netherlands. Nine were multiple object depositions and three were single object hoards. The implements were described technologically and use-wear analysis was performed. The artefact depositions analysed were mainly made up of blades and axes, but chisels and scrapers were also present.

Implements found at the depositions were produced using local and imported materials. While axes were made of both local and imported flint, blades, except for the implements coming from the hoard of Elp, were produced using French or Scandinavian flint. Other tools, such as chisels and scrapers, were produced using exclusively local flint (Van Gijn 2010a : 184-192). Scrapers and chisels were probably produced in domestic contexts and transported to the place of the deposition. Although no local flint nodules or cores were deposited in the hoards, they were found at the excavated settlements. However, little information is available for the production of axes and blades. Evidence of workshops has not been found in the Netherlands and, among the domestic flint assemblage analysed, there are no indications of axe production. Nevertheless, the small size of the axes was interpreted as an indication of their continued use (Van Gijn 2010a : 184-192). Imported daggers probably arrived as finished products. Although Grand-Pressigny fragments were recovered in some domestic contexts, the production sequences of the imported blades are missing.

Microscopic analysis showed that some of the tools had been used before their deposition. Traces related to use and hafting were present on most of the axes analysed. Axes were used to cut wood, they were often reshaped and some were buried, covered by ochre (Van Gijn 2010a : 185). Blades mainly display plant-polish-like use-wear traces, and, in addition, one blade showed hafting traces. Finally, at least seven blades displayed traces of contact with hide all along their surface. These traces were interpreted as a result of the transport of the blades inside a hide cover. The use-wear of the blades shows that the implements arrived at the deposition as finished products (Van Gijn

2010a : 191). Chisels were related to wood working as well, and in one case the tool was also buried, covered by ochre. Finally, the scraper from the De Pieperij hoard did not show use-wear traces, but the microscopic observation of the tools showed that the surface was covered by the red-orange traces of ochre (Van Gijn 2010a: 236).

2.3.8 Burials: Barrows and flat graves

In Late Neolithic, the funerary rituals changed. Although flat graves were still in use during the CWC period, the CWC people started to bury their dead in individual graves, mainly in barrows. Barrows are part of a burial ritual that includes the construction of a tumulus, or mound, to cover a grave. The use of barrows in the Netherlands started during the CWC, and lasted until Roman times. Mounds implied a change from a collective to an individual practice. Several authors (Barret 1989; Bradley 2005) propose the intentional durability of the barrows, used as visual markers (Llobera 2007) and creating a new landscape: a barrow landscape (Bourgeois 2013). CWC barrows have been found mainly concentrated in two areas: firstly in the northern Pleistocene part of the Netherlands, mostly in the provinces of Drenthe and Friesland, and secondly in the central part of the Netherlands, in the provinces of Gelderland and Utrecht. So far, no Corded Ware barrows have been found in the rest of the country (Bourgeois 2013; Drenth *et al*. 2008). Flat graves consisted of human inhumations in the ground, without a mound or a construction marking the burial. Flat graves have been found in the Pleistocene areas of the country, for example at Anloo (Jager 1985; Waterbolk 1960).

Under the barrows and in the flat graves, individual bodies were generally buried lying in a bent position on their left or right side (Drenth 1992). Bodies were usually accompanied by a vessel with a typical protruding foot beaker or AOO beaker decoration and three or four additional objects, commonly including a stone battle-axe or a flint dagger. Sometimes other flint tools, such as flint arrowheads, scrapers, flakes and hammer stones, were placed in the grave (Van Gijn 2010a: 141-142). Imported raw materials were used to produce several implements found among the grave goods. Scandinavian flint was brought to the Netherlands in the shape of unretouched blades, and was placed in flat graves and barrows. Usually, just one Scandinavian blade was placed on the grave; however, in several cases, two blades were found among the grave goods. Axes produced using northern flint were usually present in the burials. Occasionally, two axes were found in the grave, one small and one larger. Grand-Pressigny and Romigny-Léhry daggers were imported from France during the 2550-2400 fourth CWC phase (AOO period). The number of daggers was relatively small compared with other regions of Europe such as France and Switzerland (Van Gijn 2010a: 145). Consequently, around 15% of the barrows contained a dagger. Imported flint implements were brought to the Netherlands already shaped. Almost no evidence of workshops or imported material was found in the settlements, with the exception of several fragments of Grand-Pressigny flint (see Chapter 5). Traces of edge rejuvenation were observed during the microscopic analysis of several flint axes, indicating the preparation of the implements for use as grave goods (Van Gijn 2010a: 144).

Not only flint was imported. Other stones, such as quartzite, that were scarce in the northern part of the Netherlands were used to produce battle-axes (Wentink 2006). Local materials were used for a low percentage of grave goods. Small flint implements associated with the burials were produced using low-quality local flint. Small rolled pebbles and low quality flint were selected to produce scrapers and unmodified flakes. Local raw materials were used to produce other stone tools, such as querns, found in a small number of graves. Amber beads were found in only five graves (Van Gijn *in press*; Wentink *in prep*). As in the case of the settlements, amber beads were probably shaped using local flint gathered from the coastline. Finally, although bone objects were not preserved, the likelihood of their deposition should not be completely ignored (Prummel and Van der Sanden 1995).

Grave goods from barrows and flat graves have been studied from a typological and technological point of view (Hulst *et al.* 1973; Lanting and Van der Waals 1976). Use-wear analysis has been performed on grave goods from 14 barrows and three flat graves (Wentink 2006; Van Gijn 2010a). Only flint implements have been analysed and published, and no stone tools were present in the sample; hopefully further analysis will provide information about the use and production of stone tool implements, an important component of the burial goods (Wentink *in prep*). The results of use-wear analysis are diverse. While Scandinavian blades, daggers and unmodified flakes were not intensively used, or not used at all, flint axes and arrowheads showed more distinctive traces of use. The first ones displayed traces related to chopping wood, while impact traces were found in every single one of the eight arrowheads analysed (Van Gijn 2010a: 144). Nevertheless, microscopic analysis provided important information about the symbolic use of the implements; for example, the plant-polish-like traces distributed all along the edges and the ridges of the Grand Pressigny daggers were interpreted as the result of contact between the dagger and a woven sheath (Van Gijn 2010a: 145).

Grand-Pressigny daggers were studied in other European contexts (Beugnier and Plisson 2004; Vaughan and Bocquet 1987), and their use was mainly associated with cereal processing. Sickles from European Neolithic contexts have been interpreted as identity items (Palomo *et al.* 2004: 194), which seems coherent within a context when agricultural practices were common and established in most parts of Europe. In the Netherlands, the analysis of several daggers suggested a different interpretation (Van

Gijn 2010a). No evidence of cereal traces was found on the surface of the analysed blades and the contact traces left by the sheath were interpreted as damage caused while showing the daggers on special occasions (Van Gijn 2010a: 145). The low numbers of daggers and the difficulty in obtaining the implements have been proposed as reasons for the differences in use and significance of the items across the various regions. A third possible explanation could be the lesser importance of agricultural practices in the north of the Netherlands compared with countries like Switzerland or France (Beugnier and Plisson 2004; Vaughan and Bocquet 1987). Although agricultural practices were common and were extended during the CWC, harvesting, gathering, hunting and fowling had a significant impact on the economy of Late Neolithic societies (see Chapters 7 and 8).

The lack of flint sickles is a common phenomenon for this period. They are rarely found in settlement contexts, except occasionally as fragments. It is likely that a combination of the above mentioned factors provoked a different use of the Grand-Pressigny daggers in the Dutch context. The importance of the dagger in this context was probably related to the quality and symbolic properties of the raw material and the shape itself, and not to the use of the tool as in the French and Swiss contexts (Beugnier and Plisson 2004; Vaughan and Bocquet 1987). Traces of ochre were also displayed on the surface of some of the CWC Dutch daggers (Van Gijn 2010a: 189). The use of ochre has been archaeologically documented in other Mesolithic and Neolithic Dutch contexts, and its use has been considered as symbolic/ritual (Van Gijn 2010a: 228).

Additionally, two graves have been found in the tidal area in the province of Noord-Holland, at De Veken and Mienakker, related to habitation layers and features. The Dutch wetlands are known for the excellent preservation of organic remains, and human bones are no exception. To date, the two skeletons in these graves represent the best direct evidence for archaeologists to understand the Late Neolithic population in the Netherlands. The two Noord-Holland skeletons were first studied and published in 1992 (Pasveer and Uytterschaut 1992). The first one, found near Sijbekarspel, was a female skeleton between 27 and 34 years old and around 1.53 metres high. The second, found during the excavation of Mienakker, was a 26-34-year-old male skeleton (Plomp 2013: 179). Some results relating to the diet and the health condition of both individuals were inferred. First, the analysis of the diatoms found on the teeth of both specimens revealed a diet based on cereal-like plants and typical species from a marine or brackish environment. Apparently the basis of the diet followed by the two individuals was the same or similar, yet the number of pathologies detected on the skeletons exposed different health conditions. While the male skeleton did not show a single pathology, the female skeleton showed several. While her arthritis and collapsed vertebrae could be related to ageing, several instances of caries and the growth disturbance in their bones show different growing conditions (Pasveer and Uytterschaut 1992: 5-7).

A male predominance in Late Neolithic societies has been proposed on several grounds, such as a higher representation of males in the graves, distinct grave goods based on gender and the image of the male-warrior based on the battle-axes and the daggers (see Chapter 1). Although these theories have been traditionally used to explain Late Neolithic Dutch society, the lack of well-preserved skeletons in the Netherlands impedes a proper comparison. If there were social distinctions based on gender during the Late Neolithic, then a physical reflection could be expected. A lower-quality diet and several pathologies related to specific activities have been found in other assemblages where gender played a role in the socio-economic stratification of the society, and similar results have been obtained from similar assemblages in several European Late Neolithic burial contexts (Arnold 2006). Unfortunately, the skeletal sample in the Netherlands is too small for the results to be compared to the rest of Europe.

2.4 Conclusions

This chapter has presented the domestic evidence available for the European and the Dutch CWC. The information available is unequal: while burials, barrows and depositions have been studied in detail, Corded Ware settlements remain only partially excavated and the associated materials have not yet been systematically studied. In the Netherlands, interpretations of domestic implements are mainly based on typological studies. Technological studies are scarce and use-wear analysis has been performed on only two flint assemblages. The lack of a systematic study of the domestic implements of the CWC illustrates the importance of the present work. The analysis of the flint, stone and bone assemblage of three CWC settlements will be discussed in chapters 4, 5 and 6.

Chapter 3. Theory and methods

3.1 Introduction

This chapter is structured in two sections. First, the main theoretical concepts underlying the study and interpretation of artefacts from CWC domestic contexts are discussed. Tools and ornaments from domestic contexts are important components of the daily practices of prehistoric communities. In this chapter, I argue that tools from domestic contexts are: a material representation of the way(s) CWC populations perceived their landscape; transmitters of social traditions and rules; and a reflection of the main economic activities performed in the settlements. The second section of this chapter describes the methodology. The study of the CWC technological system entails the analysis of the different stages in the life-cycle of an object: the selection of the raw material, the technology used to produce the object, the way(s) it was used and its final discard. The analysis of the interconnected `*chaîne opératoires*' objects were involved in will provide a better understanding of the domestic organization of technology.

3.2 Knowledge, narratives and learning processes

Learning is a basic human action that continues throughout one's entire life. Through constant learning processes we not only achieve knowledge about the basic activities of daily life, such as walking and talking, but learning also includes more complex activities, such as the production of tools, engagement in social networks or the decoding of symbols. As humanity is linked with knowledge, knowledge is related to learning. Consciously or unconsciously, it is through teaching and learning that knowledge is transmitted.

An important component is done through physical perception, for the most part while the individual's capacity for verbal communication is limited (infancy). The physical senses act as a way to recognize the non-verbalized images (for example objects, animals or people) (Tehrani and Riede 2008). It is also through the physical senses that the first connections between the individual and the community – more specifically with the nuclear family – are made. However, another important part of the learning processes is the one taking place within the group. Perception is a biological quality of a new-born, considered part of the human capacity to understand and interpret the world in which they live. However, some sociological studies have proven that perception is also altered and determined by social context and group influence (Chapman and Gearey 2000; Ingold 2000a, 2011; Johnston 1998; Pink 2010).

At the same time, during the learning processes, the group transmits and maintains cultural traits through the so-called '*narratives*' (Zerubavel 2003: 5). These narratives refer to every aspect of social life: space, time, the individual, the community and the material culture. Narratives connect time and space within different generations of a community through foundational myths, they justify the individual role inside the community and they provide meaning to objects, places and social acts (Bender *et al*. 2007; Högberg 2006; Pearce 1994). Origin myths are a fundamental part of these narratives and have been recorded frequently by anthropologists and sociologists in different kinds of societies (Bourdieu 1973, 1994; Levi-Strauss 1973). Another important part of these narratives is the '*unconscious*' norms of behaviour implied in each individual action. Through narratives, life acquires meaning for individuals. Narratives are similar to what Hobswam calls '*invented traditions*' (Hobsbawm 1996: 1), defined as '*a set of practices, normally governed by overtly or tacitly accepted rules and of a ritual or symbolic nature, which seek to inculcate certain values and norms of behaviour by repetition, which automatically implies continuity with the past*' (Hobsbawm 1996: 1). Thus, knowledge is related to power or, as proposed by Foucault, '*knowledge works as a form of power and disseminates the effects of power*' (Foucault 1980: 69). This is what has been referred as 'mutual knowledge' (Giddens 1984: 4). Mutual knowledge allows a social group to 'go on with the routines of social life' (Giddens 1984: 4). It is the sum of what is known by the community, acquired through experience and practice, but also through narratives and memory.

But how can mutual knowledge be studied from an archaeological perspective? Some authors (Bourdieu 1973, 1994; Zerubavel 2003) have suggested that it is through daily routines that this knowledge is acquired and transmitted. During the early stage of life, children repeat activities, learn gestures, and integrate taboos and traditions which would be part of what defines them as part of the group, and that will be memorised, or even `embodied' (Zerubavel 2003; Hodder and Cessford 2004), to be transmitted generation after generation. Therefore, to study the mutual knowledge of a society, it would be important to understand how these daily routines were structured, organised and performed. From an archaeological point of view, the material result of this daily knowledge is what will be interesting to understand the organization of society. In some cases, this mutual knowledge has been investigated from the interaction between individuals and their landscape and the houses (Hodder and Cessford 2004; see next section). Other possibility is to study the material culture that was used during these daily practices. Some scholars (Dobres 1995, 2009; Dobres and Hofman 1994; Miller 2009) have argued for the active role that material culture holds on the creation and maintenance of the community. Material culture is the receptor and also the generator of social rules, norms, and processes of symbolic engagement that contribute to the creation of the social group (Dobres 1995, 2009; Dobres and Hofman 1994; Miller 2009). Therefore, the study of prehistoric technology facilitates an understanding of the society (Soressi and Geneste 2011). However, technology should be understood not only as the production of the implements itself but also as all the processes that involved the life of a tool, the entire `*chaîne opératoire*' (Pelegrin *et al*. 1988).

The production and use of implements was made possible thanks to the acquisition of knowledge, and implements were made by people who learned from other people how to produce new implements. Ethnographically, the importance of knowledge acquisition and transmission during daily activities has been extensively documented, as for example in the case of querns (Adams 1998, 1999, 2010; Hayden 1989), the production of stone tools (Arthur Weedman 2000, 2010, 2013; Stout 2002), the transmission of pottery style (Bowser and Patton 2008; Gosselain 2000, 2008), hide production (Beyries 2002; Frink and Arthur Weedman 2005), pastoral activities (Crabtree 2006) and basketry (Hurcombe 2006, 2008). Although it is difficult to prove archaeologically, some researchers have suggested that individual *gestes* can be deciphered through the analysis of lithic implements (Bamforth and Finley 2008; Ploux 1984). Therefore, the role of individuals with little knowledge of flint knapping, such as children, could be discerned (Finlay 1997; Högberg 1999, 2008; Stapert 2007; Sternke and Sörensen 2007). The imitation and observation of technological processes was a means to transmit and learn technical knowledge within the domestic context. Therefore, while cooking, hunting, fishing, producing implements and performing other daily activities, knowledge on which material was better for specific activities, on how tools were produced and maintained, on how wild animals were to be found was transmitted and embodied by the individuals. This technical knowledge was related to all the spheres of social life and, of course, implied a high level of knowledge related to landscape and the natural environment where the community was living.

3.3 Landscape

Time and space act as frameworks for '*mutual knowledge*' through the so-called '*narratives*' (Bender *et al.* 2007; Högberg 2006). Through '*invented traditions*' the community generates a present that it is linked with a past and a future. The link with the past is supported by the foundational myths and is made concrete through a connection to the ancestors (burial rituals), the reutilization of artefacts and the '*construction*' of the landscape. Archaeologically, different authors suggest the use of the natural elements of the landscape such as trees, rocks, hills or flows of water as a way of generating the social cohesion (Bradley 1998; Cummings 2003; Cummings and Whittle

2003; Evans *et al*. 1999; Pollard and Gillings 1998; Richards 1996a, 1996b; Tilley 1996). Geological and geographical elements, vegetation, animals and the cycle of climatic seasons all have physical components that were perceived and interpreted by prehistoric societies. And perception, as already discussed, is altered and determined by the social context of the individual (Chapman and Gearey 2000; Ingold 2000a, 2011; Johnston 1998; Pink 2010) through, for example, the act of remembering. Memory, in addition to narratives, works as a link between the past and the present (Zerubavel 2003: 13). Group's memory acquisition identify individual with the collective past and `*familiarizing members with that past is a major part of communities' efforts to assimilate them*' (Zerubavel 2003: 3). Through memory and perception landscape was interpreted by individuals as part of their `collective memory' (Zerubavel 2003: 3), identifying their physical surroundings (diverse geological sources, rivers, plants and animals), with `reliable locus of memories' (Zerubavel 2003: 41) and generating a deep `sense of permanence' for the individuals and a `historical continuity' of the group (Zerubavel 2003: 41). In addition, prehistoric groups were surrounded by geographical features so on the other hand, the landscape is always modified and the new situation acquires a meaning and starts to form part of the new narratives (Bender et al. 2007). In this sense, the work of several authors interpreting megalithic tombs and dwelling spaces as social markers is relevant (Bender *et al*. 2007; Chapman 1995; Hodder 1991; Patton 1993). Therefore, the landscape is used not only as recipient of knowledge but also as a generator of it. Following Bourdieu (1973), the space, or '*habitus*', is a system of dispositions that includes not only a '*way of being*' but also the '*result of an organizing action*' of being (Bourdieu 1973: 214).

Language, oral myths and tales, legends and rituals worked as tools to transmit information related to landscape. And, again, it is during the daily practices of the group that this information was exchanged. Material culture can be also used from an archaeological point of view to study how the use of the landscape was structured by prehistoric communities. As already discussed, material culture is a reflection of `communal knowledge' and plays a role in the generation of it. In this sense, the selection of specific raw materials is, in the first place, an expression of the location of a particular settlement within the wider landscape. However, it also reflects the learning processes and the transmission of knowledge from one generation to another. The use of a specific type of flint and stone, then, will work as tokens for the individuals. Through their use as implements, they become `portable relics' (Zerubavel 2003: 43), storing technical memories and helping to create a physical continuity between different generations. Again, learning processes and daily practices were fundamental to answer the question of how this `collective memory' and `communal knowledge' were generated.

The lack of information on domestic settlements until the last half of the twentieth century prevented a systematic analysis of the landscape in which they were situated. However, several pollen studies have been performed on samples from barrows and graves. These studies showed that barrows were located in an open space (Casparie and Groenman-van Wateringe 1980; Doorenbosch 2013; Waterbolk 1954). In the case of the Corded Ware communities, the barrow landscape has recently been interpreted as part of the collective material culture, through the creation of a specific landscape composed by mounds of land covering the ancestors (Bourgeois 2013). The barrows studied were mostly placed on heath, although forest was also part of the barrow landscape (Doorenbosch 2013). The barrow landscape was created by the Corded Ware people, but evolved over time, changing in spatial distribution and in social meaning (Bourgeois 2013; Doorenbosch 2013). The analysis of the CWC landscape through the analysis of the distribution of the mortuary monuments provided significant information about the use and perception of the landscape (Bourgeois 2013; Doorenbosch 2013).

After the excavations of the settlements from the CWC in the wetland areas of the North-Holland province, a preliminary analysis of the landscape through the study of botanical and palynological samples taken during the excavations was performed (Van Heeringen and Theunissen 2001). In addition, a more complete analysis of the domestic use of the landscape by the CWC is available in the recently published monographs of Keinsmerbrug (Smit *et al.* 2012), Mienakker (Kleijne *et al.* 2013) and Zeewijk (Theunissen *et al.* 2014). New analysis of botanical and faunal remains offered further insights regarding the perception and use of the landscape by the Corded Ware communities. The Noord-Holland Corded Ware settlements were located on the large tidal basins of West-Friesland. The tidal basins started to silt up between 4500 and 4000 BC as a result of sea level rise, and became habitable around 2900-2800 BC. Beach barriers developed at the beginning of the third millennium BC, resulting in a more closed coastline. As a result, peat started to grow. Between 3200 and 2900 BC, the shoreline was almost completely closed and a lagoon formed, which was active for at least two centuries. At the end of this period, the landscape was characterized by a combination of different ecological zones. Finally, from 2900 to 2250 BC, two branches of the large tidal channel developed, forming a brackish marsh environment, protected at the west border by a complex of beach barriers and connected to the sea by an open water system (Smit 2012). The Late Neolithic settlements, which flourished in this system, exploited the various ecological niches.

The analysis of the material culture from the three sites studied formed an opportunity to better understand how the corded Ware groups interacted and used the surrounding landscape. Through the identification of the different resources used in the settlements, it is possible to identify different areas of exploitation, assessing the degree of knowledge and experience required for the exploitation and use of some resources. The use and recurrence of the space and the raw material could also be suggesting the symbolic importance of the landscape for the prehistoric communities, which formed part of the `collective memory' of the society.

In addition, the reinterpretation of existing house plans and the discovery of new ones (Kleijne *et al*. 2013; Nobles 2012a, 2012b, 2013a, 2013b, 2014a, 2014b) provided a fresh opportunity to understand the relationship that Corded Ware groups had with their landscape. During the 1990s, a new approach to the dimension of the landscape was taken, based on the idea that the social and symbolic dimensions of the landscapes were to be found in the remains of everyday life (Bruck and Goodman 1999; Gerritsen 1999, 2001; Parker Pearson and Richards 1994). Dwellings began to be considered as a way of creating a link between the landscape and the society, a way of constructing a landscape (Ingold 1993: 162). Houses were considered as the centre of the social organization, providing social identity to their occupants. Therefore, the material remains found at the excavations of the prehistoric dwellings constitute a physical remainder of the use of landscape by prehistoric groups and a reflection of the social organization and identity of these communities.

Figure 3.1. Actual landscape of the Noorth-Holland province (Image courtesy of Jeroen de Groot).

3.4 Craft production systems

An economic system can be defined by three interlinked components: distribution, consumption and production. The distribution component is related to when and by whom goods are consumed. In archaeology and anthropology, distribution is studied mainly from the point of view of exchange (Akerman *et al.* 2002; Cosmides and Tooby 1992; Costin 2011; Zvelebil 2006), whereas consumption is related to the use of the goods. Not only the production of tools but also their use is embedded in social norms and constrictions. Tools can be exploited in different ways, by different people. The way people use tools is heavily influenced by cultural knowledge transmitted from generation to generation, and changes in the use of implements can be related to fundamental changes in society linked with group composition, the legitimization of power and status, and gender beliefs (Costin and Earle 1989; Frink and Arthur Weedman 2005; Hurcombe 2006; Jordan and Mace 2008; Owen 2006; Sørensen 2006).

Crafting, or the production of goods, is not free from the *'narratives'* embedded in the social spheres of a group. In fact, the production of an implement is determined by the economic, social and political organization of the society. Prehistoric tools are a reflection of these spheres, and carry information about different domains of prehistoric societies (Costin 1998, 2001; Dobres 1995, 2009; Miller 2009; Schlanger 1994). Tools express the ideas, memories, political status and beliefs of a society (Costin 2005; Giddens 1984). Therefore, understanding the production of the tools, or the economic system in which they are involved, offers an avenue to understanding the social composition of a society.

The organization of production can be structured in several ways by a society and it varies '*across space and time*' (Costin 2005: 1036). Although several attempts have been made to classify production systems (Costin 1991, 2001), generally a distinction is made between a domestic mode of production and a specialized mode of production. Whereas in a specialized production system '*fewer people make a class of objects than use it*' (Costin 2011: 276), a domestic mode of production implies that the production and consumption of tools is organized by and for the household (Shalins 1972: 100). The study of the organization of production, then, can answer two main questions referring to group composition: when and how the production occurs; and what the roles of the different agents of the society are in different productive activities. As it will be discussed in the next section, the production and use of tools are embedded in different technological systems (Lemonnier 1986, 1992). The study of cross-craft interactions, which can be understood as the process by which two or more crafts interact and the technological and social impact they have on each other (Brysbaert 2007: 328; Foxhall and Rebay-Salisbury 2009/2010: 3), is a way to understand the exchange and transmission of knowledge and materials (Brysbaert 2007: 326), how the technological daily practices of prehistoric groups were structured and which were their social relationships.

While studying the material culture associated with the daily practices of prehistoric groups, cross-craft interactions have to be taken into account. In fact, usually one or more crafts are linked and connected, as is the specific knowledge related to their work. For example, ethnographically it has been recorded that during the processing of crops, knowledge on the use and production of querns was also shared (Adams 1999, 2010; Dobres 1995; Hamon and Le Gall 2013). Therefore, different expertise and skills were shared by different people and, sometimes, even by different groups. Cross-craft interaction has been considered as `*one of the main drivers of innovation*' (Rebay-Salisbury *et al.* 2014: 3). While encountering other people, knowledge is shared and ways of doing things change and evolve (Lightfoot *et al*. 1998). The categories of groups may change and the use of implements may vary. Therefore, analysing how crafts interacted in prehistoric societies in general, and Corded Ware communities in particular, is a way to explore and comprehend which social networks existed, how technology was organised and how societies used material culture as a symbol of their identity. Some of these interactions took place inside of dwellings and houses. As already stated, house plans were reinterpreted and discovered during the NWO project and, thanks to the spatial analysis, it was possible to ascribe specific implements to specific spaces (Nobles 2012a, 2012b, 2013a, 2013b, 2014a, 2014b). Houses are not only an expression of the use of the landscape by prehistoric communities, but have also been regarded as the centre of social and economic production, reproduction and consumption (Allison 1999; Çevik 1995). Therefore, the analysis of material culture associated with domestic dwellings could provide information about the types of activities performed there, the existence of specialized areas of production and the function of the site more broadly.

3.5 The study of tools in archaeology

3.5.1 Typology, technology and chaîne opératoire

The use of categories can be understood as the definition and division of the world in small fragments for a better comprehension of reality. By doing that, things become meaningful for society (Zerubavel 1991: 5). In archaeology typology was used for relative dating of archaeological sites and stratigraphy. In fact, flint and pottery typology is still used as relative dating nowadays. Typological lists of flint tools were generated as a methodological aim for the study of lithic assemblages. The main proposals were the typologies created by F. Bordes (1950, 1961) and F. Bordes and D. Sonneville-Bordes

(1956, 1985) and the one created by G. Laplace (1954, 1957, 1964 and 1966). These lists were mainly oriented to Palaeolithic contexts through Europe and Asia. While Bordes' typology was based on the forms and shapes of lithic implements and their similarities , Laplace proposal intended to be an analytical typology introducing mathematical and statistical methods to eliminate the subjective aspect of other typological classifications (Arrizabalaga *et al.* 2014; Hermon and Niccolucci 2002). However, Bordes' typology was more widely accepted and used until the 1970's, when the arrival of more systematic dating methods, the introduction of Leroi-Gourham's concept of the *chaîne opératoire* (1964) and a change in paradigm that conceived material culture as part of social systems, changed the way tools were studied and understood.

Leroi-Gourham's concept of the *chaîne opératoire* (1964) offered a methodological approach to the ideas proposed by Mauss (1935), which considered technology and tools not only as a physical transformation of material, but also as a way to transmit social traditions (Dobres 1999: 127). Technology was understood as a reflection of social actions. Tools not only needed to be typologically classified, but their production process needed to be understood (Soressi and Geneste 2011; Terradas 2001; Tixier 1979; Tixier *et al*. 1980). The use of the concept of the *chaîne opératoire* since the 1970s has complemented and improved the use of the typological analysis that until then was the basis of archaeological studies (Bleed 2001). The use of the *chaîne opératoire* method enabled a better study of the economic practices and the social relations of a particular society, a better understanding of the relationship between people and their landscape, and a deeper insight in how knowledge and technical skills were embedded in the production of an implement (Pelegrin *et al*. 1988). The production of tools is defined by a succession of mental decisions and is 'marked' by a sequence of *gestes* that defines the entire process (Perlès 1987: 23). In addition, this production process is also determined by natural conditions (for example the geological distribution of the raw materials or the physical properties of materials). The basis of the *chaîne opératoire* is the conception of tool production as a sequence of different steps, from the selection of the raw material to the discard of the tools. The method considers the different steps taken in the production of a tool to be structured by an internal logic. The main steps are the raw material acquisition, the technical production of the tool, the use of the tool and its discard (Geneste 1989; Pelegrin 1990; Pelegrin *et al.* 1988; Sellet 1993; Terradas 2001; and for a review see Soressi and Geneste 2011).

Although the *chaîne opératoire* approach is still one of the methods widely used in prehistoric archaeology, there are some issues pertaining to its application. The first is related to the linearity and rigidity of the steps proposed by the method. Tools are produced using a technical system consisting of different technical sub-systems (Lemonnier 1986, 1992). For example, during the production of a flint knife the technological system involving the flint knapping will be related to the technological system applied to produce the wooden handle. Therefore, the tool could be used and discarded within a technical system, but reused within another. The steps followed during the production and use of an implement are not always rigid and predetermined, but rather imply an interconnectivity of different *chaînes opératoires.* Following the same example, the technological system of flint knife will be connected to the one related to the production of the wooden handle, which at the same time would be related to the flint implements used to produce it. The knife could be used to work different resources, as for example hide and bone, participating then in the different *chaînes opératoires*. Therefore, it is important to study all the steps of the production and use of an implement to understand all the technical systems the implement took part on. The second criticism deals with the assumption that the mental conception of the entire process is inside the brain of the flint knapper (Bar-Yosef and Van Peer 2009: 113-114). As suggested by ethnographic research, implements could be used as expected. However, some other tools could be produced or used in another ways, or never used (Holdaway and Douglass 2012). Again, *chaînes opératoires* have to be considered flexible, and tools have to be studied in their totality using different methodologies. In addition, it is necessary to contextualise the *chaînes opératoires* of single implements within the technical systems interpreted in the studied assemblage, and within the data obtained by other researchers.

3.5.2 Typology and functionality: form vs. function

From the point of view of functionality, typology also involved other implications. The implements classified typologically displayed not only formal, but also functional connotations. Retouched artefacts were instantly identified as “tools”, while unmodified objects were not considered to have had a function. In addition, tool classification did not take into account the real functional role of the tool, as no use-wear analysis was performed, but the possible use was instead based on the tool shape. Therefore, borers were assumed to have been used to perforate and scrapers to scrape, but typology did not take into account the real use of the implement or the different processes the tool pass through (Pawlik 2009: 9).

The form vs. function problematic has been extensively addressed by use-wear analysis. The selection of specific implements for specific tasks has been indicated the use of scrapers for scraping activities during the Late Palaeolithic and Mesolithic, and the use of geometric microliths as projectile points during the Neolithic period. However, both ethnographic and archaeological studies have demonstrated that these assumptions are not always valid (see Shott 1986 and Gibaja 2006 for an extended discussion). In addition, the use of unretouched or unmodified implements has been indicated by use-wear analysis in several archaeological contexts (Gibaja 2006; Gueret 2013; Vaughan 1985; Van Gijn 1990). Furthermore, ethnographic studies show the use of both unmodified and retouched implements (Holdaway and Douglass 2012). However, the analysis of assemblages is still determined by the typological classification of the implements, and use-wear studies are, for the most part, focused on what is considered as a '*formal tool*'. As an example, and except notable exceptions (Van Gijn 1990), most of the use-wear analysis performed on TRB and Vlaardingen flint implements focused on retouched and formal tools (see Chapter 7). This selection is mainly determined by a low budget for the performance of use-wear analysis and by preconceived ideas about tool use. The main consequence is the lack of functional information for assemblages in which unretouched tools constitute more than 50% of the assemblage, and the impossibility to reconstruct the various *chaînes opératoires* and the role played by different types of implements in the several tasks carried out in the settlements. Besides, it is possible that the results of the use-wear analysis show a misrepresentation of the importance of the function of retouched implements on the site. Therefore, the selection and analysis of implements should be based on scientific analysis, which in practical terms entails a different sampling strategy of the assemblages under study that would be determined by the context of the archaeological site studied (Hayden 1998; Holdaway and Douglass 2012).

3.6 Towards an understanding of the tools of the domestic Corded Ware settlements: Methodology, datasets and sampled materials

In this thesis tools are understood both as the material reflection of the technological system of the prehistoric communities and as the carriers of social knowledge and practices. Therefore, understanding how these tools were produced and used is a very important step towards elucidating their function within the social system of the group that used them. In this thesis, and following the *chaîne opératoire* approach, the implements were studied taking into account the different steps in which they were involved: *raw material acquisition*. The study of raw material is important to obtain information on: how was the landscape exploited by the prehistoric groups; the existence of social networks used to exchange specific raw materials; technological and functional choices related to the use of a preferred raw material to produce specific tools; *technological practices used to produce the tools.* Technology is understood both as a physical transformation of material, but also as a way to transmit social traditions

(Dobres 1999: 127). Therefore, the typological description of the implements has to be accompanied by a technological study to understand the main methodology used to produce the tools; the preference for specific methods to produce specific tools; the interaction between technologies; the social networks existing between different communities and how knowledge was passed from one generation to another, or from one group to another;and to measure the technological degree of the groups; *the use of the implements* and *their discard.* The main methodology used in this thesis is use-wear analysis. Use-wear analysis is based on the idea that the contact between two different surfaces provokes physical alterations (Semenov 1981[1957]: 27-29). Use-wear analysis provides information about the type of activities performed at settlements reveals technological traits of tool production and, frequently offers evidence about the location of the production. Therefore, the study of the implements used and produced by the Corded Ware communities will enable us to gain a deeper understanding of their social composition

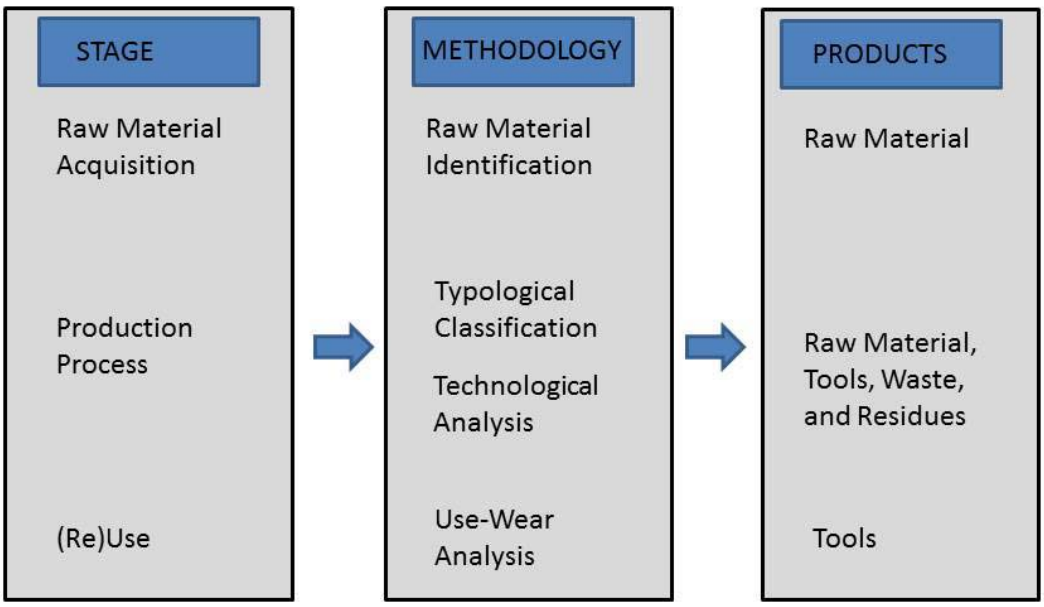


Figure 3.2. Graphic explaining the methodology followed in this book.

3.6.1 Raw material identification

Raw materials were identified using the reference collection of flint and stone of the Faculty of Archaeology at Leiden University. The main characteristics were recorded visually with the naked eye, although in some cases a stereomicroscope (5x to 100x) was used. In the case of Mienakker, the classification of the flint raw material was performed in accordance with the work published by Peeters (2001a). At Keinsmerbrug amber was analysed with the help of a stereomicroscope with magnification between 5x and 100x. At Mienakker most of the amber was missing, so a previous raw material determination performed by Bulten (2001) was used.

3.6.1.1. Flint

The main characteristics recorded for the flint implements were:

- Raw material source: if possible, flint was grouped by provenience. The main groups used were: The Netherlands, mainly flint implements which origin was located in the south of the Netherlands, as Rijckholt flint, Valkenburg flint and southern Limburg flint; Belgian flint, mainly consisting of Rullen flint; French flint, as Grand Pressigny and Cap Blanc flint; and flint with an undetermined and a northern origin, mainly composed of moraine flint, rolled pebbles and coastal flint. Raw material is an important variable for different reasons. In the first place, it gives information on the use of landscape, the preference of a determine raw material to manufacture tools and it may suggest the existence of network exchanges (Van Gijn 1990: 14). In addition, the type of raw material is determines the appearance of the wear-traces (Clemente Conte 1997; González Urquijo and Ibáñez Estévez 1994; Hurcombe 1988; Keeley 1980; Plisson 1985; Van Gijn 1990).

- Coarseness of raw material. Flint was classified into five groups: glass-like flint; fine-grained flint; medium-grained flint; coarse-grained flint; and undetermined grained flint, when it was not possible to determine coarseness of the raw material due to post-depositional alterations. The type of coarseness gives information on the type and quality of raw material, being the finest flint types the better to flake (Whittaker 1994: 66). In addition, it is crucial for use-wear analysis. As suggested by several authors, the coarnseness of flint determines the development of use-wear traces. These develop more slowly on coarse flint (Clemente Conte 1997; González Urquijo and Ibáñez Estévez 1994; Van Gijn 1990).

- Extent of the cortex. The extent of cortex was classified as: absent, when the flint implement did not show cortex; present on less than 50% of the dorsal surface; present on more than 50% of the dorsal surface; present on the platform; present on the platform and on less than 50% of the dorsal surface; present on the platform and on more than 50% of the dorsal surface; present on less than 50% of the ventral and the dorsal surface; present on more than 50% of the ventral and the dorsal surface; present on 100% of the implement; and unsure, where it was not possible to determine the presence of cortex due to heavy postdepositional alterations. The exent of cortex on a flint implement provides information on the raw material availability and the exploitation of the cores (Van Gijn 1990), and, individually, provides technological information of the implements. For example, a flake displaying 100% of cortex on the dorsal surface indicates that the flake was one of the forst ones to be removed from the core (Whittaker 1994).

- Type of cortex. The cortex was classified as: absent, when the flint implement did not show cortex; weathered; rough cortex without chalk; rough cortex with chalk; old patinated surface; and unsure, when it was not possible to determine the type of cortex due to heavy postdepositional alterations. The type of cortex provides information on the source of the raw material used.

3.6.1.2. Stone

The main characteristics recorded for the stone implements were:

- The stones were divided into six groups: sedimentary stones; metamorphic stones; igneous stones; quartz; other stones, less predominant during the classification of the assemblage; and undetermined stones, when it was not possible to determine the type of stone.
- Coarseness of raw material. Stones were classified into five groups: glass-like stone; fine-grained stone; medium-grained stone; coarse-grained stone; and undetermined grained stone, when it was not possible to determine coarseness of the raw material due to postdepositional alterations. The coarness of the stones, or *texture* (Adams 2002a: 21), provides information on the quality of the raw material and the use of specific stones for specific activities (Adams 2002a).
- The preservation of the natural surface of the stone, that was grouped into: absent, when the natural surface of the stone was not present; between 0 and 24% of the natural surface of the stone is preserved; between 25 and 49% of the natural surface of the stone is preserved; between 50 and 74% of the natural surface of the stone is preserved; 100% of the natural surface of the stone is preserved; and unsure, when it was not possible to determine the presence of natural surface of a stone due to postdepositional alterations. The

preservation of the natural surface of the stone provides information on the raw material availability, the exploitation of the raw materials and how tools were produced and used (Adams 2002a; Tsoraki 2008).

- When the natural surface of the stone was preserved, it was classified as: water-rolled; weathered; rough; old patinated surface; and unsure when it was not possible to determine the presence of natural surface of a stone due to postdepositional alterations.

3.6.1.3.Bone

Bone implements were analysed from the sites of Mienakker and Zeewijk. No modified bones were encountered at Keinsmerbrug. In both cases, the determination of the bone implements was performed by the faunal specialists of the NWO project, Zeiler and Brinkhuizen (García-Díaz 2013, 2014a; Zeiler and Brinkhuizen 2013, 2014). The determination of the faunal remains is important to acquaire information on the type of animals

3.6.2 *Technology and typology*

For the purpose of this research, the typological and technological description and categorization of the flint and stone implements was performed following the methodology developed by the Laboratory for Artefact Studies at Leiden University (Van Gijn 1990). The implements were recorded in a MS ACCESS database, one for each type of raw material studied.

3.6.2.1. Flint

All flint implements available from Keinsmerbrug, Mienakker and Zeewijk were typologically classified and studied from a technological point of view. The main objective of the technological analysis was to understand the processes involved in the manufacturing of the flint tools. The main recorded attributes were:

- Primary classification. A primary technological classification was given to every single implement. The main technological classifications used were: flake, understood as an implement obtained after a strike that presents technological traces such as a bulb of percussion and a platform of percussion (Inizan *et al*. 1995; Whittaker 1994); blade, understood as a tool twice longer than wider, and usually showing two parallel ridges and two parallel edges (Tixier *et al.* 1980: 55); waste or fragments, not showing technological modifications, but occasionally used as blanks for tools as borers or scrapers; splinter, understood as flint implements smaller than 1 mm (Inizan *et al.* 1999); block, understood as unmodified nodules of flint intentionally transported to the settlement; core and core fragments, understood as those implements used to extract blanks (Whittaker 1994); core preparation flake; core preparation blade; pebble, understood as flint nodules (unmodified or flaked) which show water-rolled cortex as their natural surface; and unsure when it was not possible to determine the primary classification due to postdepositional alterations.

- Tool type. A classification, related to typology and use, was given to every single implement. The main classifications used were: arrowheads, when typologically or by use-wear analysis it could be inferred that the tools were related to their used as projectiles; scrapers, understood as retouched implements with a steep angle (Whittaker 1994: 27). Scrapers were classified as long end scrapers, short end scrapers, round scrapers, side scrapers, and undetermined scrapers; retouched implements, classifying the retouch as steep retouch, border retouch, or surface retouch. The retouch was measured and classified as bigger than 1 millimetre or smaller than 1 millimetre; hammer stones, understood as tools used for percussion activities. The tools were classified as one side hammer stone when percussion traces were present only on one surface, bipolar hammer stone when percussion traces were recorded on two opposite surfaces, multiple sides when percussion traces were present on more than two surfaces; and borer, when use-wear traces show the use of the implement on a rotary activity.

- Metrical attributes. Metrical attributes, length, width and thickness, were taken for all implements, always in millimetres.

- Platform type: on implements where the platform was preserved, the type of platform was recorded. The main types used were: with cortex; plain (with a single flake negative); facetted; linear; point shaped; retouched; and undetermined (Whittaker 1994). The type of platform gives different information on the technology used to produce an implement, as the type of percussion used by the knapper, the level of preparation of the implement, and the skills of the knapper (Whittaker 1994). Plain platforms are generally related to direct percussion while pressure flaking flakes display other types, as point shape or linear platforms (Inizian et al. 1995; Whittaker 1994).

- Platform metrical attributes. Metrical attributes of the preserved platforms, length and width, were taken in millimetres. The size of the platform is an attribute used for differentiating between types of percussion used to produce the implements. For example, platforms of flakes produced with hard-hammer percussion tend to be bigger (Inizian *et al.* 1995).

- Dorsal face preparation. The dorsal face can be worked to create a good flaking platform and it is an indication of the type of technology applied to produce the tool and the experience of the knapper (Whittaker 1994). It was classified as: absent; retouched; and abraded.

- The impact angle, consisting of the angle form between the platform and the and the ventral side, was measured on the implement where both attributes were preserved. It is also an indicator of the percussion used to produce the tool. For example, soft-hammer percussion is related to angles higher than 90 degrees (Inizian et al. 1995; Whittaker 1994).

- Bulb of percussion. When it was preserved, the bulb of percussion was classified as: light; medium; heavy; retouched; and scarred. Bulbs are and indication of the type of percussion used to produce the implement. Hard-hammer percussion usually produces a medium/heavy bulb of percussion while soft hammer percussion and presspure flalikng produce less pronounced bulbs (Inizian et al. 1995; Whittaker 1994).

- Termination. On the distal fragments of the implements, the shape of the termination was classified as: retouched; with cortex; broken; feather; hinge; and step (Whittaker 1994). Flake terminations are and indicator of the precussion technique used. For example, hinge and step fractures are usually related to hard-hammer percussion (Van Gijn 1990; Whittaker 1994).

- Percussion technique. Taking into account the technological attributes recorded, the percussion technique was classified as: hard percussion; soft percussion; and undetermined.

- Bipolar. When it was possible to observe that the implement was produce using the bipolar technique, it was recorded on the database.

3.6.2.2. Stone

Stone tools from Keinsmerbrug, Mienakker and Zeewijk were typologically and technologically classified. Implements were given a primary classification based on their morphological characteristics and metrical dimensions, and then a functional typology was attributed to the implements. The macro- and microscopic technological traces on the stone tools were also documented with the help of a stereomicroscope (5x to 100x) (García-Díaz 2012, 2013, 2014a, 2014b). The main recorded attributes were:

- Primary classification. A primary technological classification was given to every single implement. The main technological classifications were: flake, blade, core, fine gravel (0.2 to 0.5 cm), moderately coarse gravel (0.5 to 1.6 cm), very coarse gravel (1.6 to 6.4 cm), stone (6.4 to 10 cm), boulder (10 to 50 cm), block (more than 50cm), and broken stone.

- Tool type. A typological and functional classification was given to every single implement. The main classifications were: unmodified stones, understood as stones that were brought to the settlement without a clear technological modification, but that could have been used as a tool. Unmodified stones were subdivided into broken stones, pebbles, and possible tools with a smooth surface; hammer stones, understood as tools related to percussion activities. Hammer stones were classified as one side hammer stone when percussion traces were present only on one surface, bipolar hammer stone when percussion traces were recorded on two opposite surfaces, multiple sides when percussion traces were present on more than two surfaces. The classification used for cereal processing tools varies and is not always standardized. Cereal processing tools consist of two parts: the upper surface, that is considered the active part of the tool, generally referred to as *mano*, upper grindstone or handstone, and the passive part of the tool, usually denominated quern, grinding slabs or *metates* (Hamon 2008: 1504). In this publication, when it was possible to classify the implements as lower or upper parts of the cereal processing tools, the terms handstone and quern were used; from a functional point of view, it was decided to distinguish between the tools used to process cereals and other tools used to grind other resources. Therefore, to classify a stone tool used to grind a material that was not cereal, the term grinding stone was used; polishing stone, understood as a tool with a smooth and rounded surface; flaked stone, understood as stones that show flake negatives; pestles, understood as tools that show a combination of percussion and rotational traces, usually related to crush and grind (Adams 2002a: 143); and multiple use tools, or tools with more than one use, understood as tools that show a combination of traces (percussion traces and grinding traces, for example) that could not be interpreted as related to the same use (Adams 2002a).

- Metrical attributes. As suggested by Adams (2002a: 21), the metrical attributes of a stone assemblage can reflect technological choices of the group or the available sources on the site. Metrical attributes, length, width and thickness, were taken for all implements, always in millimetres.

- Weight. All the implements were weighted and the value was registered in grams.

- Manufacturing traces provide information on the technology used to produce a stone tool (Adams 2002a). The main technological traits observed were flake negatives, polishing, pecking and grinding traces and different types of perforations.

- Rejuvenation traces. The main traces recorded were flake negatives and pecking traces.

3.6.2.3. Bone

The preservation of the bones was so poor in some cases that bones could not be typologically classified and some of the technological traits could not be inferred. However, where possible, bone tools were observed through a stereomicroscope (5x to 100x) and technological traits were described from a macro- and a microscopic point of view. The main recorded attributes were:

- Primary classification. When possible, a typological classification was given to every single implement. The main classification used were: needles, understood in this case as small and flat pins, in this case without a perforation, too small to be considered awls (Camps Fabrer 1967: 280); awl, understood as tools displaying a pointed tip made on any bone splinter (Camps Fabrer 1967: 280); bead, understood as an implement with a perforation in the centre of its body (Falci 2015: 72); pendant, understood as an implement with a perforation that is not located in the centre of its body (Falci 2015: 72); spatula, characterised as a tool displaying a rounded edge and a polished surface; ripples or *bobbelkammen*, understood as long tools usually produced from long, flat bones such as cattle ribs. One of the long edges of the bone was sawn, producing several rounded teeth, so that the tool resemble a comb (Drenth *et al.* 2008; Lauwerier in Van Heeringen and Theunissen 2001: 181); and chisel.

- Manufacturing traces provide information on the technology used to produce a bone tool. The main technological traits observed were polish and striations related to the cutting and grinding of the surface.

- Weight. The bone implements were weighted and the values recorded in grams.

3.6.2.4. Amber

Amber ornaments and by products were only analysed at Keinsmerbrug (García-Díaz 2012), while at Mienakker and Zeewijk information provided by other researchers was used (Bulten 2001; Van Gijn 2014a). In addition, technological attributes concerning the fabrication and the method of perforation were documented and entered into the database (García-Díaz 2012). The main recorded attributes were:

- Primary classification. A technological classification was given to the amber implements of Keinsmerbrug. The used terms were bead; flakes, understood as an implement obtained after a strike that presents technological traces such as a bulb of percussion and a platform of percussion; and splinter, understood as an amber fragment smaller than 1 mm.

- Metrical attributes. Metrical attributes, length, width and thickness, were taken for all implements, always in millimetres.

- Manufacturing traces provide information on the technology used to produce the beads and ornaments. The main technological traces observed were flake negatives and perforations.

3.6.3 Use-wear analysis

3.6.3.1 History of the methodology

The function of archaeological implements has always been one of the main questions in archaeology. Although several attempts were made in the nineteenth century to study the use of archaeological implements, use-wear analysis originated as a methodology in the earlier decades of the twentieth century. Semenov, a Russian archaeologist from the Academy of Science of Saint Petersburg, developed the methodology and published it in 1957 (Semenov 1981[1957]). His method was based on the assumption that, if a tool was used, its surface would be modified. This modification could be macroscopic and/or microscopic, and it would be different depending on the material being worked. Semenov (1981[1957]) differentiated four types of attributes:

micro-retouch or edge damage, edge rounding, polish and striations. The method, however, did not become popular in Western Europe and the United States until his book was translated into English in 1964.

After the translation of the book, the method spread quickly through Western Europe and the United States. Several theses and scientific articles were published during this time trying to consolidate and replicate Semenov's method (1981[1957]). The papers focused mainly on replicating the different use-wear attributes that Semenov had defined (Anderson 1980a, 1980b, 1981; Keeley and Newcomer 1977; Moss 1983a, 1983b; Newcomer 1974; Odell 1977, 1979; Tringham *et al.* 1974). On the basis of the methodologies applied to observe the use-wear traces, two different approaches emerged: the *low-power approach* and the *high-power approach*. The *low-power approach* (Odell 1977, 1980; Tringham *et al*. 1974) used a stereomicroscope (up to 60x) to examine wear traces such as striations, edge damage and edge rounding. The *high-power approach*, as developed by Keeley and Newcomer (Keeley 1974, 1980; Keeley and Newcomer 1977; Newcomer and Keeley 1979), involved an incident-light microscope (up to 400x) to observe different wear traces such as striations, edge damage, and edge rounding, but also polish and residues (Anderson 1980b; Shafer and Holloway 1979).

From 1985 to 1990, however, there was a period of pessimism. The controversial results of the blind tests carried out at Tübingen and London (Newcomer *et al.* 1986, 1987; Unrath *et al.* 1986) provoked widespread rejection of use-wear analysis. The method was considered subjective, as it was dependent on the experience of the researcher to distinguish the overlap of different attributes. In addition, several factors affect the formation of use-wear traces and obscure their interpretation (Bamforth 1988; Bamforth *et al.* 1990; Moss 1987; Odell 1980). One outcome of the blind tests was an added awareness of the importance to consider the effects of taphonomy and post-depositional surface modification (PDSM) on the preservation of use-wear traces. Several articles have been published showing the surface alteration of flint and different use-wear attributes caused by the effects of patina, abrasion, burning and heat treatment, and trampling (Gero 1978; Levi-Sala 1986, 1993; Plisson and Mauger 1988; Rottlander 1975; Stapert 1976). In addition, it has been documented by several authors that the type of raw material from which the implements are produced determines the types of traces developed (Clemente Conte 1997; González Urquijo and Ibáñez Estévez 1994; Hurcombe 1988; Keeley 1980; Shea 1987; Sussman 1985). Finally, experimental research shows that some activities left fewer traces than others. For example, the longitudinal processing of soft materials, such as meat or fish, and the impact traces on projectile points generate a small amount of edge damage, and create a poorly developed polish

(González Urquijo and Ibáñez Estévez 1994; Grace 1990; Fisher *et al.* 1984; Van den Dries and Van Gijn 1997; Van Gijn 1986).

However, with the acceptance of the limitations of the method, use-wear analysis started to become popular after 1990. Use-wear analysis has an empirical basis: experiments. The performance of experiments was fundamental to the origin of the use-wear analysis as a methodology and it is still necessary for a good development of the method. The formulation of a replication experimental programme gives the researcher more detailed knowledge of the production processes in which the tools are involved (González Urquijo and Ibáñez Estévez 1994). The performance of an experimental programme is based on the necessity of answering questions within a research framework. The experimental programme is an empirical way to reconstruct the social and economic techniques and uses of prehistoric societies through an archaeological interpretation of their tools (Baena Preysler and Terradas Batlle 2005: 145). The need for this methodology emerges from the study of archaeological tools, and their analysis generates knowledge and, at the same time, new working hypotheses. Therefore, the role of the experimental programme, which could be considered both dynamic and dialectical, is also a constant training tool for the researcher (Baena Preysler and Terradas Batlle 2005: 147).

From 1990 onwards, the use of a combination of low and high power approaches was proposed, and flint implements were analysed taking into account the main characteristics of both low and high magnifications (Clemente Conte 1997; González Urquijo and Ibáñez Estévez 1994; Gräslund *et al.* 1990; Ramos Millán 1990; Van Gijn 1990, 2010a). Since 1995 the technique was applied not only to flint but also to other materials such as stone, bone, antler, pottery and shell (Adams 2002a, 2002b; Buc 2011; Cuenca Solana 2013; Cuenca Solana *et al.* 2011; Dubreuil 2004; Gravina *et al.* 2012; Hamon 2005, 2008; LeMoine 1994, 1997; Maigrot 2000, 2003, 2005; Sharovskaya 2008; Van Gijn 2006a; Van Gijn *et al.* 2002; Van Gijn and Hofman 2008).

However, use-wear analysis on stone and bone implements is not as well developed as in the case of flint. The absence of microscopes that allow a proper analysis of large objects is one of the reasons for the lack of stone tool analysis with higher magnifications. The use of acetate foil and dental casts, and the analysis of implements under low magnifications have been the traditional options to solve the problems concerning microscope availability. However, a large number of publications related to the use-wear analysis of stone tools have been published over the last two decades (Adams 1988, 2002a, 2002b; Adams *et al.* 2006; Delgado Raack *et al.* 2008, 2009;

Dubreuil 2001a, 2001b, 2004; Hamon 2005, 2008; Hamon and Plisson 2005; Martial *et al.* 2011; Verbaas 2005; Van Gijn and Houkes 2006; Van Gijn and Verbaas 2009).

Deciphering the functionality of bone implements was one of the objectives of Semenov's publication (1981[1957]). Some pioneering work published by French researchers focused on the study of prehistoric bone typology and technology (Camps-Fabrer 1968, 1979). However, during the last two decades bone implements began to be studied more frequently. The study of bones has focused on every step of their production process, from raw material acquisition to the use and discard of the implements (Averbouh and Choyke 2012/2013; Beugnier and Maigrot 2005; Choyke and Schibler 2007; LeMoine 1994, 1997; Maigrot 1997, 2000, 2001, 2003; Van Gijn 2006a).

In addition, use-wear analysis reveals technological traits of tool production, especially with respect to bone and antler manufacturing. The technological *gestes* could be observed with low and high magnifications through the observation of the physical modifications produced in the surface of the tools. A good example of the possibilities of use-wear analysis as a technological methodology is the analysis of bone tool production. Flint and bone technology are both reductive processes, generating a variable amount of debitage, but whereas the debitage of flint technology is usually documented, bone debitage generally disappears from the archaeological record (LeMoine 1997). However, most methods of manufacturing bone tools leave microscopic traces on the tools that are as distinctive as the wear patterns themselves. This means that use-wear analysis can be performed on bone tools to reconstruct both the manufacturing process and the functionality of the object (d'Errico *et al*. 1984; LeMoine 1994, 1997; MacGregor 1975; Newcomer 1974; Plisson 1984).

3.6.3.2 Use-wear analysis in the context of the corded Ware Culture

One of the main aims of the NWO project was to understand the type of settlement that Keinsmerbrug, Mienakker and Zeewijk were, and the role played by the material culture in the activities performed there (see Chapter 1). Use-wear analysis, therefore, is a suitable method to discern which activities were carried out on each site; whether some settlements were specialized in some activities; which tools were used for each activity; whether toolkits for specific activities could be identified; and which relationships existed between each craft. Use-wear analysis, however, must be contextualized and considered in relation to other types of analysis. Spatial analysis of the used tools can reveal the existence of specialized areas and the way space was structured. In addition, through the integration of the results of use-wear analysis with raw material identification and the technological and typological analysis, it is possible to understand the interconnectivities between different *chaînes opératoires* (Pelegrin *et al*. 1988; Soressi and Geneste 2011).

Until 2009 CWC assemblages were never analysed microscopically (see Chapter 2). Therefore, the possibilities and expectations of the analysis were high, but so were the challenges. The first challenge was that, with the exception of the case of Mienakker, an accurate inventory of the implements was lacking. While for the small assemblage from Keinsmerbrug this did not pose significant issues, the case of Zeewijk was different. The Zeewijk assemblage comprises more than 10,000 flint implements and more than 7,000 stone tools. It was decided that a basic technological and typological classification would be given to every flint and stone implement from all three sites under investigation. A database from the Leiden Material Culture Studies at Leiden University, interconnected with the technological and typological classification of the implements, was used to register all the data concerning use-wear analysis. In addition, flint, stone and bone implements and amber ornaments selected for use-wear analysis were drawn, and the main characteristics of the use-wear traces were mapped and indicated on the drawings.

The second challenge concerned the sampling process. The presumed difference in functionality established by traditional typology between formal and non-formal tools has already been discussed. To avoid this limitation, all the flint and stone implements from Keinsmerbrug and Mienakker were analysed for the presence of use-wear. This decision was taken for two reasons. First, the flint assemblage from both sites was small enough to analyse all the implements at low magnifications. Secondly, the Keinsmerbrug and Mienakker use-wear analysis could be used as a departure point to sample the larger assemblages, forming the basis for subsequent analyses to be performed on implements from Mienakker and Zeewijk. Zeewijk consisted of thousands of flint implements, so the results from Keinsmerbrug helped to define a better sampling strategy for Zeewijk (García-Díaz 2012, 2013). During the classification of the Zeewijk flint artefacts, 596 were considered suitable for use-wear analysis. The selection was taken by observing the pieces under a stereoscopic microscope at low magnifications or with the naked eye. The selection of tools was based on the presence of the following parameters: a) rounding, b) edge damage, c) the presence of retouch, d) a suitable edge for use, such as a point or regular cutting edge, and/or e) visible polish. As the collection was too large to examine microscopically, 23% of the implements (N=140) were selected for use-wear analysis (García-Díaz 2014a).

The selection of the Zeewijk stone implements for use-wear analysis was based on the presence of macro-traces. These included: a) rounding b) a flat and/or polished surface, c) macroscopically visible striations, and d) the presence of pounding traces on the surface. A total of 69 tools were selected as suitable for use-wear analysis. Of these, a random sample of 53 implements (76.8%) was analysed. The selection comprised one axe, four flaked stones, two hammer stones, seven cereal processing tools (two handstones and seven querns) and 39 unmodified stones (one broken and 38 with a smooth surface). Upon microscopic analysis, 21 tools were seen to display no use-wear traces, ten tools were classified as not interpretable and 22 tools showed use-wear traces on a total of 29 edges (García-Díaz 2014a).

The surface preservation was also a limitation for the use-wear analysis. At the three sites, the percentage of burnt implements was relatively high. In addition, other type of alterations, such as several types of patinas, fractures and abrasion, were documented on flint and stone implements (García-Díaz 2012, 2013, 2014a; see Chapters 4, 5 and 6). Similarly the preservation of bone implements was not excellent. Bone implements were available for analysis at Mienakker and Zeewijk, and in this case, as the assemblage was small enough, the selection of the analysed tools was made based on the level of preservation of the bone surface. Bones mainly presented fractures and/or patinas, although other types of alterations such as burning traces or abrasions were present. In addition, several tools were treated with consolidate glue, that impeded their analysis in several cases (García-Díaz 2013, 2014a; see Chapters 5 and 6). At Mienakker, 29 of the 53 bones available were selected for use-wear analysis, while at Zeewijk, 11 bones were available for study, of which five were considered unsuitable for use-wear analysis (García-Díaz 2013, 2014a; See Chapters 5 and 6).

Cleaning the artefacts was fundamental before the analysis of the implements. All analysed flint implements were cleaned with water and soap first. If a more thorough cleaning was still necessary, a 10% HCL solution was subsequently applied in an ultrasonic tank during 30 to 45 minutes. Additional cleaning was needed during the analysis. To remove the grease and the dirt coming from the hands of the analyser, alcohol and/or refined petrol were used, following the indications of other researchers (Clemente Conte 1997; González Urquijo and Ibáñez Estévez 1994; Semenov 1981[1957]; Van Gijn 1990, 2010a). In addition, stone artefacts were cleaned with water and soap if needed, while amber and bone were not cleaned at all. In the case of amber, the analysed fragments were probably washed after the excavation, and the surface was clean enough (García-Díaz 2012). However, in the case of the analysed bone implements, the decision not to clean was taken because of the fragility of their surfaces, which probably won't tolerate aggressive cleaning methods to remove glue and other chemical preservatives used after the excavation (Graziano 2014).

Finally, the last challenge concerned the methodology employed. Within the context of this thesis use-wear analysis was applied to a wide range of materials that include flint, different types of stone, bone and amber. A combination of both high-power approach and low-power approach was used, independently of the raw material. This approach was followed taking into account the questions of the research project, as the objective of the analysis was not only to determine which tools were used, but also to understand the functionality of the tool at its maximum extent. Therefore, a combination of both approaches was considered more appropriate, according to the other published research (see for example Clemente Conte 1997; González Urquijo and Ibáñez Estévez 1994; Gräslund *et al.* 1990; Maigrot 1997, 2000, 2001, 2003; Ramos Millán 1990; Van Gijn 1990, 2010a). As such, use-wear analysis was performed using a stereoscopic microscope with magnifications ranging from 7-160x and an incident light microscope with magnifications between 50 and 1000x. Photographs were taken of the more representative traits of the use-wear traces (Table 3.1).

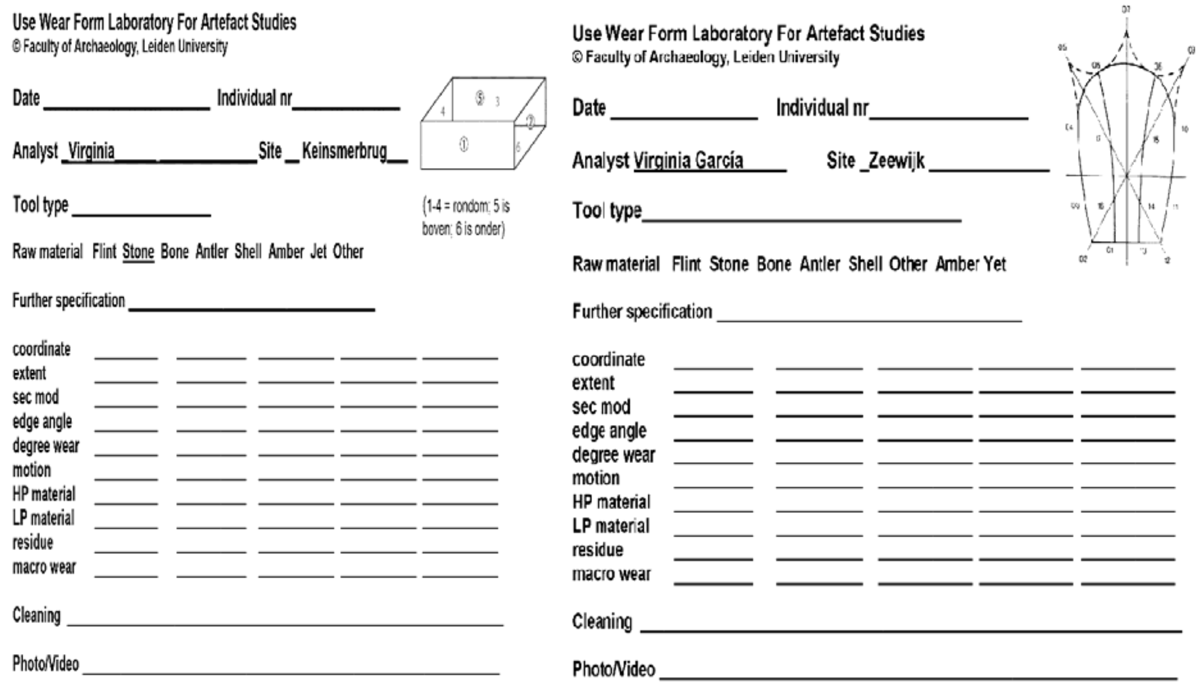
Stereomicroscope	Camera Type	Flint	Stone	Bone	Amber
Nikon (7-63x)	Nikon DXM1200	x	-	-	x
Wild M3z (26-160x)	Nikon DSFi1	-	x	x	-

Metallographic Microscopes	Camera Type	Flint	Stone	Bone	Amber
Nikon Optiphot-2 (50-1000x)	Nikon DXM1200	x	x	x	x
Leica DM6000M (50-100x)	Leica DFC450	x	-	x	x

Table 3.1. Types of microscopes and cameras used during this dissertation.

3.6.3.3 Use-wear recording

During the analysis of the flint, stone, bone and amber implements the information inferred about these variables was entered in a MS ACCESS database, one for each material analysed. In addition, a paper form was created containing a schematic drawing of every analysed implement. The implements were divided following a coordinate system based on Van Gijn's work (1990). In this form, then, use-wear traces were mapped and additional information was recorded when needed in relation to the coordinates (Figure 3.3).


Use Wear Form Laboratory For Artefact Studies
© Faculty of Archaeology, Leiden University

Date ________________ Individual nr___________

Analyst _Virginia____ ___________Site _ Keinsmerbrug__

Tool type ______________

(1-4 = rondom; 5 is boven; 6 is onder)

Raw material Flint Stone Bone Antler Shell Amber Jet Other

Further specification ________________________

coordinate
extent
sec mod
edge angle
degree wear
motion
HP material
LP material
residue
macro wear

Cleaning ____

Photo/Video ______________________________________

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Date ______________ Individual nr_______________

Analyst Virginia García_____ Site _Zeewijk ____________

Tool type______________________________

Raw material Flint Stone Bone Antler Shell Other Amber Yet

Further specification ___________________________

coordinate
extent
sec mod
edge angle
degree wear
motion
HP material
LP material
residue
macro wear

Cleaning ____

Photo/Video ______________________________________

Figure 3.3. Forms used to map use-wear traces on flint and stone implements (García-Díaz).

The recording of the use-wear traces are based on the distinction of the four attributes considered by Semenov (1981[1957): polish, edge-damage, edge rounding and striations.

- Polish. Although the characteristics of polish have not been unanimously defined by the researchers, in this dissertation a combination of the classification used by several authors (Clemente Conte 1997; González and Ibáñez 1994; Van Gijn 1990) was used. Polish was classified based on the following categories:

- Distribution. It provides information about the worked raw material and the type of work performed. For flint and bone implements, and referring to the used edge, the category includes the following: only ventral; only dorsal; ventral and dorsal equal; dorsal and ventral, but more extended on the dorsal surface; and dorsal and ventral, but more extended on the ventral surface. For stone and amber implements, the coordinate system was used to classify the distribution of the polish.

- Degree of linkage. It refers to extension and dimension of the polish. Depending of the characteristics of the polish, it can be characterised as as:

- Open: when the polish of the active zone are isolated points and without any contact between them.
- Half-linked: when the polish of the active zone is more extended and in some places the polish begins to unite in a single extension.
- Linked: when more than half of the surface of the polish area shows a uniformed polish.
- Compact: when practically all the surface shows polish.

- Texture or aspect. This characteristic refers to the uniformity of the polish and, basically, can be described as smooth, rough and greasy.
- Brightness or reflectivity: Refers to the intensity of the light reflected by the polish area. This intensity can be classified as very bright, bright and dull.
- Morphology (Clemente Conte 1997), micro-topography (González e Ibáñez 1994) or topography (Van Gijn 1990). This characteristic refers to the appearance of the polish in its more developed stage. Polish can be flat, domed and pitted.

- Edge damage. Edge damage can be defined as the fractures produced by the contact of the edge with the worked material. Its location gives information about the type of work performed, but also about the hardness of the contact material and the performed motion. Keeley (1980) suggested that edge damage can be classified by its general appearance, its deepness and its size. Following this author, edge damage classification was performed by taking into account the distribution of the edge damage, its morphology, its length, and its width.

- Striations. The formation of striations is determined by various factors: the addition of abrasive material into the worked material; the hardness of the worked material; the morphology of the active edge/surface of the tool; the pressure appplied during the use of the tool; and the duration of the work (Mansur-Franchomme 1980: 26). Striations were classified following this categories:

- Location of the striations. For flint and bone implements, and referring to the used edge, the category includes the following: only ventral; only dorsal; ventral and dorsal equal; dorsal and ventral, but more extended on the dorsal surface; and dorsal and ventral, but more extended on the ventral surface. For stone and amber implements, the coordinate system was used to classify the distribution of the striations.

- Directionality of the striations, which provides information of the motion in which the tool was used. The directionality was classified as: parallel to the active edge; perpendicular to the active edge; diagonal to the active edge; random (Van Gijn 1990).

- Edge rounding. The formation of edge rounding depends on: the morphology of the used edge; the duration of work; the abrasive characteristics of the worked material; and the type of work carried out (Clemente Conte 1997). Edge rounding was classified as: sharp; slightly rounded; and very rounded.

The formation of use-wear traces depend on different variables, which have been described more or less uniformly by different researchers (Clemente Conte 1997; González and Ibáñez 1994; Van Gijn 1990). Some general variables, common to all implements, are related with the type of raw material and the typological and technological classification already discussed (Clemente Conte 1997; González and Ibáñez 1994; Van Gijn 1990). Other variables are related to the specific functionality of the tool and the active edge/surface of the implement (Clemente Conte 1997; González and Ibáñez 1994; Van Gijn 1990).

The main variables registered in relation with the functionality of the flint, stone, bone and amber implements were:

- Degree of wear. It has been classified as: without traces; lightly worn; medium worn; and heavily worn.

- Number of active edges/surfaces.

- Worked material. The more significant characteristics of the worked material in the use-wear formation process are: the hardness, the level of humidity, the flexibility and the elasticity.

- Degree of probability, classified as high or low, taking into account the results of the analysis.

The main variables registered in relation with the active edge/surface of the tool were:

- Edge angle (only for flint implements). The angle of the used edge was measured using a goniometer.

- Type of edge/surface. If the edge/surface was retouched/reshaped/modified before use or unmodified.

- Surface preservation. If the edge/surface is broken or is complete. In addition, it is really important to distinguish the alterations from the use-wear traces. In the case of the analysed materials, this alterations are mainly caused by fire. A prolonged contact with fire produce different types of alterations that, depending on its degree of development, can affect the preservation of the use-wear traces, and even make them disappear (Mansur-Franchomme 1986; Clemente Conte 1997). During the current analysis, the degree of burning was recorded. It was classified as: not burned; glossy; red spots present; and *craquelé*. In addition, thermal fractures were also registered. Different types of patinas were frequently recorded on the studied assemblage. Patinas are chemical reactions that develop gradually and can cover the entire surface of the implements, making difficult or impossible the analysis (Mansur-Franchomme 1986; van Gijn 1990). During the analysis of the implements, the presence and degree of patinas was recorded as: not patinated; light gloss patina; heavy gloss patina; light colour patina; heavy colour patina; light white patina; and heavy white patina. Mechanical alterations were also documented in the studied assemblage. The main ones were erosion, abrasion and macro and micro fractures, which were documented both on the database and the use-wear form. Fiinally, bone implements showed several alterations produced after the excavation that impeded partially or totally the performance of use-wear analysis. Abrasion and erosion of the surface caused by contact with the sediment, partial fractures, and gnawing are present on some of the tools. In addition, some of the bone implements were restored using glue and other chemical preservatives which covered the original surface of the tools. Consequently, the technological and functional traces on these could not be analysed (García-Díaz 2013, 2014)

Taking into account the functional variables and the use-wear attributes, functional interpretations of the tool were made in different levels:

- Functionality of the implement. Taking into account the degree of use-wear traces and the post-depositional alterations, the analysed tools have classified as: without use-wear traces; probably used; used; and not interpretable.

- Motion: longitudinal; transversal; boring/piercing; diagonal; hafting; multiple use; dynamic activities, including percussion activities (pounding, chopping, wedging) and shooting; and not interpretable.

