ANALECTA PRAEHISTORICA LEIDENSIA

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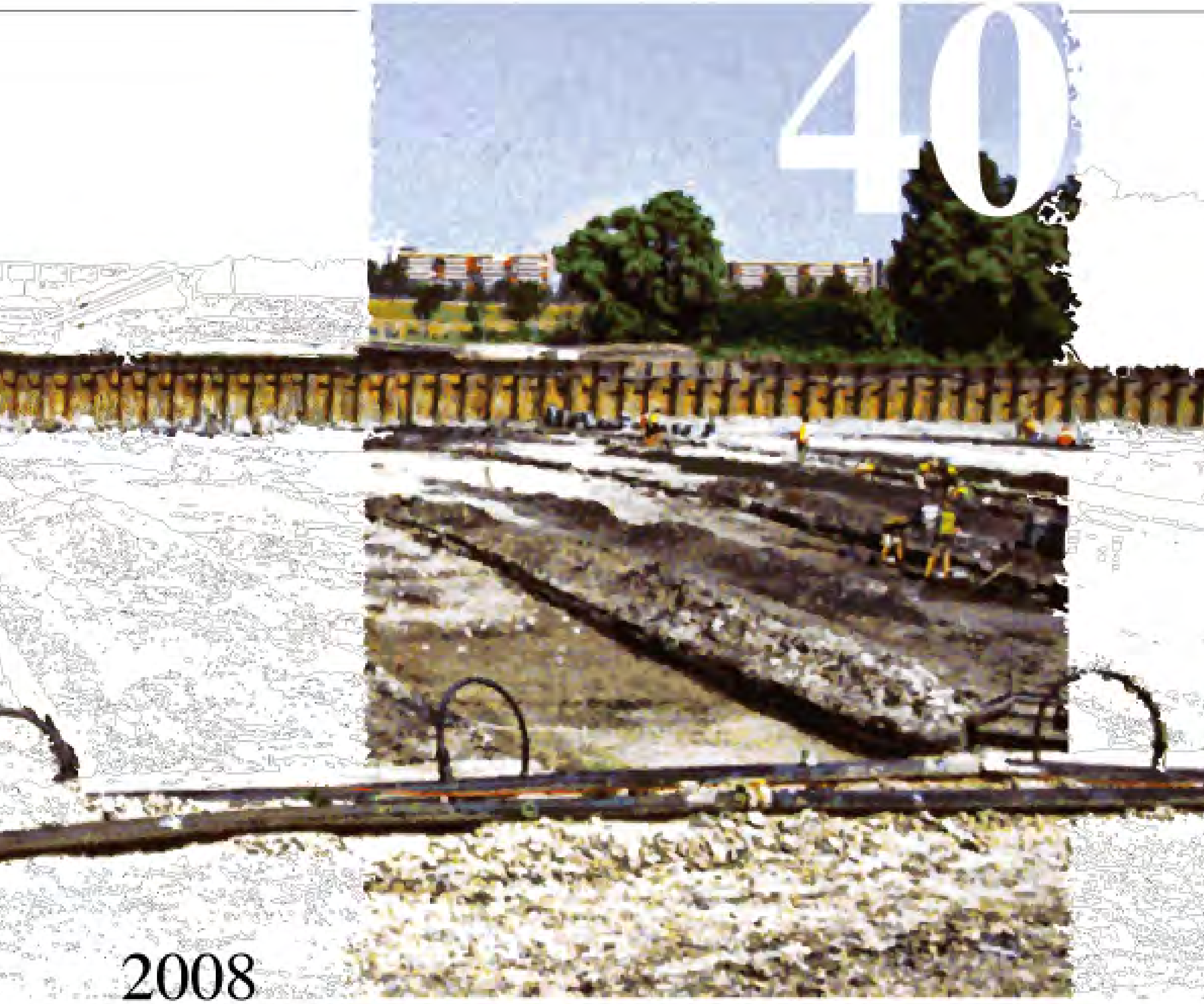

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AN EXTENDED BROAD SPECTRUM OF PAPERS
PRESENTED TO LEENDERT LOUWE KOOIJMANS

EDITED BY
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Preface

Leendert Louwe Kooijmans is in the process of retiring. He has been retiring already for a few years and we hope he will be retiring for the next decennium as well......without really becoming retired.

In 2003, at the age of 63, Leendert ended his administrative duties after being a dean of the Faculty of Archaeology for 20 years, a Faculty he created and let flourish. He ceased administration and education, but carried on his research on the neolithisation of north-western Europe. The large National Science Foundation grant that he obtained in 2003 for his project *From Hardinxveld to Noordhoorn, from forager to farmer* was a great reward for his work on the subject.

Neolithisation has been Leendert's research field since the nineteen-sixties, undoubtedly triggered partly because of his study in Physical Geography. His education in Prehistory in Leiden with P.J.R. Modderman must have influenced his interest in the Early Neolithic as well. One of his first important studies on the subject was his 1971 survey of *Bone and antler implements from the North Sea* in which we also find the first version of his sea level curve, which was published in the final version in his dissertation of 1974. This sea level curve in fact characterizes his style of work: meticulous command of data and innovative research. It is telling that Roeleveld, in his 1974 dissertation on the same subject, acknowledged Leendert's work with the statement "the data from the Groningen coastal area appear to correlate astonishingly well with Louwe Kooijmans' curve for the Western Netherlands, even though our curve does not provide the same degree of detail" (Roeleveld 1974, 116).[1] Apart from being a thorough scientist, Louwe Kooijmans is also a very experienced excavator and a real wizzard when it comes to documentation and conservation of the fragile wetland finds that he excavated. First in the Hazendonk, next in Berchsenhoek, in Hardinxveld-Giessendam and last but not least in Schipluiden. The report on the Schipluiden excavations, published as *Analecta Praehistorica Leidensia* 37/38, demonstrates all his skills in 516 pages: excavator, coordinator of research, model maker, critical and careful editor, care for high quality images and drawings.

It is almost impossible to sum up the enormous number of publications from his hand on the Meso-Neo transition in north-western Europe. It is also virtually impossible to match his encyclopaedic knowledge of sites and finds, which was formed during his period as the keeper of the Dutch department of the National Museum at Leiden (1966-1982) and was extended by his teaching in Leiden (1982-2003). The enormous numbers of slides of sites and cultures which he used in teaching the first year students his European Prehistory lectures are by now legendary.

His knowledge and innovative views made him a respected teacher and colleague who still is one of the leading international figures in the field. This immediately became clear when we send out a call for papers in May 2007. The problem with people who are in the process of retiring is that it is difficult to find a suitable moment to commemorate their career. We are therefore grateful that Leendert helped us with the timing by announcing – in April 2007 – that his valedictory address had been set for June 13, 2008. That was the signal we had been waiting for. The enthusiastic reactions and high standard of contributions that we received has shown that most scholars not only consider Leendert Louwe Kooijmans a fine scientist but also a good friend.

The book could have been five times as thick if we had invited everyone who might have been interested to contribute something to honour Leendert. He has initiated so many projects and institutions, and educated so many students that the list is nearly endless. Instead we have chosen a subject that is dear to him, one on which he has focused his own research: the Meso-Neo transition. The title almost presented itself, based as it is on a combination of his most recent project and one of the lasting concepts that he added to the tools of archaeological interpretation: *the extended broad spectrum economy* (with thanks to Jos Kleijne).

Eventually twenty-three colleagues were able to contribute to this *liber amicorum* and another twenty to the conference that has been organised in advance of the valedictory address on June 13, 2008. It is interesting that the 'hard core' of this group was already present at the conference *Settlement Patterns around the Southern North Sea*, that was organised by Leendert himself in March 1982 on the occasion of Modderman's valediction as head of the Institute for Prehistory. This demonstrates that many of the scholars who contributed to Leendert's valediction are not only his friends, but also lifelong valued guests and colleagues of the Faculty of Archaeology.

The editors want to thank the contributors for their patience with us. You all delivered within a relatively short period of time and responded promptly and adequately to our editorial comments. The research students involved in the project, Hedwig Ponjee and Jos Kleijne, were very critical seconds and had a considerable contribution to the success of the project and the fact that we survived the ‘race to the printer’. Corijanne Slappendel was the spider in the web of both the production of the book ánd the organisation of the conference. She was in fact the *sine qua non* of this book.

We hope, Leendert, that you appreciate our homage to your scientific career and that you will use the text as stimulus for the work that you undoubtedly will continue to do.

Harry Fokkens
Bryony Coles
Annelou van Gijn

note

1 Roeleveld, W. 1974. *The Holocene Evolution of the Groningen Marine-Clay District*. Amerstfoort (supplement Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek 24).

Contents

1 Jan Hendrik Holwerda and the adoption of the three-age system in the Netherlands

Leo B.M. Verhart

1.1 Introduction

The classification of Prehistory into Stone, Bronze and Iron Ages is nowadays so self-evident and common that it is hard to realise that the general adoption of the three-age system occurred amid much discussion and resistance. In the Netherlands it took a very long time for the three-age system to be generally accepted, and its first uses led to heated debates around the start of the twentieth century. A particularly outspoken part was played by Jan Hendrik Holwerda, who in 1904 became the first keeper of the Dutch department in the National Museum of Antiquities in Leiden. In spite of his classical background, he concerned himself fervently with Dutch archaeology for the next 30 years.

At the time of his appointment Holwerda was 31 years of age, had read classics and written a thesis on a classical archaeological subject. Once in the museum he proved to be a Jack-of-all-trades, concerning himself not only with the classical department but also all Dutch periods: Prehistory, Roman and Medieval. It would be another 62 years before a keeper would be appointed to devote his time exclusively to Prehistory: Leendert Louwe Kooijmans. He has always appreciated his predecessor, in spite of the fact that many have considered Holwerda to be a maverick, with his extremely dissenting opinions on, among other things, the Stone Age and the three-age system. Leendert Louwe Kooijmans has highly valued Holwerda's museum activities and his efforts to introduce archaeology to a wider audience, issues in which Leendert Louwe Kooijmans himself has been a pioneer as well.[1]

In general, Dutch archaeologists have regarded Holwerda as a self-important, pompous, arrogant man, refusing to move with the times, holding archaic opinions, biased and unable to handle criticism. His scientific contributions are therefore no longer appreciated, although there is merit in his work. This paper concentrates on the, to our modern eyes, controversial opinions of Holwerda concerning the Stone Age and the non-existence of a Bronze Age. It examines these opinions in the context of the developing study of prehistory in the Netherlands. A closer examination proves his views to be carefully considered, albeit divergent, thereby presenting a more balanced image of Jan Hendrik Holwerda.

1.2 Prelude

In the last century BC the Roman writer Lucretius formulated in his *De Rerum Natura* (On the Nature of Things) the classical three-age system assuming a sequence from stone to bronze and eventually iron tools for ancient times. For centuries this idea, without any empirical foundation, was to determine all thought about the past.

The clergyman Johan Picardt (1600-1670) from Drenthe deserves the credit for being one of the first in the Netherlands to concern himself more extensively with the pre-Roman period (Picardt 1660). Although not himself engaged in archaeological investigations, he felt that the builders of the megaliths had been the oldest inhabitants of the Netherlands, on the basis of statements by other writers and his own observations. They needed to have been giants, to have been responsible for the construction of the megaliths, the in his perception gigantic stone monuments in which they were buried. That the giants were not the sole inhabitants at that time is demonstrated by a picture in his book showing one of the giants eating a normal-sized human being (fig. 1.1; Picardt 1660, 22-23).

Yet even before Picardt scholars -often well-to-do citizens or “scientists” from non-archaeological disciplines- had concerned themselves with the inhabitants of the Netherlands in pre-Roman times, but without providing much clarification (Langereis 1999). The major traces of their presence, the stone axes, were often considered natural phenomena. These were thought to be stones hurled by Donar, the god of thunder. Later these were generally considered to be thunderstones, formed in locations where lighting had struck the ground. As lightning would never strike the same place twice, these thunder chisels were particularly outstanding ways to protect hearth and home (Eijk 2007).

A century later this view would be radically different, with the start of a more scientific approach. In 1760 Johannes van Lier wrote in his *Oudheidkundige Brieven*, as a result of his own finds and explorers' travel accounts, that there must have been a period in the Netherlands with people who did not yet have metals and only used stone for their tools (Van Lier 1760). Without stating this explicitly he empirically defined a Stone Age and a Metal Age.

Figure 1.1 The clergyman Johan Picardt (1600-1670) felt that the builders of the megaliths must have been giants. That the giants were not the sole inhabitants at that time is demonstrated by this picture in his book from 1660 showing one of the giants eating a normal-sized human being.

1.3 Discovery of the Stone Age and development of the three-age system[2]

In 1815 Nicolaas Westendorp (1773-1836) remarked in the postscript to his at that time still unpublished *Verhandeling over de hunebedden* from 1813 that there must have been a period in the past when tools were made of copper (read bronze), before iron was in general use (Westendorp 1813; 1815; 1822).[3] He repeated this view in his publication on the find of a bronze socketed axe (Westendorp 1820). Essentially this entails a three-age system, but Westendorp did not elaborate, as he took the classical three-age system for granted and assumed his readers would do so as well.

In Denmark, too, ideas about a three-age system were soon formulated. In 1813 L.S. Vedel Simonsen wrote in his book concerning Danish history about the chronological framework of stone, bronze and iron tools. Christian Jürgensen Thomsen (1788-1865) was appointed keeper of what was to become the Danish National Museum in 1816 and was the first to apply this tripartite classification when presenting his archaeological finds. In 1836 he published his famous *Ledetraad til Nordisk Oldkyndighed* (Guide Book to Scandivanian Archaeology) appearing in 1837 in a German translation and in 1848 in English (Thomsen 1836; 1837). A Dutch translation was never published. Yet Thomsen's classification of prehistory was still not soundly based on archaeological evidence. A pupil and later colleague of his, Jens J.A. Worsaae (1821-1885), published a scientific foundation for the three-age system in 1843 in the form of a systematic and stratigraphic analyses of Danish burial mounds and bog finds. For this last publication, Worsaae worked in close cooperation with the biologist Japetus S. Steenstrup (1813-1897).

Soon these Danish ideas were adopted in Europe, and English and French scholars in particular undertook a further classification of the Stone Age. John Lubbock (1834-1913) in his book *Pre-historic Times* made a distinction between

Palaeolithic and Neolithic and in France Édouard Lartet (1801-1871) and Louis de Mortillet (1821-1898) concentrated on the classification of the Palaeolithic. In Germany enthusiasm for the three-age system was less pronounced and objections continued to be raised. By the end of the 19th century the word Mesolithic had been used for the first time for the period between Palaeolithic and Neolithic (Brown 1893). By the introduction of the term Mesolithic the three-age system as a chronological framework had been widely accepted.

1.4 The role of the Netherlands

In the Netherlands archaeology was off to a flying start with the appointment in 1818 of the first professor, C.J. Reuvens (1793-1835) at the State University of Leiden and the establishment of the National Museum of Antiquities, where Reuvens was appointed director as well. In his field investigations he would mainly concentrate on Roman remains, but he also paid attention to prehistory on his study tours. Actually, it is not known whether Reuvens had any idea there had been a Stone Age. Since together with Nicolaas Westendorp he edited the magazine *Antiquiteiten* in the period 1819-1826, it is likely that the idea of a Stone Age was not unknown to him, as Westendorp had already mentioned this in the unpublished postscript to his 1813 treatise on the megaliths.

Reuvens suspected that copper axes had succeeded those of stone, but he rarely commented upon them in his publications (*Antiquiteiten* 2, 2). In his inaugural oration he mentioned *Druïdische en Celtische steenen* (Druid and Celtic stones) and associated these with the Celts, the original inhabitants of the Netherlands in pre-Roman times (Langereis 2007, 93). In his hand-written report on his 1833 trip through the province of Drenthe in the north of the Netherlands he occasionally remarked on the pre-Roman era. In his notes about Zeijen and Roden, small villages in the province of Drenthe, he mentioned the period immediately preceding the Romans when stone tools comparable to finds from Northern France, were in use (Brongers 1973, RA 31, leaf 8). He did not mention a Stone Age and, as far as is known, was never in contact with Thomsen.[4] Reuvens' death at an early age put an end to a promising development. As he died a year before Thomsen's book was published, it remains conjecture what he would have made of the new views.

Reuvens' successor as Director of the Museum, C. Leemans, was less involved in Dutch archaeology, but the Museum Keeper appointed in 1835, L.J.F. Janssen (1806-1869), kept up the good work (fig. 1.2). In the past, Janssen has been considered predominantly an armchair scholar, classifying data and keeping accounts, but more recently, partly due to research by Wout Arentzen, it has become clear that he was much more active in research and thought during his years in his Museum post from 1835 to 1869 (Arentzen 2005; 2006; 2008). He was a man of international standing and prestige, who visited international congresses and made trips abroad. Janssen was in regular correspondence with the greatest scholars of his age, among them Thomsen and Worsaae, and in his private book collection was the German translation of Thomsen's *Ledetraat*.[5]

Figure 1.2 L.J.F. Janssen (1806-1869) Museum Keeper in Leiden from 1835 to 1869.

It was a long time before Janssen began to use the concept Stone Age and he was clearly quite cautious about it. He often was non-committal or put the Stone Age into an ethnical context. He appears to have been influenced by the German archaeologist G.C.F. Lisch (1801-1883), who related the stone, bronze and iron objects to three different types of tombs: Hunengräber, Kegelgräber and Wendengräber (Arentzen 2008). The first and last have an ethnic meaning. In the works of the Swedish archaeologist S. Nilsson, from which Janssen appears to have derived many of his ideas from as well, a link between material and ethnic groups occurs as well (Nilsson 1863; Janssen 1853).

Janssen accepted the sequence Stone Age, Bronze Age and Iron Age. Still, he thought a relative dating based on materials was impossible because according to him the materials were often used simultaneously. This he illustrated by means of perforated jasper wedges from Limburg, the holes in which must have been made with a metal tool, in order to carry them as pendants on a belt (Janssen 1853). The major arguments, however, came from his own research in the vicinity of the town Hilversum, where remains of "houses" had been discovered containing primitive stone objects together with a piece of sandstone worked by the Romans (fig. 1.3). Almost a century later it became clear that in this case forgery was involved (Arentzen 2008; Bakker 1990).