- Worked material. Besides the main characteristics already discussed, the combination of the four different attributes and their characteristics can guide to the interpretation of the contact material. The contact material was divided in three main types: plant materials, including all types of wood (hard wood, soft wood, bark and unspecific wood), siliceous plants (cereals, reeds, grasses and unspecified siliceous plants), non-siliceous plants and unspecified plant materials, defined by their hardness (hard, medium and soft plants and undetermined plant materials); animal materials, including bone, antler, bone/antler when it is not possible to distinguish between both materials, hide (classified as dry hide, fresh hide, hide with mineral addition or hide unspecific when it was not possible to determine), fish, meat, and animal unspecific; and inorganic, including different types of stone and fossil resins (pyrite, jet, amber, schist or undetermined types of stones), pottery/clay, and shell.

3.6.3.4 Experiments

As already discussed, experimental archaeology is a basic tool to perform use-wear analysis. In this dissertation, the experimental collection of the Laboratory of Material Culture Studies, from the University of Leiden, was used as a reference. At the time of this analysis the reference collection was composed of c. 2000 experimental tools, covering the entire range of raw materials analysed in this dissertation. To address specific issues and questions and where the Leiden reference collection was lacking, additional experiments were performed (García-Díaz 2013; Chapter 5), specifically pertaining to amber bead production and the use of borers. The experiments were performed taking into account the variables discussed above and:

- The duration of the work is a fundamental variable of the use wear process, because the longer the tool surface and the worked material stay in contact a more developed wear traces can be recorded.

- The presence or absence of hafting. The tools can be use without hafting (hand held), with a wooden, bone or horn haft, but also using an intermediate material as skin. Hafting affects the development of use-wear traces, because when a tool is hafted, it is easier to apply a greater amount of force during the activity.

The experimental program had two main objectives. The first one was the understanding, reconstruction and recording of the technological process of amber bead production. The second one focused on the different use wear traces recorded on the flint borers. Following the previous work of Bulten (2001), six steps are distinguished in the production sequence of amber beads:

- Raw material acquisition. Although some authors have suggested that the amber arrived to the North-Holland province as a result of exchange networks with the Baltic area (Brongers and Woltering in Bulten 2001), it seems more plausible that the small nodules of amber were picked up from the nearby beaches of the North Sea (Garcia Diaz 2012, 2013, 2014; Van Gijn 2006, 2008). Bulten (2001) suggests that the rounded shape of the amber implements coming from Mienakker could be interpreted as a consequence of the transportation and alteration of the sea (Bulten 2001).

- Cortex removal. Removing the cortex could be done by two different methods: by flaking or by scraping (Bulten 2001). Both methods left different patterns on the surface of the amber, with flaking being the easier process to be recognized in the archaeological samples. Negatives of cortex removal by flaking have been recorded for different amber beads from different sites, like Keinsmerbrug (García-Díaz 2012), Mienakker (Bulten 2001) and Kolhorn (Bulten 2001). However, scratching marks related to cortex removal are difficult to determine on archaeological tools, as they can be easily misinterpreted as traces related to post depositional alterations or polishing. During our experiment we used both methods to remove the cortex. In the first case, we used a small quartz pebble to remove the cortex while, in the second, we used a flint scraper. Both tool types proved to be effective.

- Cutting. The cutting of amber can be done using a rope or a string or using a flake or a blade. In our case, we used a flake to cut the amber in the cases that we need it. The use of a string has been tested on several occasions, as in the case of the Laboratory of Artefact Studies. The marks inflicted on the surface of the amber, described by Bulten (2001: 474) as concentric circles, were observed on some amber pieces of Mienakker.

- Polishing and shaping. The shaping of the amber bead was done using an abrasive stone. In our case we used a medium grain quartzite. Bulten (2001: 474) suggests that this first shaping will be accompanied with a first polishing of the surface. As in the cases of the cortex removal, those marks could also be covered by the marks left by subsequent stages of production, such as the final shaping or post depositional surface alterations.

- Perforation. The perforation is the more delicate step in the production of the bead because of the risk of mistakes or accidental fracturing. Through the analysis of the beads from several sites, three different kinds of perforations have been recorded:

- one sided conical perforation. The one sided conical perforation does not occur very often. This type of perforation is irregular, being wider at the beginning of the side from which the borer started to work than at the end. Some authors interpret this type of perforation as a mistake (Bulten 2001: 475). However, I think that probably this kind of perforation was produced on purpose, as it is easy and quick to do and produces a wide enough hole to permit the string to pass easily. For the experimental program one hafted flint borer was used to produce these perforations. The flint borer was used in regular time intervals of 15 minutes to a maximum of one hour of work.
- bi-conical or hourglass-shaped perforation. The risk in this type of perforation is the miscalculation of the location of the perforations. Such mistakes are frequently seen in the archaeological samples (Van Gijn 2006: 200). Bi-conical perforations are mainly done with flint borers, like in the case of the conical ones. Five experimental borers were used to produce this kind of perforations. In every case the borers were used without hafting. The borers were used in regular intervals of 15 minutes to a maximum of 90 minutes of work.
- cylindrical perforation. Because of the characteristics of the perforation (its homogeneity and size) it is believed that these perforations were made with hafted bone or antler borers. In the experimental program, one bone borer was used to perforate the beads. Making a cylindrical perforation is a hazardous step in the entire sequence due the fragility of the beads. Probably this is the main reason why this step often was performed before the final shaping of the bead. This type of perforation was done in two ways, with a bow drill or by holding the hafted drill in the hand. In both cases it is crucial to immobilize the amber bead in order to concentrate the pressure on just one point of the bead. In addition, the information obtained from a previous experiment of the Laboratory of Artefact Studies was used. In this experiment, an antler borer was used, hafted in a wooden stick, with the help of a bow. In both cases, the main priority of the experiment was to immobilize the amber bead to prevent it from breaking.

- Polishing and final shaping. The final step of the production process consisted of the polishing and shaping of the beads. A medium grain quartzite was used to perform this action, with acceptable results, although Bulten (2001: 476) suggest the use of different kind of stones for the two polishing processes, as a fine grained sandstone.

The experimental reconstruction of amber bead production reveals interesting information when we compare the findings to the archaeological samples (García-Díaz 2013, 2014; Chapter 4 and 5) and the use-wear analysis of the flint replicas used to produce the beads have allowed us to describe the main patterns of the use-wear produced by boring amber. The main characteristics of the use-wear are mainly reflected in the rounded edge and the generation of a well-developed polish.

- Edge rounding develops very fast, being constant during the entire process and easily observable even during the first 15 minutes just with the naked eye. The rounding of the edges is concentrated on the point of the borer and on the dorsal ridges, the areas that have more intensive contact with the amber during the work.
- Edge fractures. In one case, one of the borers presents a fracture of the edge due to contact with the amber, after 15 minutes of work. However, with the continued use of the borer the rounding of the edge became more developed and the fracture almost disappeared.
- Striations are not common and none have been recorded on the experimental tools.
- Polish: the polish does not develop very quickly. After 15 minutes of work the polish distribution is restricted to isolated spots on the edge. The polish is flat, relatively bright, and well delimitated, with a rough appearance. After 30 minutes of work the polish shows a more developed appearance and is widely distributed. However, the polish distribution never became continuous and the degree of linkage was minimal with the polish present for the most part as isolated spots. Polish is located at the more prominent areas of the edge. However, and after one hour, the edge/working surface became more regular and polish appears in some other areas.

3.7 Conclusions

In this chapter it has been argued that tools and ornaments from domestic contexts provide detailed information about the nature of the society in which they are used. These tools are not only a reflection of the economic practices of the groups and an indicator of the skill level of their owners, but they are also embedded within the '*symbolic knowledge*' (Broadbent 1989) of the groups. Through the production and use of material culture, the '*mutual knowledge*' of the groups, as defined by Giddens (1984), is learned, structured and maintained. Therefore, the study of Corded Ware tools from domestic contexts will allow a better understanding of the society which used and produced them. For such an understanding to be achieved, tools from settlements contexts have to be understood and studied in their entirety and contextualized. In this thesis, and following the *chaîne opératoire* approach, tools are considered and studied from the moment the raw material was selected, taking into account the production of the tools, their uses and how they were discarded. The function of the different implements is accomplished through the application of use-wear analysis on a wide range of materials. The results of the analysis of the three studied assemblages are present in Chapters 4, 5 and 6, and will be contextualized in Chapters 7 and 8.

Chapter 4. Keinsmerbrug[6]

4.1 The site

Keinsmerbrug was discovered in 1985 and excavated in 1986 (Van Heeringen and Theunissen 2001). Three occupation layers were documented, dating to the Medieval, Roman and Neolithic periods. The Neolithic layer was 20cm thick, and in the profile drawings several layers indicates several occupations of the site (Nobles 2012a). In addition, five charcoal concentrations were interpreted as hearths. Several features, such as 25 pits and more than 600 stake and postholes, were recorded in the Neolithic layer, but at the time of excavation no structure was identified. Subsequently, however, at least five dwelling structures were revealed during the spatial analysis (Nobles 2012a, 2012b). In the south of the site there were two structures which overlapped, and some posts where occasionally reused (Nobles 2012b: 176). Another structure was identified in the central area of the site, and, finally, two overlapping structures were recorded in the northern part of the site. The five structures had a trapezoidal shape with rounded corners, and a central post line (Nobles 2012). Based on the analysis of the sections (Nobles 2012a, 2012b), two phases were distinguished: during the first phase southern structures and some water pits were constructed and then abandoned; during Phase 2 the central structure and the two northern structures were built (Nobles 2012b; Smit *et al*. 2012).

Keinsmerbrug is located within the large tidal basins of West-Friesland. The area started to silt up between 4500 and 4000 BC as a result of sea level rise, becoming habitable around 2900-2800 BC. At the beginning of the third millennium BC, the beach barriers developed, resulting in a more closed coastline. Peat started to form and by 3200-2900 BC the shoreline was almost completely closed. A lagoon also formed, and was active for at least two centuries. At the end of this period, the landscape was characterized by a combination of diverse ecological zones. Finally, from 2900 to 2250 BC, two branches of the large tidal channel developed, forming a brackish marsh environment, protected on the west border by a complex of beach barriers and connected to the sea by an open water system (Smit 2012). Late Neolithic settlements flourished in this environment, with the inhabitants exploiting several ecological niches. The site of Keinsmerbrug was located on the highest parts of the tidal flats, and the archaeological materials were '*embedded in the lowest level of peat covering tidal flats*' (Smit 2012 following Bosman 1986: 19) (Figure 4.1).

[6] This chapter is an altered and abbreviated version of García-Díaz 2012.

Botanical analysis suggests that Keinsmerbrug was located in a brackish environment, with salt marsh areas and some fresh water areas nearby. Keinsmerbrug was situated in an open landscape, and the local vegetation was dominated by grassland. Trees were not numerous in the immediate vicinity of the site, although pollen spectra show that trees may have been present (Kubiak-Martens 2012: 87). Cereal consumption was identified during the botanical and chemical analysis of the organic residues found on several pots. Five of the six residues contained indicative plant remains suggesting that emmer grains were eaten after being cooked in liquid with a small amount of animal fat (Oudemans and Kubiak-Martens 2012: 129). However, evidence of crop cultivation was not found (Kubiak-Martens 2012). The faunal assemblage shows a strong maritime influence. Both saline and freshwater fish species were identified, some of which migrated between the two water currents. Although fishing activities were focused on catching flounder, the analysis of the other fish species caught indicates a broad diversity of fishing activities (Zeiler and Brinkhuizen 2012). Fowling, however, was the most important subsistence activity at the site. In fact, the analysis of the large quantities of duck bones collected during the excavations has revealed that the inhabitants specialized in hunting several duck species. Mallard, teal, and widgeon were the most numerous, but at least 16 bird species were identified. Most birds will have been consumed, even though some of them, such as the eagle, may have been caught for their feathers (Zeiler and Brinkhuizen 2012: 137). The number of birds calculated – between 5,000 and 10,000 individuals – implies mass kills. Fowling techniques may have included nets, hunting traps, or hunting with arrowheads. In addition, the hunt might have taken place during the moulting period, when ducks cannot fly (Zeiler and Brinkhuizen 2012: 138). Other mammal remains were not numerous. However, the presence of domestic animal bones (mostly cattle, but also pig and dog) and wild animals (wolf, polecat, marten, mice and some amphibians) suggests that a combination of hunting and herding was taking place (Zeiler and Brinkhuizen 2012).

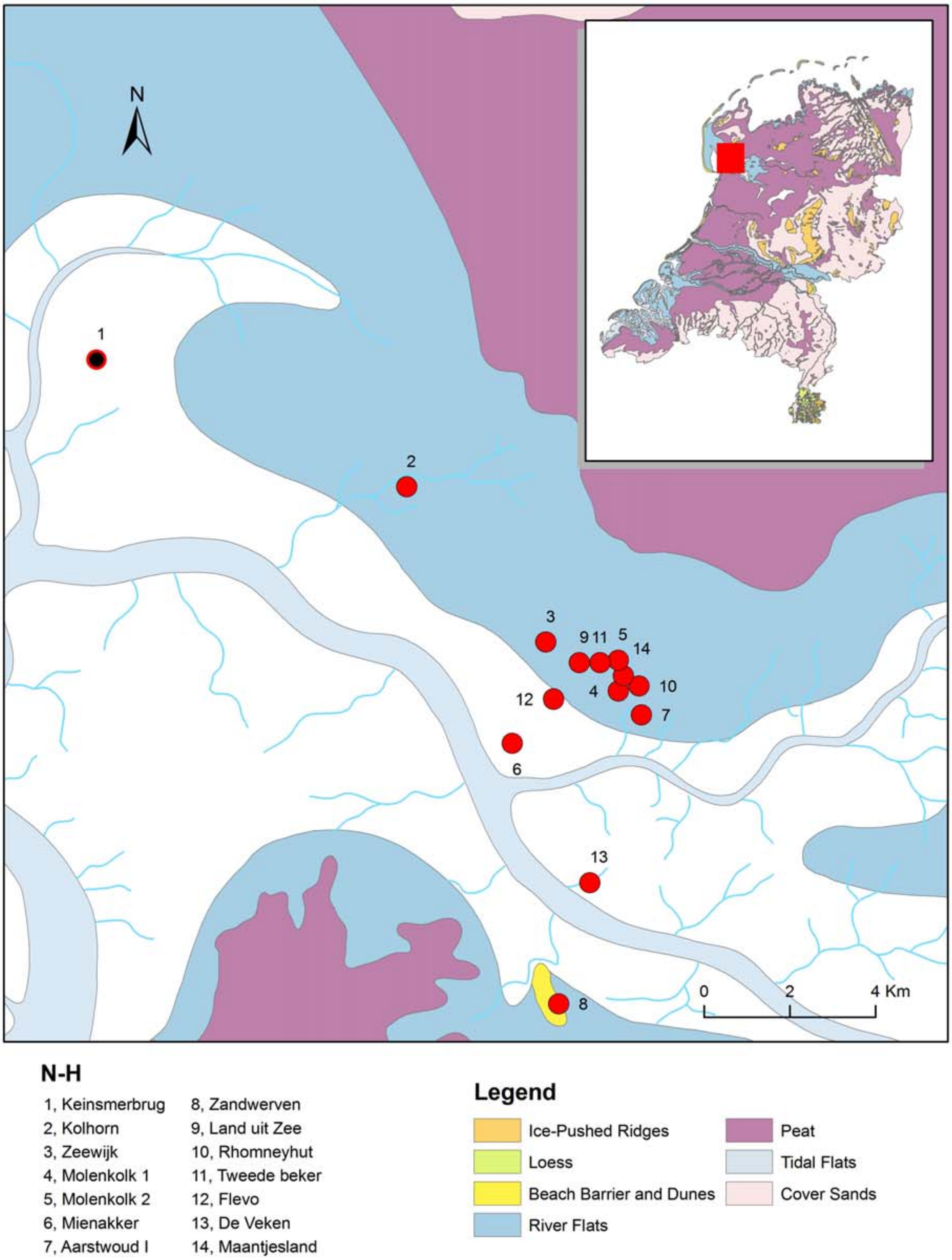

Figure 4.1. Location of Keinsmerbrug and other known Corded Ware Culture sites (after Vos and de Vries 2011).

Pottery analysis revealed a great variety of forms. The 219 sherds analysed belonged to at least 19 vessels, with a wide typological variety. Three different types of vessels could be distinguished: thin-walled, medium-walled and coarse-walled pottery, tempered with seven types of materials, and 14 different temper combinations. The vessels have a high rim and neck zone with flat bases. In addition, some of the thin-walled vessels have a fluid S-shaped profile (Beckerman 2012b). A possible functional differentiation of the different types of vessels was dismissed following the analysis of the organic remains (Oudemans and Kubiak-Martens 2012). Instead, pottery variation was interpreted as the result of several potters, potentially with diverse origins, producing the vessels (Beckerman 2012b: 55). During post-excavation, the site was dated by pottery typology to the CWC period. In 2013, six calibrated radiocarbon dates were published, all falling within the period of 2900-2300 cal BC. However, the calibration curve shows a clear plateau which prohibits a final delimitation of calibrated dates (Smit 2012: 20) (Figure 4.2).

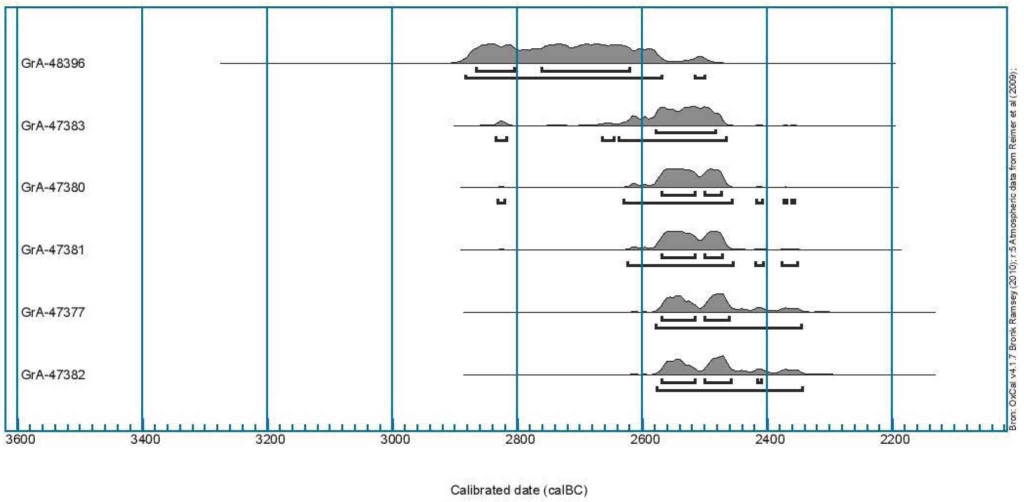

Figure 4.2. Multiplot of calibrated 14C outcomes (Smit 2012: 21).

4.2 The material analysed

Keinsmerbrug was excavated in its totality. The site was divided into four trenches, each separated by a metre-wide bank (Nobles 2012a). Trench 1 was excavated down to the peat layer. During the excavation, several pits were documented. The few finds from these pits were ascribed by typo-chronology to the Roman period. Trench 2 was also excavated down to the peat layer in meter squares in artificial spits of five centimetres. The site was excavated by trowel, and the soil from every square meter was sieved. At the start of the excavation, the location of each find was documented individually; however, as the excavation proceeded it became clear that the site was bigger than expected, so artefacts were then collected by square metre. Trench 3 was divided into squares of 4x4m. These squares were again divided into four squares. One of the squares was completely excavated using a spade, after which the soil was sieved. The other three squares were excavated by trowel, and the soil was also sieved using a 2mm mesh. The information concerning the excavation of Trench 4 was not published in the original site report, so the methodology is unknown (Nobles 2012a: 24). During the excavation, a small amount of archaeological material was recovered, which provided an excellent opportunity to understand the nature of the site, the activities that took place, and the spatial patterns of occupation.

The assemblages of flint, stone and amber were small enough to make a complete analysis of the sample possible. A total of 416 flint implements were recovered at Keinsmerbrug, the majority of which were picked up by hand, but an undetermined number of implements came from the sieve. In addition, a total of 94 stone pieces were recovered. Most of the pieces are very small (between 10 and 50 millimetres), with no traces of manufacture or use. Finally, half a bead and two small fragments of amber were recovered. The level of fragmentation in both stone and flint implements from Keinsmerbrug was very high: more than 80% of the flint implements displayed some kind of fracture, and for some tools, such as flakes, the percentage was even higher. Out of a total of 159 flakes, only 45 are complete (28%). The same is true of blades and cores. This may be attributed to the large quantity of waste fragments collected at the site. It also suggests, as will be discussed below, that knapping took place at the site. Another reason for the high level of fragmentation at Keinsmerbrug could be the extent to which the flint was exposed to fire. More than 50% (N=218) of the flint implements show different degrees of heating. In most cases (N=128) the surface of the implements has cracks (*craquelé)*. This complicates not only the use-wear analysis, but also attempts to determine the source of the flint. Consequently, a lot of information about the tools has been lost. Moreover, some of the flint implements had some post-depositional surface modifications (PDSM), such patinas and abrasion, but in most cases the edges and use-wear could still be readily analysed. Most of the stone fragments also displayed a high level of degradation, especially the granite, which degraded as a result of weathering. In some cases, this led to some fragments of granite being almost entirely reduced to gravel. At the same time, a high percentage of granite (42.3%) showed signs of heating which caused clear physical modification of the stones, including colour changes and decomposition. In contrast, thermal alteration or fragmentation of quartzite is not as extensive as for the granite. However, the quartzite surfaces are not very well-preserved either, due to PDSM. As a result, the use-wear traces on the stone artefacts were not very well preserved and interpretation of the worked raw material was not possible. Finally, no residues were observed. Even though the three amber artefacts were in good condition, the level of fragmentation was very high. In the case of the one finished bead, a recent fracture was observed, so only half of the bead was preserved. All three were microscopically studied for traces of production and wear.

4.3 Flint, stone and amber procurement network

Although Keinsmerbrug was located in a resource-rich environment, from a lithological perspective the immediate areas surrounding Keinsmerbrug were poor. Flint, stone and amber were not present in the close vicinity of the site, and the materials had to be brought in from further away. Northern flint and stones were probably obtained from the Pleistocene deposits of Wieringen and Texel, located 15km away from the settlement.

The flint was classified into six diverse groups, all considered to have a northern origin (García-Díaz 2012) (Table 4.1). As previously stated, the amount of material with alterations caused by contact with fire is very high, and around 30% of the flint could not be characterized in terms of its raw material origin. The common characteristics of the documented flint are a light-grey colour with a fine-grained matrix.

R1	Grey and fine-grained flint with fossils
R2	Grey and fine-grained flint without fossils or mineral inclusions
R3	Flint with old surface
R4	Rolled pebbles
R5	Grey flint without fossils but with light inclusions
R6	Fine-grained flint with a yellow and grey mottled colour

Table 4.1. Classification of flint raw material.

	Flakes	Wastes	Corefragment	Core	Cpdf	Blades	Splint	Pebbles	Tested pebbles	Uns	Total
R1	40.3	30.5	83.3	44.4	40	43.5	25	-	-	-	34.9
R2	13.8	12.1	16.7	11.2	20	13	37.5	-	-	-	13
R3	18.2	16.8	-	44.4	20	13	12.5	-	-	25	17.5
R4	-	-	-	-	-	-	-	100	100	16.7	1.4
R5	5.7	1.1	-	-	20	4.3	-	-	-	-	3.1
R6	0.6	-	-	-	-	-	-	-	-	-	0.2
Rind	21.4	39.5	-	-	-	26.1	25	-	-	58.3	29.8
Total	100	100	100	100	100	100	100	100	100	100	100

Table 4.2. Flint primary classification versus flint variety (%)(Cpdf: core piece decortification fragment; Uns: unsure; ind: indetermined)(García-Díaz 2013: 60).

	Flakes	Wastes	Corefrag	Core	Cpdf	Blades	Splint	Pebbles	Tested pebbles	Uns	Total
R1	64	58	5	4	2	10	2	-	-	-	145
R2	22	23	1	1	1	3	3	-	-	-	54
R3	29	32	-	4	1	3	1	-	-	3	73
R4	-	-	-	-	-	-	-	2	2	2	6
R5	9	2	-	-	1	1	-	-	-	-	13
R6	1	-	-	-	-	-	-	-	-	-	1
Rind	34	75	-	-	-	6	2	-	-	7	124
Total	159	190	6	9	5	23	8	2	2	12	416

Table 4.3. Flint primary classification versus flint variety (N) (Cpdf: core piece decortification fragment; Uns: unsure) (García-Díaz 2013: 60).

The variety of stones found at Keinsmerbrug was very low, with a predominance of igneous rocks (89.2%). Granite was very fragmented, mainly because of natural alterations such as weathering. Metamorphic rocks, mostly quartzite (12.76%), were also represented, with a total weight of 113 grams. The quartzite represented was all fine-grained with a dark-grey colour. A small number of other types of stones were also recorded. One fragment of an unspecified type of sedimentary rock and one fragment of jet completed the inventory of raw materials (Table 4.4) (García-Díaz 2012).

		N=	%
Metamorphic			
	Quartzite	12	12.7
Igneous			
	Granite	78	83
Sedimentary			
	Uns	1	1.0
	Jet	1	1.0
Indeter			
	Uns	2	2.1
Totals		94	100

Table 4.4 Stone raw material frequencies (Uns: unspecified)(García-Díaz 2013: 61).

Finally, the two small fragments of amber and the broken bead found at Keinsmerbrug were characterized by a translucent orange colour. Traditionally, three possible provenances for amber have been considered. First, amber nodules may have been washed out from Saalian boulder clay deposits. Secondly, amber nodules may also have been washed out by marine transgressions in the Baltic area. And finally, some of the amber may also derive from lignite deposits dating from the Pliocene in the northern Netherlands and Germany (Huisman 1977). It is therefore entirely possible that the most suitable area for obtaining amber could have been the tidal Pleistocene deposits of Wieringen, or the coastal zone of the Noord-Holland province.

4.4 Techno-typological analysis of the flint, stone and amber implements

4.4.1 Flint

At Keinsmerbrug, the presence of cores, fragmented cores and core preparation flakes suggests that flint was carried to and knapped at the site. The production process reveals that people from Keinsmerbrug used small flint nodules and rolled flint pebbles to produce the tools they needed. The size of the cores, between 12 and 53mm, suggests that they were exploited until their exhaustion. The necessity of collecting the raw material approximately 20km away from the site explains why the cores were exhaustively exploited. The low quality of the raw material determined to a great extent the final tool types obtained.

A combination of direct hard percussion and bipolar flaking was applied to the cores and pebbles. At Keinsmerbrug, the sample is so small that it is not possible to determine if there was a predetermined technique to produce some tool types. Only five cores display evidence of a bipolar approach, but only one flake and two blades show evidence of bipolar flaking. Bipolar flaking is generally related to low quality flint, and, in the case of the CWC in general, also with obtaining particular tool types.

Flakes were the most frequently occurring typological category, making up almost 38% (N=159) of the assemblage; few blades were present (Table 4.2 and 4.3). Flakes were not well preserved, with more than 70% fragmented. Around 50% of the flakes (N=81) had a cortical surface, supporting the hypothesis of local production of flint at the site. The absence of blade cores suggests that blades were an accidental product of flake production; only 13% of them were complete. Medial-proximal fragments occurred frequently (43.47%; N=10), with fewer medial and distal ends. Most of the blades were small (between 7.5 and 32mm) and made of R1 flint (43.4%; N=10). The platform or impact point was generally missing, and no preparation of the platform was observed. The widths of the platforms varied between one and 30mm and the angles of percussion ranged from 50 to 130 degrees. The impact point was mostly flat but sometimes displayed a slight cone of percussion. This suggests that the implements were knapped using a hard percussion technique.

A small number of retouched tools were found at Keinsmerbrug. The retouched tools included one end scraper (1465), three retouched flakes (1485, 1471 and 1721) and one retouched blade (1856). One borer produced from a blade was recovered (1671). The borer was very burnt so it was not possible to distinguish the retouch. However, the proximal side had been modified to obtain an elongated edge. Two strike-a-lights were also recovered. One of them (1486) had a pointed shape and the other one (1783) had a prismatic shape, but both had a rounded point on one of the edges (Figure 4.5).

	Flake	Retouched flake	Blade	Retouched blade	Borer	Scraper
R1	64	-	9	1	-	1
R2	21	2	3	-	-	-
R3	28	1	4	-	-	-
R4	-	-	-	-	-	-
R5	10	-	1	-	-	-
R6	1	-	-	-	-	-
Rind	35	-	5	-	1	-
Total	159	3	22	1	1	1

Table 4.5 Flint artefact type versus flint variety (N)(Ind: indeterminate)(García-Díaz 2013: 61).

4.4.2 Stone implements

Less than 100 fragments of stone were found at Keinsmerbrug. Due to a high degree of fragmentation, heating and various PDSM, traces of production and use were poorly preserved and difficult to distinguish. Besides one hammer stone and one flake, the other stone implements recovered from the site showed no modifications that could be associated with manufacture or use (Table 4.6). The flake (1901) was only 40mm long, 26mm wide and 4mm thick. It had a very well-developed bulb of percussion, suggesting the use of hard percussion. The surface was altered, and the flake displayed two fractures on the proximal side. Finally, the hammer stone was a fragment of granite with no clear technological traits. The stone was probably selected for its natural shape and used without modification. The tool did not have any fractures, making it one of the few complete implements from the site. The surface showed slight weathering but the tool showed no traces of heating, or any other kind of alterations. One of its surfaces showed impact scars suggesting its use as a hammer stone (García-Díaz 2012).

		Hammer stone	Flake	Modified	Unmodified	Total (N)	% modified
Metamorphic							
	Quartzite	-	1	1	11	12	8.3
Igneous							
	Granite	1	-	1	77	78	1.2
Sedimentary							
	Unspec	-	-	-	1	1	-
Others							
	Jet	-	-	-	1	1	-
Indeter							
	Uns	-	-	-	2	2	-
Total		1	1	2	92	94	9.5

Table 4.6 Raw material versus artefact type (Unspec: unspecific; Uns: unsure) (García-Díaz 2013: 62).

4.4.3 Amber

Amber ornaments are very common at Neolithic sites and, of course, in Corded Ware settlements in the Noord-Holland province (Bulten 2001; Piena and Drenth 2001; Van Gijn 2014a). Amber represents a large portion of the material assemblage at several sites, but amber accounted for just a tiny proportion of the assemblage from Keinsmerbrug. Only half a bead and two small fragments were recovered. Taking into account the small number of amber artefacts and the absence of production waste, amber ornaments were probably not produced at Keinsmerbrug. However, the production of amber beads and ornaments has been documented at several Corded Ware settlements, such as Mienakker, Zeewijk and Aartswoud (Bulten 2001; García-Díaz 2013; Piena and Drenth 2001; Van Gijn 2014a). The analysis of the bead found at Keinsmerbrug showed that the amber was modified to create a circular shape. Experimental work has shown that amber can be worked in two different ways: by cutting and by flaking (Bulten 2001; García-Díaz 2013). Flaking negatives were observed on the surface of the bead and it had a biconical perforation. A flint borer was probably used to produce this perforation. Small borers have been found at other Neolithic sites such as Mienakker, and preliminary analysis suggests that they were used to produce beads and amber ornaments. No borers with these characteristics were found at Keinsmerbrug, further supporting the idea that amber bead production did not take place there. The absence of production waste similarly indicates that amber production took place elsewhere. As is the case with other Neolithic sites (Bulten 2001; Van Gijn 2014a;

Verschoof 2008), beads and pendants were curated objects: removed when the site was abandoned. In this case, the broken bead was simply discarded.

4.5 The use of the domestic implements at Keinsmerbrug

4.5.1 Flint

A small percentage of flint implements – 16 artefacts (3.8%) with 18 used zones – display traces of use (Fig. 4.5 and 4.6, Table 4.7). In addition, seven implements have non-interpretable use-wear traces. All of them are so deteriorated because of contact with fire that it is not possible to identify whether traces were present. Most of the artefacts that display use-wear are blades (N=5) and flakes (N=7), with four waste fragments also showing traces of wear.

		Longitudinal	Transverse	Boring	Pounding	Hafting	Indeter	Total
Plant								
	Reeds	1	-	-	-	-	-	1
	Wood	2	2	-	-	-	-	4
Animal								
	Bone	1	3	-	-	-	-	4
	Hide	2	2	-	-	-	-	4
	Soft animal	-					1	1
	Animal uns	-	-	1	-	-	1	2
Mineral								
	Pyrite	-	-	-	2	-	-	2
Hafting								
	Indeter	-	-	-	-	3	-	3
Indeter								
	Indeter	-	-	-	-	-	7	7
	Total	6	7	1	2	3	9	28

Table 4.7 The relationship between contact material and function (Uns: unsure; Indeter: indeterminate)(García-Díaz 2013: 66).

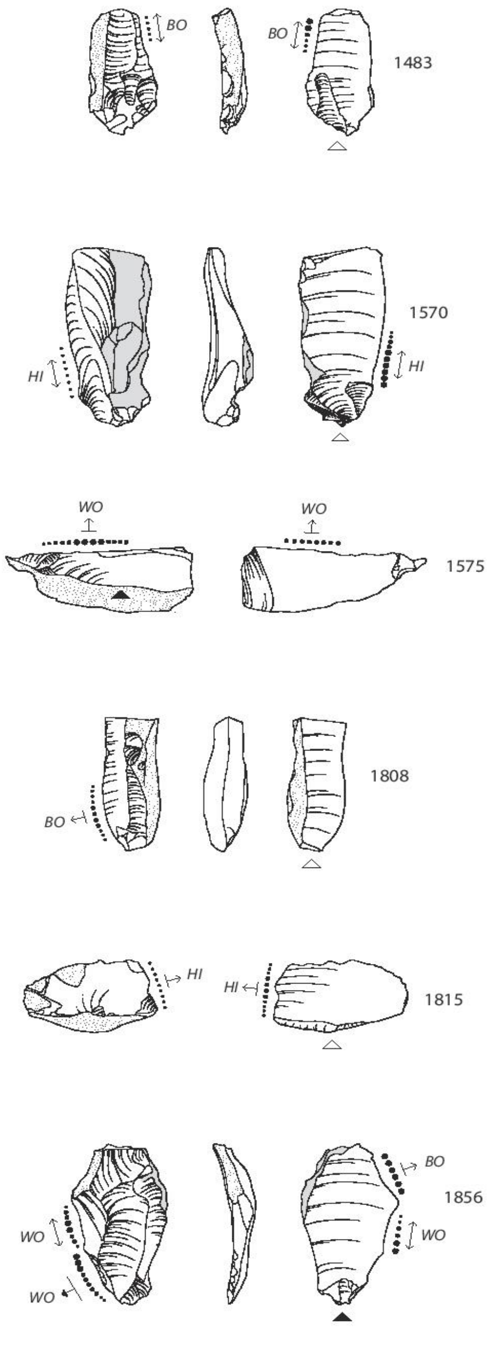

Figure 4.3. Flint artefacts with traces of different materials (scale 1:1). 1483: unmodified blade; 1570: unmodified blade; 1575: unmodified fragment; 1808: unmodified blade; 1815: unmodified flake; 1856: retouched blade (García-Díaz 2012: 64).

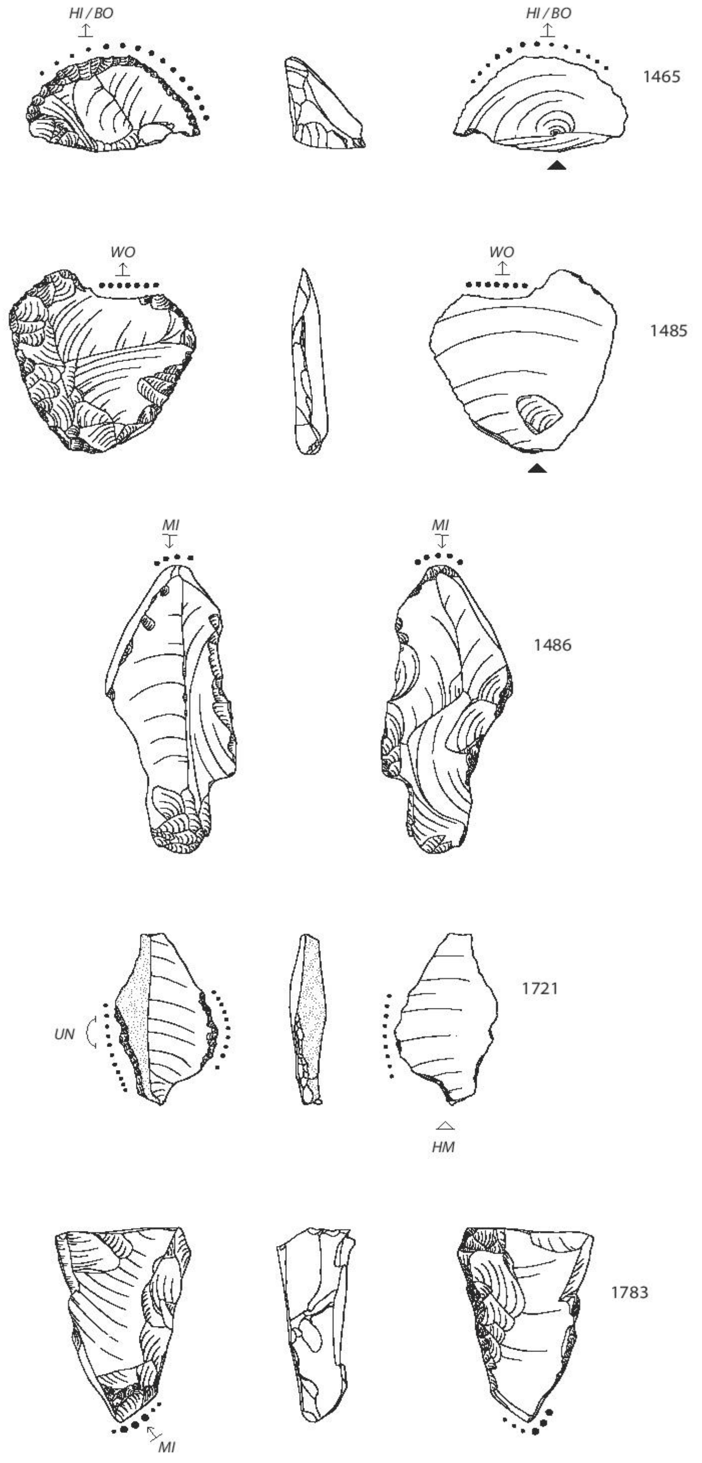

Figure 4.4. Flint artefacts with traces of different materials (scale 1:1) 1465: retouched flake; 1485: retouched flake; 1486: strike-a-light; 1721: retouched flake; 1783: strike-a-light (García-Díaz 2012: 65).

4.5.1.1 Plant processing and woodworking

One distal fragment of a flake (1522) displays a very well-developed polish. On both faces the polish has a fluid appearance, but on the dorsal face it is well-delimited by the edge of the tool. The use-wear is very much like the wear traces obtained from cutting softwood.

One blade, one flake and one piece of waste were used to work hard wood. The blade (1856) displays three used areas, two of which show traces of contact with hard wood; the other one, which will be discussed below, shows traces of contact with bone. On the proximal left edge of the blade, on the dorsal face, a row of small and edge damage can be observed. Around these retouches is a well-developed, bright and smooth polish. However, on the ventral face an isolated polish line parallel to the edge has been recorded. This suggests that the working angle of the tool was mostly high, with the dorsal face receiving most of the contact with the worked resource. The apparent transversal directionality seen on the tool further indicates that this tool was used for scraping wood. In addition, the left medial edge of the blade shows a wood polish with longitudinal motion, and small geometrical edge damage surrounded by wood polish can also be seen on the dorsal face; this use-wear is indicative of sawing hard wood.

One flake (1485) also shows use-wear of the type caused by sawing wood (Fig. 4.5). The polish is mostly developed on the ventral face so it is possible that the working edge was around 45 degrees. The flake also shows edge retouch on its left side. No use-wear has been documented on this edge, and the retouch may be derived from use, possibly from hafting.

Finally, a piece of waste (1575) displays isolated edge damage on the medial section of the distal edge. The use-wear is not very developed, but shows a clear longitudinal directionality. This probably means that the tool was used for only a short time to cut wood.

4.5.1.2 Animal resources

Traces of contact with animal resources are observed more frequently. A total of 64.7% (N=11) of the artefacts were used for working various animal materials. Eight tools show clear traces of bone and skin work and three flint tools show possible traces that resemble work on indeterminate animal resources.

Hide working

Two unmodified flakes, one retouched flake and one blade were used to work hide. Two of the flakes (1815 and 1471) show a transversal motion and another (1583) has a clear longitudinal motion. On the retouched flake a greasy polish is documented inside and around the edge retouch. In none of these cases is the use-wear very developed, which makes it impossible to infer whether they were used on fresh or dry skin. On the other hand, the blade (1569) displays a well-developed polish with a longitudinal directionality. The surface of the tool shows extensive damage from contact with fire. However, remarkably enough, on the dorsal side of the blade the damage produced by fire affects only the right side, and the damage is clearly marked by a straight line. One explanation for this observation is that this straight line represents the limit of a handle.

Bone working

Three blades and one scraper were used to work bone. Points of a well-delimited, highly reflective polish have been recorded on two of the blades (1483 and 1808). One blade shows a longitudinal motion while the other has evidence of a transversal motion. The third blade (1856) displays bone and wood polish. The bone polish is located on the left distal edge of the tool and is only preserved on the ventral face. The directionality in the polish suggests that the blade was used to scrape bone. Unfortunately, the dorsal face of the edge consists of a cortex on which it is impossible to distinguish any kind of use-wear. Lastly, the scraper (1465) shows a very well-developed polish from bone working on the ventral and dorsal sides (Fig. 4.6).

Unspecified animal resources

Three tools display use-wear that can be related to contact with unspecified animal materials. One borer (1671) is made of a proximal blade fragment. The surface of this blade is so altered by fire that it is impossible to distinguish even the kind of flint it is made from. The proximal part of the blade was prepared in such a way as to form an elongated, pointed end. The fire also caused the right side of the proximal part of the blade to break. However, the left side of the tool and the point are very rounded, indicating that it was used as a borer. Also, a polish very similar to that caused by working hide has been recorded. One flake fragment (1704) displays a polish that is very similar to the wear traces obtained from contact with a hard animal material like bone, but again, because of the fire and PDSM, it was not possible to interpret the animal material or motion. Finally, one retouched flake (1721) also displays use-wear, but its poor development makes a more detailed interpretation impossible. The proximal and medial left edges of the tool show small and continuous retouch. On the unmodified ventral face, isolated spots of polish without directionality are visible. This type of polish has been interpreted as the result of the contact between the tool and its haft, although the medial part of the right lateral edge also shows small and continuous retouch. Polish from contact with an unspecified hard animal material has been recorded on both sides of the edge, as well as polish from a medium soft material that could not be specified. Although the poorly developed polish and PDSM make it difficult to determine use-wear, all the evidence points to this implement being hafted and involved in butchering activities.

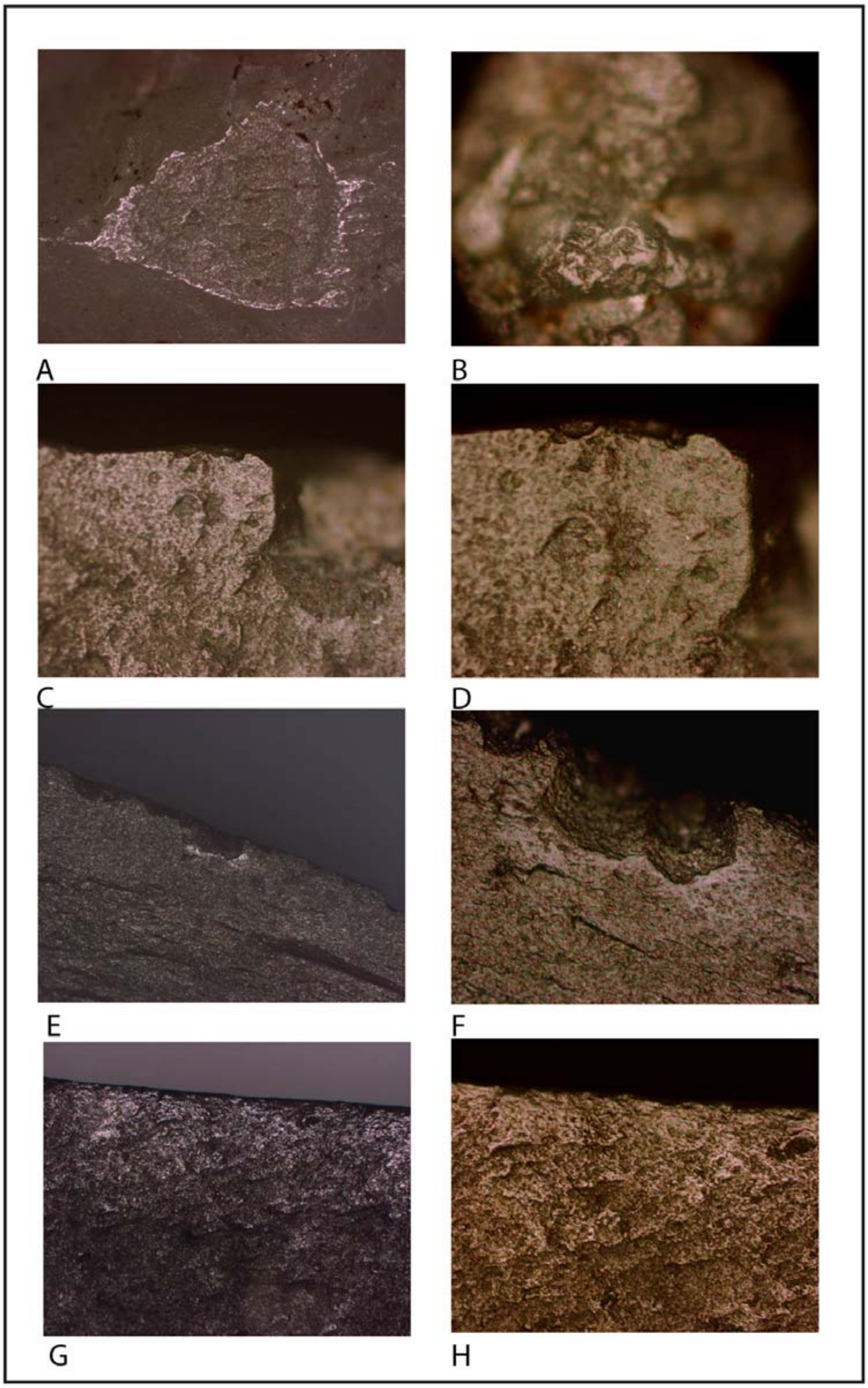

Figure 4.5. A: bright surface produced by contact of the flint implement surface with mineral (50x) (1485); B: rounded edge with linear and small bands of mineral polish (50x)(1485); C and D: use-wear displayed on a hide scraper (100x and 200x)(1471); E and F: edge damage and polish produced by bone work (50x and 200x) (1483); G and H: very well developed longitudinal polish produced by the contact with soft wood (50x and 200x)(3-1-71 n1)(García-Díaz 2012: 67).

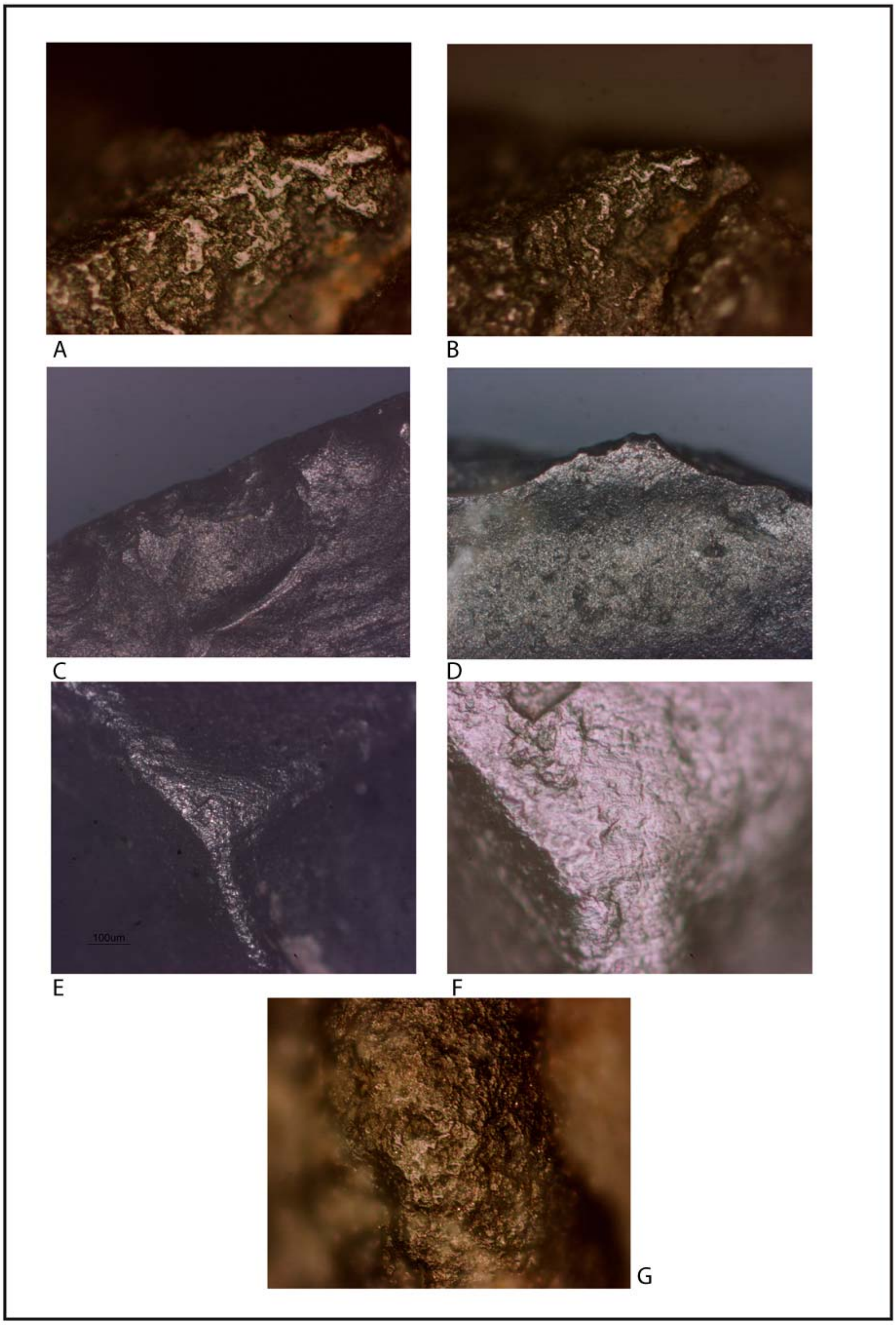

Figure 4.6. A and B: use-wear displayed on a hide scraper (20x and 5x) (1586); C and D: use-wear displayed on a bone scraper (5x and 10x)(1465); E and F: bright surface produced by a contact of the flint implement surface with mineral (10x and 20x)(1783); G: polish very similar to the one that develops after boring skin (20x)(1671) (García-Díaz 2012: 69).

4.5.1.3 Mineral resources

Two waste flints were found at Keinsmerbrug (1486 and 1783). Both implements had an elongated side on which use-wear was observed. The use-wear is very well-developed and is characterized by small impact fractures and a rounded edge with small linear bands of mineral polish. This observation suggests that these tools were used as strike-a-lights. Both tools have a very bright surface, a fact which has been explained by other authors as the result of contact between flint and pyrite, with the powder acting as an abrasive on the tool's surface (Van Gijn *et al.* 2006: 155). Strike-a-lights were a common tool type during the Mesolithic, and they have been interpreted as personal items (Van Gijn *et al* 2006: 155; Van Gijn 2010a: 132, 175). In this sense, strike-a-lights could be compared with the amber beads, which are also related to the personal identity of individuals in the past.

4.5.1.4 Unknown materials

This category contains seven tools that display ambiguous and poorly developed traces. Unfortunately, the poor preservation of the surface of the tools makes a functional interpretation impossible. All of them have been altered by contact with fire and only some archaeological edge damage can be observed. The vast majority of the tools are complete or fragmented flakes, although use-wear traces were identified on a complete blade (1871) and a distal blade fragment (1769).

4.5.1.5 Hafting traces

Hafting traces tend to be overlooked in use-wear analysis. Increasingly, however, experimental work has shown that hafting can leave substantial traces (Rots 2008; Rots and Vermeersch 2004). The authors stress that the absence of experimental references and the resulting lack of experience with hafting traces are responsible for the fact that some hafting traces, such as the bright spots, are often interpreted as PDSM. At Keinsmerbrug, three implements showed features suggestive of hafting. In two cases, the use-wear recorded on the tools can be defined as bright *spots* (Rots and Vermeersch 2004: 1295). On the other tool, the position of the fire-induced alterations, clearly marked by a straight line in its surface, suggests that the tool was hafted when it came into contact with the fire. In any case, the incidence of hafting is not very high. This can in part be explained as the result of a high level of alteration of the flint implements, but also because most of the tools were probably used without hafting.

4.5.2 Stone

Although the entire assemblage of stone tools was analysed for use-wear analysis, only one hammer stone displays traces of use (Fig. 4.7): the distal edge of the tool displays traces of pounding and percussion. Unfortunately, the worked material could not be inferred and there was no clear evidence of hafting or handling. The hammer stone was sent for phytolith analysis, but unfortunately, even though the surface of the hammer stone shows some phytolith remains, the plant species could not be determined (García-Díaz 2012).

Figure 4.7. Traces of pounding and percussion (10x)(García-Díaz 2012: 70).

4.5.3 Amber

Use-wear analysis can also provide interesting information about the use of the amber beads. Sometimes, the friction of the cord on the surface of the amber provides important information which enables us to understand the use and shape of the ornaments. The half fragment of an amber bead found at Keinsmerbrug shows wear traces along the rim of the perforation, indicating that it was worn on a cord as a decorative ornament. The function of the bead was probably related to the social status of the individual and their position within the group and wider community (Fig. 4.8).

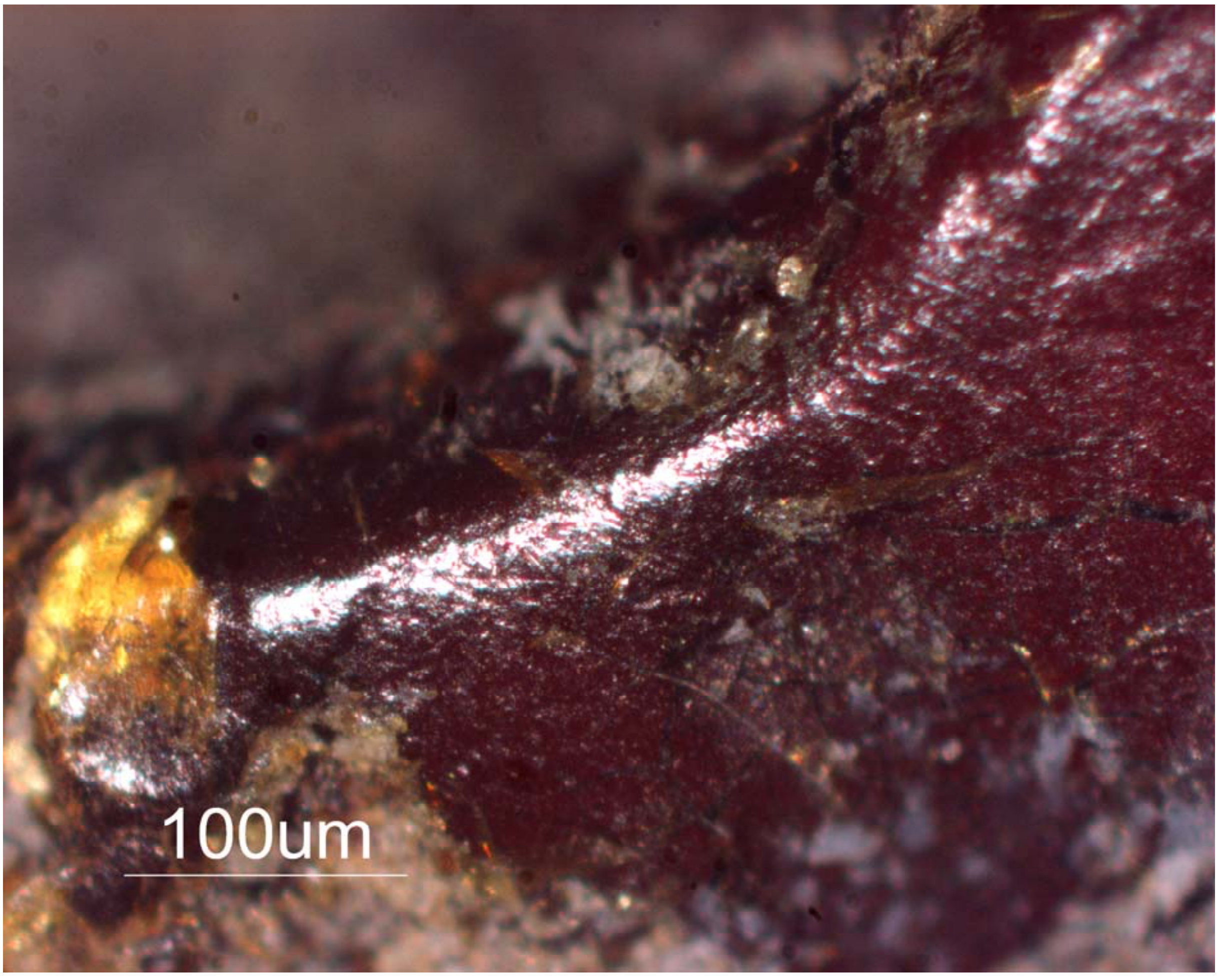

Figure 4.8. Wear traces along the rim of the perforation of the half amber bead (10x)(García-Díaz 2012: 71).

4.6 The spatial distribution of flint, stone and amber implements at Keinsmerbrug

Nobles' spatial analysis (Nobles 2012b) shows that seven activity areas were present at Keinsmerbrug. During the analysis, the northern structures were considered as a palimpsest. Consequently, it was estimated that the use of the space did not change between the construction phases (Nobles 2012b). Flint distribution analysis was based on 354 of the 416 implements analysed, which come from the cultural layer and from features. Stone distribution analysis was based on 91 stones, and three fragments of amber were used for the amber distribution analysis. The map of the flint spatial patterning shows a general distribution of the flint across the site (Fig. 4.9), although some concentrations of flint are recorded, mostly in the northern part of the site, and to a lesser extent in the south (Fig. 4.9). These concentrations are related to the activity areas which Nobles designated Areas 1, 2, 3 and 4.

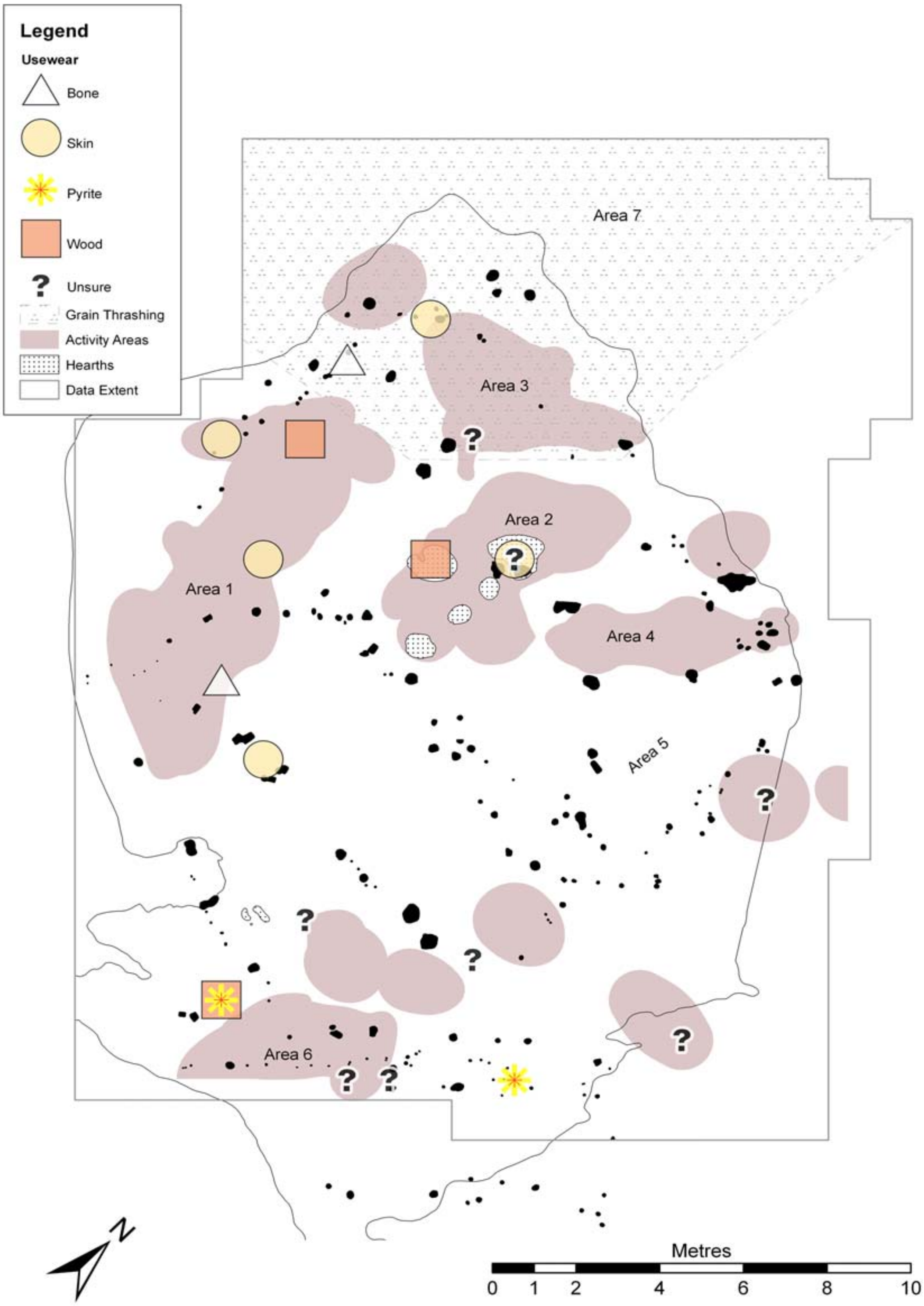

Figure 4.9. Distribution patterns of use-wear analysis on flint artefacts (García-Díaz 2012: 73).

Areas 1, 2 and 3 are related to the use of the Northern Structure Number 2. Other remains, including mammal and bird bones, were found in these distribution areas. These areas appear closely associated with domestic structures. Unfortunately, the use-wear distribution does not allow us to identify them as specialized areas (Fig 4.9). At Area 1, located at the entrance side of the central posthole line, implements with use-wear traces related to skin processing are the most common, though work with bone and wood is also represented. Activities related to bone and wood have also been recorded in Area 2, and the hammer stone was also collected from this Area. Area 2 is located around the hearths interpreted as the northern structure, suggesting that the hearth was the centre of domestic activities. The three amber fragments were recovered in the northern part of the site, in association with structure 2; the bead fragment was recovered from inside a posthole, suggesting a more recent chronology of this amber bead. Area 3 is located opposite the entrance, towards the back of the structures, and contains a high number of faunal remains, which suggests that it was possibly a refuse area (Fig. 4.10).

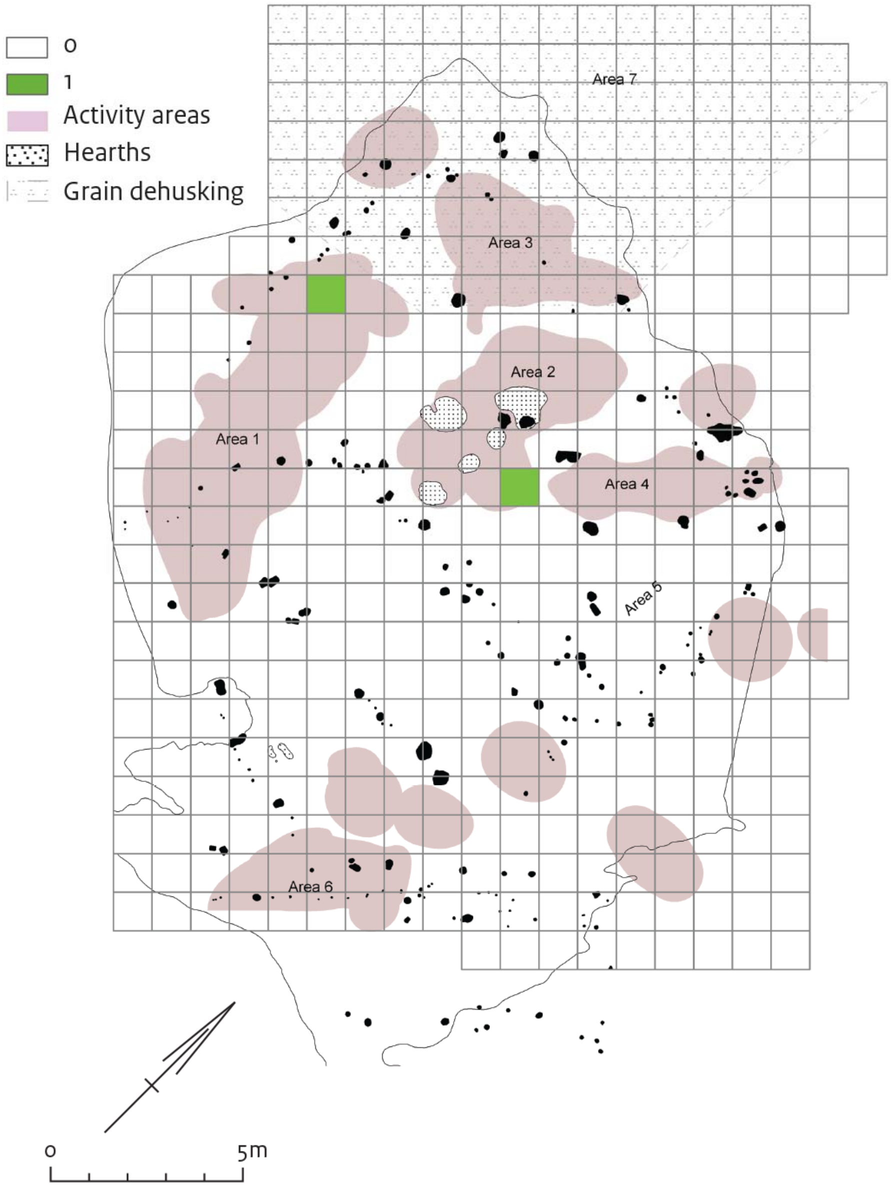

Figure 4.10. Distribution patterns of amber ornaments (García-Díaz 2012: 77).

Finally, Activity Area 4 yielded mostly flint flakes and waste, indicating that this may be the location where flint tools were produced. The burnt flint distribution shows a random spread over the entire site. Even though some hearths were found during the fieldwork, the wide distribution of burnt flint does not seem to be related to the intentional preparation or modification of tools.

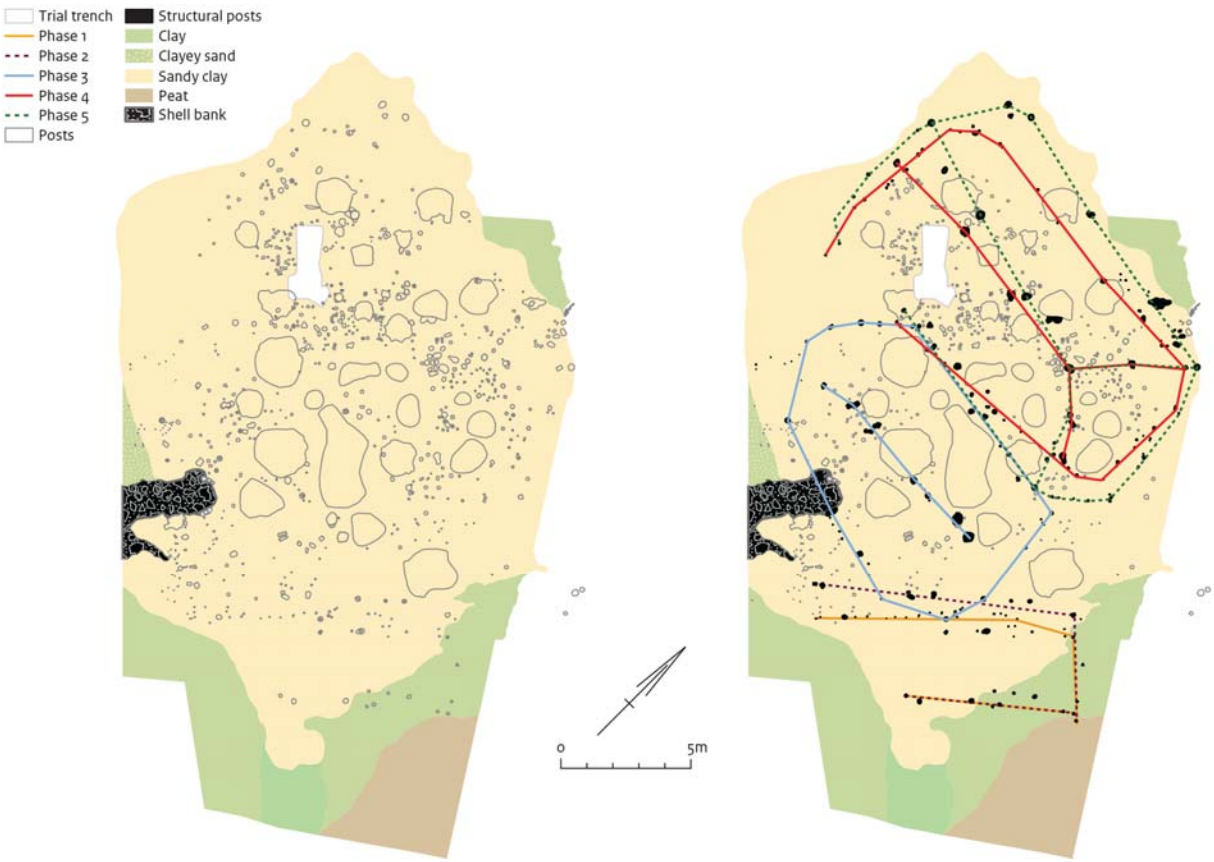

Figure 4.11. Interpreted structures before and after Nobles analysis (Nobles 2016: 95).

4.7 Conclusion: Group composition and site function

The analysis of flint and stone implements provides some clues as to group size and the function of the site. First, a deep knowledge of the landscape and natural environment is suggested by the use of material resources as far as 20 km away. Along with other resources lacking at Keinsmerbrug – for example quality wood or edible fruits and nuts – flint and stone were probably collected and brought back to the site from the glacial till deposit of Wieringen. Flint tools were conditioned by the quality and size of the raw material. The flint tools were produced on-site using a combination of bipolar and unidirectional hard hammer percussion, and were used for a limited range of activities. The characteristics of the material culture found at the site, and the limited range of activities documented, indicates a short occupation period. Thanks to the analysis of the faunal remains, the seasonality of the site is clearly delimited to the time between spring and the late autumn (Zeiler and Brinkhuizen 2012). Analysis of several dwelling structures has revealed evidence of the site being reoccupied several times, probably as part of seasonal activities related to fowling and fishing. The absence of evidence for these activities from the use-wear analysis of tool assemblage points to the existence of other kinds of technology, such as wooden traps, or other hunting strategies that left no material traces (Zeiler and Brinkhuizen 2012). Fish, bird and duck meat may have been preserved and stored for later consumption either at Keinsmerbrug or at other settlements. The diet was completed with vegetal resources, with naked barley, emmer, nuts, berries and seeds being collected and transported to the site. Although flint and stone tools did not have a predominant role in subsistence activities, they would have been extremely important in maintenance activities such as clothing, basketry and tool repair. Pottery vessels and some flint implements provide the main artefactual evidence of the social composition of the group. On one hand, the great variety of materials used to temper and produce the pottery vessels can be used to argue that there was variety in the knowledge and social practices of the group. On this basis it is likely that members of diverse groups gathered at Keinsmerbrug. On the other hand, flint production shows a great uniformity, which may be explained by the suggestion that flint was exclusively produced for the event, or events, represented at the site, while pottery was curated by individuals from permanent settlements located elsewhere.

Although the proportion of tools that show use-wear traces is low (3.8%), some conclusions can be drawn. First, most of the tools displaying use-wear traces (64.7%) were used to process animal resources; four of them have traces of skin processing. Ethnographic examples suggest that hide was used to produce a range of items such as clothes, rope, containers and canoes. In addition, it was also employed as a construction material for roofing and dividing the inner space of dwellings (Rahme and Hartman 1995: 1, 11). Hide processing has previously been considered as an indicator of seasonality (Van Gijn 1989). Taking into account the use-wear traces documented at Keinsmerbrug, it is most likely that the tasks performed there were mostly related to the repair and maintenance of hides and that the actual preparation of the hide was not taking place at the site.

Four tools have traces related to bone working. Bone was used to produce tools, for example needles, awls or spoons. In Neolithic times it was also used to temper pottery, converted into glue, or modified to create ornaments and pendants. Several bone implements have been documented at the Corded Ware wetlands sites (Van Iterson Scholten and De Vries-Metz 1981; see also Chapters 5 and 6). Surprisingly, not a single bone tool was found at Keinsmerbrug. It is likely that bone tools were personal curated objects which people took with them as they moved on from a site. Their absence could, however, also be due to preservation circumstances.

Furthermore, two blades were used in butchering activities. Traces of softer materials, such as meat, could not be observed because of the high degree of PDSM observed on the surface of the tools. Therefore, butchering and hunting traces cannot be assessed within the lithic assemblage at Keinsmerbrug. As stated, longitudinal activities on soft materials, like meat, create ephemeral traces (González Urquijo and Ibáñez Estévez 1994; Van Gijn 1998; Vaughan 1985), so if butchering traces are not well developed it can be difficult to distinguish them from soil sheen (Vaughan 1985: 43-44). The low tools related to butchery activities fits with the broader faunal evidence: remains from wild mammals were scarcely present, and were mostly represented by small fur animals and sea mammals (Zeiler and Brinkhuizen 2012), suggesting that mammal hunting was clearly not a key feature of the economic activities carried out at this site.

The absence of flint arrowheads further supports the argument that hunting was not practised at the site, but rather at the coastline or at other distant locations such as Wieringen or Texel. If the inhabitants of Keinsmerbrug were travelling to these places for other raw materials, including plant foods, it is not inconceivable that they also took advantage of these forays to hunt. Then again, the scarcity of hunting and butchery tools may be down to the inhabitants of Keinsmerbrug simply using alternative organic technologies such as traps, or bone and wooden arrowheads, which have not been preserved. Wooden projectiles have been documented by ethnographic sources as practice projectiles, or as weapons used to hunt birds or small game (Dale Guthrie 1983). Interestingly, this explanation fits well with the interpretation of the faunal assemblage that has characterized Keinsmerbrug as a place of fowling ducks and other birds. During the moulting period, between July and August, ducks and geese are unable to fly, and the use of small boats and nets to encircle and catch birds is a method proposed by some researchers as a means of fowling *en masse*. It is an approach that could also have been used at Keinsmerbrug in the nearby lagoon (Zeiler and Brinkhuizen 2012).

The absence of use-wear traces related to fish processing is somewhat at odds with the archaeozoological evidence. We know that fishing was one of the main activities practised at the site by the large amount of fish remains identified (Zeiler and Brinkhuizen 2012). Biomolecular analysis of the pottery sherds has identified fish residues, further supporting the argument for fish playing an important dietary role for the site's inhabitants (Oudemans and Kubiak-Martens 2012). In this light, the absence of fish-processing use-wear traces could be due to several reasons: first, it could be related to the poor preservation of the tool surfaces and general poor condition due to PDSM and fire alteration, as discussed. Secondly, bone or wooden tools, missing from the archaeological record, may have been used to process fish, as documented in other contexts (Semenov 1981[1957]). It is also possible that specialized gear, for example hooks, harpoons and nets, was curated: transported from one site to another. It should also be remembered that there are several ways of processing and preserving fish that do not require the use of tools (Van Gijn 1986).

Traces of plant processing and woodworking have been recorded on four tools, one of which displays traces of soft wood processing. These tools were probably used for various tasks such as producing rope, making clothes or possibly even working reeds for roofing material, as proposed by Kubiak-Martens (2012). The other three tools were probably used to work hard wood. Wood was used to build the dwellings, but diverse implements, such as tools and weapons, would also have been produced from wood. None of the tools present showed traces of harvesting cereals. As in the case of the arrowheads, the absence of sickles is a common phenomenon in these wetlands and very few flint sickles have been found in Late Neolithic and Early and Middle Bronze Age settlements or graves (Bakels and Van Gijn 2014; Van Gijn 2010a). At Keinsmerbrug, very small quantities of naked barley and emmer remains were collected during the excavation and local consumption of these crops was also documented on pottery residues (Oudemans and Kubiak-Martens 2012); however, analysis of pollen and plant macro-remains has shown that cereals were probably not locally cultivated (Kubiak-Martens 2012; Van Haaster 2012).

Overall, Keinsmerbrug is interpreted as a temporary settlement supporting the interpretation proposed by Hogestijn (1992, 1997, 1998, 2001, 2005). The settlement was probably visited on several occasions between spring and autumn (Smit *et al.* 2012). Taking into account the information provided by the different specialist reports, it has been proposed by the researchers of the NWO project that this is a place where different groups gathered (Smit *et al.* 2012: 221). At Keinsmerbrug people gathered and performed specific economic activities, such as fowling, fishing and cattle herding. Additionally, the settlement itself worked as a mechanism for social cohesion, whereby people came, feasted on specific foods, and in due process shared information and knowledge about their environment, materials, technology, skills and practices. Through these activities, different groups generated and maintained a form of cultural cohesion, with Keinsmerbrug at the spatial epicentre.

Chapter 5. Mienakker[7]

5.1. The site

The site of Mienakker was located in a former tidal basin, known as the Bergen tidal basin (Fig. 5.1). The topography of the area was formed during the Holocene, when the sea level rose and Pleistocene soil became covered by peat. Before Mienakker was inhabited a large tidal channel existed in the area, which formed high levees in the landscape around Mienakker (Kleijne and Weerts 2013). The topography of the site was determined by these channels, which created a landscape of depressions and former creek beds. The site of Mienakker was located on top of a small levee between two tidal creeks. During the time of the occupation, two small water channels were open, which were linked up with the larger tidal channel connecting the coast and the hinterland (Kleijne and Weerts 2013). Pollen analysis showed that the area was characterized by an open, treeless landscape, influenced by brackish water. Herbaceous vegetation dominated, mostly on the high salt marshes, offering many possibilities for grazing and hay production. Fresh water streams near the site also provided the opportunity for freshwater marsh vegetation to grow (Kubiak-Martens 2013).

[7] This chapter is an altered and abbreviated version of García-Díaz 2013.

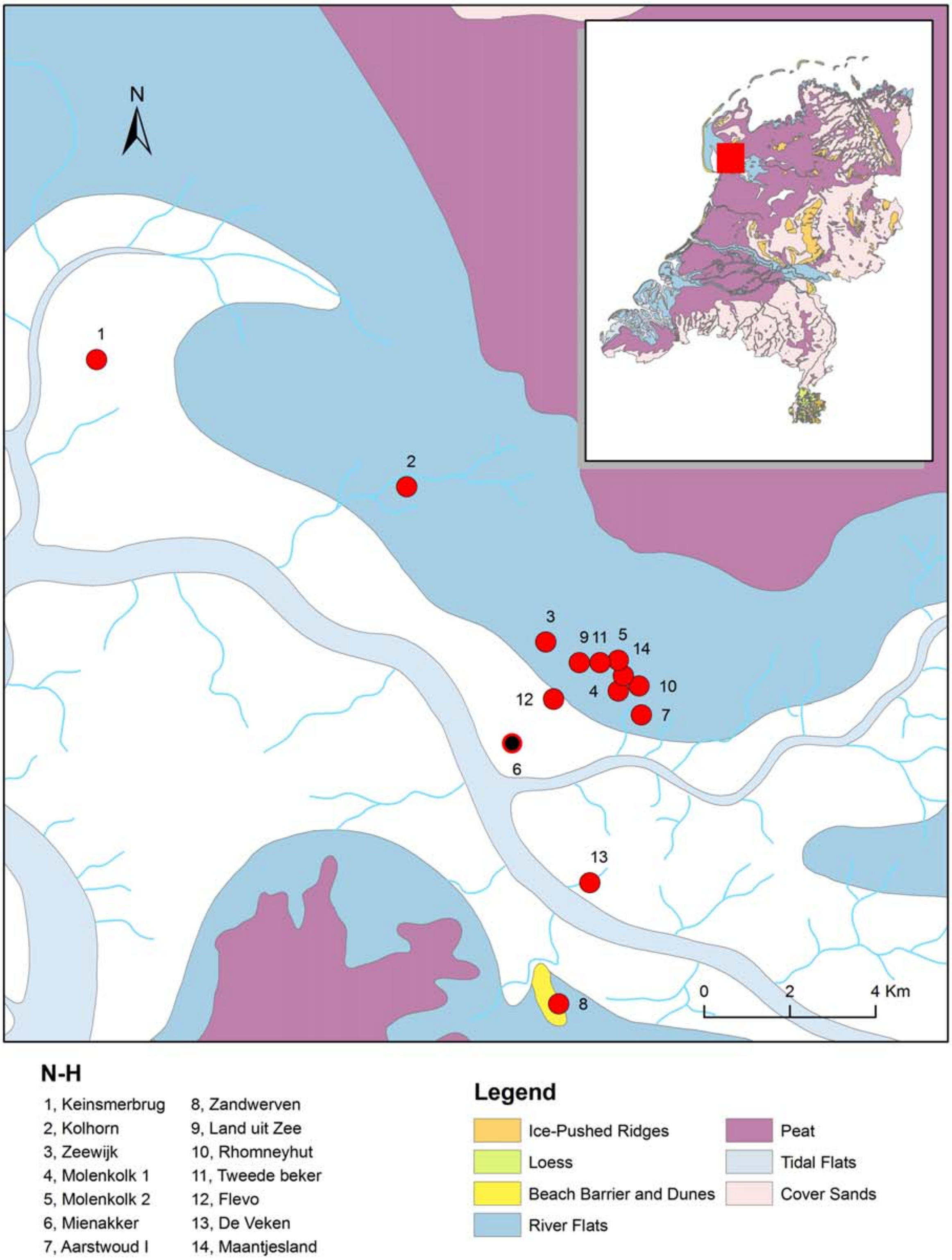

Figure 5.1. Location of Mienakker (after Vos and de Vries 2011).

The predecessor of the Dutch Cultural Heritage Agency, the State Service for Archaeological Investigations (*Rijksdienst voor het Oudheidkundig Bodemonderzoek*, ROB), excavated Mienakker in 1989. The settlement was divided into six rectangular areas and excavated in squares of 50x50cm, which were then excavated in artificial layers of 2cm (Nobles 2013a). The stratigraphy of the site suggested it was a palimpsest of occupation creating an accumulation of archaeological materials (Nobles 2013a). The six ^{14}C dates available for this site indicate at least two different occupation phases: the first one between 2850 and 2580 cal BC and the second between 2581 and 2346 cal BC (Kleijne and Weerts 2013; Nobles 2013a) (Figure 5.2). However, it proved difficult to relate archaeological materials to specific occupation phases, and pottery and flint could not be chronologically distinguished. One of the ^{14}C datings obtained from the burial suggested that the skeleton was placed at Mienakker at the end of the second phase, between 2577 cal BC and 2434 cal BC (Kleijne and Weerts 2013; Plomp 2013). The skeleton was buried in a filled space, with no clearly associated grave goods. The burial contained a man between 26 and 35 years old, who was buried with his head to the east and the legs to the west, with the skull facing south (Plomp 2013), a burial practice which has typically been linked to female skeletons. In the Swedish Battle Axe culture, however, in north central Poland, Finland and the Baltic region, graves were also generally oriented north-south (Larsson 2009: 61). Isotopic analysis of the bones revealed a diet based on cereal-like plants, with marine and freshwater elements.

The dietary reconstruction confirms the results of the faunal analysis. The types of species identified within the faunal assemblage indicate an open landscape with a strong marine influence, where some fresh water was also present. Studies show that cattle breeding, haddock and flatfish fishing and duck fowling were the main activities performed at the site (Zeiler and Brinkhuizen 2013). Hunting of seals and fur animals also took place but was of comparatively minor importance (Zeiler and Brinkhuizen 2013). Fruits and nuts such as apples, hazelnuts and acorns were probably collected at Wieringen, and stored for winter use. Naked barley and emmer were processed and stored at the site, as suggested by the two concentration areas documented (Kubiak-Martens 2013; Nobles 2013b). The presence of potential arable weeds has been used as evidence for local crop production (Kubiak-Martens 2013).

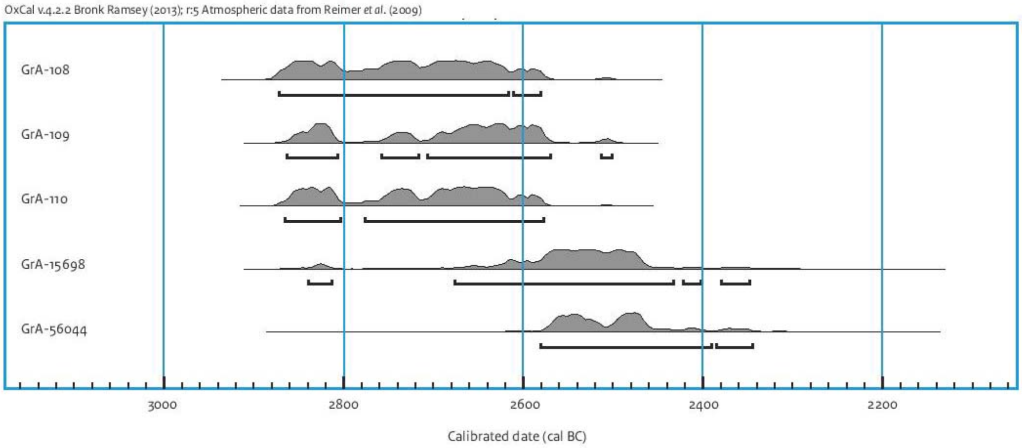

Figure 5.2. Multiplot of calibrated 14C dates of Mienakker (Kleijne and Weerts 2013: 25).

The analysis of the organic residues found on several pottery vessels also suggests a diet based on the consumption of crops (mostly emmer), other vegetables and animal fats, mostly from fish (Oudemans and Kubiak-Martens 2013). Organic residues were found only in thin-walled pottery vessels, which were the only decorated vessels. Four types of decoration were displayed: cord, zigzag patterns, oblique spatula impression in rows in a single direction and oblique spatula impression in alternating directions (Beckerman 2013). Compared to Keinsmerbrug, the pottery assemblage displays great uniformity. Around 91% of the analysed sherds were tempered with grog and sand, and almost all vessels displayed a '*tripartite form with either a slender "beaker type" or a more S-shaped profile*' (Beckerman 2013: 57).

Besides the burial, more than 1,500 features were documented during the excavation, of which most were postholes, pits, plough marks, or hearths. Two house structures were found during the 1990s excavation and were interpreted as *huts* by the excavators, although only one, MKII, was published (Arnoldussen and Fontijn 2006; Drenth *et al.* 2008; Hogestijn 1992, 1998, 2001; Hogestijn and Drenth 2000; Kossian 2007; Nobles 2013a; Van Ginkel and Hogestijn 1997). During the spatial analysis performed by the NWO Odyssee project, the structures were interpreted differently (Fig. 5.3). The MKII structure, which is sub-oval and measures 16.5x4m, is said to relate to the first phase of Mienakker occupation (Nobles 2013a). At least one hearth was associated with the structure, and its function was interpreted as domestic on the basis of the type and distribution of the material culture. The MKI structure was trapezoidal:

22m long, and 3-6m wide. What is remarkable is the lack of archaeological implements within this structure and the presence of a skeleton buried in association with one of the postholes of the structure. Consequently, Nobles (2013b) suggested a symbolic functionality of the construction. A similar structure documented at Zeewijk (see Chapter 6) was similarly interpreted as a ritual construction (Hogestijn 1992, 1998). Parallels with central European TRB dwellings have also been suggested by Nobles (Nobles 2014a; see Chapter 6).

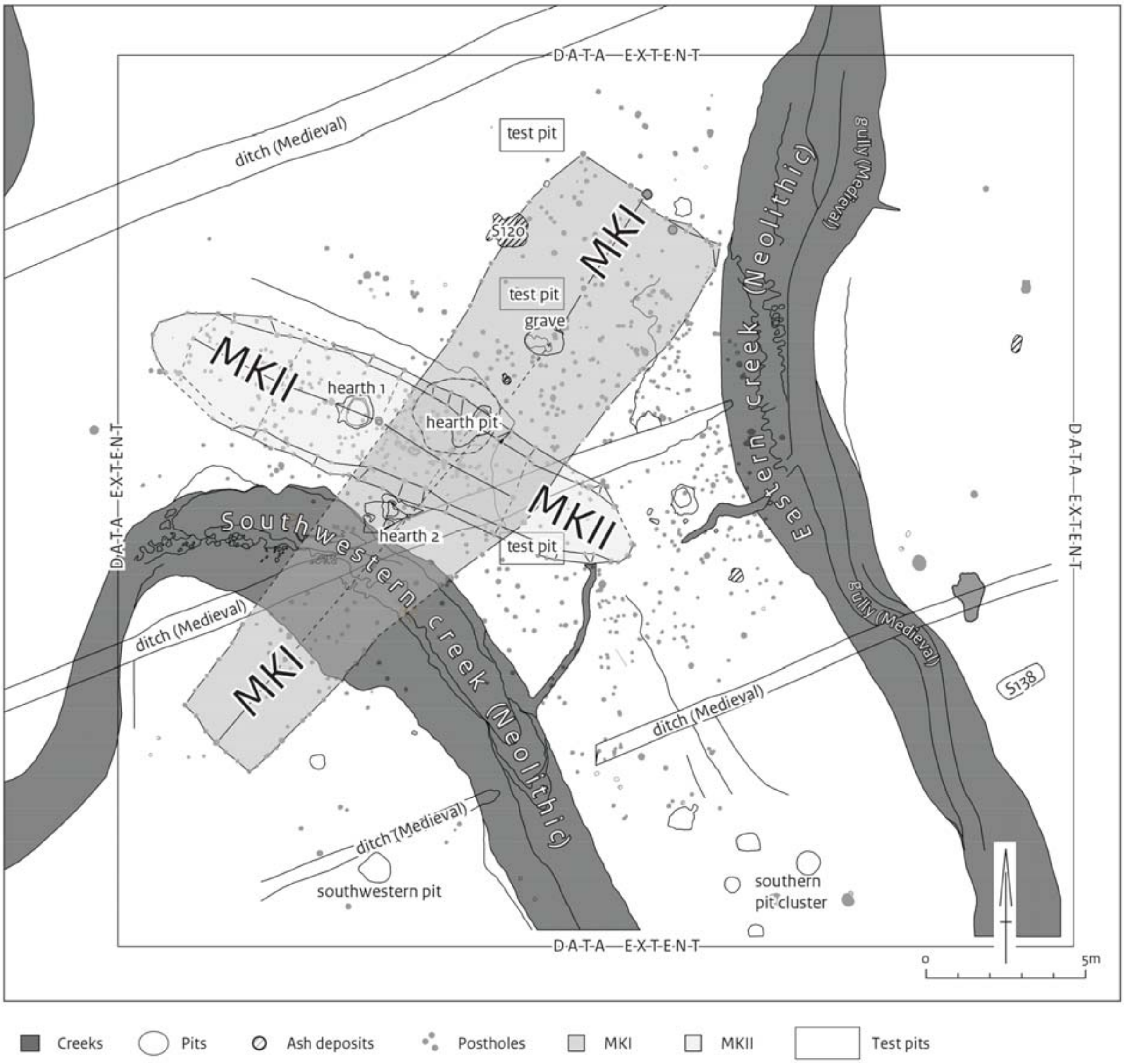

Figure 5.3. Structures interpreted during the spatial analysis of Mienakker (Nobles 2016: 143).

5.2 The material analysed

During the 1990 excavation at Mienakker a considerable amount of flint, stone and amber was recorded. After the excavation, two reports were published on the artefacts discussed in this section (Van Heeringen and Theunissen 2001). The first report included the analysis of 1,218 flint and seven stone implements from the excavation (Peeters 2001a) while the second report was dedicated to the analysis of 316 amber ornaments (Bulten 2001). The databases that formed the basis of these two reports were also published. As a result, a number of discrepancies were noted. A considerable quantity of artefacts recorded in these reports was missing and therefore unavailable for this new phase of analysis. Of the 1,218 flint implements, 1,077 were available. Most of the missing artefacts were retouched pieces and tools made with high quality flint. In addition, instead of seven stone implements, 862 stone fragments were available and studied as part of this research. In contrast, instead of the 316 amber fragments recorded by Bulten (2001), just 134 fragments of amber were available; all the complete beads and bead fragments were missing. The majority of worked bone was also gone. Consequently, the current work is based on the analysis of 1,077 pieces of flint, 862 stone artefacts, and 134 amber artefacts. The analysis of the flint assemblage is based on Peeters' report (2001a); the stone and bone tools had not previously been analysed. Finally, since most of the amber artefacts have gone missing, only a summary of Bulten's article (2001) is presented here.

The degree of preservation of Mienakker's flint and stone implements is low. Only 10% of the flint implements are complete, and 26.7% of the flint implements display physical alterations due to contact with fire, such as red spots, a glossy appearance or a craquelé surface. In addition, 14% of the flint implements show different kinds of patina altering the surface. The degree of fragmentation of the stone artefacts is also very high, with fewer than 6% of the artefacts identified as complete. Almost half the implements, 48.3%, show traces of contact with fire. Various physical alterations, as observed on the flint, such as red spots or the blackening or *craquelé* of the surface, are also visible. Bone tools are not well preserved; most show several post-depositional alterations such as heavy rounding and abrasion of the surface, recent fractures, diverse patinas or traces of contact with metal.

A total of 53 bones were available for use-wear analysis. The modified bones were selected during the analysis of the archaeozoological material - all were found during the 1990 campaign. Due to the poor preservation of the tools, typological classification and analysis of the assemblage were limited. After a preliminary analysis, only 29 implements were selected for further use-wear analysis, as the preservation of the other tools was not sufficient for use-wear analysis.

5.3 Flint, stone, bone and amber procurement networks

Mienakker was located in an open, treeless landscape covered mainly with grassland and exposed to the sea. The area was considered to be rich in natural resources (Kleijne *et al.* 2013), but from a lithological perspective the immediate areas surrounding the site are poor. Raw materials, therefore, must have been brought to the settlement from elsewhere, as was also suggested for Keinsmerbrug.

5.3.1 Flint

The classification of the raw material provenance was performed in accordance with the work published by Peeters (2001a). However, due to the absence of some of the implements, the final results of the analysis differed (Table 5.1). Flint raw material was divided into four main groups: northern flint, southern flint, undetermined flint and other stones (Peeters 2001a). According to Peeters (2001a), around 40% of the material has a northern origin, while 35.3% has a southern origin. The origin of 22.7% of the material could not be determined, and the remaining 0.6% has been classified as part of the fourth group. Around 40% of the southern group consists of undetermined flint, while 13.4% has been classified as southern rolled flint, 42.6% as southern Maasei and 3.3% as Grand-Pressigny. The characterization of the Grand-Pressigny flint was performed on the basis of petrographic analysis of one thin-section by Henk Kars at the State Service for Archaeological Investigations (Peeters 2001a). Due to the fact that artefacts have gone missing, the percentages of raw materials in the present study vary a little from those obtained by Peeters (Table 5.1).

			Peeters		García-Díaz	
			Number	%	Number	%
Northern flint	Brown/yellow	Opaque/bryozoa	7	0.6	5	0.5
		Opaque	17	1.4	14	1.3
		Translucent/bryozoa	22	1.8	18	1.7
		Translucent	137	11.2	116	10.8
	Light grey	Opaque/bryozoa	6	0.5	10	0.9
		Opaque	30	2.4	27	2.5
		Translucent/bryozoa	23	1.9	19	1.8
		Translucent	209	17.1	210	19.5
	Dark/dark grey	Opaque/bryozoa	3	0.2	3	0.3
		Opaque	4	0.3	3	0.3
		Translucent/bryozoa	1	0.1	1	0.1
		Translucent	21	1.7	19	1.8
	White	Opaque/bryozoa	2	0.2	2	0.2
	Northern-like	Opaque/bryozoa	1	0.1	1	0.1
		Opaque	-	-	-	-
		Translucent/bryozoa	1	0.1	1	0.1
		Translucent	2	0.2	2	0.2
Southern flint	*Maasei*		90	7.3	72	6.7
	Southern-like indet.		191	15.6	163	15.1
	Fluvial rolled pebbles		115	9.4	97	9.0
	Grand Pressigny		14	1.1	3	0.3
	Rijckholt		1	0.1	-	-
Indet.			321	26.2	291	27.0
Others	Other stones		7	0.6	*	*
	Total		1225	100	1077	100

Table 5.1 Classification of the raw material by Peeters (2001) and García-Díaz (2013)(García-Díaz 2013:61).

5.3.2 Stone

A variety of stones were documented at Mienakker. Igneous rocks (91.7%), and more specifically granite (88.6%) are the most frequently occurring rock types. The rest of the igneous rocks include one fragment of basalt (0.1%), two small fragments of diorite (0.2%) and 24 undetermined igneous stones (2.8%). Quartz (6.1%) is also well represented, mainly in the form of small rolled pebbles. Most of these are fragmented and much eroded. Sedimentary rocks are also encountered in the assemblage but in low numbers (1.8%). Mienakker is located in an area where stone is not available; the nearby beaches and the glacial till deposits at Wieringen are the most likely source location of the igneous rocks and the sandstone (Van der Lijn 1973; Zandstra 1988) (Table 5.2).

	Igneous				Sedimentary			Quartz	Type uns	Total	
	Granit	Diorite	Basalt	Unsp	Sandstone	Limestone	Unsp	Quartz	Indet		%
Flake	2	-	-	1	2	-	-	-	-	5	0.6
Cereal processing	6	-	-	-	-	-	-	-	-	6	6
Flaked stone	1	-	-	-	-	-	-	1	-	2	0.2
Multiple use tool	1	-	-	1	-	-	-	-	-	2	0.2
Hammer stone	3	-	-	1	4	-	-	-	-	8	0.9
Grinding stone	-	-	-	-	1	-	-	-	-	1	0.1
Unmod	751	2	1	22	5	2	1	52	2	838	97.2
Total	764	2	1	25	12	2	1	53	2	862	100
%	88.6	0.2	0.1	2.9	1.4	0.2	0.1	6.1	0.2	100	

Table 5.2. Stone tool artefacts versus raw material (Unsp:unspecified; Indet: indeterminate; Unmod:unmodified)(García-Díaz 2013:81).

5.3.3 Amber

The amber nodules collected and used at Mienakker were probably small and weathered. The colour of the fragments varies from light yellow to orange. Amber could have several possible provenances (Waterbolk and Waterbolk 1991; see Chapter 4), but most authors agree that the coastlines of the wetland areas of the Noord-Holland province or the tidal Pleistocene deposits of Wieringen were the source of most of the amber used at Mienakker (Huisman 1977; Waterbolk and Waterbolk 1991).

5.3.4 Bone

Osseous tools were mainly produced from the bones of large mammals such as cows, goats and sheep (Zeiler and Brinkhuizen 2013). Keeping livestock, especially cattle, was one of the main subsistence strategies carried out at Mienakker. Mainly bovine adults and subadults were slaughtered, which provided a continuous source of raw material. In addition, hunting was also practised, but its contribution to the subsistence pattern was substantially less than that of livestock (Zeiler and Brinkhuizen 2013).

5.4 Flint: Technology, typology and use

5.4.1 Typology and technology

		N
Cores		
	Flake core	40
	Blade core	1
	Total	41
Flakes	Scraper	12
	Retouched flake	7
	Unmodified	154
	Total	173
Blades	Retouched blades	2
	Unmodified	12
	Total	14
Pebbles	Tested Pebble	3
	Unmodified	22
	Total	25
Waste and Splinters	Retouched	11
	Borers	6
	Unmodified	792
	Total	809
Indetermined		15
Total		1077

Table 5.3. Overview of the technological categories of the flint artefacts from Mienakker (García-Díaz 2013:62).

Cores

Cores and core fragments (N=41; 3.8%) are, like the rest of the lithic artefacts, small. Their metrical dimensions vary between 15 and 53mm in length, six and 42mm in width and two and 26mm in thickness. The cores are mainly related to flake production (87.8%). Different technological attributes were recorded by Peeters (2001a), leading him to conclude that the unidirectional approach was the most frequently practised, followed by the bifacial and multidirectional approach. Core rejuvenation was occasionally practised, as shown by the presence of five core rejuvenation flakes. Finally, one complete core (7835-1) was used to obtain blades. This implement is small (Table 5.7) and its surface does not show any alteration related to burning or patination.

Flakes

Flakes represent 15% (N=166) of the implements from Mienakker. In the majority of cases flakes show no retouch (N=143; 88.5%). There are, however, seven retouched flakes (4.2%) and twelve scrapers produced from flakes (7.2%) (Table 5.3)(Peeters 2001a: 556-557). The twelve scrapers are small (Table 5.4). Only four of them are complete, and four show different degrees of burning. In three cases the scrapers have two retouched edges. Although Peeters (2001a) recorded 35 scrapers, most of which have gone missing, the morphological characteristics of the remaining scrapers are similar to what he described (Table 5.4). The shapes and forms of the scrapers are not standardized, although the retouched edge tends to be convex (Peeters 2001a: 551).

Number	Length (mm)	Width (mm)	Thickness (mm)	Primary classification	Scraper type	Fragment
3761-8	9	18	2	Flake	Side	Distal
2823-1	21	19	9	Flake	Shortend	Complete
3279-1	19	13	5	Flake	Side	Broken along debitage axis
2015-1	19	13	5	Flake	Longend	Complete
1937-1	25	17	5	Flake	Side	Broken along debitage axis
3761-3	20	14	6	Flake	Side	Broken along debitage axis
7321-1	16	11	6	Flake	Side	Distal
9321-1	14	16	8	Flake	Side	Distal medial
7949-1	21	24	8	Flake	Shortend	Distal medial
3990-3	23	16	10	Flake	Side	Broken along debitage axis
793-1	18	17	7	Flake	Shortend	Complete
7457-2	14	26	7	Flake	Shortend	Complete

Table 5.4. Metrical data for the scrapers (García-Díaz 2013: 63).

Seven flakes (0.6%) preserve the distinctive cortex of the rolled pebbles and constitute direct proof of the use of rolled pebbles as cores, a phenomenon that is common at other contemporaneous Neolithic sites such as Keinsmerbrug and Zeewijk (García-Díaz 2012; Peeters 2001a). Finally, four flakes (0.4%) were produced from a polished axe recycled as a core. Three of them are complete and also have small dimensions, all being less than 20mm in width (Table 5.5).

Number	Length (mm)	Width (mm)	Thickness (mm)	Fragment
4498-1	16	15	3	Complete
4654-1	15	16	4	Distal medial
115-1	21	13	3	Medial proximal
7254-1	9	15	4	Length
9913-1	12	19	2	Complete
7828-1	19	26	7	Complete
7007-1	20	21	5	Complete

Table 5.5. Metrical data for the retouched flakes (García-Díaz 2013: 67).

Blades

Few blades (N=12; 1.1%) have been found. Even though most of them were produced using flake cores, they have been classified as blades following a typological definition (Tixier *et al*. 1980: 55) (Table 5.6). The existence of one possible blade core suggests the possibility of intentional, if minor, production and use of blades at Mienakker. Most of the blades distinguished in the present study are not modified (83.3%), and only two show retouch. The one blade classified by Peeters (2001a) has a distal fracture and is not very well preserved: almost the entire surface is covered with a heavy blue patina, except inside the lateral retouches. The blade was produced by soft direct percussion. In view of the technological aspects of the blade, and the blue patina, which is absent from the other implements from Mienakker, Peeters (2001a) suggests that it could be part of an older assemblage that was reused by the inhabitants of Mienakker (Peeters 2001a: 523).

Number	Length (mm)	Width (mm)	Thickness (mm)	Type	Fragment
2829-4	36	11	5	Unmodified	Complete
2206-1	58	22	9	Retouched	Distal/ medial
9188-2	18	6	2	Unmodified	Broken along debitage axis
742-1	21	7	2	Unmodified	Broken along debitage axis
2688-1	48	18	8	Unmodified	Broken along debitage axis
10070-1	29	9	4	Retouched	Broken along debitage axis
4500-1	5	7	3	Unmodified	Medial
5663-1	10	8	2	Unmodified	Medial/ proximal
4288-1	18	14	5	Unmodified	Medial/ proximal
3711-1	13	10	4	Unmodified	Medial/ proximal
2632-1	28	17	4	Unmodified	Medial/ proximal
8190-1	12	7	3	Unmodified	Proximal

Table 5.6. Metrical data for the blades (García-Díaz 2013: 68).

Pebbles

A small number of pebbles (N=25) were documented. Only three complete pebbles, with small metrical dimensions, were found (Table 5.7). In addition, three tested pebbles were recovered. The pebbles are very small, with metrical dimensions of between 27 and 33mm in length, 19 and 22mm in width and eight and 14mm in thickness. At least 50% of the cortex is preserved on the three cores, indicating that the pebbles were tested to obtain flakes. Finally, eleven pebble fragments were found. The presence of these fragments in the archaeological record supports the hypothesis that flake production predominated at the site. All of them preserve cortex on at least 50% of the surface, which is also consistent with the idea of an '*ad hoc*' local exploitation of the pebbles. Hard percussion was used to process all the pebbles at Mienakker. The bipolar technique was the most common, with unidirectional flaking occurring less frequently (García-Díaz 2013; Peeters 2001a).

In general, the preservation of the pebbles is relatively good when compared to pebbles from other sites like Keinsmerbrug. The percentage of patinated implements is very low: only seven implements, three unmodified pebbles and four fragments show a light white patina. Only two implements, one fragment and one unmodified pebble, show traces of burning. Finally, the degree of fragmentation is minor compared with the site at Keinsmerbrug.

The use of rolled pebbles has been documented at other archaeological sites from the same period, like Keinsmerbrug (García-Díaz 2013; see Chapters 2 and 3) and Zeewijk (García-Díaz 2014a; see Chapter 5). The presence of unmodified pebbles supports the hypothesis that raw material was gathered on nearby beaches and transported to the site where the flaking process was carried out. The rolled pebbles are technologically related to the use of simpler flaking methods always involving hard percussion, for example the hammer and anvil technique. The size of the pebbles determined the final size of the products, as well as their form.

Waste and splinters

Around 75% of the implements from Mienakker have been classified as waste (N=553), or splinters (N=256). The material, like the rest of the implements, is very small. Almost 97.7% of this material has not been modified, with the exception of eleven retouched implements and six borers. The six borers are made of flint waste or undetermined fragments and five of them have a similar shape and size. The sixth, a borer, is considerably larger (Table 5.9). All the borers show one rounded edge where use-wear traces have been identified. As mentioned, the borers were probably obtained from rolled pebbles by means of hard percussion. The use of the hammer and anvil technique guaranteed that similar final products would be obtained, which explains the similar shapes and sizes of five of the borers. Finally, eleven retouched fragments (1.4%) were found.

Primary classification	N	Minimal length	Maximun length	Average length
Blade	1	36	36	36
Core	22	15	51	25.4
Flake	64	5	36	15.7
Pebble	6	12	49	28.2
Tested pebble	1	41	41	41
Unsure	3	13	39	28

Primary classification	N	Minimal width	Maximun width	Average width
Blade	1	11	11	11
Core	22	6	42	18.5
Flake	64	5	38	16.4
Pebble	6	20	36	25.2
Tested pebble	1	31	31	31
Unsure	3	11	35	26.7

Primary classification	N	Minimal thickness	Maximun thickness	Average thickness
Blade	1	5	5	5
Core	22	2	26	11
Flake	64	1	10	4.2
Pebble	6	3	19	11.2
Tested pebble	1	20	20	20
Unsure	3	5	21	10.3

Table 5.7. Overview of the dimensions of the complete tools analysed (García-Díaz 2013: 69).

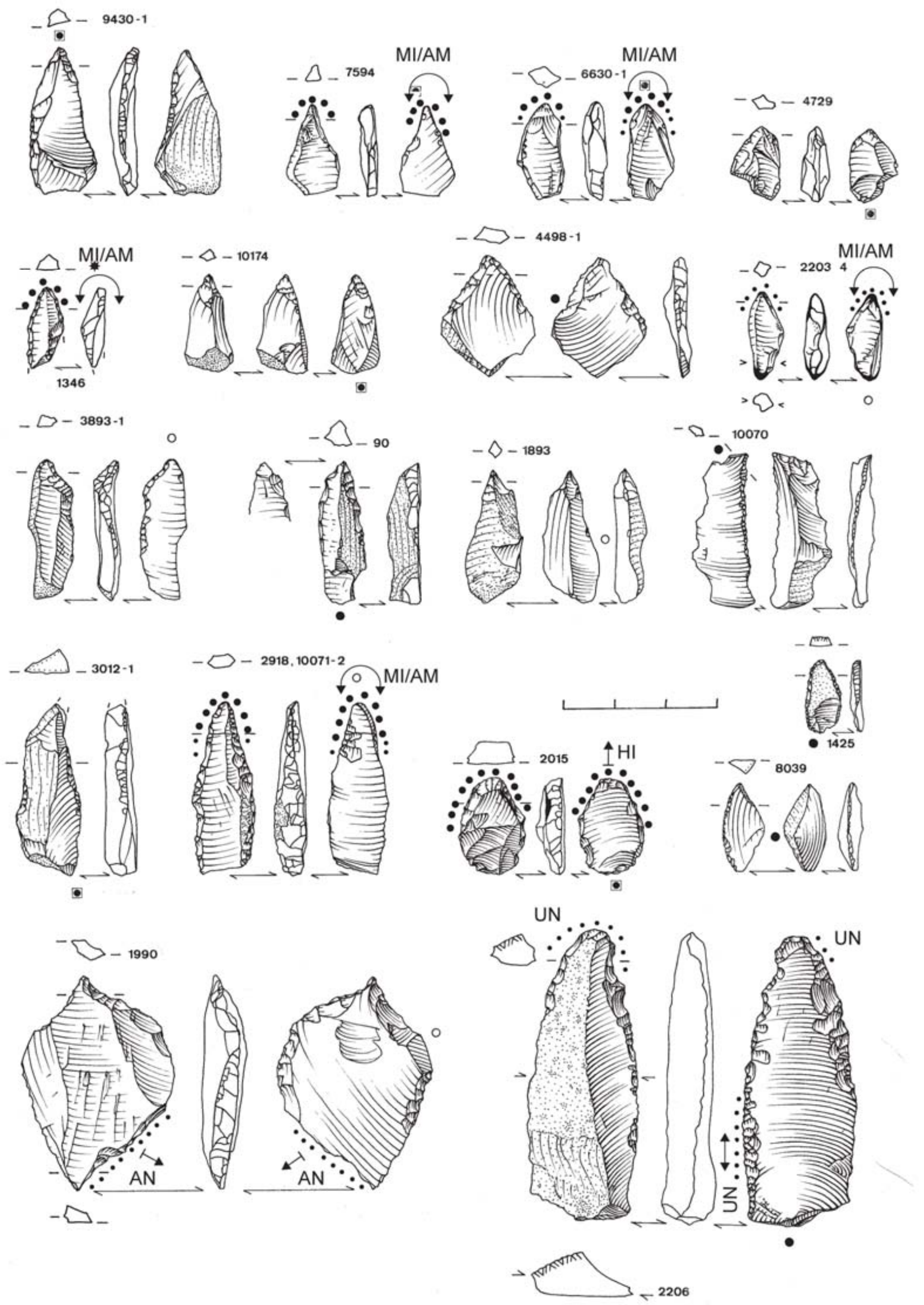

Figure 5.4. Selection of the flint artefacts discovered at Mienakker, some displaying traces of different materials. 9430: retouched fragment; 7594: fragment-borer; 6630-1: fragment-borer; 4729: fragment; 1346: fragment-borer; 10174: unmodified fragment; 4498-1: retouched flake; 2203-4: fragment-borer; 3893: borer (HP); 90: borer (HP); 1893: unmodified fragment; 10070: retouched blade; 3012-1: retouched fragment; 2918: borer; 2015: scraper; 8039: borer (HP); 1425: borer (HP); 1990: retouched flake; 2206: retouched blade (following Peeters 2001a and García-Díaz 2013).

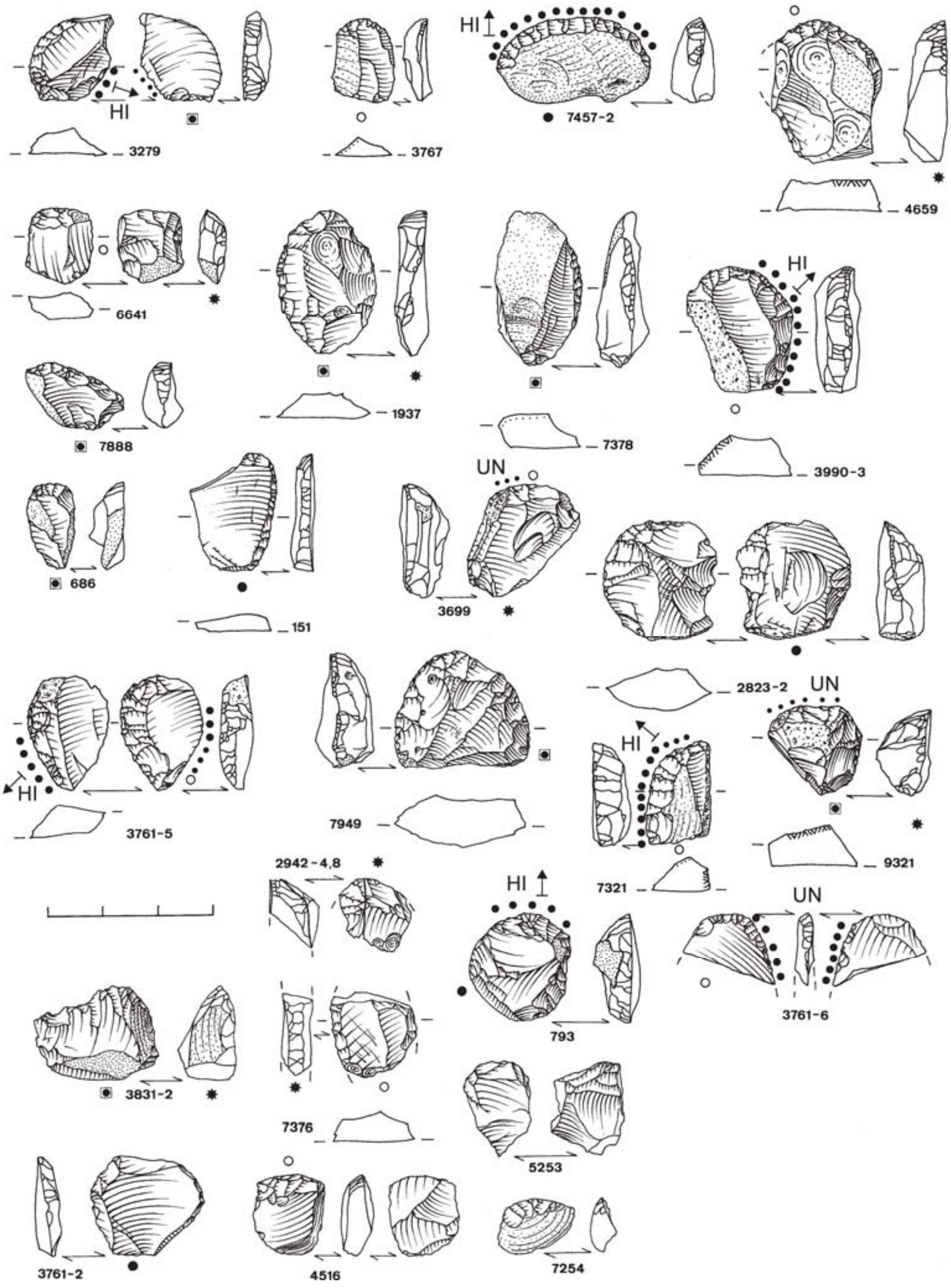

Fig. 5.5. Selection of the flint artefacts discovered at Mienakker, some displaying traces of different materials. 3279: scraper; 3767: retouched flake; 7457-2: scraper; 4659: undetermined; 6641: fragment; 1937: scraper; 7378: scraper; 3990-3: scraper; 7888: scraper; 686: scraper; 151: scraper; 3699: retouched fragment; 2823-2: scraper; 3761-5: scraper; 7949: scraper; 7321: scraper; 9321: scraper: 2942-4: unmodified fragment; 793: scraper; 3761-6: scraper; 3831-2: scraper; 7376: retouched fragment; 5253: scraper; 3761-2: retouched flake; 4516: unmodified flake; 7254: retouched flake (after Peeters 2001a and García-Díaz 2013).

5.5 The use of flint artefacts

Preliminary scanning for traces of use was performed on the complete flint assemblage. All implements were first analysed under a binocular microscope (5-50x). The implements suitable for use-wear analysis were then examined at higher magnifications (50-500x). The large majority (96.8%) of the 1,077 flint implements analysed revealed no use-wear traces. Nevertheless, 3.1% of the implements (N=34) show clear use-wear traces on 40 edges and 1% show use-wear traces that were insufficiently developed to allow an interpretation of tool function (henceforth the percentages of use and the data used will refer to the used edges) (Table 5.8). Around 47% of the edges with traces were used on animal materials, 23.5% on plant materials and 20.5% showed use-wear related to mineral materials. The worked material could not be inferred for the remaining 26.4% of the tools with traces.

		Motion							
Contact material		Cutting	Scraping	Engraving	Boring	Hafting	Indeter	Total	%
Plant									
	Soft wood	1	-	-	-	-	1	2	5
	Hard wood	2	-	1	-	-	1	3	7.5
	Uns plant	-	1	-	-	-	1	2	5
Animal									
	Hide	-	13	-	-	-	-	13	32.5
	Meat	1	-	-	-	-	-	1	2.5
	Bone	-	1	-	-	-	-	1	2.5
	Uns	-	-	-	-	-	1	1	2.5
Mineral									
	Jet	-	-	-	1	-	-	1	2.5
	Amber	-	-	-	6	-	-	6	15
Indeter									
	Indet	1	-	-	-	3	5	9	22.5
Total		5	15	1	7	3	9	40	100
%		12.5	37.5	2.5	17.5	7.5	22.5	100	-

Table 5.8. Flint use wear: contact material versus motin (Uns: unsure; Indeter: indetermined) (García-Díaz 2013: 70).

5.5.1 Plant processing and woodworking

Use-wear traces related to the processing of vegetal materials are displayed on 23.5% of the used edges. Four edges were used for working hard wood, and two edges were related to the working of soft wood (Fig 5.3). Finally, two edges were used for processing soft plant materials.

Soft wood

One blade and one unmodified fragment were used to process soft wood. The blade (4288-1) was used to cut soft wood. Even though the use-wear traces are poorly developed, the edge displays continuous edge damage. In addition, isolated points of a smooth and matt polish on the ventral and dorsal face are present, showing a clear longitudinal directionality. In the case of the unmodified fragment, the worked material has been interpreted but because of the poor development of the use-wear traces it is not possible to distinguish the motion exerted. The sharp angle of the used edge (25 degrees) suggests that the action performed was related to a longitudinal motion.

Hard wood

Four edges of two flakes, one blade and one retouched piece of waste display use-wear traces resulting from the processing of hard wood. The first flake (478-1) shows a very well developed and delimited smooth and dull polish on both faces, resembling that produced by working a hard-medium wood. The polish distributed along the edge, indicating a longitudinal motion such as cutting. On the second flake (1884-1), both the ventral and dorsal faces of the left edge display a narrow line of smooth polish located very close to the edge. The polish is well developed along the edge, with a compact distribution, showing a clear longitudinal directionality, and is accompanied by slight edge damage. The distal edge of the blade displays a very bright and well-developed polish, which in the case of the ventral face is associated with long, deep striations. Moreover, the entire edge shows slight edge damage. The directionality related to the use-wear is more diagonal than longitudinal. This fact and the distribution of the edge damage suggest that the tool was probably used to engrave hard wood.

Finally, the piece of retouched waste (3612-2) was probably used to cut hard wood. On the dorsal face the polish has developed primarily on the ridges of the retouch. The polish is bright and well delimited, smooth and associated with a reticulated pattern, as documented by various authors (Keely 1980; Moss 1983a; Plisson 1985; Vaughan 1985; Van Gijn 1990). Although the ventral face is not very well preserved due to some post-depositional alterations, some polish is displayed on the areas closer to the edge. The distribution and formation of the use-wear suggest that the working edge was close to 45 degrees, and that the ventral face was in direct contact with the worked material. Because the use-wear was poorly developed, no activity could be inferred, although, taking into account the high angle, it is possible that this tool was used for scraping wood. This theory is based on the fact that it has a high edge angle, which is not practical for a longitudinal motion on a hard material like wood.

Unspecified plant

One flake (379-1) was used to work an undetermined plant material. The distal edge of the flake shows some rounding and edge damage. The polish is not very well developed and the preservation of the surface on the ventral face is very poor due to post-depositional alterations. It has been possible to identify a slightly diagonal directionality to the use-wear traces. Unfortunately, as the degree of use-wear is not very well developed, it has not been possible to arrive at a more detailed functional inference. Additionally, one flake (478-1) was used for scraping an unspecified plant material. The fact that the other edge of the flake was used to cut hard wood would suggest that this edge was used for processing the same type of resource, as reinforced by the presence of continuous edge damage on the used edge. The poor development of the polish does not allow a more detailed interpretation of the use-wear.

5.5.2 Animal resources

Traces interpreted as being the result of processing animal materials are displayed on 47% of the used edges. The most well-represented worked material is hide (N=13), while one edge was used to work bone and another to process meat. Finally, one edge was used to process an undetermined animal material (Fig. 5.4).

Hide

Traces of scraping hide are characterised by the rounding of the used edge and the formation of a bright, half-linked or linked linkage. Polish has been classified as matt and showing a pitted topography (Keely 1980; Mansur-Frachomme 1983). Seven scrapers were used to process hide. One of the scrapers (2015-1) displays three used edges. While two edges were used to work only hide, the right edge of the scraper shows use-wear related to working hide with mineral additives. On this edge, the polish is very well developed and shows a thin parallel band of polish that resembles the one created after the processing of a mineral material. The polish is limited to the ridges of the retouch, meaning the edge was probably retouched post-use. In this case, the polish is more bright and with rougher aspect, and long perpendicular striations were present, matching the interpretations made by other authors (Keely 1980; Mansur-Frachomme 1983; Vaughan 1985). The inclusion of mineral additives during hide scraping has been documented in ethnographic and archaeological case studies (Beyries and Rots 2008; Rots and Williamson 2004). Finally, two retouched fragments (8334-1 and 337-1) and two unmodified flakes (9913-2 and 2940-1) were also used to scrape hide.

Meat

Just one piece of waste (2208-1) shows one edge with use-wear traces that suggest that the tool was used to cut meat. Usually, because of the softness of the meat, traces related to its processing are obscured by other traces and in general are less developed than those from other materials (Clemente Conte 1997; González Urquijo and

Ibáñez Estévez 1994; Grace 1990; van Gijn 1990). Post-depositional alterations to the tool surface are known to destroy the use-wear traces related to soft materials such as meat. Additionally, as a tool usually comes into contact with other resources such as hide or bone during butchery, the presence of wear traces from these materials can complicate analysis. In this case, the left edge of the tool shows edge rounding accompanied by slight edge damage. A greasy polish is developed within the depressions of the edge removals, suggesting that the tool was used to work a soft material. The polish displays a clear longitudinal directionality. The presence of some edge damage might also suggest that, even though meat was the main worked material, the edge probably also came into contact with other harder materials.

Bone

One retouched flake (7007-1) was used to scrape bone. The angle of the used edge is 80 degrees. The use-wear is mostly displayed on the dorsal face of the retouched edge. A thin line of polish is present, mostly in the medial part of the edge. A few isolated spots of a very bright, link and smooth polish, as described by Keely (1980: 43) for scraping bone activities, are also present on the crests of the retouch on the ventral face.

Unspecified animal materials

Finally, one retouched flake (1990-1) shows isolated spots of polish in the retouched area of the edge. In this case, the flake was cleaned by immersion for 45 minutes in an ultrasonic cleaning tank in a 10% HCl solution. Nevertheless, a greasy alteration covered the surface of the tool, preventing the analysis. Even though the polish displayed suggests that the flake was used to process a hard animal material, such as bone or antler, the poor preservation of the use-wear traces restricted the final interpretation.

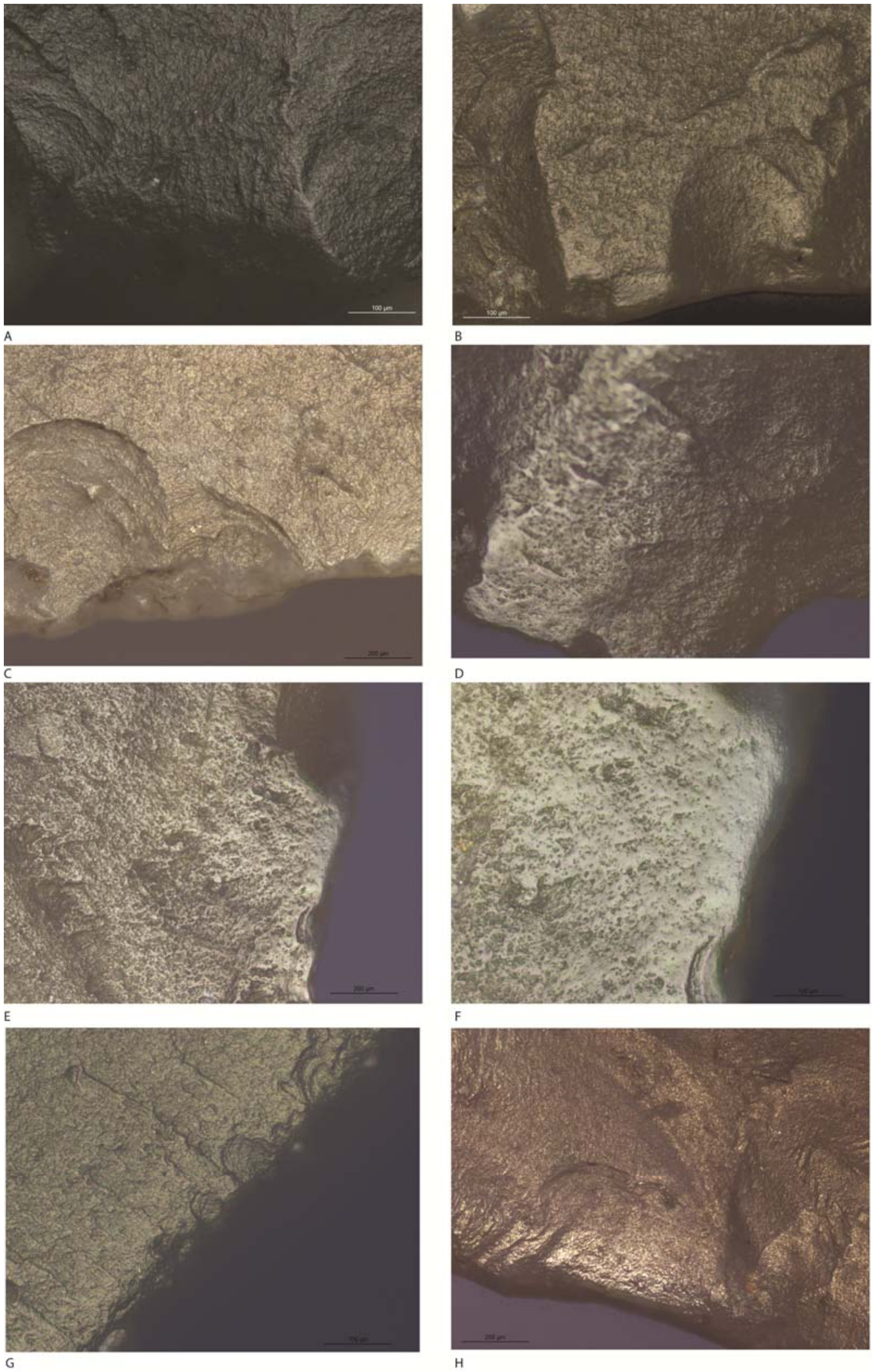

Figure 5.6. Traces of various materials. A: use wear related to hide processing (2940-1)(20x); B and C: use wear related to an undetermined material (2206-1) (20x and 10x); D, E. and F: use wear that suggests that the tool (2829-4) was used to engrave hard wood (20x, 10x and 20x); G and H: use-wear traces from cutting soft wood seen on a blade (4288-1)(20x and 20x)(García-Díaz 2013: 72).

5.5.3 Mineral resources

Seven borers display use-wear traces related to the working of mineral resources (Fig. 5.5). They are all made of flint waste or undetermined fragments and five of them have a similar shape and size. Given their size, the borers were probably hafted when used (Table 5.9). Unfortunately, no traces of hafting have been preserved. Two interpretations of the possible use of the borers have been proposed. The first inference is that the borers were hafted onto a wooden stick and rotated by hand. The second possibility is the use of a bow drill. The borer would be hafted in a long wooden stick, and the rotational movement would be produced not with the hands but with the help of a bow (Piena and Drenth 2001).

Two different type of use-wear traces have been recorded on the borers. The first is characterized by a large degree of rounding on the used edge and a very well-developed polish. The polish is well delimited and linked, flat and bright. The second kind of use-wear trace is also characterized by a rounded edge, but the polish is less developed, less bright and less compact. Both types of traces are similar to the ones formed by experimental drilling of jet and amber respectively. It is thus likely that these tools were related to the production of jet and amber beads. Some other examples of this kind of borer have been recorded at other Neolithic sites in the Netherlands, such as Schipluiden, Ypenburg and Geleen-Janskamperveld (Van Gijn *et al.* 2006; Van Gijn and Verbaas 2008; Verbaas and Van Gijn 2008). The traces on the Mienakker borers are only slightly developed, however. Also, due to the limited number of experiments making amber and jet beads, I designed an experimental programme to determine not only how the borers were used but also how the beads were produced (García-Díaz 2013). Six replicas of the flint borers were made; one of the borers was hafted using a long wooden stick. All the borers were then used to perforate experimental amber beads for a duration of time ranging from five to 60 minutes. The use-wear on the experimental flint borers was similar to the use-wear present on the archaeological tools (Fig. 5.6 and 5.7), and the final results suggest that at least six borers (6830-1, 1346-1, 7594-1, 2203-41, 6822-1 and 2918-1) were used to drill holes in amber beads. It should be noted that the use-wear present on another borer did not resemble the experimental use-wear. This borer had also been used to work a mineral material, and it is suggested that it was therefore used to drill a harder material, for example jet. Even though jet beads have not been found at Mienakker, the presence of ornaments made of this material has been recorded at other contemporaneous sites such as Zeewijk (Van Gijn 2014a; see Chapter 6).

5.5.4 Unknown materials and hafting traces

Nine edges (26.4%) show use-wear traces related to the working of an undetermined material. In one case the use-wear was related to a longitudinal action; in five cases the motion could not be inferred. The wear on the remaining three tools are most likely hafting traces. In this case hafting has been determined by the presence of bright spots without any linearity suggesting a specific motion. This '*mineral-like polish*' is generally isolated and very close to the edge. Bright spots are considered by some authors as '*indubitable evidence for assessing that a tool was used in a haft*' (Rots 2008; Rots and Vermeersch 2004: 161).

Number	Length (mm)	Width (mm)	Thickness (mm)	Primary classification
6485-1	12	4	4	Waste
7594-1	16	10	3	Waste
1346-1	15	6	4	Waste
6830-1	17	8	3	Waste
6822-1	14	8	4	Waste
2203-4	16	6	4	Waste
2918-1	32	11	5	Uns

Table 5.9. Metrical data for the borers (Uns: unsure)(García-Díaz 2013: 77).

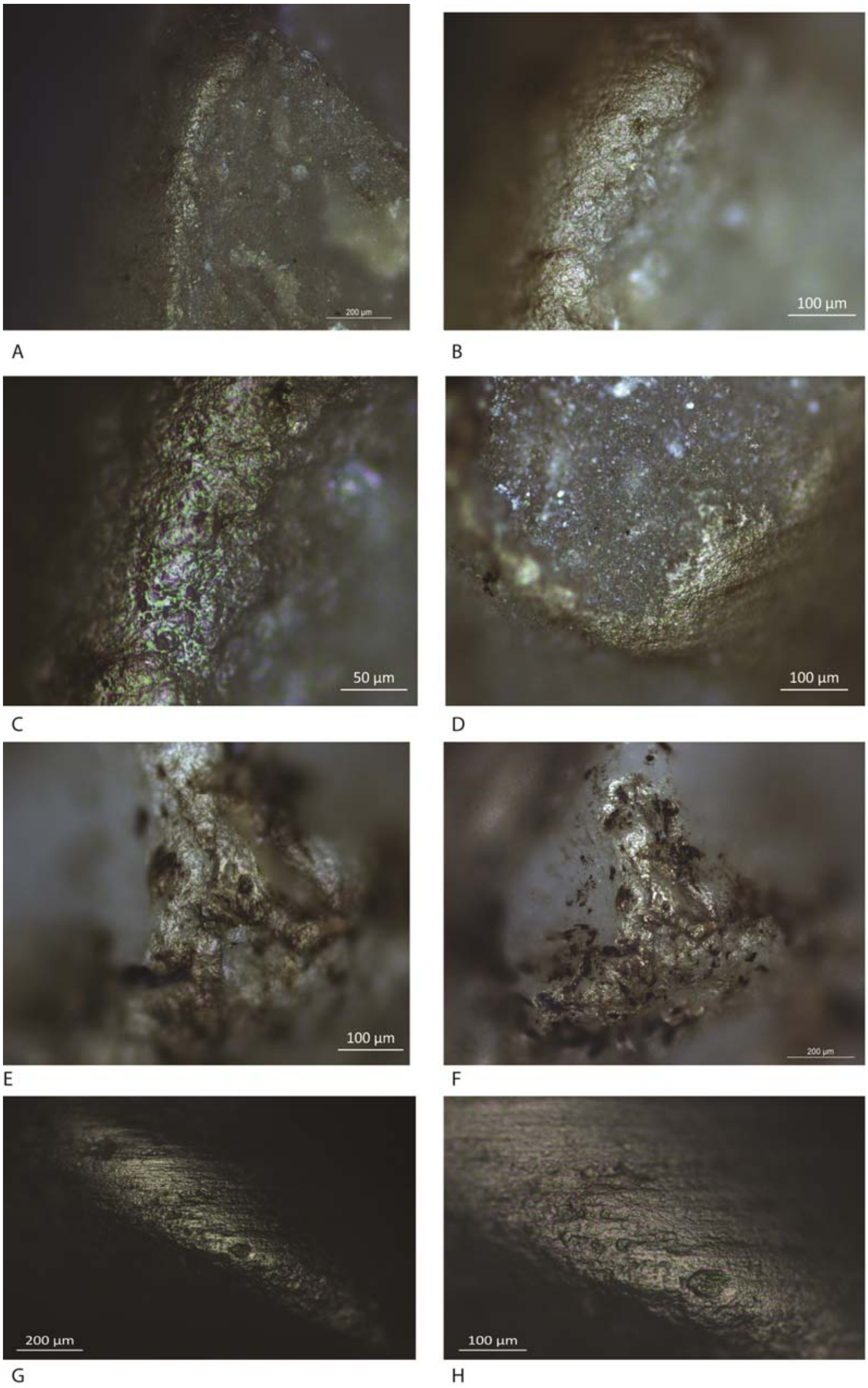

Figure 5.7. Use-wear traces of drilling mineral materials. The first six images (A-F) are probably the result of boring amber to produce beads. The last two images (G-H) are probably the result of the contact between the borer and a harder mineral material, maybe jet (García-Díaz 2013: 78).

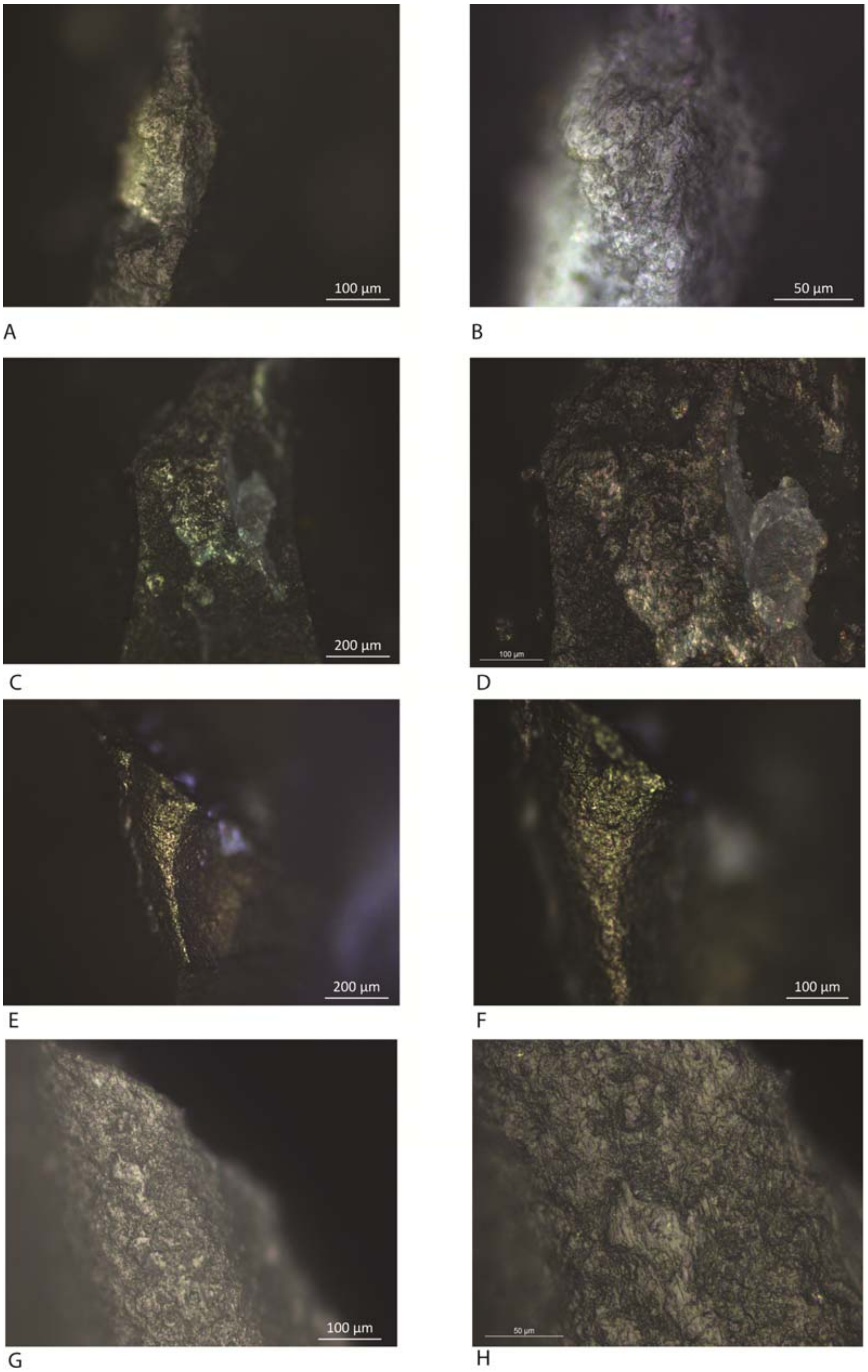

Figure 5.8. Use-wear traces on experimental tools used to drill amber; A: rounding of the tip after 15 minutes of work (200x); B: same (500x); C: rounding and polishing of the edge covering fractures on the tip (100x); D: same (500x); E: rounding of the lateral side of the borer after 15 minutes of use (100x); F: same (200x); G: after 60 minutes the polish also extends into the depressions (200x); H: same (500x) (García-Díaz 2013: 79).

5.6 Stone tool technology, typology and use

Although most of the stones recovered at the site (97.2%) do not show any technological modification, or use-wear traces, the 3% that do have use-wear traces are notably varied. Some of them, like the querns and the grinding stones, were flaked to obtain the desired shape. Others, such as the hammer stones, were used without further modification and could only be distinguished by the presence of percussion marks.

Flakes

Five stone flakes were recovered at the site (Table 5.10). Two of them (4017-1 and 5898-1) show some fractures, but the remainder are complete. Even though some alterations are visible, the overall preservation of the flakes is good. Only two flakes show traces of burning and the extent of post-depositional alteration is small. The edges and ridges are rounded in most cases. In addition, some crystals located on the higher topographical areas of the surface show rounding due to post-depositional alterations. The five flakes were probably produced by hard hammer percussion; none show secondary modifications.

Number	Length (mm)	Width (mm)	Thickness (mm)	Raw material main category	Raw material subcategory	Fragment
5898-1	7	10	2	Sedimentary	Sandstone	Broken
4017-1	25	22	5	Igneous	Granite	Broken
5700-1	11	12	5	Igneous	Unsp	Complete
5840-1	20	32	7	Sedimentary	Sandstone	Complete
5051-2	6	13	12	Igneous	Granite	Complete

Table 5.10. Metrical data for the stone flakes (García-Díaz 2013: 82).

One flake (5840-1) shows a completely polished and smoothed dorsal surface. The crystals are heavily polished and the surface contains striations related to work performed using a transversal motion. The polish has resulted from contact with a mineral resource. This flake was probably part of a polished stone that was later used as a flake core. The use-wear displayed on the flake is thus likely to reflect the production traces on the polished stone. The previous modification of the surface has completely covered the possible use-wear traces on the flake and no use-wear analysis could be performed.

Flaked stones

Two fragments of stone have flake negatives on the surface. One of the stones is a small fragment of granite (6504-1); the other is a small fragment of quartz (155-1). The first has a clear flake negative on the dorsal face, probably as a result of the decortification process. The second stone has some flake negatives preserved on the ventral face; it also shows some rounding, and some of the crystals show isolated points of polish probably related to use-wear. Unfortunately, the surface is *craquelé*, so it is not possible to infer the function of this tool.

Cereal processing tools

The cereal processing tools consist of two parts: the upper surface that is considered the active part of the tool, or the handstone, and the passive part of the tool, the quern (the lower grindstone) (Adams 2002a: 103). The querns are easily recognizable because at least one of the faces displays a very smooth surface. Both parts of the cereal processing tools were used together, so even if they could be used for other kind of activities, the use-wear traces on one part of the tool usually correspond to those on the other (Adams 1999).

One complete cereal processing tool and five fragments were included in the present analysis (Table 5.11). Apart from one sandstone fragment (9052-1), the tools are made of granite. At least two quern fragments have flake negatives on the surface, reflecting the production processes related to the querns: the fragment of granite was modified by flaking the surface of the stone to obtain the desired shape. Two of them (6452-1 and 5810-2) are part of the same tool. Taking into account the preservation of the fractures (fresh edges), the stone probably broke after use and was discarded.

In general, the shape of the cereal processing tools is similar. All of them present one or two flat surfaces. Considering their morphology and the presence of use-wear traces, five of them (10073-1, 3829-1, 6452-1, 9052-1 and 7552-1) were probably used as querns. As has been observed on other cereal processing tools (Adams 1999; Verbaas 2005), both the upper and lower surfaces were smoothed. In the case of the cereal processing tools from the site at Geleen-Janskamperveld, the use-wear on the bottom of the tools has been described as '*resembling that resulting from contact with cereal*' (Verbaas and Van Gijn 2008: 196), but with some differences, probably due to the contact with other materials such as hide used to catch cereals and flour falling off the quern (Verbaas and Van Gijn 2008: 196). Finally, one tool (5810-2) was used as a handstone (Fig 5.9).

One complete quern (7552-1) and four fragments show use-wear traces related to the processing of plant resources. Five of them (10073-1, 3829-1, 6452-1, 9052-1 and 7552-1) show clear traces of cereal processing. Finally, the polish and the rounding of the crystals suggest that the handstone was also used to process cereals.

Artefact 7552-1 is a complete quern. The perimeter of the tool shows at least four flake negatives reflecting the rejuvenation process on the active surface of the tool. The shape of the tool is quite rounded and the tool has two flat areas. Again, the use-wear traces suggest that one of the surfaces was located on the floor, while the other was in contact with the cereals.

Number	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Subtype	Raw material	Fragment
7552-1	120	111	60	1435	Quern	Granite	Complete
5810-1	67	59	41	181	Handstone	Granite	Broken
6452-1	77	75	39	309	Quern	Granite	Broken
3829-1	105	85	70	688	Quern	Granite	Broken
9052-1	140	110	92	2446	Quern	Sandstone	Broken
10073-1	180	120	85	2731	Quern	Granite	Broken

Table 5.11. Metrical data for the cereal processing tools (García-Díaz 2013: 82).

One quern fragment (10073-1) has two surfaces with use-wear. The surface has been severely altered by post-depositional traces. Nevertheless, the bottom of the tool shows isolated points of polish related to cereals and indications of friction with an underlying surface such as hide. The top shows a flat, smooth surface, with rounded *arêtes*. The polish, which is related to cereal processing, is very well developed and distributed all over the surface. Traces from cereal processing have been described as consisting on a combination of levelled grains (Adams *et al.* 2006; Dubreil and Savage 2014; Hamon 2008; Verbaas 2005) and a '*granular polish*' distributed over the surface `*in small linked spots*' (Verbaas and Van Gijn 2008: 196). Traces are generally developed on the higher parts of the surface; a prolonged use of the tool could cause more extensive development of the traces. The formation of the polish occurs firstly in the shape of small isolated spots of bright polish that would develop into more compact and linked spots after sustained use (Verbaas and Van Gijn 2008). On the quern fragment, the extension of the use-wear suggests a transversal motion. Some mineral-like traces suggesting stone contact are also present on the surface of the tool and are related to the contact between the handstone and the quern. Mineral-like traces develop as well-delimitated spots of bright polish isolated in the polished surface (Verbaas 2005). As might be expected, similar use-wear traces are present on the quern 3829-1. On the top, the polish is very well developed, mainly on the more elevated topographical areas of the surface of the quern. However, the motion is not very clear, and some patina and post-depositional alterations are also present. By comparison the bottom has a smooth flat surface, with rounded crystals and a very well developed cereal polish, caused by friction between the stone, an underlying surface – most likely hide – and cereal grains that fell off the quern, ending up between the stone and hide. Finally, the last quern, 6452-1, shows minor development of use-wear traces; even though the polish is clearly related to cereal processing, the wear is mainly visible on the higher topographical areas of the surface.

Only one handstone was found at the site. It has two used areas; the colour and the roughness of the surface are different in both allocations, as the result of the modification of the crystals by the use of the implements. More developed use-wear traces were observed on the top. The polish, present on the entire surface accompanied by extensive rounding of the crystals, is clearly related to cereal processing and has the same characteristics as the one described above.

Grinding stones

One grinding stone (7949-1) was found. As in the case of the querns, the shape of the tool was produced by flaking the surface. This is an incomplete grinding stone, consisting of two fragments that could be refitted, allowing the original size of the tool to be reconstructed (53x56x27mm). Post-depositional alterations are highly developed. First of all, the entire surface is very weathered and the edges are very rounded. Additionally, the tool has a black appearance probably related to burning. Even though the alterations might have partially covered some use-wear traces, three used areas have been distinguished. First, the top and the bottom of the tool exhibit flat surfaces, and under the microscope both surfaces display a rough and bright polish that was most likely created by contact with an animal material, possibly hide. Polish from hide working in stone tools has been described macroscopically as characterised by a `*visible, lustrous sheen and a distinctive smoothing of the edges of the rock grains*' (Hamon 2008: 1516), which matches with the topography of the studied tool. However, as a bright patina covers the use-wear it has been classified as not interpretable.

Hammer stones

Eight hammer stones were recovered during fieldwork. Four are made of volcanic rocks, and another four are made of sandstone. Most of the hammer stones are water-rolled pebbles with a rectangular or circular shape. An initial selection based on the shape and raw material of the implements was probably made among the tidal Pleistocene deposits of Wieringen, after which the stones were transported to the site. The length of these hammer stones varies between 51 and 74mm, with a width range between 32 and 62mm (Table 5.12).