Another major observation by Janssen concerned the fact that there were extremely few metal finds in the Netherlands. Bronze and particularly iron tools were very rare in pre-Roman times. According to Janssen, they were so rare in the Netherlands that it was not sure there had actually been a Bronze and Iron Age, comparable to other countries where finds of bronze and iron tools were abundant. In his cautious approach to the new system, Janssen followed the German archaeologists who criticised Thomsen's views. The main representative of these was G.O.C. von Estorff who, without dismissing the concept of a Stone Age, felt that stone tools were unsuited as guide artefacts for that period (Von Estorff 1846). Others would accept the system more easily: in 1845 an ex-serviceman from the Veluwe, H.G. Haasloop Werner (1792-1864) was the first Dutchman to write about the three-age system and adopt it without any critical remarks (Haasloop Werner 1845, 130-131).

Janssen did not get along with his director Leemans and left the museum after a professional disagreement in 1869. His departure essentially signified the end of professional active interest in the earliest Dutch history. His successor W. Pleyte (1836-1903), who mainly engaged in Egyptian archaeology, published the series *Nederlandse Oudheden* (Dutch Antiquities) from 1877 onwards and avoided the use of the three-age system there, but appears to have shared Janssen's opinion.[6] He characterised anything prehistorical as Germanic, whereas a relative outsider like T.C. Winkler, employed at the Teyler Museum in Haarlem, adopted and published the three-age system and its refinements by E. Lartet in the same year (Winkler 1877).

The Leiden wall chart published in 1903 by assitent curator R. Jesse is the sole instance of a tripartite division: a prehistoric Stone and Bronze Age and an Iron Age coinciding with the Roman era (fig. 1.4). This wall chart was granted only a short life. The appointment of a new curator in 1904 made an end of the distribution of this wall chart, which was replaced by a new one in 1907 with another view on the three-age system.

Figure 1.3 Fake antiquities from Hilversum discovered in 1852/1853: axes and a piece of worked sandstone of supposed Roman age.

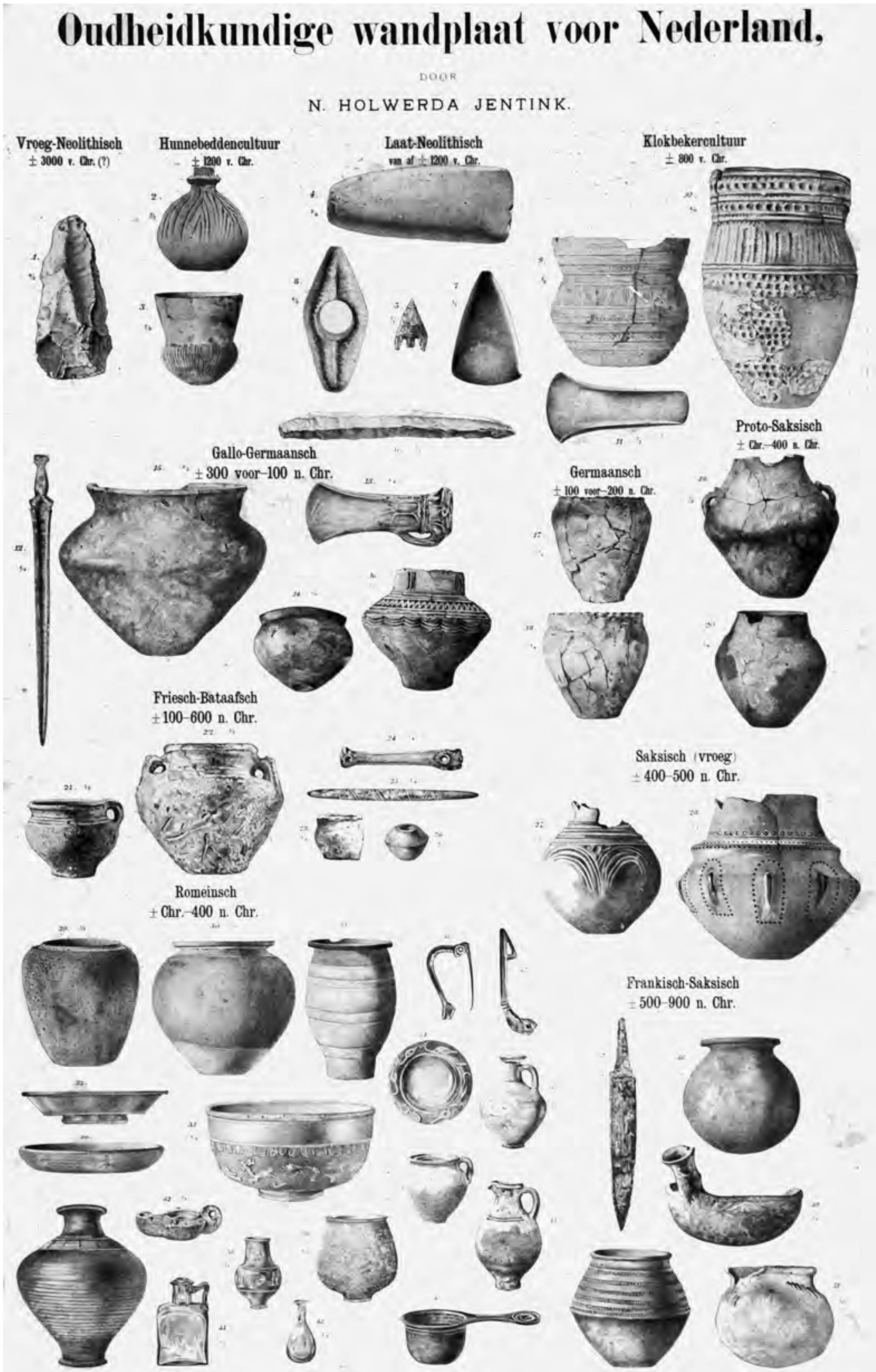

Figure 1.4 Wall chart published by J.H. Holwerda in 1907.

1.5 The appointment of "the Holwerdas"

In 1896 A.E.J. Holwerda, classics teacher and father of Jan Hendrik, was appointed professor at the University of Leiden. Seven years later, in May 1903, he was also appointed director of the National Museum of Antiquities. At a meeting of *the Koninklijke Nederlandse Oudheidkundige Bond* (Royal Dutch Antiquarian Society) on July 9, 1904 in Leiden, his ideas about Dutch prehistory were revealed. A.E.J. Holwerda spoke about his plans for scientific archaeological research and the presentation of Dutch archaeology. He envisioned a central role for the museum, with exhibitions and documentation and advocated co-operation with local and provincial museums. He ended by expressing his hopes of finding a man who could realise all this (Holwerda 1904, 161-165).

Within a month of the July 1904 meeting, P.C.J.A. Boeles, keeper of the *Fries Museum* in Leeuwarden, had responded to Holwerda senior's speech (Boeles 1904). He was enthusiastic about the Leiden Museum's grand plans, but also had – to our eyes – harsh criticism. Of course, as keeper of the *Fries Museum* he would be wary of the central role that the National Museum aimed at. More fundamental was Boeles' view of abolishing the presentation by site, as was the custom in Leiden until then. Boeles proposed a chronological arrangement, as realised by him in the *Fries Museum*, in accordance with what was by then the prevailing three-age system, and comparable to the archaeological wall chart recently compiled by R. Jesse which was in use in the Museum.[7] Boeles had also aired his views on who was to set up that new Dutch department: it should not in any circumstances be a classical archaeologist and, reading between the lines, Boeles may well have considered himself to be a suitable candidate.

On September 1 of that very same year the director's son, Jan Hendrik Holwerda (fig. 1.5), was appointed keeper – probably to general amazement for as far as we know he had not previously concerned himself with Dutch prehistory.[8] In 1904 and 1905 Jan Hendrik therefore undertook a number of study trips to acquaint himself with the new world of Dutch archaeology, and he trained in Germany to master the latest excavation techniques.

On one of these early trips he visited the *Fries Museum* in Leeuwarden where he clashed with Boeles. This argument, which was to have a major impact on future developments, culminated in a flaming row, eventually involving even the government (Verhart in prep.).

Figure 1.5 J.H. Holwerda (1873-1951) around 1905.

1.6 J.H. Holwerda's thoughts and conclusions

The development of Holwerda's thoughts on the Stone Age and the three-age system can be deduced remarkably easily from his notes, letters, articles and books, and from his views on studying Dutch archaeology. A case in point is his stance in his first publications (Holwerda 1906b; 1907). Immediately after his appointment he stated, in a sort of manifest, his first views on Dutch archaeology. This, he wrote, is a field that has been dominated by amateurs, but despite their valuable contributions it is a good thing that professionals – with a classical background – are now getting involved in a systematical way. Amateurs think too easily of Stone Age, Bronze Age and Iron Age and indiscriminately attribute an object to one of these periods. Abroad a Stone Age was defined with two phases: Palaeolithic and Neolithic, and Holwerda's head was spinning with the tens of thousands of years mentioned in the publications (Holwerda 1906b, 237). He reproved the prehistorians, in particular the French and Danish, for having postulated classifications without relating this to the classical data (Holwerda 1907, 1-2).

Holwerda appears to have derived many of his ideas from his predecessors in Leiden. Major arguments for him were the observations and remarks by Janssen, such as the limited amount of metal finds in the Netherlands and the use of stone tools in later periods, which made it impossible to attribute them to a specific period. Another important source for his opinions were the publications by archaeologists like Hoernes and Undset, which made a distinction between regions in Europe that were rich or poor in bronze and where older traditions could long be maintained (Hoernes 1892; Undset 1878).[9] According to Holwerda the rare bronze artefacts found in the Netherlands would long have remained in use due to their value, and were therefore unsuitable as dating material (Boeles 1927, note 15).[10]

Crucial to the thoughts of J.H. Holwerda were his own first-hand observations of archaeology. For example, the

National Museum contained Neolithic flint objects from Spiennes in Belgium that were, in his opinion, as coarse in nature as the so-called Palaeolithic ones. According to Holwerda it was impossible to attribute an object to a period on the basis of its shape and processing. Another observation arose from his visit to the flint sites near Rijckholt-Sint-Geertruid in 1905 (Verhart 2006, 206-207). Holwerda was amazed that prehistoric flint objects this old could still be found on the surface and he related this to a third observation, at the Roman walls of Tongeren in Belgium. There he had found flakes as well, and rightly felt they stemmed from processing flint and marl blocks. This led him to conclude that the so-called workshops of Sint-Geertruid could be locations where in Roman times, or even later, flint and marl had been processed for building. Thus for Holwerda flint-working *per se* was not a chronological indicator.

As the Stone Age contained many uncertainties as a period, J.H. Holwerda felt the same was true for more recent periods as well. He pointed out that the various regions of Europe had been strongly different in cultural respects (Holwerda 1906b, 240-241). One could not therefore simply adopt a (three-age) system from the north. Moreover, Holwerda felt a clearly defined period could only be said to occur when it was terminated by a period using new materials and rejecting the old. In his opinion the Stone Age did not end until stone was no longer used for tools.

J.H. Holwerda agreed that there had been a Stone Age in which there were exclusively stone tools. A good example, to him, was the megalithic age, but he doubted that the Bronze Age would have ended that Stone Age in the Netherlands. He advanced a number of arguments to this end.

First, the number of stone tools in the Netherlands was enormous, the number of bronze tools however very small, and iron tools were particularly rare. Secondly, there were only a few graves from that Stone Age, but a large number of urn fields, which were exactly the areas where the largest concentrations of stone tools had been found. To his mind it was obvious to suppose a relation between these two matters. Third, in addition quite regularly stone tools were retrieved from ‘younger’ graves, was his opinion. That was his name for Germanic urns containing axes and Merovingian graves in France with stone tools. The same phenomenon had been proven to occur in the Netherlands in the urn fields, the Frisian terp mounds (Dutch: *terpen*) and the inhabited higher grounds (*woerden*) in the river district (Holwerda 1906b, 242-243, notes 2 and 3).

Holwerda therefore concluded that, unlike other areas where bronze and iron were introduced, in the Netherlands stone objects had long continued to be in use. The occasional bronze and iron objects were valuable and rare imported articles. This conclusion was an elegant solution for several problems. For instance, from Nijmegen a stone hammer had been retrieved with an iron shaft cover and iron pegs, from the Betuwe a stone knife with remains of a bronze handle and in Hilversum ‘houses’ stone tools, a bone button and an early medieval stone building fragment had been found together. According to him the use of stone for tools had continued for a long time, thereby making void the principle that stone objects could indicate a Stone Age with a specific time span (Holwerda 1906b, 245; 1907, 10).

Although the stone tools could be related directly to a Stone Age thanks to the nature of the material, this was much harder for pottery. Yet J.H. Holwerda had always had a lively interest in it, and he felt that regional and temporal differences should be discernible on the basis of workmanship, shape and decoration. Pottery could also, and more easely, be linked to other cultures phenomena or culture areas.

From the Netherlands he knew the megalithic pottery, which he considered to be the oldest. The megaliths were felt to be related to the major burial constructions in the classical countries, in particular the primitive ancestors of the beehive tombs from the Mycenaean age (Holwerda 1906b, 247). To this he also related another early type of pottery, decorated with lines, that had been awarded the name of *bandceramiek*, in his eyes a misnomer. Comparable pottery had been discovered in the pre-Mycenaean layers of Troy, thereby lending support to the views about eastern influences in Western Europe (Wout Arentzen, pers. comm.).[11]

The northern funnel beaker pottery was an independent development, but according to Holwerda the bandceramic pottery stemmed from immigrants from the south.

Holwerda at that time did not know the bandceramic pottery from the Netherlands, only from the surroundings of Liège (Fred Brounen, pers. comm.).[12] There it had been found in large pits, the *fonds de cabanes*, and he first saw it during a study trip to Liège and Tongeren (Verhart 2006). He also knew it from German literature and took great pains to secure specimens for the museum. There was still a lot of uncertainty about dating the pottery, but he felt it was more or less contemporaneous with the megalithic pottery, estimating the age around 1200 BC.

Holwerda was more outspoken concerning the various tomb shapes linked by foreign scholars to specific eras. For instance Sophus Müller (1846-1934) distinguished a sequence in stone tombs in Scandinavia that would reflect differences in age as well (Müller 1891; 1897). On the basis of a series of arguments Holwerda concluded that this was no more than an unsubstantiated hypothesis. A number of these arguments supported his criticism, but he went too far in the alternative view he proposed. He stated that, as far as the Stone Age was concerned, this phenomenon was of no importance to the classification of Dutch prehistory, that the various burial forms did not yield enough data for a subdivision and finally, that “Bronze Age types” continued until some centuries BC and in some places even until the Roman age (Holwerda 1907, 20-21).

It was early in his career at the Museum that J.H. Holwerda clearly stated that the three-age system was useless, and he held on to that opinion despite all the comments that his attitude elicited.[13] In his 1918 survey of Dutch prehistory and its reprint in 1925 he stood firm. In his last publication to deal with prehistory, in 1935, he did mention new discoveries and developments, but hastened to add that these were as yet extremely dubious. He repeated his belief in the actual non-existence of the Bronze Age in the Netherlands, in view of the extremely rare and fragmented finds that had been recovered. Major, sizeable bronze finds like the Voorhout hoard were dismissed as left behind by a passing trader (Holwerda 1908).[14] This might have been a plausible explanation for the Voorhout hoard, but is barely credible for the Ommerschans treasure, which was brought to his attention in 1927. It contained a rare ceremonial dirk and other bronze objects. Holwerda did not dismiss the Ommerschans find because it did not fit his theory; it was rather a question of the rights of ownership, because he could not purchase the treasure for the museum.

In any case it appears that J.H. Holwerda held on to the idea of a long continuation of a Stone Age all his life, and that to him, for the Netherlands actual periods like Bronze and Iron Ages were absolutely out of the question (Holwerda 1935).[15] As remarkable as this highly dissenting opinion is to us, just so remarkable it was at the time of his publications. For instance, by 1920 Boeles had clearly demonstrated that the bronze scarcity was not as great as supposed and that in Gelderland and Friesland a Bronze Age clearly had occurred (Boeles 1920). In 1935, in the introduction to his dissertation, W. Willems explicitly stated that recently, as a result of the research by his teacher Van Giffen, it had been scientifically and conclusively ascertained that there had been a Bronze Age in the Netherlands (Willems 1935, 1-3). Willems also explicitly reminded his readers of Boeles’ role in that recognition. Mention of Boeles and Van Giffen (fig. 1.6) draws attention to an alternative explanation for Holwerda’s rigid attitude.

1.7 Involvement by others

The outline sketched above suggests that Holwerda’s rejection of the three-age system was determined solely by intrinsically scientific reasons. It is, however, a matter of conjecture whether his views were based only on the study of scholarly literature and his own observations. Personal motives appear to have played a part as well. The blunt criticism by Boeles in 1904 and the subsequent incidents during his visit to the *Fries Museum* in April of 1905 appear to have had something to do with it. During that visit Holwerda was shown around by Boeles and was allowed the opportunity to document the collection. Boeles also accompanied him on a visit to the excavations of the Hoogebeintum *terp*, which were supervised by the *Friesch Genootschap* (Frisian Society). Holwerda got the impression that Boeles’ personal escort was a sign of distrust and

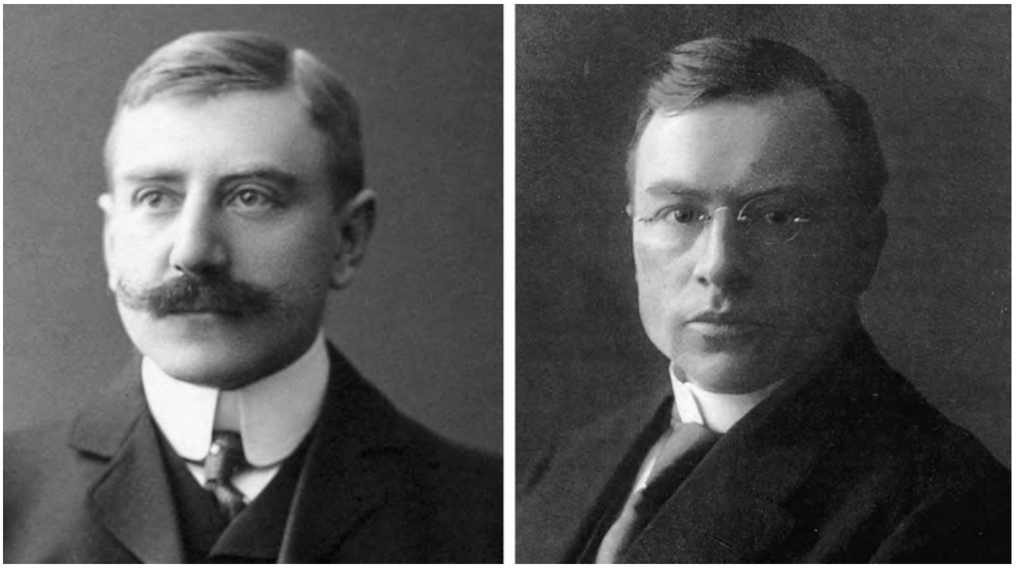

Figure 1.6 Portraits of P.C.J.A. Boeles (1873-1961) en A.E. van Giffen (1884-1973).

suspicion, and shortly afterwards he also discovered that finds in the museum had purposely been kept from him. He wrote a report to his father, essentially stating that a civil servant should be informed of everything. The elder Holwerda expounded in a letter to the *Friesch Genootschap* once again his view that Leiden should be the central location where all major national archaeological finds were to be seen, and that there was therefore no room for 'silent obstruction by petty jealousy and local narrow-mindedness".