Number	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Subtype	Raw material	Fragment
6142-1	74	64	30	180	Pounding/polishing	Sandstone	Broken
1888-1	59	44	35	136	Bipolar	Sandstone	Complete
5480-1	61	61	55	323	Multiple sides	Granite	Complete
3827-1	55	32	20	56	Pounding/polishing	Sandstone	Broken
6480-1	61	61	58	323	Multiple sides	Granite	Complete
8974-1	51	50	39	137	Pounding/polishing	unsp	Complete
4690-1	63	50	42	207	Bipolar	Granite	Complete
6603-1	65	65	58	368	Multiple sides	Sandstone	Complete

Table 5.12. Metrical data for the hammer stones (Uns: unspecified)(García-Díaz 2013: 86).

Seven hammer stones show use-wear traces. Four of them (1888-1, 3827-1, 6480-1 and 4690-1) have nine used areas related to percussion. Most of them functioned as bipolar hammer stones, using both ends, although one of them (6480-1) has three surfaces with percussion traces. In one case (8974-1) the use-wear traces suggest that the hammer stone was used to process some undetermined plant material.

Figure 5.9. Four hammer stones related to percussion activities (García-Díaz 2013: 83).

Figure 5.10. Three querns and one handstone recovered showing use wear related to cereal processing (García-Díaz 2013: 84).

Multiple use tool

One tool (21390-1) has been classified as a multiple use tool. It is a fragment of granite that presents both a flat surface and well-developed traces of percussion. Its use-wear traces suggest it was employed for pounding and polishing. Percussion traces are related to a small rounding of the edge. Percussion and polishing were probably performed simultaneously, as if the tool were used as a pestle. Even though the polish is not very well developed, the use-wear traces suggest that the worked material was not very hard and that the tool was in use only briefly.

Unmodified stones

Finally, 838 stones without clear intentional modification of the surface were analysed. The raw material is diverse. Most of the stones are granite (89.6%), but other raw materials are also present, including quartz (6.2%), sandstone (0.5%), limestone (0.2%) and diorite (0.2%). The stones have been classified into three different groups: broken stones (87.2%), pebbles (8.4%) and stones with a smooth surface (4.2%).

A large quantity of broken stones (N=731), with a total weight of 2,814g, were recovered. Around 53% of the stones are fire altered. The broken stones are mostly fragments of granite (94.5%) but other raw materials are also present. 71 water-rolled pebbles have been recovered at the site with a total weight of 45g. Most of them are quartz pebbles but other raw materials are also present, including basalt. The pebbles have a high level of post-depositional alteration on the surface. The diameter of the pebbles ranges between four and 42mm, with an average of 9mm. Finally, 36 stones have been categorized as stone with a smooth surface. These stones do not show any technological modifications such as flaking or polishing traces, but at least one surface suggests use as a tool. Most of these stones are also granite, although other materials, such as basalt and quartz, have been recorded at a lower level.

Unmodified stone use-wear

A number of stones (N=18) have probable used areas. Three are related to plant processing, while a further three have use-wear related to processing of mineral materials. Twelve contain traces related to unspecified contact materials (Table 5.13).

Mineral resources

Three tools have a surface that is related to the working of inorganic materials. One of these (1965-1) displays a very flat, bright surface. Around 70% of the top surface is polished. The polish is very well developed, mostly on the higher parts of the micro-topography, where the polish resembles that produced by contact with a hard mineral material. In the areas with a lower topography the polish is also very well developed, although there it more closely resembles the polish generated by contact with a softer but more abrasive mineral. Comparison with the reference collection revealed comparable use-wear traces on an experimental tool used to polish and smooth clay. During the smoothing process using the experimental tool, a mineral additive was used, which might explain the rough, abraded surface found on the archaeological tool. The directionality of the polish is mostly transversal, but some longitudinal and diagonal directions were also observed. Polish is bright, well developed, with a pitted topography and small and parallel striations are developed. These traces are also similar to the ones described by other authors in archaeological and experimental implements for flint implements (Clemente Conte 1997; Gassin 1993; Groma-Yaroslavski *et al.* 2013; Van Gijn 1990).

On two tools an area used to process mineral resources was identified. The first, consisting of two fragments (3977-1 and 3977-2), has isolated points of wear that could be related to use. Unfortunately the tool is not well preserved: the entire surface of the artefact shows a red coloration, probably related to contact with fire. The second tool (1839-1) is also a small fragment measuring 12mm whose polish has a clear transversal directionality. The polish is developed mostly on the high topography of the grains. Polish can be described as bright and compact, with a smooth texture and a flat topography, similar to what has been described by other authors for flint implements (Clemente Conte 1997; González Urquijo and Ibáñez Estévez 1994; Van Gijn 1990, 2006). However, the preservation of the surface is not very good due to the presence of post-depositional alterations and fire damage. As a consequence, the contact material could not be inferred.

Plant materials

Three tools display one area related to the processing of plant material. One tool (2716-3) is a fragment of granite that has a smooth surface with rounded crystals. The distribution of the polish varies across the surface: first, on the areas of the surface with a higher micro-topography and in some crystals, the polish is very well developed and resembles that created by working hard wood. Polish is bright, linked and well delimitated with a pitted morphology, similar to the traces distinguished by other authors for flint (Juel Jansen 1994; Vaughan 1985; Keely 1980) and stone implements (Deuvril and Savage 2014; Verbaas 2005). The directionality associated with the polish is not clear: where it could be interpreted, it seems to be transversal. On the rest of the surface, however, the polish is more extensive but less well developed. The worked material has been interpreted as a soft to medium-hard plant material and the directionality related to the polish is clearly transversal. The irregular development of the use-wear traces could be explained as the result of working two different materials (both vegetal resources, but one harder than the other) or as the discontinuous development of the use-wear traces due to an irregular tool surface. Either way it seems clear that the unmodified stone was used to polish and smooth wood, which may relate to the production of wooden implements that unfortunately have not been preserved.

A small pebble measuring 40mm (2716-2) displays three areas with use-wear related to plant processing. On two sides, located opposite each other, use-wear traces are the result of the implement being used as a hammer stone forming percussion and pounding traces characterised by small but numerous rounded depressions. One area was probably battered with another (stone) tool while the other area was in contact with the plant material. This hypothesis is supported by the existence of isolated points of polish on the ventral face. A rough and dull polish, linked and well delimitated, is related to an abrasive, medium-hard material, and the distribution of the polish and the presence of slight edge rounding suggest a transversal motion. The third area that shows use-wear traces, the bottom, displays a smooth surface with a very well-developed polish and considerable rounding of the grains, mostly on the left part of the surface. The latter area could be related to the smoothing of an unspecified hard, abrasive vegetable

Finally, one fragment of granite (7493-1) displays a small area that is smooth and flat. Here, the crystals are rounded and show isolated points of a bright, linked and well delimitated polish with a pitted morphology. The polish is clearly related to the processing of a hard wood, but unfortunately the preservation and development of the use-wear traces do not allow a functional interpretation.

Unspecified contact materials

Finally, twelve tools display 13 used areas with wear traces that are not distinctive or characteristic enough to allow a functional inference. Half of the tools are poorly preserved due to a long period of contact with fire. In the case of the remaining implements, the very minor development of the use-wear traces prevents better characterization of the worked materials and activities performed.

Artefact type	Plant	Animal	Inorganic	Unesp	Total (N)
Grinding stone	-	-	-	1	1
Hammer stone	1	-	-	6	7
Hammer/polishing stone	-	-	-	1	1
Quern	6	-	-	-	6
Flaked stone	-	-	-	1	1
Flake	-	-	-	1	1
Unmodified stone	3	-	3	12	18
Total (N)	10	-	3	22	35
Total (%)	28.6	-	8.6	62.9	

Table 5.13. Stone tool use wear: tool type versus contact material (Unesp: unspecified)(García-Díaz 2013: 87).

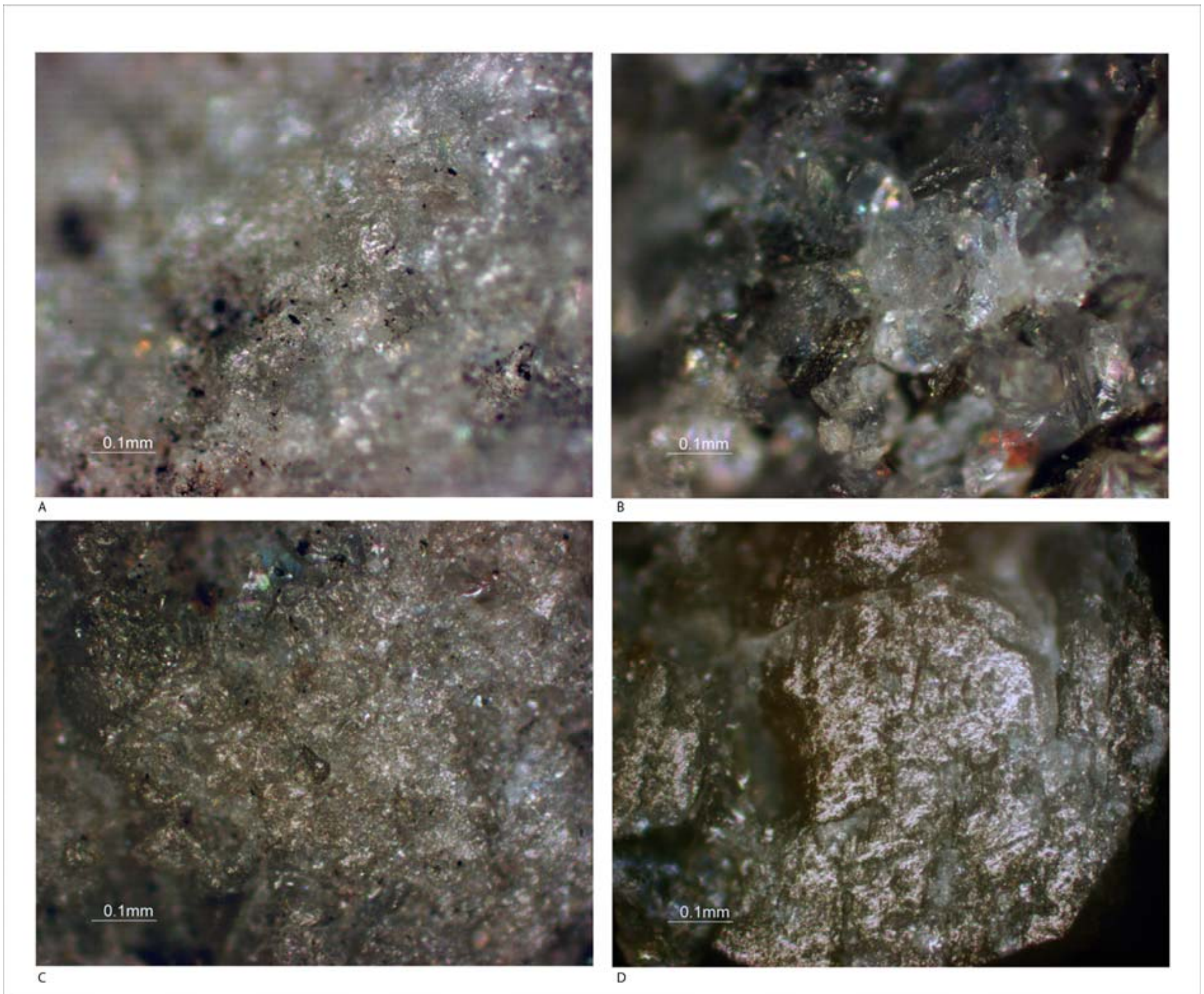

Figure 5.11. Use-wear traces related to hammer stones and querns. A: crystal alterations related to pounding and percussion (10x); B: polish and rough surface related to pounding and percussion (20x); C: very well-developed cereal polish on the active surface of the quern (10x); D: polished surface of the handstone as a result of grinding cereals (20x) (García-Díaz 2013:85).

5.7 Bones: Typology and use

5.7.1 Bone tool typology and technology

Mienakker provided thousands of bone remains, including 61 bones that were described as worked bones (Schnitger 1991; Lauwerier 2001). The preservation of the assemblage was described as poor (Jans *et al.* 2001; Schnitger 1991), due to the state of preservation of the tools, meaning that only one tool could be typologically classified. In this case (1640), the shape of the tool suggests that the fragment could have functioned as the distal part of a bone chisel. Some of the elements are described as '*bone ripples*' by the archaeozoological specialists. Bone ripples, or *bobbelkammen* in Dutch, are long tools usually produced from long, flat bones such as cattle ribs. One of the long edges of the bone was sawn, producing several rounded teeth, so that the tool resemble a comb.

The function of this type of implement is still unclear. Unfortunately, due to poor preservation use-wear analysis was not possible.

Microscopic analysis has revealed information about the technology employed to produce 16 of the tools. Two different kinds of traces associated with tool manufacturing have been interpreted: long deep striations, and the polishing of the surface. Striations are present on nine tools. Usually, the striations are long and wide, and located perpendicularly to the used edge. Four bone tools show an abraded surface which is probably the result of intentional polishing of the surface during manufacturing. Finally, two artefacts (1947 and 2665) have combined traces. Several polishing materials have been documented by ethnographic and experimental research, for example the use of a coarse grained stone (Campana 1980; LeMoine 1985 in LeMoine 1997; Newcomer 1974; (Semenov 1981[1957]); fine sand and leather (Van Gijn and Verbaas 2008); horsetails (Richie 1975 in LeMoine 1997); and flint tools (Semenov 1981[1957]).

The poor preservation of the tools prevents a more precise interpretation of the techniques employed to produce them. The use of long bones suggests employment of the '*metapodium technique*' to produce blanks: '*With a sturdy point the natural groove on the metapodia could be deepened, then the distal end would be sawed and broken off, after which the bone could be split before being ground into its final shape*' (Van Gijn 1990b: 81). The '*metapodium technique*' has been documented from the Mesolithic until the Late Neolithic throughout Northern Europe (David 2007). This technique has also been observed at some Dutch Neolithic sites, such as Hekelingen III (Maarleveeld 1985 in Van Gijn 1989). At Hekelingen III, the '*metapodium technique*' was mainly connected to red deer and roe deer bones. However, at Mienakker these ungulates are absent from the faunal spectrum (Zeiler and Brinkhuizen 2013); nonetheless, two bone implements, a chisel and an awl, both made from the metatarsus of a red deer were described by Schnitger in a previous inventory (Jans *et al.* 2001; Schnitger 1991). Both implements could have been manufactured with bones obtained elsewhere in the landscape and transported to Mienakker as finished tools. Unfortunately, the implements were not among the bones analysed in this study, as they were not present in the find boxes retrieved from the repository.

Square	Serial	Species	Element	Part	%	Weight (g)	Artefact	Macroscopically visible mod		
								Polish	Round	Other
Use-wear										
Plant working										
1414	398	Large mammal	Costae/vertebrae	Indet	0-10	0.7	-	Yes	No	Charred
1685	5636	Mammal, indet	Indet	Indet	0-10	0.4	-	Yes	Yes	-
1604	9694	Mammal, indet	Costae/vertebrae	Indet	0-10	0.3	-	Yes	No	Parallel scratches
1040	7735	Mammal, indet	Indet	Indet	0-10	0.7	-	Yes	No	Charred
1782	3938	Medium mammal	Long bone	Diaphysis	0-10	2.8	-	Yes	Yes	-
2051	4712	Ovis aries/Capra hircus	Metatarsus	Diaphysis	0-10	0.8	-	Yes	Yes	-
2112	4720	Medium mammal	Long bone	Diaphysis	0-10	2.0	-	Yes	Yes	Parallel scratches
2171	4725	Ovis aries/Capra hircus	Metatarsus	Diaphysis	0-10	0.5	-	Yes	Yes	-
Hide working										
1636	3294	Large mammal	Costae	Corpus	0-10	10.1	-	Yes	No	Charred
2171	4726a	Medium mammal	Long bone	Diaphysis	0-10	0.6	-	Yes	No	Parallel scratches
2837	6518	Mammal, indet	Indet	Indet	0-10	0.1	-	Yes	Yes	-
Undetermined										
1155	6969	Mammal, indet	Long bone	Diaphysis	0-10	3.1	-	Yes	No	Charred, groove
1962	3636	Mammal, indet	Indet	Indet	0-10	0.3	-	Yes	Yes	Charred
2171	4726b	Medium mammal	Long bone	Diaphysis	0-10	0.4	-	Yes	No	Parallel scratches
2252	2234	Mammal, indet	Costae/vertebrae	Indet	0-10	0.6	-	Yes	Yes	Charred
2602	6341	Large mammal	Long bone	Diaphysis	0-10	2.4	-	Yes	No	Charred, groove
No use-wear										
Too altered for use-wear traces										
1160	7925	Mammal, indet	Indet	Indet	0-10	0.1	-	Yes	Yes	-
1470	1265	Ovis aries/Capra hircus	Metapodium	Diaphysis	okt-25	2.2	-	Yes	Yes	-
1723	10084	Mammal, indet	Indet	Indet	0-10	0.3	-	Yes	No	-
2008	2730	Mammal, indet	Indet	Indet	0-10	1.5	-	Yes	No	Charred
2071	2035	Large mammal	Costae	Corpus	0-10	6.2	\`Ripples'	Yes	Yes	-
2787	5720	Large mammal	Long bone	Diaphysis	0-10	0.8	-	Yes	No	Parallel scratches
No use-wear										
980	6803	Mammal, indet	Costae/vertebrae	Indet	0-10	0.3	-	Yes	No	-
1043	7638	Mammal, indet	Costae/vertebrae	Indet	0-11	0.7	-	Yes	No	-
1099	7919	Mammal, indet	Indet	Indet	0-12	0.1	-	Yes	No	-
1947	3642	Large mammal	Long bone	Diaphysis	0-13	2.3	\`Ripples'	Yes	Yes	Charred
2073	1983	Large mammal	Costae	Corpus	0-14	3.7	-	No	Yes	-
2071	2035	Large mammal	Indet	Indet	0-15	2.9	-	Yes	Yes	-
2665	5015	Mammal, indet	Costae/vertebrae	Indet	0-16	0.3	-	Yes	Yes	-
2846	5478	Mammal, indet	Costae/vertebrae	Indet	0-17	0.1	-	Yes	No	-

Table 5.14. Overview of the archaeozoological analysis of the bone implements primarily selected for use-wear analysis (Indet: Indetermined; Macroscopically visible mod: Macroscopically visible modifications) (García-Díaz 2013: 89).

Square	Serial	Species	Element	Part	%	Weight (g	Artefact	Macroscopically visible mod		
								Polish	Rounding	Other
388	9000	Large mammal	Costae	Corpus	0-10	30.8	'Ripple'	Yes	Yes	Charred
913	8073	Large mammal	Costae	Corpus	10-25	21.7	'Ripple'	Yes	Yes	-
1101	8020	Large mammal	Long bone	Diaphysis	0-10	26.4	'Ripple'	Yes	Yes	-
1038	7633	Mammal indet	Indet	Indet	0-10	0.1	-	Yes	No	-
1038	7633	Mammal indet	Indet	Indet	0-10	0.1	-	Yes	No	-
1038	7633	Mammal indet	Indet	Indet	0-10	0.2	-	Yes	No	-
1038	7633	Mammal indet	Indet	Indet	0-10	0.5	-	Yes	No	-
1038	7633	Mammal indet	Indet	Indet	0-10	0.5	-	Yes	No	-
1038	7733	Large mammal	Costae	Corpus	0-10	1	-	Yes	Yes	-
1038	7733	Mammal indet	Indet	Indet	0-10	0.1	-	Yes	No	-
1038	7733	Mammal indet	Indet	Indet	0-10	0.2	-	Yes	No	-
1038	7733	Mammal indet	Indet	Indet	0-10	0.2	-	Yes	No	-
1038	7733	Mammal indet	Indet	Indet	0-10	0.2	-	Yes	No	-
1038	7733	Mammal indet	Indet	Indet	0-10	0.3	-	Yes	No	-
1043	6704	Large mammal	Costae	Corpus	25-20	32.9	'Ripple'	Yes	Yes	-
1156	7645	Large mammal	Costae	Corpus	10-25	23.8	'Ripple'	Yes	Yes	Charred
1156	7745	Mammal indet	Indet	Indet	0-10	1.2	-	Yes	No	Charred
1156	7745	Mammal indet	Indet	Indet	0-10	1.4	-	Yes	Yes	-
1156	7745	Mammal indet	Indet	Indet	0-10	0.4	-	Yes	No	-
1340	7090	Large mammal	Costae	Corpus	10-25	11.1	-	Yes	Yes	-
1455	61	Medium mammal	Radius	Diaphysis	0-10	2.7	-	Yes	No	Charred, groove
1508	322	Bos taurus	Metatarsus	Proximal part	10-25	37.5	-	Yes	Yes	Scgratches
1515	926	Large mammal	Costae	Corpus	10-25	13.3	'Ripple'	Yes	Yes	-
1515	926	Mammal indet	Costae	Corpus	0-10	0.2	-	Yes	Yes	-
1827	2528	Mammal indet	Costae	Corpus	0-10	4.3	-	Yes	No	-
1997	3688	Large mammal	Long bone	Diaphysis	0-10	20.6	-	No	Yes	Calcinated
2097	4242	Large mammal	Long bone	Diaphysis	0-10	1.4	-	Yes	No	Charred
2124	1902	Large mammal	Costae	Corpus	0-10	14.2	'Ripple'	Yes	Yes	-
2142	5307	Bos taurus	Metatarsus	Proximal part	10-25	35.1	-	No	Yes	Cut marks
2675	4092	Large mammal	Vert. thoracales	Spinae	10-25	26.4	'Ripple'	Yes	Yes	-
2785	5469	Mammal indet	Costae/vertebrae	Indet	0-10	0.5	-	Yes	No	-
3023	5226	Large mammal	Vert. thoracales	Spinae	10-25	64.4	'Ripple'	Yes	Yes	-
-	8024	Large mammal	Long bone	Diaphysis	0-10	5.1	'Ripple'	Yes	Yes	-
-	10180	Bos taurus	Metatarsus	Distal part	25-50	78.3	-	No	Yes	-

Table 5.15. Overview of the archaeozoological analysis of the bone implements that were not suitable for use-wear analysis(Indet: Indetermined; Macroscopically visible mod: Macroscopically visible modifications) (García-Díaz 2013: 90).

5.7.2 Use-wear analysis on bone implements

The range of activities and materials documented by use-wear analysis is limited due to the poor preservation of the surface of the tools. Six tools were not suitable for use-wear analysis. Of the remaining 23, 62% (N=18) show traces of use.

Plant working

Plant working is the most commonly represented activity in the assemblage. In every case, the traces displayed are related to a transversal motion. The interior part of three fragments of long bones (2051, 2112 and 1782) have been used to scrape an undetermined vegetable material. The distal and proximal edges of the tools are heavily rounded and the polish is well developed, very bright and smooth, with numerous, fine, and shallow scratches as the one documented by other authors for plant working (Maigrot 2000, 2001, 2005; Martial *et al.* 2011; Van Gijn 2006a, 2006b) (Fig. 5.11).

Additionally, one tool (1685) shows traces resembling the experimental traces generated by scraping an undetermined plant.

The small fragment interpreted as the distal end of a chisel (1640) shows wear traces related to plant working, probably wood (Fig. 5.13). The distal tip is extremely rounded and the surface is polished. The polish is bright, smooth and has a domed topography (Fig. 5.12). Deep, wide, parallel striations have developed along the used edge. Chisels from other Neolithic contexts in the Netherlands have been interpreted as tools used for fine woodworking (Maigrot 2000; Van Gijn 2006).

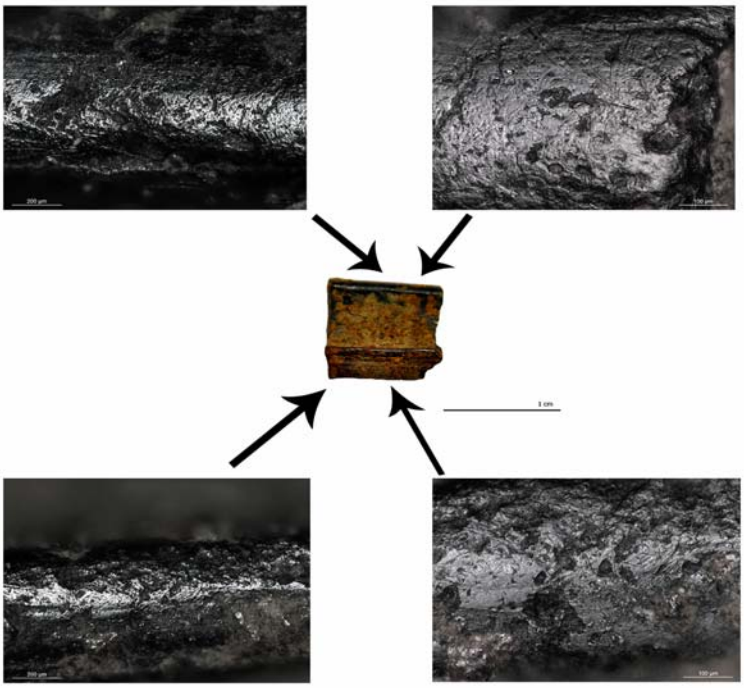

Figure 5.12. Use-wear traces on bone (2171-4725) related to the scraping of an undetermined vegetable material. Use-wear traces are developed on both distal and proximal edges (100x and 200x; 100x and 200x) (García-Díaz 2013: 92).

Finally, two fragments of bones (1414 and 1604) display use-wear related to an undetermined hard plant material, possibly plant, although use-wear traces are not developed enough to interpret the worked material (Fig. 5.12). In both cases the edges are very rounded and the polish is bright and smooth, compact and clearly delimited.

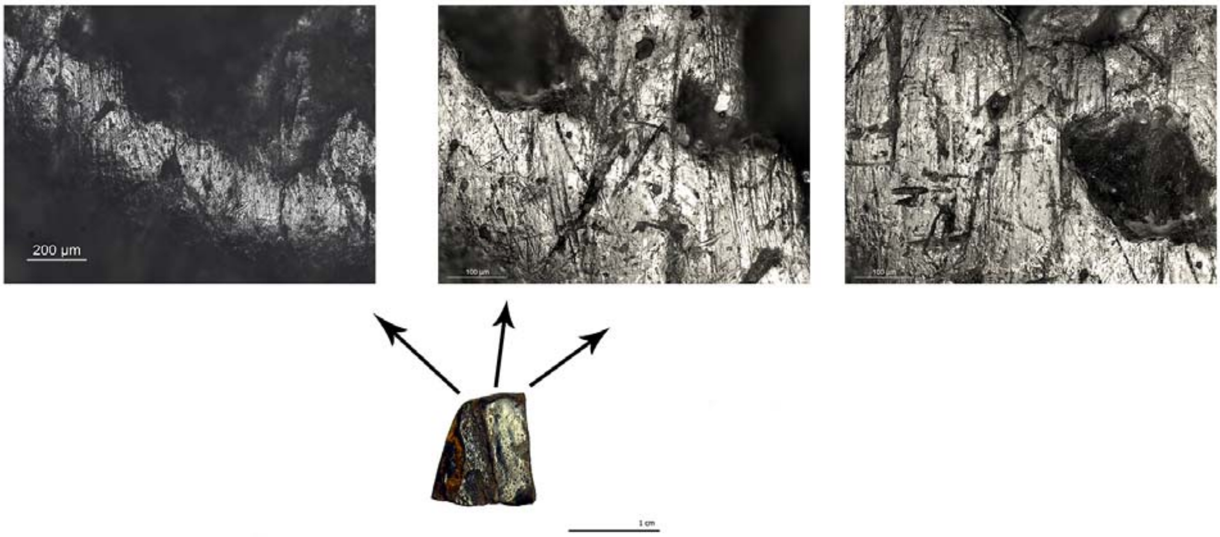

Figure 5.13. Distal fragment of a bone chisel (1040-7735) related to wood working (100x, 200x and 200x) (García-Díaz 2013: 92).

Hide working

Use-wear traces related to hide-working have been interpreted in three tools (2837, 1636 and 2171). In two cases the polish developed is rough, slightly bright and striated. The used edge displays heavy abrasion and rounding. On the third tool (1636) the polish displayed is rough and bright, with numerous small deep striations, as documented by other authors (Buc 2011; Maigrot 2000, 2001, 2005; Martial *et al*. 2011; Van Gijn 2006a, 2006b). The state of preservation of the tools is very poor and only half of the tool could be analysed at high magnifications. The other half is covered by mineral concretions and the surface appearance suggests that the tool has been in contact with fire. Where the analysis could be performed, the tool displays well-developed use-wear traces related to hide processing. The high number of striations and the pronounced rounding of the edge suggest the use of some sort of mineral additive to scrape the skin (Fig. 5.14).

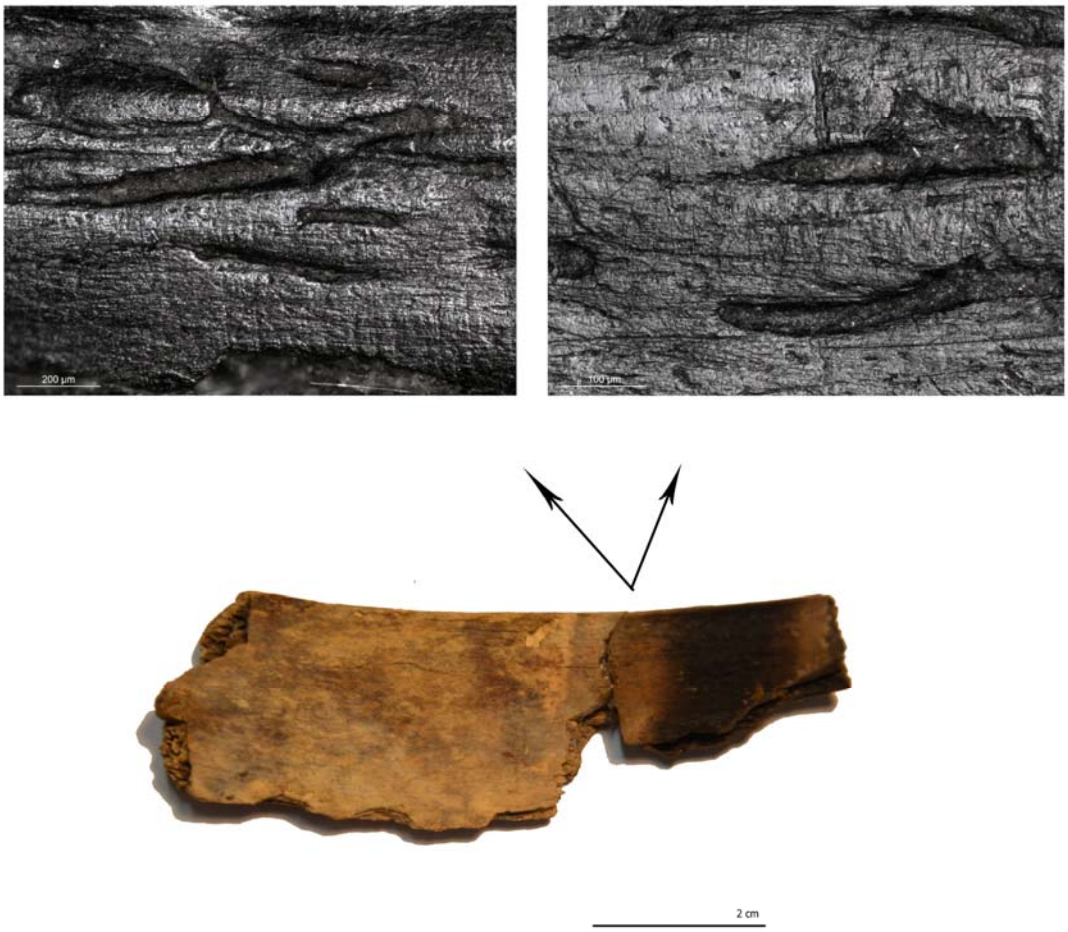

Figure 5.14. Use-wear traces on a bone implement (1636-3294) related to hide-processing, probably using a mineral additive (100x and 200x)(García-Díaz 2013: 93).

Undetermined/Unspecified materials

Use-wear related to an undetermined abrasive material was visible on five tools. Even though these tools are very fragmented, the bones show a rounded edge. The polish is bright and very smooth, and the motion inferred is always transversal except for one fragment (1155), where both longitudinal and transversal motions have been recorded.

Finally, a small fragment of bone (2602) shows traces related to an undetermined hard material. The tool has a flattened surface. In one of the corners a triangular concavity is present with clear traces of use. The shape of the hollow and the distribution of the use-wear suggest the tool was used as a sharpener (Fig. 5.15). Because of the poor state of preservation and the small dimensions of the tool it was impossible to reach an interpretation of its function.

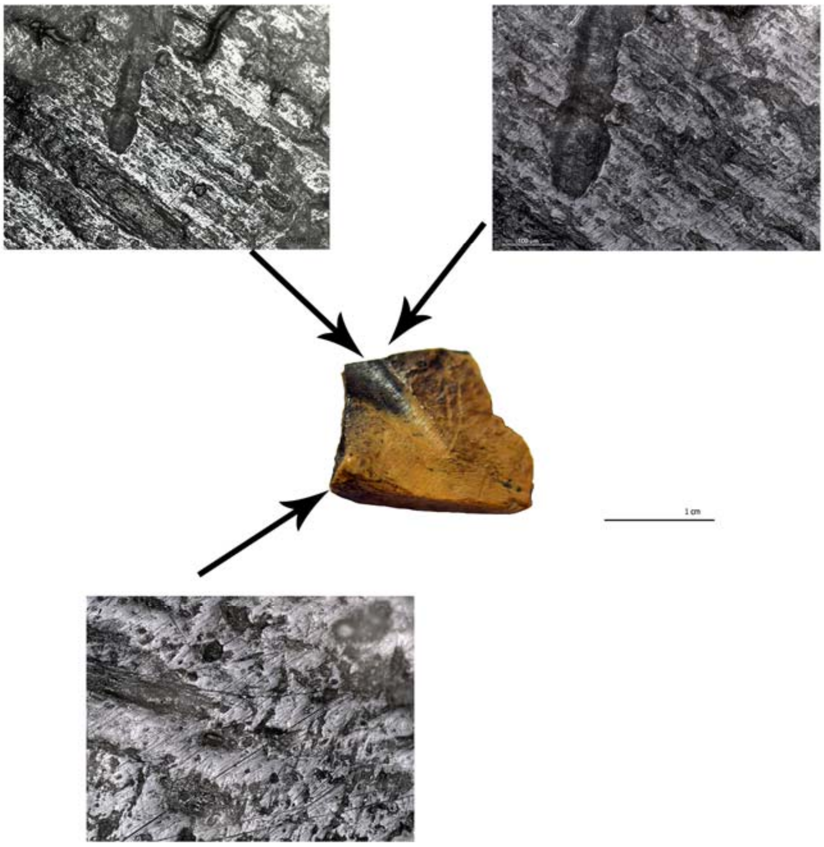

Figure 5.15. Bone tool (2602-6341) possibly used as a sharpener. On the top of the image, use-wear traces related to an unspecified hard material (100x and 200x). On the bottom of the image, polished surface of the tool (200x)(García-Díaz 2013: 94).

5.8 The Mienakker amber

Of the 316 amber fragments studied by Bulten (2001) only 134 were available for the current analysis. Bulten's report (2001) has therefore been used as the basis of this study and the main points of the analysis are explained in the next section of this chapter. According to Bulten (2001: 473), the amber at Mienakker was collected from the coastal areas of the North Sea, brought to the site and then worked. The nodules were probably small; the colour of the implements varies from light yellow to orange.

Bulten considers the beads and pendants of Mienakker to be typologically homogenous. The ornaments are flat and button-shaped, with facetted sides. Using analysis of several amber implements and following Hirsch and Liversage (1987), Bulten (2001) reconstructs the entire production process of the amber beads. Five different steps are defined, from raw material selection to use. After the selection of the raw material, the cortex is removed, a process which can be performed by flaking the amber, analogous to flint, or by scraping the cortex with a flint flake or scraper. Even though it is possible that both techniques were used at the site, the traces left by scraping can easily be confused with post-depositional alterations, so it was not possible to make this distinction. Flaking was certainly used, as 47 tools show flaking marks on their surface.

The second step in the production of the ornaments is cutting the amber. One fragment has the typical circular traces produced by this technique (Bulten 2001). Afterwards, final shaping was performed by polishing, just before perforating the ornaments. According to the data compiled by Bulten (2001: 473), a total of 46 implements have a perforation, most of them being fractured (78.2%). There are also two examples of a double perforation, reflecting repair events. The author distinguishes between three different kinds of perforations: conical, bi-conical and cylindrical. The implications of these perforations are interesting from the point of view of the production processes, as they relate to the type of borer used to drill the holes. Conical and bi-conical perforations are related to the use of flint borers, while the cylindrical perforations are probably related to the use of bone or antler borers. Even though 4mm and 1mm sieves were used during the excavation, no bone or antler borer was recovered. One possibility is that the production of these specific type of ornaments was performed outside the site. Bulten, however, believes that the entire production sequence was performed on-site (Bulten 2001: 471), which, together with the presence of the flint borers, would suggest two possibilities: firstly, that the lack of bone and antler borers is a preservation issue. However, as well-preserved bone and antler fragments and even tools were recovered at Mienakker (Zeiler and Brinkhuizen 2013), the absence of these borers in the archaeological record is more likely to be due to them being undetected during the excavation and/or post-excavation process (Zeiler and Brinkhuizen 2013).

The bi-conical perforation was made in two stages: first, one half of the bead was drilled, and then the bead was turned and drilled again. The boring was completed with the conjunction of both perforations in the middle of the ornament, resulting in a hole with an hourglass shape. However, the cylindrical and conical perforations were made from only one side of the bead. The cylindrical perforation was made through the ornament from one side to the other. Because of the small size of the borer and the rotational movement, the walls of the perforation are usually parallel and straight. In addition, and due to friction, the cylindrical perforation was a delicate process and sometimes the bead was accidentally broken. The conical perforation was also the result of a complete perforation from just one side of the ornament. The final step of the production process suggested by Hirsch and Liversage (1987) is the polishing of the beads. In this case Bulten suggests that all ornaments were polished after perforation (Bulten 2001).

Even though the beads could not be analysed, Bulten (2001: 472) observed that at least 23 implements show a worn area inside the perforation, suggesting that the implements were used as pendants.

5.9 The domestic space at Mienakker: the spatial distribution of flint, stone and bone implements and amber ornaments

At the time of the excavation several features, including two house structures and one burial, were documented. During the excavation it was clear that no objects were associated with the burial. The two house structures, however, displayed a large number of artefacts which could be interpreted from a functional perspective (García-Díaz 2013; Nobles 2013b).

Flint

Although the flint had a wide distribution, the denser concentrations of implements were found around and inside the south-western creek (Fig. 5.16). Four significant concentrations could be distinguished; a) Concentration Flint Area 4 was divided in two sub-areas. Concentration Flint Area 4a is composed of flakes, splinters and flint fragments and is associated with the hearth inside the MKII structure. Similar characteristics were observed at Area 4b, an area dominated by waste, splinters and flakes, concentrated around a hearth inside the MKI structure. Due to the composition of the assemblages and their vicinity to a combustion area, both concentrations were interpreted as flint knapping areas. The spatial analysis of the refitted flint provided information about different flint knapping episodes. Peeters' RMU1 (Raw Material Unit 1) shows two flaking episodes (Peeters 2001b): the first episode took place in the northern part of the settlement, possibly in relation to the MKI structure or to the area with burnt grain (S120); the second episode was documented in the southern part of the site, within the area of the MKI structure, and next to a hearth. RMU2, RMU9 and RMU13 were related to one single knapping event. RMU2 and RMU13 were concentrated around hearths, the first within the MKII structure and the second inside the MKI structure. Finally, a knapping event related to RMU9 took place outside the MKII structure (Nobles 2013) (Fig. 5.17 and 5.18).

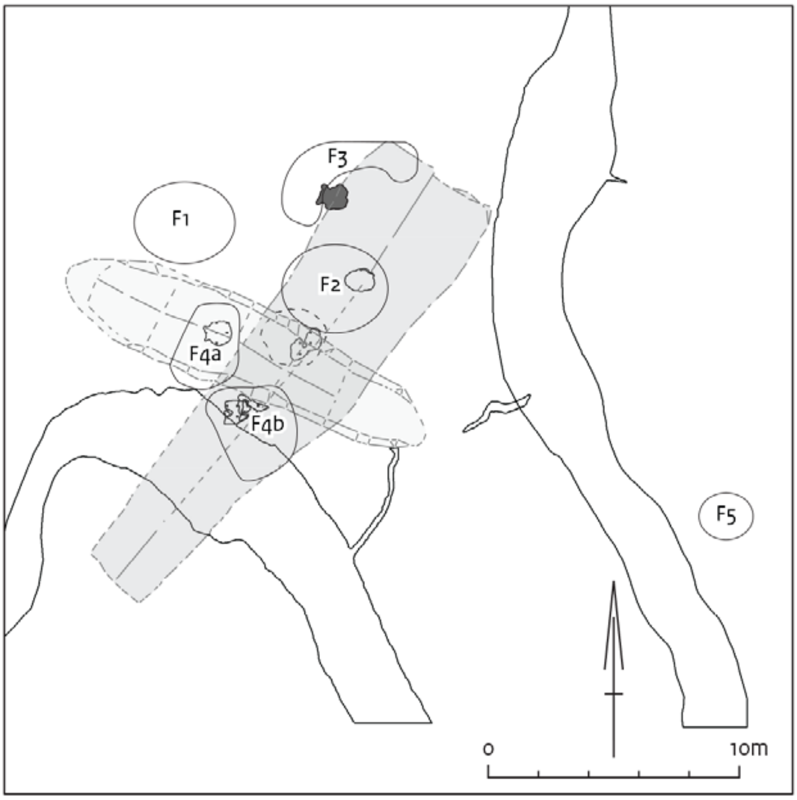

Figure 5.16. Flint areas interpreted by Nobles (2016). The distribution of the tool types did not display a clear pattern, but blades, borers, scrapers and a large number of flakes are mainly documented within the structures. Although a spatial distribution of the use-wear traces was not performed, it seems that the use of the flint implements is related to a domestic use of the space (Nobles 2016: 164).

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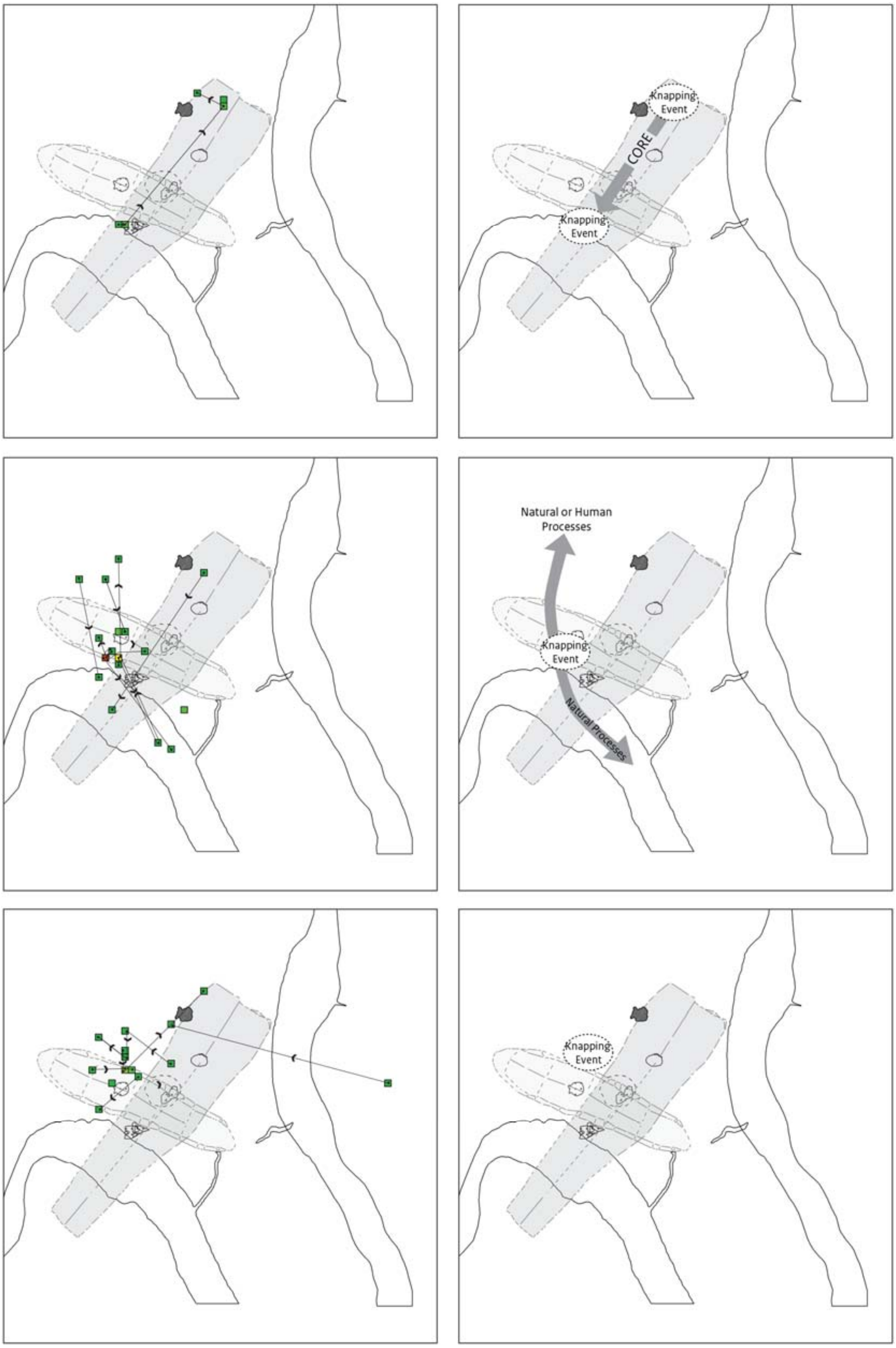

Figure 5.17. Lithic refitting of the Raw Material Units (RMU) defined by Peeters (2011a)(Nobles 2016: 166).

Figure 5.18. Lithic refitting of the Raw Material Units (RMU) defined by Peeters (2011a) (Nobles 2016: 167).

Stone

Stone was mainly concentrated in the north-western part of the site, and three clear concentrations could be discerned. Two concentration areas were related to the MKII structure: Area 1 is located outside it and Area 2 is located inside it and around the hearth. The tool type distribution suggested the presence of stone tools, like querns and flakes. Area 3 was located around a pit (S120 feature) containing large quantities of charred grain remains. Due to the high density of charred barley grains documented, the structure has been interpreted as a storage pit (Kubiak-Martens *et al.* 2013; Nobles 2013a). Although use-wear traces related to cereal processing are present on several querns, none of these stones was found close to the S120 feature, suggesting that the processing of the cereals was performed outside the storage area. Notwithstanding the lack of a spatial distribution of the use-wear traces, the presence of different tool types inside the structures indicates a domestic use of these spaces (Nobles 2013a, 2013b).

Amber

Two clear concentrations were documented (Bulten 2001; Nobles 2013b). One group was clustered in the centre of the excavation area, close to a pit (feature S138); the second group was concentrated inside the MKII structure, around a hearth. While a clear interpretation was not possible for the second group, Nobles suggests that it represents an amber ornaments production area. As in the case of flint, the manufacture of amber beads was performed around the hearth, inside a domestic area. Moreover, the use-wear analysis of the flint implements suggested the use of small borers to drill the amber beads. Unfortunately, a spatial relation between flint borers and amber could not be established; although one borer was located inside the MKII, and another nearby, most of the drills were documented far away from the presumed production zone of amber beads (Nobles 2013b).

5.10 Conclusion: Group composition and site function

Mienakker is interpreted as a year-round residential settlement supporting the interpretation proposed by Hogestijn (1992, 1997, 1998, 2001, 2005). The settlement was structured around two dwellings, MKI and MKII, linked to the two occupation phases documented during the stratigraphic analysis. Evidence of domestic activities was found inside the structures. Food processing and butchering of animal remains took place in the north of the structure, while stone, flint and amber working was documented around the fireplaces of MKI and MKII structures. As in the case of Keinsmerbrug, households seemed to be the centre of the domestic activities at the settlement.

Mienakker was located in a salt marsh environment in an open landscape dominated by grass vegetation. Trees were scarce, although oak and hazel were probably present in the surrounding areas, and willow and alder grew in the freshwater environments. Salt marshes provided a rich environment for pasturing cattle and fowling. Salt-water creeks provided a fishing source, as suggested by the archaeological remains of catfish and pike. Fishing, in fact, was one of the main subsistence activities at Mienakker, along with fowling and stockbreeding. Hunting played only a minor role in the subsistence economy of the group and was mainly directed towards obtaining hide and fur (Zeiler and Brinkhuizen 2013). Mallard and teal were probably caught in late summer, which was also the season when various fish species such as flounder and grey mullet were caught. Fishing of haddock was probably performed during winter. The diet was completed with cereals, wild nuts and fruits. Wild fruits and nuts were probably gathered at the end of summer and early autumn. As saltwater floods occurred during autumn and winter, cereals had to be seeded in spring and harvested at the end of the summer. The archaeozoological and archaeobotanical information suggests that the settlement was used during the entire year.

The acquisition, production and use of portable material culture is an important indicator of different aspects of the group that enables an understanding not only of settlement variability but also of the exploitation of the landscape in a broader sense. The fact that most of the retouched and modified artefacts, including the amber beads, have gone missing, severely limited the general interpretation of the use of the material culture. Nonetheless some general conclusions can be drawn about the settlement. Firstly, raw material procurement points to a broader use of the territory compared with the site at Keinsmerbrug. It demonstrates the exploitation of nearby areas such as the coastlines or the glacial till deposits at Wieringen. The exploitation of nearby resources characterizes not only other sites in the vicinity, such as Keinsmerbrug and Zeewijk, but also archaeological assemblages from TRB and Bell Beaker settlements, where small nodules of flint were utilized (see Chapter 7). Amber appears to have been collected on the nearby beaches, as at other archaeological sites such as Aartswoud. The igneous rocks could, however, have been obtained from the glacial till deposits at Wieringen. The presence of southern flint and sandstone indicates the exploitation of a wider territory, which would probably imply a broader exchange network. The use of southern flint has also been demonstrated at settlements of the Vlaardingen group – mostly the ones located on river and Pleistocene dunes – and may have been a recurrent phenomenon at other Corded Ware settlements such as Kolhorn and Zeewijk (albeit in a smaller proportion). Unfortunately, the stone tools from the Vlaardingen and TRB settlements have not been systematically studied, but sandstone and quartzite are also present at nearby sites like Kolhorn, Aartswoud and Zeewijk. The origin of sandstone, quartzite and the southern-like flint remains uncertain. Even though the materials originally came from the south, their transport to the Noord-Holland province could also relate to geological transformations in the landscape. The Meuse and Rhine rivers ended in the present-day Waddenzee, so river gravels are commonly found in the moraine. Consequently, even though a southern origin for the stones cannot be ruled out, some authors (Van der Lijn 1973; Zandstra 1988) suggest Drenthe or the deposits at Wieringen as the acquisition source area.

The choice of raw material is closely connected with the technological approaches used by the Single Grave communities. Bipolar reduction was used on the flint rolled pebbles, while unidirectional flaking was applied to bigger flint nodules. The existence of different technological strategies within the same settlement is a characteristic of Neolithic technological flint management. Bipolar approaches are nearly always related to low quality flint and, in the case of the CWC in general and Mienakker in particular, with obtaining particular tool types. Small borers were obtained using this method, while scrapers were produced from larger flint nodules. Because of the small size of the cores, flakes are the most frequently occurring blank category, and few blades are present. Retouched tools are also scarce, as are scrapers. Together with a raw material selection that predisposes the use of granite for grinding and cereal processing activities and sandstone for pounding and hammering, the stone artefacts provide evidence of various technological approaches. Querns and grinding tools display flaking negatives while sandstone and granite hammers were used in their natural form. Flaking querns and grinding stones became a common phenomenon after the first Linearbandkeramik (LBK), and querns have also been found at other Corded Ware settlements such as Kolhorn and Zeewijk.

Use-wear analysis suggests the coexistence of craft and subsistence activities. While subsistence activities were poorly represented at Keinsmerbrug, at Mienakker there is convincing evidence of cereal processing and storing. Querns with cereal traces were found inside the structures; it can be assumed that cereals were probably processed within the dwellings. Use-wear traces of butchery were inferred from only one flint implement, although the importance of fish and meat in the diet of Mienakker inhabitants was certainly greater, as suggested by the large number of fish remains and mammal bones displaying cut marks, and from the results of the analysis of organic residues from several vessels. Therefore, the near absence of evidence of either activity on the flint and stone tools analysed is curious. One explanation for the absence of functional traces related to fish and meat processing is that the associated wear traces were obliterated by post-depositional alterations (see Chapters 3 and 4). Moreover, several methods of fish processing could be performed without tools, leaving no wear (Van Gijn 1986).

Craft activities are also evident at the site. As in the case of Keinsmerbrug these are mostly related to hide scraping and plant working, but the production of amber beads is also very well represented. Hide scraping was accomplished predominantly with flint scrapers and retouched implements, although bone implements were another integral part of hide processing. The type of use-wear traces documented suggests that, in contrast to Keinsmerbrug, the entire process of skin preparation was performed at the site. Plant working was performed with flint, stone and bone implements. The variety of vegetal resources worked included hard and soft wood, as well as soft vegetal resources.

Chapter 6. Zeewijk[8]

6.1 The site

The site of Zeewijk was located in a former tidal basin. During the Holocene the sea level rose and the Pleistocene soils were covered by peat. The topography of the area was created by the action of two water channels connecting the coast and the mainland (Smit 2014). The settlement was located on an open landscape, with a strong marine influence (Fig. 6.1). The analysis of charred seeds and pollen samples indicates the predominance of herbaceous vegetation such as common sea-lavender, arrow-grass and species of the goosefoot family (Kubiak-Martens 2014). In addition, freshwater wetland plants such as great sedge and branched bur-reed demonstrated that fresh water accumulated at several places around the settlement (Kubiak-Martens 2014). Although some trees such as alder, willow, ash and bird cherry were probably growing in the near vicinity of the site, the landscape was largely devoid of trees (Brinkkemper and Van den Hof 2014).

[8] This chapter is an altered and abbreviated version of García-Díaz 2014.

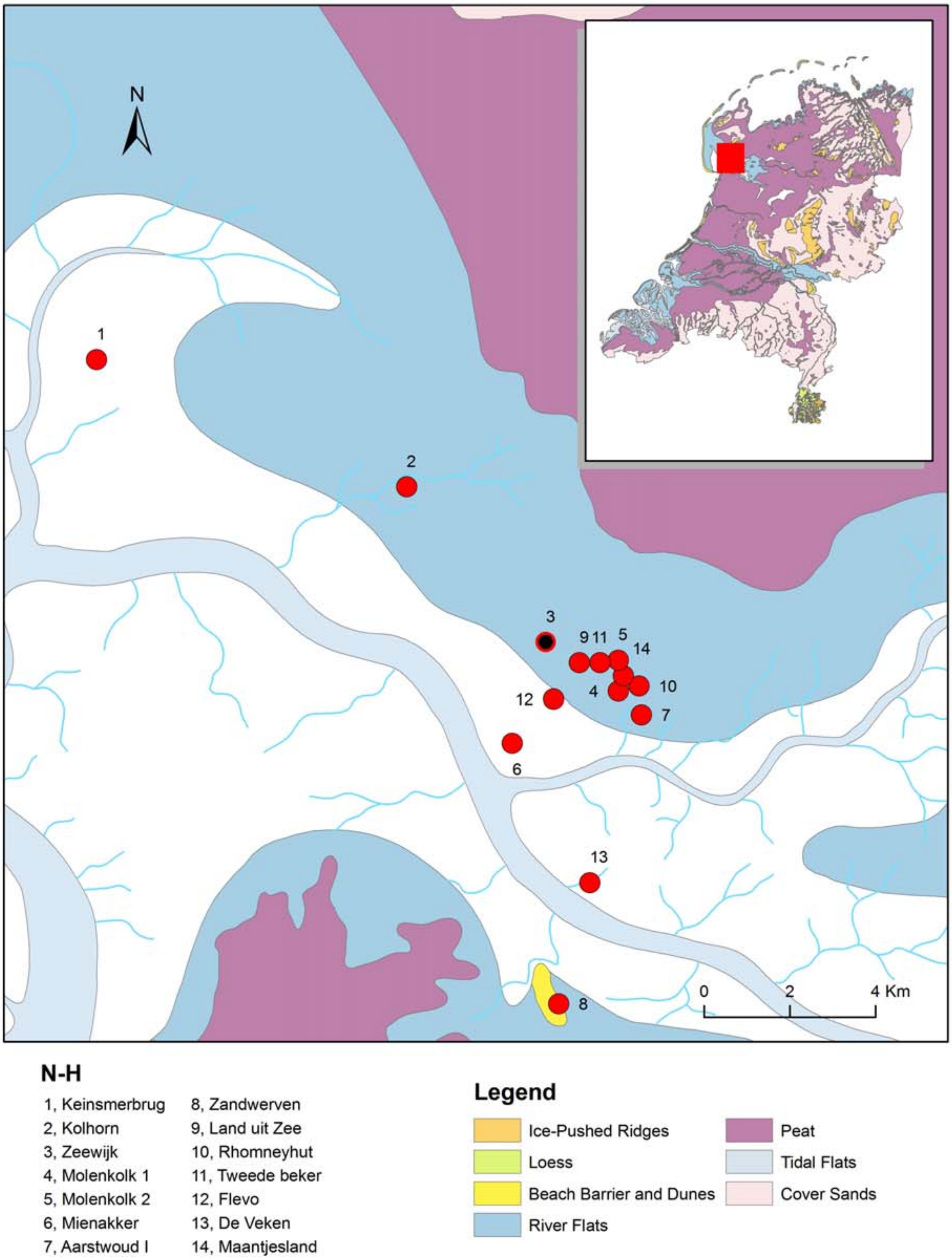

Figure 6.1. Location of Zeewijk (after Vos and de Vries 2011).

Zeewijk was discovered in 1983 and it is one of the largest CWC sites known in the Netherlands. The site was only partially excavated. Two distinct areas, Zeewijk-West and Zeewijk-East, were defined, based on two large concentrations of a dark cultural layer divided by a gully. In 1984 an amateur archaeologist, Wit, conducted a small-scale excavation. A test pit of 3x3m was dug, revealing an archaeological layer 50cm thick. A ^{14}C dating obtained from a bone fragment in the cultural layer yielded a date of 3925 ± 40 BP (Van Heeringen and Theunissen 2001: 67)[9]. In 1986 and 1987 the Biologisch Archaeologisch Instituut of the University of Groningen (Biological Archaeological Institute, BAI) conducted several campaigns (Gerrets *et al.* 1988), and finally, in 1992, 1993 and 1994 the State Service for Archaeological Investigations (ROB)[10] organized a series of excavations (Hogestijn 1993; Van Heeringen and Theunissen 2001). In 1992, 270 geological cores were taken, and an archaeological excavation was planned. Due to lack of time and money, only 20-25% of the site was excavated. In 1992, one small excavation of 2x2m, three larger excavations and two trenches from Zeewijk-East to Zeewijk-West were investigated. In 1993, an excavation was executed at Zeewijk-East, until it was realized that the cultural layer was missing. In addition, an excavation was conducted in the western area. Finally, in 1994, several $2m^2$ trenches were excavated in the higher part of the levee, where the cultural layer was found (Theunissen 2014; Van Heeringen and Theunissen 2001).

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[9] GrN-no. 15565.

[10] Now Rijksdienst voor het Cultureel Erfgoed (Cultural Heritage Agency of the Netherlands, RCE).

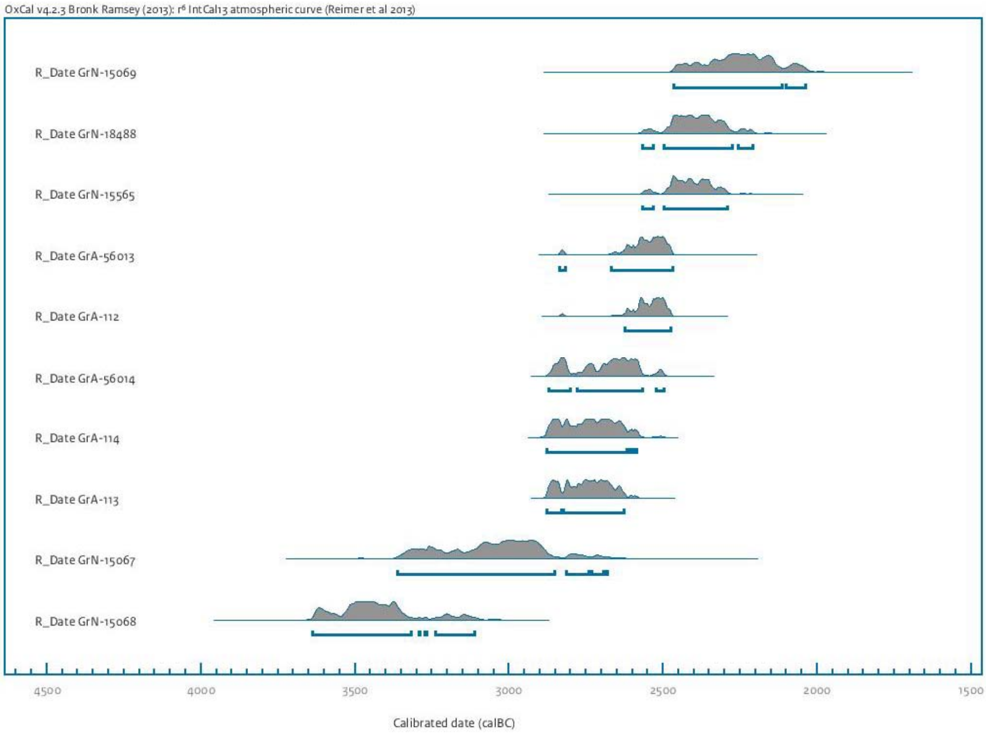

Figure 6.2. Multiplot of calibrated 14C outcomes (Smit 2014: 36).

During the excavation of Zeewijk, and although more than 7,000 postholes were documented (Nobles 2014a), only two structures were interpreted. At Zeewijk-West, a schematic house plan of 3.5-4.5m by 12-14m was published (Nobles 2014; van Ginkel and Hogestijn 1997: 112). The house was compared with the structure found at Mienakker and a quern deposition was interpreted as intentional (van Ginkel and Hogestijn 1997: 112). However, during the spatial analysis performed by Nobles (2014b), no clear clustering patterns could be inferred.

The second structure was recognized at Zeewijk-East. It was a symmetrical and uniform trapezoidal construction, measuring 22m by 5-5.7m, oriented northeast-southwest along its axial line (Nobles 2014a, 2014b). A possible entrance was inferred in the northeast side of the structure. According to Nobles' interpretation, the entrance was built so as to restrict visibility, and the view into the interior of the structure was probably blocked (Nobles 2014a). Five wooden poles, 30-80cm in diameter, formed the central post line of the structure. The poles were partially preserved and recovered during the excavation and the analysis of the wood remains indicates that oak was used as a building material. Oaks were not part of the natural vegetation growing around the settlement; the wood had to be brought to the settlement, probably from the Pleistocene deposits of Wieringen, 15km away from Zeewijk (Brinkkemper and Van den Hof 2014). A ^{14}C date of 3910 ± 50 BP was published for the Zeewijk-East structure (Van Heeringen and Theunissen 2001: 67). The purpose of this structure has been related to '*a ritual or a ceremonial function*' given the absence of any domestic refuse and its regular shape (Drenth *et al*. 2008: 158).

Ard marks were numerous in the east and west areas of the site (Nobles 2014a). The distribution of the ard marks suggested that the people who lived at Zeewijk had fields close to the settlement. The fields were probably located on the highest parts of the salt marshes and on the levees. An '*intensive or garden cultivation*', characterized by a small-scale farming, has been proposed for Zeewijk (Kubiak-Martens 2014: 132). Cereal cultivation was dominated by barley and emmer, both of which were represented not only by charred seeds but also by spikelet forks, glume bases and basal rachis segments, indicating that the complete ears of barley and emmer were carried to the settlement and threshed at the site (Kubiak-Martens 2014). Wear traces associated with cereal processing were identified on several querns (García-Díaz 2014a, 2014b) and the consumption of cereals was indicated by the analysis of organic residues on the pottery vessels. Emmer, perhaps along with naked barley, was probably cooked as porridge, with the addition of protein and fats (Kubiak-Martens and Oudemans 2014). Food was cooked using a broad range of vessels, but there is a clear correlation between the thickness of the vessel's wall and the amount of residue documented (Beckerman 2014). In addition, a correlation between the decoration and the thickness of the vessels was recognized, so the vast majority of the cord-decorated vessels were probably used for cooking (Beckerman 2014). Organic residues show that acorns were cooked in ceramic vessels, possibly as a soup. The importance of plant gathering was also indicated by the archaeobotanical analysis. Remains of tubers, sea club-rush, crab apple, hazelnuts, and acorns were probably used as a food source (Kubiak-Martens 2014).

A small number of animals were kept close to the settlement, as indicated by the numerous cow hoofmarks present at the site. The cow hoofmarks were mainly recognized in areas with a low density of postholes, marking a clear distinction between the domestic area and the breeding structures (Nobles 2014a, 2014b). The importance of cattle is indicated by the faunal analysis (Zeiler and Brinkhuizen 2014). In both areas of Zeewijk, the mammal assemblage was dominated by cattle, followed by sheep/goats, pigs, wild boar and dogs (Zeiler and Brinkhuizen 2014). On the higher parts of the salt marshes seeds from non-cereal remains dominated the sample. As in the rest of the region, the high salt marshes were probably used as grazing marshes (Kubiak-Martens 2014). Cutting marks displayed on the bones indicate that some animals were slaughtered at the site. Fowling and fishing played an important role in the subsistence strategy. Although other species were documented, fowling was mainly focused on ducks, especially mallards and teal (Zeiler and Brinkhuizen 2014). As in the case of Mienakker, these birds were probably caught between July and August, during the moulting period, when the animals could not fly. Although maritime and freshwater fish species were identified, fish remains indicate the exploitation of freshwater bodies and tidal flats (Zeiler and Brinkhuizen 2014). Finally, hunting was less important than in other contemporary domestic settlements. The small number of fur animals – mainly beaver, stoat, wild cat and brown bear – and the small amount of remains of red deer and roe deer illustrate that hunting was mainly focused on the procurement of wild boar (Zeiler and Brinkhuizen 2014).

6.2 Materials analysed

Because of the large number of finds and the time limitations, for the purpose of this doctoral research it was decided to sample material unearthed from the area excavated in 1992, where the structures were identified (Nobles 2014a). Therefore, the first step in the analysis was to enter all the available implements into a database. In total, 7,537 stone, 11 bone and 10,700 flint implements were entered in the database of the Laboratory of Artefact Studies at Leiden University (García-Díaz 2014a). Unfortunately, after the assemblages were entered in the database, it became apparent that the material from some excavated areas was missing. Most of the flint material from the 1992 was gone, and a great number of the materials from the 1993 and 1994 trenches were also unaccounted for. Finally, in Zeewijk-East, flint and stone from inside the plan of the large structure were almost completely absent (Fig. 6.3). As a consequence, it was decided that the available flint, stone and bone would be studied as a whole, without taking into account the sample area.

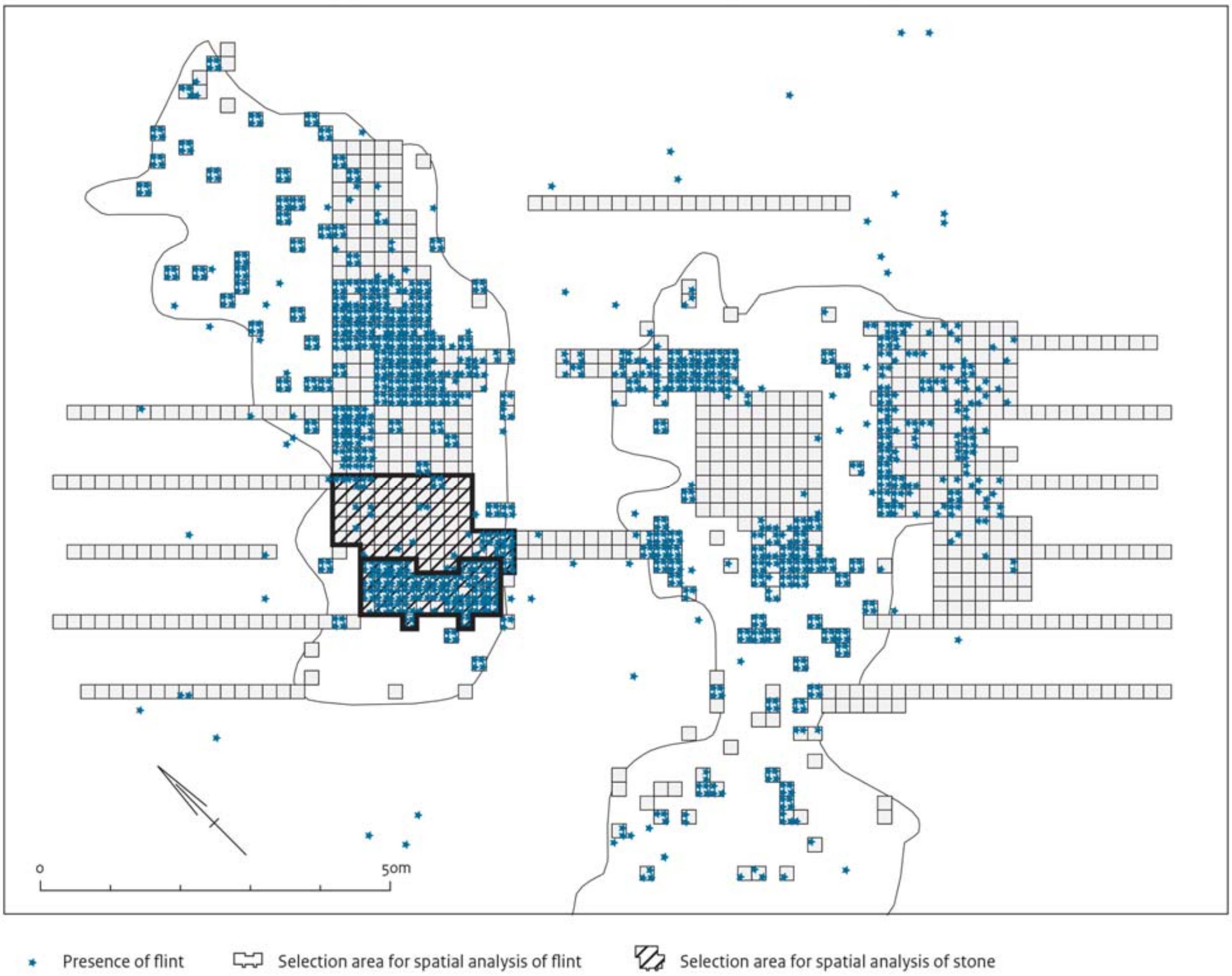

Figure 6.3. Overview of the flint distribution with the sampled area is indicated. After the spatial analysis it became evident that the flint sample was not representative. Consequently, the excavated area was treated as one entity. For the spatial analysis of the stone the sampled area is indicated (García-Díaz 2016: 86).

All the stone, bone and flint implements were described in terms of their morphological characteristics, according to the specifications of the Laboratory for Artefact Studies at Leiden University. In addition, use-wear analysis was performed on flint, bone and stone implements and amber ornaments. In the case of flint, during the classification of the artefacts 596 were considered suitable for use-wear analysis. The selection was performed by observing the pieces under a stereoscopic microscope at low magnifications or with the naked eye. As this number was too large to examine microscopically, a further selection was made. This selection was performed randomly and 23% of the implements (n=140) were selected for use-wear analysis, including a standard percentage for every tool type described (García-Díaz 2014a). The selection of stone implements for use-wear analysis was based on the presence of several macro-traces. A total of 69 tools were selected as suitable for use-wear analysis. Of these, a random sample of 53 (76.8%) was analysed (García-Díaz 2014a). 11 bone implements were available for analysis, although following a preliminary analysis five tools were considered unsuitable for use-wear analysis. Finally, Van Gijn (2014a) studied all amber and jet finds with traces of production under a stereomicroscope, while a metallographic microscope was used to examine the use-wear traces around the perforation and on the surface of the beads.

The preservation of the materials was not uniform. The rate of fragmentation of the flint artefacts was high, and only 15% of the implements were complete. Moreover, 32% of the flint implements displayed different types of physical alterations due to contact with fire, such as red spots, a glossy appearance, or a *craquelé* surface. In addition, almost 30% of the implements showed different kinds of patinas that altered the surface. In the case of the stone artefacts, the fragmentation was even higher, with less than 6% of the artefacts being listed as complete. Moreover, around 37% of the implements showed traces of contact with fire, and various physical alterations, such as red spots or the blackening or *craquelé* of the surface, were visible. The surface of the bone tools had been modified by several post-depositional alterations that complicated, or impeded, systematic analysis. Abrasion and erosion of the surface caused by contact with the sediment, partial fractures, and animal chewing were present on some of the tools. In addition, some of the bone implements were restored using glue and other chemical preservatives which covered the original surface of the tools. Consequently, the technological and functional traces on these implements could not be analysed. Finally, the level of preservation of amber ornaments varied. Although some of the amber finds showed alteration that impeded the observation of technological and use-wear traces (Van Gijn 2014), other amber finds showed a fresh surface.

6.3 Raw material procurement network

6.3.1 Flint

Flint was classified into three main groups based on the provenance of the raw material: northern flint, southern flint and flint with an undetermined origin. The raw material of 1.7% of the flint could not be identified due to a high degree of alteration of the surface caused by contact with fire. The largest group comprises flint with a northern origin (94.4%), which is mainly light grey, or black/dark grey with a fine or medium grain size. Light grey flint with bryozoan and northern translucent flint with bryozoan are also present. Southern flint is represented by only five fragments. One unmodified flake was Valkenburg flint, whose main characteristic is its coarse-grained structure. This flint is located in the Emael deposits of the Maastricht formation. Valkenburg flint is known to have been exploited since the LBK period, but its exploitation was at its height during the time of the Vlaardingen groups (de Grooth 2011). Two fragments have a Belgian origin (García-Díaz 2014a), two unmodified flakes were produced from undetermined southern flint, and the origin of 3.7% of the flint could not be determined.

6.3.2 Stone

Various raw materials are present in the stone assemblage from Zeewijk (Table 6.1). The most frequently occurring raw materials are igneous rocks, more specifically granite, but diorite and basalt also occur in small numbers. The second group is sedimentary rocks (32.1%), the majority of which are sandstone, though other sedimentary rocks such as limestone and conglomerates have also been identified. In addition, quartz (8.6%) and metamorphic rocks (0.3%) are also present. Finally, 0.5% of the assemblage could not be identified due to the poor preservation of the surface. As already stated, Zeewijk is located in an area where stones are not available in the immediate vicinity. The nearby beaches and the glacial till deposits at Wieringen, located at a distance of approximately 15km, were the source of volcanic, metamorphic and sedimentary rocks (Zandstra 1988; Houkes 2011) and the quartz. Therefore, the stones were collected and transported to the settlement, as at Keinsmerbrug (García-Díaz 2012) and Mienakker (García-Díaz 2013; Peeters 2001a).

	Igneous					Sedimentary						Metamorphic				Quartz	Unsp	Total(N)	Total(%)
	Granit	Diorite	Basalt	Gabbro	Unsp	Sandstone	Quartzitic sandstone	Loam	Conglomerate	Limestone	Unsp	Amphibiolite	Shale/slate	Others	Uns	Quartz	Unsp	Total	%
Flake	2	-	-	-	-	2	11	-	-	-	-	-	-	-	-	-	-	15	0.2
Handstone	1	1	-	-	1	-	10	-	-	-	1	-	-	-	-	-	-	14	12.0
Quern	5	1	-	-	1	-	14	-	-	-	-	-	-	-	-	-	-	21	0.3
Rubbing stone	-	1	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	6	0.08
Flaked stone	3	-	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	19	0.2
Adze	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	2	0.03
Hammer stone	2	3	-	-	-	-	13	-	-	-	-	-	-	-	1	1	1	21	0.3
Grinding stone	1	5	-	-	-	2	4	-	-	-	-	-	-	-	-	-	-	12	0.2
Polishing stone	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.01
Block	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.01
Unmod pebble	35	1	-	-	1	22	197	-	-	-	2	7	-	-	-	391	-	656	8.7
Unmod broken	3717	520	14	1	16	811	1154	-	15	2	10	11	9	1	-	257	30	2851	37.8
Unmod smooth	48	19	1		3	17	114	1	1	-	2	-	1	-	-	2	2	211	2.8
Total(N)	3815	551	15	1	22	854	1540	1	16	2	15	18	10	1	1	651	34	7547	100
Total(%)	50.5	7.3	0.2	0.01	0.3	11.3	20.4	0.01	0.2	0.03	0.2	0.2	0.1	0.01	0.01	8.6	0.5	100	-

Table 6.1. Stone artefacts versus raw material (Unsp:unspecidfied; Unmod:unmodified) (García-Díaz 2014: 105).

6.3.3 Worked bone

The analysis of the faunal remains used to produce the bone implements is coherent with the rest of the faunal assemblage. Although the species determination was not possible for some of the worked bones, there was a clear predominance of the use of mammals, mostly domestic species, to produce bone tools. The majority of the bones belonged to cattle and sheep/goats, and one dog tooth was used to produce a pendant (Table 6.2).

Square	Serial	Species	Element	Part	%	Weight(g)	Artefact type
Possible hide working							
7094	3	Medium mammal	Long bone	Dyaphysis	0-10	1	Needle
7094	1	Medium mammal	Long bone	Dyaphysis	0-10	2.7	Needle
String							
17501	1	Dog (Canis familiaris)	Tooth	Incisor	10-25	0.3	Pendant
7188	2	Sheep/goat (Ovis aries/Capra hircus)	Tibia	Dyaphysis	0-10	4.8	Bead
8834	1	Sheep/goat (Ovis aries/Capra hircus)	Tibia	Dyaphysis	0-10	2.2	Decorated bead
Undetermined							
16272	1	Sheep/goat (Ovis aries/Capra hircus)	Tibia	Proximal epiphysis/diaphysis	25-50	24	Awl
Not interpretable							
18802	1	Cattle (Bos taurus)	Costa	Corpus	0-10	4.5	`Ripple'
21363	1	Medium Mammal	Long bone	Indet.	0-10	1.5	Unknown
14984	1	Cattle (Bos taurus)	Costa	Corpus	10-25	28.7	`Ripple'
14973	1	Cattle (Bos taurus)	Costa	Corpus	0-10	5.4	`Ripple'

Table 6.2. Bone implements versus animal determination (Zeiler and Brinkhuizen 2014: 177).

6.3.4 Amber and jet

The amber used is most likely to be Baltic amber, washed ashore on the beaches of the northern Netherlands (Van Gijn 2014a). The surface of the nodules indicated that the amber was not as extensively weathered as the amber obtained from sediments. Although other source areas such as the boulder clay deposits located 8-10km north of the site could not be excluded, amber nodules were probably collected on the beaches situated along the nearby tidal creek (Van Gijn 2014a). The amber was mostly translucent, and its colour varied from yellow to brown (Van Gijn 2014a).

In contrast, only one piece of jet was recovered at Zeewijk, and its source area is unknown. A possible source is the area around Cap Blanc Nez, in the Pas de Calais area (Van Gijn 2014a). The jet was probably transported north by the tidal working of the Channel and the North Sea (Van Gijn 2014a).

6.4 Flint typology and technology

The flint assemblage was classified into five types of blanks: flakes; blades; cores; blocks and pebbles; and waste and splinters (Table 6.3). The flaking techniques were determined by the irregular size and the quality of the available raw material. Consequently, the flint implements are characterized by their small size, although a standardized size or shape has not been documented for flint implements. In addition, the assemblage displays a low level of preservation due to several alterations.

Primary classification	Number	%
Flake	3249	30.3
Blade	138	1.3
Core	413	3.8
Pebble	81	0.7
Block	41	0.3
Waste and Splinter	6216	58.1
Other	563	5.2
Total	10.701	100

Table 6.3. Overview of the tool types documented at Zeewijk (García-Díaz 2014: 88).

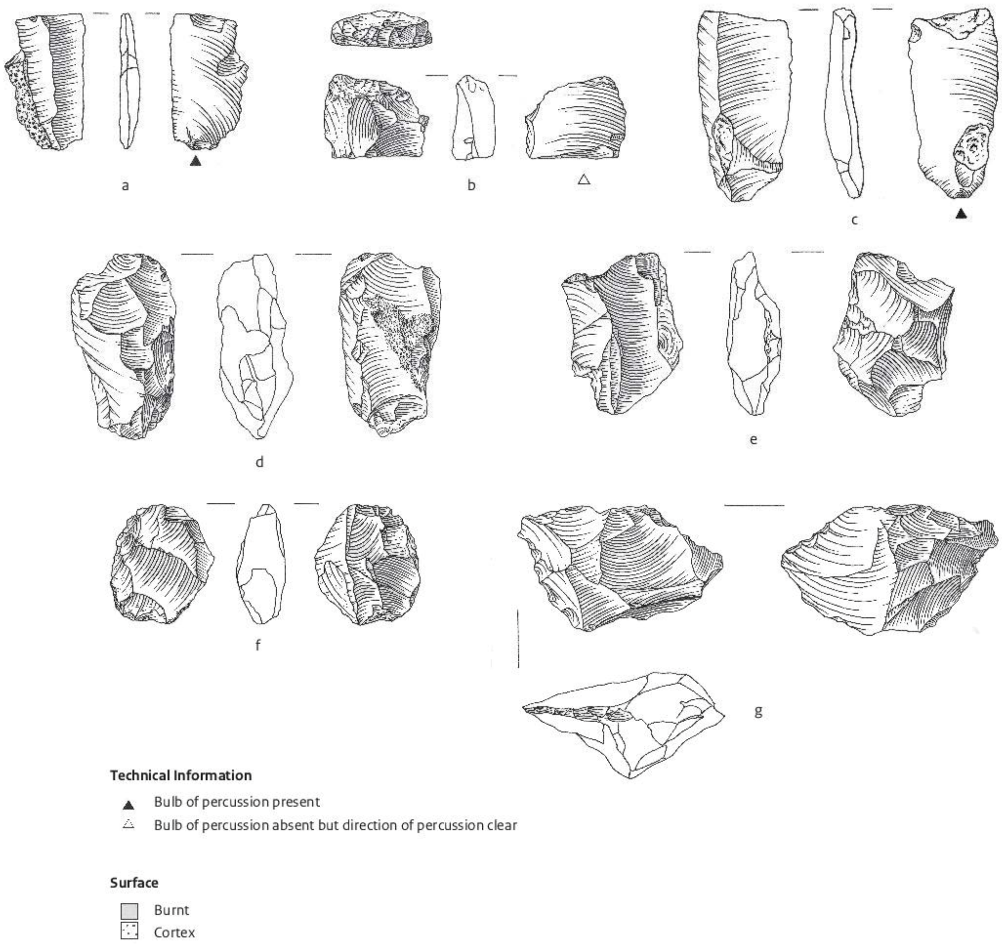

Figure 6.4 Selection of several flint implements: a.13114-1: blade; b. 15022-23: scraper; c.15022-1: blade; d. 14362-1:core; e.23342-4: core; f.23971-5: core; g.23983-3: core (scale 1:1) (García-Díaz 2014: 92).

6.4.1 Cores, pebbles and blocks

The knapping process was performed at the site, as inferred from the presence of 413 cores (Table 6.4), 317 of which are fragmented and 96 complete. The majority of the cores (91.5%; N=378) are related to flake production, although blade production has also been documented on six cores. Finally, the production traces on 29 cores were inconclusive, so it was not possible to distinguish whether they were exploited for flake or blade production. The small dimensions of the cores (Table 6.5) are directly related to the relatively small size of the implements. A combination of different technological approaches was applied at Zeewijk, with unidirectional flake and blade extraction being the main technique used. Three cores show more than two platforms. In addition, 4.3% (N=18) of the cores show technological traits that suggest their exploitation involved bipolar percussion. This technique is mainly linked with the exploitation of small flint pebbles, and was employed in other contemporaneous settlements such as Mienakker and Keinsmerbrug. At some domestic sites, like Mienakker, the use of this technique is also related to the production of specific tools, such as borers (García-Díaz 2013; Peeters 2001a; see Chapter 5). Finally, 15 finished cores were modified after use: 11 cores were retouched and four were converted into scrapers, taking advantage of their convex shape. The use of pebbles as cores is a common phenomenon at Late Neolithic settlements (García-Díaz 2012, 2013; Peeters 2001a). At Zeewijk, 81 pebbles have been documented. Around half the pebbles (N=40) are complete while the rest were used to extract flakes. Even though unidirectional hard percussion was the most frequently employed technique, at least one of the pebbles (13083-33) shows traits of bipolar flaking. The dimensions of the complete pebbles are varied (Table 6.5). Finally, along with the pebbles and the cores, 41 flint blocks were also found at the site.

Core type	Number	%
Flake	378	91.5
Blade	6	1.4
Unsure	29	7.0
Total	413	100

Table 6.4. Overview of the type of cores documented at Zeewijk (García-Díaz 2014: 91).

Main type	Complete (N)	Length (mm)				Width (mm)		Thickness (mm)		
		Min.	Max.	Average	Min.	Max.	Average	Min.	Max.	Average
Flake	95	1.6	40	18.3	1.3	40	13,6	0.6	29	7.1
Blade	1	1.4	1.5	1.6	1.7	1.8	1.9	0.9	0.1	0.9

Table 6.5. Metrical data for the cores (Min: minimal; Max:maximum) (García-Díaz 2014: 92).

6.4.2 Flakes

Tool production at Zeewijk was focused on flake production, as indicated by the fact that flakes represent 30.4% of the implements analysed (Table 6.3). Unmodified flakes are the most common type of implement in the archaeological assemblage: 89% of the flakes do not show any secondary modification (Table 6.6), although retouched flakes and scrapers were also present in the assemblage. Both types are characterized by their small metrical dimensions (Table 6.7). The technological characteristics of the scrapers and the retouched flakes indicate that the knapping was performed with a hard hammer. In addition, two retouched flakes and one scraper show evidence of bipolar flaking.

Flake type	Number	%
Unmod	2884	89
Borer	2	0.1
Arrowheads	2	0.1
Retouched	107	3.3
Scraper	130	4
Decortification flake	31	1
Axe	22	0.7
Rejuvenation/Preparation	61	1.8
Total	3239	100

Table 6.6. Overview of the types of flakes documented at Zeewijk (Unmod:unmodified)(García-Díaz 2014: 88).

Two borers and two arrowheads on flakes were recovered. One borer (23933-18) is complete (Table 6.5) and shows two elongated and rounded edges that were used for drilling. The second borer (15224-4) is a flake, probably obtained from a small rolled pebble, which shows a heavily rounded tip on the distal end. The entire surface of the two arrowheads is retouched. Both arrowheads are typologically similar to other Corded Ware points discovered in the domestic context of Aartswoud (Van Iterson Scholten 1981). The arrowheads have a '*pine tree*' shape, typical of the Corded Ware contexts (Beuker 2010), characterized by one tag being shorter than the barbs. In addition, the arrowheads display a bifacial retouched surface, confined mostly to the edges, without covering the central part of the arrowheads. Arrowheads are not very common in Neolithic domestic contexts in the Netherlands, although TRB and Vlaardingen domestic settlements have provided some examples (Beuker 2010; Raemaekers 2005; Van Gijn 2010a) and arrowheads have been documented in other CWC domestic contexts (Beuker 2010: 195; Drenth 2005; Van Gijn 2010a; Van Heeringen and Theunissen 2001).

Finally, the archaeological assemblage provided a small number of polished axe flakes (N=22; 0.7%), 29 core rejuvenation flakes and 62 decortification flakes. The technological characteristics of these types of flakes suggest that knapping was performed with a hard hammer (García-Díaz 2014a).

Main type	Complete (N)		Length (mm)			Width (mm)		Thickness (mm)		
		Min.	Max.	Average	Min.	Max.	Average	Min.	Max.	Average
Unmod	1126	0.6	59	11.8	0.4	44	11.1	0.1	18	2.7
Borer	1	21	21	21	16	16	16	6	6	6
Arrowhead	1	31	31	31	18	18	18	4	4	4
Retouched	54	1.9	42	18.8	1.8	44	17.7	0.4	12	4.8
Scraper	84	1.1	37	16	1.2	32	15.2	0.3	11	5.1
Decortification flake	18	2	42	21.45	1.2	52	17.8	0.5	10	5.7
Axe	7	9	35	17.8	11	34	20.8	2	9	4
Rejuvenation	6	16	31	21.5	4	23	12.8	2	6	3.6

Table 6.7. Metrical data for the flakes (Min: minimal; Max: maximum; Unmod: unmodified) (García-Díaz 2014: 88).

6.4.3 Blades

Blades (N=138) represent 1.3% of the implements analysed at Zeewijk. Even though most of the blades (N=107) are unmodified, some blades (N=15) show one retouched edge (Table 6.8). The retouch is smaller than 1mm in nine blades. Finally, two different types of retouch have been identified: border retouch and steep retouch. The technological characteristics of the retouched blades indicate the use of a hard hammerstone in the case of 14 artefacts. In one case (19154-3) the blade shows a pointed platform that could be related to the use of a softer hammer, even though the use of hard percussion is also possible in this case.

Blade type	N	%
Unmodified	107	77.5
Retouched	15	10.8
Rejuvenation blades	12	8.7
Decortification blades	4	2.9
Total	138	100

Table 6.8. Overview of the type of blades documented at Zeewijk (García-Díaz 2014: 90)

The level of fragmentation of the blades is very high, as just 33.3% of the implements are complete (Table 6.9). Even though most of the blades were produced during flake manufacturing, the presence of blade cores and the morphological characteristics of some implements suggest that blade production was performed at the site. On-site flint knapping is indicated by the presence of 12 rejuvenation blades and four decortification blades (Table 6.8). Blades displayed regular and parallel ridges and two straight edges which, from a functional point of view, might be suitable for some specific activities, such as cereal harvesting. Blade production is uncommon at corded Ware settlements, mainly due to the small dimensions of the raw material available.

Main type	Complete (N)		Length (mm)			Width (mm)			Thickness (mm)	
		Min.	Max.	Average	Min.	Max.	Average	Min.	Max.	Average
Unmod	37	1.5	43	19.1	0.5	20	8.2	0.2	8	2.8
Retouched	8	16	42	25.8	7	22	11.3	2	7	3.3
Rejuvenation	2	2.7	23	12.8	0.8	8	4.4	0.8	3	1.9

Table 6.9. Metrical data for the blades (Min: minimal; Max:maximum; Unmod: unmodified) (García-Díaz 2014: 90).

6.4.4 Waste and splinters

Unmodified waste and splinters are the more frequently represented type (58%) within the Zeewijk assemblage. However, some of the fragments were retouched and used as tools (Table 6.10), while production waste was used to produce six borers. In addition, waste fragments were retouched and transformed into scrapers in 24 cases. Two of the scrapers (15022-23 and 25251-22) are double, while 12 are short-ended scrapers, four are long-ended scrapers and three have been classified as side scrapers. Finally, 33 flint fragments and four splinters were retouched on one of their edges (García-Díaz 2014a).

Waste and splinters	Number	Total
Unmodified	6149	98.9
Borer	6	0.1
Scraper	24	0.4
Retouched	37	0.6
Total	6216	100

Table 6.10. Overview of the type of waste and splinters documented at Zeewijk (García-Díaz 2014: 94).

6.4.5 Others

Some of the flint remains show a high degree of post-depositional alteration such as patina or burning traits, making typological classification impossible. This is the case with 563 artefacts that have been classified under the category '*type unsure*'. Most of them (N=490) are poorly preserved, and the technological traits and even the raw material are difficult or impossible to recognize. However, 30 of them could have been part of a scraper and 36 show possible retouch (García-Díaz 2014a).

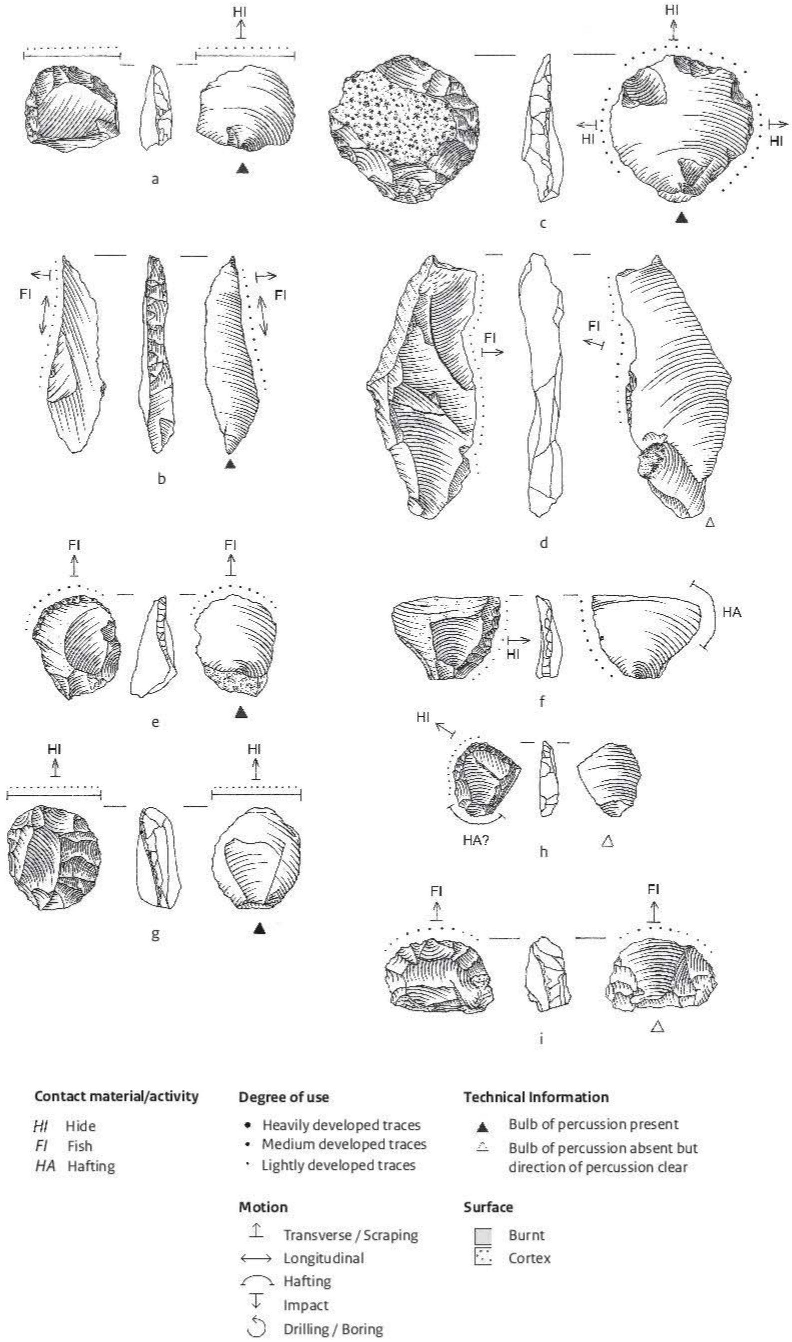

Figure 6.5. Selection of flint artefacts showing use-wear traces related to animal processing: a.22-1:scraper; b. 24241-4: retouched blade; c. 13061-10: scraper; d.13062-3: flake; e.13062-4: scraper; f.13721-6: scraper; g.14372-11: scraper;h.15022-21: scraper; i.15032-2: scraper (scale 1:1) (García-Díaz 2014: 93).

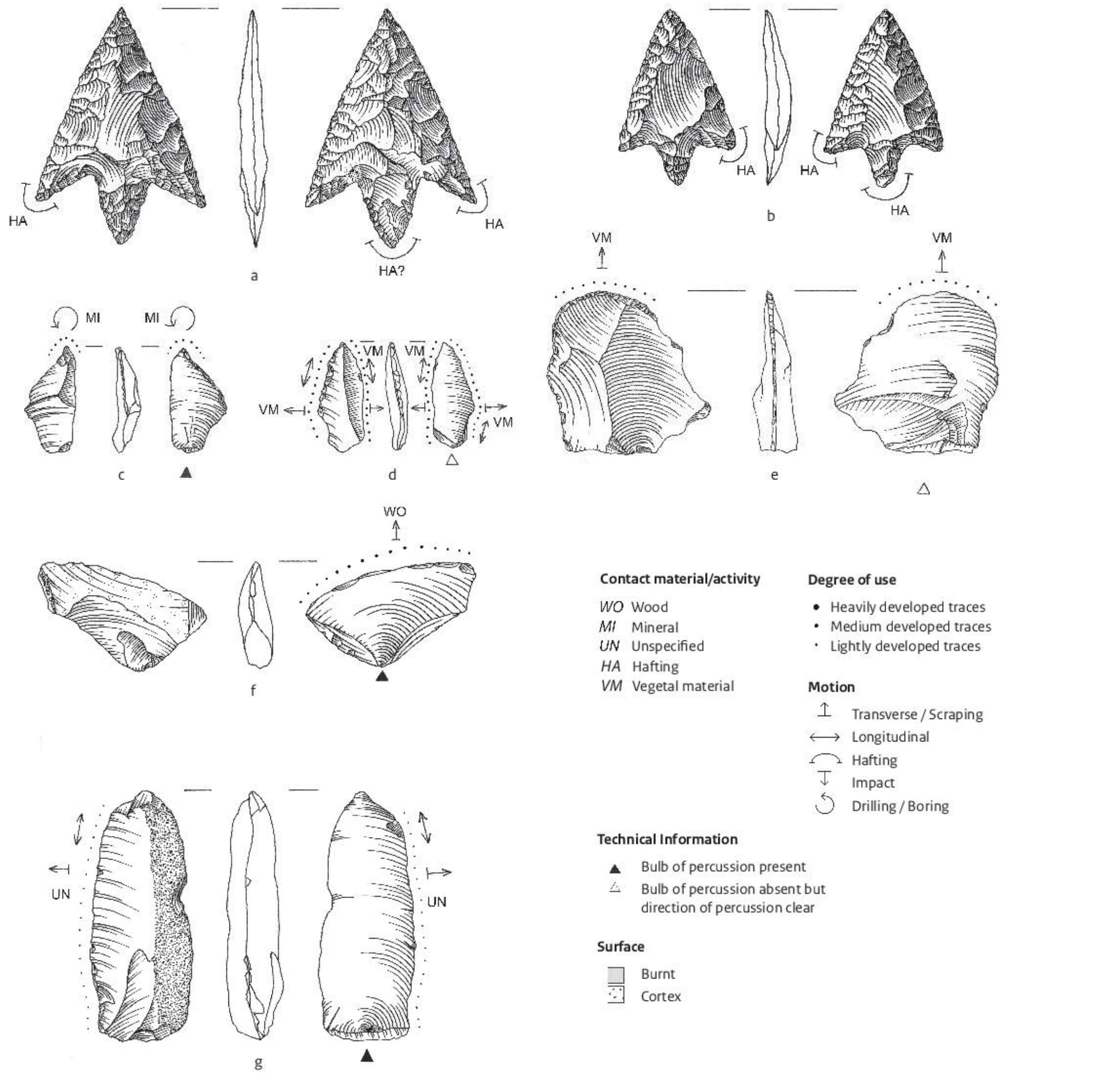

Figure 6.6. Selection of flint artefacts showing use-wear traces related to the working of different materials: a.7188-1: arrowhead; b. 27821-82: arrowhead; c.13083-30: borer; d.13091-7: retouched flake; e.13721-42: retouched flake; f.13083-1: flake; g. 30951-1: blade (scale 1:1) (García-Díaz 2014: 95).

6.5 The use of flint implements

During the classification of the artefacts, 596 were considered suitable for use-wear analysis. As this number was too large to examine microscopically a further selection of 140 implements was made (García-Díaz 2014a). After the analysis, 45 tools (28%) showed no use-wear traces and 89 edges of 116 tools showed use-wear traces. Finally, 30 edges of 34 tools were not interpretable.

	Flake	Blade	Core	Waste/splinter	Uns	Total(N)	Total (%)
Unmod	172	37	11	54	-	274	45.97
Retouched	69	12	11	23	25	140	23.5
Scraper	103	-	3	18	24	148	24.8
Point	2	-	-	-	-	2	0.3
Borer	2	-	-	6	6	14	2.3
Axe fragment	-	-	-	1	-	1	0.1
Core preparation	3	-	-	-	-	3	0.5
Core rejuvenation	-	2	-	-	-	2	0.3
Type unknown	-	-	-	-	12	12	2.0
Total(N)	351	51	25	102	67	596	100

Table 6.11. Overview of the flint tool types with possible use-wear documented (Unmod: unmodified; Uns: unsure)(García-Díaz 2014: 94).

Tool type		Traces	No Traces	Not interpretable	Total
Blade	Unmodified	7	8	8	23
Blade	Retouched	3	-	1	4
Core	Blade core	-	1	-	1
Core	Flakec	-	2	-	2
Core	Scraper	1	-	-	1
Flake	Unmod	9	18	3	30
Flake	Point	2	-	-	2
Flake	Retouched	9	2	2	13
Flake	Scraper	19	1	7	27
Waste	Unmodified	5	10	1	16
Waste	Retouched	3	1	2	6
Pebble	Waste	-	1	-	1
Waste	Scraper	2	-	2	4
Waste	Borer	1	1	-	2
Unspecified	Unmodified	-	-	2	2
Unspecified	Borer	1	-	-	1
Unspecified	Retouched	-	-	1	1
Unspecified	Scraper	2	-	1	3
Unspecified	Retouched/axe fragment	1	-	-	1
Total (N)		65	45	30	140
Total (%)		46.3	32.1	21.4	100

Table 6.12. Overview of the flint tool types on which use-wear analysis was performed (Unmod: unmodified)(García-Díaz 2014: 96).

6.5.1 Animal material

Use-wear traces from contact with animal material are the most frequently encountered. Around 63% of the edges show use-wear traces related to working hide, bone, meat or fish, or unspecified animal resources (Table 6.14).

Hide

A total of 31 tools, mostly scrapers and retouched tools, have been used to scrape hide (Table 6.13). Use-wear traces are characterised by the rounding of the used edge and the formation of a matt, half-linked polish with a pitted topography (Keely 1980; Mansur-Frachomme 1983). Tools were probably selected taking into account the edge morphology, that usually have an obtuse angle, higher than 40 degrees (García-Díaz 2014a). Although in general the implements show only one used edge, in some cases tools show more than one used area: one tool (13061-10) has three used areas. In this case, a matt polish was developed on both the ventral and the dorsal surface of the edges, with poorly rounding edges probably due to the frequent resharpening of the implement; in three other cases (15023-2, 15014-19 and 13073-13) the scrapers have two used areas (Figure 6.6). In general, and although traces were clearly recognised, the development of hide working traces was low, so it was not possible to determine if the traces were related to an specific step of hide production (García-Díaz 2014a).

Bone

One edge of an unmodified flake (14332-1) was used to work bone. The flake is complete and the right edge of the tool, with an angle of 40 degrees, was used to scrape the bone. The surface of the tool has been altered by post-depositional processes and it is difficult to determine whether bone was the only material worked or whether the traces are the result of butchering activities. The use-wear is mostly developed on the dorsal face of the tool. A thin line of very bright, smooth polish, as described by several authors (Keely 1980; Vaughan 1985) for scraping bone activities polish is visible.

Butchering traces

One edge of an unmodified flake (13081-5) displays use-wear related to different animal materials. Isolated points of a bright and smooth hard animal material polish are present on the areas close to the edge, while a greasy polish resembling experimental polish from working a softer animal material, such as meat, is present on the inner parts of the edge. This well-developed use-wear has a longitudinal motion. The combination and distribution of the use-wear suggests the tool was used for butchering, as suggesting by several authors (Odell 1980; Vaughan 1985; Van Gijn 1990) (Table 6.14).

Fish processing

At Zeewijk, seven edges show use-wear related to fish processing (Table 6.13, 6.14) (Figure 6.7), which is characterised by a combination of wear attributes formed by the contact with different kind of materials (soft, medium and hard materials) (Clemente Conte and García-Díaz 2008; García-Díaz 2009; García-Díaz and Clemente Conte 2008). Two edges show a longitudinal motion, and in five cases the use-wear developed suggests use of the tools for scraping scales and fish skin. During the scaling process the active edge of the tool has to be cleaned on a regular basis. In fact, ethnographic observations in Mali show that this work is sometimes performed in or close to the waters of the Niger River to prevent the edges from blunting (Clemente Conte *personal observation*). The scales remaining on the edges protect the edge from being polished by use, generating a pitted texture (García-Díaz 2009; García-Díaz and Clemente Conte 2008). Besides a greasy and dull polish, medium and big size edge damage evenly distributed along the edge and extensive edge rounding are also visible (García-Díaz 2009). Finally, one tool (15032-2) displays isolated spots of a bright, smooth and well delimitated polish caused by a harder material, probably fish bone. The distribution of the use-wear and the edge damage indicate that the tool was used to clean fish. Use-wear related to fish processing has rarely been definitively identified by researchers and has only occasionally been the subject of investigation. Use-wear traces from fish processing have been discussed in several publications (Anderson 1981; Briels 2004; Clemente Conte 1997; Clemente Conte and García-Díaz 2008; García-Díaz 2009; García-Díaz and Clemente Conte 2008; Gutiérrez Sáez 1990; Iovino 2002; Moss 1983; Plisson 1985; Semenov 1981[1957]; Van Gijn 1986, 1990). In the Netherlands, fish polish has been recognized in Mesolithic (Niekus *et al.* 2014) and Neolithic contexts (Houkes and Verbaas *in press;* Van Gijn *et al.* 2001a*;* Van Gijn *et al.* 2001b), but always in very small numbers. In the case of the CWC, Zeewijk is the first site showing use-wear traces related to fish processing, as Keinsmerbrug and Mienakker (García-Díaz 2012, 2013) did not yield any tools with use-wear related to fish processing.

Unspecified animal resources

Ten edges were used to work unspecified animal resources (Table 6.13, 6.14). Two scrapers (15033-14 and 15021-14) display three used areas where the edges were used to scrape a medium-soft animal material. In addition, one of the scrapers (15033-14) displays use-wear traces indicating work with a harder material, although post-depositional alterations prevent a more detailed interpretation. One retouched flake (13064-1) shows use-wear on two edges, from contact with both a medium-soft and an abrasive animal material. One edge displays isolated spots of polish from contact with a harder animal material worked with both a transversal and a longitudinal motion. The other edge shows polish from an abrasive material worked with a longitudinal motion. However, in neither case is the polish well developed and the worked material could not be determined. Finally, one retouched blade (13083-22) and one retouched fragment (14392-14) each display one used edge. The blade shows a slightly developed polish from contact with an unspecified material and an edge that was used in a transversal motion. The used edge was rounded and scarred by edge damage. The retouched fragment has an altered surface due to burning. Use-wear shows a transversal motion and poorly developed use-wear traces, as a result of which the material could not be identified. However, the distribution of the polish inside the retouch suggests that the edge was used to work a soft to medium-hard animal material.

	Motion										
Tool type (edges)	Boring/piercing	Shooting	Hafting	Longitudinal/ sawing	Longitudinal unspecific	Transversal/longitudinal	Transversal/ scraping	Transversal/ unspecific	Unsure	Not interpretable	Total
Blade unmodified	-	-	1	-	1	4	2	-	1	1	10
Borer	2	-	-	-	-	-	-	-	-	-	2
Flake unmodified	-	-	-	1	-	-	6	-	2	1	10
Point	-	1	1	-	-	-	-	-	-	-	2
Retouched/Axe fragment	-	-		-	-	-	-	1	-	-	1
Retouched blade	-	-	1	-	-	1	1	-	-	1	4
Retouched flake	-	-	1	-	1	3	7	-	-	1	13
Retouched waste	-	-	-	-	-	-	4	-	-	-	4
Scraper long end	-	-	-	-	-	-	4	1	-	-	5
Scraper short end	-	-	-	-	-	-	14	1	1	-	16
Scraper side	-	-	1	-	-	-	10	-	-	-	11
Scraper type unknown	-	-	1	-	-	-	3	-	-	-	4
Waste unmodified	-	-	1	-	-	1	3	-	2	-	7
Total	2	1	7	1	2	9	54	3	6	4	89

Table 6.13. Flint use-wear: tool type versus motion (García-Díaz 2014: 102).

		Bone	Fish	Dry hide	Hide unsp	Meat/bone	Medium animal unsp	Amber	Hard anorg unsp	Medium anorg unsp	Anorg unsp	Medium plant unsp	Hard wood	Wood unsp	Unsp	Unsp fricglos	Hard unsp	Medium unsp	Soft unsp	Hide/wood	Total	%
Blade	Unmod	-	1		2	-	-	-	-	1	1	-	2	-	1	-	1	1	-	-	10	11.2
Blade	Retouched	-	1	-	-	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-	4	4.5
Flake	Unmod	1	2		3	1	-	-	-	-	-	-	1	-	1	-	-	1	-	-	10	11.2
Flake	Point	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1		-	-	-	2	2.2
Flake	Retouched	-	-	-	6	-	2	-	-	-	-	2	-	1	1	-	1	-	-	-	13	14.6
Flake	Scraper	-	3	-	17	-	6	-	1	-	1	-	-	-	1	-	-	-	-	2	31	34.8
Core	Scraper	-	-	-	1	-		-	-	-	-	-	-	-	-	-	-		-	-	1	1.1
Waste	Retouched	-	-	-	2	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	4	4.5
Waste	Scraper	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	2	2.2
Waste	Unmod	-	-	1	2	-	-	-		-	1	-	-	-	-	-	1	2	-	-	7	7.8
Unsp	Retouched/axe fragment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1.1
Unsp	Scraper	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2.2
Uns	Borer	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	2	2,2
																						2.2
Total		1	7	1	36	1	10	1	1	1	3	3	3	1	7	1	4	5	1	2	89	100
%		1.1	7.9	1.1	40.4	1.1	11.2	1.1	1.1	1.1	3.4	3.4	3.4	1.1	7.9	1.1	4.5	5.6	1.1	2.2	100	

Table 6.14. Flint use-wear: tool type versus contact material (Unsp: unspecified; Unsp fricglos: Unspecified friction gloss)(García-Díaz 2014: 102).

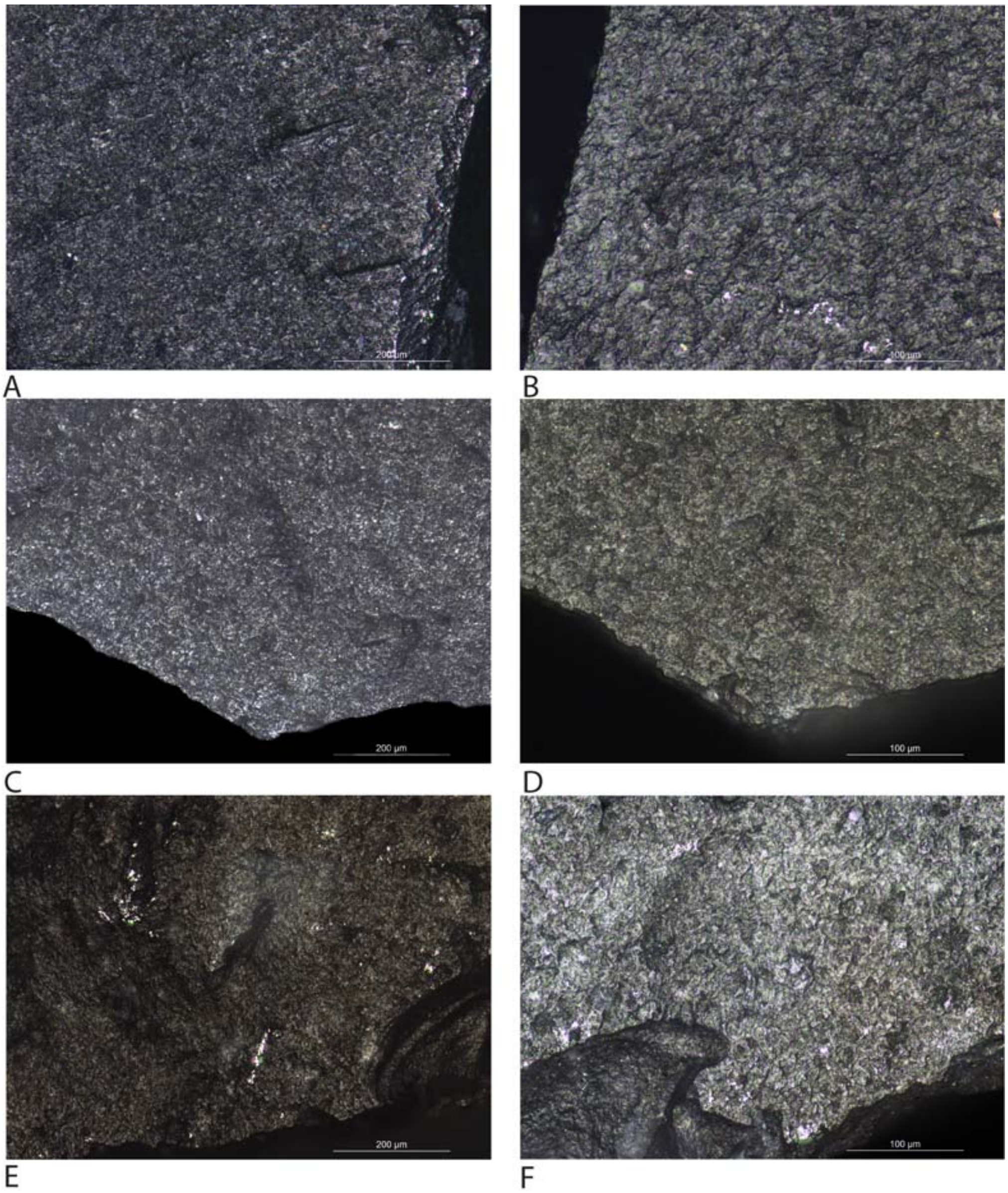

Figure 6.7. Hide scraping was the most commonly represented activity at the settlement. Hide scraping was mostly performed using scrapers. Images A-F: use-wear traces related to processing hide documented on three scrapers. A and B (10x and 20x)(13061-10); C, D and E (10x, 20x and 10x) (13721-6) andF (20x)(22-1) (García-Díaz 2014: 97).

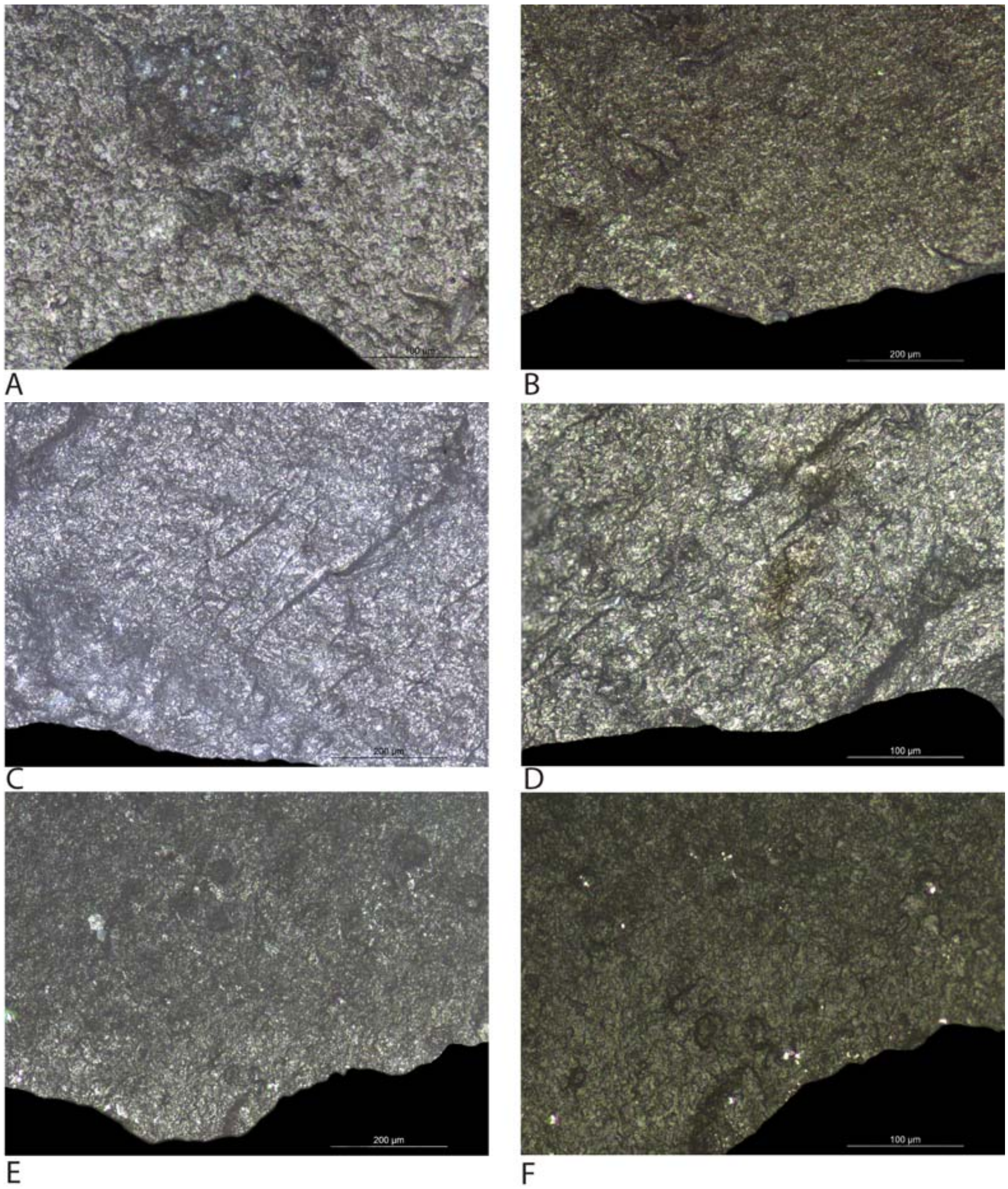

Figure 6.8. Fish processing was documented on seven edges during the analysis of the Zeewijk flint implements. Zeewijk is the first CWC context where fish processing has been documented through use-wear analysis. The polish developed on these tools has a rough and greasy aspect and it is extremely invasive. Images A-F: use-wear traces related to fish processing, probably scaling, in A and B (20x and 10x)(24241-4); C and D (20x and 10x) (13062-4); E and F (10x and 20x) (13062-3) (García-Díaz 2014: 98).

6.5.2 Plant material

Wood

Three tools were used to work wood: a blade, an unmodified flake and a retouched flake (Table 6.14). Both used edges of the blade (13091-16) show a very well developed, smooth and dull polish, largely in the medial part of the edges. The polish is well defined and has developed mostly on the ventral face. The polish is slightly invasive and shows a combination of transversal and longitudinal motion. The distribution of the wear traces points to the work of a medium-hard wood.

The unmodified flake (13083-1) also shows use-wear traces related to scraping a medium-hard wood. The angle of the used edge is 45 degrees. The polish has developed mostly on the distal part of the edge and shows a clear transversal directionality. The smooth and dull polish is very well developed even though it has been slightly altered by a glossy patina.

Finally, the retouched flake (13721-42) displays use-wear traces related to scraping a medium-hard wood. The used edge has an angle of 55 degrees. Both faces of the used edge show well-developed use-wear traces. However, on the dorsal face the polish has developed mainly on the higher areas of the retouch, while on the ventral edge the polish is concentrated along the edge (Figure 6.9).

Unspecified plant material

Three edges are related to the processing of an undetermined plant material. One retouched flake (13091-7) displays two edges with use-wear similar to that observed after working a medium-hard plant material. Both edges show a very bright, smooth, half-linked polish, with a pitted morphology, showing few thin striations. The polish is well developed along the edges and inside the retouch. One of the used edges has an angle of 50 degrees while the other edge displays an angle of 40 degrees. The use-wear on both edges shows a clear combination of longitudinal and transversal motion. Finally, one retouched flint fragment (13053-13) displays use-wear traces related to an undetermined medium-soft vegetal material. Polish can be classified as bright, is half-linked, with a smooth texture developed perpendicular to edge, suggestion that the motion related to the work is clearly transversal. The retouched flint fragment has another edge used to scrape hide.

6.5.3 Inorganic material

Amber

One borer (13083-30) displayed traces that could reflect contact with amber. The use-wear is characterized by a rounding of the tip and the development of a bright polish. The polish has developed principally on the very tip and the lateral edges of the borer, and is not well delimited. This type of polish strongly resembles the polish obtained experimentally from drilling amber (García-Díaz 2013; Chapter 3). Similar borers have been found at other contemporaneous sites (Bulten 2001; García-Díaz 2013;

Peeters 2001a, 2001b; Piena and Drenth 2001) and their actual role in amber bead production has been demonstrated at the domestic site of Mienakker (García-Díaz 2013). Numerous amber beads have been found at Zeewijk, along with a substantial quantity of manufacturing waste. The presence of the borer provides further proof of the local production of the beads at the site, as at Mienakker. The borer is small (17mm x 10mm x 4mm) and displays one rounded edge with a very well-developed polish (Figure 6.9).

Undetermined inorganic material

One blade (23453-2) and one waste fragment (13052-1) display use-wear traces related to an undetermined mineral material. The blade displays isolated points of polish from a medium-hard material without a clear directionality. The polish has developed near the edge. The waste fragment shows a very well-developed polish on one edge, with both a longitudinal and a transversal directionality.

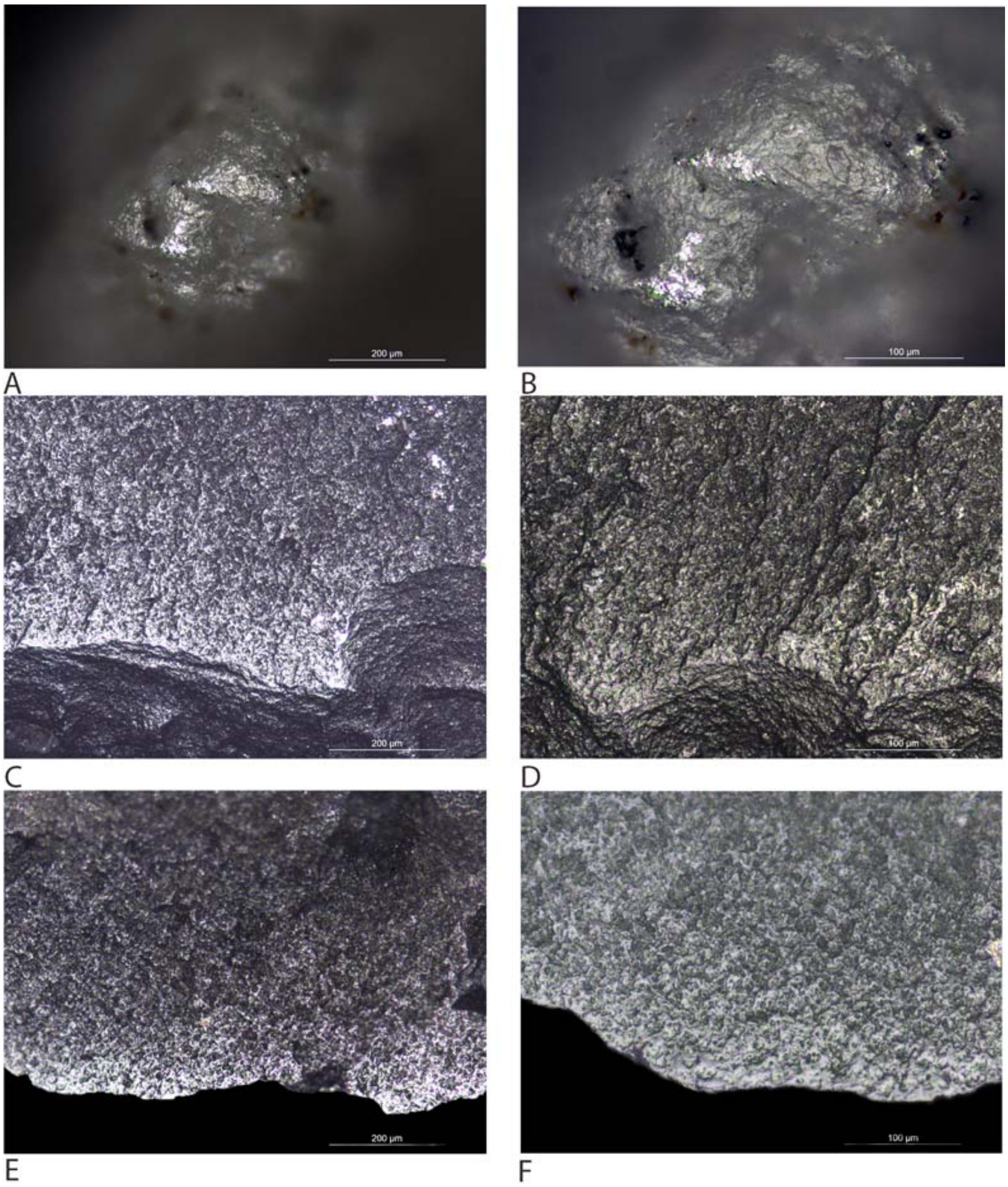

Figure 6.9. Amber beads were probably produced at the site, as suggested by the use-wear traces documented on one flint borer (13083-30), A and B (10x and 20x); Wood and other unspecific plant resources were also worked with flint artefacts, probably to produce other implements like wooden tools, clothes and weapons. The image shows use-wear traces related to scraping wood observed in an unmodified flake (13083-1), C and D (10x and 20x), and a retouched flake (13721-42), E and F (10x and20x) (García-Díaz 2014: 100).

6.5.4 Hafting traces

Hafting traces are not always easy to distinguish. Nevertheless, seven tools display traces of hafting (Table 6.13). One blade (13722-4) displays use-wear on the left lateral edge. On the dorsal face of the edge, isolated points of mineral-like polish are visible inside the edge damage, similar to those described by other authors and interpreted as hafting traces (Rots 2002, 2008; Rots and Vermeersch 2004). Two scrapers (13721-6 and 15022-21) display isolated points of polish from contact with a hard material. For the most part the polish has developed close to the edge and is combined in both cases with a slight rounding of the edge. One of the arrowheads (28821-82) shows traces of hafting, consisting of a bright line of mineral-like polish on the tang and one of the barbs, indicating that the projectile point was hafted (Figure 6.10). No hafting residues were detected on the surface of this arrowhead.

6.5.5 Undetermined material

Eighteen edges display use-wear traces which could not be interpreted in terms of contact material (Table 6.13; Table 6.14). In several cases the use-wear is not developed enough to allow a more detailed inference, while in other cases the tools show surface alterations that limit the interpretation of the use-wear. One edge of a retouched axe fragment (27081-4) was used to scrape an undetermined soft material, five edges show traces interpreted as the result of working medium-soft materials and four edges show traces related to hard materials (García-Díaz 2014a). Finally, one arrowhead (7188-1) shows use-wear traces which could not be interpreted. The tips of the barbs and the tang display slight rounding. Grounded barbs are usually seen on Late Neolithic arrowheads (Van Gijn 2010a). Unfortunately, the entire surface is abraded and it is not possible to determine if the rounding was produced by the use or the hafting of the arrowhead.

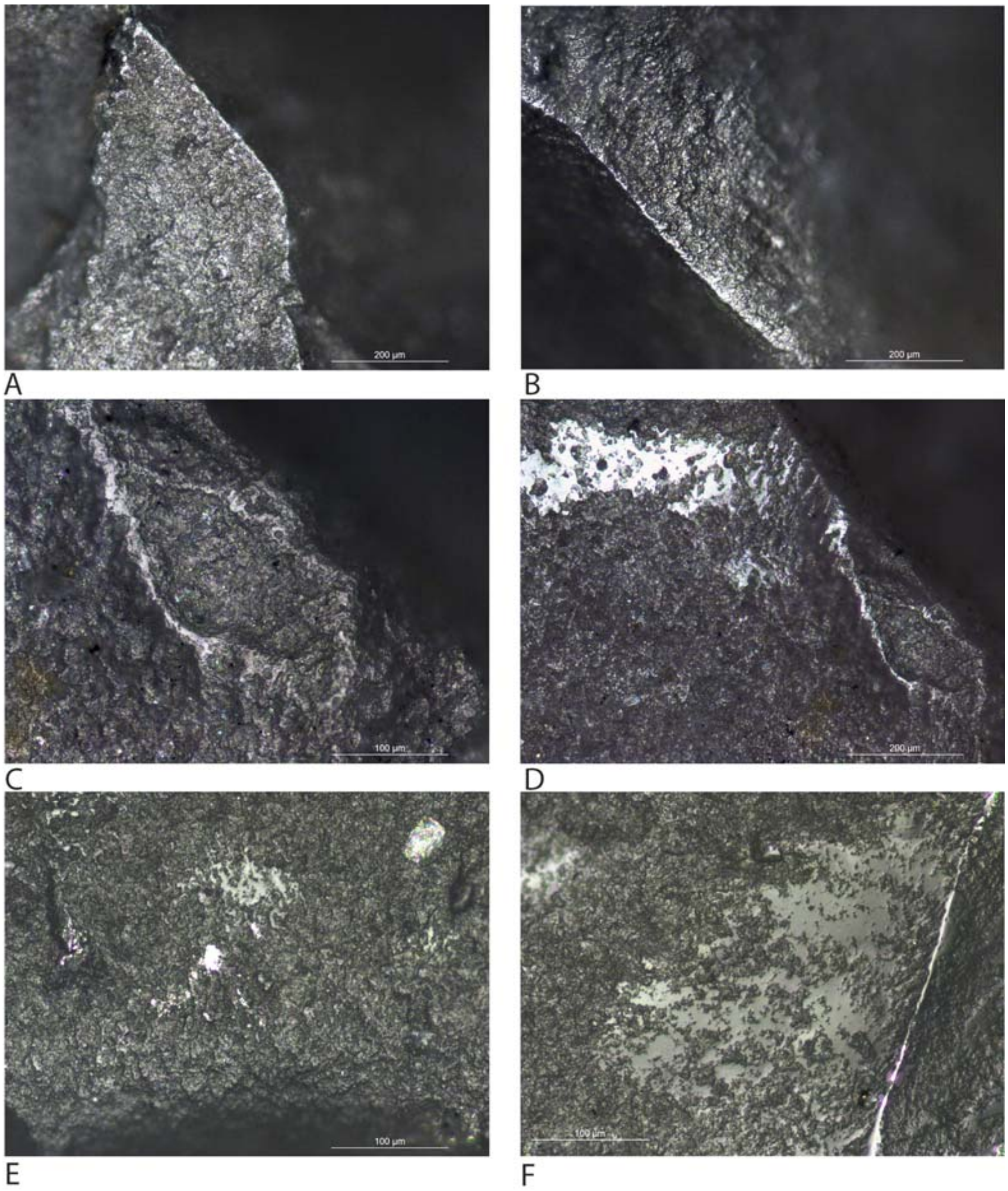

Figure 6.10. Hafting traces were documented on seven tools. A-D: two of the implements displaying hafting traces were the 'pine tree'-shaped arrowheads (10x, 10x and 20x) (7188-1a and 27821-82). Even though no clear traces of use were documented during analysis, hafting traces were documented on the barbs and the tag of the arrowheads. In addition, other tools, such as flakes and scrapers, were also hafted and used. E and F: hafting traces documented on a scraper (10x and 20x) (13721-6) (García-Díaz 2014: 101).

6.6 Stone technology and typology

Stone implements have been grouped in 10 categories, with querns and grinding stones being the most frequently occurring tool types at the site (Table 6.1). The majority of the stones were not modified. In most cases the implements were used taking advantage of their natural shape. However, grinding stones and querns show technological traces. Volcanic and sedimentary rocks were selected to produce grinding tools and querns, whereas sandstone pebbles were mostly selected for use as hammer stones.

Grinding tools

Several grinding stones (0.19%; N=15) were encountered, of which nine were made of sedimentary and six of volcanic rock. Only four of the implements are complete, and their dimensions are shown in Table 6.15. Even though the majority of the implements display no traces of manufacture, four were flaked to obtain the desired shape or to revive the used surface. Similar patterns have been observed in the manufacture of the grinding tools, querns and other similar archaeological tools (García-Díaz 2013).

Cereal processing tools

Cereal processing tools are easily recognizable because at least one of the faces shows a smooth surface (Figure 6.10). Both parts of the tool were used together and the use-wear traces on the handstone generally match those on the quern. Both handstones (0.18%; N=14) and querns (0.23%; N=21) are represented in the assemblage. The handstones were made of sandstone (N=11) and volcanic rock (N=3). The level of fragmentation is high, with only five complete specimens present (Table 6.15). Three handstones display technological traces on their surface in the form of flake negatives. However, the artefacts were probably selected on the basis of their natural morphology. Querns were made of sedimentary (14) and volcanic (7) rocks. Only two implements (14344-9 and 14362-6) are complete (Table 14). Technological traits have been found on the surface of twelve implements. The artefacts were flaked to revive the surface, or to obtain the desired shape. Similar technological behaviour has been documented in the Netherlands in relation to several querns from different Neolithic contexts (García-Díaz 2013; Verbaas 2005; Verbaas and Van Gijn 2008).

Main type	Complete (N)		Length (mm)			Width (mm)			Thickness (mm)	
		Min.	Max.	Average	Min.	Max.	Average	Min.	Max.	Average
Flake	5	17	38	25.4	2	7	4	10	35	18.2
Flaked stone	1	11	11	11	7	7	7	8	8	8
Handstone	5	54	66	61.2	32	70	55.4	52	66	58.8
Quern	2	180	190	185	85	90	87.5	134	190	162
Grinding stone	4	46	121	80.8	31	36	33.8	44	96	67.5
Hammer stone	10	52	72	62.9	29	51	40.4	39	65	51.1
Pestle	1	76	76	76	71	71	71	74	74	74
Unmod (pebble)	199	3	27	10.2	2	13	5	2	20	7.5
Unmod (smosurf)	1	62	62	62	36	36	36	44	44	44
Polishing stone	1	46	46	46	9	9	9	26	26	26

Table 6.15. Metrical data for the stone implements (Min: minimal; Max:maximum; unmod: unmodified; Smosurf: smooth surface) (García-Díaz 2014: 107).

Pestles

Pestles are characterized by a combination of hammering and grinding/polishing traces. The three implements found at Zeewijk have been considered as possible pestles due to their morphology and the disposition of the macroscopically visible traces. Two of the three implements, made of sandstone, are broken (Table 6.15). One of the broken implements (13683-4) displays flake negatives on the surface related to manufacture. Finally, the third artefact was manufactured from diorite. No technological traces have been found. Pestles were probably selected on the basis of their natural form and only modified if the edge needed to be revived.

Polishing stones

One implement (17552-6) has been classified as a polishing stone. This artefact displays an extremely rounded, flat surface. It is made of fine-grained quartzitic sandstone and it is complete (Table 6.15).

Hammer stones

A small number of hammer stones (0.27%; N=21) has been found. Sedimentary rocks (62%; N=13) were the most frequently used raw material for hammer stones, but some were made of volcanic rocks (23.8%; N=5), quartz (4.7%; N=1), metamorphic rocks (4.7%; N=1) or undetermined material (4.7%; N=1). The hammer stones do not show any technological modification. The classification of the implements has been based on the presence of hammering and pounding traces on the surface. Even though most of the hammer stones show only one surface with pounding traces, several (N=5) display percussion traces on more than one surface. Only ten hammer stones are complete (Table 6.15).

Flaked stones

Several stones (N=19) display flake negatives on the surface. Only one of the implements is complete (23224-1) (Table 6.15). The majority of the implements are fragments of sandstone, though three of the artefacts were made of granite.

Figure 6.11. Three querns recovered from Zeewijk displaying use-wear traces related to cereal processing) (García-Díaz 2014: 107).

Flakes

A small number of stone flakes (N=15) were found at Zeewijk. Only five implements are complete. The dimensions of the complete flakes are small (Table 6.15). The majority of the flakes were made of sandstone (N=13), but two granite flakes have also been found at the site.

Axe fragments

Two fragments of polished axes have been retrieved. The first fragment (13111-5) is poorly preserved due to severe post-depositional alterations and burning, and the raw material could not be identified. However, the second fragment (27821-2) is from an axe made of fine-grained quartzitic sandstone.

Blocks

One unmodified volcanic block has been found at Zeewijk. The block is altered due to burning and post-depositional alterations, such as abrasion. The presence of the block reinforces the idea of tool production at the site, as in the case of flint tools, and at other contemporaneous archaeological sites.

Unmodified stones

Most of the stones (98.5%) found at Zeewijk do not show any technological modification of the surface. Three categories have been used to classify the unmodified stones: small pebbles (8.7%), broken stones (87%) and stones with a smooth surface (2.7%) suitable to have been used as a tool (Table 6.16).

6.7 Stone use

The selection of stone implements for use-wear analysis was based on the presence of several macroscopically visible traces. These included: a) a heavy edge rounding, b) a flat or polished surface, c) macroscopically visible striations, d) noticeable edge damage and e) the presence of pounding traces on the surface. A total of 69 tools were selected as suitable for use-wear analysis. Of these, a random sample of 53 (76.8%) were analysed. The selection comprised one axe, four flaked stones, two hammer stones, seven cereal processing tools (two handstones and five querns) and 39 unmodified stones (one broken and 38 with a smooth surface). Upon microscopic analysis, 21 tools displayed no use-wear traces, ten tools were classified as not interpretable and 22 tools showed use-wear traces on 29 surfaces (Table 6.16).

6.7.1 Animal material

One unmodified stone with a smooth surface displays some polished areas on the dorsal surface along with a slight rounding of the edge. The polish is rough, bright and well developed, and its distribution and the rounding of the grain edges suggests that it was produced by contact with hide. Similar traces have been interpreted by other authors (Hamon 2008; Verbaas 2005). The motion of the polish points to the use of the implement to clean or process hide. Ethnographic studies have documented the use of stones to work hide: at Sahara (Morocco), stones were used to scrape the hide during the process of cleaning, and the dry, cleaned skins were also scraped with a stone to soften the leather (Ibáñez Estévez *et al*. 2002: 89).

6.7.2 Plant resources

Use-wear traces related to vegetal resources are displayed on 26 edges, located on 20 tools. The worked material could not be identified in six cases. Traces from siliceous plants (N=19) were frequently seen and one edge was used to work wood.

Siliceous plants

Use-wear related to cereals has been recorded on 19 surfaces of cereal processing tools and unmodified stones (Table 6.16) (Figure 6.12). Traces from cereal processing have been described as consisting on a combination of levelled grains (Adams *et al.* 2006; Dubreuil and Savage 2014; Hamon 2008; Verbaas 2005) and a '*granular polish*' distributed over the surface in `*small linked spots*' (Verbaas and Van Gijn 2008: 196). The polish is usually concentrated on the higher parts of the surface. However, prolonged use of the tool could generate more extensive and linked development of the traces. The formation of the polish occurs firstly in the shape of small isolated spots of bright polish, which develop into more linked and compacted spots after sustained use (Verbaas and Van Gijn 2008).

Ten worked surfaces were inferred on five querns. One quern (15022-1) shows traces of use on three surfaces because one of the lateral parts was also used to process cereals. The distribution of the use-wear shows that the tool was used as a mortar, to grind and crush the cereal grains. Three querns (14983-1, 14344-6 and 14344-7) display two used surfaces. Both surfaces show traces from contact with cereals, one related to the actual processing of the grains and the other surface, constituting the bottom of the tools, related to contact with spilt cereals during the grinding process. In all three cases, the querns have been flaked to obtain the desired shape and to rejuvenate the edges and the surface of the implements. One quern (15034-6) shows a surface with use-wear related to cereals. The polish is well developed on one face of the tool. Isolated points from contact with a harder material are also present on the opposite face of the implement, suggesting that the tool was used occasionally to process a harder material. Finally, one tool was interpreted as a handstone (15223-1). The tool shows a highly reflective patina covering almost the entire surface, but where the patina is not present the tool displays a slightly developed cereal polish. The distribution of the polish indicates that the tool was used employing a transversal motion, and its small size and rounded shape indicates its use as a handstone.

Eight unmodified stones show use-wear interpreted as being from working cereals. The eight stones are fragmented and they are made of diorite (N=1) and sandstone (N=7). The stones were probably part of querns, and the tools were probably discarded after fragmentation.

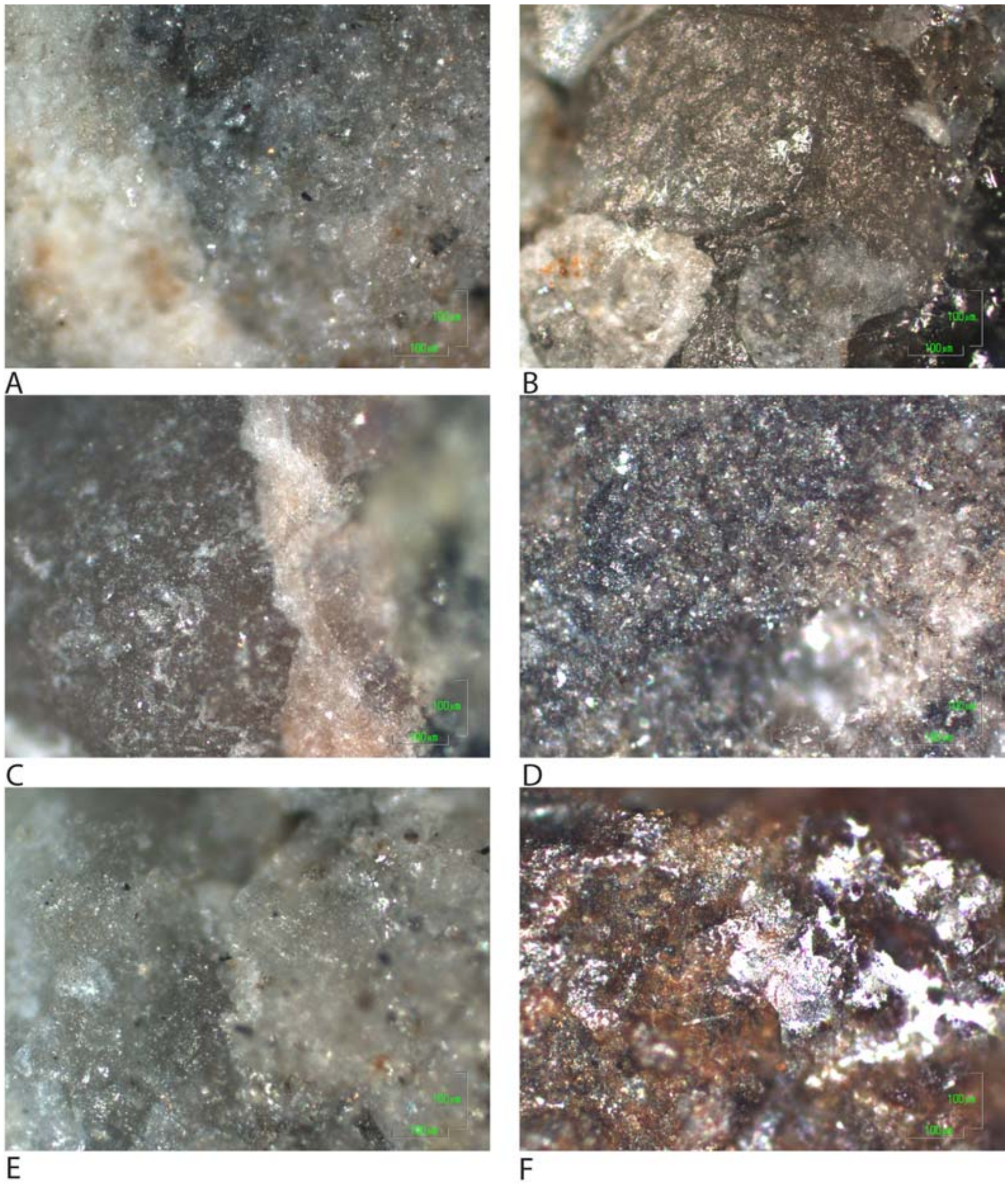

Figure 6.12. Use-wear traces related to querns and grinding stones. Processing of cereals and plant resources were the most commonly represented activities at Zeewijk. A-D: use-wear traces related to cereal processing on three querns (10x) (A: 14983-1), (B: 14361-1), (C-D: 15223-1). In addition, other plant resources were also processed with stones. E-F: use-wear traces documented on an unmodified stone (10x) (14333-4) related to an undetermined plant resource and traces indicating wood processing on a mano (20x)(14993-1) (García-Díaz 2014: 110).

Wood

One handstone (14993-1) displays use-wear traces possibly related to smoothing wood (Figure 6.12). Isolated points of a bright, linked and well delimitated polish, with a pitted morphology (Dubreuil and Savage 2014; Juel Jansen 1994; Vaughan 1985; Keely

1980; Verbaas 2005), probably from contact with hard wood, are present and the edge of the grains are heavily smooth. The distribution of the use-wear and the morphology of the used surface suggest a transverse motion. The tool has been flaked to obtain a rounded shape. The use-wear distribution indicates that this handstone should be regarded as a rubbing stone to smooth the surface of a wooden object while it is being made. Wooden tools accounted for a large proportion of the implements used by prehistoric communities; unfortunately, such implements have been preserved in only a few exceptional contexts. Bowls, spoons, digging sticks, sickles, spears and tool hafts have been recorded in Neolithic archaeological contexts where wood has partially survived (Bosch I Lloret *et al*. 2006, 2011). In addition, wood was used to build houses and other structures.

Unspecified plant material

Several surfaces, all on unmodified stones, display traces related to working unspecified plant material (Table 6.16). In three cases, the stones display traces related to working a medium-hard resource. However, the surface of these tools was heavily affected by fire and post-depositional alterations, making detailed inferences impossible.

One surface of an unmodified stone (13741-2) displays traces related to the processing of a hard material. The use-wear is related to possible percussion traces located on two edges of the implement. However, these traces are not well developed, and it is not possible to determine whether they are a result of the use of the tool. Finally, one unmodified stone displays traces from the processing of an undetermined resource (Figure 6.12).

	Plant			Animal	Unspec	
Artefact type	Wood	Cereals	Unespec	Hide	Unspec	Total
Ginding stone	-	-	-	-	-	-
Hammer stone	-	-	-	-	1	1
Quern	1	11	-	-	-	11
Flake	-	-	-	-	-	-
Unmodified stone	-	8	6	1	1	16
Total (N)	1	19	6	1	2	29

Table 6.16. Stone use-wear: artefact type versus contact material (Unespec: unspecified) (García-Díaz 2014: 109).

6.7.3 Unspecified resources

Two tools, one hammerstone (18183-1) and one unmodified stone (13741-2), show traces related to the pounding and hammering of an undetermined material. In neither case is the use-wear sufficiently developed, meaning that the material worked could not been interpreted.

6.8 Bone technology and typology

Several tool types were distinguished on the basis of morphological and functional characteristics (Table 6.17). One spatula (29714-1) made from a long bone of a large mammal was documented. The tool shows an abraded surface and no technological traces could be identified. Consequently, the classification of the tool was based on the shape of the implement. The tool shows a rounded edge and one of its surfaces seems to have been polished. Bone spatulas have been recovered at other domestic Corded Ware settlements such as Aartswoud (Drenth *et al.* 2008).

Two beads, one complete and one fragment, and one pendant were analysed (Figure 6.13). The pendant (17051-1) was made from the incisor of a dog (*Canis familiaris*). A conical perforation was made in the middle of the incisor and the tip of the tooth was slightly rounded. The use of teeth as personal ornaments has also been observed at the contemporaneous domestic site of Aarstwoud. The two beads from Zeewijk were first published as flutes (Van Ginkel and Hogestijn 1997), and later as toggles (Lauwerier in Van Heeringen and Theunissen 2001). However, use-wear analysis suggests that the artefacts were used as ornaments. The bead fragment (8834-1) was made from the diaphysis of a hollow bone. The fragment has small dimensions, measuring 25mm x 13mm x 10mm. The bead was decorated on three sides with simple, short incisions, probably made using a flint tool (Fig. 6.13). Similar bone ornaments have been found at other Corded Ware settlements (Van Heeringen and Theunissen 2001). The complete bead (7188-2) was made from the diaphysis of a sheep/goat tibia. It was decorated with long narrow incisions all along its surface, again probably produced using a flint tool. In addition, a perforation was made in its central surface (Fig. 6.13; Fig, 6.18). Finally, the entire surface of the bone was polished, probably to give it a uniform appearance. Similar beads, at first interpreted as small flutes, the contemporaneous site of De Vrijheid (Van Heeringen and Theunissen 2001).