The executives of the *Friesch Genootschap* defended their keeper and reported that Boeles had considered Holwerda a private visitor. This did not go down well with the elder Holwerda, as the visit had been one of a civil servant in the execution of his duties. He moreover emphasised that the National Museum of Antiquities, a government institution, was going to pay more attention to archaeological research in the province, but should by no means be considered a competitor. Increasing the unease of the *Friesch Genootschap* after these remarks, he included his son's response, which was blunt to a fault. Jan Hendrik felt he was beyond reproach, he was only doing his duty as a civil servant and was convinced of the malice and obstinacy of the other party.

Not long afterwards, in 1906, the younger Holwerda wrote a review of the recent publication by Boeles: *De Friesche terpen* (Boeles 1906a; Holwerda 1906a, 131-132). In this review he mentioned the possibilities that real archaeologists, with knowledge of soil traces, would have had if they had conducted the investigation of the terp mounds. Without any reserve, he called Boeles unprofessional and reproached him for trying to give the impression in a roundabout way that research into the terps was making good progress. Nothing could be further from the truth, according to Holwerda. Boeles had the opportunity to write an immediate rejoinder (Boeles 1906b). He deplored the belligerent attitude of the younger Holwerda, since he had the impression that the latter's father had buried the hatchet and explained his side of the matter. One of his conclusions was that Leiden obviously did not realise that there were institutions in the provinces that could play a part in archaeological research. Finally he turned to the remarks about professionalism. He upbraided the younger Holwerda for his lack of diplomacy and the arrogance of a government-appointed, classically taught archaeologist, who sketched the general outlines of prehistory without any trace of doubt in his very first article in the magazine *Onze Eeuw*. It was clear to Boeles that the Holwerda junior had already found the path through the darkness (Boeles 1906b, 142).[16]

These public outbursts set the stage and the consequences were soon to be felt. The *Friesch Genootschap*, hoping for national archaeological interest in its province, lost all trust in Leiden. They went looking for their own solution, and in 1908 a young biology student was appointed to archaeologically accompany the commercial digging of terps. This was the 24-year old Albert Egges van Giffen, later to be a colleague of J.H. Holwerda and finally professor in Groningen. Although, like others, at that time he mainly limited himself to gathering finds in commercial diggings, his ambitions for the terp research were great (Knol, Bardet, and Prummel 2005). He, too, however clashed with Boeles and the *Friesch Genootschap* and in 1911 he responded to a request from Leiden to become assistant-keeper to the younger Holwerda.

Quite soon van Giffen's relations with both Holwerdas, in particular the son, became impossible, partly due to intrinsic differences, but mainly because of major personal problems (Verhart 2005). Van Giffen ended up leaving for Groningen in 1917, and afterwards Holwerda and he would oppose each other as much as possible, with the latter mainly being in the right scientifically. Boeles and Van Giffen continued to oppose Holwerda's ideas in later publications, and at times qualified them as completely aberrant. Van Giffen opposed him on many issues, while Boeles long concentrated on the three-age system (Van Giffen 1922; 1924; 1930; Boeles 1951, 44).

1.8 Concluding remarks

It is clear that J.H.Holwerda was a man who stood on his dignity, taking for granted that authority came with the position of national archaeologist. That is obvious not only from this history of the three-age system, but from other issues and fields as well. That this kind of attitude, perceived as arrogance, was the sole factor deciding his position in scientific matters, leading to charges of prejudice from his opponents, is a point that needs some qualification. Holwerda appears to have been greatly influenced by his predecessors in Leiden, Reuvens and Janssen. It is likely that Holwerda's notions about the backwardness of certain regions, that allowed old customs to be preserved for so long, originated with Reuvens. In his notes of his trips through Drenthe in 1833, Reuvens had expressed thoughts almost identical to what Holwerda would commit to paper 75 years later (Brongers 1973, RA 31, leaf 13).

The notebooks of Holwerda's study trips and his letters provide us with an idea of the private man and his development as an archaeologist, and it is remarkable that many of his archaeological views sprang into existence very early and quickly when he first entered Dutch archaeology and were partly not to evolve noticeably in subsequent years. His notes and records, however, reveal an original mind, someone who did not indiscriminately adopt the views that were assumed to be valid for all of Europe at that time. This is an attitude currently highly valued in modern scholars, but the dangers are great. Unorthodox ideas that later are proven to be correct, provide fame and glory; but fallacies often lead to derision. The common remark that

Holwerda rejected the existence of the Bronze and Iron Ages, causing him to be considered an archaeologist advancing dissenting theses without any substantiation, does not do him justice. In his opinion, beyond the Netherlands there most certainly was a sequence in time from Bronze to Iron Age. Bronze and iron had been used in the Netherlands as well, but on a scale that to him pointed more to a cultural stage than to a period in time. It was this plus the prolonged use of stone tools that made him doubt the existence of a Bronze and Iron Age in the Netherlands. In his earliest publications Holwerda had inveighed against groups of archaeologists who advanced theories and then made their finds fit without critical examination of the data or adjustment of their theories. He pretended to be averse to the practice himself, but of course he acted in the same way. He too had his pet theories and turned a deaf ear to the building criticism.

Holwerda now appears in a less than positive light and he deserves to have his merits and qualities mentioned as well. He had a facile, journalistic pen. His excavations were published within a year, with numerous illustrations and, as mentioned before, he was the first to take up Stone Age research in a scientific manner. For instance, he undertook the first excavations of a Stone Age settlement in the Netherlands at the Uddelermeer, and his excavations of the megaliths in Drouwen and Emmen were the first scientific studies of megalithic monuments in the Netherlands (Holwerda 1912; 1913a; 1913b; 1914). With these investigations, he broke new ground and earned international renown for Dutch research as well. Impressive is also the fact that Holwerda managed to reconstruct and restore dozens of pots from the thousands of sherds, within a single year.

As a keeper, Holwerda insisted on promoting the interests of the National Museum of Antiquities on all fronts. In this he was very strict and clear, to the annoyance of others who wanted a part of the action as well, or felt their position was threatened. This caused a lot of vexation and lack of understanding, creating an image of Holwerda as the stubborn, tenacious and arrogant archaeologist from Leiden. This he usually was, as in fact diplomacy was not his strong suit. Nevertheless, for his museum activities he deserves great credit. His enormous energy led to new expositions and guides. For the first time Dutch archaeology was introduced to a wide audience, not only by his exhibitions, but also by his popular publications and his numerous articles and lectures. In this sense his successors owe a lot to his pioneering activities in the field. He provided a framework for a general and growing public interest in archaeology that still benefits the current generation of archaeologists and which they themselves attempt to expand.

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Notes

1 Immediately after his appointment in 1966 he began work on the realisation of a new permanent exposition, opened in 1968. In addition publications like *Archeologie in Nederland*, with an accompanying radio programme, and *Sporen in het land*, but in particular the unprecedented successful popularisation of Dutch archaeology: *Verleden Land*, written in co-operation with T. Bloemers and H. Sarfatij, have contributed to an increased interest in archaeology among the Dutch population (Louwe Kooijmans 1976; 1979; 1985).

2 For an extensive description of this period cf. Trigger 1989.

3 This note is a postscript in his *Verhandelingen over de hunebedden* and is kept in the Archive of the Nederlandsche Maatschappij der Wetenschappen in Haarlem (pers. com. W. Arentzen). In 1815 a printed version was published, but without this note; nor was it included in the second edition.

4 In a letter from Reuvens' successor, C. Leemans, to the Ministry of Home Affairs, dated September 10, 1859, the remark is made that he has made the acquaintance of mr. Thomsen several years before, during his visit to Leiden. Presumably this will have been after 1850. It is unknown what the reason was for this visit and whether this was the first time. It seems however highly unlikely that Thomsen visited the museum in Reuvens' time. As far as can be ascertained, they did not correspond.

5 A specimen rests with the library of the National Museum of Antiquities, but it is unknown in which year the booklet was acquired.

6 In his 1889 article on the Hunneschans Pleyte points out that Ubaghs feels that stone tools were manufactured as late as the Roman era (Pleyte 1889; Ubaghs 1887). In his *Nederlandsche Oudheden van de vroegste tijden tot op Karel den Groote. IV West Friesland* from 1902 he mentions this as a matter of fact and without his own comments.

7 As early as 1901 Boeles had already suggested making expositions in accordance with the three-age system.

8 In his publications before his appointment as keeper he never wrote about the archaeology of the Netherlands. His travel notes of the time are also strictly limited to classical subjects. Neither are such notes or publications known from his father. Holwerda jr. first public pronouncements on Dutch archaeology were made during the meeting of the Koninklijke Nederlandse Oudheidkundige Bond in Leiden, on July 9, 1904.

9 Both writers did use the three-age system.

10 To illustrate this Holwerda uses a bronze axe from the Bornwerd terp. Due to the fact that bronzes are absent in the terps and the

provenance of the find is unclear, Boeles feels this may have been a case of site falsification. This is unlikely, as the Pleistocene deposits outcrop in Bornwerd or are covered with a thin layer of Holocene sediments.

11 There are no Mycenaean layers in Troy. A handful of Mycenaean sherds have been recovered from Troy VIIa. In order to stratigraphically identify the Trojan War, this is sometimes referred to as the Mycenaean layer. It is however questionable to speak of a Mycenaean layer on the basis of a handful of sherds amongst an overwhelming amount of local pottery.

12 In 1925 in Stein the first LBK-sherds were retrieved, but not recognised as such. This did occur in the case of the 1927 finds in the Belvédère quarry near Maastricht.

13 In this context I refer also to Vollgraff (1908) with his criticism of the museum guide published in 1908.

14 This is a Middle Bronze Age hoard, containing 33 palstaves and one chisel.

15 The reason Holwerda never published the results from Ommerschans may be connected with his highly esteemed pupil A.E. Remouchamps. He was to concern himself with this find, but died quite shortly after the discovery. See also in this context Bakker 2004, K9.

16 In 1907 Boeles, possibly shocked by his harsh words, will review the new Dutch department of the Leiden museum in a highly conciliatory way, but in a letter to the Groningen historian J.A. Feith, dated March 15, 1908, he writes about Holwerda's views: "That stone period among our Germans, who defeated the Romans, is a very foolish thought, the more so as not a single Roman author mentions it" (Waterbolk 1987).

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2 The temporality of culture change

Harry Fokkens

2.1 Introduction

Apart from being an inspiring scholar and teacher, Leendert has the gift to summarise his data in high quality and inspiring images. We have seen a number of these in for example *Verleden land* (1981), in *Sporen in het Land* (1985) and in *The Prehistory of the Netherlands* (2005). Especially the latter book took him and Medy Oberendorff a solid year to conclude: hundreds of images were redrawn or redesigned to the right scale and in a consistent style. For *The Prehistory of the Netherlands* one of his own original drawings was redrawn as well (Van Gijn/Louwe Kooijmans 2005, 345): the image had already been published twice (Louwe Kooijmans 1993; 1998) but was due for some fine tuning again. It is this figure (fig. 2.1) that will be the starting point of my discussion of how culture change in several periods and regions has different temporalities and different trajectories.

Leendert's model shows, in a very compact form, the neolithisation process in the southern North Sea Basin. It has many layers of interpretation embedded and on first sight it is extremely complex, but with the right explanation added to it (cf. Louwe Kooijmans 1998) it is really a marvel of models. The model has in fact three dimensions: time, region and process. In vertical scale time is projected, in the horizontal scale four different regions are shown and as a function of time and region the process of Neolithisation is represented by shading, which shows the phasing of the

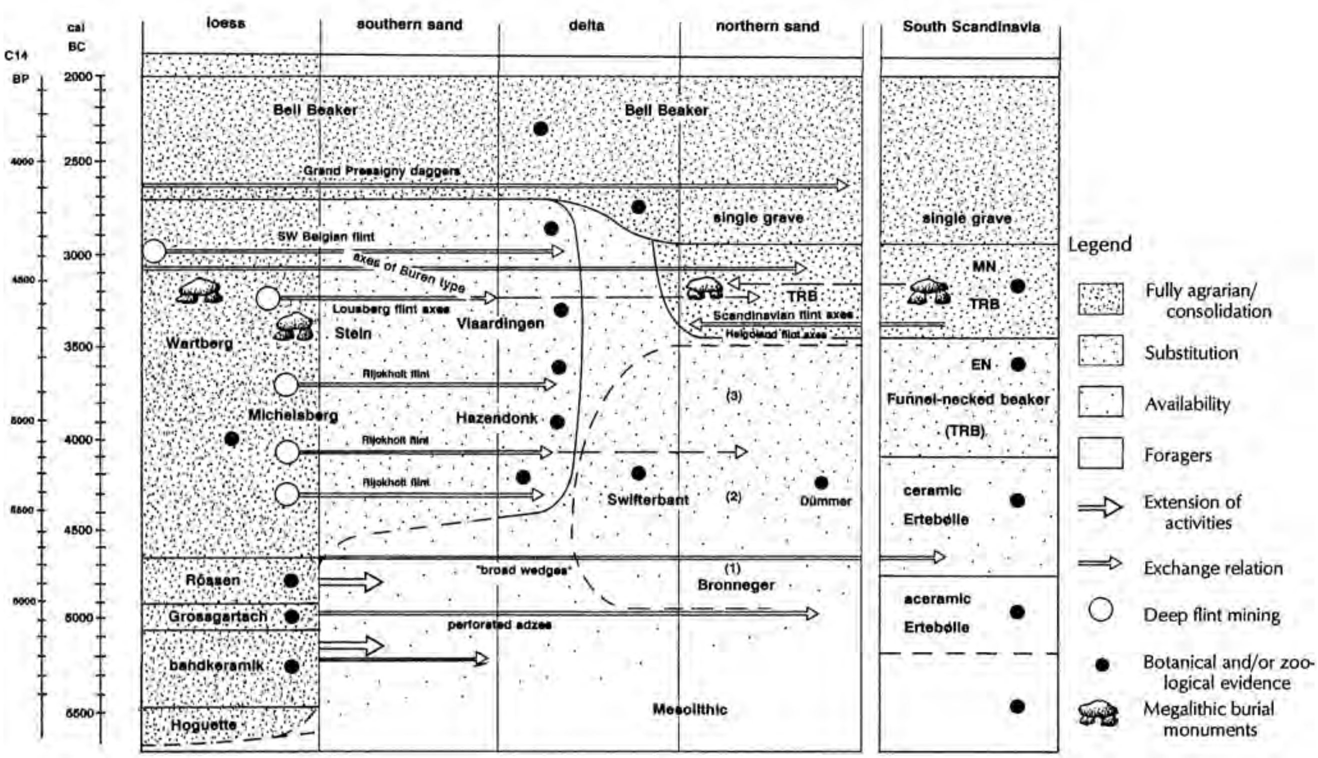

Figure 2.1 Louwe Kooijmans' dynamic model of Neolithisation (from Louwe Kooijmans 1998, 420).

process (fig. 2.1; cf. Louwe Kooijmans 1998, 420). Basically the model shows how the neolithisation in the Netherlands is the result of two important developments: in the south the LBK development on the loess around 5300 cal BC and the north the Ertebølle and subsequent TRB-cultures. It demonstrates how on the loess plateaus the process was instant, brought about by colonisation of LBK farmers around 5500 cal BC, in the lowlands however the adoption of the Neolithic elements was much more gradual. Some aspects were taken over, but basically the Mesolithic economy remained intact. The choice of settlement location, generally on the fringe of ecological zones, is typical for a hunting-gathering economy, seasonal encampments were still part of the settlement system (Louwe Kooijmans 2003). Neolithic elements seem to have been adopted only very selective and at a late stage, like the Rössener *Breitkeile*.

In the north the transition is of a different quality. Here the LBK is absent and there seems to be a gradual development from Ertebølle to TRB, where in Ertebølle context first pottery is adopted but its economy remains fully Mesolithic (Madsen 1982; 1986). In this phase, from 4700 cal BC onwards, the distribution of *Breitkeile* indicate contacts with the people of the loess, although the distribution of these wedges into southern Jutland and the areas of the Dutch coast, may be for a large part due to down the line exchange. This would to a certain extent explain why nothing seems to have been exchanged from the coast into the inland zone (Louwe Kooijmans 1998, 421).

Louwe Kooijmans interestingly weaves the 'availability – substitution – consolidation' model of Zvelebil and Rowley-Conwy (1984; Zvelebil 1986; fig. 2.2) in his image. Zvelebil's model describes how innovations become accepted within a given society according to a more or less standard pathway: first domestication is available but only a limited set of elements are adopted, subsistence remains largely based on foraging (Zvelebil 1986; fig. 2.2), then the acceptance gains momentum, the acceptance curve runs steeper when people gradually substitute up to 50% of their subsistence with domesticates, and finally there is the phase of consolidation. Farming is now the principle mode of production and more than 50% of the subsistence consists of domesticates.

Zvelebil and Rowley-Conwy apparently have developed their model independently from geographical research that deals with the spread and acceptance of innovations. In Geography especially Thorsten Hägerstrand has been influential with his simulation models for spatial distribution of innovations (cf. Haggett *et al.* 1977: 231 ff.) while the sociologist Everett Rogers developed models for the spread of concepts, the role of leaders and problems of resistance to change (Rogers 2003; cf. Haggett *et al.* 1977, 232). Both approaches have their value, but the problem with the

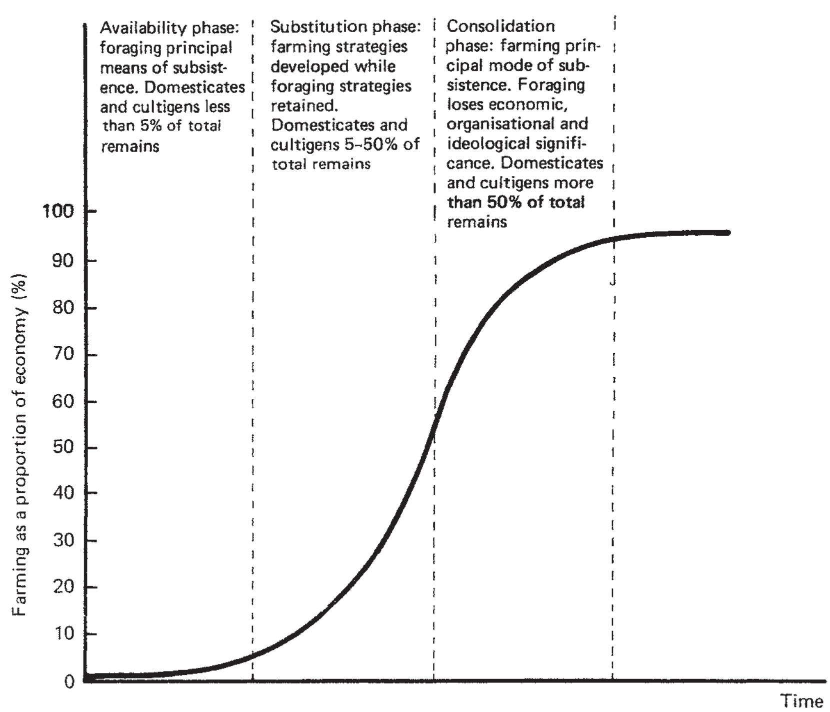

Figure 2.2 The availability – substitution – consolidation model, according to Zvelebil (from Zvelebil 1986, 12).

time-geography approach of Hägerstrand is that it sees innovation as 'automatic process': once it starts, it will carry on in a distinct (constant) rate that is dependant from distance between innovators and population density.

In the sixties of the last century, Childe's idea of a Neolithic revolution that was transmitted through diffusion and migration (Childe 1942) seemed to make such models applicable to archaeology as well. Edmondsen (1961) tried this, for instance, in an article titled *Neolithic diffusion rates* (1961). But even then one of his critics, C.J. Becker, argues that Edmondson's approach is old-fashioned: "Today we can follow, in broad lines, the development of the first Neolithic cultures in central and northern Europe. The Danubian cultures must have spread very rapidly through the whole of Central Europe, from the Ukraine to Belgium. But after that it was nearly a thousand years before food-producing cultures, with the aid of a new technique, and carried by new peoples, penetrated southern Scandinavia. And it was perhaps more than two thousand years later that a civilization based on farming could colonize northern Scandinavia (or parts of it)." (Becker 1961, 87).

And of course later research has demonstrated that the process of neolithisation is far more complex and depends on a number of aspects, among which the social-cultural may be the most important. That is also what Rogers demonstrates in his seminal *Diffusion of Innovations*, which saw five reprints between 1962 and 2003, each time modified and expanded (Rogers 2003, xv). Although Hägerstrands work is certainly relevant for archaeology as well, I will discuss here Rogers' work in more detail because I want to focus on the socio-cultural process of the acceptance of innovations.

2.2 Properties of innovation process

The logistic curve that Zvelebil (1986) sketches, is in fact an S-shaped curve of cumulative numbers (fig. 2.3). The curve results from the observation that in most cases the successful adoption of an innovation follows a normal bell-shaped distribution pattern (Rogers 2003, 275). Rogers divides the 'innovativeness' of adopters into categories by using the standard deviations. When taking the average time at which an innovation spreads, at 1 sigma on either side of the average we find the early and late majority, at 2 sigma the early adopters and the laggards. The first 2.5% of the early adopters are called the innovators (Rogers 2003, 282 ff.; fig. 2.4). In any given population, the steepness of the S-curve, or the length of the standard distribution, is

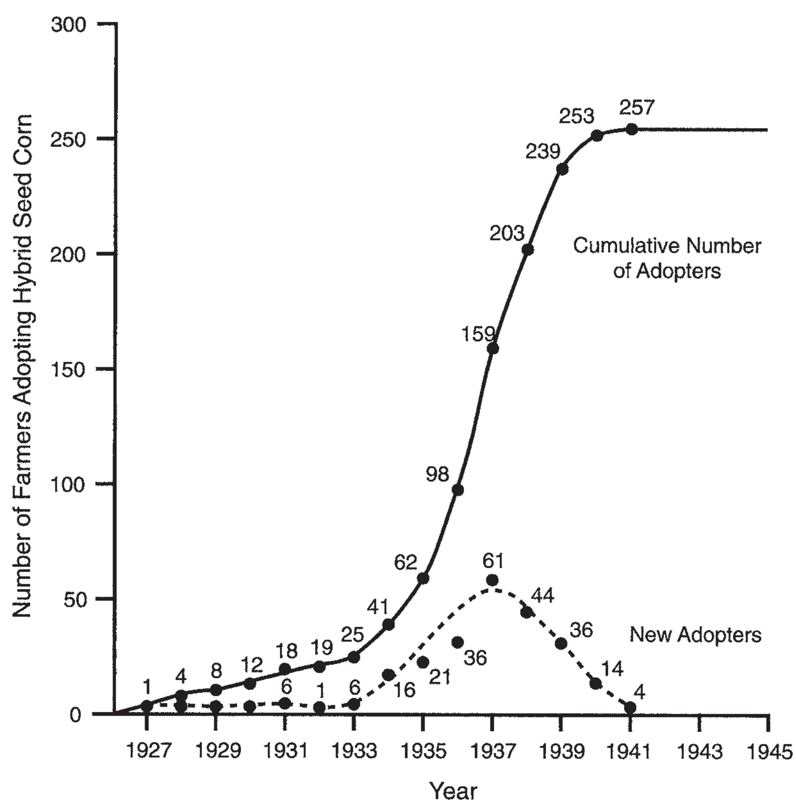

Figure 2.3 The cumulative adopters of hybrid seed corn (from Rogers 2003, 273).

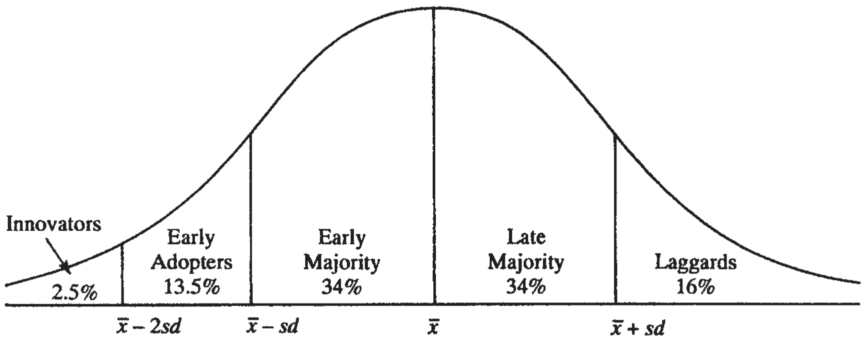

Figure 2.4 Adopter categorisation on the basis of innovativness (from Rogers 2003, 281).

determined by the time period in which an innovation is adopted. The aspects that play a role in this diffusion process are the subject of Rogers' study. Innovation is defined as "an idea, practice or object that is perceived as new by an individual or other unit of adoption. It matters little, so far as human behavior is concerned, whether or not an idea is 'objectively' new. […] The perceived newness of the idea for the individual determines his or her reaction to it. If an idea is new to the individual, it is an innovation" (Rogers 2003, 12).

Diffusion is defined as the process by which "(1) an innovation is (2) communicated through certain channels (3) over time (4) among the members of a social system" (Rogers 2003, 11). Rogers distinguishes a number of variables that determine the rate of adoption of innovations (fig. 5; cf. fig. 6.1). He states that about 50% of the adoption rate is determined by the perceived attributes, about the contribution of the four other classes of variables little research is done (2003, 222). It is unnecessary to discuss all of these variables in great detail since not all of them are relevant for the period we are discussing. I will focus in particular on one variable: compatibility. The concept of compatibility is defined as "the degree to which an innovation is persistent with existing values, past experiences and needs" (Rogers 2003, 240). Does the innovation fit in the local culture? Rogers cites a number of examples that demonstrate how obvious health or technological improvements were not at all, or only very slowly, adopted because they did not fit in the local or regional culture, a problem that has to be faced by many of the development workers for instance. Incompatibility is one of the main reasons that even superior technological innovations do not necessarily diffuse themselves (Rogers 2003, 10).

Compatibility is probably of great relevance for the process of neolithisation (cf. below). Closely connected to this factor is the nature of the social system. The rate of innovation is influenced by how the community is structured, how the chains of command are organised and how the communication networks function. Important is also the type of the decision. Is it optional, is it a collective decision to adopt or is adoption prompted by authority.

Compatibility is important, but for the rate of introduction also the concept of critical mass needs to be discussed. Critical mass is "the point after which further diffusion becomes self-sustaining" (Rogers 2003, 343; fig. 2.5). Especially in interactive innovations, for instance where new communication technology is involved, the idea of a critical mass is relevant. It predicts that at a certain point in time individuals cannot communicate with each other any longer if they have not yet adopted the innovation. This is for instance the case with cellular telephones or beamers. Not adopting such innovations means that one places oneself outside the mainstream of social interaction. Although this concept has been developed for the information age, it may well be relevant for the adoption of some innovations in the past. Especially when these had an ideological aspect, it may have been – socially speaking – impossible not to follow the innovation. People who were raised in small village communities know how this works: in order to be part of the community, one follows its mainstream and rules, even if authority or leadership may not be part of the process. Collective decisions are just as 'coercive'. The introduction of the Bronze Age three-aisled farm, for instance, may be an example. Its introduction took a few hundred years. But the last part of that development, after 1500 cal BC took place in probably a few generations (Arnoldussen 2008; see par. 2.3.3). It appears that in this point in time a critical mass was reached and any social constraints on adoption that previously may have slowed down the introduction, were now 'absent'.

2.3 The implication of diffusion models for archaeology

The question we may rightfully ask is whether these models are useful at all for describing processes of change in the

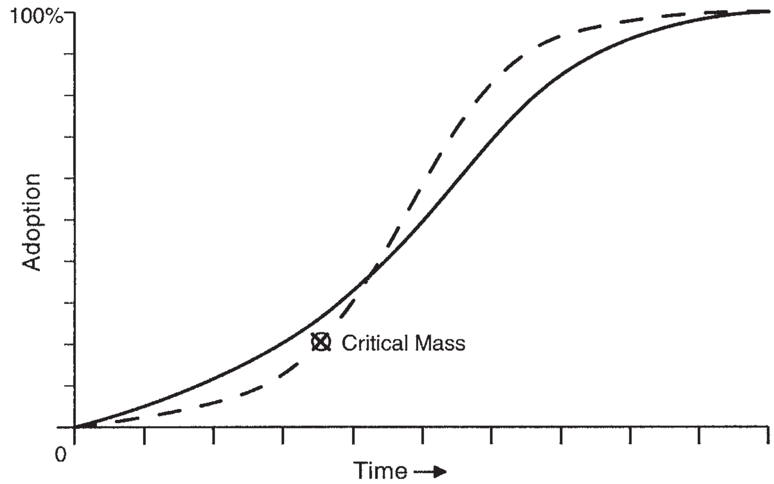

Figure 2.5 The concept of critical mass, showing how the rate of adoption changes when critical amss is reached (from Rogers 2003, 344).

Neolithic or in other periods of Prehistory. In my opinion they are useful indeed. Archaeologists study culture change through means of objects and other visible manifestations of culture, like burial ritual, settlements, etc. But generally they, implicitly, consider all changes as being more or less of similar magnitude and as part of one coherent process. Yet, it hardly needs discussion that for instance a pottery style may change under different conditions and in a different trajectory than, say, burial ritual. These are different culture processes that may have different temporalities and conditions.

This realisation has important implications for the study of culture change. It implies, for instance that major change does not occur automatically with the first occurrence of an innovative product. It also implies that we always have to discuss the trajectory of change of a given phenomenon and that we cannot assume a standard process. I will discuss both issues in more detail.

2.3.1 The visibility phase of the innovation curve

As discussed in paragraph 2.2 the acceptance of innovation follows an S-shaped curve. Generally archaeologists, however, visualise innovation as a linear process of appearance and disappearance. Dating the beginning and the end of certain phenomena is therefore an important aspect of archaeological reasoning. However, the curve of figure 2.6 shows that the number of adopters is very low in the first phase, this is probably a phase in which not much changes. Next to that, post-depositional processes, influencing the visibility of the archaeological record, can decrease the chance of us archaeologists finding these trendsetters. After reaching the critical point, or just before, when the adoption curve becomes steeper, the innovation settles in and causes culture change to occur. Generally this is the phase in which archaeologists see 'quick' developments, which in the past was interpreted as the result of migration or 'revolution'. We could call this *the visibility phase,* defined as the phase that innovations gain cultural impact and visibly become an integral part of culture processes.

To give an example, in earlier publications I have argued that the start of the Single Grave Culture in our regions is associated with the introduction of the *ard* (Fokkens 1986, 1998). Nevertheless it is clear that we have dating evidence

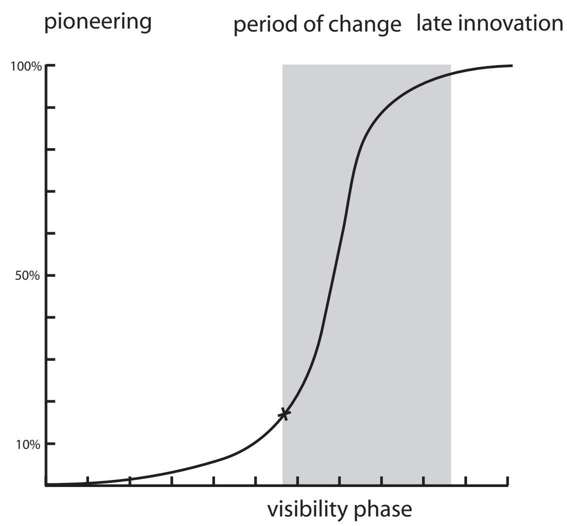

Figure 2.6 The period of change occurs when the critical mass is reached and an innovation is accepted in a fast rate. This is the period in which most innovations become visible archaeologically.

of older *ard* marks associated with the Funnelbeaker Culture (TRB) in, for instance, Groningen around 3000 cal BC (Kortekaas 1987; Lanting/Van der Plicht 2000, 67).[1] Although this is undoubtedly correct, it does not undermine my main argument in any way, as is demonstrated by figure 2.6. People may have experimented with the *ard* much earlier, it may have been available, but was probably not an integral part of TRB culture. It became accepted on a much larger scale after 3000 cal BC and was only adopted in all of the Netherlands after 2500 cal BC (see below). In 1998 I argued that the use of the *ard* can be seen as a technological innovation that becomes only possible when the forest has been cleared, tree trunks were removed and larger open areas existed (Fokkens 1998). In such open spaces, especially after fallow periods, dense root systems develop that are difficult to work with a hoe (Boserup 1965). In such landscapes the *ard* is a helpful, possibly even an indispensable tool. But still, it does not mean that it necessarily was adopted everywhere.

2.3.2 The trajectory of the process

The *ard* is an example of an innovation that could 'turn the world around' in the sense that its adoption implied more then just using an instrument. Oxen, for example, needed to be trained and guided on the field. We have absolutely no evidence for the work division between men and women, but if women were doing most work in hoe agriculture and men in plough agriculture, which is the case in parts of Africa for instance (*e.g.* McCann 1995), the introduction of the plough potentially meant a change in labour division. This means that such an introduction process may meet many social constraints, much more than for instance the introduction of a new pottery style. We therefore cannot assume a standard trajectory, but have to take regional situations and constraints into account.

In fact, even within the borders of the Netherlands, we can see two different developments in this respect. Louwe Kooijmans' models (fig. 2.1 and 2.7) shows that the Vlaardingen culture in the south and west did not adopt a fully agrarian lifestyle until *c*. 2500 cal BC. There is no evidence of *ard* marks from earlier periods in that region. In the centre, the north and the east of the country, however, the *ard* was already introduced in the TRB culture and became an integral part of the economic system during the Late Neolithic, from *c.* 2850 cal BC onwards. One can only understand this properly by looking at the palaeo-geographical maps of the period (fig 2.8). They demonstrate that around 2750 cal BC the lower Rhine-Meuse basin formed a wide zone of riverbeds, levees and marshes. This is the area inhabited by the Vlaardingen people and they seem to have resisted the Single Grave tradition. There are no Single Grave finds *sensu stricto* in this area, the oldest Beaker finds belong to All Over Ornamented (AOO) and All Over Corded (AOC) Beakers.[2]

After 2500 cal BC it appears that in the whole of the Netherlands the Bell Beaker tradition takes over and a fully agrarian economy is established also in the lower Rhine-Meuse basin (fig. 2.7). It is quite clear that the *ard* is part of the Bell Beaker economy, for instance demonstrated by the plough marks underneath the Bell Beaker barrows at Oostwoud (Lanting/Van der Plicht 2000, 87 ff.), but several sites in the delta or river valleys show that for instance fishing remained important (cf. Molenaarsgraaf: Louwe Kooijmans 1974; Oldeboorn: Fokkens 1998).

In conclusion, it is clear that even within the Netherlands different trajectories exist for the introduction of the plough. These trajectories may have been influenced by the physical landscape of these regions, which do, or do not, favour the use of a plough. But on the other hand, cultural restraints may have played a role as well. Where on the sandy uplands the TRB culture had paved the path for the introduction of the plough as an integral element of the economy short after 3000 cal BC, in the river valleys this happened only after 2500 cal BC. Here the previous Vlaardingen groups may have had little use for a plough and possibly its social consequences may have been incompatible with the mixed Mesolithic/Neolithic life style and the 'extended broad spectrum economy'.