Figure 6.13. Two bone beads (7188-2 and 8834-1) and one pendant (17051-1) recovered at Zeewijk showed traces related to their use as ornaments (García-Díaz 2014: 113).

Other tools made of bone included two needles and an awl (Figure 6.14). One of the needles (7094-1) was produced using a medium-sized mammal diaphysis. The production traces displayed on the tool suggest that the surface was scraped and polished to obtain the desired shape for the implement. The second needle was also made using a diaphysis from a medium-sized mammal. The needle has a broken tip and a square head with rounded and polished edges, and its surface was polished and scraped. These tool types have been found in several CWC settlements in the wetland areas of the Netherlands, including Aartswoud (Drenth *et al.* 2008; van Iterson Scholten and De Vries-Metz 1981). Only one awl was found that was made of a sheep/goat tibia (16272-1). One of the edges of the tibia had been broken and transformed into a tip. Unfortunately, the abrasion of the surface covered any technological traces that may have been present. Bone awls were also present at the Corded Ware site of Aartswoud (Drenth *et al*. 2008; Van Heeringen and Theunissen 2001).

Figure 6.14. The bone awl (16272-1) and two needles (7094-1 and 7094-3) (García-Díaz 2014: 113).

At least three cattle ribs were used to produce bone implements defined as ripples or *bobbelkammen* (Drenth *et al.* 2008; Lauwerier in Van Heeringen and Theunissen 2001: 181). The tools were probably produced by scraping and polishing, and have a shape resembling a comb with rounded teeth (Lauwerier in Van Heeringen and Theunissen 2001: 182). Only limited technological information has been obtained from these tools. One of the ripples (14973-1) was too abraded and fragmented and it was not possible to perform a microscopic analysis. The second ripple (14984-1) and a fragment of a ripple (18802-1) were restored and consolidated using a chemical preservative that covered the technological and functional traces on the surface (Figure 6.15). Only a small part of the surface remained unaltered. Similar tools were studied at Mienakker (García-Díaz 2013); unfortunately, the preservation of the tools was poor and the interpretations therefore limited. Finally, one fragment (21363-1), made from a fragment of a long bone of a medium-sized mammal, was so eroded and altered that the tool type could not be identified.

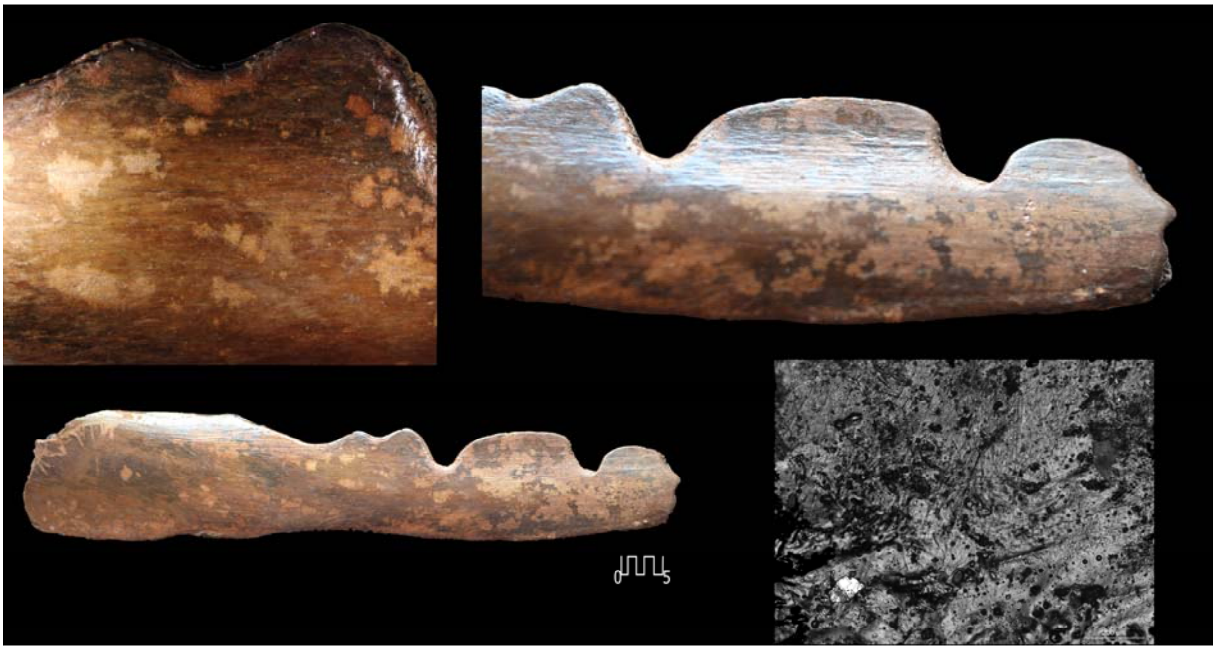

Figure 6.15. Cattle ribs were used during the Corded Ware Culture period to produce tools denominated 'ripples' (bobbelkammen in Dutch) by fauna specialists. Three of these tools were recovered at Zeewijk. The restoration of the tools using a chemical preservative covered the technological and functional traces on the surface. This prevented a proper understanding of the function of the tools. This 'ripple' (14984-1), was probably produced by scraping and polishing (García-Díaz 2014: 113).

6.9 Bone use

The range of activities and materials inferred by use-wear analysis is limited due to the small quantity of bones analysed. After the preliminary analysis, five tools were considered unsuitable for use-wear analysis due to post-depositional alterations. The remaining six objects (50%), comprising two needles, one awl, two beads and one pendant, displayed traces of use (Table 6.17) but the worked materials could not always *be identified*.

Square	Serial	Artefact type	Use-wear	Medium	Edge rounding	Striations	Degree of polish	Contact material	Motion
7094	3	Needle	Yes	Medium	Light	Yes	Medium	Hide?	Perf
7094	1	Needle	Yes	Medium	Uns	Yes	Medium	Hide?	Perf
17501	1	Pendant	Yes	Low-medium	No	No	Medium	Rope	Pending
7188	2	Decorated bead	Yes	Medium	Medium	No	Medium	Rope	Pending
8834	1	Bead	Yes	Medium	Medium	No	Medium	Rope	Pending
16272	1	Awl	Yes	Low	Medium	Uns	Medium	-	Perf
18802	1	`Ripple'	Not interp	Not interp	Heavy	Uns	Light	Not interp	Transvers
21363	1	Unknown	Not interp	Not interp	Light	Uns	Absent	Not interp	Uns
14984	1	`Ripple'	Not interp	Not interp	Heavy	Uns	Uns	Not interp	Uns
14973	1	`Ripple'	Not interp	Not interp	Medium	Uns	Uns	Not interp	Uns
29714	1	Spatula?	Not interp	Not interp	Medium	Yes	Not interp	Not interp	Not interp

Table 6.17. Overview of the use-wear analysis of the bone implements (Uns: unsure; Not interp: not interpretable; Perf: perforation; Transvers: transversal)(García-Díaz 2014: 114).

One of the needles (7094-1) displayed traces related to the working of an abrasive material, interpreted as hide. The use-wear traces suggest that the needle was used to pierce hide. The polish is not well developed. However, striations indicating a rotational movement have been documented near the tip (Fig. 6.16). These striations are similar to the ones displayed by the second needle (7094-3), which were located on the body of the needle (Fig. 6.17). Unfortunately, the tip is broken, making a detailed inference impossible. In addition, the proximal edge of the first needle shows heavy rounding, produced by contact with an undetermined material. Even though the wear traces are not well developed, the distribution of the use-wear along the tip and body of the needle implies that the tool could have been used as a pin. The awl (16272-1) has an abraded surface and the very end of the tip is broken off. However, it seems that the tool was used to drill an undetermined material as the lateral sides of the tip are severely rounded and a slightly developed polish displays short striations, suggesting a rotational movement.

Figure 6.16. Use-wear traces documented on a needle (7094-1) suggest that the tool was used to pierce hide. In addition, the distribution of the use wear among the tip and body of the awl suggests that the tool could have been used as a pin (García-Díaz 2014: 115).

Figure 6.17. Needle (7094-3) displaying traces related to working an abrasive material, interpreted as hide. Use-wear traces suggest that this implement was used to pierce hide (García-Díaz 2014: 115).

Finally, the two beads and the pendant displayed traces related to use as personal ornaments. In the case of the pendant made from a tooth (Fig. 6.18), use-wear was located around the perforation, indicating that the pendant was hung from a string. The complete bead displayed use-wear traces around the lateral hole and around the central perforation (Fig. 6.19). The distribution of the traces suggests that a string was introduced from the lateral holes to the central perforation. The bead could have been used as a pendant, but also as a button to tie clothes. The lateral rounding of the fragmented bead points to a similar use for this bead.

Figure 6.18. This pendant (17051-1) made from the incisor of a dog displays a conical perforation. Use-wear is located around the perforation, suggesting that the pendant was hung from a string (García-Díaz 2014: 116).

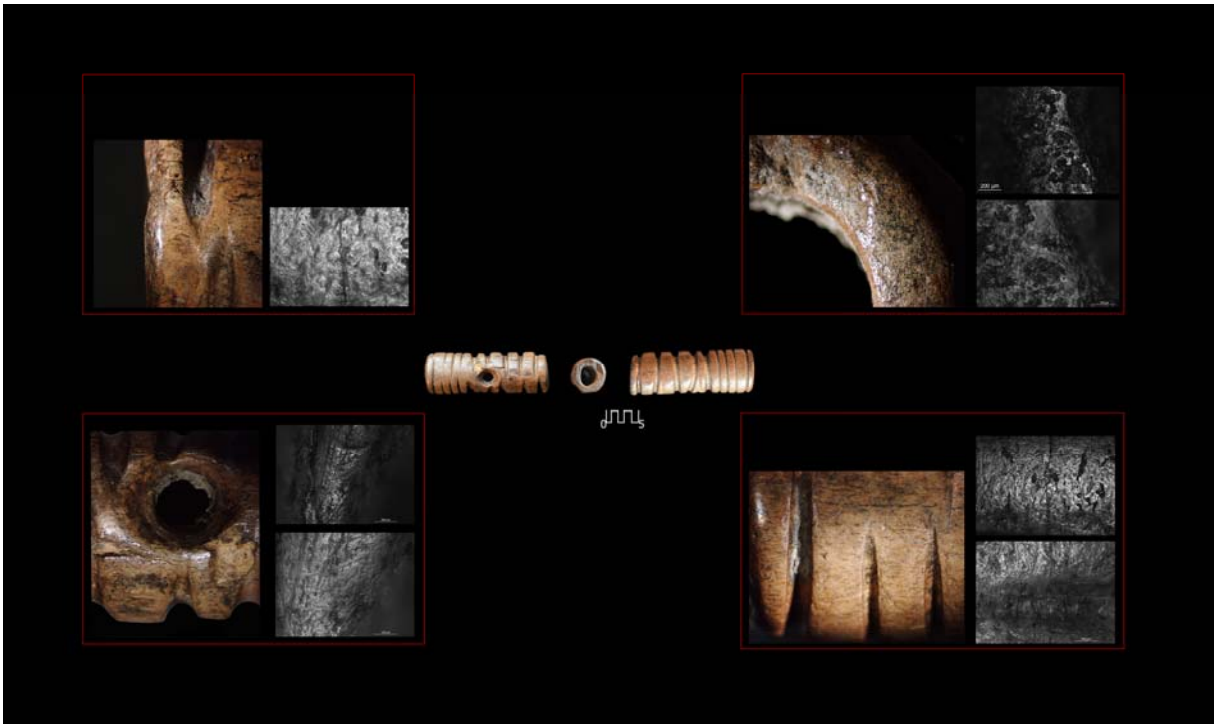

Figure 6.19. Decorated bead (7188-2) with long narrow incisions all along its surface. In addition, a perforation was made in its central surface. The bead displayed use-wear traces around the lateral hole and around the central perforation, suggesting that a string was introduced from the lateral holes into the central perforation (García-Díaz 2014: 116).

6.10 Amber: Technology and typology

During the analysis of the finished products found at Zeewijk several bead types were distinguished (Van Gijn 2014a), predominantly disc-shaped beads usually facetted and biconically perforated (Fig. 6.20). In addition, barrel-shaped and globular beads were also present (Table 6.19). Finally, a large number of beads could not be classified into a specific type (Van Gijn 2014a: 124). The pendants were more difficult to classify, as two were irregularly shaped and six could not be typologically classified (Van Gijn 2014a).

The analysis of the production of amber beads and pendants indicates that although several steps were performed, the sequence of steps was not always the same for each bead, '*indicating that there was no strictly defined chaîne opératoire*' (Van Gijn 2014a: 121). Blocks and small nodules were flaked and/or sawn to obtain the desired shape, and amber flakes were sometimes used as blanks. Flaking and sawing traces had already been documented at other contemporaneous assemblages, such as Mienakker (Bulten 2001). These methods were also used to eliminate the cortex and the imperfections of the amber cores (Bulten 2001). In addition, flint scrapers were sometimes used to remove the cortex of the beads.

Some beads – mainly the small, flat, disc-shaped beads – were faceted (n=24). The way these facets were made is still under discussion. Experiments showed that the facets could be produced by fixing a perforated bead on a bow drill and applying the facets with a flint blade (Drenth *et al.* 2011; van Gijn 2014a). However, some of the faceted beads did not show a perforation, so other methods were probably used (Van Gijn 2014a). Grinding traces were found on the surface of several ornaments and the technique was probably performed using a fine-grained sandstone (Van Gijn 2014a). The preservation of the technological traces was so good that grinding marks were '*sometimes incredibly fresh, with the grinding dust still visible*' (Van Gijn 2014a: 121).

Typology	Primary classification	Number
Bead	Block	10
Bead	Flake	7
Bead	Nodule	8
Bead	Old bead	1
Bead	Unknown	42
Semi-finsihed bead	Unknown	21
Subtotal		89
Pendant	Unknown	4
Semi-finished pendant	Unknown	4
Subtotal		8
Unmodified	Nodule	12
Unmodified	Block	6
Unmodified	Flake	20
Total		135

Table 6.18. Amber: primary classification and types (Van Gijn 2014: 122).

Bead perforations were drilled both before and after shaping the amber beads. Most of the perforations on pendants and beads were biconical, although cylindrical perforations were also encountered. Unfinished and not well aligned perforations were present on several beads (Van Gijn 2014a). Flint drills were used for the conical and biconical perforations. The use-wear traces found on one borer at Zeewijk (García-Díaz 2014a), and on several borers at Mienakker (García-Díaz 2013), provided another indication that beads were produced locally. However, the physical characteristics of some of the perforations suggested that other types of drills were also employed. Fine and regular scratches documented on the perforations were probably the result of the use of a wooden or an antler drill (Van Gijn *personal comment*). As already commented, these types of borers had not previously been documented at any Corded Ware settlement.

Typology	Ornament type	Number
Beads	Barrel-shaped	2
	Disc-shaped	32
	Globular	1
	Undet	21
	Type Uknown	33
Pendants	Irregular	2
	Undet	3
	Type unknown	3
Total		97

Table 6.19. Type of perforations seen on the beads and pendants (Undet: undetermined) (Van Gijn 2014: 123).

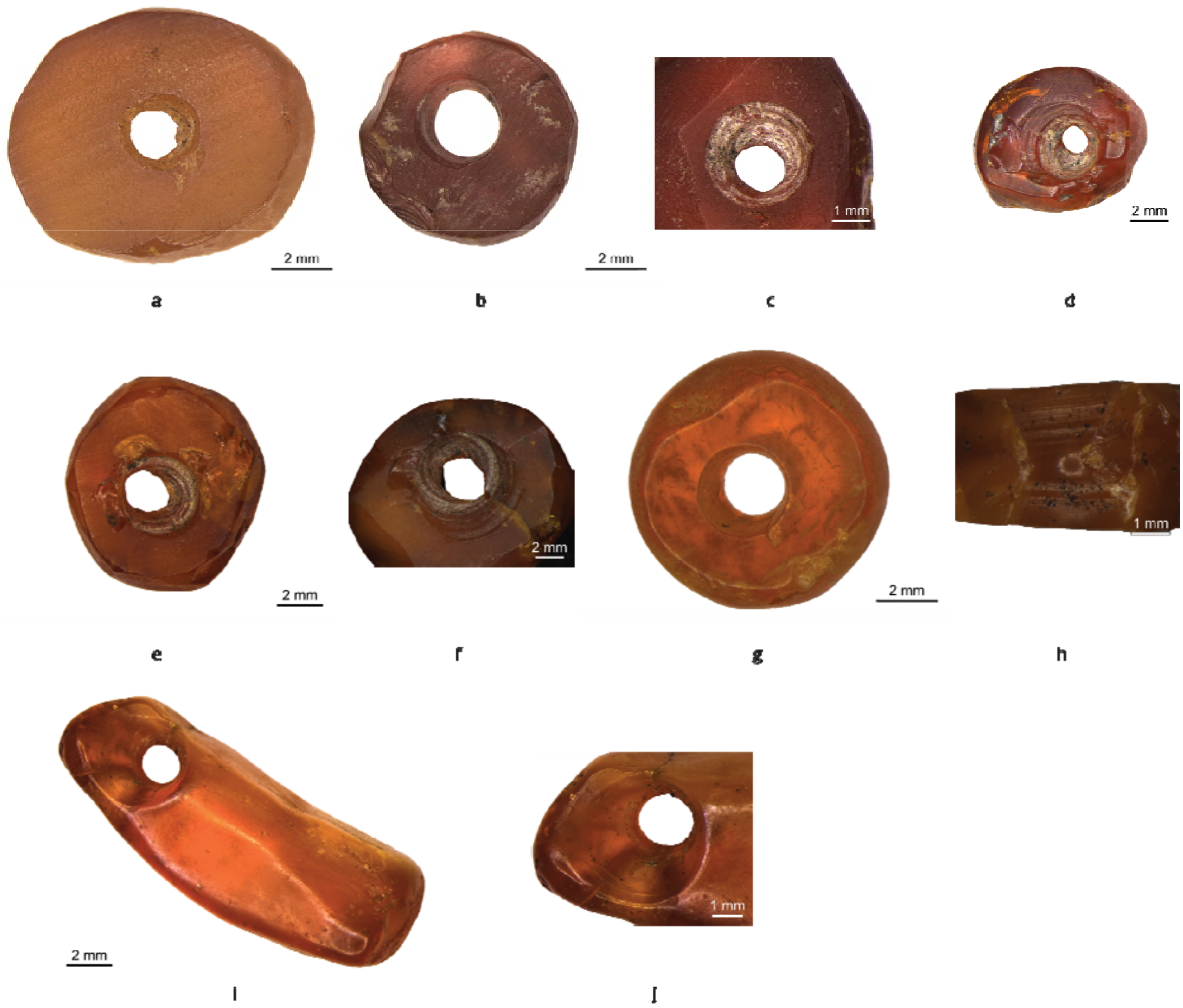

Figure 6.20. Traces of manufacture and use on beads and pendants: a. Grinding traces (17501-2); b. grinding traces and perforation marks on a disc-shaped bead (15784-1) with facetted edges; c. disc-shaped bead (17554-4) with a perforation made by a flint drill bit; d. bead (16901-2) displaying a misplaced biconical perforation made with a flint drill; e. disc-shaped bead (17564-3-1) with a slightly misplaced biconical perforation made with a flint drill; f. detail of the perforation of bead (17564-3-1); g. heavily worn disc-shaped bead (17604-8) with a rounded, worn perforation; h. heavily used, broken bead (17563-3); i. heavily worn and polished pendant (17504-2); j. detail of this same pendant (17504-2) (van Gijn 2014: 120).

6.11 The use of amber

The use of beads and pendants was documented at several ornaments (Fig. 6.21). Use-wear traces revealed that the amber beads were used as ornaments. Traces were located mainly on the perforations and sometimes on the surface of the beads (Van Gijn 2014a). The development of the traces was used (Van Gijn 2014a) to interpret the degree of wear of the beads and the implements, distinguishing between pendants that had been heavily worn and those that had been only moderately worn (Fig. 6.21). The fact that most of the beads and pendants displaying use-wear traces were fractured indicates that the ornaments were abandoned after use. However, the fact that a broken bead (15032-3) with heavy traces of use displayed two biconical perforations, both of which display wear around their rims (Van Gijn 2014a), may suggest that old beads were reworked, as in other Neolithic archaeological contexts (Van Gijn 2008).

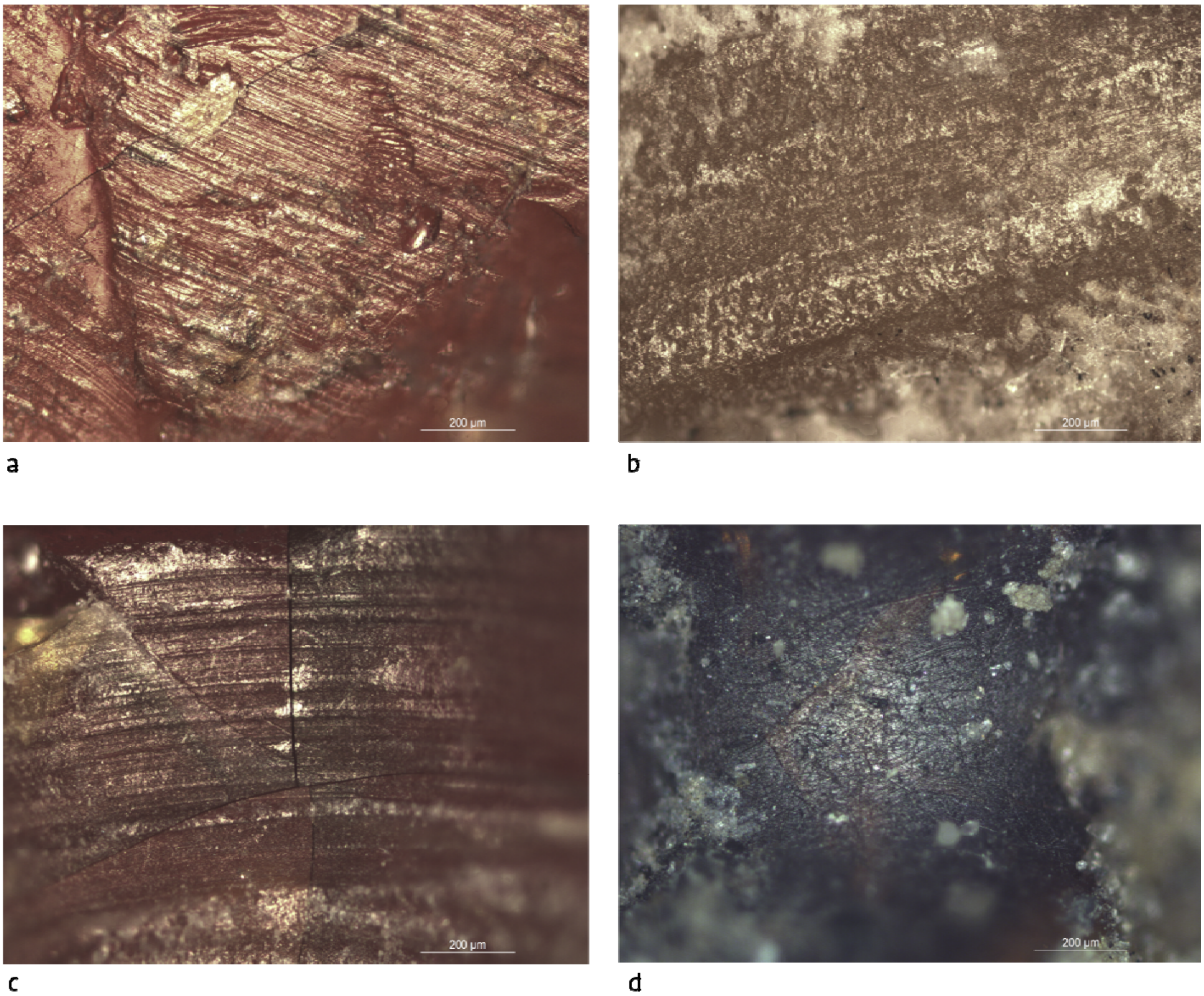

Figure 6.21. Technological and functional traces on amber beads: a. and b. Grinding traces (15003-1 and 13691; 100x); c. circular and regular scratches suggesting that the perforation was performed with a tool other than a flint drill (13724-9; 100x); d. extensive abrasion from a cord on the inside of an amber bead (22684-1; 100x) (van Gijn 2014: 125).

6.12 The spatial distribution of flint, stone and bone implements and amber ornaments: The use of the space at Zeewijk

Zeewijk was understood to be either a big settlement (Hogestijn 1992, 1998, 2001) or as two interrelated settlements (Drenth *et al.* 2008). Unfortunately, the question of the settlement type could not be answered during this new analysis (Nobles 2014b). What was clear after the spatial analysis was that two different areas with concentrations of postholes, Zeewijk-East and Zeewijk-West, were defined. As already stated, the material culture associated with these two areas was considerable, so only a sample could be studied. In both east and west Zeewijk the areas related to the possible structures were selected. However, it was clear from the materials analysed that the sample was incomplete and some of the materials had gone missing. Therefore, the conclusions of the spatial analysis were limited (Nobles 2014b).

Zeewijk-West was considered as a palimpsest of several dwellings (Nobles 2014a, 2014b). A clear spatial distinction between the cow hoofmarks and the postholes implied that the house had a domestic character. However, the materials related to the postholes did not reveal clear concentrations which would have helped to explain the function of the settlement. In addition, a clear identification of the western structure was not available, so a clear connection with the materials that were studied could not be made (Nobles 2014a, 2014b). Most of the flint from the 1992 excavation campaign in the western area was unavailable, and the large amount of stone within the 1992 assemblage showed no clear clusters. Animal remains and pottery analysis showed a similar pattern. However, a concentration of amber in the north of the sampled area suggested that amber was worked there, indicating that amber ornaments were manufactured locally (García-Díaz 2014a; Nobles 2014a, 2014b; Van Gijn 2014a).

A similar situation was observed at Zeewijk-East. The materials analysed derived mostly from the test-pits within the structure, albeit in small numbers. Besides the case of flint, no clear concentrations were observed, and no clear association between the structure and the flint concentration could be established (Nobles 2014a). The absence of materials within the structure leaves the debate of its function open. It is not clear whether the absence of materials is due to a mistake in the excavation and the storage of the findings, or if it is a reflection of the non-domestic function of the structure. On one hand, the interpretation of the structure has always referred to a possible ritual and ceremonial functional (Drenth *et al.* 2008; Nobles 2014a; Van Ginkel and Hogestijn 1997). This interpretation was mainly based on the absence of materials and the trapezoidal shape of the structure, which is uncommon for the Late Neolithic period. In addition, parallels between the Zeewijk-East structure and the Mienakker I structure have been suggested (Nobles 2014a). The similarities between the structures would support the symbolic interpretation of the structures (Nobles 2014a). On the other hand, parallels with other structures found lately in the Netherlands can be drawn as well. At Habraken te Veldhoven one trapezoidal structure was excavated (Van Kampen and Van den Brink 2013; Van Kampen 2013) and compared with the Zeewijk-East structure. However, the building was related to a domestic function and was interpreted as a grain store. In this case, although a lack of archaeological materials was also observed, a significant amount of botanical remains were found in the postholes of the structure. Taking into account the egalitarian society that inhabited the settlement, it has been inferred that the structure was probably used for communal purposes (Kubiak-Martens *et* *al.* 2013; Van Kampen 2013). Unfortunately, both possibilities are still open and further analysis is needed to interpret the character of the structure.

6.13 Conclusion: Group composition and site function

The geological and natural surroundings of Zeewijk determined the social organization of the settlement. Zeewijk was located in an open landscape, characterized by a scarcity of trees, and the predominance of herbaceous vegetation (Kubiak-Martens 2014). Therefore, hard wood and lithic raw materials were scarce, and other geological areas had to be exploited. The analysis of flint, stone and bone implements pointed to a use of the territory similar to the site at Mienakker. Flint and stone were collected from nearby areas, such as the coastline or the glacial deposits at Wieringen. The exploitation of nearby resources is characteristic of other Corded Ware settlements of the area, such as Keinsmerbrug, Mienakker and Kolhorn. The presence of southern flint indicates a broader use of the territory, comparable with the use of other Corded Ware settlements such as Mienakker (García-Díaz 2013) or sites of the Vlaardingen group (see Chapter 8).

The technological approaches employed at Zeewijk were also similar to those used generally during the Neolithic, when different technological strategies were combined. At Zeewijk, unidirectional flaking was used in combination with bipolar approaches, the latter being used mainly on poor-quality rolled pebbles. Bipolar reduction is a recurrent phenomenon in the Dutch Neolithic, being present at other Corded Ware settlements, and also in Vlaardingen, TRB and Bell Beaker settlements (Croese 2010; García-Díaz 2012, 2013, 2014a; Louwe Kooijmans 1974; Metaxas 2010; Peeters 2001a, 2001b; Van Gijn 1990, 2010a, 2010b; see Chapter 8). The raw material and the strategies employed to exploit the flint and the stone largely determined the tools obtained. Even though blades are present in the assemblage, unmodified flakes are the most frequent tool type. Retouched tools, scrapers and borers are scarce and only two arrowheads were documented. The assemblage at Zeewijk is similar in composition to other Late Neolithic settlements, where unmodified flakes are the most common tools.

Stone tools also show great similarities with other Corded Ware settlements studied in terms of manufacture and use. Querns and grinding stones were flaked to rejuvenate their surface, while the instruments related to percussion activities, such as hammer stones, anvils, mortars and handstones, were usually unmodified. And, finally, bone tool typology points to the use of an established production of the implements. In conclusion, it seems that regularity in the production of the tool assemblage during the Neolithic period probably links them to some Mesolithic traditions, as in the case of the bone implements (Van Gijn 2006). On the one hand, there is evidence of a standardized production sequence for awls, for example using the '*metapodium technique*' which has strong roots in the Mesolithic. On the other hand, we also observe the '*ad hoc*' use of production waste and pieces of bone with a suitable edge which is not modified, or hardly modified, prior to use. This too has been noted before at other Neolithic settlements such as Schipluiden and Hekelingen (Van Gijn 2006).

Despite all the concerted efforts by various specialists involved in this project, the function of the Zeewijk structures remains a mystery. At Zeewijk-West the interpretation of the archaeological assemblages pointed to a domestic use of the dwellings. Although a clear correlation between flint, stone and bone assemblages and the house structures could not be established, use-wear analysis showed that craft and subsistence activities were performed at the site. Fowling and fishing, and to a lesser extent hunting, made a major contribution to the diet at Zeewijk (Zeiler and Brinkhuizen 2014). Several duck and fish species and wild boar were exploited as a meat source. In addition, cutting marks on bones from cattle, goats/sheep and pigs revealed the importance of domestic animals for the subsistence strategies of the Late Neolithic community. Flint was used to butcher animals, and to scale and process fish. In addition, although sickles were not found at the settlement, cereal processing is well documented at Zeewijk. The absence of sickle blades is a common phenomenon in the wetlands (Bakels and Van Gijn 2014), where very few sickles have been found in Late Neolithic and Early and Middle Bronze Age settlements or graves (Van Gijn 2010a). Cereals were processed at the settlement, as inferred from the traces displayed on several querns, and afterwards consumed, as implied by the results of the analysis of the cooking residues left on the pottery vessels of Zeewijk (Kubiak-Martens and Oudemans 2014).

Craft activities were dominated by hide processing and plant working. The exploitation of small fur animals dominated the hunting activities. Fur was scraped, pierced and cut with flint, stone and bone implements; it was then transformed into containers and clothes, and possibly used in the construction of houses or canoes. Different types of wood and plant resources were worked with a range of implements. Some of the vegetal resources used were collected near the settlement, but others had to be transported from more distant areas, such as Texel or the Plaitoceine deposits of Wieringen (Brinkkemper and Van den Hof 2014; Kubiak-Martens 2014). Some of these resources could have formed part of the subsistence practices of the community. However, the functional traces evidenced on the flint, stone and bone implements suggested that other types of vegetal resources were also used to produce other implements and tools. In addition, several types of plants could have been used as building materials or furnishing for the dwellings (Kubiak-Martens 2014). Finally, amber was processed into beads and pendants which, along with the bone beads, decorated the clothes and bodies of the inhabitants of Zeewijk.

The analysis of the faunal and botanical remains indicated that Zeewijk was used almost continuously during the entire year, and was probably conceived as a permanent settlement. As suggested by the combined results of the research performed at Zeewijk's assemblages, the site probably played a prominent role among the cluster of settlements that flourished in the area during the CWC (Theunissen *et al.* 2014b).

Chapter 7. The domestic implements of the Corded Ware Culture: An overview

7.1 Flint, stone, bone and amber procurement networks

The three settlements studied were located in a former tidal basin, which started to silt up between 4500 and 4000 BC as a result of sea level rise. The tidal basin was formed during the Holocene, when Pleistocene soils started to be covered by peat. The settlements were located on an open and treeless landscape covered by grasses, heavily influenced by brackish waters, although fresh water sources were close to the settlements. Although the area was characterized by a rich combination of ecological niches, some resources were not available for the communities living in the area. Besides several types of wood, nuts, and fruits (Kubiak-Martens 2012, 2013, 2014), flint and stone had to be acquired and transported from elsewhere.

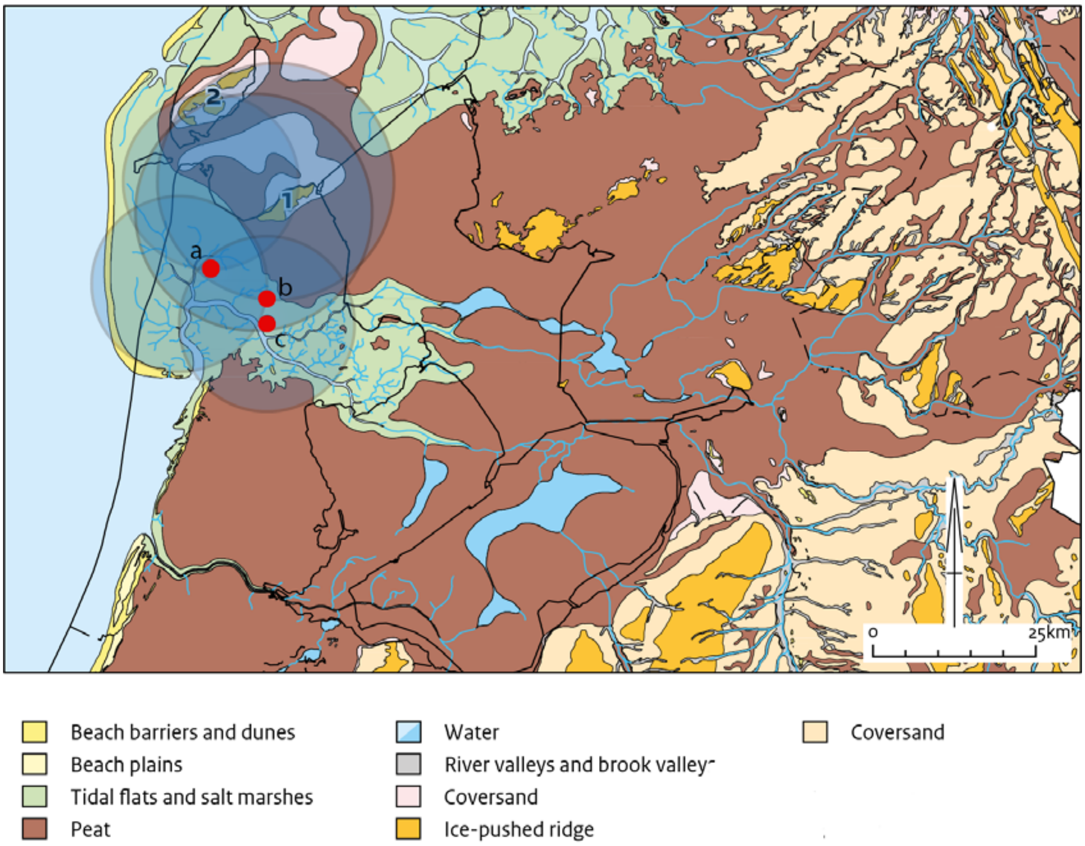

Figure 7.1. Relation between the three studied settlements and the procurement areas used by the Corded Ware Culture populations. 1:deposits of Wieringen; 2: Texel; a: Keinsmerbrug; b: Zeewijk ; c: Mienakker (after Kleijne and Weerts 2013).

Northern flint and stones

Northern flint and stones were probably obtained from the Pleistocene deposits of Wieringen and Texel, located 15 to 20km away from the settlements. Expeditions in search of lithic material and/or wood could easily have been combined with other activities, such as hunting, fishing, or gathering fruits. The treeless landscape in which the settlements were located probably forced the community to organize expeditions to obtain some scarce natural resources, such as apples, wild fruits, berries, hazelnuts and acorns (Kubiak-Martens 2012, 2013, 2014), but also good-quality wood necessary to build houses and fences. Accordingly, raw material acquisition of stone, flint and amber was probably intertwined with subsistence activities. Put another way, and as suggested by Binford for the Eskimo groups, raw material acquisition was '*embedded in basic subsistence schedules*' (Binford 1979: 259). The use of the glacial till deposit of Wieringen as a raw material procurement source area has been documented for other Corded Ware settlements in this area (Drenth and Kars 1990), as well as for other Neolithic sites (see Chapter 8). Therefore, the continuous use of the deposits of Wieringen by prehistoric groups suggests that the area was part of the '*mutual knowledge*' of the Neolithic inhabitants of the northern part of the Netherlands. This '*mutual knowledge*' was related to landscape perception, and it was transferred from one generation to the next and from one group to another (see Chapter 3). This idea is similar to Schlanger's term '*persistent place*' (Schlanger 1992: 97), a term used to define the areas of a landscape that were used repeatedly over time (Schlanger 1992: 97). The exploitation of the Pleistocene deposits of Wieringen and Texel continued among the Neolithic groups of the Netherlands through long-term memory processes. The landscape, therefore, was part of the material culture of prehistoric societies. The use and reutilization of specific places relate to the social norms and rules imposed by previous generations. The Pleistocene deposits of Wieringen were also part of the TRB and Vlaardingen narratives. At the beginning of the third millennium BC, new possibilities for occupation became available to the Neolithic groups: a mosaic of landscapes was available in the tidal basins of West-Friesland. These areas were exploited and used, and the '*mutual knowledge*' of TRB and Vlaardingen groups was expanded, adapted and maintained by the so-called CWC.

Figure 7.2. Actual deposits of Wieringen at the Noorth-Holland province and modern distribution of raw material (García-Díaz).

Amber

It is generally accepted that the amber found in the Noord-Holland province had a Baltic origin (Bulten 2001; Van Gijn 2014a; Waterbolk and Waterbolk 1991). Amber is carried along the tidal streams of the North Sea and it can still be found today on the shores of the Frisian Islands (Waterbolk and Waterbolk 1991), so it is plausible that the nodules were collected by the Corded Ware communities on nearby beaches, 15 to 18km away from the settlements (Van Gijn 2014a). Amber could also have also been obtained from the boulder clay deposits located approximately 8-10km north of Zeewijk and 15-20km of Mienakker. In addition, two other sources are mentioned in the literature: the first is the Pliocene lignite deposits of the northern Netherlands, in which small amounts of amber are present (Huisman 1977), and the second concerns amber from tertiary sources transported by the rivers in the central Netherlands (Van der Valk 2007 in Van Gijn 2014a). Amber nodules were transported to such permanent or semi-permanent settlements as Mienakker (Bulten 2001), Zeewijk (Van Gijn 2014a) and Aartswoud (Piena and Drenth 2001), where beads and pendants were locally produced. At other sites, such as Keinsmerbrug, where ornaments were probably not locally made (García-Díaz 2012), the ornaments may have been worn and then discarded, or accidentally lost. The collection of amber nodules was probably a simple task which could have been combined with other activities, such as shell gathering and fishing.

Southern flint and imported material

At Keinsmerbrug, Mienakker and Zeewijk the presence of southern flint was mostly due to the geological formation of the landscape. The Meuse and Rhine rivers ended in the present day Waddenzee, so river gravels are commonly found in the moraine (Houkes 2011). Therefore, although a southern origin for the stones cannot be discarded, some authors suggest Drenthe, or the Pleistocene deposits at Wieringen, as the acquisition source (Peeters 2001b).

Southern flint is commonly used in Vlaardingen settlement context, notably at settlements located on river dunes and the Pleistocene dunes (Devriendt 2013; Van Gijn 2010a, 2010b; Van Regteren Altena 1963; Van Regteren Altena *et al*. 1963; Verhart 1983), and at other CWC settlements (see Chapters 2 and 8). In addition, long-distance movement of stones is shown by the presence of Scandinavian flint blades and axes in CWC burials. French flint, such as Grand-Pressigny or Romigny-Léhry, is also present in the form of daggers from the All Over Ornamented period (Van Gijn 2010a: 145-148). Peeters (2001b) interpreted the fragments of Grand-Pressigny obtained at Mienakker as a reutilization of one of these daggers. Indirectly, the fragments of Grand-Pressigny would have been part of a broader social network, which influenced the acquisition of high quality raw materials, or implements (Peeters 2001b). It has been proposed that daggers which had been accidentally broken would be reused to produce other tools (Van Gijn 2010a: 140). Although some Grand-Pressigny fragments have been found at Corded Ware settlements (Delcourt-Vlaeminck in Van Heeringen and Theunissen 2001: 161; Woltering 1989), during the CWC complete Grand-Pressigny daggers are only found in graves (Van Gijn 2010a: 145). The daggers were probably imported as finished objects, as no production waste from the production of Grand-Pressigny blades has so far been found. Several authors have discussed the role of technology as a transmitter of the social and cultural worldviews of prehistoric communities (Dobres 2009; Edmonds 1995, 1999; Sørensen 2006). The selection of the raw material and the technological processes used to manufacture the tools imply a conscious choice for the reproduction of the norms and social rules of the society. The use of finished implements as a raw material source could point to this interpretation: these finished implements were intended to be part of the ritual life of the community, but the broken tools were reshaped and used for domestic proposes.

Bones

Bone acquisition is different from the lithic procurement. First, if bones are procured from wild animals the animals' own pattern of mobility has to be taken into account. The migration patterns of prey animals will have '*an impact on the timing and reliability of access to osseous raw materials* and *other animal products*' (Gravina *et al*. 2012: 3). In addition, the obtained raw materials like metapodia generally have an identical form and shape, with similar or identical characteristics, which helped to produce regular and standardized items. Bone acquisition was closely connected to the subsistence activities of the groups. In the case of the studied settlements, both wild and domesticated animals were used to produce bone implements. Hunting, and especially fowling, strategies suggest that the Corded Ware communities had a wide knowledge of the natural cycles of the wetlands. The mass catching of ducks during the moulting period suggests that the Corded Ware communities possessed a thorough knowledge of the behaviour of the birds. This knowledge was probably rooted in the Mesolithic and maintained during the Neolithic, when hunting and fowling continued to be important subsistence activities.

The domestication of animals, however, implied a change in social practices. Domesticated animals were treated in a different way from wild animals, which led to a change in values and practices (Cummings and Harris 2011). In the first place, domestic animals could not care for themselves the way wild animals do, but instead required more attention from people (Chadwick 2007). Animals had to be fed and the settlement, as the centre of pastoral activities, had to be located in areas with adequate pasture and water supplies. This requires '*choosing the right combination (bundle) of animals to herd at the right time and the right place*' (Carlstein 1982: 114). The combination of diverse herds (pigs, cattle and sheep/goats in the case of the CWC) is one of the main tactics that agro-pastoralist societies used to maximise the long-term viability of the household (Russell 1998: 43). The former tidal basin where the settlements were established was rich in pastures and grasses. Short-distance journeys were common for the Corded Ware people. The deposits area of Wieringen did not only offer a well-supplied source for stone and northern flint acquisition, but would also have provided rich pasture land for animal herds. In addition, living and working with domesticated animals encouraged a change in the symbolic life of these communities. Many hunter-gatherer societies considered wild animals to be part of their daily landscape, as part of nature, and interacted with them, trying to maintain an equilibrium between the community's needs and their natural environment (Ingold 2000a, 2000b). However, domestication changed the way animals were perceived by the communities, as domesticated animals started to be treated like objects, and considered property (Ingold 2000b; Orton 2010). Furthermore, the use of secondary products introduced new forms of interaction between humans and animals and a new range of products to consume and exchange (Orton 2010).

Social strategies related to bone procurement were probably affected by animal domestication. In the first place, the primary source of bones, i.e. the domesticated animals, were embedded in the social rhythms of the groups, meaning that animals formed part of the daily resources of the Corded Ware groups. The production of bone implements was probably embedded in other economic systems deriving from the exploitation of animal products. As inferred from the archaeological remains found at CWC settlements, domestic animals were used both as a meat source and for the production of clothes (hide) and ornaments (teeth). In addition, ethnographic research and experimental archaeology suggest that tendons could have been used to produce ropes, and blood could have been consumed. Animal slaughtering provided the Neolithic population with a wide variety of resources that could be used for domestic activities, and by controlling the slaughtering rhythms they could also control the storage of bones and tendons to produce other implements at a later time. However, live domestic animals were also part of other economic systems, and their exploitation included the acquisition of other products, such as milk and wool in the case of sheep and goats, and the use of cattle for animal traction (Bogucki 1993). In addition, several authors consider that cattle functioned as wealth and capital during the Neolithic (Fokkens 1998; Russell 1998). The value of cattle was related to the effort and work invested in raising and keeping the animals. Large animals, like cattle, reproduced slowly; the effort required to breed these animals was significant, and the value of the investment was not realised in the short term (Russell 1998: 42). Therefore, the decision to slaughter cattle was probably planned taking into account the benefit to the community. In the case of the settlements under study, mostly adult and subadult animals were slaughtered (Zeiler and Brinkhuizen 2012, 2013, 2014).

7.2 Knowledge as praxis: Techno-typological analysis of the flint, stone and bone implements and amber ornaments

7.2.1 Flint

Technology

The technology of the Corded Ware settlements has traditionally been classified as '*opportunistic*' (Beuker 2010; Drenth 2005; Peeters 2001a). The term is based on Binford's categorization of Eskimo technology (Binford 1979). If a curated technology infers a planned organization of the production and use of tools, the term '*opportunistic*' refers to a technology that suggests the opposite. During the analysis of the three Corded Ware settlements, the perception of the technology employed by the groups changed. Although initially it was assumed that tool production could be defined using the concept of '*opportunistic*' technology (García-Díaz 2012: 79), by the end of the present study this concept had been revealed to be inaccurate, and it was considered inappropriate to define the organization of the technology during the Corded Ware period as '*opportunistic*' (García-Díaz 2013, 2014a). Following the analysis of the assemblages of the three sites, and their interpretation along with the rest of the archaeological data obtained from the excavations, the technology was considered to be more complex than initially thought. The continuity of some Neolithic technological traditions, such as the bipolar technique, the selection of raw material, and the repetition and specialized processes to produce several types of tools, suggests that the technology was planned, and conditioned by the specific needs existing at every site. Therefore, the technological processes involved in the production of domestic implements should be considered intentional, and not opportunistic.

Technological choices are, to some extent, dictated by the raw material used. Technological approaches were oriented to different types of flint and stone, taking into account the physical properties of the material. Flint pebbles were usually exploited using a bipolar technology, while bigger flint nodules were flaked using a unidirectional or bidirectional approach. At the three settlements, the analysis of the flint assemblage suggests that the flaking process was carried out on-site, after the raw material was brought to the settlement. This is supported by the high number of implements displaying cortex in the three assemblages and the presence of primary flakes and unworked nodules (García-Díaz 2012, 2013, 2014a; see Chapters 4, 5 and 6). In addition, the refitting of a number of flint implements recorded by Peeters at Mienakker (Peeters 2001a) confirms the idea that flint nodules were carried to the settlements and knapped in several episodes (García-Díaz 2013; Nobles 2012b).

A combination of different methods of core reduction characterizes the Corded Ware domestic flint technology. The use of bipolar techniques coexisted with others requiring more advance planning and preparation. Two technical approaches could be distinguished: the first approach is based on the exploitation of small flint nodules with hard direct percussion, while the second is based on the exploitation of larger nodules, using a bidirectional reduction sequence (García-Díaz 2013, 2014a; Peeters 2001a). The selection of raw material for the production of tools, as in the case of the borers and the scrapers, is also an example of this combination of techniques. While at Mienakker and Zeewijk borers were produced using low-quality flint (rolled pebbles), scrapers were principally produced from flint nodules of higher quality (García-Díaz 2013, 2014a; Peeters 2001b). Similar borers have been documented at other contemporaneous sites, such as Aartswoud I (Van Heeringen and Theunissen 2001; Van Iterson Scholten and De Vries-Metz 1981), Warmond Park Klinkenberg (Dijkstra and Bink in Bink 2006), and De Veken (Peeters in Van Heeringen and Theunissen 2001). In addition, preliminary analysis confirmed the presence of small borers in the flint assemblage from Kolhorn (García-Díaz *personal observation*). Therefore, it could be suggested that the use of rolled pebbles was directly linked to obtaining similar borers by bipolar percussion, and that it was a common practice in Corded Ware settlements. The existence of different technological strategies within the same settlement is characteristic of the Neolithic technological system and has been observed elsewhere (Binder *et al*. 1990; Guyodo and Marchand 2005). As previously stated, bipolar techniques were commonly used during the Neolithic period and were linked to low-quality raw materials and the acquisition of specific tool types (Binder *et al*. 1990; Guyodo and Marchand 2005).

The use of bipolar technology is considered to reflect an unplanned technology regarded as easy and simple, not requiring a high level of knowledge and practical skills. This technological approach could be related to knapping activities performed by children (apprenticeship) (Sternke and Sörensen 2007), or to the production of flint tools by low-skilled individuals (Stapert 2007). The development of bipolar techniques has also been linked to the disintegration of Neolithic production systems: due to '*inégalité dans l'accès aux savoirs techniques, elle apparaît comme un effet collatéral du développement des hiérarchies sociales […]*' (Guyodo and Marchand 2005: 548). However, the use of bipolar technology in the CWC could be related to the uniformity and standardization of the products obtained. Some of these similar implements are what has been classified as '*splintered pieces*' or '*pièces esquillées*'. These tools have been identified in numerous archaeological contexts with different chronologies, from Late Palaeolithic to Late Neolithic. The splintered pieces have been defined as rectangular implements which display bifacial splinters on two ends due to hard percussion (Sonneville-Bordes and

Perrot 1956: 552). In addition, and as experimentally observed, bipolar flaking of pebbles produces a high number of regular flakes with long, and sharp edges, characterized by several features: a large quantity of cortex; rounded or semi-rounded fragments with cortex with steep angles; thin flakes displaying cortex on the entire dorsal surface; triangular-shaped section flakes with cortex present on the entire dorsal face; squared and pointed fragments; and a large quantity of small flakes and splinters. Blades are rare, but do occur. Blades can be obtained from a bipolar core if the knapper prepares the core. Therefore, some mental planning is needed to flake small pebbles and acquire the desired shapes (D. Pomstra *pers. comm*.). Bipolar flaking, therefore, results in tools with similar shapes, with a wide range of angles available to work with.

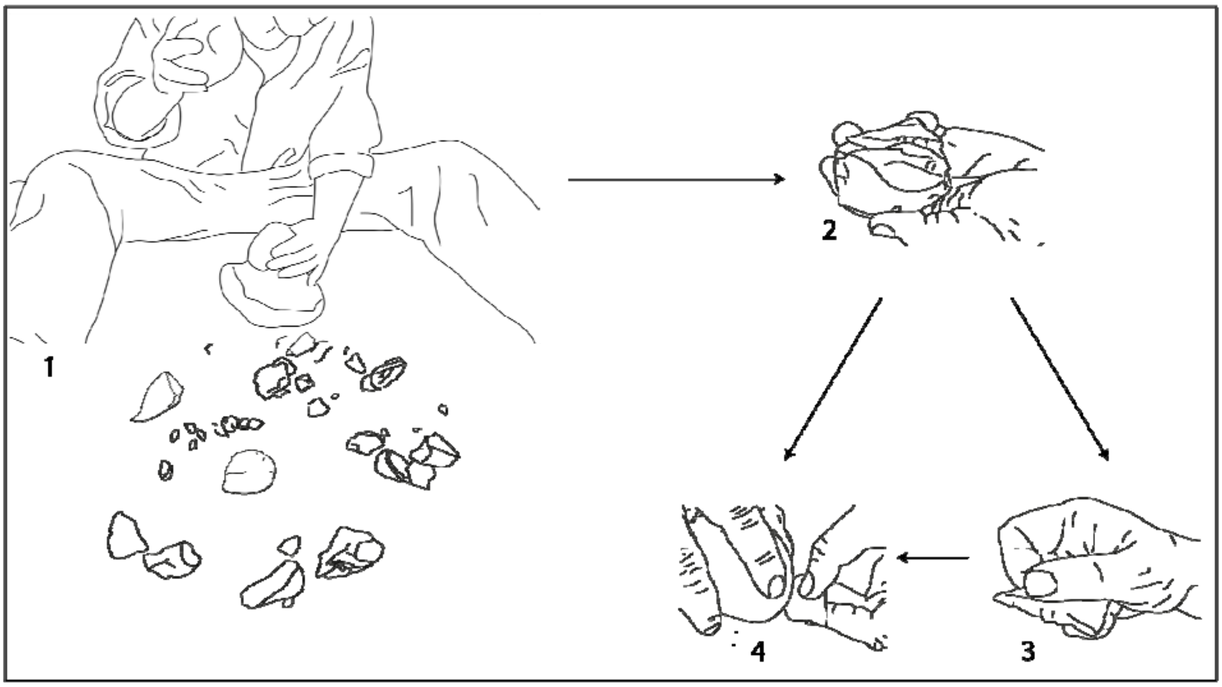

Figure 7.3 Flint technology in the Corded Ware Culture was characterised by an extended use of bipolar technology. The products of this technology, mostly flakes, were primarily used without further modification. However, retouched flakes and blades, scrapers and borers were also produced with bipolar technology (García-Díaz).

The low quality and small size of the flint nodules used at the three settlements studied determined the technological practices adopted by these communities. The variability of the tools seems to be related to the temporal and functional characteristics of the three settlements. In the first place, a smaller assemblage was found at Keinsmerbrug, interpreted as a special settlement (see Chapter 4). Although unmodified flakes are the most frequently represented tool type in all cases, the diversity of types at Mienakker and Zeewijk is greater than at Keinsmerbrug. Mienakker and Zeewijk have been interpreted as permanent or semi-permanent settlements (see Chapters 4, 5 and 6). Several studies relate group mobility to the degree of diversity of tool types used at the site (Binford 1979, 1980; Douglass 2010; Holdaway and Stern 2004; Holdaway and Douglass 2012; Kuhn 1994; Torrence 1983). Shott states that '*mobility frequency may limit the number of tools, and the number of tool classes that can be carried between residences*' (Shott 1986: 20). Therefore, the lower degree of mobility of the groups allows for a higher degree of tool specialization, and reduces the multifunctional character of the tools transported by more mobile communities (Torrence 1983). However, the idea of a single cause for tool variability has been extensively criticized. A combination of several factors, such as site formation processes and the intensity and duration of occupation, has been suggested by several researchers (Douglass 2010; Holdaway and Stern 2004; Holdaway and Douglass 2012). In fact, a relationship between the functionality of the settlement and its tool types seems to be explicit at the settlements studied. At Mienakker and Zeewijk, where specialized activities were performed, a higher number of specialized tools were documented (see Chapters 5 and 6). The correlation between the small drills and borers used to produce amber beads and ornaments locally and the large quantity of scrapers and retouched tools oriented towards hide preparation should be noted in this regard. The presence of querns could also be related to the more permanent character of the settlements. At settlements where agricultural activities played an important role for the subsistence strategies of the groups, as in Mienakker and Zeewijk, grinding and cereal processing implements were found in greater quantities than at Keinsmerbrug, where hunting and fowling were the basic economic practices and overall agricultural implements, such as axes, adzes and sickles, are lacking.

Tools were produced within the domestic arena at Keinsmerbrug and at Mienakker (García-Díaz 2012, 2013, 2014a; Nobles 2012b, 2013b). At Keinsmerbrug, an area outside the houses (Area 4) was interpreted as a knapping zone due to the quantity of flint flakes and waste present (García-Díaz 2012; Nobles 2012b). At Mienakker, two flint concentrations, both associated with hearths located inside the dwellings, were interpreted as flint knapping areas. Houses were an integral part of the identity of the group. Ethno-archaeological studies show that houses reflect cosmological beliefs, gender and social inequality, and provide links to the ancestors and their '*narratives*' (see González Ruibal 2001; Horton 2005; Lanee 2005; Waterson 2013; see Chapter 3). In domestic spaces, cultural ideas and values that structure daily life were transmitted through habitual practices (Bourdieu 1973; Çevik 1995; Gerritsen 1999; Gerritsen 2001; Hodder 1990). Hearths, as part of domestic spaces, structured social activities. Fire was used in many domestic activities, from cooking and pottery production to heating and lighting. In addition, hearths are closely related to the structure of the household space.

It is assumed that hearths played an important part in the social life of prehistoric communities, as places where people gathered to conduct a wide range of activities.

Typology

The main observation from the typological analysis of the assemblages of the three settlements is that the proportional representation of the tool types on the assemblage is variable. The variability of the tools seems to be related to several conditions. In the first place, a scarcity of raw materials probably determined the size and shape of the final products, which is interesting considering the small size of the implements of the CWC. Cores were exhaustively exploited, probably due to the fact that the area of raw material acquisition was approximately 15 to 20km from the settlements. As observed in several ethnographic studies of stone tool makers in Australia and the western United States, flint scarcity determines the technological choices applied to the raw material and to the tools obtained from it (Andrefsky 1994).

Although the range of tool types at the settlements varied, common traits can be observed. Unmodified flint implements were the dominant feature of the studied assemblages, with flint fragments and splinters being the most frequently represented tools. Flint knapping was for the most part oriented towards obtaining flakes, and retouched tools mainly included flakes, scrapers and borers. In addition, fragments of flint were also retouched at the three settlements, and at Zeewijk exhausted cores were occasionally retouched. Some tool types, such as blades and arrowheads, are scarcely represented in the assemblages. Blade technology was probably constrained by raw material quality and nodule size. The blade cores and blades confirm the ability of the Corded Ware communities to produce these implements, and suggest that the absence of blades was a deliberate technological choice. Although a systematic analysis of flint technology is lacking for other Corded Ware assemblages from the Noord-Holland province, preliminary results from several assemblages suggest a similar behaviour (Van Heeringen and Theunissen 2001; see Chapter 2). The scarcity of blade technology in domestic contexts is a common phenomenon in the Late Dutch Neolithic (see Chapter 8). Blades found at the settlements lack a regular appearance with parallel edges and ridges, and most of them could be considered an accidental by-product of flake knapping.

In the CWC, few examples of arrowheads have been documented in domestic contexts. Besides the two '*pine-shaped*' points from Zeewijk, arrowheads have been unearthed at Ede-Frankeneng and Donk-Het Spookestraatje (Drenth *et al*. 2008), Aartswoud (Van Iterson Scholten and De Vries-Metz 1981) and Molenkolk 2 (Peeters 2001c). Archaeozoological remains suggest that hunting still held great importance in the economy of Corded Ware communities (Zeiler 1997; Zeiler and Brinkhuizen 2012, 2013, 2014); as such, the low number of arrowheads could not be interpreted strictly in terms of changes in subsistence strategies. One reason to explain the relative scarcity of these implements in the archaeological record could be that projectiles were very valuable tools and had a prolonged use.

Bipolar technology produced regular shapes, which facilitated the production of specific tools. The analysis clearly shows that borers were produced from the squared and pointed fragments obtained from bipolar flaking. In addition, although the majority of scrapers were obtained from unidirectional flaking, bipolar fragments and triangular shape-section flakes were used to produce scrapers and retouched tools at Mienakker and Zeewijk. The use of bipolar percussion to obtain specific tools has also been recorded in other European Late Neolithic contexts, such as the western French Chalcolithic (Binder *et al*. 1990; Guyodo and Marchand 2005). In these contexts, bipolar techniques were intentionally used to obtain scrapers and borers (Guyodo and Marchand 2005: 546).

7.2.2 Stone

At Keinsmerbrug, stone tools were almost completely absent and only one hammer stone was recovered, while at Mienakker and Zeewijk the quantity and diversity of implements were greater. As in the case of the flint tools, the selection and variability of stone implements could be a reflection of the social organization of the settlement (Shott 1986). At settlements of a more permanent character, stone tools were used more frequently and exhibit higher variability, while at sites related to mobile populations stone tools was seldom used. However, as in the case of flint, the selection of stone tools was probably dependent on other factors (Holdaway and Stern 2004; Holdaway and Douglass 2012). The stone assemblages at Mienakker and Zeewijk were dominated by querns and hammer stones, although other tools such as pestles and grinding tools were also present (García-Díaz 2013, 2014a). Querns and hammer stones have been catalogued at other CWC settlements such as Steenendam, Aartswoud I, Zandwerven and Kolhorn (Drenth and Kars 1990; Fokkens 1980; Regteren Altena and Bakker 1961; Van Iterson and De Vries-Metz 1981).

Raw materials were probably selected on the basis of natural shape and lithological characteristics (García-Díaz 2013, 2014a, 2014b). Grinding and cereal processing tools were usually fashioned from granite and sandstone, while quartzite was selected for percussive implements (García-Díaz 2012, 2013, 2014a, 2014b). Due to the physical composition of sandstone and granite, characterized by the hardness of their individual grains, both raw materials are suitable for grinding and cereal processing activities (Delgado Raack 2008, 2009; Schneider 2002). Quartzite, on the other hand, was the most appropriate raw material available for percussive activities due to the interlocking quartz crystals which form the internal structure of the stone. A similar selection of raw materials was observed at the contemporaneous settlement of Kolhorn, where querns were mainly produced from granite and gneiss, while quartzite was chosen for hammer stones (Drenth and Kars 1990). The selection of raw materials based on their petrographic characteristics is a common phenomenon observed in several archaeological contexts (Adams 1999; Andrefsky 1994; Delgado Raacks *et al.* 2008; Delgado Raack and Risch 2008; Delgado-Raack *et al.* 2009). Knowledge about the physical properties of the stones was probably passed on from one generation to another. The information generated and carried by the tools was part of the social norms and rules defined by the groups, but it was also generated through knowledge and learning.

Figure 7.4 The chaîne opératoire of the querns and grinding stones at Mienakker and Zeewijk suggest that after the selection of the raw material, querns were used for cereal processing. When the surface was blunted, flaking was used to reshape and revive the grinding surface. On the image, quern with several flake negatives (García-Díaz).

The technology applied to these tools was simple: implements dedicated to percussion activities show no manufacturing traces, although grinding and cereal processing implements were intentionally modified prior to use. The latter display flake negatives on their surfaces, not only related to the initial shaping of the tool, but also to the rejuvenation of their use surfaces. Similar production traces were observed in contemporaneous assemblages (Fokkens 1980; Regteren Altena and Bakker 1961; Van

Iterson and De Vries-Metz 1981), and additionally, at Kolhorn, some handstones showed traces of percussion along their lateral perimeter. Although the shape of the implements changed, and the tools were probably adapted to the needs of the communities and the availability of raw material, the technology applied to these tools remained similar, if not precisely the same. The production of querns in agro-pastoral societies has generally been associated not only with the increased dependence of the human diet on cereals, but also with the social organization of the household, gender interactions and learning processes (Adams 1999, 2010; Hamon and Le Gall 2013). Ethnographic studies show that querns were usually related to other implements and *chaînes opératoires*, such as for example wooden mortars (Hamon and Le Gall 2013), and that they were used in different craft interactions; querns are usually associated with women, and the use and maintenance of the tools is passed from one generation to another during the daily practices of the group (Adams 1999, 2010; Dobres 1995; Hamon and Le Gall 2013). Therefore, while learning, women preserved and transmitted the '*mutual knowledge*' of the communities (Broadbent 1989; see Chapter 3).

7.2.3 Bones

The physical morphology of implements has been considered as a way of communication '*through which people negotiate their personal and social identity*' (Wiessner 2006: 60). Although not many bone tools were available for study, it seems that the Mienakker and Zeewijk bone assemblages have a distinct character, with awls, needles and ripples the most frequently occurring implements (García-Díaz 2013, 2014a; see Chapters 5 and 6). Some Corded Ware settlements displayed similar bone tool types: at De Vrijheid 1 and 2 and at Flevo (Van Heeringen and Theunissen 2001) the main tool types were awls and needles, and one bone was interpreted as a flute (Van Heeringen and Theunissen 2001). The worked bone assemblage at Aartswoud was also composed primarily of needles and awls, but also included spatulas, ornaments, weights, scrapers, axes and *retouchoirs* (Cavallaro 1994 in Drenth *et al.* 2008: 164). In addition, bird bones were selected to produce borers (Van Wijngaarden-Bakker 1997), and teeth were used for ornaments. Three perforated teeth (from a dog, a pig and a deer) were also recovered during the excavation of Aartswoud (Van Heeringen and Theunissen 2001).

Although the analysis of bone implements from the Corded Ware settlement assemblage is partial and unsystematic, a certain continuity is observed within the preserved Neolithic assemblage. Vlaardingen settlements have well-preserved bone assemblages that consist of awls and chisels as well as a large amount of the waste produced during their manufacture (Van Gijn and Bakker 2005). Bone implements were produced using the '*metapodium technique*' used at other contemporaneous sites such as

Hekelingen III (Maarleveld in Van Gijn 1989). Antler was used to produce hammers, handles and points at Vlaardingen (Maarleveld 1985; Van Gijn 1989), and in addition one antler point was found at Barendrecht-Carnisselande (Moree *et al.* 2011). Technological choices made in the production of tools probably relate to this observed uniformity. The '*metapodium technique*' was used to obtain long bones in order to produce tools. Other techniques used to produce bone tools were probably simpler, in view of the shapes of some bones displaying use-wear traces. The use of a combination of techniques has also been documented at other Neolithic settlements in the Netherlands, such as at Schipluiden (Van Gijn 2006), Hazendonk (Van den Broeke 1983) and Hekelingen III (Louwe Kooijmans 1985; Van Gijn 1989).

7.3 Domestic activities at the Corded Ware settlements

Use-wear analysis reflected the different functions of the three settlements. The use-wear traces observed at Keinsmerbrug indicate that the settlement was used sporadically, and that the traces were the result of maintenance activities. However, traces displayed on the implements from Mienakker and Zeewijk pointed to sites of a more permanent character, and to a greater diversity in the activities performed at the settlements. As already discussed in previous chapters, households were at the centre of the activities performed at the settlements. At Zeewijk, no spatial patterning of activities was identified. However, at Keinsmerbrug some of the implements displaying use-wear traces were found near to hearths within the Northern Structure (Nobles 2012b), while at Mienakker both occupation episodes were clearly related to the construction of two dwelling structures, which hold a high density of archaeological implements (Nobles 2013b). At the Corded Ware settlements, therefore, the house was the focal point of production and consumption activities. As already discussed (see Chapter 3), these cycles were embedded in the '*mutual knowledge*' of the groups. This knowledge was evidenced not only in the way of tools were produced, but also in the way they were used and discarded.

7.3.1 Tools to make tools

At the three settlements under study, the spatial distribution of flint and stone implements indicated that tools were produced inside the structures, around the hearths (García-Díaz 2012, 2013, 2014a; Nobles 2012b, 2013b, 2014b). The production, retouch and maintenance of flint implements were carried out using hammer stones. Although no clear correlation between use-wear traces and the production of flint implements could be established at any of the sites, the spatial analysis at Mienakker showed that tools were produced during different episodes, probably in response to the needs of the inhabitants of the settlements (García-Díaz 2013; Nobles 2013b). In addition, as shown by ethnographic sources (Hayden 1989), hammer stones could also be used to produce and repair querns and other grinding tools. The *chaîne opératoire* of the querns and grinding stones at Mienakker and Zeewijk suggest that after the selection of the raw material, querns were used for cereal processing. When the surface was blunted, flaking was used to reshape and revive the grinding surface (Figure 7.2).

Although the preservation of the bone implements did not permit a proper recognition of the techniques employed to produce them, the '*metapodium technique*' would have been the most suitable technique. The analysis of faunal remains permitted a better understanding of the production system of bone implements. Flint and stone implements were employed during raw material acquisition, as inferred from the cut marks on bones. Both scraping and cutting actions were inferred from the use-wear traces on several flint implements, suggesting that the production and maintenance of bone implements was performed locally. However, no traces of bone processing were displayed on any stone tool. Although percussion activities were probably performed with hammer stones, traces developed after percussive activities are hardly ever developed enough for the worked material to be inferred. In addition, and as already discussed in Chapter 5, the polishing of the bone surfaces during the manufacturing process could have been performed with flint implements (Semenov 1981[1957]), or with several other implements that were not archaeologically recovered, such as fine sand and leather (Olsen 1979; Van Gijn and Verbaas 2008) or horsetails (Richie 1975 in LeMoine 1997).

Use-wear traces suggest that amber beads and ornaments were produced at semi-permanent and permanent settlements such as Mienakker and Zeewijk (Bulten 2001; García-Díaz 2013; Van Gijn 2014a). The *chaîne opératoire* of the amber implements suggest that the raw material was collected and transported to the settlements from nearby beaches (see Chapter 5). At the settlement, cortex was removed by scraping the surface with a flint implement, or by flaking the amber nodule with a hammer stone. Afterwards, amber was cut with a flint implement and the final shaping of the bead was performed by polishing the surface with a stone. The final step in the production of the amber beads was the perforation of the ornaments with bone, antler and flint borers. Although several implements were required for the production of amber ornaments and pendants, at Mienakker and Zeewijk only the implements of the final production stage were found, such as small borers related to the production of amber beads displaying a heavily rounded edge and a well-developed flat and bright polish (García-Díaz 2013). The analysis of the amber assemblages corroborated the interpretation of the functional traces on the small borers. At Mienakker (Bulten 2001) and Zeewijk (Van Gijn 2014a) all the steps of the production process were observed. Although use-wear analysis has not been performed at other wetland settlements, similar borers have been found at other contemporary sites such as Warmond Park Klinkenberg (Dijkstra and Bink 2005), Aartswoud (Van Heeringen and Theunissen 2001; Van Iterson Scholten and De Vries-Metz 1981), De Venken (Peeters in Van Heeringen and Theunissen 2001) and Kolhorn (García-Díaz *personal observation*; Woltering 1976), suggesting that the production of beads and ornaments occurred at several settlements.

7.3.2 The use of vegetal resources

Vegetal resources were frequently exploited by the Corded Ware inhabitants of Keinsmerbrug, Mienakker and Zeewijk, as shown by the use-wear traces of the domestic implements, but also by the analysis of botanical and palynological remains and the organic residues preserved in the pottery vessels (Oudemans and Kubiak-Martens 2012, 2013, 2014). Plant resources were used for two main purposes. In the first instance, vegetal resources played an important role in the diet of Neolithic populations in general, and in the CWC in particular, as indicated by the analysis of the skeletal remains found at Mienakker (Plomp 2013). In addition, leaves and grasses were used as the main food source for the cattle. Secondly, vegetal resources were used as raw material for the construction of buildings and for furnishing (Kubiak-Martens 2013, 2014), but also to produce necessary equipment, tools, and other goods such as clothes or ropes. Traces of wear recorded on the domestic implements of the three settlements illuminated the range of activities performed at the settlements and the social structure of the groups.

7.3.2.1 The use of plants as a food source

Archaeobotanical analysis implied that both domestic and wild plants were used as food at Keinsmerbrug, Mienakker and Zeewijk (Kubiak-Martens 2012, 2013, 2014; Kubiak-Martens *et al.* 2015; Oudemans and Kubiak-Martens 2012, 2013, 2014). Remains of emmer and naked barley are present at the three settlements, and the cultivation of both crops was proposed for Mienakker and Zeewijk (Kubiak-Martens 2012, 2013). In addition, further evidence supports the idea of local cultivation, for instance the plough marks recorded during the excavation of Zeewijk at the same level as the Neolithic features (Nobles 2014a). Cereals were sown in spring, in order to avoid saltwater flooding during autumn and winter, and cereal harvesting was performed at the end of summer (Kubiak-Martens 2013, 2014).

No flint sickles were found at the settlements. The absence of sickle blades is a common phenomenon in the wetlands (Bakels 2014; Van Gijn 2010a), and very few sickles have been found in Middle and Late Neolithic and Early and Middle Bronze Age settlements or graves, although evidence for cereal harvesting and processing exists in the Hazendonk group (Kubiak-Martens 2006; Van Gijn 2006). The absence of flint sickles might be explained by the use of other materials, such as wood or bone, to make sickles, although unfortunately no such tools have been identified. In addition, ethnographic studies have also documented the harvesting of cereals without the use of sickles (Ibáñez Estévez *et al.* 2000). Botanical remains of cereal processing were present at Mienakker and Zeewijk. At Keinsmerbrug, however, emmer was probably carried to the settlement as naked grain. From the organic residues found in pottery vessels, it was inferred that cereals were processed and consumed in the settlements (Oudemans and Kubiak-Martens 2012, 2013, 2014).