2.3.3 Interference

Another interesting phenomenon that may be explained by innovation trajectories is that of 'periods without data'. For instance in the period between 3100 and 2900 cal BC megalithic graves are no longer built (although they are still used) but barrows are not yet erected. Another period without data is the period 1800-1500 cal BC with regards to settlement data (house plans). All of the three-aisled Bronze Age houses that we know date to the period 1500-1200 cal BC (Arnoldussen 2008). Yet, the youngest two-aisled house from the Netherlands dates to *c.* 1850 cal BC (Noordwijk: Van der Velde 2008). From the period in between we know virtually nothing. A few settlement pits are known, but no house plans.

These periods 'without data' seem to coincide exactly with the interference of two major traditions. Since the three-aisled house plans appear fully developed and as a stable system after 1500 BC, what we look at is probably the point that the critical mass is reached: the innovation settles in, change becomes visible (par. 2.3.1). But that does not mean that there was nothing before that period. Between 1800 and 1500 BC the two-aisled farm and the ideology that adheres to it has slowly disappeared and was replaced by the three-aisled farm and its ideological significance (Fokkens 2005).

The conflict of both ideologies apparently made house structures invisible. I do not understand exactly why, but it is interesting that the same phenomenon becomes visible again

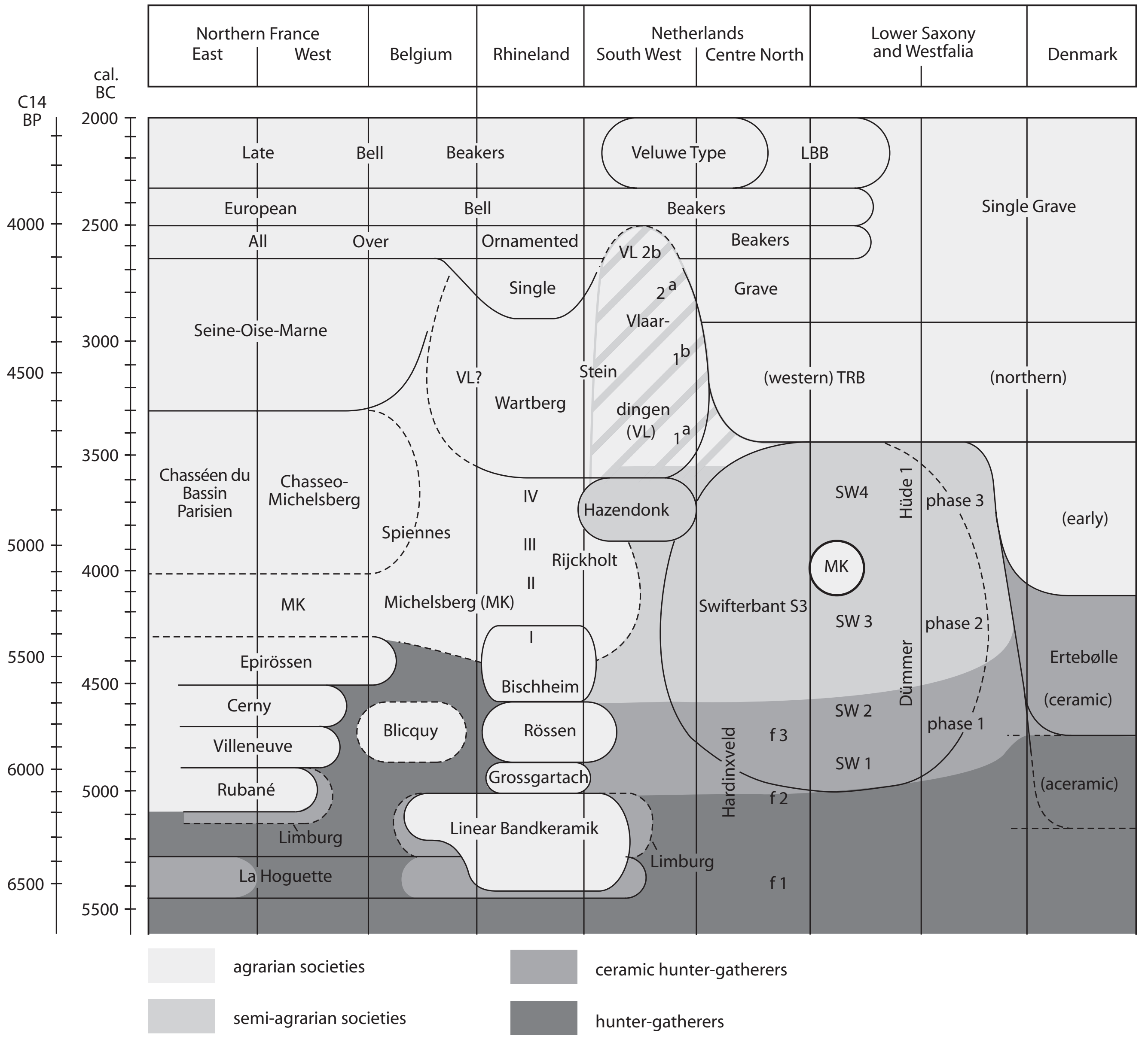

Figure 2.7 Louwe Kooijmans' most recent chrono-geographical diagram of the Lower Rhine Basin and adjacent areas. The colours indicate the stages of neolithisation (after Louwe Kooijmans 2006, 512).

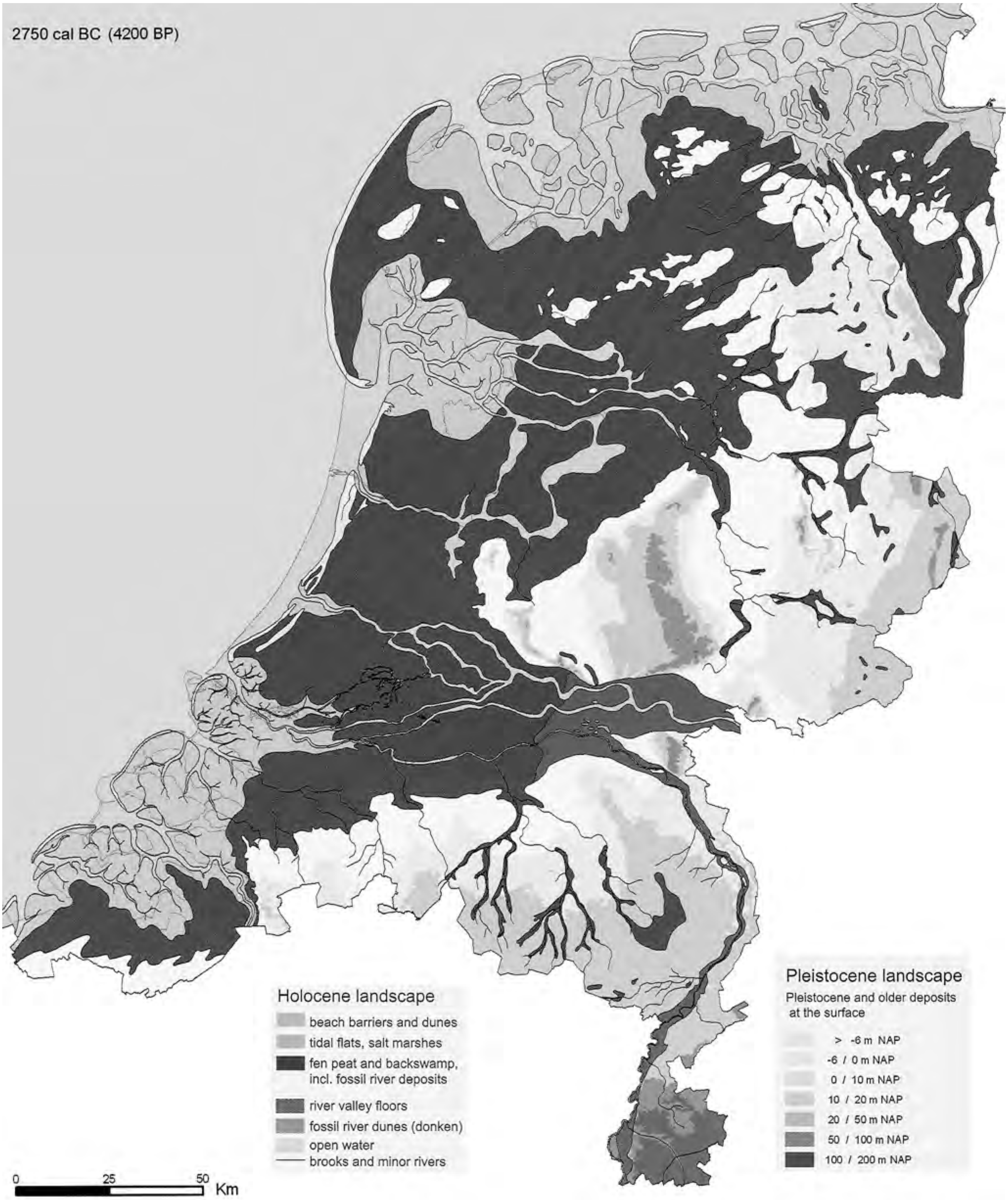

Figure 2.8 The palaeogeographical map of the Netherlands *c.* 2750 BC (from Vos/Kiden 2005, 22).

in the eleventh to tenth century BC when the three-aisled farm is replaced by the short Late Bronze Age/Early Iron Age farm. What these developments do demonstrate is that these were not 'just' technical innovations. Apparently these influenced culture processes to such an extent that they had an interference effect, making a clear pattern invisible for a while. In itself the presence of that effect may be used to support the idea that – following the house example – the three-aisled farm represented a fundamental concept in society.

2.4 Concluding remarks

I hope to have made clear that when studying cultural change, we should be aware of the many variables that influence the adoption of innovations. I have tried to make clear that even if a technological innovation can be considered to be superior, incompatibility with the existing social structure may prevent its acceptance. Of course it is almost impossible to find evidence for suppositions that are made on the basis of this approach, but in fact neither is there any evidence for the suggestion that pottery style comparisons are reliable evidence for cultural contacts or process. What I wanted to make clear is that one cannot just 'assume' culture change to be a standardised and uniform process. We should at least try to bring the complexity of it into the analysis. Leendert's model of neolithisation in the Low Countries was a good start in the right direction and probably will continue to inspire students in the future.

Acknowledgements

I would like to thank Karsten Wentink and Quentin Bourgeois for the critical editing of the text.

Notes

1 The Groningen arable is dated by two dates a *t.p.q.* is given by the date of charcoal in a vague pit underlying the arable: 4515 ± 30 BP (3360-3090 cal BC at 2 sigma; Lanting/Van der Plicht 2000, 67). The base of the arable itself is dated as well, but this date is less secure: GrN 13441 4565 ± 35 BP or 3500-3460/3380-3260/3240-3100 cal BC (Lanting/Van der Plicht 2000, 67). The date is on charcoal in the base of the arable layer and could belong to older (ploughed-up) material. Nevertheless the Groningen arable probably dates between 3100 and 3000 cal BC.

2 The Dutch typological tradition places AOO at the end of the Single Grave tradition (Lanting/Van der Waals 1976; Lanting/Van der Plicht 2000, 80). With Single Grave *sensu stricto*, the typical Protuding Foot Beaker phase is indicated here. Elsewhere AOO (and AOC) are considered the oldest Bell Beakers (*e.g.* Needham 2005), especially in areas without an earlier Corded ware tradition. Also in the southern and western Netherlands, where the Corded tradition is absent, AOO and AOC pottery marks the transition to the Bell Beakers proper.

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3 Timing, tempo and temporalities in the early Neolithic of southern Britain

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Alasdair Whittle
Frances Healy

3.1 Introduction: cross-Channel perspectives on Neolithisation

The work of Leendert Louwe Kooijmans across four decades of research has made enormous contributions to our understanding of the processes of Neolithisation in Europe. Although working principally in two regions within the Netherlands, his results have major implications for how we can think about sequences of change at the Mesolithic-Neolithic transition everywhere. Diversity and detail are the keys.

On the one hand, Leendert's investigations in the Rhine-Maas estuaries and coastal areas, from early work at Hazendonk through to the complex, large-scale investigations of the Hardinxveld sites and Schipluiden, have strongly suggested the gradual transformation of indigenous communities (for example: Louwe Kooijmans 1974; 1993; 1998; 2001a; 2001b; 2007; Louwe Kooijmans *et al.* 2005; Louwe Kooijmans/Jongste 2006). Beginning *c.* 5000 cal BC, these populations first adopted pottery, then pigs, cows and sheep, and finally, by *c.* 4000 cal BC, cereal cultivation. The occupation of Schipluiden in coastal Delfland, beginning *c.* 3600 cal BC, is taken to represent a small, sedentary and agriculturally based community. It is, however, one placed firmly in a long, slowly developing indigenous tradition by its range of activities, as well as by isotopic signatures of still significant aquatic/marine input into the diet (summarized in Louwe Kooijmans 2007).

On the other hand, and reflecting another strand of Dutch Neolithic research, work on the Linearbandkeramik (LBK) has suggested the intrusion on to the loess of the southern Netherlands of agriculturalists from the outside (Louwe Kooijmans 2007, 295-6). Specifically, Leendert's work at Geleen-Janskamperveld added significant detail to our understanding of western LBK settlements, not least in the number of smaller houses and the unusually well preserved and recorded fence lines around and among the longhouses (Louwe Kooijmans *et al.* 2003).

Such characterizations rely especially on a sense of context and tradition, supported by the fine detail of Dutch fieldwork and the unusual preservation of organic remains down the subsequently covered sides of old dune and sand ridges in the estuarine/coastal area. They serve, among other things, to put current models for the processes of neolithisation in Britain into perspective. Here, as elsewhere, there is a continuing debate between advocates of colonization (*e.g.* Sheridan 2007; Bradley 2007; Rowley-Conwy 2004) and proponents of indigenous change (*e.g.* Thomas 1999; 2007). Rarely are such models applied to different regions within Britain (for an exception see Cummings/Whittle 2004, 1-7, 89-91); rare too are integrationist or fusion models (Zvelebil/Lukes 2008; Whittle 2003; 2007). Supporters of both main models appear to agree on an informal date estimate for the start of the Neolithic across Britain as a whole at *c.* 4000 cal BC, though we must note the more nuanced models of Alison Sheridan (2003; 2004; 2007), albeit also based simply on the visual inspection of calibrated radiocarbon dates. There is, so far, a lack of investigated sites comparable to those of the Dutch estuaries, though some would argue that this apparent absence up and down the eastern side of England and Scotland is support for the model of intrusive colonization (Pailler/Sheridan forthcoming).

What, however, of the timescales of all this? Broadly speaking, the proposed Dutch chronology cannot be doubted. The LBK in the Netherlands cannot belong to the earliest phase of that culture, and must be earlier than wells, for example at Erkelenz-Kückhoven in the Rhineland (Weiner 1998), associated with developed LBK pottery styles and dendrochronologically dated to just before 5050 BC.[1] The appearance of the western LBK beyond the Rhine is often dated to *c.* 5300 cal BC (*e.g.* Lüning 2005). But to what date between 5300 and 5000 cal BC does a site like Geleen-Janskamperveld actually belong, and for how long did it last? There is a hiatus in the visible sequence in the estuarine sites in the second half of the fifth millennium cal BC (Louwe Kooijmans 2007, fig. 2), so at what date does cereal cultivation actually appear in that zone, and what was the pace of change between the use of sites like Hazendonk and that of sites like Schipluiden – a gap informally estimated at up to four centuries? It is clear that in both the Netherlands and Britain, despite our varying success in locating sites directly relevant to processes of neolithisation, only broad chronologies have been produced, principally based on the informal inspection of calibrated radiocarbon dates.

3.2 Modelling chronologies

To fully understand both the flow of life and change in prehistoric societies, we need robust chronologies. From more precise timings come the relationships between events and so the durations of past actions – and from these emerges tempo. Tempo to the level of the single lifetime or even generation opens up the relationship of short-term change to long-term change for examination. So, what has happened that has suddenly placed such resolution within our grasp?

In this paper we present an introduction to the modelling of radiocarbon dates in a Bayesian statistical framework. This approach is fast being adopted as best practice in English archaeology (Bayliss/Bronk Ramsey 2004), and we believe it currently provides the most effective method available for producing explicit, quantifiable estimates of chronology (at least for those regions which lack extensive dendrochronologies). We go on to present two examples of Bayesian models for the chronology of causewayed enclosures from the early Neolithic of southern Britain, to show the potential of the method for establishing different kinds of temporality, at both short and longer timescales. Finally, we offer our first attempts at the formal modelling of the date of the appearance of Neolithic practices in southern England for two contrasting and physically separate regions. These new chronologies raise many implications for our understanding of sequences and processes of change, some of which we discuss briefly below.

3.2.1 Statistics and radiocarbon dates

A generation of archaeologists has grown up with the understanding that radiocarbon measurements have to be calibrated (*e.g.* Pearson 1987). In the Neolithic period, for example, typically this means that a hazelnut shell, which actually fell off its tree on one particular day of one particular year, has a calibrated date range which spans a hundred years or more. Groups of calibrated dates from such samples cover even wider swathes of time, as estimating radiocarbon ages is in itself a probabilistic process and so calibrated dates scatter around the actual ages of the dated samples. Given the uncertainties on most calibrated radiocarbon dates and the relative brevity of much human activity, this statistical scatter on the dates can be substantial in comparison to the actual duration and dates of the archaeological activity in question. Proportionately, the quantity of scatter is greater when the actual period of dated activity is short and/or the number of radiocarbon dates is large.

Take, for example, the assemblage of 21 calibrated radiocarbon dates from a fictitious Neolithic enclosure shown in figure 3.1. At first sight, these appear to span the middle centuries of the fourth millennium cal BC, with the earliest

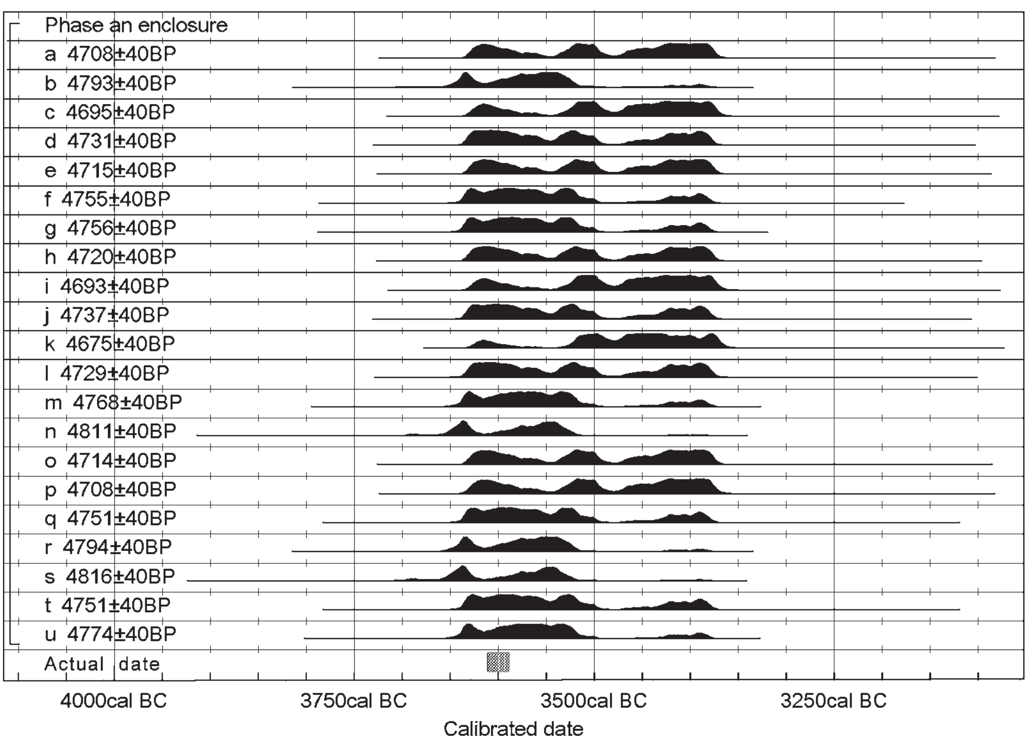

Figure 3.1 Calibrated radiocarbon dates (Stuiver/Reimer 1993; Reimer *et al.* 2004) from a fictitious Neolithic enclosure. The radiocarbon ages have been simulated from samples which actually date to 3615–3585 BC (see table 3.1).

sample dating to 3660-3520 cal BC (95% confidence; n and s; table 3.1), and the latest to 3630-3360 cal BC (95% confidence; k; table 3.1). But in fact, these calibrated dates come from radiocarbon ages which have been simulated (by a process of back-calibration) from samples whose actual ages are known. These samples actually date to between 3615 BC and 3585 BC – a span of 30 years, not 300! Simple visual inspection of groups of calibrated dates such as this runs a very significant risk that past activity will appear to start earlier, end later, and endure for longer than was actually the case. In our view, it is the ability of Bayesian statistics to tackle this issue formally which is one of the major, practical attractions of the approach.

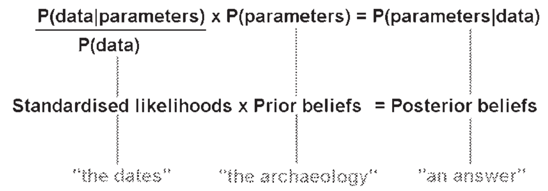

Figure 3.2 Bayes' theorem.

3.2.2 The Bayesian approach

The basic idea behind the Bayesian approach to the interpretation of data is encapsulated in Bayes' theorem (Bayes 1763; fig. 3.2). In archaeological terms this simply means that we analyze the new data we have collected about a problem ('the standardized likelihoods') in the context of our existing experience and knowledge about that problem (our 'prior beliefs'). This enables us to arrive at a new understanding of the problem which incorporates both our existing understanding and our new data (our 'posterior belief'). This is not the end of the matter, however, since today's posterior belief becomes tomorrow's prior belief, informing the collection of new data and their interpretation as the cycle repeats (fig. 3.3).

Identifier	Actual Age	Simulated Radiocarbon age	Calibrated date (68% confidence)	Calibrated date (95% confidence)
a	3615 BC	4708±40BP	3630-3375 cal BC	3635-3365 cal BC
b	3615 BC	4793±40BP	3640-3525 cal BC	3655-3385 cal BC
c	3615 BC	4695±40BP	3625-3370 cal BC	3635-3365 cal BC
d	3610 BC	4731±40BP	3635-3380 cal BC	3640-3370 cal BC
e	3610 BC	4715±40BP	3630-3375 cal BC	3635-3370 cal BC
f	3610 BC	4755±40BP	3635-3385 cal BC	3640-3375 cal BC
g	3605 BC	4756±40BP	3635-3385 cal BC	3640-3375 cal BC
h	3605 BC	4720±40BP	3630-3375 cal BC	3640-3370 cal BC
i	3605 BC	4693±40BP	3625-3370 cal BC	3635-3365 cal BC
j	3600 BC	4737±40BP	3635-3380 cal BC	3640-3370 cal BC
k	3600 BC	4675±40BP	3520-3370 cal BC	3630-3360 cal BC
l	3600 BC	4729±40BP	3635-3375 cal BC	3640-3370 cal BC
m	3595 BC	4768±40BP	3640-3520 cal BC	3645-3375 cal BC
n	3595 BC	4811±40BP	3645-3530 cal BC	3660-3520 cal BC
o	3590 BC	4714±40BP	3630-3375 cal BC	3635-3370 cal BC
p	3590 BC	4708±40BP	3630-3375 cal BC	3635-3365 cal BC
q	3590 BC	4751±40BP	3635-3385 cal BC	3640-3375 cal BC
r	3585 BC	4794±40BP	3640-3525 cal BC	3655-3385 cal BC
s	3585 BC	4816±40BP	3645-3535 cal BC	3660-3520 cal BC
t	3585 BC	4751±40BP	3635-3385 cal BC	3640-3375 cal BC
u	3585 BC	4774±40BP	3640-3525 cal BC	3645-3380 cal BC

Table 3.1 Radiocarbon ages simulated by a process of back-calibration from samples whose actual ages are between 3615 and 3585 BC. These measurements are used in figures 3.1-3.3 The calibrated date ranges have been calculated using the maximum intercept method (Stuiver and Reimer 1986) and data from Reimer *et al.* (2004).

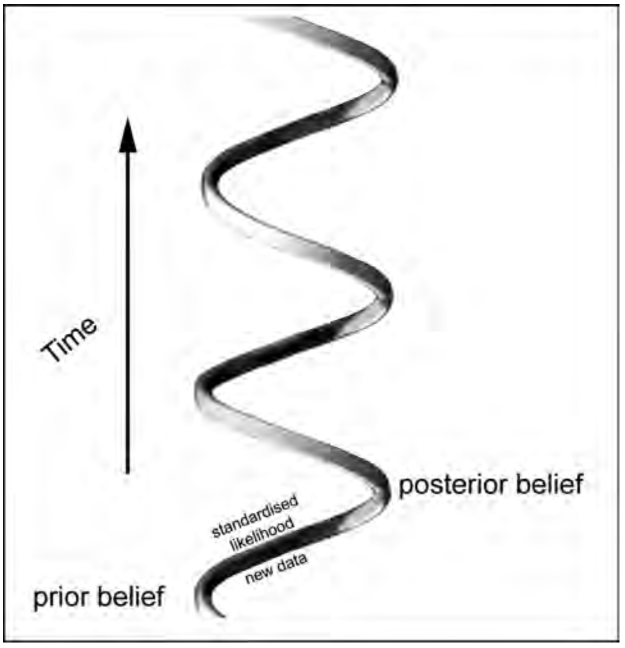

Figure 3.3 Bayes' theorem and the hermeneutic spiral (after Hodder 1992, fig. 22).

In terms of dating a Neolithic site, we may have obtained a series of radiocarbon dates. Perhaps less frequently, we may have a tree-ring date, a luminescence age, or a calibrated archaeomagnetic date. All these dates form the 'standardized likelihoods' component of our chronological model. These dates are interpreted within the framework of our understanding of the site, the taphonomy of the dated samples, and the stratigraphic sequence of the deposits from which they were recovered. This additional information forms the 'prior beliefs' component of our model. Together, these strands of evidence enable us to suggest dates for when the site was in use. These are the 'posterior beliefs' that are the outputs of our model.

None of this is revolutionary. Radiocarbon dates have been interpreted contextually within archaeology since the pioneering days of the 1950s, a practice to which Hans Waterbolk made a signal contribution (1971). What Bayesian statistics do provide, however, is an explicit, quantitative method which can combine our raw scientific dates with the other 'prior information' included in a model to produce formal statistical date estimates which combine both sorts of evidence. Technically these are known as *posterior density estimates*. By convention, these interpretative dates are cited *in italics* to distinguish them clearly from dates based on independent scientific information alone.[2]

3.2.3 A step-by-step guide to a Bayesian model

At this point, a worked-through example may clarify matters. Returning to our fictitious Neolithic enclosure, we have 21 calibrated radiocarbon dates (fig. 3.1; table 3.1), which form the 'standardized likelihoods' component of our Bayesian model. But what 'prior beliefs' do we have about our site?

First, we know that it is a site. At some, unknown, point in time in the past people came and constructed our enclosure. They then used it for some period before they stopped using it. It had a period of use. *Faute de mieux* we assume that this period of activity was relatively constant and relatively continuous, and so we model it as uniformly distributed (Buck *et al.* 1992). The model which incorporates this interpretation is shown in figure 3.4. Here the *posterior density estimates* which are the outputs of our Bayesian model are shown in black, and the calibrated radiocarbon dates (the standardized likelihoods component) are shown in outline. In addition to a posterior distribution for each dated sample, however, we now also have two new parameters. These formally estimate the dates when the enclosure was built (*start*) and when it went out of use (*end*). These estimates do not relate to any particular radiocarbon sample, but rather to all of them and to the distribution of dated events. They allow for the fact that in reality it is extremely improbable that we will have dated the earliest sample to be deposited on the site.

The model shown in figure 3.4 estimates that our fictitious Neolithic enclosure was constructed in *3650-3585 cal BC (95% probability; start)*, probably in *3640-3605 cal BC (68% probability)* and went out of use in *3630-3535 cal BC (82% probability; end)* or *3525-3485 cal BC (13% probability)*, probably in *3610-3550 cal BC (68% probability)*. Furthermore, by calculating the difference between these two distributions, we can estimate that the site was in use for *1-130 years (95% probability; use*; fig. 3.5), probably for *1-65 years (68% probability)*.

In this simulated case the actual dates of use of the enclosure are known, so we can see that the true date for its construction (3615 BC) lies within the posterior density estimate provided by our model at both 95% and 68% probability. Equally the true date for the end of its use (3585 BC) lies within the posterior density estimate for that parameter at both 95% and 68% probability, and the true duration of its use (30 years), also lies within the relevant posterior density estimate at both 95% and 68% probability.

It is perhaps worth examining the prior information that has been used in this example in a little more detail. Technically, the assumption of a uniformly distributed phase is known as an 'uninformative prior belief'. This is not because it necessarily has little effect on the outputs of a model, but because the outputs of the model should be relatively robust against it being untrue. In this example, the samples actually only span a period of 30 years, although each calibrated date

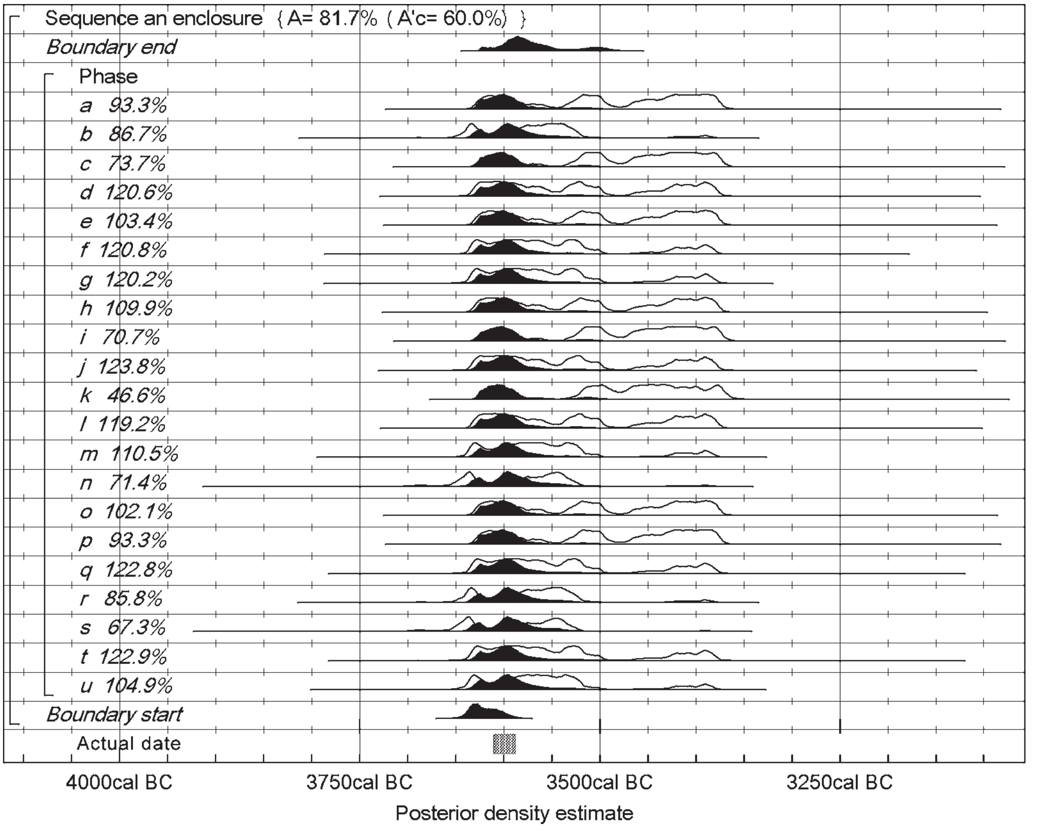

Figure 3.4 Probability distributions of simulated dates from a fictitious Neolithic enclosure. Each distribution represents the relative probability that an event occurs at a particular time. For each of the dates two distributions have been plotted: one in outline, which is the result of simple radiocarbon calibration, and a solid one, based on the chronological model used; the event associated with, for example, 'a', is the growth of the dated sample. Distributions other than those relating to particular samples correspond to aspects of the model. For example, the distribution '*start*' is the estimated date when the enclosure was constructed. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly (http://c14.arch.ox.ac.uk/). The simulated dates are those shown in figure 3.1 and detailed in table 3.1 (3615-3585 BC).

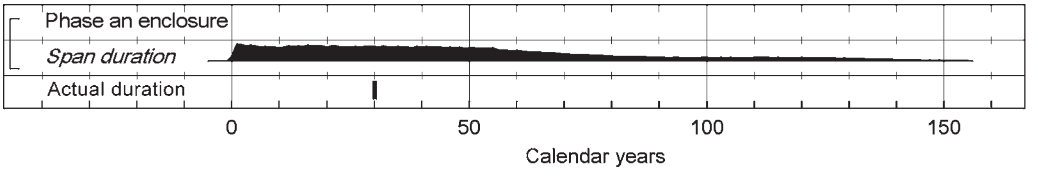

Figure 3.5 Number of years during which the fictitious Neolithic enclosure was in use, derived from the model defined in figure 3.4.

spans around 300 years. As the calibrated dates are so similar, however, the model is able to determine that a large proportion of each calibrated date is a product of statistical scatter rather than variation in actual calendar date. If the period of use of the fictitious enclosure had in reality lasted for three hundred years from *c*. 3600-*c*. 3300 cal BC, then some of the dates would have scattered into the 38th century cal BC and on to the 3300-3000 cal BC plateau in the calibration curve, but proportionately the amount of scatter observed from 21 radiocarbon dates would have been less.

This type of prior information is perhaps more abstract and less intuitive for archaeologists than that derived from, for example, physical stratigraphy. But it is vital. The need for this type of prior belief has been highlighted by Steier and Rom (2000; and see also Bronk Ramsey 2000). In practice, the uniform distribution is very forgiving. Archaeologically 'relatively constant and relatively continuous' could mean 'was inhabited continuously', or 'was used for a week once a year', or 'was used once by each generation'. A quantified illustration of just how wrong this assumption has to be before the outputs of a model are importantly wrong (Box 1976, 792) is provided in Bayliss *et al.* (2007a).[3]

3.2.4 Another model explained

A second model for the chronology of our fictitious Neolithic enclosure is provided in figure 3.6. This uses the same set of simulated radiocarbon dates, but in this case the 'prior beliefs' component of the model has been varied. In addition to treating the site as a coherent period of human activity, we also have stratigraphic information that provides relative dating information about the samples. They are from animal bones in the enclosure ditch, which were articulated and so they cannot be residual, and their relative dating is the same as that of the sequence of deposits. For this reason, we can include the information that samples a-f ('phase 1') are earlier than samples g-n ('phase 2'), which are in turn earlier than samples o-u ('phase 3'). This is a much more 'informative' prior belief and affects the output of the model strongly.