The presence of cereal processing tools at Mienakker and Zeewijk reflected the importance of cereal consumption at both settlements, and in the CWC as a whole. The percentage of tools with use-wear traces related to cereal processing is high at both settlements, and querns were heavily used. As already stated, some of the querns present at Mienakker and Zeewijk are flaked, probably as a way of rejuvenating and/or preparing the surface. In addition, the use-wear present on the used surfaces is intensely developed in some cases, and use-wear traces present on the bottom of the querns give a good indication of the length of use of the querns (Verbaas and Van Gijn 2008: 196), as this part of the tool does not need to be rejuvenated. At Mienakker, the bottom zones of the querns are highly worn and rounded, indicating a prolonged use of the tools (Chapter 5; García-Díaz 2013). The raw material selection would have played an important role in the functionality of the tools. For grinding and cereal processing stones, the physical characteristics of the raw material '*influence their fineness of grind; efficiency of processing, in terms of both volume and moisture content of the substance being processed; resistance to dulling; durability of the stone; ease with which the stone may be worked, and its use-wear characteristics*' (Horsfall 1989: 369). The presence of querns and grinding tools within the archaeological context has been interpreted by various authors as an economic marker (Adams 2002). One argument that supports this hypothesis focuses on the relationship of querns to food production and productivity. The higher efficiency and use-intensity of the cereal processing tools is directly related to their productivity and thus increases the capacity to feed a larger number of people. Therefore, a demographic increase of the population could be sustained by agricultural economies, materialized through grinding and cereal processing activities, and long-term occupations will appear in close proximity to the fields. Although population increase during the Late Neolithic is still a current debate, the interpretation of the settlements at Mienakker and Zeewijk pointed to permanent or long-occupation settlements (Kleijne *et al*. 2013; Theunissen *et al.* 2014). This hypothesis was supported by the documentation of two concentrations of cereal remains interpreted as storage and/or cereal processing areas at Mienakker (Kubiak-Marteens 2013). Food storage would permit the consumption of cereals, which had to be collected after the summer to avoid the winter floods, at a later date (Kleijne *et al.* 2013; Theunissen *et al.* 2014). Cereal storage would have been one of the main strategies used by the Corded Ware communities to reduce the risk of starvation. Besides the economic diversification practised by the Corded Ware communities, food storage guaranteed that they could survive periods of scarcity (Groot and Lentjes 2013; Halstead and O'Shea 1989).

Food grinding has been considered a gender-specific task, based on several ethnographic models from the U.S. Puebloan and non-Puebloan groups (Adams 2002, 2010). Food grinding was a technology learned within the community by women, among women. Although the context of the native North Americans is different from the Late Neolithic Dutch context, a similar strategy could have been followed at settlements of the Dutch CWC. According to Sherratt (1996), women were relegated to the domestic sphere after the discovery and diffusion of secondary product innovations. The production of daily equipment, food processing and maintenance work were part of the tasks undertaken by women. If Sherratt’s suggestion is valid, querns were part of the toolkit associated with female activities. Accordingly, the analysis of these tools provides important information about the technical skills of women and the way these skills were applied (Adams 2002). Stone tools, as much as basketry and textile production, were a means of transmitting technical knowledge within the domestic context (Hurcombe 2006). Although during the spatial analysis no direct link between the querns and the grain remains could be established, a possible concentration of stones associated with the MKII structure (Nobles 2013b) might suggest that the cereals were processed near to, or within, dwellings. Cereal processing at the door of houses has been documented in non-Pueblo groups, while women from Pueblo groups process food daily inside their homes (Adams 2010). The mobile nature of querns and grinding tools would provide flexibility to work, depending on other circumstances such as social events, the weather or a change of owner (Hamon and Le Gall 2013).

In addition, wild nuts, fruit and seeds were used as a food source at Mienakker and Zeewijk. At Keinsmerbrug, however, botanical remains of nuts and fruits were absent, although seeds were probably consumed (Kubiak-Martens 2012). Hazelnuts and acorns, stored for winter use, could be opened with the help of a pebble or a small hammer. In addition, at Mienakker there is also evidence of storing dried apples cut into small pieces (Kubiak-Martens 2013). Flax and orache seeds, recorded at the settlements and used as a food source, could have also been processed with hammer stones (Kubiak-

Martens 2012, 2014; Kubiak-Martens *et al.* 2013). However, although hammer stones are numerous at Mienakker and Zeewijk, use-wear traces related to vegetal processing were observed only on one hammer stone (García-Díaz 2013).

7.3.2.2 The use of plants as equipment and construction material

Several types of plants have been identified as raw material for the construction of dwellings at Mienakker and Zeewijk (Kubiak-Martens 2012, 2013, 2014). The remains of wooden posts from the central post line of the Zeewijk-East structure suggest that alder wood and willow twigs were used to build the frame of the dwellings (Kubiak-Martens 2014), with reed, cattail leaves and stems of club-rush also being used as construction material (Kubiak-Martens 2013, 2014). Evidence for the use of other types of wood, such as oak and hazel, was recovered from the charcoal samples studied at the excavation, suggesting their use as building material as well as fuel. However, evidence of coarse woodworking was not observed on tools from any of the three sites. The fragments of flint axes found at the three assemblages may suggest the use of these tools to chop wood, although no use-wear traces supporting this hypothesis were displayed. In addition, other organic implements could have been used: archaeologically, ethnographic and experimental research shows the use of bone and antler implements to chop wood (LeMoine 1994, 1997; Maigrot 2000; Pomstra and Van Gijn 2013). As already discussed, the three settlements were located on a relatively treeless landscape. Oak and hazel did not grow near the three settlements, and they were probably obtained from more distant areas such as Texel or the Pleistocene deposits of Wieringen (Kubiak-Martens 2012, 2013, 2014). Therefore, coarse woodworking was likely performed outside the domestic area, and the tools were probably carried and used outside the settlements, which could partially explain their absence from the archaeological record. In addition, the absence of flint axes could also be explained by the reutilization of broken axes into cores, as suggested by the small number of implements displaying a polished surface (García-Díaz 2012, 2013, 2014a; see Chapters 4, 5 and 6)(Fig. 7.3).

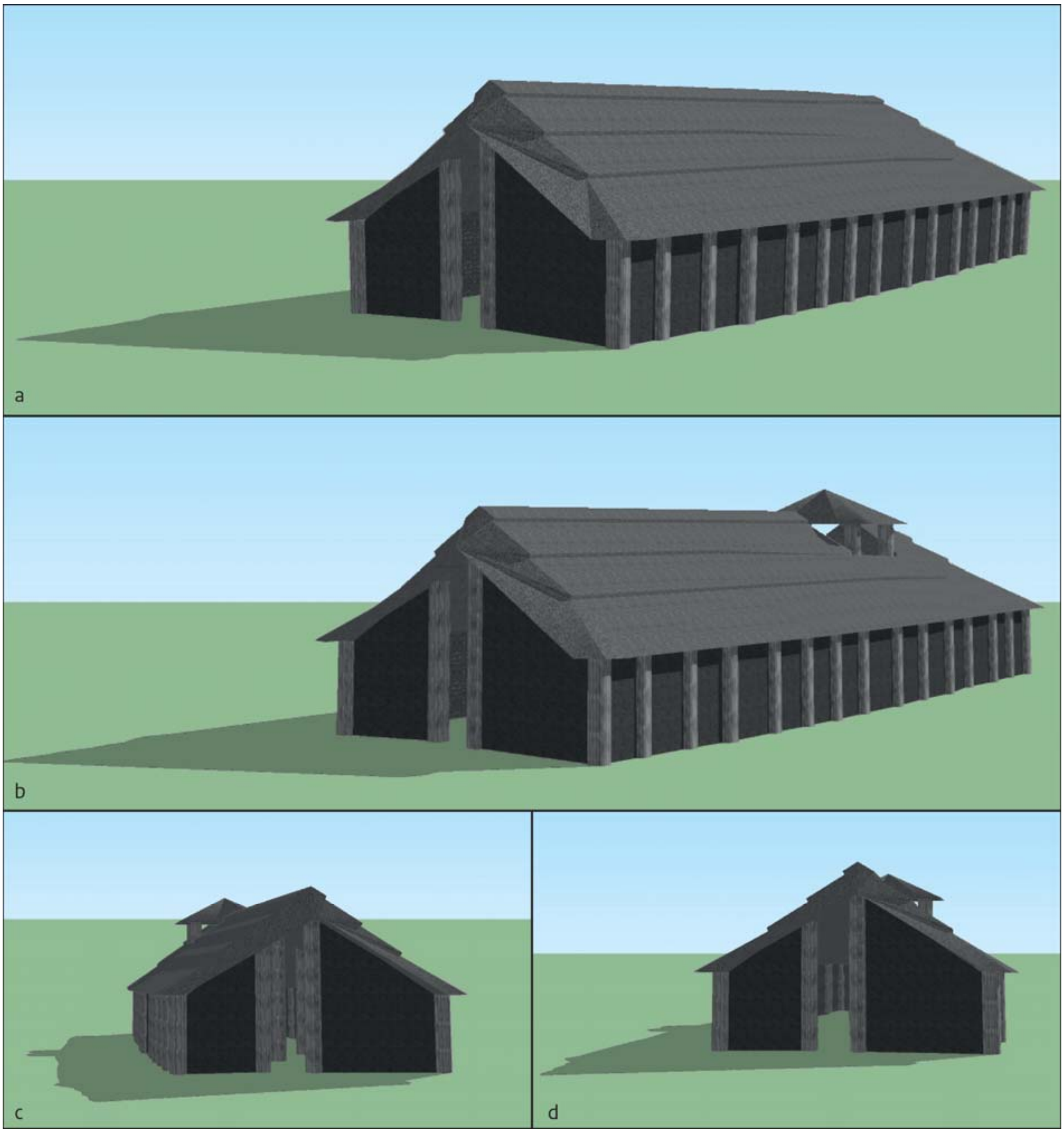

Figure 7.5. Image of the possible Zeewijk-East house reconstruction (Nobles 2014: 208).

Cattail leaves and club-rush stems could be used to produce sitting and sleeping mats, while willow twigs could be used to produce ropes and traps for fishing and fowling (Kubiak-Martens 2013). In addition, flax was used for its oil-rich seeds and possibly also for its fibres (Herbig and Maier 2011). Flax could have been used for producing ropes and clothes and as insulation for the houses (Kubiak-Martens 2013, 2014). Wooden tools accounted for a large proportion of the implements used by prehistoric communities, although unfortunately such implements have been preserved only in a few exceptional contexts. Bowls, spoons, digging sticks, sickles, spears and tool hafts have been recorded in Neolithic archaeological contexts where wood has partially survived (Bosch i Lloret *et* *al.* 2006, 2011). In addition, wood was used to build houses and other structures. Based on ethnographic research, plant craftwork has been considered a female task. Textile and basketry production have been considered an important craft of the domestic sphere of the Neolithic population both from a functional point of view and from a social perspective. Hurcombe (2006) stated that social cohesion and mutual knowledge were created, maintained and transmitted by the style and patterns present on clothes, pots and baskets. Women would have been important agents in the construction and preservation of cultural norms and traditions.

Wood, both soft and hard, was processed with flint implements and stone and bone tools. At Mienakker, use-wear traces related to plant processing were observed on 23.5% of the tools with traces of use (García-Díaz 2013). Although the percentage of flint tools with use-wear traces at Keinsmerbrug and Zeewijk was lower, flint implements were probably used in combination with other organic implements such as wood and bone tools. Although the sample analysed was small and the preservation of the implements was unequal, the result of the use-wear analysis indicated that bone tools played an important role in plant processing activities at the Corded Ware settlements. At Mienakker, three bone implements displayed traces of wood and hard plant processing. The use of organic implements to process vegetal materials is well-represented at other Dutch Neolithic settlements. At Schipluiden several awls were related to basketry, while woodworking traces were displayed on bone chisels and one possible wedge. Woodworking traces were, however, rarely observed on flint flakes and blades, and were mainly visible on flint axes, probably used for chopping wood. Bone tools complemented the flint axes, and were used for fine woodworking (Van Gijn 2006, 2008). At the Late Neolithic settlement of Chalain Station 4 in France flint tools used to process vegetal resources were present in small numbers, and plant resources were mainly worked with implements made from antlers, bones and teeth. Bone implements were used for fine plant working such as debarking and separating fibres for basketry (Maigrot 2000, 2005). At Keinsmerbrug, Mienakker and Zeewijk fine woodworking were probably performed with bone implements and flint tools, as unmodified blades, and retouched flakes and fragments.

7.3.3 Animal resources

7.3.3.1 Animals as a food source

The importance of animals, both wild and domestic, in the subsistence activities of the Corded Ware settlements is reflected in the high quantity of bones present in the three settlements under study. Fowling was a characteristic economic activity of the CWC in the Noord-Holland province and was performed at every settlement studied, making it one of the most important activities. It implied a good knowledge of the natural life cycle of the wild animals that surrounded the settlements, and social cooperation in mass catching and storage. The vast majority of the bird bones excavated came from ducks, predominantly mallard, teal/garganey and widgeon (Zeiler and Brinkhuizen 2012, 2013). During summer, ducks and geese were in their moulting period and were unable to fly. Therefore, mass catches were probably performed without using arrowheads (Zeiler and Brinkhuizen 2012, 2013). Birds were probably caught with nets and traps made from perishable materials, in the way it was still performed until recently in the area (Zeiler and Brinkhuizen 2013). Therefore, although from a functional perspective use-wear traces related to this activity are almost non-existent among the domestic implements of the settlements, traces related to plant processing could be interpreted as part of the production process of traps and nets to catch birds.

At Keinsmerbrug the remains of only six wild animals were found (Zeiler and Brinkhuizen 2012), but at Mienakker and Zeewijk wild boar and fur animals were exploited (Zeiler and Brinkhuizen 2013, 2014). As already discussed, arrowheads were only found at Zeewijk. Although both of the flint arrowheads recovered at Zeewijk display impact traces (García-Díaz 2014a), the small number of arrowheads could be explained in several ways. In the first place, arrowheads were probably carried from the settlements to the catchment areas, and they will only have been abandoned if they were fractured or accidentally lost. In addition, arrowheads and projectile implements could be repaired and transformed into other implements after use (Keeley 1982). Finally, the absence of flint arrowheads could also suggest that Corded Ware groups were using other materials or strategies: projectile points made of wood or bone might have been used instead of flint, as observed in both ethnographic and archaeological sources (Dale Guthrie 1983; Legrand and Radi 2008; LeMoine 1994, 1997), and traps could have been used to catch small fur animals.

Wild animals were used as a meat source. However, birds, goats and cattle were the main sources of meat at the three settlements. Most of the bird species excavated were probably consumed. Although butchering traces were absent from most of the remains, the distribution of the skeletal remains suggest that Corded Ware groups selected the meaty parts of the bird to consume at the settlements, and that ducks were not exploited only for their feathers (Zeiler and Brinkhuizen 2012, 2013, 2014). In addition, traces of butchering activities are present on bone remains of cattle at Keinsmerbrug, Mienakker and Zeewijk (Zeiler and Brinkhuizen 2012, 2013, 2014). As indicated by the analysis of the faunal remains, adult and sub-adult cattle specimens were selected for slaughtering. At Mienakker, cut marks on a mandible fragment and in several fragments of long bones, vertebrae and ribs shown that the meat was cut loose from the bone (Zeiler and Brinkhuizen 2013: 158), and similar processes have been inferred at Zeewijk (Zeiler and Brinkhuizen 2014). Although butchering traces are scarce at the three settlements, it is necessary to consider the effects of taphonomy and the high degree of post-depositional alterations on the preservation of the use-wear traces at the three assemblages that were studied. And, secondly, the poor development of use-wear traces on tools processing soft materials like meat or fish should also be considered as an important factor (González Urquijo and Ibáñez Estévez 1994; Grace 1990; Van Gijn 1986). Therefore, although meat was probably cleaned with flint implements (Zeiler and Brinkhuizen 2012, 2013, 2014) traces of this activity are underrepresented.

Tools displaying traces related to fish processing are scarce. Although use-wear related to fish processing has been discussed in several publications (Anderson 1981; Briels 2004; Clemente Conte 1997; Clemente Conte and García-Díaz 2008; García-Díaz 2009; García-Díaz and Clemente Conte 2008; Gutiérrez Sáez 1990; Iovino 2002; Moss 1983; Plisson 1985; Semenov 1981[1957]; Van Gijn 1986, 1989), these traces are not well displayed in these assemblages. In the Netherlands, use-wear traces related to fish processing have been documented in Mesolithic (Niekus *et al*. *in press*) and Neolithic contexts (Houkes and Verbaas *in press*), but always in low percentages (Van Gijn *et al.* 2001a; Van Gijn *et al.* 2001b). Although fish remains were very common at Corded Ware settlements (Zeiler and Brinkhuizen 2012, 2013, 2014), traces related to fish scaling and cleaning were only inferred at Zeewijk. However, the lack of evidence could also be related to the use of several techniques to process fish that did not require regular use of flint tools, such as smoking or drying (Rostlund 1952; Stewart 1977; Trigger 1969). In addition, other tools could have been used to scale fish or to remove their heads; wooden or bone tools would be effective enough. Fishing would have been important not only for the diet of the Corded Ware communities but for other activities as well. Ethnographic documentation shows that fish skins can be used as waterproof material to produce clothes, shoes and containers (Hurcombe 2014; Newell *et al.* 1990).

Fishing has been traditionally studied as a reflection of subsistence and technological practices performed by prehistoric populations (Schulting and Richards 2002). However, lately some articles have focused their attention on the importance of the maritime landscape for coastal populations, not only as a food supply but also as a generator of knowledge and traditions. Considering the sea as landscape '*provides a new perspective on how people in coastal areas actively create their identities, sense of place and histories*' (Cooney 2003: 323). Fishing implied specialized technology and equipment. Besides possible remains of a canoe found at Mienakker, evidence for specialized gear was not found at the studied settlements. However, fishing nets, hooks and traps are common finds for the Vlaardingen period (Van Iterson Scholten 1977), and their use during the Corded Ware Culture is assumed. In addition, fishing also implied the generation of a specialized environmental knowledge concerning '*not only seasonal cycles and the ecology of plants and animals, but also long- and short-term weather and tidal cycles*' (McNiven 2003: 330). Ethnographic research also suggests that the sea played a significant role in the creation of myths, social norms and cultural traditions (Barber 2003; Cooney 2003; McNiven 2003). In Late Neolithic wetlands, fishing was mainly performed in freshwater streams and tidal flats (Zeiler and Brinkhuizen 2012, 2014). Tidal areas have been interpreted as a meeting place and a boundary between the land and the sea, and, therefore, as an area with strong symbolic meaning for some communities (McNiven 2003). The symbolic role of the tidal areas has also been proposed for the Neolithic megaliths at Brittany and Orkney (Phillips 2003), as the visibility of these constructions from the sea would have further strengthened the importance of marine resources in the lifeways of the Neolithic communities in specific areas. The role played by fishing in the coastal areas and the wetlands during the Neolithic period supports the conception of the sea as part of the landscape and as a generator of knowledge and contacts (Needham 2009).

7.3.3.2 The use of animal resources as equipment and for the production of other implements

Fur animals predominated in the faunal assemblages of the three settlements, pointing to the importance of skin processing in the economic system of the Corded Ware society (Zeiler and Brinkhuizen 2012, 2013, 2014). In addition, cutting marks on cattle and seal bones suggested that these animals were also exploited for their skin (Zeiler and Brinkhuizen 2012, 2013, 2014). Fur animals could probably be hunted and skinned during winter (Van Gijn 1989).

Hide processing involves at least four steps (Beyries 2002; Beyries and Rots 2008; Hodges 1989; Rahme and Hartman 1995). The first step was the removal of the layer of subcutaneous fat. Although the layer protects the live animal against the cold, after death the fat starts to decompose, causing the degeneration of the entire skin. Secondly, the epidermis layer has to be removed, including the hair if the skin is going to be dehaired. The removal of hair and epidermis can be performed following different methods, including the use of several additives. Skin dressing techniques of the Naskapi Indians included the employment of additives like calcareous earths, bone dust or flour, which were related to the '*absorbance of fat and grease*' (Mason quoted in Brink 1978: 364). In addition, among the Sami and other Native American Indians wood ashes were '*rubbed into the moistened surfaces, the alkalis so produced attacking the epidermis and hair*' (Hodges 1989: 149). The use of urine was also a common practice to remove hairs, due to the level of alkalinity of the ammoniac (Rahme and Hartman 1995). The use of additives to prepare hide generates specific use-wear traces on the implements used that can be characterized and distinguished from the traces formed without additives (Beyries 2002; Brink 1978; Mansur-Franchomme 1983). After removing the epidermis, the hide has to be dried and tanned to prevent bacterial decay. Ethnographic and experimental analyses have revealed that tools with sharp angles are not suitable for defleshing and hide working activities, because they tend to '*cut too deeply into the hide and puncture it*' (Hayden 1989: 92). Consequently, scrapers would be more appropriate tools for hide working.

Although hide is barely preserved in archaeological contexts, use-wear analysis provides some of the small amount of direct evidence of the hide working process, besides ethnographic information. At Keinsmerbrug, the tasks performed at the site were mostly directed to the repair and/or maintenance of the skins, but the actual preparation of the skin did not take place at the site (García-Díaz 2012). However, the type of use-wear traces displayed at Mienakker and Zeewijk suggests that flint scrapers and bone implements were used in different phases of hide working. At Mienakker and Zeewijk, flint scrapers and retouched fragments were probably used for defleshing and dehairing skins. Due to their small size and the absence of hafting traces, the implements were probably used without hafting (García-Díaz 2013, 2014a). Experimental analysis has shown that, in societies where hide was not worked in great quantities, scrapers and even unretouched tools could be used without hafting (Hayden 1989). However, the flint tools were probably selected based on their working edges, as the used implements display working edges ranging between 40 and 65 degrees (Table 7.1 and 7.2). As inferred from the abrasive characteristics of the polish shown on one scraper and on three bone implements, flint and bone implements formed part of the toolkit used in different stages of hide processing. Skin and hide were not only repaired and preserved at the settlements, but also produced and prepared there.

K+M+Z	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	borer	strike-a-light	total	%
Transversal(scrap)	-	-	1	6	6	9	7	8	7	12	5	5	3	1	3	-	-	73	46.5
Graving/Diagonal	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2	1.2
Transversal/Longitudinal	-	-	-	1	1	-	3	-	1	-	-	-	-	-	-	-	-	6	3.82
Longitudinal	-	-	2	1	4	5	-	1	-	1	-	-	-	-	-	-	-	14	8.9
Unspecific	1	3	1	5	6	7	4	2	2	4	1	1	1	-	1	-	-	39	24.8
Borer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	8	5.1
Strike-a-light	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1.2
Hafting	1	-	1	1	1	-	3	-	-	4	-	2	-	-	-	-	-	13	8.2
Total	2	3	6	14	18	21	18	11	10	21	6	8	4	1	4	8	2	157	100
%	1.2	1.9	3.8	8.9	11.4	13.3	11.4	7.0	13.3	13.3	3.8	5.1	2.5	0.6	2.5	5.1	1.2	100	

Table 7.1 Relation between the type of motion and the edge angle used on the three studied settlements.

K+M+Z		20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	Borer	Strike-a-light	Total
Animal	Hide	-	-	1	4	4	7	5	8	6	7	3	2	1	1	2	-	-	51
	Meat	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	2
	Fish	-	-	-	-	-	-	1	-	-	2	-	1	1	-	-	-	-	5
	Bone	-	-	-	1	2	2	-	-	-	-	-	-	1	-	-	-	-	6
	Uns	1	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	3
	Uns Soft	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Uns Med	-	-	-	1	-	-	1	-	-	3	2	1	-	-	1	-	-	9
Plant	Hard Wood	-	-	-	1	-	3	3	-	-	-	-	1	-	-	-	-	-	8
	Sooftwood	-	1	1	-	2	2	-	-	-	-	-	-	-	-	-	-	-	6
	Wood Uns	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
	Unsp Soft Plant	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Unsp Medium Plant	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	2
Hide/Wood	Hide/Wood	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	2
Hafting	Uns	1	-	1	1	1	-	3	-	-	4	-	1	-	-	-	-	-	12
Mineral	Uns	-	-	-	2	-	-	-	-	1	2	1	-	-	-	-	-	-	6
Unspec	Uns	-	2	2	3	6	5	3	2	2	3	-	2	-	-	1	-	-	31
Borer		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	9
Strike-a-light		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
Total		2	4	6	14	18	21	17	11	10	21	6	8	4	1	4	8	2	157
%		1.2	2.5	3.8	8.9	11.4	13.3	10.8	7.0	6.3	13.3	3.8	5.1	2.5	0.6	2.5	5.1	1.2	100

Table 7.2. Relation between the type of worked material and the edge angle used on the three studied settlements (Unspec: Unspecific; Uns: unsure).

The use of bones for the preparation of skins has been reported in several prehistoric and ethnographic contexts (LeMoine 1997: 46; Semenov 1981[1957]: 319-322). For the Dutch Neolithic, the site of Ypenburg-4 yielded one awl probably used to process hide (Van Gijn and Verbaas 2008), and at Schipluiden an awl was used to pierce hides and one small fragment displayed use-wear traces suggesting a scraping motion (Van Gijn 2006). At other European Neolithic sites with similar chronologies to Mienakker and Zeewijk, such as Chalain Station 4, bone tools played an important role in hide working (Maigrot 2005: 118). Based on the narrow edge displayed by the tools, bone implements at Chalain were probably used for defleshing (Maigrot 2005).

Due to the several steps required for processing hide, it has been traditionally considered as an indicator of long-term or permanent occupation. Permanent or semi-permanent settlements have been linked to the execution of specialized tasks, which would involve a diverse toolkit and, frequently, specialized knowledge and skilled individuals. Ethnographic research indicates that hide working was a predominantly female activity (Arthur Weedman 2010; Frink and Arthur Weedman 2005; Hayden 1992) and that women participated in several steps of hide production. This would also have included the preparation of the stone tools needed to work hide (Arthur Weedman 2000, 2010, 2013).

Ethnographic examples suggest that hide could be used to produce clothes, rope and containers, but also as a building material employed to prepare roofs or the inner spaces of dwellings (Beyries 1990, 2002; Rahme and Hartman 1995). Finally, hide would also be used for canoe manufacture. During the excavation of Mienakker, several groups of branches were interpreted as possible frames of skin canoes (Nobles 2013c; Van Ginkel and Hogestijn 1997). This interpretation is in accordance with the analysis of the fish remains. The presence of deep-water fish, exemplified by the haddock, indicates the need of a proper fisher's tool-kit, including boats (Zeiler and Brinkhuizen 2013).

In addition, animal bones were used as raw material for the production of implements. Although the degree of preservation of bone implements at the settlements under study was low, the majority of the bones identified pertained to large/medium mammals, goats/sheep and cattle (García-Díaz 2013, 2014a). In addition, an incisor of a dog was used at Zeewijk to produce a pendant. Dogs were the fourth most frequent domestic animal encountered at Zeewijk. Most of the dog remains were teeth, suggesting that the production of pendants from this type of raw material was common at the settlements. In addition, cut marks below the proximal epiphysis on a femur implied that dog meat was part of the diet of CWC inhabitants (Zeiler and Brinkhuizen 2014). Although flint implements and stones were probably used in most stages of bone production, use-wear analysis only revealed part of the *chaîne opératoire*. Although both unmodified and retouched implements were used, it seems that a selection based on the edge angle of the implements was favoured.

7.4 The selection of flint tools for functional purposes

The formal variability of flint implements is still a current debate in archaeology (see Chapter 3). Traditionally, several inferences were made based on flint typology. A widely-held belief was that only the formal tools were used for the execution of tasks at the settlements. In addition, the traditional typology also suggested the use of specific tools for specific tasks. However, use-wear analysis and experimental archaeology have invalidated some of the interpretations of traditional archaeology, and the case of the Corded Ware settlements is no exception.

The use of unmodified implements and '*non-formal*' tools was common at the three settlements. At Keinsmerbrug, unmodified flakes represent 35.7% of the implements displaying use-wear traces (Table 7.3), while at Mienakker that percentage is 20%. In addition, 17.5% of the flint implements displaying use-wear traces were small flint fragments, occasionally used after the retouch of one of their edges. If the percentage of the borers, produced from small flint fragments, is added the percentage grows to 32% of the sample (Table 7.4). And finally, at Zeewijk retouched implements are more frequently represented in the sample than at Keinsmerbrug and Mienakker. More than 65% of the implements displaying use-wear traces are retouched fragments, with scrapers being the most commonly occurring ones (40.4%) (Table 7.5). However, unmodified implements represent 30.35% of the implements displaying use-wear traces. If the percentage of the borers, produced from small flint fragments, is added, the percentage grows to 32.6% of the sample (Table 7.5). Most of these tools were unmodified flakes and blades, although 7.8% of the flint implements displaying use-wear traces were small, unmodified flint fragments (Table 7.5).

(edges)	Flake	Flake	Flake	Blade	Blade	Waste	Waste	Uns	Total	%
	Unm	Retgen	Scrap	Unm	Retgen	Unm	Strike-a-light	Borer		
Hide	2	1	-	1	-	-	-	-	4	14.2
Bone	-	-	1	1	2	-	-	-	4	14.2
Animal soft	-	1	-	-	-	-	-	-	1	3.5
Anim unsp	1	-	-	-	-	-	-	1	2	7.1
Hard wood	-	1	-	-	2	1	-	-	4	14.2
Soft wood	1	-	-	-	-	-	-	-	1	3.5
Mineral	-	-	-	-	-	-	2	-	2	7.1
Und	5	-	-	2	-	-	-	-	7	25
Hafting	1	1	-	1	-	-	-	-	3	10.7
Total	10	4	1	5	4	1	2	1	28	100
%	35.7	14.2	3.5	17.8	14.2	3.5	7.1	3.5	100	

Table 7.3. Relation between the type of worked material and the tool type used at Keinsmerbrug (Und: undetermined; Uns: unsure; Unsp: unspecified).

	Flake	Flake	Flake	Blade	Blade	Waste	Waste	Waste	Uns	Total	%
	Unmod	Retouched	Scraper	Unmod	Retouched	Unmod	Retouched	Borer	Borer		
Hide	2	-	9	-	-	-	2	-	-	13	32.5
Meat	-	-	-	-	-	1	-	-	-	1	2.5
Bone	-	1		-	-	-	-	-	-	1	2.5
Anim uns	1	-	-	-	-	-	-	-	-	1	2.5
Hard wood	2	-	-	1	-	-	1	-	-	4	10
Soft wood	-	-	-	1	-	1		-	-	2	5
Plant unsp	2	-	-		-			-	-	2	5
Hafting	1	1	-	-	-	1	-	-	-	3	7.5
Amber	-	-	-	-	-	-	-	6	1	7	17.5
Uns	-	-	3	-	2	-	1	-	-	6	15
Total	8	2	12	2	2	3	4	6	1	40	100
%	20	2	30	5	5	7.5	10	15	2.5	100	

Table 7.4. Relation between the type of worked material and the tool type used at Mienakker (Unmod: unmodified; Unsp: unspecified; Uns: unsure).

	Blade	Blade	Flake	Flake	Flake	Flake	Core	Waste	Waste	Waste	Unsp	Unsp	Unsp		
	Unmod	Retouched	Unmod	Point	Retouched	Scraper	Scraper	Scraper	Unmod	Retouched	Retouched/ Axe fragment	Scraper	Borer	Total	%
Bone	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1.1
Fish	1	1	2	-	-	3	-	-	-	-	-	-	-	7	8.0
Dry hide		-		-	-	-	-	-	1	-	-	-	-	1	1.1
Hide unsp	2	-	3	-	6	17	1	1	2	2	-	2	-	36	41.3
Meat/bone	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1.1
Medium animal	-	1	-	-	2	6		-	-	1	-	-	-	10	11.4
Amber	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1.1
Hard inorg	-	-	-	-	-	1	-	-		-	-	-	-	1	1.1
Medium inorg	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1.1
Inorg unsp	1	-	-	-	-	1	-	-	1	-	-	-	-	3	3.4
Medium plant	-	-	-	-	2	-	-	-	-	1	-	-	-	3	3.4
Hard wood	2	-	1	-	-	-	-	-	-	-	-	-	-	3	3.4
Wood unsp	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1.1
Uns	1	1	1	1	1	1	-	-	-	-	-	-	1	6	6.8
Unsp fricglos	-	-	-	1	-	-	-	-	-	-	-	-	-	1	1.1
Hard unsp	1	1	-		1	-	-	-	1	-	-	-	-	4	4.5
Medium unsp	1	-	1	-	-	-		1	2	-	-	-	-	5	5.6
Soft unsp	-	-	-	-	-	-	-	-	-	-	1	-	-	1	1.1
Hide/wood	-	-	-	-	-	2	-	-	-	-	-	-	-	2	2.2
Total	10	4	10	2	13	31	1	2	7	4	1	2	2	88	100
%	11.3	4.5	11.3	2.2	14.7	35.2	1.1	2.2	7.95	4.5	1.1	2.2	2.2	100	

Table 7.5. Relation between the type of worked material and the tool type used at Zeewijk (Uns:unsure; Unsp: unspecified; Unmod: unmodified; Hard inorg: hard inorganic; Medium inorg: medium inorganic; inorg unsp: inorganic unspecified; Unsp fricglos: unspecified friction gloss).

The analysis of the Corded Ware flint assemblages indicated that several tasks were performed using different types of flint implements. Although scrapers are traditionally related to hide scraping, at Keinsmerbrug and Mienakker this task was also performed with unmodified flakes and blades (Table 7.3; Table 7.4). However, at Zeewijk, a correlation between the use of specific tool types for the performance of specific activities could be observed (Table 7.5). Hide scraping is one of the most frequently represented activities at the settlement. Although some unmodified implements were used for this activity, most of the tools that display traces of hide processing are retouched (32.5%), with flake scrapers constituting the primary tool type used, followed by retouched flakes. Unmodified blades were also used to process different types of material. Some animal materials, such as meat, fish and bone, were processed only with unmodified implements. Unmodified implements were also used exclusively for hard wood working, while other types of plant materials were worked with retouched implements (Table 7.5).

Through use-wear analysis and experimental archaeology, it has been observed that several types of activities are better accomplished with a specific type of angle. Therefore, while small angles are more suitable to cut soft materials, larger angles are preferred to scrape harder materials (Gassin 1996; Gibaja 2006; Ibáñez Estévez and González Urquijo 1996; Van Gijn 1990; Vaughan 1985). As mentioned at the beginning of this chapter, the use of bipolar technologies provided the Corded Ware communities with a uniform range of flint implements. Therefore, uniformity in the edges of the used implements could also be provided by this production system. Through the study of the edge angles of the flint implements with use-wear traces, a selection based on the morphology of the edge could be identified. During the analysis at Keinsmerbrug, it was observed that longitudinal activities were mainly performed with implements with angles of between 35 and 45 degrees, while implements with 40- and 45-degree angles were used to perform most of the transversal activities (Table 7.6). In fact, 60.7% of the implements with use-wear traces had an edge angle of between 35 and 45 degrees. In the case of the Mienakker assemblage, transversal actions were most common within the sample studied. Although a wide range of angles was documented (Table 7.7), the angles between 40 and 70 degrees were predominant. Longitudinal and diagonal activities were mainly performed with smaller angles, between 30 to 45 degrees. In fact, 60% of the implements with use-wear traces had an edge angle of between 40 and 65 degrees. The type of material would probably have influenced the angle selected. Hard materials, such as hard wood, were worked with larger edge angles than softer materials, such as soft wood (Table 7.7). Finally, at Zeewijk transversal actions were the most represented among the sample. Although a wide range of angles were documented (Table 7.8), the most predominant angles were between 35 and 65 degrees. Specifically, 75.2% of the implements with use-wear traces have an edge angle of between 35 and 65 degrees. Longitudinal activities were hardly present, although several edges show a combination of transversal and longitudinal activities, mainly performed with implements with edge angles larger than 45 degrees. Again, the type of activity performed would probably have influenced the angle, with implements with the larger edge angles being used for transversal activities such as hide and fish scraping (Table 7.8).

	20	25	30	35	40	45	50	55	60	65	Borer	Strike-a-light	Total
Longitudinal	-	-	1	1	2	2	-	1	-	-	-	-	7
Transversal	-	-	-	2	2	1	-	-	-	1	-	-	6
Unspecified	1	1		2	1	3	1	-	-	-	-	-	9
Borer	-	-	-	-	-	-	-	-	-	-	1	-	1
Strike-a-light	-	-	-	-	-	-	-	-	-	-	-	2	2
Hafting	-	-	1	1	-	-	1	-	-	-	-	-	3
Total	1	1	2	6	5	6	2	1	-	1	1	2	28
%	3.6	3.6	7.1	21.4	17.9	21.4	7.1	3.6	-	3.6	3.6	7.1	100

Table 7.6. Relation between the type of work and the edge angle employed at Keinsmerbrug.

	25	30	35	40	45	50	55	60	65	70	75	80	85	90	Borer	Total
Transversal	-	-	1	3	-	1	4	1	2	2	1	1	-	1	-	17
Graving/Diagonal	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	2
Longitudinal	-	1	-	1	3	-	-	-	-	-	-	-	-	-	-	5
Unspecified	1	-	1	-	1	-	-	-	2	-	1	-	-	-	-	6
Borer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	7
Hafting	-	-	-	1	-	1	-	-	1	-	-	-	-	-	-	3
Total	1	2	2	5	4	3	4	1	5	2	2	1	-	1	7	40
%	2.5	5	5	12.5	10	7.5	10	2.5	12,5	5	5	2.5	-	2,5	1.5	100

Table 7.7 Relation between the type of work and the edge angle employed at Mienakker.

	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	Borer	Total
Transversal	-	-	1	3	1	8	6	4	6	9	3	4	2	1	2	-	50
Transversal/Longitudinal	-	-	-	1	1	-	3	-	1	-	-	-	-	-	-	-	6
Longitudinal	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	2
Unspecified	-	1	1	2	4	3	3	2	2	2	1	-	1	-	1	-	23
Borer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Hafting	1	-	-	-	-	-	1	-	-	3	-	2	-	-	-	-	7
Total	1	1	2	6	7	11	13	6	9	15	4	6	3	1	3	1	89
%	1.1	1.1	2.2	6.7	7.8	12.3	14.6	6.7	10.1	16.8	4.4	6.7	3.3	1.1	3.3	1.1	100

Table 7.8. Relation between the type of work and the edge angle employed at Zeewijk.

Use-wear analysis has shown its value to challenge functional ascriptions to flint tools assumed by traditional typology. The methodology has provided a better understanding of the flint domestic assemblage of the CWC. *'Formal tools'* had a similar functional value to the unmodified objects. The shape of the tool seems to have been less important than the edge angle and the functional capacities of the chosen implement. Although these conclusions are more noticeable within the analysis of flint implements, similar conclusions have been drawn from the use-wear analysis of stone tools. At both Mienakker and Zeewijk, use-wear analysis has shown that unmodified stones were selected to perform various activities. These conclusions should, therefore, modify the way implements are conceived and studied. A change to the parameters used to select and analyse implements is needed, and unmodified implements should also be taken into account in order to reach a deeper understanding of the technological organization of the assemblages.

7.5 Conclusions

In this chapter, the main results of the analysis of the assemblages of Keinsmerbrug, Mienakker and Zeewijk have been collated and contextualized. Several differences can be found between the three settlements: Keinsmerbrug was used seasonally, and specialized in the mass catching of birds, especially ducks, in combination with other economic activities such as fishing and herding; Mienakker and Zeewijk were used all year round, and although fishing and hunting were important, the economy was mainly based on crop cultivation and animal herding. However, all share several similarities: the use of local raw material; a combination of technological approaches to produce implements, such as bipolar technology and the '*metapodium technique*', which show technological continuity with other Neolithic groups; a limited variety of tool types and the importance of '*non formal*' tools; and the use of domestic implements for both craft and subsistence activities. Since the main characteristics of the three settlements have been established, and with the objective of understanding the origins of and the relationship between the CWC and other Dutch Neolithic groups, in Chapter 8 the material culture of the TRB Culture and the Vlaardingen groups will be examined and compared with that of the CWC.

Chapter 8. The domestic implements during the fourth and third millennia BC

8.1. Introduction

The transition between the fourth and third millennia BC in the north of the Netherlands is characterized by the exploitation of diverse ecological areas by two cultural groups: the TRB and the Vlaardingen group, the later of which is partially contemporaneous with the CWC. The production system included diverse economic activities: fishing, hunting, gathering, fowling, farming and food production. This model was valid until, probably, the beginning of the Early Bronze Age, when farming became the principal subsistence activity (Fokkens 2005). The emergence of the CWC can be better understood by studying the groups present in the Netherlands before and during the period when the CWC was active. The working hypothesis of this work is that the '*mutual knowledge*' of both the TRB and the Vlaardingen group was, at least partially, transmitted and shared by the Corded Ware communities. The selection of raw materials, the technological processes involved in the production and maintenance of the implements and the way tools were used and discarded by the CWC were probably influenced by knowledge shared with the TRB and Vlaardingen groups. In this chapter, an overview of the implements found in domestic TRB and Vlaardingen contexts is presented. The objective is to analyse possible connections between these two groups and the Corded Ware communities through the tools used for daily activities, understood both as sources of the social identity of the groups, and as a reflection of change and social interaction (Dobres 1995, 2009; Dobres and Hofman 1994; Miller 2009).

8.2 TRB group

The TRB in the Netherlands formed part of the Western TRB group, composed of TRB groups from the Netherlands and Northern Germany Several attempts have been made to provide a typo-chronology of the Western TRB group based on pottery (Bakker 1979; Brindley 1986b; Knöll 1959; Van Giffen 1925-1927), Brindley's typology (1986b) is the most widely accepted. The TRB was divided into seven chronological horizons based on pottery shape, decoration techniques and decoration motifs. According to Brindley (1986b), Horizon 1 started around 3400 cal BC, with the late phase of the TRB culture placed around 2850 cal BC. Consequently, the TRB period would have lasted for about 550 years (Brindley 1986b). However, developments in ^{14}C dating and newly obtained samples have provided a different chronology for the group. Lanting and Van der Plicht (1990/2000) proposed that the Western TRB group would have started and finished later than Brindley (1986b) proposed, between 3350 cal BC and 2750 cal BC (Lanting and Van der Plicht 1990/2000). However, a precise dating of the group is still lacking and the origin of the Western TRB group is still under discussion, although a combination of local traditions (flint and stone technology) and external developments (pottery technology) has been proposed (Lanting and Van der Plicht 1990/2000)(Table 8.1).

	Horizon	Brindley 1986b	Van Giffen 1927	Van den Broeke et al. 2005	Midgley 1992	Lanting and Van der Plicht 1999/2000
Starting date	1	3400	Drouwen	3400	3700	3350
	2	-	Drouwen	-	-	-
	3	3300	Drouwen	-	-	-
	4	3200	Drouwen	-	-	-
	5	3050	Early Havelte	-	-	-
	6	2950	Middle Havelte	-	-	-
Ending date	7	2850	Late Havelte	2900	2850	2750

Table 8.1. Dating of the Dutch TRB (years in cal. BC) (after Verschoof 2011).

Most of the data concerning the western TRB group originates from burials. Dutch TRB settlements are mainly located on the Pleistocene soils of the Netherlands, and due to the acidic properties of these soils the preservation of organic remains is generally poor. Animal and human bones are not well represented, limiting the amount of information available about the economic and social life of the inhabitants. It is generally assumed that the economy of the TRB group was based on crop cultivation and farming, while hunting and fishing were also practised (Van Gijn and Bakker 2005). In addition, neither house structures nor objects made from organic materials such as wood are usually preserved. However, there are some exceptions: two house plans were attributed to the TRB group in Hattemerbroek-Bedrijventerrein Zuid (Hamburg *et al*. 2011) and a plan of a long house was documented at Bouwlust–Slootdorp (Van Heeringen and Theunissen 2001). In addition, faunal remains were recovered at both sites (Hamburg *et al.* 2011; Van Heeringen and Theunissen 2001) and at Wetsingermaar (Raemaekers *et al*. 2011/2012).

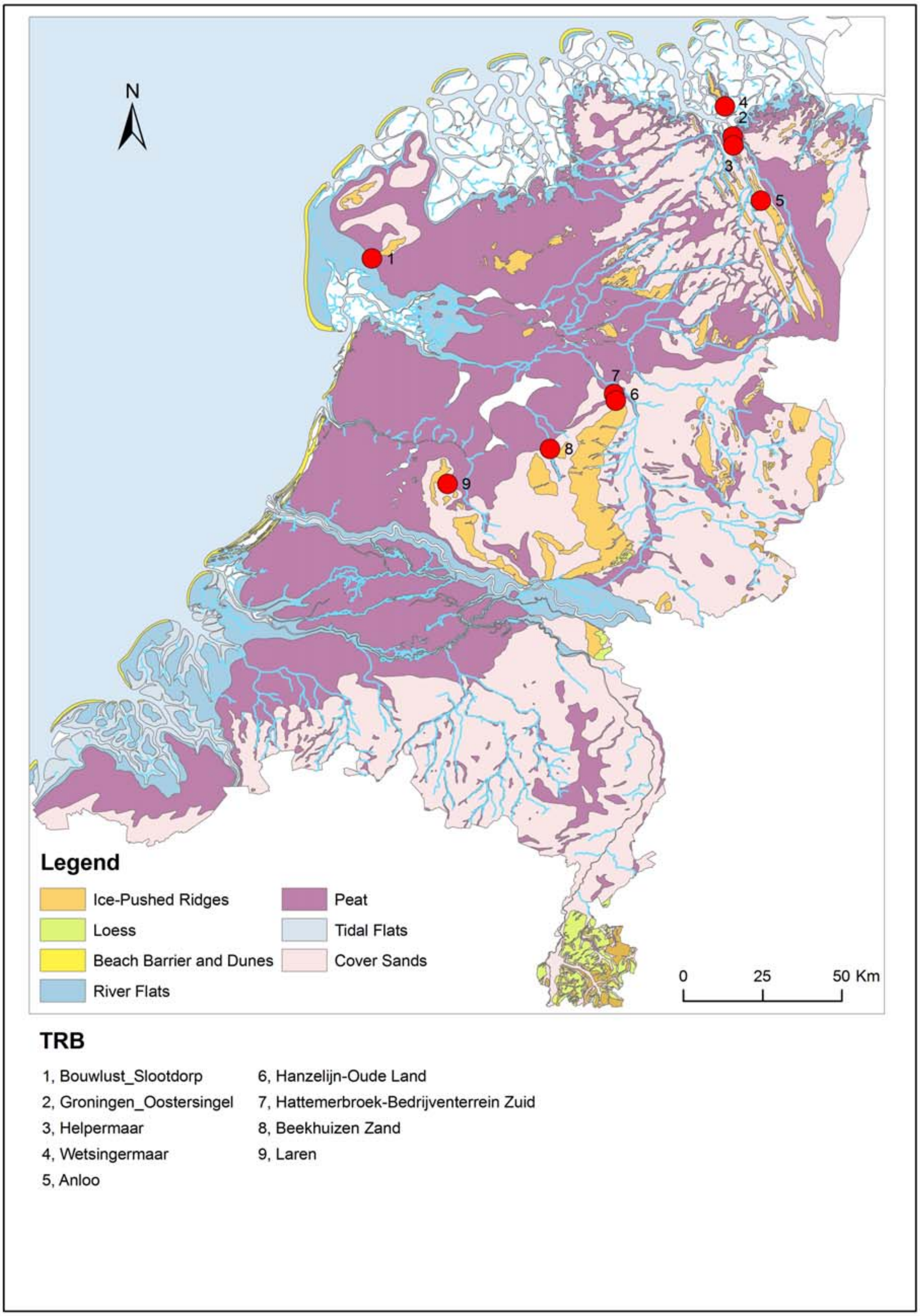

Figure 8.1. Overview of the TRB settlements cited on the text (after Vos and de Vries 2011).

8.2.1 Flint, stone and amber procurement network

In 2005 Raemaekers suggested that the study of TRB flint implements had been '*ignored*' (Raemaekers 2005: 276) and unfortunately, although new analysis of grave goods has been conducted and published since then, a systematic study of flint assemblages from TRB settlements is still lacking. Despite this, the diverse publications of settlement assemblages show the predominant use of local stones and a small percentage of southern and imported materials. The TRB settlements were mostly located to the north of the main rivers and as such locally available flint and stone were limited to the moraine outcrops. Flint and stone were collected from the Meuse and Rhine areas at Hanzelijn-Oude Land (Verbaas *et al.* 2011a; Verbaas *et al.* 2011b) and Hattemerbroek-Bedrijventerrein Zuid (Knippenberg *et al.* 2011a; Knippenberg *et al.* 2011b). At the former site, the boulder clay deposits of the Drenthe Plateau were also used as a source area. Although a provenience analysis was not conducted, it can be assumed that the boulder clay deposits of the Drenthe Plateau were also used as a source area for Anloo (Jager 1985; Waateringe 1960), Beekhuizen Zand (Modderman *et al*. 1977) and Laren (Bakker 1961).

Fragments of amber, ochre and fossils were used at Hanzelijn-Oude Land. While fossils could have easily been collected at the boulder clay deposits or in the river areas, ochre probably derived from the Ardennes, or areas of Germany. On a smaller scale, Veluwe flint and water-rolled northern material were also used at Hattemerbroek-Bedrijventerrein Zuid (Knippenberg *et al*. 2011a).

The use of local flint was also the norm in both the Noord-Holland and Groningen provinces. At Bouwlust–Slootdorp, although a small number of southern implements were encountered, the majority (76.6%) of flint and stone materials were collected from moraine outcrops, probably from the nearby deposits of Wieringen (Peeters 2001a). Flint and stone were mainly obtained from the nearby boulder clay deposits at the settlements of Wetsingermaar (Niekus *et al*. in (Raemaekers *et al.* 2011/2012: 12-13), Groningen-Oostersingel (Boersma *et al.* 1990; Kortekaas 1990) and Helpermaar (Fens and Mendelts 2013a, 2013b). In the later site, exotic flint and stone were also used to produce axes. Stone-axe fragments suggested that the material had a Scandinavian provenance (Fens and Mendelts 2013a, 2013b). Finally, amber could have been collected from the North Sea coastline (Waterbolk 1991).

The predisposition to use local materials is similar to the tendency observed for the *hunebedden* grave goods, where imported implements were deposited along with a high percentage of artefacts produced from local flint (Van Woerdekom 2011), but it contrasts significantly with the TRB axe hoards and depositions; the sources of materials in the latter are located at a great distance from TRB settlements. Some hoards also included imported flint nodules that, similar to the axes, were imported in an unmodified state from Germany and Denmark (Beuker 2010; Van Gijn and Bakker 2005; Wentink 2006; Wentink and Van Gijn 2008). These axes have been interpreted as special objects, produced for the specific purpose of their deposition (Wentink 2006). The axes were deposited in peat bogs, water streams and other waterlogged places, suggesting the importance of water for TRB communities.

8.2.2 Techno-typological analysis of the flint, stone and amber implements

The character of the domestic TRB flint technology was influenced by the low quality and the small size of the local raw material. The technology applied to the cores to obtain flakes was not standardized, and variation in the size and shape of the cores resulted in products with variable metrical attributes. Core preparation was minimal at most of the sites, or even absent, as in the case of Bouwlust–Slootdorp (Peeters 2001b). Flint nodules and pebbles were exploited mainly using direct hard percussion and the hammer and anvil technique (Fens and Mendelts 2013a).

Flint assemblages were mainly made up of flakes, and blades were present only in low numbers. Unmodified flakes dominated the sample in every flint assemblage, with low percentages of retouched tools that ranged from 1.9% at Bouwlust–Slootdorp (Peeters 2001b) to 6.5% at Location 2 of Hattemerbroek-Bedrijventerrein Zuid (Knippenberg *et al*. 2011a) and 9% at Hanzelijn-Oude Land (Verbaas *et al*. 2011a). One exception is Location 3 of Hattemerbroek-Bedrijventerrein Zuid, where 16% of tools were retouched (Knippenberg *et al*. 2011a). Retouched tools were dominated by scrapers, as exemplified by Location 1 of Hattemerbroek-Bedrijventerrein Zuid, where scrapers comprised more than 25% of the retouched assemblage. A predominance of scrapers was also documented at Laren (Bakker 1961), Anloo (Jager 1985; Waateringe 1960;), Hanzelijn-Oude Land (Verbaas *et al*. 2011) and Helpermaar (Fens and Mendelts 2013a). Other tools, such as drills, transversal arrowheads, retouched flakes, retouched blades, axes and TRB picks were also documented, albeit in lower numbers, in TRB assemblages (Bakker 1961; Fens and Mendelts 2013a; Jager 1985; Knippenberg *et al*. 2011; Peeters 2001b; Verbaas *et al.* 2011a; Waateringe 1960).

	Laren	Anloo	Bouwlust–Slootdorp	Hanzelijn-Oude Land	Hattemerbroek-Bedrijvventerrein Zuid (Location 1)	Hattemerbroek-Bedrijvventerrein Zuid (Location 2)	Hattemerbroek-Bedrijvventerrein Zuid (Location 12)	Harderwijk-Beekhuizerzand	Groningen-Oostersingel	Groningen-Helpermaar	Total
Unmodified Flakes		-	-	-	2565	245	42	119	16	-	2987
Unmodified Blades	*	-	-	-	89	11	2	9	12	33	156
Retouched Flake		-	-	27	266	27	3	-	17	-	340
Retouched Blades		-	-	7	21	2	-	-	1	-	31
Retouched general		-	27	14	-	6	1	-	-	257	305
Core and core fragments		-	163	220	1081	68	15	18	1	487	2053
Scrapers	*	*	18	41	234	16	7	75	14	505	910
Borers		*	13	-	1	2	1	-	3	55	75
Wedges		-	-	-	-	-	-	-	-	-	
Hammerstone		-	-	1	1	-	1	-	-	-	3
Arrowheads	*	*	7	2	10	3	-	2	4	95	123
Sickle		*	-	-	-	-	-	-	-	4	4
Strike-a-lights		-	2	2	1	-	-	-	-	-	5
Burins		-	1	-	-	-	-	-	-	-	1
Pics		-	21	-	1	-	-	-	-	59	81
Axe		-	2	1	1	-	-	-	-	1	5
Block		-	-	39	421	10	-	-	-	32	502
Waste	*	*	3846	94	1252	73	10	-	-	9438	14713
Flint general	50	-	10.137	945	6925	517	98	600	-	33195	52.467

Table 8.2. Flint tool types and number of implements found at the TRB settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Technological approaches to stone tools have only recently been applied to the assemblages from the sites of Hanzelijn-Oude Land (Verbaas *et al*. 2011b), Hattemerbroek-Bedrijventerrein Zuid (Knippenberg *et al*. 2011b) and Helpermaar (Fens *et al*. 2010; Fens and Mendelts 2013b). As a whole, stone implements were used without any modification prior to their use. However, querns and grinding tools often display flake negatives suggesting that the tools were fabricated so as to obtain a specific shape, and/or were rejuvenated after use. The main types documented at the TRB settlements were querns, grinding stones, whetstones, anvils and hammer stones. In addition, one schist axe was documented at Laren (Bakker 1961), and polished axes were collected at Hattemerbroek-Bedrijventerrein Zuid (Knippenberg *et al*. 2011b), Hanzelijn-Oude Land

(Verbaas *et al*. 2011b) and Helpermaar (Fens *et al*. 2010; Fens and Mendelts 2013b). However, the chronology of the axes from the two former settlements is not accurate, and a Corded Ware chronology cannot be disregarded.

	Laren	Anloo	Bouwlust–Slootdorp	Hanzelijn-Oude Land	Hattemerbroek-Bedrijvventerrein Zuid (Location 1)	Hattemerbroek-Bedrijvventerrein Zuid (Location 2)	Hattemerbroek-Bedrijvventerrein Zuid`(Location 12)	Harderwijk-Beekhuizerzand	Groningen-Oostersingel	Groningen-Helpermaar	Total
Flake	-	-	-	2	74	10	-	-	-	13	99
Core	-	-	-	-	4	-	-	-	-	-	4
Quern	-	*	-	-	8	-	2	-	-	-	10
Flaked stones	-	-	-	-	17	2	-	-	-	-	19
Grinding tools	*	*	-	-	2	-	-	-	-	13	15
Anvil	*	-	-	-	-	-	-	-	-	-	-
Hammerstones	*	*	-	1	108	15	1	5	-	6	136
Rubbing topol	-	-	-	-	8	-	-	-	-	-	8
Polishing stones	1	-	-	-	-	-	-	-	-	1	2
Pounder	-	-	-	-	-	-	-	-	-	6	6
Axe	1	-	-	-	1	-	-	1	-	1	4
Weight	-	-	-	-	-	-	-	-	-	-	-
Cubic stones	-	-	-	-	-	-	-	-	-	-	-
Broken stones	-	*	-	21	534	-	-	-	-	4	559
Stones general	-	-	-	24	806	91	21	6	-	58	1006

Table 8.3. Stone tool types and number of implements found at the TRB settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

8.2.3 The use of the tools during the TRB period

Use-wear analysis on domestic sites of the TRB culture is unequally represented. Flint from settlements located in the central parts of the Netherlands, such as Laren (Bakker 1966) and Harderwijk-Beekhuizerzand (Modderman *et al.* 1976), was too abraded for microscopic analysis, while implements from more recently excavated settlements located '*on the fringes of the plateaus proved to be more suitable for microscopic analysis*' (Van Gijn 2013: 26). Use-wear analysis has been performed on flint implements from four TRB settlements: Bouwlust–Slootdorp (Van Gijn 2010a, unpublished material), Groningen-Oostersingel (Van Gijn 2010a, unpublished work), Hattemerbroek-Bedrijventerrein Zuid (Knippenberg *et al.* 2011b) and Hanzelijn-Oude Land (Verbaas *et al.* 2011a). In addition, a small sample of stone tools from

Hattemerbroek-Bedrijventerrein Zuid (Knippenberg *et al.* 2011b) and Hanzelijn-Oude Land (Verbaas *et al.* 2011b) was analysed.

Vegetal resources

Although the results of the use-wear analysis of TRB domestic contexts are limited, some conclusions can be drawn. First, use-wear traces related to plant working and processing are highly represented. At Bouwlust–Slootdorp, traces of several plant materials were documented on five of the analysed edges (26.3%) (Van Gijn 2010a, unpublished material), while at Location 1 of Hattemerbroek-Bedrijventerrein Zuid the results of the use-wear analysis indicated the importance of basketry and the production of bone and wooden objects (Knippenberg *et al*. 2011b). Most of the traces could be related to the on-site manufacture of tools. Organic remains played an important role in TRB communities, not only as building material but also as raw material for the production of tools, as suggested by the findings from wetland settlements with similar chronologies (Menotti and O'Sullivan 2013; Müller 2012).

TRB communities are understood to have practised an extensive method of cultivation known as '*slash-and-burn*' cultivation, which involved the creation and maintenance of open areas in the forest (Bakels and Zeiler 2005; Van Gijn and Bakker 2005). If this hypothesis is correct, a number of tools meant for forest clearance, the preparation of the soil, and the harvesting and processing of cereals should be documented. Cereal impressions on pottery and cereal grains have been found at several sites (Bakels and Zeiler 2005), but tools suggestive of such activities are hardly ever found at TRB settlements (Van Gijn 2013). Complete axes, adzes, and sickles are rarely documented at TRB settlements, and only one sickle-blade from a domestic context is known for the TRB period (Van Gijn 2010a, unpublished work). As already stated, the absence of sickles is a common phenomenon in the Dutch Neolithic that could be explained in several ways (Bakels and Van Gijn 2014): the use of bone and wooden sickles for cereal harvesting have been documented ethnographically and archaeologically (Anderson and Peña-Chacorro 2014; Anderson and Rodet-Belarbi 2014), as have agricultural practices not involving tools at all (Ibáñez Estévez *et al.* 2000). Most of the stone tools with traces related to cereal processing were documented in the province of Overijssel. At Hanzelijn-Oude Land, most of the 24 stones analysed display use-wear traces related to cereal processing (Verbaas *et al.* 2011b) and at Location 1 of Hattemerbroek-Bedrijventerrein Zuid subsistence activities were mainly represented by cereal processing. In addition, use-wear analysis was carried out on two granite querns found at Location 2, which displayed use-wear related to cereal processing. The function of the tools was supported by the phytolith analysis, which revealed the presence of siliceous plant on the surface of the querns (Knippenberg *et al.* 2011b).

Although some implements related to plant working are missing from the settlements, studies of the flint assemblages from several megaliths show that sickles and axes were intentionally removed from domestic contexts and deposited at funerary structures instead (Van Gijn 2010a, 2013; Van Woerdekom 2011). The axes from the tombs were heavily used, but they were re-sharpened before their final deposition. However, use-wear polish and other use-wear traces were partially preserved on the surface of the tools, indicating that the axes were used for chopping wood (Van Gijn 2010a, 2013). Similar to the axes, sickles with heavily developed wear traces were documented in burial contexts (Van Gijn 2010a, 2013).

Animal resources

Although TRB groups are considered to have been farmers, the importance of fowling and hunting was revealed by the excavation of the archaeological site of Bouwlust–Slootdorp. This settlement, located in the wetland area of the Noord-Holland province, displayed similar characteristics to the Corded Ware settlements presented in this volume (see Chapters 4, 5 and 6). The analysis of the wild animal remains indicated that ducks were regularly fowled and consumed within the site, as, occasionally, were red deer (Lauwerier 2001 in Van Heeringen and Theunissen 2001; Schnitger 1991b; Woltering and Jager 1991). Finally, shellfish gathering and fishing were also common activities, as the remains of mussels and several fish species, especially sturgeon, indicate. Moreover, use-wear traces related to fish processing were documented at Location 1 of Hattemerbroek-Bedrijventerrein Zuid, reinforcing the great importance of this resource for the diet of the TRB groups on the Pleistocene sands (Knippenberg *et al.* 2011b). Hunting and fishing were probably performed with the transversal arrowheads found in TRB domestic contexts and at TRB megaliths (Van Gijn 2010a; Van Woerdekom 2011), but the importance of other tools produced with bone, wood and other perishable materials should not be disregarded.

Hide scraping traces are frequently documented at the TRB flint assemblages. Craft activities were dominated by hide scraping at Hattemerbroek-Bedrijventerrein Zuid and Groningen-Oostersingel (Knippenberg *et al.* 2011b; Van Gijn 2010a, *unpublished work*) and one retouched blade and several scrapers were used to scrape skin at Hanzelijn-Oude (Verbaas *et al.* 2011a). Although other implements were used for hide scraping, this task is generally related to a specific tool type: flint scrapers. The special meaning of the flint scrapers is inferred from scrapers with hide processing use traces that were placed on the *hunebedden* (Van Gijn 2010a; Van Woerdekom 2011).

Fire

Strike-a-lights are commonly documented at TRB settlements. At Bouwlust–Slootdorp use-wear traces were documented on two implements, one core and one unmodified flake, suggesting their use as strike-a-lights (Van Gijn 2010a, unpublished material). The use of several tool types as strike-a-lights is a documented phenomenon in prehistory. In the Bronze-Age Netherlands, both long blades and blade-like flakes were used, and no uniform typology of the tools occurred (Van Gijn 2010a). Strike-a-lights are considered to be personal items. Traditionally, it has been assumed that the TRB '*pics*' were used as strike-a-lights (Van Gijn 2010a). Although a systematic study of this tool type has not been performed, TRB '*pics*' from several *hunebedden* display traces of wear that have been interpreted as strike-a-lights (Van Gijn 2010a; Van Woerdekom 2011). In contrast to the traces displayed by the implements from domestic contexts, the traces of use displayed by the tools were not heavily developed, indicating a short duration of use. It has even been argued that '*pics*' were exclusively produced for funerary rituals (Van Gijn 2010a).

8.2.4 Settlement tools as identity markers: The TRB flint

The use of domestic implements as grave goods is a recurrent practice during the TRB period. Flint axes, sickles, arrowheads, scrapers and strike-a-lights were placed, after their use, in megalithic graves. The importance of these implements within the daily practices of the TRB community may have been the reason for their secondary role as grave goods (Wentink *et al.* 2011: 403).

Axes, strike-a-lights and sickles played an important role in the agricultural cycle of the TRB communities, which was characterized by '*slash-and-burn*' cultivation (Bakels and Zeiler 2005). The ritualization of agricultural tools was a common practice during the Dutch Neolithic, as exemplified by the intentional fragmentation of querns and sickles during the LBK period and at the Hazendonk sites respectively, and the deposition of sickles in hoards during the Late Bronze Age (Van Gijn 2014b). This practice was also documented outside Dutch territory, and parallels have been documented in several contexts (Hamon 2005, 2008; Hamon *et al.* 2011; Jadin 2003; Knutsson 2014; Van Gijn 2014b), indicating the great significance that agricultural practices held for the TRB groups (Van Gijn 2014b). Agricultural practices were an important element of the '*mutual knowledge*' of the TRB groups. Agriculture implied the transformation of the landscape by destroying and growing, which symbolically linked this activity to the cycles of life and death and the cosmologies of prehistoric populations (Bradley 2005; Knutsson 2001, 2014; Van Gijn 2014b). It also implied the investment of knowledge and skills in the different steps related to the cultivation of cereals, from clearing the space to the selection of different harvesting techniques and tools (Anderson and Peña-Chacorro 2014; Anderson and Rodet-Belarbi 2014; Smerdel 2014).

Arrowheads and scrapers, on the other hand, reflected the importance of hunting, fowling and fishing for the TRB society. Hunting, fowling and fishing were, as in the case of agricultural practices, activities which implied a high level of knowledge of the landscape and the rhythms of nature (Ingold 2000a). In addition, the technological implications probably included a large range of equipment, of which the transversal arrowheads found in the various TRB contexts were only a small part. The use of hooks, fishing nets, traps, fences and pitfalls for fishing and hunting were common in the TRB period, as suggested by several remains found in other European settlements with better preservation of organic remains (Hallgren 2012; Marciniak 2005; Menotti and O'Sullivan 2013; Müller 2012). Animals were not only a fundamental part of the subsistence practices of the TRB communities; animal materials were also used for several crafts such as hide working. Hide could be used to produce clothes, rope and containers, but also as a building material employed to prepare roofs or the inner spaces of dwellings (Beyries 2002; Beyries and Joulian 1990; Rahme and Hartman 1995).

The reutilization of domestic implements during the TRB in burials could be understood as a reflection of the intrinsic '*mutal knowledge*' embedded in the use of tools from domestic contexts. Graves were '*places deeply embedded in the history and genealogy of the local group*' (Wentink *et al.* 2011: 404). The settlement tools worked as a link between the ancestors and the groups, forming part of the narratives of a community. The activities performed with these tools implied a high level of social interaction between the landscape and the society, but also an investment of knowledge and skills learnt through the community. In this sense, the deposition of domestic implements in funerary contexts '*symbolized activities relevant to the community at large*' (Van Gijn 2010a: 175).

8.3 Vlaardingen

The Vlaardingen culture dates to between 3400 and 2500 cal BC, coexisting with the first Corded Ware communities. Although cremated human bones were found at Vlaardingen and Hekelingen III, the main information about the group originates from the settlements, which are distributed in various ecological environments. Although the first excavated Vlaardingen site, Zandwerven, was documented on top of a dune in the salt marshes of Westfrisia, most of the other documented Vlaardingen settlements – more than 30 – are located further south on coastal barriers in the Older Dune area, on stream ridges in the freshwater-intertidal areas, and on river dunes and levees of the peat and the river clay areas (Raemaekers 2003; Van Gijn and Bakker 2005: 293). Palynological and botanical studies showed that the Vlaardingen sites were located in wet environments, in a landscape dominated by alder carr and fresh-water marshes (Brinkkemper *et al.* 2011). The best-supported theory is that Vlaardingen groups combined different economies, adapting their subsistence choices to the exploited environment. The groups which settled in the interior of the Netherlands focused on farming and cropping, while the subsistence strategies of the coastal settlements mainly involved gathering, fishing and hunting. Remains of naked barley and emmer wheat were present at most of the excavated sites, and ard marks were documented at Hellevoetsluis-Ossenhoek (Gosens 2009). Hazelnuts, wild apples and berries were collected and used as a food source. In addition, hunting, predominantly of red deer and wild boar, and fishing, principally for sturgeon, were an important subsistence source in the fresh-water marshes. Finally, cattle and pigs and less frequently sheep and goats were bred and stocked (Brinkkemper *et al.* 2011; Zeiler 1997).

Although structures and house plans are not commonly encountered during the excavations, at Vlaardingen several concentrations of postholes, flint, pottery and bone remains were documented. Two of these concentrations, one on the eastern levee and another on the western levee, were interpreted as possible house structures dated between roughly 2500 and 2300 BC (Glasbergen *et al*. 1961; Van Regteren Altena *et al*. 1962). At Hellevoetsluis-Ossenhoek, one fence, one structure and several plough marks were documented during the excavation (Van Hoof 2009a). Recently, however, the most striking find came to light during the excavation of Habraken te Veldhoven: several structures, such as water and fire pits, five houses and one building were identified among more than 200 postholes registered at the site (Van Kampen 2013). The houses had a long, trapezoidal plan, measuring six metres in width and between 25 and 40m in length. In addition, one more building was also documented. Although some comparisons were made with the house found at Zeewijk, which was interpreted as a ritual structure (Drenth *et al*. 2008; see Chapters 6 and 7), the building at Habraken te Veldhoven was interpreted as a grain storage facility (Van Kampen 2013). Habraken te Veldhoven was inhabited by an egalitarian society with a farming-based economy, and the grain storage would have had communal purposes (Kubiak-Martens *et al*. 2013; Van Kampen 2013). The six structures were dated between 2900 and 2500 BC (Van den Brink and Van Kampen 2013), confirming an occupation during the first half of the third millennium BC, but a precise association with a specific group could not be determined, and the typology of the material culture did not help. The pottery showed some specific traits of the Stein group, but several recurrent forms and features were considered typically Vlaardingen, so it was suggested that the pottery belonged to the pottery group defined by Beckerman and Raemaekers (2008) as '*Vlaardingen and Stein*' pottery (Beckerman and Raemaekers 2008; Van Kampen and Van den Brink 2013: 94-98).

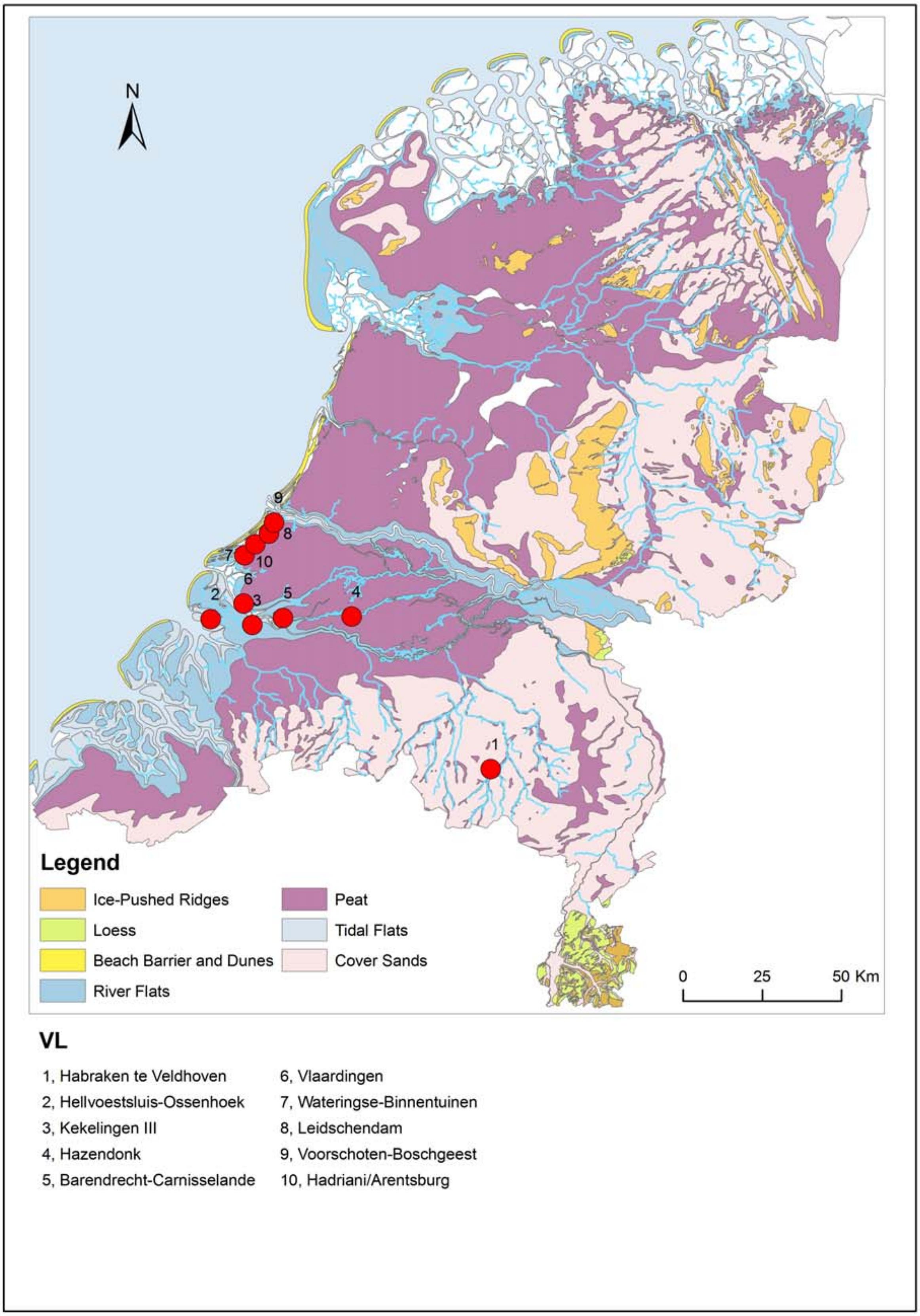

Figure 8.2. Overview of the Vlaardingen settlements cited on the text (after Vos and de Vries 2011).

8.3.1 Flint, stone, amber, jet and bone procurement networks

Raw material acquisition differed from one settlement to another. In some settlements, the local exploitation of mineral resources predominated. Flint and stone were collected from the fluvial deposits of the Meuse and the Rhine rivers at Leidschendam (Van Beek 1990), Voorschoten-Boschgeest (Glasbergen *et al*. 1967), Vlaardingen (Van Regteren Altena *et al*. 1962; Van Gijn in Van Beek 1990), Barendrecht-Carnisselande (Moree *et al*. 2011) and Wateringe-Binnentuinen (Mullaart 2012: 26; Houkes and Verbaas *in press;* Houkes and Verbaas *in press*). In addition, small nodules of amber were probably collected from the nearby coastlines and beaches (Waterbolk 1991). The procurement and use of local materials is a reflection of the landscape perception of the Vlaardingen groups, who used different environments, adapting their economic choices and exploiting the raw material available in each zone. The collection of stones, flint and amber was, as in the case of the CWC (see Chapter 7), probably embedded in other economic activities, for example animal herding or fishing.

However, southern and imported mineral resources were present in high percentages at several sites. At Vlaardingen some authors (Van Regteren Altena *et al.* 1962; Van Gijn in Van Beek 1990) suggest a southern origin for part of the flint and for some types of quartzite, which were probably collected in France and Ardennes in Belgium (Van der Lijn in Van Beek 1990). At Hekelingen III, most of the flint used was imported. Two possible areas for the flint acquisition have been suggested (Verhart 1983): the region of Boulogne-Sur-Mer (France) and the Belgian Lanaye deposits, where Hainault Spiennes flint was acquired (Van Gijn 1989; Verhart 1983). The former region was also used for the inhabitants of Wateringe-Binnentuinen (Mullaart 2012: 26; Houkes and Verbaas *in press;* Houkes and Verbaas *in press*) and Hellevoetsluis-Ossenhoek, along with flint from western Belgium and Limburg (Van Hoof and Metaxas 2009: 83-84). Hellevoetsluis-Ossenhoek is located in an area where stones are not present, so all raw materials were brought to the site from elsewhere. Granite was probably collected in the form of erratic blocks from the basin of the old Meuse River, the moraines near Amersfoort or South Limburg (Van Hoof and Metaxas 2009: 83-84). The origin of four fragments of pyrite found at the site could be traced to the Ardennes, Achterhoek or the Calais region, and the main source for a jet bead was located in the area of Calais (Van Hoof and Metaxas 2009: 83-84). Jet was probably washed away and carried to the southern coast by the sea (Van Gijn and Verbaas 2009).

Although it has been argued that Vlaardingen people did not consider flint important in the expression of their own identity (Van Gijn 2010a: 139), the use of exotic raw materials seems to have been significant. Raw material selection is not systematic and it does not seem to be related to specific tool types (Van Gijn 2010a). However, although it is not clear why this raw material was selected, the use of imported raw material has been considered an important activity intended to maintain social relationships between different groups (Van Gijn 2010a: 22).

8.3.2 Techno-typological analysis of the flint, stone and bone implements and jet and amber ornaments

Flint

In 2005, the study of the Vlaardingen flint assemblage was considered too '*new and recent*' to allow for an accurate interpretation of the results of the few available technological analyses (Raemaekers 2005: 274). Essentially, a systematic technological and typological analysis of the Vlaardingen flint assemblage is still lacking, although some conclusions can be drawn from the published settlement reports. Broken flint axes, flint nodules and pebbles were used as cores and the flint assemblage is characterized by its small size. Generally, the size of the axes was bigger, so flint tools obtained from axes also had larger metrical dimensions, as in the case of the Hellevoetsluis-Ossenhoek assemblage (Metaxas 2010; Van Hoof and Metaxas 2009). Although it is still unknown whether axes were brought to the site complete or broken, what seems clear is that the axes were imported and not produced *in situ*. No *debitage* or production waste was found during the excavations, suggesting that axes were transported as finished products to the settlement (Houkes and Verbaas 2014b).

Vlaardingen flint technology has been classified as '*ad hoc*' (Moree *et al.* 2011). It was oriented towards the production of flakes, while blades were scarce (Van Beek 1990), as at Hekelingen III (Van Gijn 1990; Verhart 1982) and Wateringe-Binnentuinen (Mullaart 2012, *in prep;* Houkes and Verbaas *in press*); it is even possible that blades were completely absent (Moree *et al*. 2011; Van Gijn 1990; Verhart 1983). Flint technology was characterized by the use of hard, direct percussion, without proper preparation of the core platforms, and was occasionally combined with the use of bipolar techniques. The assemblage is characterized by low variability in terms of tool types; unmodified flakes, splinters and waste by-products dominate most assemblages (Table 8.4), although other tool types such as retouched flakes and blades, scrapers, strike-a-lights, axes, borers and arrowheads were also documented. In most cases, flint production took place on-site and a high number of splinters and cortical pieces were recovered at several sites (Houkes and Verbaas 2014a; Metaxas 2010; Van Hoof and Metaxas 2009). However, at other sites, such as Barendrecht-Carnisselande, although cortex was present on some of the implements, the percentage of flakes exhibiting more than 50% of cortical surfaces was low. Consequently, the authors suggested that it is likely that some of the tools were knapped off-site (Moree 2011).

	Voorschoten-Boschgest	Voorschoten-De Donk	Leideschendam	Vlaardingen	Hekelingen III	Hellevoetsluis-Ossenhoek	Wateringe-**Binnentuinen**	Barendrecht-Carnisselande	Habraken te Veldhoven	Hadriani / Arentsburg	Hazendonk	Total
Unmodified Flakes	134	1520	-	4809	-	206	1125	3	310	219	2	8328
Unmodified Blades	-	62	4	104	-	7	41	-	23	6	-	247
Retouched Flake	-	-	-	-	-	49	-	-	12	29	31	121
Retouched Blades	-	-	-	-	-	3	-	-	3	-	6	12
Retouched general	2	-	-	-	64*	-	307	4	-	5		380
Core and core fragments	38	121	131	80	49	6	52	-	-	15	1	493
Scrapers	-	-	116	628	119	91	619	-	8	50	5	1636
Borers	-	-	6	89	23	5	7	-	-	-	-	130
Hammerstone	-	-	-	-	-	-	4	-	5	-	-	9
Arrowheads	-	-	7	44	11	4	8	-	3	6	1	84
Sickle	-	-	-	-	-	-	4	-	-	-	-	4
Strike-a-lights	-	-	-	-	1	1	-	-	-	4	-	6
Burins	-	-	-	-	-	-	-	-	-	2	-	2
Chisel	-	-	-	-	-	-	-	-	3	-	-	3
Axe	-	-	-	341	3	14	-	-	-	-	-	358
Axe flakes and fragments	24	24	51	-	-	23	-	-	31	22	13	188
Block	-	-	-	-	-	-	23	1	-	-	1	25
Waste	-	152	-	-	-	167	346	-	-	110	-	775
Others	-	-	-	619	-	-	848	6	296	1001	-	2770
Flint general	258	2022	1773	6.714	1.011	847	3384	14	694	1469	196	1.485.913

Table 8.4. Flint tool types and number of implements found at the Vlaardingen settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Stones

The stone tool assemblage was dominated by querns, grinding stones and hammer stones. Other tool types, such as polishing stones, polished axes, and anvils, were present but in smaller numbers (Table 8.5). Generally speaking, stones were brought to the site and used without any modification. However, some tools showed traces of intentional modification prior to use. At Hadriani/Arentsburg, one fragment of a handstone showed traces of pecking, while several fragments of querns were flaked to obtain the desired shape and to rejuvenate their use surface. In addition, at least one rejuvenation flake from a quern was documented at the site (Houkes and Verbaas 2014b). At Habraken te Veldhoven several production fragments collected at the site suggest that the unworked nodules were brought to the site and modified when needed. Traces of flaking and pecking, as well as 13 flakes related to stone tool production, were documented at the settlement (Devriendt 2013). At Barendrecht-Carnisselande 1, stones were selected and modified on several occasions. An axe and a grinding stone showed evidence of pecking, after which the axe and the axe fragment were polished (Moree *et al*. 2011).

	Voorschoten-Boschgest	Voorschoten-De Donk	Leideschendam	Vlaardingen	Hekelingen III	Hellevoetsluis-Ossenhoek	Wateringe-Binnentuinen	Barendrecht-Carnisselande	Habraken te Veldhoven	Hadriani / Arentsburg	Hazendonk	Total
Flake	-	-	-	-	-	3	19	-	13	4	-	39
Core	-	-	-	-	-	-	-	-	-	-	-	-
Quern	-	-	*	26	-	17	15	1	-	2	-	61
Flaked stones	-	-	-	1	-	-	-	-	9	1	-	11
Grinding tools	-	-	-	23	-	18	3	-	27	-	-	71
Anvil	-	-	-	-	-	-	-	1	2	-	-	3
Hammer stones	-	-	*	10	-	6	10	1	-	-	-	27
Rubbing topol	-	-	-	-	-	-	3	-	4	-	-	7
Polishing stones	-	-	-	4	-	-	-	-	1	-	-	5
Pounder	-	-	-	-	-	-	-	-	-	-	-	-
Axe/Axe fragment	-	-	*	3	-	1	27	2	1	-	-	34
Weight	-	-	-	-	-	-	-	-	-	-	-	-
Cubic stones	-	-	-	-	-	-	-	-	-	-	-	-
Broken stones	-	-	-	-	-	111	-	-	-	-	-	111
Others	-	-	-	4277	-	10	804	2	1001	3922	-	10016
Stones general	-	-	680	4344	-	166	881	7	1058	3929	-	11065

Table 8.5. Stone tool types and number of implements found at the Vlaardingen settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Antler, bone and wooden tools

Due to the good preservation of organic materials, a significant number of bone, antler and wood/plant implements were recovered at several Vlaardingen settlements. Waste by-products and splinters of bone were also recovered, along with several finished and half-finished tools, pointing to local production of bone tools (Van Gijn and Bakker 2005). Bone implements were produced using the '*metapodium technique*', also documented at contemporaneous sites such as Hekelingen III (Maarleveld in Van Gijn 1990). As already discussed in Chapter 7, the '*metapodium technique*' is known to have been employed from the Mesolithic, linking the '*mutual knowledge*' of the Mesolithic and the Neolithic population, and suggesting a continuity in the practices of both groups (Van Gijn 1990). At Vlaardingen, bones were mainly used to produce chisels or awls, while antler was used to produce hammers, handles or points. In addition, at Barendrecht-Carnisselande 1, one antler point and one unknown object made from a pig bone were documented (Moree *et al.* 2011).

Wooden tools and objects reflect the importance of the sea during the Vlaardingen period. Fishing was one of the main activities documented at the Vlaardingen settlements, as inferred from the high number of fish bones recovered (Brinkkemper *et al*. 2011; Zeiler 1997). An oak-dug canoe and a paddle made of ash wood were recovered at Hazendonk (Van Iterson Scholten 1977); a paddle was found at Hekelingen III (Van Gijn and Bakker 2005: 295-296); and the remains of a fishing net, fragments of a string and a net sinker were documented at Vlaardingen (Van Iterson Scholten 1977). Water was not only important for fishing; it was also a means of transportation and communication for prehistoric communities. The importance of water for prehistoric communities increased from the Mesolithic (Cummings 2003; Warren 2000) until the Bronze Age, when the existence of *mariorities*, understood as '*institutions that served specifically for the conduct of certain kinds of interaction across the water*', is proposed (Needham 2009: 20). The formation of the supposed '*mariorities*' during the Bronze Age could be related to the emergent importance of the sea during the Middle and the Late Neolithic, which manifested itself in the gradual rise and increased sophistication of maritime technologies and the ritualization of the sea by prehistoric communities (Cummings 2003; Needham 2009; Warren 2000).

	Voorschoten-Boschgest	Voorschoten-De Donk	Leideschendam	Vlaardingen	Hekelingen III	Hellevoetsluis-Ossenhoek	Wateringe-Binnentuinen	Barendrecht-Carnisselande	Habraken te Veldhoven	Hadriani / Arentsburg	Hazendonk	Total
Chisel	-	-	-	*	*	5	-	-	-	-	8	13
Awl	-	-	-	-	*	2	-	-	-	-	-	2
Knife	-	-	-	-	-	-	-	-	-	-	1	1
Point	-	-	-	*	-	-	-	1	-	-	12	13
Tubes	-	-	-	-	-	2	-	-	-	-	-	2
Hammer	-	-	-	*	-	-	-	-	-	-	-	-
Handle	-	-	-	*	-	-	-	-	-	-	1	1
Undetermined	-	-	-	-	-	-	-	-	-	-	17	17
Total	-	-	-	*	-	9	-	-	-	-	39	48

Table 8.6. Bone tool types and number of implements found at the Vlaardingen settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Ornaments

Ornaments are rarely found at Vlaardingen settlements and always in low numbers. When they are excavated, the finds are mainly made of jet and amber. Bead fragments were documented at Hellevoetsluis-Ossenhoek (Goossens 2009) and Leideschendam (Glasbergen *et al*. 1967). At Vlaardingen the ornament assemblage mainly comprised long polished amber beads and one pierced canine tooth (Van Regteren Altena *et al*. 1962). At Voorschoten-Boschgeest three jet beads displayed an hourglass/biconical perforation and several scratches in the surface (Glasbergen *et al*. 1967). At Hellevoetsluis-Ossenhoek, one fragment of an amber bead and one fragment of a jet bead were documented during the excavation. Both bead fragments were produced by cutting the material. The amber bead was polished, and an hourglass type of perforation was performed. The jet bead displayed flake negatives, suggesting that the final shape of the bead was produced by knapping (Van Gijn and Verbaas 2009).

8.3.3 The use of tools in the Vlaardingen Culture

Vlaardingen settlements are among the best-studied sites in the Netherlands from a use-wear perspective. The absence of burials for this group focused the interest of the researchers on the settlements from the very beginning. Therefore, flint was extensively studied and Vlaardingen implements were among the first on which use-wear analysis was carried out (Bienefeld 1986, 1988; Van Gijn 1984, 1989). In addition, the good preservation of the materials, including organic implements, provided abundant information about the economic and social practices of the Vlaardingen communities. Functional information about Vlaardingen assemblages is available for nine settlements. Although flint is the most frequently analysed material, stone, bone and amber have also been studied. Through the analysis of the Vlaardingen implements, some conclusions about the role of the settlements and the composition of the groups can be drawn.

Vegetal resources

Vegetal resources played an important role in the Vlaardingen group. Use-wear traces related to soft plant processing were documented on a large number of tool edges at Leidschendam (Van Gijn 1990), Vlaardingen (Van Gijn 1984; Van Gijn in Van Beek 1990) and Hekelingen III (Van Gijn 1990) and were proportionally more important at other studied assemblages such as Hellevoetsluis-Ossenhoek (Metaxas 2010; Van Hoof and Metaxas 2009) and Hadriani/Arentsburg (Houkes and Verbaas 2014a). These traces demonstrate the importance of textiles for these communities, not only for the production of clothes, but also for the production of other objects such as bags and baskets, or the manufacture of nets and ropes used for fishing, similar to the ones found at Vlaardingen and Hekelingen III (Van Iterson Scholten 1977; Van Regteren Altena 1962; Van Regteren Altena *et al.* 1963). As has also been observed at Corded Ware settlements, traces of woodworking seem to be underrepresented, although use-wear traces suggesting debarking and woodworking activities are present at the sites of Habraken te Veldhoven (Van Gijn and Siebelink 2013), Hazendonk and Hekelingen III

(Van Gijn 1984, 2012; Van Gijn in Van Beek 1990; Van Gijn and Bakker 2005), hinting at the local production of wooden tools. Although infrequent, more than one excavation yielded several wooden objects, as well as evidence for the use of wooden posts employed for house construction. While traces related to the production of small tools or the repair of implements are present, tools such as axes or adzes are missing. It is possible that other materials such as bone were used for axe production, although the absence of complete flint and stone axes for the Vlaardingen period could also be explained by their reuse as cores to obtain other types of tools.

Implements with traces related to cereal harvesting were documented at several sites (Metaxas 2010; Van Gijn 1990; Van Hoof and Metaxas 2009). It has been assumed that the economic practices represented in the Vlaardingen settlements were linked to an economic model characterized by the exploitation of diverse geographical areas and their natural resources. Cereals were probably consumed at several settlements, as inferred from the archaeobotanical analysis (Brinkkemper *et al.* 2010; Brinkkemper *et al.* 2011). However, local production of crops was probably not performed at every settlement. The absence of cereal-harvesting traces led to the suggestion that agricultural products such as linseed, naked barley or emmer wheat were imported to Hekelingen III (Louwe Kooijmans 1980; Out 2009). However, sickles were documented at Leidschendam (Van Gijn 1990) and Hellevoetsluis-Ossenhoek (Metaxas 2010; Van Hoof and Metaxas 2009), supporting the hypothesis that cereals were cultivated locally on the dune ridge. Querns were documented and studied at Wateringe-Binnentuinen (Houkes and Verbaas *in press*), Hellevoetsluis-Ossenhoek (Van Gijn and verbaas *in press*), Hadriani/Arentsburg (Houkes and Verbaas 2014b), Habraken te Veldhoven (Van Gijn and Siebelink 2013) and Barendrecht-Carnisselande (Moree *et al.* 2011). At Wateringe-Binnentuinen traces of nut cracking were also present, confirming the archaeobotanical studies that suggested a large contribution of hazelnuts to the Vlaardingen diet (Bakels and Zeiler 2005; Brinkkemper *et al.* 2010; Brinkkemper *et al.* 2011; Out 2009).

Animal resources

Vlaardingen communities consumed animal resources very frequently. Fishing, fowling and hunting were mainly practised at coastal settlements, while cereal cultivation and cattle livestock were predominant at inland settlements. The archaeozoological analysis shows that animals were exploited for diverse purposes: domestic and hunted animals were exploited to obtain several raw materials with which the Vlaardingen groups produced daily implements; cattle were probably used for animal traction, breeding and meat production; and cut marks indicate that beavers, otters and wildcats were hunted not only for furs, but also for their meat (Brinkkemper *et al.* 2011: 213).

In this context, it is not strange that bone and hide working were two of the most frequently inferred activities at Leidschendam (Van Gijn 1984, 1989), Vlaardingen (Van Gijn 1984; Van Gijn in Van Beek 1990), Hekelingen III (Van Gijn 1989), Hellevoetsluis-Ossenhoek (Metaxas 2010; Van Hoof and Metaxas 2009), Hadriani/Arentsburg (Houkes and Verbaas 2014a) and Habraken te Veldhoven (van Gijn and Siebelink 2013). As in the case of the TRB group, hide processing was mainly performed with flint scrapers, although traces of cutting and piercing of hides were also documented at several sites (Metaxas 2010; Van Gijn 1989; Van Hoof and Metaxas 2009). Use-wear analysis shows that implements were used to work both fresh and dry hide, suggesting that the entire process of animal skin processing was carried out at the settlements.

The local production of bone tools was also corroborated through the use-wear traces. Use-wear related to cutting, engraving and sawing bone could indicate butchering activities, but it could also suggest the production and manufacturing of tools and other implements. Despite the importance of hunting and fishing, use-wear traces of neither activity is well represented. Besides fur animals, red deer and wild boar were frequently found at several settlements, such as Vlaardingen and Hekelingen III (Brinkkemper *et al.* 2010; Brinkkemper *et al.* 2011; Zeiler 1997). However, only four arrowheads displaying impact traces were documented at Hadriani/Arentsburg (Houkes and Verbaas, *in prep*) and Hellevoetsluis-Ossenhoek (Metaxas 2010; Van Hoof and Metaxas 2009). At the former site, the arrowheads also preserved residues of tar, showing how projectiles were hafted. The great importance of fishing is inferred from the high number of fish remains collected at the settlements. Although sturgeon is the most commonly represented species at most sites, the Vlaardingen communities also consumed other fresh- and saltwater species such as herring, eels, catfish and pike (Brinkkemper *et al.* 2010; Brinkkemper *et al.* 2011). Unexpectedly, despite this widespread use of fish as a food source, use-wear traces of fish processing were only encountered at Wateringe-Binnentuinen (Houkes and Verbaas *in press*). As already explained in Chapter 6, the absence of use-wear traces related to fish processing could be due to several factors, such as tool preservation and working techniques (Anderson 1981; Briels 2004; Clemente Conte 1997; Clemente Conte and García-Díaz 2008; García-Díaz 2009; García-Díaz and Clemente Conte 2008; Gutiérrez Sáez 1990; Iovino 2002; Moss 1983; Plisson 1985; Semenov 1981[1957]; Van Gijn 1986, 1990).

Fire making

Traces of fire making were documented at several settlements (Houkes and Verbaas 2014a; Metaxas 2010; Van Hoof and Metaxas 2009). The strike-a-lights excavated were heavily worn, suggesting repeated use over time. As already suggested, these tools have been interpreted as personal items (Van Gijn 2010a, 2010b; Van Gijn *et al.* 2006). Besides the symbolic use of strike-a-lights within the TRB communities, fire control was an important skill for prehistoric communities. Fire was used in a wide range of activities, and hearths could be understood as a socializing space around which daily tasks were performed and social norms were shared and established. Hearths became focal points in the daily life of the inhabitants of these settlements (see Chapter 7).

8.3.4 The role of flint, stone and bone implements in the Vlaardingen Culture

The numerous analyses of the settlement implements of the Vlaardingen Culture provide a great body of data to study the social implications of the organization of settlement technology. Although the use of flint implements has been understood to have been '*ad hoc*' (Van Gijn 2010a, 2010b), use-wear analysis of other tools showed that the domestic technology was more complex and was important in the expression of the Vlaardingen identity. In the first place, bone implements played a major role in the transmission of the cultural traditions and '*mutal knowledge*' of the Dutch Neolithic groups. The good preservation of the organic materials at Vlaardingen revealed the importance of bone tools for the economic practices of the Vlaardingen groups (Maarleveld in Van Gijn 1990; Moree et al. 2011; Van Gijn and Bakker 2005). The analysis of the *chaîne opératoire* of the implements established that they were produced using the '*metapodium technique*', which linked the technological traditions of the Vlaardingen culture with Mesolithic groups (Van Gijn 2005). Mesolithic traditions were probably maintained and transmitted by earlier Neolithic groups, as suggested by the use of this technique at other Neolithic settlements such as Schipluiden (Van Gijn 2006). The use-wear analysis of the Vlaardingen assemblages revealed the importance of flint tools in the local production of bone tools (Houkes and Verbaas 2014a; Metaxas 2010; Van Gijn 1984, 1989, 1990, 2010a, 2010b; Van Hoof and Metaxas 2009). Although the functional studies of bone tools are limited, the main tool types documented at the archaeological settlements suggest their use in craft activities. (Moree *et al.* 2011; Van Iterson Scholten 1977; Van Regteren Altena 1962; Van Regteren Altena *et al.* 1963). Flint implements were extensively used for craft activities; whereas scrapers and retouched tools were principally used for hide scraping and woodworking, flint tools were also used for the production of amber and jet ornaments, pottery and fire-making (Van Gijn 2010b).

Use-wear analyses of Vlaardingen stone implements confirmed their importance in subsistence activities. Cereal processing was mainly performed with both stone and flint implements. Stone tools were primarily used to grind cereals (Houkes and Verbaas *in press*; Houkes and Verbaas 2014b; Van Gijn and Verbaas 2009; Van Gijn and Siebelink

2013) and, despite the low number of flint sickles, they were also used in at least part of the process of harvesting crops (Van Gijn 2010a, 2010b). In addition, and despite the problems with the development of traces from soft materials (see Chapters 3 and 7), flint implements seem to have had an important role as part of the communities' fishing gear. In the first place, traces observed on pointed flakes used to split willow have been interpreted as evidence that the tools were used to manufacture fish traps (Van Gijn 2010a: 90). The rest of the fishing toolkit was mainly comprised of wooden tools, as suggested by the wooden implements recovered at several excavations (Van Gijn and Bakker 2005: 295-296; Van Iterson Scholten 1977). Finally, flint also played a role in the final processing of fish, as inferred by the traces of use at several sites (Van Gijn 201a, 2010b).

8.4 The Corded Ware Culture as a local development: the role of Vlaardingen and TRB groups as generators of knowledge

The Corded Ware community emerged in a context in which strong changes were appearing. Farming and crop cultivation became the main activity of the TRB groups, who began to modify their surrounding landscape intensively (Bakels 2005). The TRB communities witnessed the arrival of the plough and wheeled vehicles (Fokkens 1986, 2005, 2012; Van Gijn and Bakker 2005), innovations which, generated as they were by the emergence of a new economic system, would strongly impact the development of the Beaker groups. In addition, a strong dependence on fishing, gathering and hunting was also present, as inferred from the archaeological remains at Bouwlust–Slootdorp and most of the Vlaardingen settlements studied. Although the origins of the CWC in the Netherlands are still under study, a local component in the formation process of the group is widely accepted (Fokkens 1986; Van der Waals 1964, 1984; Van Gijn and Bakker 2005; see Chapter 2). The economy of the Corded Ware communities was based on a combination of several activities (see Chapter 7). Crop cultivation and farming were combined with hunting, gathering and fowling. In this sense, it could be suggested that Corded Ware groups continued the economic practices developed by the Vlaardingen and TRB communities, developing some innovations and generating and assimilating others. As a reflection of this continuity, the analysis of the flint and stone implements from settlement contexts proposed a connection between and the continued evolution of the material cultures of the three groups. The rate of change probably depended on the assemblage type and the internal characteristics of the group. The merging of cultural traits could have been easier in places where social and cultural cohesion was stronger. With a more uniform group composition and similar economic practices, the spread of the new developments could be easily absorbed, as shown by the pottery analysis. While the pace of transition between TRB and Corded Ware pottery types was fast, Vlaardingen pottery types coexisted with CWC pottery types for some time, and evolved until the beaker-shaped type began to dominate during the Vlaardingen 2b phase (Beckerman 2012a). Recent pottery analysis suggest a close connection between Vlaardingen and CWC groups. The technological and morphological characteristics of the pottery remains found at Zandwerven and other Corder Ware settlements have been considered as *`similar ceramic developments between 3090 BC and 2200 BC in both parts of the coastal area'* (Noord-Holland and Zuid-Holland province) (Beckerman 2016: 187), and interpreted as a technological continuity between the groups.

The study of the flint and stone assemblage of the three groups leads to some conclusions. In the first place, it seems that there is clear continuity in the use and exploitation of the space. This persistent use of the space had already been inferred from the fact that groups settled repeatedly in similar locations. In this sense, the most striking case was Zandwerven, where a Corded Ware settlement was placed on top of a Vlaardingen site (Van Regteren Altena and Bakker 1961). The occupation of Zandwerven and Bouwlust–Slootdorp could be understood as a precedent for the extensive use of the Noord-Holland province by the Corded Ware community. One explanation for this is the importance of water resources, along with the strategic position of this region, which provided easy access to other resources extensively exploited by the CWC. The water marshes of the Noord-Holland province were the natural habitat of various birds which, along with several fish species, completed the diet of the groups (Bakels 2005; Zeiler 1997; Zeiler and Brinkhuizen 2012, 2013, 2014; see Chapter 7). Despite the importance of water sources, the vicinity of the Pleistocene deposits of Wieringen as an explanation for settlement in Noord-Holland could not be disregarded. The use of flint and stone from this area was already documented at settlements located in similar areas during the TRB (Bouwlust–Slootdorp) and the Vlaardingen period. The quality of the raw materials used by both groups in different areas was similar, and in this sense, the use of this location by the Corded Ware community could be seen as a link between the three groups. If the landscape is understood as a generator of knowledge (Bourdieu 1973; see Chapter 3), then the stone and flint implements collected from this area represent the material reflection of this knowledge (Scarre 2004). The presence of local materials in the TRB *hunebedden* shows the symbolic importance of the domestic implements produced using local material, which was used alongside imported material. The use of local material would influence the flint and stone assemblage produced by the Corded Ware communities (see Chapter 7).

Technological traditions continued in the production of flint and stone implements. Bipolar technology was used more intensively by the Corded Ware groups and dominated the Bell Beaker technology (Croese 2010; Louwe Kooijmans 1974). The simplicity of bipolar technology implied that the entire group could produce flint implements and no specialists were needed (see Chapter 7). Both TRB and Vlaardingen settlements are considered to have been non stratified societies, with no clear distinctions made inside the settlements and, in the case of the TRB group, in burial rituals. In fact, a communal effort was probably required to build the *hunebedden* (Bakker 1992, 2005). The use of a technology where no specialist would be needed could imply that the egalitarian character of the Vlaardingen and TRB societies was incorporated into the Corded Ware communities. Following the analysis of the Corded Ware settlements, as observed in Chapters 4, 5 and 6, it can be assumed that these communities were also egalitarian.

The technology conditioned the tool types produced. Flint technology was oriented to produce small implements, mainly unmodified flakes, and blade technology remained scarce. Other types of tools such as scrapers and retouched flakes, already well represented in the TRB and the Vlaardingen assemblage, were produced and used at the Corded Ware settlements. It seems clear that the functionality of the implements depended on the characteristics of each individual settlement, but two main activities were predominant: plant working and hide processing. For the former activity, during the TRB and the Vlaardingen period scrapers and retouched tools were selected. This tool type was also predominantly preferred at the Corded Ware settlements, as suggested by the use-wear analysis of Mienakker (García-Díaz 2013; see Chapter 5) and Zeewijk (García-Díaz 2014a; see Chapter 6).

Although the analysis of settlement implements suggests that technological continuity was the norm during the fourth and third millennia, changes can be observed when implements from settlement contexts are compared to the funerary assemblages. As already stated, the assemblage in the communal burials of the TRB culture, the *hunnebedden*, was characterized by a high percentage of local flint. It was common to find domestic tool types characteristic of settlement contexts, such as scrapers, flakes and sickles, the latter showing traces of extensive use (Van Gijn 2010a; Wentink 2006). In the Corded Ware burials, a change in the selection and use of the grave goods is observed. Arrowheads and unmodified flakes made of local flint were still documented in the graves (Van Gijn 2010a: 145; Chapter 2), but it is clear that imported flint was beginning to play an important role in funerary practices. This is suggested by the imported axes, the Scandinavian blades and the Grand-Pressigny and Romigny-Léhry daggers imported from France during the AOO period. As already stated in Chapter 7, the skills reflected in the imported material contrast sharply with the simplicity of the settlement assemblages. In addition, use-wear traces show a distinction between the grave goods of the TRB and the CWC. Some implements documented at the Corded Ware burials suggest a connection with the daily activities of the TRB communities. Analysed arrowheads with impact traces (Van Gijn 2010a) and battle-axes that were probably used to clear the landscape (Wentink *in preparation*) reflect the economy of the Corded Ware groups. However, some of the imported material, for instance the French daggers, had a different symbolic meaning. Use-wear traces suggest that the implements were hafted and placed on a bast sheath, and the daggers were probably taken in and out of the sheaths in several occasions, as a symbolic display (Van Gijn 2010a). This suggests that the importance of these implements was no longer connected to their previous use, but to their origin and the technology employed to produce them. Daggers and blades were imported to the Netherlands as finished products, implying that, by the Late Neolithic, neither the technology and nor the acquisition of the raw material were performed by Dutch communities.

From the TRB to the Late Neolithic B, a deep transformation took place in society. While TRB, Vlaardingen and Corded Ware were organized as egalitarian communities, the first manifestations of the changes in the social structure of the groups began to emerge in the graves. The change in the rituals observed to bury members of the community, from communal to singular, was probably a consequence of a gradual change in the identity and the social structure of the group. The adoption of farming and agriculture by the TRB groups was one of the first steps in social change (Fokkens 1986), and technology played an important role, in the first place because technological innovations, exemplified by the plough and wheeled vehicles, facilitated the adoption of the new economic system. The way these technological innovations were incorporated within society probably also generated changes. Through learning processes and social rules, implements were produced and incorporated into the communal practices of the groups. However, the importation of technologically complex finished objects such as French daggers redefined the conception of '*mutual knowledge*'. The technological referents were no longer inside the community, but outside, and the use and benefit of these items ceased to be communal.

Chapter 9. Conclusions

Material culture is a reflection, or a material product, of the social relationships of prehistoric people. Social rules guiding the production processes of implements, from the selection of the raw material to the production, consumption and discard of the tools, create and reaffirme the identity of social groups (Dobres 2009; Gosselain 1998; Ingold 1993). Through analysis of the material culture, intangible practices can be interpreted. The analysis of the Keinsmerbrug, Mienakker and Zeewijk assemblages provided relevant information to answer some of the main research questions formulated in Chapter 1.

9.1 The perception and appropriation of the landscape

The analysis of the assemblages suggested that the Corded Ware communities possessed a deep knowledge of their surrounding landscape. The economy of the groups was based on the exploitation of diverse natural resources. In the case of flint, stone, high quality wood and some fruits and nuts, this implied the use of a territory at least 20 km away from the settlements. A certain degree of mobility and specialization was adopted to take advantage of particular resources, such as fowling and fishing, which would have required a precise familiarity with the natural rhythms of the landscape. Detailed knowledge of the landscape would have been gained from long-term appropriation of different resources, but also through the observation of natural lifecycles, especially in relation to animals and their growth cycles. This type of knowledge is related to long-term memory and can be generated, changed or replaced with more knowledge. It requires attention, memory and the capacity to understand and decode the information contained in the landscape. As discussed in Chapter 3, this type of knowledge would be acquired and transmitted from one generation to another through learning practices, but also during the daily practices of the communities. The landscape formed part of the `collective memory' of the Corded Ware Culture societies, and the perception of resources and features such as bodies of water/rivers of surrounding landscapes would have been heavily embedded in oral traditions, creation myths and other stories (Taçon 1991).

Landscapes are also a means of communication: they connect people and provide relevant information (Stark 1998). Landscapes are not only part of the history of the group, a place where '*history is congealed*', but also a generator of information and knowledge, creating a new history (Ingold 2000a: 150). Material objects are fundamental to construct this history, as they work as an expression of it, with significant consequences for the social and political life of the groups (Chernela 2008). The creation of memories and tools are '*the fruits of a certain way of living in the land*' (Ingold 2000a: 148).

Therefore, the selection of specific raw materials is, in the first place, an expression of the location of a particular settlement within the wider landscape. However, it also reflects the learning processes and the transmission of knowledge from one generation to another, as well as the social and political relationships the Corded Ware communities established with other groups. The use of specific areas to obtain resources, such as the Pleistocene deposits of Wieringen, could be understood as part of the Late Neolithic communities' relationship with areas that had been used in the past by the other prehistoric communities (see Chapter 8). The materials obtained from that area, such as the flint pebbles and the stones, acted as a physical and a symbolic entanglement of these communities. In addition, water sources were not only a means of communication and subsistence; they also provided some of the materials used by the CWC communities, such as amber nodules, that were later modified and transformed into ornaments that most likely carried strong associations with individual people and were regarded as personal items. These ornaments related the entangled landscape to the Corded Ware personhood as markers, and as symbols of belonging to the community.

9.2 Knowledge, continuity and group composition

The analysis of the Corded Ware assemblages indicates continuity of technological praxis: the '*metapodium technique*' could link the Corded Ware bone technology with the Mesolithic tradition; the use of bipolar technology with small nodules of flint was documented in Vlaardingen and TRB settlements; and the technology associated with the production and maintenance of querns is similar to other techniques already employed by other Neolithic groups (see Chapters 7 and 8).

The suggestion for the existence of a shared knowledge between the TRB, Vlaardingen and the CWC societies implies continuity of traditions, such as pottery and flint production (Beckerman 2012a, 2015; Fokkens 2012; Lanting 1990/2000). The technical traits of the Corded Ware communities, however, could be contextualized within the European Neolithic. As already suggested, the combination of different technological approaches was a common phenomenon during the Neolithic period, probably determined by the '*mixed economy*' spectrum of the groups (Binder *et al.* 1990; Guyodo and Marchand 2005). The continuation of different technological practices could be understood as part of the construction and generation of '*mutual knowledge*' by Neolithic populations. During this process, learning probably took place inside the dwellings, where tools were produced and used. Through praxis, observation and imitation the technical gestures performed during the production of implements from settlement contexts were learned and embedded in the communal practices and daily life of each generation. But technical skills would not have been the only knowledge transmitted during these encounters; social rules, proscriptions and accepted ways of doing possibly would have also been reproduced and learnt within these daily contexts of practice (Edmonds 1995)

The technical continuity observed in these stone and hard animal material assemblages, however, contrasts with the distinct techniques employed to produce pottery. Pottery changes could be explained by the presence of several cultural traditions (Beckerman 2015), as at Keinsmerbrug, where the different clay and temper choices were interpreted as the result of different choices followed by different groups (Beckerman 2012b). In addition, new techniques in firing, tempering and shaping were probably added to the TRB and Vlaardingen techniques, generating a change in the material culture. A similar phenomenon has been documented in the third millennium BC in Sweden, where the use and combination of new techniques changed the way people produced pottery (Larsson 2008, 2009).

The theory of continuity is also challenged when burial practices are analysed. Although single burials existed during the TRB period, it is clear that this ritual became the standard practice during the CWC. Moreover, the grave goods associated with the burial ritual changed significantly. The change from collective to individual burial has generally been interpreted as the origin of an elite society (Renfrew 1976; Thomas 2000). However, the analysis of the settlements revealed a different situation. Following the definitions of social inequality used by several researchers (Clark and Blake 1994; Hayden 1995, 2001), the Corded Ware groups could be considered as non-highly stratified society. The introduction of agricultural and pastoral practices changed the groups' perception of the animals and the land, as people began to see both as property. The analysis of the Corded Ware settlements, however, suggested that land and animals, and the products obtained from them, were still considered communal possessions and that their benefits were shared among the entire group.

The fact that societies were considered egalitarian does not mean that no inequalities existed within the group (Hayden 2001). The use-wear analysis of the studied tools identified a wide range of activities, which through ethnographic analogies could be potentially ascribed to a specific gender. A gendered division of labour usually applies to herding, with herding tending to fall into the masculine sphere (Russell 1998). Meanwhile, cereal processing, the working of vegetal resources and several steps of hide processing are activities generally linked to women (Adams 1999, 2010; Anderson 2014; Arthur Weedman 2013; Frink 2005). There are, however, some activities to which gender is difficult or impossible to ascribe, such as for example the production of implements: flint knapping has been traditionally linked to men, but several artefacts uncovered at the sites prove the relationship between women and the production of implements (Arthur Weedman 2010; Gero 1991). Overall, the technology applied to produce the implements did not reveal any characteristic that could point to the necessity of a specialist, and the implements were probably produced when needed by non-specialized people.

9.3 C*haînes opératoires* and cross-craft interaction

Through the analysis of the *chaîne opératoire* of the archaeological assemblages it is possible to understand the networks of activities and cross-craft interactions embedded in different social systems (Brysbaert 2007, 2008; Dobres 2000; Schlanger 1994). As already discussed in Chapter 3, cross-craft interaction can be understood as the process by which two or more crafts interact and the technological and social impact they have on each other (Brysbaert 2007; Foxhall and Rebay-Salisbury 2009/2010). The consequences of these interactions imply the sharing and/or adoption of skills and knowledge necessary for the execution of different activities. Therefore, the study of cross-craft interaction is a way to understand the exchange and transmission of knowledge and materials (Brysbaert 2007: 326), how the technological daily practices of prehistoric groups were structured and which were their social relationships.

The study of the archaeological implements of the three settlements show that there was an interaction between different crafts and different *chaîne opératoires.* The *chaîne opératoire* of the implements was characterized by a high degree of knowledge of the surrounding landscape, but also of the physical characteristics of the materials employed. As discussed in Chapter 3, the landscape was part of the cognitive system of the prehistoric populations. Therefore, and through the perception and use of the landscape, memories and knowledge on the acquisition of raw materials were transmitted and adopted generation after generation. In this sense, and in an environment with a similar geology, the knowledge of areas with suitable stone and flint was probably transmitted from the old generation to the new one after their ascription to the memories of the community. Through interaction between generations and through daily practice, individuals learned to recognise and discard the raw materials needed for the production of implements and ornaments. As suggested in Chapter 4, 5 and 6, the acquisition of different raw materials was probably performed simultaneously and embedded in other activities, as for example pastoring activities or gathering wild nuts and fruits. Therefore, the interconnectivity of crafts and *chaîne opératoires* already started with the acquisition of the raw materials. In the case of bone acquisition, faunal analysis suggests the use of wild animals to produce some of the implements. Therefore, hunting was strictly linked to raw material acquisition of bones, but also of other animal resources as teeth, hide, fat and meat.

Technologically, an interaction between different *chaîne opératoires* is observed in the three settlements. At Keinsmerbrug, Mienakker and Zeewijk the production and use of flint, stone and bone implements were interrelated, and played a role in several steps of the production system. Flint implements were used to produce ornaments, bone tools, and, as suggested by the use-wear traces in several implements, for hide working and plant processing. Stone tools mainly took part in flint production and in the rejuvenation of stone implements as querns, although use-wear analysis suggest that they were probably taking part in the production of ornaments. And, finally, and bone tools were used for hide processing and plant processing, suggesting their participation in of the production of several tools that have not been preserved at the settlements. As already suggested, the production of implements in the three studied settlements was linked to the domestic space and the daily practices of the communities (Fig. 9.1).

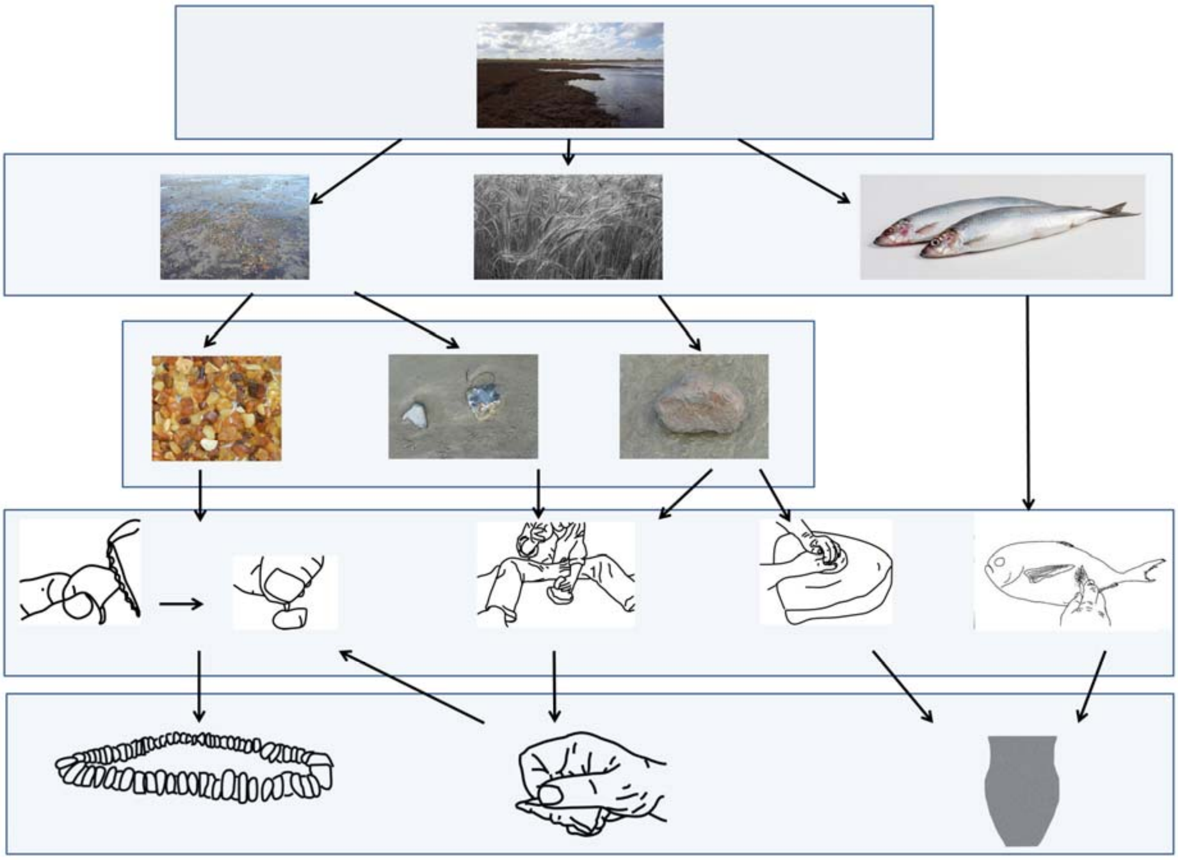

Figure 9.1. Interaction of different chaîne opératoires documented at the Corded Ware settlements. Corded Ware communities used the landscape to obtain different resources. Flint and stone, collected at the Pleistoceine deposits of Wieringen *were mainly used for the production of other tools, as flint and stone tools. Use-wear analysis shows that stone implements were mainly used to processes plant resources, as cereal grains were cultivated in the crop fields located close to Mienakker and Zeewijk. Flint implements were used for different activities, as for example the production of amber beads and pendants, as suggested by the chaîne opératoire observed at Mienakker and Zeewijk, and fish processing, as suggested by the traces documented at eight implements at Zeewijk (García-Díaz).*

The use-wear analysis of the implements and ornaments of the CWC settlements revealed an interconnectivity of different crafts and production systems. Use-wear analysis suggested that tools were interrelated and functioned in different spheres of the domestic life. In fact, tools were probably used for several activities based on their physical properties and qualities, such as grain roughness in the case of stone tools, and the edge angles in the case of the flint implements. Stone tools played a part in subsistence activities, in the form of querns used to process naked barley and emmer grains, while hammer stones were probably used to crack wild nuts such as hazelnuts and acorns and to process flax and orache seeds. In addition, butchering activities and fish processing were performed with flint implements, while flint arrowheads were used in hunting. Craft activities were performed with a range of implements. Hide processing was the main craft activity carried out at the three sites. Although most of the implements with use-wear traces of skin processing were flint scrapers and retouched pieces, bone tools also played an important role in hide processing at Mienakker and Zeewijk. Soft and hard wood was processed with flint implements, stone and bone tools.

Cross-craft interactions are observable in almost every activity carried at the Corded Ware settlements. One of the main examples is based on the organic residues found in the pottery vessels of the three analysed sites. The residues showed the presence of different organic materials, as for example fish and animal fat, different cereal grains, and plant seeds (Oudemans and Kubiak-Martens 2012, 2013, 2014). All these resources, as already explained, were obtained with the use of different implements. Therefore, and taking a look at the activity of cooking, it is clear that both subsistence and craft activities were interrelated. Cooking and other activities performed in the domestic sphere of the prehistoric communities were part of the daily practices of the Corded Ware Culture. As already suggested, during the daily practices of these activities the mutual knowledge of the community was shared.

9.4 Form vs function

The problematic use of typologies was addressed in Chapter 3, as well as the strict classification of implements without taking into account several constraints affecting the decisions of the tool-makers. At Keinsmerbrug, Mienakker and Zeewijk, specific tool types were created for specific activities: small flint borers were produced to perforate amber beads and pendants, and querns were rejuvenated and maintained to grind cereals. However, most of the flint implements documented in the Corded Ware domestic contexts could not easily fit into a formal typological classification system.

One of the main objectives of this book was to identify tools and their function in the CWC settlement assemblage. Chapter 3 addressed the problem of form and typology, which assumes a single and specific use for some tool types. However, use-wear has shown that those tools were used differently, and that unmodified implements were also functional (Gibaja 2006; Shott 1986; Van Gijn 1990). The results of the study of the flint assemblage of the three settlements have revealed a recurring and consistent use of unmodified implements and non-formal tools to perform various tasks. The selection of these implements was based mainly on the functional characteristics of the tool such as the edge angle. The main technological approach used by these groups, that of bipolar flaking, provided a uniformity of tool shapes and edge angles that favoured certain tool forms, including unmodified flakes. Therefore, unmodified tools played an important role in the economic activities of the groups and coexisted with the formal tools. Instead of considering these implements as waste, or refuse from flint knapping activities, they should be analysed and considered on their own merits as important items within the technological system of the CWC. This will require a change to the methods used for future research. In addition, tools that are usually related to specific tasks, as scrapers for hide working, have been proved to be used for different activities. To understand all dimensions of flint functionality, the selection of tools should not only cover '*formal tools*', but should also comprise unmodified implements.

In contrast, the technology used to produce the items deposited in the burials had a different character. Although the deposition of domestic implements, such as scrapers and flakes, continued from the TRB throughout the CWC, the majority of the tools excavated from funerary contexts differed from those found in the domestic context. The quality of the raw material, the time spent and the regularity of the implements all suggest an important investment (Van Gijn 2010a; Wentink *in preparation*).

9.5 The function of Corded Ware settlements

As already stated in Chapter 2, several interpretations of the function of CWC settlements in Noord-Holland have been published (Drenth *et al.* 2008; Van Ginkel and Hogestijn 1997; Hogestijn 1992, 1993a, 1993b, 1998, 2001) in which the settlements were classified based on their size – large and small – and on their presumed function. The small settlements, such as Keinsmerbrug, were interpreted as possible logistic camps, occupied for a short period of time to perform specific activities, whereas the larger sites, such as Mienakker and Zeewijk, were considered as base camps, occupied for a longer period of time (Hogestijn 2005). However, some problems derived from these interpretations. These interpretations were based on the analysis of semi-excavated settlements and assemblages that were not studied fully. In addition, they did not take into account the absolute chronology of the settlements; although it was assumed that the settlements were roughly contemporaneous, the fact is that some settlements could have been used while others were not. This is the case at Keinsmerbrug and Mienakker, which were probably not in use contemporaneously. The analysis of the assemblages of the three settlements and the procurement of new absolute dates provided significant information to advance the debate about the function of the settlements (Kleijne 2013; Smit 2012; Theunissen 2014).

The *NWO-Odyssee* project has shown that different types of settlements existed in the North Holland province: permanent, semi-permanent and temporary settlements. The semi-permanent and permanent settlements were based on agricultural and pastoral practices, although hunting, fowling and fishing still played an important role. The temporary settlements, on the other hand, exploited the landscape to obtain specific seasonal resources such as duck fowling and hunting fur animals, in combination with other economic activities such as herding (Zeiler and Brinkhuizen 2012). To some extent, the type of settlement determined the technological choices followed and the tool types present at the settlements. Keinsmerbrug was a settlement where fowling, fishing and hunting were the main activities. Zooarchaeological and botanical analyses suggested that the occupation of the settlement was seasonal and that it was mainly occupied during late spring and summer, taking advantage of the ducks' moulting period (Zeiler and Brinkhuizen 2012). Although flint knapping was performed at the site, the presence of a small number of implements suggest, in the first place, that relatively few tools were needed, and also that other raw materials such as bone and wood played a predominant role. Due to its seasonal use, it is possible that people brought the implements they needed to the settlement. Flint flaking was focused on producing implements that were in demand. The limited tool variation and minimal development of use-wear traces suggested that the main activities performed at Keinsmerbrug were related to the maintenance and repair of specific tools, and not to their production (García-Díaz 2012).

Mienakker and Zeewijk, on the other hand, were semi-permanent or permanent settlements, where a wider range of activities were performed. Although hunting, fishing and fowling were still important, pastoralism and agricultural practices were growing in importance (Brinkkemper 2014; Kubiak-Martens 2012; Zeiler and Brinkhuizen 2013, 2014). As already discussed, technological and use-wear analysis suggested that the assemblages were part of a complex production system in which the assemblages interacted in several production processes. Therefore, the various techniques employed at both settlements created '*multiple relations of interdependence, which confer on them a systemic character*' (Lemonnier 1986: 154). Flint, stone and bone implements played a role in several steps of the production system. Apart from the use of flint implements for a variety of subsistence activities, flint tools were also used to produce bone implements, stone tools and amber ornaments. Stone tools mainly took part in cereal and plant processing, and bone tools were used for hide processing and plant processing.

9.6 Contribution to technological studies and future research

Until the beginning of the NWO-Odyssee project '*Unlocking Noord-Holland's Late Neolithic Treasure Chest*', the CWC in the Netherlands was mainly known from burials and depositions. Settlements were not systematically studied, and information about the daily life of the Corded Ware people was scarce. By the time the project ended, three settlements had been intensively studied, combining knowledge from different specialists. In the course of this project, three monographs have appeared (Kleijne 2013;

Smit 2012; Theunissen 2014), along with three doctoral theses (Beckerman 2015; Nobles 2016) including the current thesis. Although there is still work to do, our understanding of the CWC in the Noord-Holland province has substantially increased.

The main objective of this thesis was to increase the knowledge of the domestic CWC contexts in the Netherlands mainly through the study of tool assemblages. The study of prehistoric implements is necessary, not only because the tools are an essential part of the material culture unearthed by archaeologists, but also because they are woven into a web of intangible social relations. The raw material provenance of the stone tools shows a close relationship between the Corded Ware inhabitants and their landscape. The procurement of different raw materials for the production of tools used for daily or regularly performed activities was embedded in other economic practices of the groups, such as animal herding, fishing and the collection of wild fruits and nuts. The selection of specific stones to produce tools, as has been observed in Mienakker and Zeewijk, reflected a deep understanding of the textural characteristics of the available material. The technological choices of the Corded Ware groups revealed a continuity of technological practices between other Neolithic cultures and the CWC. The bipolar technology used in Corded Ware tool production was a common practice in other Dutch Neolithic periods, such as the Vlaardingen group and the TRB culture, but was also employed in other contemporaneous European contexts (Guyodo and Marchand 2005). In addition, quern and bone manufacture shows traits that could link this praxis to the LBK and the Mesolithic groups respectively.

The presence of several tools in the archaeological record also provided important information about the social and economic structure of the settlements. In contrast to the limited diversity of tool types and the low degree of traces inferred at Keinsmerbrug, the greater variability of tools at Mienakker and Zeewijk and the specialized tasks performed at the settlements supports the faunal, botanical and palynological analysis (Kubiak-Martens 2012, 2013, 2014; Van Haaster 2012; Zeiler and Brinkhuizen 2012, 2013, 2014) suggesting the existence of different type of settlements: Keinsmerbrug, probably used only during summer, and Mienakker and Zeewijk, used semi permanently or all year round. The activities performed at the settlements also provided some clues about the social composition of the Corded Ware Culture. Therefore, the study of the tools used by the Corded Ware communities during their daily practices provides information about their economic practices, their networks, their knowledge and skills, and about the structure of their society (Dobres 2009; Dobres and Hofman 1994; Lemonnier 1992; Miller 2009).

These connections are significant, but the information also needs to be contextualized within the settlements and with the data generated by other researchers, which is why an interdisciplinary project is important. Thanks to the NWO project, the information about the tools and implements of the CWC could be integrated with other cultural and ecological information (Kleijne 2013; Smit 2012; Theunissen 2014). In the first place, spatial analysis of the three studied sites provided new insights into the social structure of the space. The spatial analysis revealed several dwellings (Nobles 2012a, 2013a, 2014a) and confirmed the predominant role of households as the setting for domestic activities (Nobles 2012b, 2013b, 2014b), and the main economic activities of the CWC were inferred through the analysis of both botanical and animal remains. Herding, fowling and fishing were combined with crop cultivation and the gathering of wild nuts and fruits (Kubiak-Martens 2012, 2013, 2014; Van Haaster 2012; Zeiler and Brinkhuizen 2012, 2013, 2014). Finally, the analysis of pottery remains provided an insight into the social composition of the groups, their technological achievements and their diet (Beckerman 2012b, 2013, 2014; Oudemans and Kubiak-Martens 2012, 2013, 2014). Thanks to the NWO project, new insights into settlement practices and subsistence activities have been identified (Theunissen et al. 2014) and our understanding of the CWC has increased.

The domestic sphere of the CWC in the Noord-Holland province will benefit from the study of other contemporaneous archaeological settlements. Although excavations of Corded Ware and Corded Ware settlements are still scarce in comparison with burials in the entire European context, new discoveries are generating new data and information all the time. An interdisciplinary analysis of the different regional contexts of the Corded Ware phenomenon will illuminate the role played by different local groups, and the analysis of their domestic implements will have an important role to play in understanding the social relationships of these groups.

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Figure 5.7. Use-wear traces of drilling mineral materials. The first six images (A-F) are probably the result of boring amber to produce beads. The last two images (G-H) are probably the result of the contact between the borer and a harder mineral material, maybe jet (García-Díaz 2013: 78).

Figure 5.8. Use-wear traces on experimental tools used to drill amber; A: rounding of the tip after 15 minutes of work (200x); B: same (500x); C: rounding and polishing of the edge covering fractures on the tip (100x); D: same (500x); E: rounding of the lateral side of the borer after 15 minutes of use (100x); F: same (200x); G: after 60 minutes the polish also extends into the depressions (200x); H: same (500x) (García-Díaz 2013: 79).

Figure 5.9. Four hammer stones related to percussion activities (García-Díaz 2013: 83).

Figure 5.10. Three querns and one handstone recovered showing use wear related to cereal processing (García-Díaz 2013: 84).

Figure 5.11. Use-wear traces related to hammer stones and querns. A: crystal alterations related to pounding and percussion (10x); B: polish and rough surface related to pounding and percussion (20x); C: very well-developed cereal polish on the active surface of the quern (10x); D: polished surface of the handstone as a result of grinding cereals (20x) (García-Díaz 2013:85).

Figure 5.12. Use-wear traces on bone (2171-4725) related to the scraping of an undetermined vegetable material. Use-wear traces are developed on both distal and proximal edges (100x and 200x; 100x and 200x) (García-Díaz 2013: 92).

Figure 5.13. Distal fragment of a bone chisel (1040-7735) related to wood working (100x, 200x and 200x) (García-Díaz 2013: 92).

Figure 5.14. Use-wear traces on a bone implement (1636-3294) related to hide-processing, probably using a mineral additive (100x and 200x)(García-Díaz 2013: 93).

Figure 5.15. Bone tool (2602-6341) possibly used as a sharpener. On the top of the image, use-wear traces related to an unspecified hard material (100x and 200x). On the bottom of the image, polished surface of the tool (200x)(García-Díaz 2013: 94).

Figure 5.16. Flint areas interpreted by Nobles (2016). The distribution of the tool types did not display a clear pattern, but blades, borers, scrapers and a large number of flakes are mainly documented within the structures. Although a spatial distribution of the use-

wear traces was not performed, it seems that the use of the flint implements is related to a domestic use of the space (Nobles 2016: 164).

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these tools has a rough and greasy aspect and it is extremely invasive. Images A-F: use-wear traces related to fish processing, probably scaling, in A and B (20x and 10x)(24241-4); C and D (20x and 10x) (13062-4); E and F (10x and 20x) (13062-3) (García-Díaz 2014: 98).

Figure 6.9. Amber beads were probably produced at the site, as suggested by the use-wear traces documented on one flint borer (13083-30), A and B (10x and 20x); Wood and other unspecific plant resources were also worked with flint artefacts, probably to produce other implements like wooden tools, clothes and weapons. The image shows use-wear traces related to scraping wood observed in an unmodified flake (13083-1), C and D (10x and 20x), and a retouched flake (13721-42), E and F (10x and20x) (García-Díaz 2014: 100).

Figure 6.10. Hafting traces were documented on seven tools. A-D: two of the implements displaying hafting traces were the 'pine tree'-shaped arrowheads (10x, 10x and 20x) (7188-1a and 27821-82). Even though no clear traces of use were documented during analysis, hafting traces were documented on the barbs and the tag of the arrowheads. In addition, other tools, such as flakes and scrapers, were also hafted and used. E and F: hafting traces documented on a scraper (10x and 20x) (13721-6) (García-Díaz 2014: 101).

Figure 6.11. Three querns recovered from Zeewijk displaying use-wear traces related to cereal processing) (García-Díaz 2014: 107).

Figure 6.12. Use-wear traces related to querns and grinding stones. Processing of cereals and plant resources were the most commonly represented activities at Zeewijk. A-D: use-wear traces related to cereal processing on three querns (10x) (A: 14983-1), (B: 14361-1), (C-D: 15223-1). In addition, other plant resources were also processed with stones. E-F: use-wear traces documented on an unmodified stone (10x) (14333-4) related to an undetermined plant resource and traces indicating wood processing on a mano (20x)(14993-1) (García-Díaz 2014: 110).

Figure 6.13. Two bone beads (7188-2 and 8834-1) and one pendant (17051-1) recovered at Zeewijk showed traces related to their use as ornaments (García-Díaz 2014: 113).

Figure 6.14. The bone awl (16272-1) and two needles (7094-1 and 7094-3) (García-Díaz 2014: 113).

Figure 6.15. Cattle ribs were used during the Corded Ware Culture period to produce tools denominated 'ripples' (bobbelkammen in Dutch) by fauna specialists. Three of these

tools were recovered at Zeewijk. The restoration of the tools using a chemical preservative covered the technological and functional traces on the surface. This prevented a proper understanding of the function of the tools. This 'ripple' (14984-1), was probably produced by scraping and polishing (García-Díaz 2014: 113).

Figure 6.16. Use-wear traces documented on a needle (7094-1) suggest that the tool was used to pierce hide. In addition, the distribution of the use wear among the tip and body of the awl suggests that the tool could have been used as a pin (García-Díaz 2014: 115).

Figure 6.17. Needle (7094-3) displaying traces related to working an abrasive material, interpreted as hide. Use-wear traces suggest that this implement was used to pierce hide (García-Díaz 2014: 115).

Figure 6.18. This pendant (17051-1) made from the incisor of a dog displays a conical perforation. Use-wear is located around the perforation, suggesting that the pendant was hung from a string (García-Díaz 2014: 116).

Figure 6.19. Decorated bead (7188-2) with long narrow incisions all along its surface. In addition, a perforation was made in its central surface. The bead displayed use-wear traces around the lateral hole and around the central perforation, suggesting that a string was introduced from the lateral holes into the central perforation (García-Díaz 2014: 116).

Figure 6.20. Traces of manufacture and use on beads and pendants: a. Grinding traces (17501-2); b. grinding traces and perforation marks on a disc-shaped bead (15784-1) with facetted edges; c. disc-shaped bead (17554-4) with a perforation made by a flint drill bit; d. bead (16901-2) displaying a misplaced biconical perforation made with a flint drill; e. disc-shaped bead (17564-3-1) with a slightly misplaced biconical perforation made with a flint drill; f. detail of the perforation of bead (17564-3-1); g. heavily worn disc-shaped bead (17604-8) with a rounded, worn perforation; h. heavily used, broken bead (17563-3); i. heavily worn and polished pendant (17504-2); j. detail of this same pendant (17504-2) (van Gijn 2014: 120).

Figure 6.21. Technological and functional traces on amber beads: a. and b. Grinding traces (15003-1 and 13691; 100x); c. circular and regular scratches suggesting that the perforation was performed with a tool other than a flint drill (13724-9; 100x); d. extensive abrasion from a cord on the inside of an amber bead (22684-1; 100x) (van Gijn 2014: 125).

Chapter 7

Figure 7.1. Relation between the three studied settlements and the procurement areas used by the Corded Ware Culture populations. 1:deposits of Wieringen; 2: Texel; a: Keinsmerbrug; b: Zeewijk ; c: Mienakker (after Kleijne and Weerts 2013).

Figure 7.2. Actual deposits of Wieringen at the Noorth-Holland province and modern distribution of raw material (García-Díaz).

Figure 7.3 Flint technology in the Corded Ware Culture was characterised by an extended use of bipolar technology. The products of this technology, mostly flakes, were primarily used without further modification. However, retouched flakes and blades, scrapers and borers were also produced with bipolar technology (García-Díaz).

Figure 7.4 The chaîne opératoire of the querns and grinding stones at Mienakker and Zeewijk suggest that after the selection of the raw material, querns were used for cereal processing. When the surface was blunted, flaking was used to reshape and revive the grinding surface. On the image, quern with several flake negatives (García-Díaz).

Figure 7.5. Image of the possible Zeewijk-East house reconstruction (Nobles 2014: 208).

Chapter 8

Figure 8.1. Overview of the TRB settlements cited on the text (after Vos and de Vries 2011).

Figure 8.2. Overview of the Vlaardingen settlements cited on the text (after Vos and de Vries 2011).

Chapter 9

Figure 9.1. Interaction of different chaîne opératoires documented at the Corded Ware settlements. Corded Ware communities used the landscape to obtain different resources. Flint and stone, collected at the Pleistoceine deposits of Wieringen were mainly used for the production of other tools, as flint and stone tools. Use-wear analysis shows that stone implements were mainly used to processes plant resources, as cereal grains were cultivated in the crop fields located close to Mienakker and Zeewijk. Flint implements were used for different activities, as for example the production of amber beads and pendants, as suggested by the chaîne opératoire observed at Mienakker and Zeewijk, and fish processing, as suggested by the traces documented at eight implements at Zeewijk (García-Díaz)

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Table 8.3. Stone tool types and number of implements found at the TRB settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Table 8.4. Flint tool types and number of implements found at the Vlaardingen settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Table 8.5. Stone tool types and number of implements found at the Vlaardingen settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Table 8.6. Bone tool types and number of implements found at the Vlaardingen settlements cited on the text. When the tool types or the material are mentioned but the number is not specified, an asterisk is used.

Appendix 1

List of symbols used in the figures

Contact material

HM Hard material
HI Hide
BO Bone
WO Wood
MI Mineral
UN Unsure

Degree of use

● Heavily developed traces
• Medium developed traces
· Lightly developed traces

Motion

↥ Transverse / Scraping
⟷ Longitudinal
⌒ Hafting
↧ Impact
↺ Drilling / Boring

Technical information

▲ Bulb of percussion present
△ Bulb of percussion absent but direction of percussion clear

Surface

▢ Burnt
⁘ Cortex

Samenvatting (Dutch summary)

Het hoofddoel van het onderzoek is het dagelijks leven van de inwoners van Noord-Holland in de Enkelgrafcultuur te begrijpen, en daarmee de sociale implicaties van hun handelen en besluiten. Er wordt vanuit gegaan dat de huishoudelijke artefacten van de Enkelgrafgemeenschap de reflectie van hun sociale acties zijn (Dobres 1994, 2009; Miller 2009) en daarmee een belangrijke informatiebron vormen voor de studie van de sociale samenstelling van deze archeologische groepen. In dit proefschrift wordt daarvoor onderzoek naar grondstoffen, technologie en gebruikssporen van artefacten (vuursteen, steen en benen voorwerpen en ornamenten van barnsteen) uit de Enkelgrafcultuur gecombineerd.

De Enkelgrafcultuur, daterend tussen 2900 en 2450 BC, wordt traditioneel onderzocht aan de hand van de graven en het grafritueel. Een vergelijking van de voor Europa beschikbare gegevens zorgt voor een beter begrip van de economische en sociale gewoonten en de sociale samenstelling van deze groepen. In **hoofdstuk twee** wordt een overzicht van de bekende nederzettingen en vondsten uit andere Nederlandse en Europese Wikkeldraadbeker/Enkelgrafcultuur opgravingen gepresenteerd. Er is een verschil tussen de beschikbare data voor zowel de Nederlandse als de Europese contexten: terwijl graven, grafheuvels en deposities uitgebreid zijn bestudeerd, zijn de nederzettingen meestal slechts gedeeltelijk opgegraven en de gevonden materialen zijn niet systematisch onderzocht.

In Nederland zijn tijdens de tweede helft van de vorige eeuw, en dan voornamelijk tussen eind zeventiger jaren en de vroege negentiger jaren, diverse EGK nederzettingen gevonden en opgegraven (Van Heeringen en Theunissen 2001). Tijdens de opgravingen bleek de uitzonderlijke kwaliteit van de sites, met name de zeer goede conservering van het organische materiaal. Echter, de interpretaties van de materiële cultuur uit de nederzettingen zijn voornamelijk gebaseerd op typologische studies. Technologisch onderzoek is zelden uitgevoerd en slechts twee assemblages zijn onderzocht op gebruikssporen. Daarom is besloten drie van deze sites, Keinsmerbrug, Mienakker en Zeewijk, te onderzoeken met de artefacten als uitgangspunt. Het ontbreken van een systematisch onderzoek van de huishoudelijke artefacten van de EGK illustreert het belang van het huidige onderzoek.

Om het belang van de analyse van de huishoudelijke artefacten van de Enkelgrafcultuur beter te kunnen begrijpen, is het van belang de rol van de materiële cultuur op het menselijk handelen en de samenlevingsstructuur te onderzoeken. In **Hoofdstuk 3** worden daarom de theoretische achtergronden en methodologie die zijn gebruikt voor dit onderzoek gepresenteerd. Werktuigen worden hierbij niet alleen gezien als producten van een economisch systeem, maar ook als de neerslag van de keuzes die gemaakt zijn door de samenleving in relatie tot hun omgeving en de aanwezige natuurlijke bronnen. Daarom moet het gehele productieproces van een assemblage onderzocht worden om de rol van de artefacten in de samenleving te begrijpen. De analyse van de archeologische vondsten moet zich vervolgens bezighouden met de *chaîne opératoire* van de artefacten: het verkrijgen van het ruwe materiaal, de technologie die is gebruikt voor het vervaardigen van de artefacten, het gebruik en uiteindelijk het afdanken ervan.

In **hoofdstuk 4** wordt de analyse van het materiaal van Keinsmerbrug besproken. Het bestudeerde assemblage is klein en bestaat voornamelijk uit vuursteen. Daarnaast zijn een klein aantal stenen artefacten en ornamenten van barnsteen onderzocht. Doordat het een klein assemblage is konden alle voorwerpen worden onderzocht en functioneert het als een methodologische testcase voor de grotere sites zoals Mienakker en Zeewijk. Tijdens de ruimtelijke analyse van de archeologische grondsporen die zijn geïdentificeerd tijdens de opgraving zijn een aantal huisplattegronden onderscheiden (Nobles 2012b). Dankzij de integratie van de ruimtelijke analyse en de resultaten van de gebruikssporenanalyse van de vuurstenen en stenen artefacten kon interessante informatie over nederzettingsgebruik worden achterhaald. Dit heeft het team geholpen een beter begrip te krijgen van de verschillende activiteiten die plaatsvonden binnen de nederzetting.

In **Hoofdstuk 5** wordt de analyse van het assemblage van Mienakker gepresenteerd, dat bestaat uit vuurstenen, stenen, barnstenen en benen artefacten. Dit assemblage is aanzienlijk groter dan dat van Keinsmerbrug. Tijdens de analyse van het materiaal ontstonden een aantal problemen. In de eerste plaats kwam het aantal vondsten dat beschikbaar was voor analyse niet overeen met het aantal van een eerdere studie (Peeters 2001a). Tijdens die analyse van Peeters zijn 1218 vuurstenen artefacten geregisterd (Peeters 2001a), waaronder diverse artefacten vervaardigd van niet-lokaal materiaal, zoals Grand-Pressigny en Rijckholt vuursteen. Tijdens de huidige analyse bleek het overgrote deel van het Grand-Pressighny vuursteen te ontbreken en ondanks alle moeite die is gedaan, was niet het mogelijk om het missende materiaal te vinden. Ten tweede heeft Bulten (2001) onderzoek gedaan naar de barnstenen kralen en hangers, maar deze materialen bleken ook afwezig te zijn en alleen de splinters en het productieafval waren beschikbaar voor onderzoek. Ten slotte was, hoewel het assemblage bijna compleets is, de conservering van het botmateriaal niet zo goed als verwacht. Been is een zacht en makkelijk te beschadigen materiaal en post-depositionlele processen hebben het oppervlak van diverse artefacten beschadigd.

De ruimtelijke analyse van de grondsporen en structuren die zijn gevonden tijdens de opgraving heeft geleid tot de identificatie van de resten van een aanvullende structuur (Nobles 2013b). Ruimtelijke analyse was in dit geval minder productief dan voor Keinsmerbrug. Hoewel geen activiteit gebieden konden worden onderscheiden, heeft de distributie van het materiaal wel informatie opgeleverd over de vorming van de site en over de functie van de geïdentificeerde structuren.

Hoofdstuk 6 is gewijd aan de analyse van het assemblage van Zeewijk, dat bestaat uit een grote hoeveelheid vuurstenen (meer dan 10.000 stuks), stenen en benen voorwerpen. Alle artefacten zijn typologisch en technologisch geanalyseerd, maar gezien de grote hoeveelheid materiaal was het niet mogelijk om alle voorwerpen op gebruikssporen te onderzoeken en is daarvoor een selectie gemaakt. Hierbij is gebruik gemaakt van de expertise uit de andere onderzoeken om tot een goede selectie te komen. Naast dit materiaal zijn ook de diverse barnstenen voorwerpen gevonden en onderzocht. De gegevens van deze analyse, uitgevoerd door van Gijn (2014a), worden ook opgenomen en besproken in dit hoofdstuk. Helaas was het niet mogelijk om een ruimtelijke analyse van het materiaal te doen. Er was te weinig materiaal beschikbaar uit die delen van de nederzetting die voor de ruimtelijke analyse waren uitgekozen. Hierdoor was het slechts gedeeltelijk mogelijk om mogelijke activiteitsgebieden te onderscheiden binnen de site.

Hoofdstuk 7 omvat de belangrijkste conclusies van de analyses uit de voorgaande hoofdstukken en plaatst de resultaten in een bredere Nederlandse en Europese context. Er zijn diverse verschillen te vinden tussen de nederzettingen: Keinsmerbrug werd seizoensmatig gebruikt en de belangrijkste activiteit was het op grote schaal vangen van vogels, voornamelijk eenden, in combinatie met andere activiteiten als vissen en het hoeden van vee. Mienakker en Zeewijk, daarentegen, werden het hele jaar rond bewoond en hoewel vissen en jagen belangrijk waren, was de economie voornamelijk gebaseerd op het verbouwen van gewassen en het houden van vee. Maar er zijn ook diverse overeenkomsten tussen de drie sites zoals het gebruik van locale materialen, de combinatie van verschillende technologieën voor het vervaardigen van voorwerpen (zoals de bipolaire techniek en de metapodium techniek), een beperkte variatie in werktuigtypes, het belang van ‘ *informele*’ , niet gemodificeerde, werktuigen.

In **hoofdstuk 8** wordt een synthese van de resultaten bereikt door vergelijking met de beschikbare gegevens van Trechterbeker en Vlaardingen nederzettingen. Het hoofdstuk richt zich op de informatie die is verkregen door de analyse van materiële cultuur van zowel oude als nieuwe opgravingen in Nederland. De vergelijking tussen de EGK, de TRB en de Vlaardingen groepen leidt tot enkele conclusies. In de eerste plaats lijk het erop dat er een duidelijke continuïteit is in de exploitatie van de ruimte en dat technologische tradities in het vervaardingen van vuurstenen en stenen werktuigen grote overeenkomsten vertonen. Maar als de TRB en EGK grafrituelen worden vergeleken zijn er enkele verschillen te zien in de gebruikte grondstoffen en de werktuigtypen. Waar in de TRB graven voornamelijk huishoudelijke artefacten voorkomen, worden de grafgiften van de EGK gekenmerkt door bijzondere artefacten die zijn gemaakt met niet-lokaal materiaal. Vanaf de TRB tot het Laat Neolithicum B en de bronstijd is er een transformatie te zien in de samenleving. Terwijl TRB, Vlaardingen en EGK egalitaire samenlevingen waren, zijn de eerste manifestaties van deze veranderingen in de sociale structuur al te zien in de graven.

Credits

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Curriculum vitae

Virginia García-Díaz was born in Geneva (Switzerland) in 1981. She got her Bachelor degree from Universidad Complutense de Madrid (UCM) in 2004, when she moved to Barcelona. In this city, she got trained in functional analysis with Ignacio Clemente Conte, from the Spanish National Research Council (C.S.I.C.); collaborated with archaeological projects related to the Neolithic occupation of the Spanish Pyrenees and the Mediterranean coast; was employed in the Catalan Museum of Archaeology and as an archaeologist for different commercial firms and graduated from Universitat Autònoma de Barcelona (UAB) in the field of Prehistoric Archaeology in 2009. From that year onwards, she started her PhD at the Faculty of Archaeology at Leiden University within the framework of the NWO-founded "*Unlocking Noord-Holland's Late Neolithic Treasure Chest*" project.