This is why the posterior density estimates output from the model shown in figure 3.6 are rather more precise than those provided by the model shown in figure 3.4. They suggest that the enclosure was constructed in *3645-3590 cal BC*

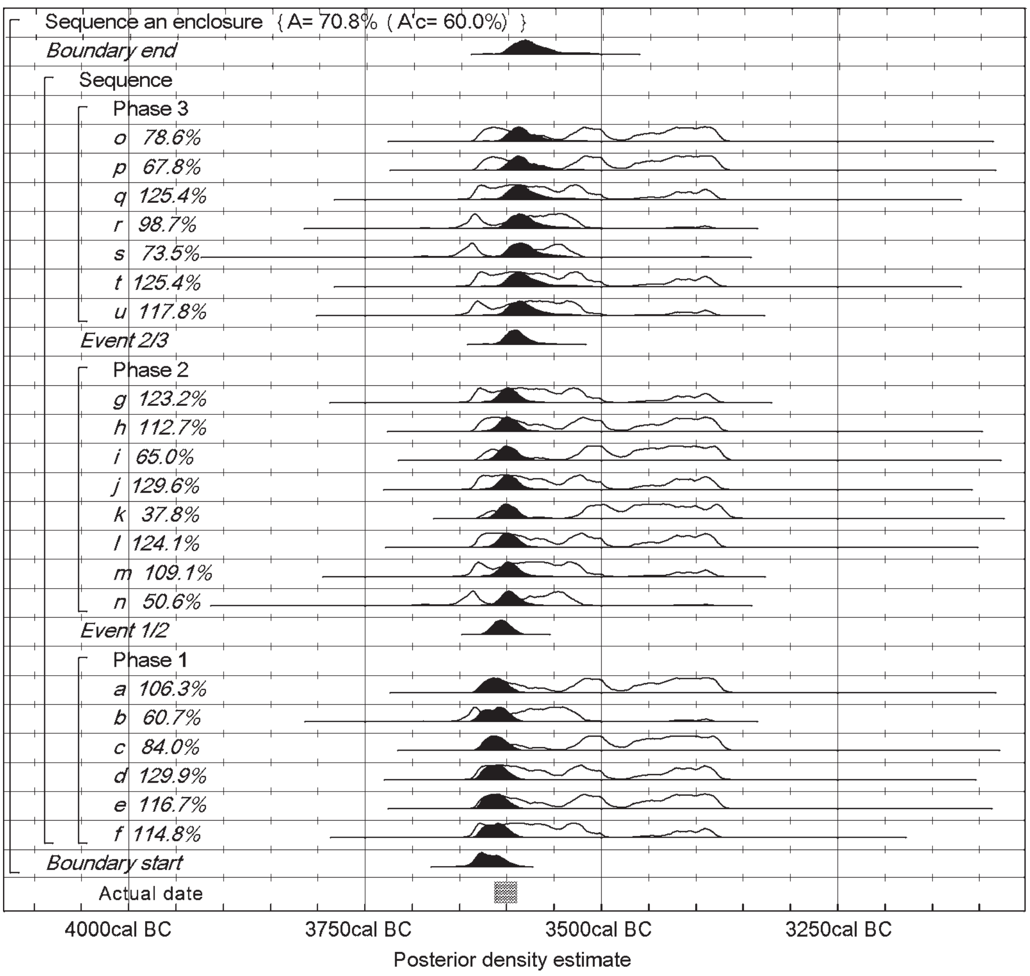

Figure 3.6 Probability distributions of dates from a fictitious Neolithic enclosure, incorporating the information that samples a-f are earlier than samples g-n, which are earlier than samples o-u. The format is identical to that of figure 3.4. The simulated dates are those shown in figure 3.1 and detailed in table 3.1 (3615-3585 BC). The large square brackets down the left-hand side along with the OxCal keywords define the overall model exactly.

(95% probability; start), probably in *3635-3605 cal BC (68% probability)*. The boundary between phases 1 and 2 occurred in *3625-3585 cal BC (95% probability; 1/2)*, probably in *3620-3595 cal BC (68% probability)*, and the boundary between phases 2 and 3 in *3615-3545 cal BC (95% probability; 2/3)*, probably in *3605-3570 cal BC (68% probability)*. The site went out of use in *3610-3510 cal BC (95% probability; end)*, probably in *3605-3570 cal BC (68% probability)*. Again, by taking the difference between the distributions for the start and end of activity on the site, we can estimate that it was in use for *1-105 years (95% probability*; distribution not shown), probably for *1-65 years (68% probability)*.

Again, in this example, in every case the true values for each parameter lie within the relevant posterior density estimate calculated by the model at both 95% and 68% probability. A summary of the actual and estimated dates for the key parameters from the models shown in figures 3.4 and 3.6 is provided in table 3.2. More extensive discussion of the accuracy of Bayesian chronological models in the fourth millennium cal BC, and of their sensitivity to various archaeological and technical factors, is provided in Bayliss *et al.* (2007a). A more extensive introduction to Bayesian chronological modelling for those with a limited background in mathematics is provided in Bayliss (2007).

3.3 Two causewayed enclosures from the Thames estuary

The first Neolithic enclosure we will consider is that at Lodge Farm, St Osyth, Essex. It lies at 15 m OD on a low spur of gravel, 3 km inland from the broad embayment formed by the mouths of the Colne and Blackwater estuaries. Excavations in 2002-3 revealed the remains of a very large causewayed enclosure with three irregular circuits (Germany 2007). Generally the ditches contained few finds, although there were seven concentrations of artefacts, mainly of Mildenhall Ware sherds. Within the ditches, mostly on the western side, were 117 small pits, sometimes arranged in small groups of two or more. The fills of around half of these features were dark with carbonised wood and plant remains, the remainder being similar to the surrounding natural sand; a few had been recut. Artefacts were generally concentrated in charcoal-rich deposits in the pits, and a small number of pits contained large concentrations of material.

The chronological model for the Neolithic enclosure and pits at Lodge Farm is shown in figure 3.7. There are no stratigraphic relationships between samples, and so the model simply incorporates the assumption that the Neolithic activity on the site formed a single, relatively constant and continuous, period of use (see above, example shown in figure 3.4). This model suggests that the start of Neolithic activity on the site, and potentially the initial construction of the causewayed enclosure, dates to *3660-3630 cal BC (70% probability; start St Osyth)* or *3565-3540 cal BC (25% probability)*, probably to *3655-3635 cal BC (61% probability)* or *3555-3545 cal BC (7% probability)*. This period of activity, and the use of the enclosure, ended in *3640-3620 cal BC (69% probability; end St Osyth)* or *3550-3530 cal BC (26% probability)*, probably in *3640-3625 cal BC (61% probability)* or *3545-3540 cal BC (7% probability)*.

The duration of Neolithic activity on the site is estimated to have been *1-35 years* (*95% probability*; figure 3.8), probably *1-20 years (68% probability)* – within the span of a single generation.

Parameter	Actual Date	*Posterior density estimate (95% probability)*	*Posterior density estimate (68% probability)*
Figures 3.4 and 3.5			
start	3615 BC	*3650-3585 cal BC*	*3640-3605 cal BC*
end	3585 BC	*3630-3535 cal BC (82%)* or *3525-3485 cal BC (13%)*	*3610-3550 cal BC*
duration	30 years	*1-130 years*	*1-65 years*
Figure 3.6			
start	3615 BC	*3645-3590 cal BC*	*3635-3605 cal BC*
1/2	3610 BC / 3505 BC	*3625-3585 cal BC*	*3620-3595 cal BC*
2/3	3595 BC / 3590 BC	*3615-3545 cal BC*	*3605-3570 cal BC*
end	3585 BC	*3610-3510 cal BC*	*3600-3560 cal BC*
distribution not shown	30 years	*1-105 years*	*1-65 years*

Table 3.2 Summary of key parameters from the models described in figures 3.4 and 3.6.

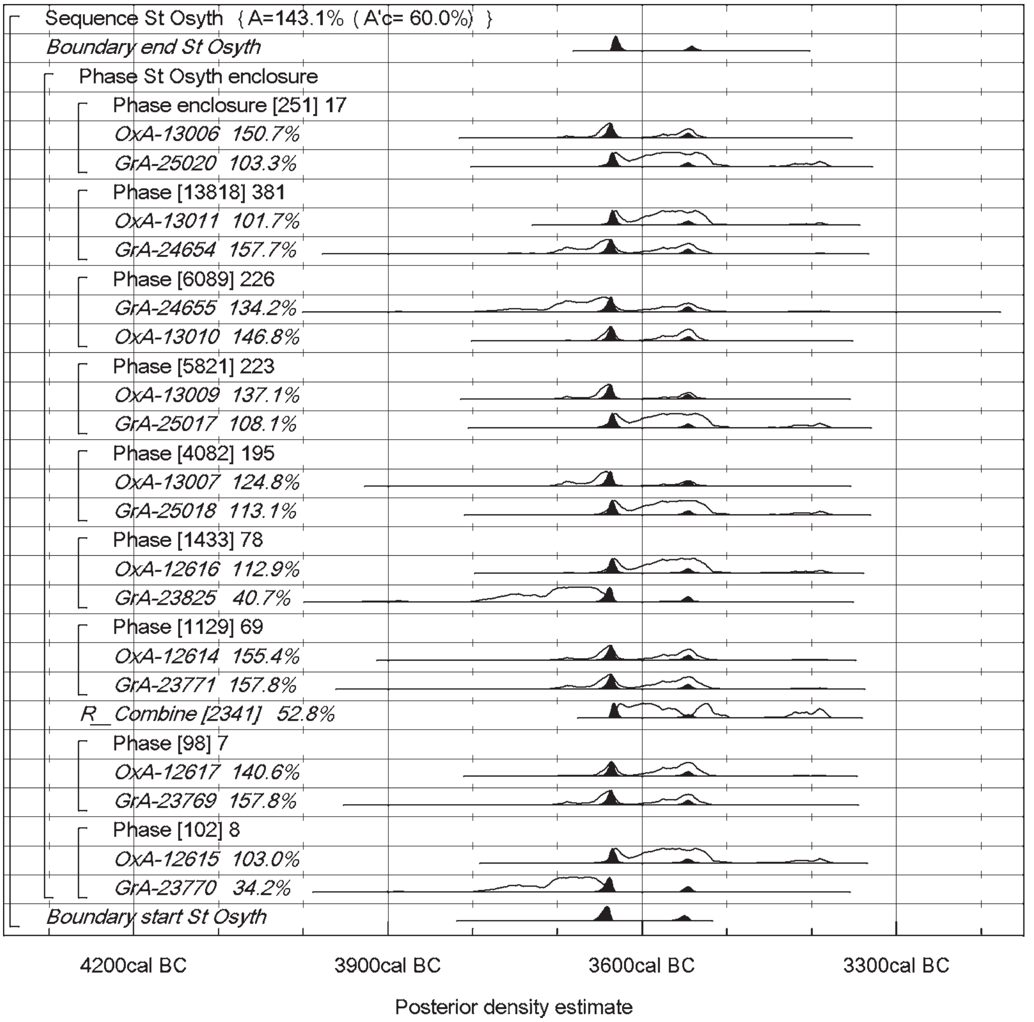

Figure 3.7 Probability distributions of dates from the causewayed enclosure at Lodge Farm, St Osyth. The format is identical to that of figure 3.4. The model is defined exactly by the brackets down the left-hand side of the diagram. The two peaks of probability for each posterior density estimate result from a pronounced wiggle in the calibration curve around the time when the site was used.

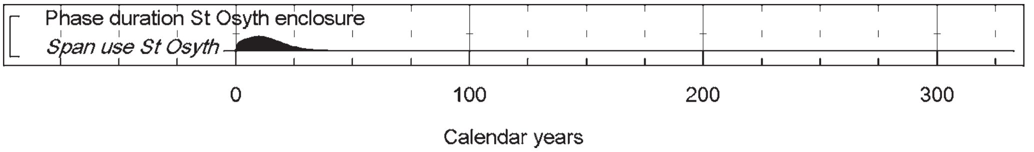

Figure 3.8 Probability distribution of the number of years during which the causewayed enclosure at Lodge Farm was in use, derived from the model shown in figure 3.7.

The second Neolithic enclosure to be considered is at Chalk Hill, Ramsgate, Kent. This lies at 30 m OD on the south side of the Isle of Thanet. Excavations by the Canterbury Archaeological Trust in advance of road building in 1997-8 revealed three interrupted ditch circuits with a maximum dimension of approximately 150 m, internal features, and two closely spaced, parallel interrupted linear ditches cutting the outer and middle circuits and in turn cut by the ditches of a possible cursus monument (Shand 1998; 2001; Dyson *et al.* 2000). The circuits were formed of conjoined pits. Postholes marked possible entrances, especially in the north.

The model for the chronology of the Chalk Hill enclosure is shown in figure 3.9. This includes the relative dating provided by stratigraphy from a series of samples on articulating bones and residues from refitting groups of pottery sherds from the outer ditch, in addition to the assumption that the Neolithic activity on the site formed a single, relatively constant and continuous, period of use (see above, example shown in figure 3.6). On the basis of this model, the first dated circuit of the enclosure was built in *3780-3680 cal BC (95% probability; start Chalk Hill)*, probably in *3740-3690 cal BC (68% probability)*, and the enclosure went out of use in *3635-3560 cal BC (95% probability; end Chalk Hill)*, probably in *3630-3595 cal BC (68% probability)*.

The Chalk Hill enclosure seems to have been in use for *45-165 years* (*95% probability; use Chalk Hill*; figure 3.10), probably for *65-115 years (68% probability)*.

3.4 Some thoughts on causewayed enclosures

These results illustrate some of the more general points that have become apparent following our wider study of the chronology of early Neolithic causewayed enclosures in southern Britain (Whittle *et al.* in prep).

First, although not all enclosures were built at the same time, they do form a concentrated horizon. Chalk Hill is one of earliest examples, perhaps constructed in the latter part of the 38th century cal BC (fig. 3.9), whereas St Osyth was probably constructed in the middle part of the 37th century cal BC (fig. 3.7). Hambledon Hill, Dorset, the modelling of which inspired the wider programme described here, can be formally estimated to have begun in the earlier 37th century cal BC (Healy 2004; Mercer/Healy in press). In contrast, informal modelling of the radiocarbon results available from the 1980s excavations at Maiden Castle, Dorset, suggested construction very early in the fourth millennium cal BC, between 3900 and 3700 cal BC (Sharples 1991, 104-5). Re-assessment of sample longevity and of context in turn proposed that the whole enclosure could have been younger than Sharples had envisaged and that the inner circuit could have pre-dated the outer (Cleal 2004, 169, 188). Our programme has confirmed the essence of this suggestion (Whittle *et al.* in prep., chapter 4).

These are results from just three sites, but it is clear from our programme as a whole, which has dated some 30 out of a probable total of some 90 or more sites and modelled existing results from five others, that these results indicate the recurrent chronological position of southern British causewayed enclosures.

Second, these three examples illustrate very different histories for the use of the monuments. At St Osyth, this use appears to have been brief – a number of episodes, on the evidence of some inter-cutting pits, but spread across a few decades at most. Such brevity has rarely been observed, or suggested, for Neolithic monuments (but see Saville 1990, 265-6, for the Hazleton long barrow; Bayliss *et al.* (2007b) for West Kennet long barrow; and Evans and Hodder (2006, 329) for the Haddenham enclosure). In contrast Chalk Hill was in use for several generations – certainly more than two and perhaps for four or five. This probably takes us beyond the span of the personal memory of any one individual in the community, although probably still within reach of a direct oral tradition passed on by parents or grandparents. For whatever reasons, the people who used St Osyth moved on after a few decades, but those at Chalk Hill persisted in the use of the same space. An even greater contrast is provided by the much larger complex of Neolithic earthworks on Hambledon Hill, where activity persisted for more than 300 years, as it did at Windmill Hill, in Wiltshire (Whittle *et al.* in press). Such longevity, however, now seems the exception rather than the rule.

3.5 The place of enclosures within the early Neolithic of southern Britain

The models already presented for a small sample of long barrows (Bayliss/Whittle 2007; Whittle *et al.* 2007) have now been extended by the much wider programme of modelling of radiocarbon results from causewayed enclosures. With these models it becomes possible to begin to construct a much more precise and robust chronology, based on formal date estimates, for the first centuries of the southern British Neolithic. We will report this in full in due course (Whittle *et al.* in prep.), but we can already begin to add time-depth to, and appreciate change within, this period of transition.

We now have evidence which indicates that causewayed enclosures did not begin in the very first phase of the southern British Neolithic. We appear to be dealing with a sequence within the first centuries of the southern British Neolithic in which long barrows appeared before causewayed enclosures. Probably few long barrows were built before *c.* 3800 cal BC (Whittle *et al.* 2007), though there may be exceptions. Burn Ground, Gloucestershire, may be one (Smith/Brickley 2006; though there are uncertainties about outlying dates and whether dated samples represent deposited

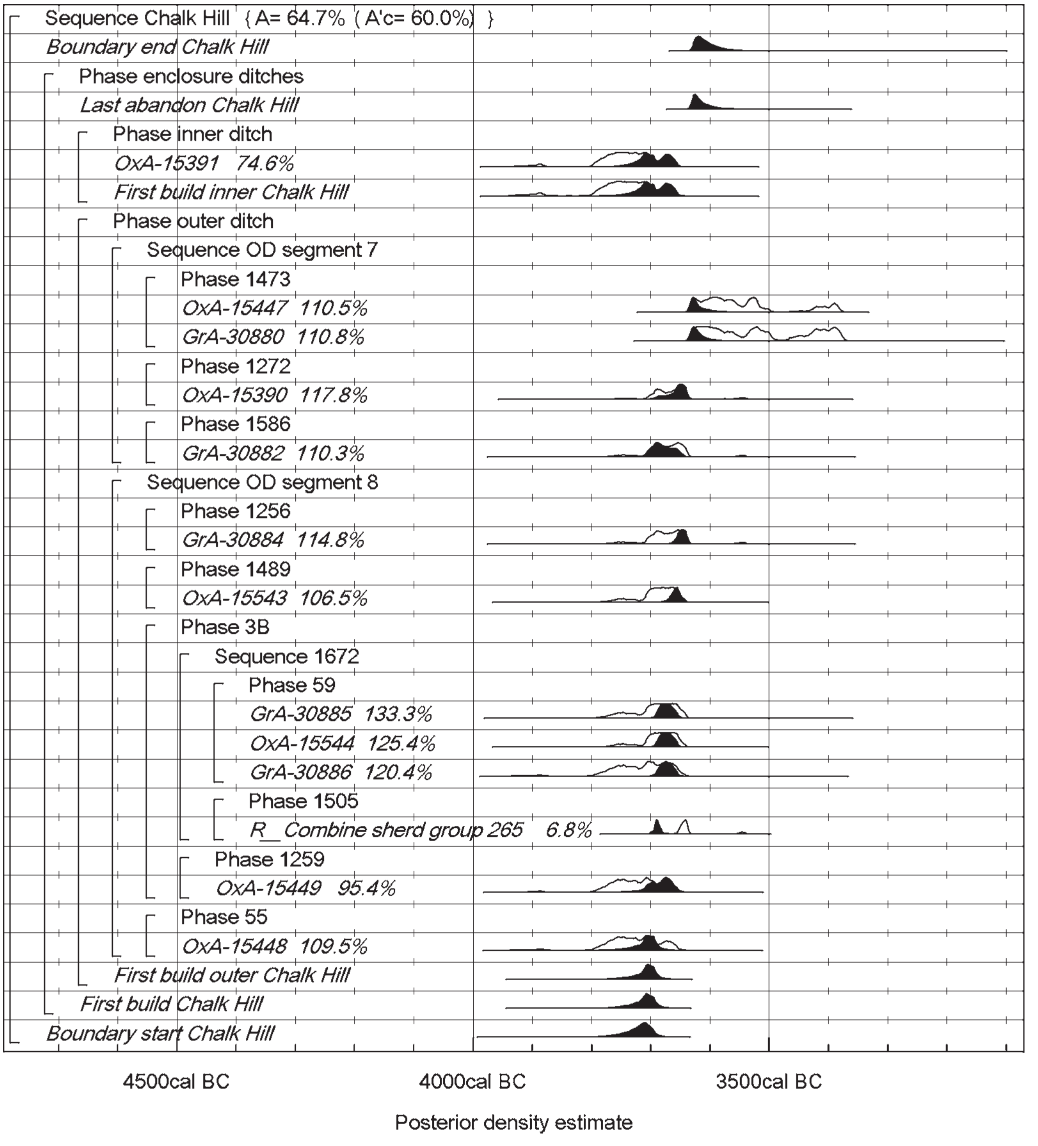

Figure 3.9 Probability distributions of dates from the causewayed enclosure at Chalk Hill. The format is identical to that of figure 3.4. The model is defined exactly by the brackets down the left-hand side of the diagram.

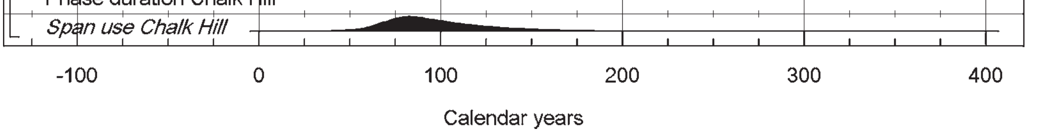

Figure 3.10 Probability distribution of the number of years during which the causewayed enclosure at Chalk Hill was in use, derived from the model shown in figure 3.9.

intact bodies in all cases: Whittle *et al.* in prep., chapter 8). Coldrum, Kent, although the original form of the monument is uncertain, is another (Wysocki *et al.* in prep.). Ascott-under-Wychwood, Oxfordshire, stands currently as a monument probably built in the 38th century cal BC (Benson/Whittle 2007, 221-36; Bayliss *et al.* 2007c). In our wider programme, we have not dated any causewayed enclosure earlier than probably the late 38th century cal BC (Whittle *et al.* in prep., chapter 14).

What then of the start of the southern British Neolithic? Can we refine this date, and indeed is this a question of a single date? How can the sequence from southern Britain be compared now with those across the Channel, including in the Dutch estuaries? Much ink, of course, has been spilt on the Mesolithic-Neolithic transition in Britain as a whole (to say nothing of Ireland). Suffice it to say here that once critical review of samples and association had begun (Kinnes 1985; Kinnes/Thorpe 1986), higher estimates (*e.g.* Case 1969; Whittle 1977) fell out of favour. General opinion, on date though not on process, shifted to a start *c.* 4000 cal BC. This suggested date has been widely repeated (*e.g.* Bradley 2007; Edmonds 1999; Darvill 2004; Pollard/Reynolds 2002; Russell 2002; Schulting 2000).

It is worth noting, however, that variations have also been proposed, for example of a 'Final Mesolithic/?First Neolithic' dating to ?4200-3800 cal BC (Barclay 2007), and of a possible virtually aceramic 'earliest or contact Neolithic', *c.* ?4100-3850 cal BC (Cleal 2004). Alison Sheridan has argued for a number of years for three, if not four, strands of earliest Neolithic activity in Britain and Ireland: the first represented by fifth millennium contacts indicated by the Ferriter's Cove evidence; the second a 'Breton strand' along the Atlantic and Irish sea façade, argued to date to *c.* 4200-3900 cal BC and to be marginally earlier than the Carinated Bowl tradition; the third the Carinated Bowl-associated Neolithic, extending to the eastern side of England and Scotland, claimed to date between *c.* 3950/3900 and 3700 cal BC; and the fourth a northwest French (probably Normandy) – southwest English complex of simple bowl pottery and simple passage tombs in the first quarter of the fourth millennium cal BC (*e.g.* Sheridan 2003; 2004; 2007; Pailler/Sheridan forthcoming).

3.6 The date of the first Neolithic in the Thames Estuary and beyond

In an attempt to address some of these issues, we have gathered existing radiocarbon determinations associated with diagnostically early Neolithic material in the areas where we have dated enclosures. All these dates have been subjected to critical evaluation to determine the association between the radiocarbon date and the Neolithic activity with which it was related (Waterbolk 1971). Some samples, for example unidentified charcoals, simply provide *termini post quos* for their contexts. The dates, or key parameters from sites which have sufficient dates for formal modelling, are then incorporated in the appropriate manner into a model where the early Neolithic is treated as a period of relatively constant and continuous activity. This is critical because, in order to provide a reliable estimate for the start of the Neolithic, it is necessary to impose a statistical distribution on the phase of activity sampled for radiocarbon dating to counteract the statistical scatter on the group of radiocarbon dates. If this is not done, the results can easily be interpreted erroneously as suggesting a start date for the Neolithic which is anomalously early.[4]

The chronological model shown in figure 3.11 includes dates from sites around the Thames estuary which contained diagnostic early Neolithic material (excluding those from causewayed enclosures). It is sobering that measurements from only seven sites are available. Obviously any chronology proposed on such a small sample of data must be highly provisional. Nonetheless, this model suggests that diagnostic Neolithic material first appeared in this region in *4315-3880 cal BC (95% probability; start Estuary Neolithic)*, probably in *4120-3935 cal BC (68% probability)*. On the evidence of two sites – the megalithic monument at Coldrum and the timber longhouse at White Horse Stone – the Neolithic had arrived in Kent by the 40th century cal BC at the latest. Further, by taking the difference between our estimate for the date of construction of the White Horse Stone longhouse and our estimate for the construction of the first circuit at Chalk Hill, we can suggest that the interval between the appearance of Neolithic practices in Kent and the appearance of the first enclosure in that region was probably *95-410 years* (*95% probability*; distribution not shown), probably *195-340 years (68% probability)*.

By way of comparison, a chronological model of similar form shown in figure 3.12 includes dates from sites which contained diagnostic early Neolithic material from the southwest peninsula of England (Cornwall and Devon). This model suggests that the earliest Neolithic activity in this region began in *3900-3690 cal BC (95% probability; start SW Neolithic)*, probably in *3820-3730 cal BC (68% probability)*. This is *55-530 years (95% probability*; distribution not shown), probably *145-360 years (68% probability)* later than the first appearance of Neolithic practices around the Thames estuary.

These results seem to confirm that, around the Thames estuary at least, Neolithic practices had appeared several centuries before the first causewayed enclosure. They may also suggest that the Neolithic did not appear everywhere across southern Britain at the same time – indeed there may

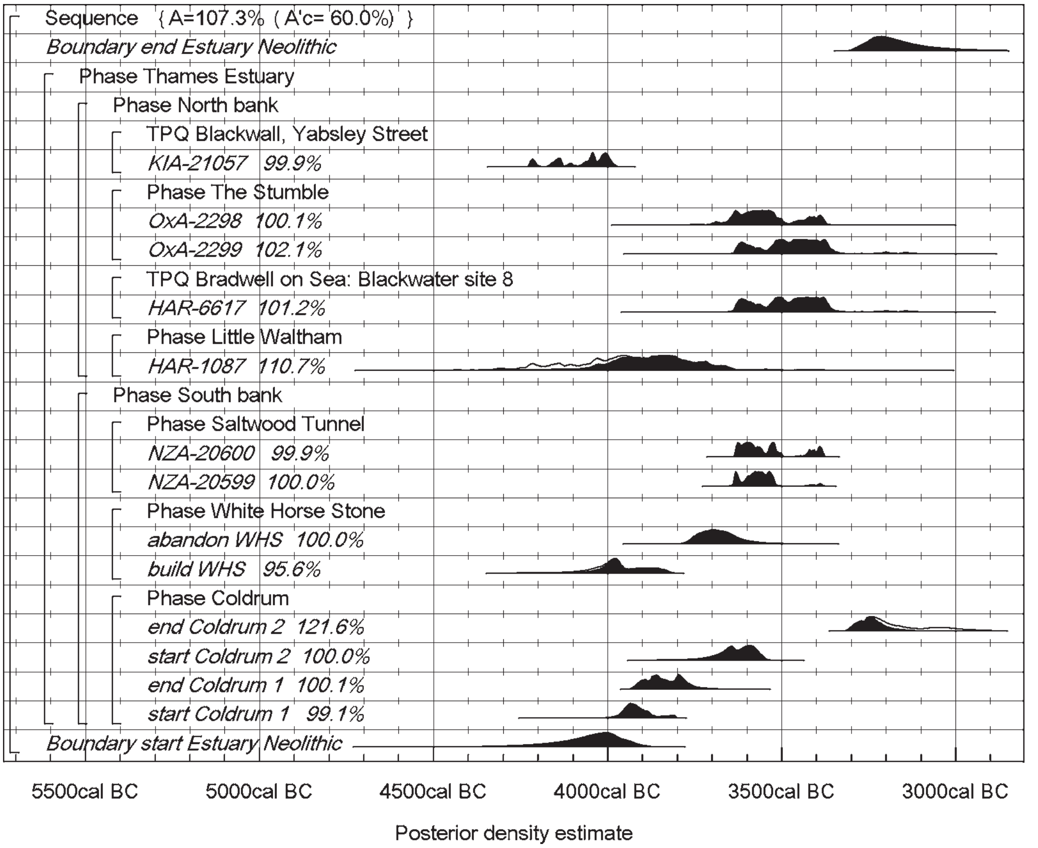

Figure 3.11 Probability distributions of dates for early Neolithic contexts in the Thames estuary (excluding causewayed enclosures). The format is identical to that of figure 3.4. The distributions for White Horse Stone and Coldrum have been taken from the models defined in Whittle *et al.* (in prep., figs 7.26-7). Details of all the radiocarbon dates included in this model are provided in Whittle *et al.* (in prep., tables 7.3 and 7.6-7). The model is defined exactly by the brackets down the left-hand side of the diagram.

have been a transitional period of several centuries whilst these practices spread throughout the island.

At this stage, all this must be tempered with caution. We have dates from seven sites in the Thames estuary (fig. 3.11) and eight in the southwest peninsula (fig. 3.12). This is hardly an adequate sample, and not necessarily representative (what about portal dolmens or entrance graves from the southwest, for example?). As yet the wider early Neolithic has not seen a sustained dating programme to compare with those that we have been able to undertake for some long barrows and for the causewayed enclosures. Nonetheless, formal modelling may be beginning to reveal structure in the existing data which has not previously been apparent.

3.7 The context of enclosures and the start of the southern British Neolithic

These variant and more refined models raise important questions: wider than we have space to go into here (see Whittle *et al.* in prep., chapters 12, 14 and 15). What we have presented here, for southern Britain at least, suggests the importance of both formal modelling and the need for regionally-specific models. The Carinated Bowl-associated Neolithic may indeed start as early as Sheridan has suggested in southeast England, but it is far from clear that this date can be extrapolated to the whole of Britain. The simple bowl pottery of the southwest may start no earlier than the late 39th or 38th century cal BC: in line with the general tenor of Sheridan's model, but more precisely. There is no support yet from formally modelled results for the claimed earlier date of the 'Breton' strand, and indeed discussion of the validity of such a concept must also be reserved for another occasion (Whittle *et al.* in prep.).

Why and how does any of this make a difference to our understanding of neolithisation processes? One of us once argued (as radiocarbon samples began to be re-assessed) that a high start date (*e.g.* earlier-mid fifth millennium cal BC)

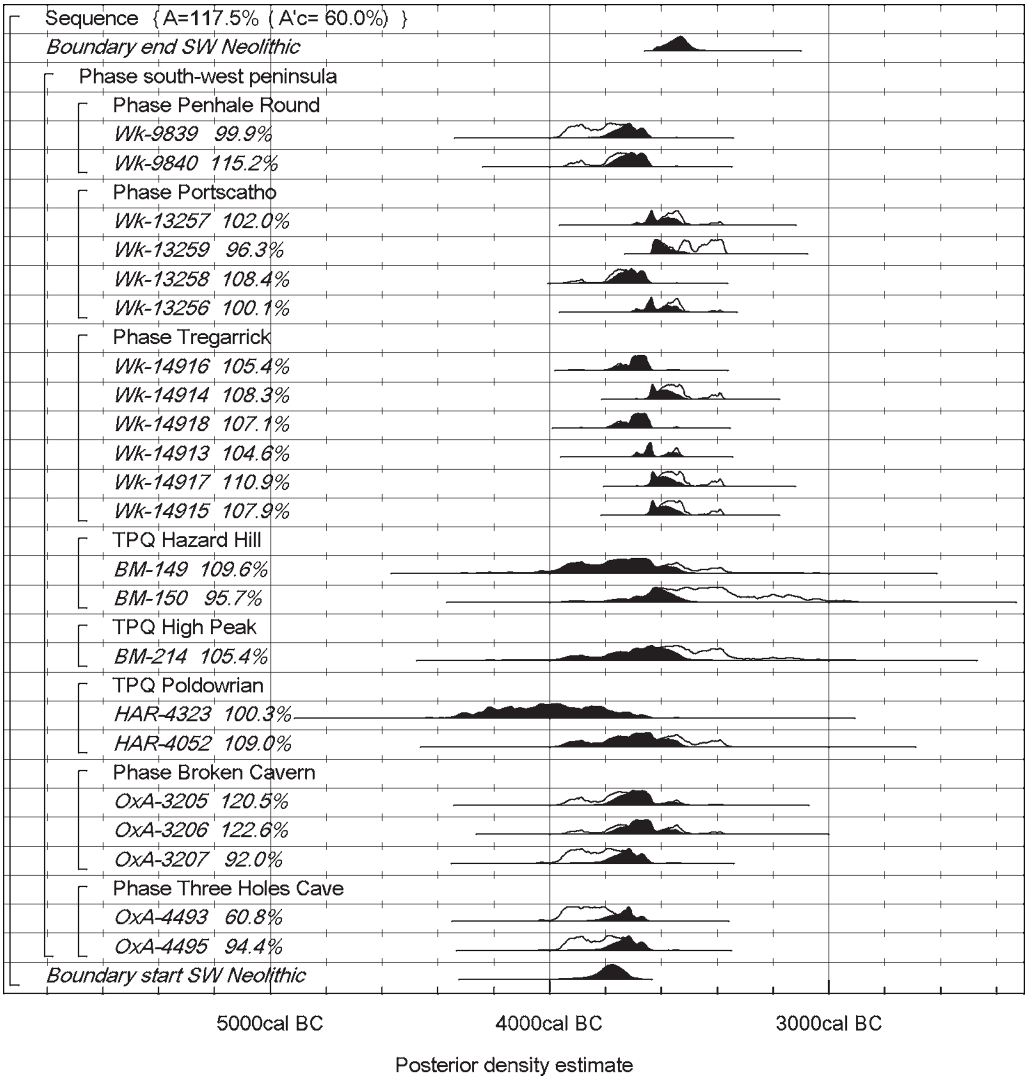

Figure 3.12 Probability distributions of dates for early Neolithic contexts on the south-west peninsula (excluding causewayed enclosures). The format is identical to that of figure 3.4. Details of all the radiocarbon dates included in this model are provided in Whittle *et al.* (in prep., table 10.5). The model is defined exactly by the brackets down the left-hand side of the diagram.

for the southern British Neolithic might indicate colonisation, from the expanding post-LBK settlement system, whereas a low start date (e.g. late fifth millennium or *c.* 4000 cal BC) might suggest acculturation, in a context of cultural convergence represented by the Chasséen, Michelsberg, TRB and insular Carinated Bowl complexes (Whittle 1990). This no longer seems tenable: not least because both the Dutch estuarine/coastal and Danish sequences suggest that acculturation was one major strand in wider processes of change in northwest Europe during the fifth millennium cal BC and again *c.* 4000 cal BC (Louwe Kooijmans 2007; Larsson 2007), but also because formal estimates of regionally varying start dates for Neolithic practices in southern Britain may allow us to specify much more precisely what was in the repertoire of the pre-enclosure horizon before the end of the 38th and the 37th centuries cal BC.

Unlike in the Dutch coastal and estuarine zone, the sites available for characterisation are relatively few and far between. The pre-monument occupation at Ascott-under-Wychwood, Oxfordshire, provides one context with formal date estimates probably of the 40th and 39th centuries cal BC (Bayliss *et al.* 2007d); here are *inter alia* domesticated animals, carinated bowls, a leaf arrowhead and a fragment of a probable polished flint axe, from spreads of occupation and especially a more concentrated midden (Benson/Whittle 2007, 27-54).

If monuments other than enclosures – long barrows and simple forms of chambered tombs, perhaps including portal dolmens – can be shown in the future to have been introduced gradually, then *perhaps* the arguments for colonisation are reduced – since there has been a view that we are dealing with coherent packages, which by their alleged, bounded difference are by definition intrusive (*e.g.* Sheridan 2003; 2004; 2007; Pailler/Sheridan forthcoming), and a view that allegedly abrupt and uniformly dated change requires people from the outside (*e.g.* Schulting 2000). If new practices, and – most importantly – the beliefs which they reflected, were taken up gradually and piecemeal (what Julian Thomas (1999) has called cultural *bricolage*), then it becomes attractive to think of on-going processes involving all manner of contacts between continental and indigenous peoples. Some of the adjacent continental coast at least was occupied by long established indigenous people themselves engaged in a slow process of shifting their practices and identities – as the work of Leendert Louwe Kooijmans has shown.

It is immediately striking that our preliminary date estimates for the start of the Neolithic in southern Britain are earliest in southeast England, the area closest to the continent. Is this an argument for immigration, even though it may have been on a smaller scale and led to less rapid spread within England than usually envisaged by supporters of the colonisation model? There need be no question of choosing between colonisation and indigenous change: both probably occurred.

There is instead the challenge of establishing the extent and nature of their roles in the adoption of beliefs and practices from the mainland. Some of these may have echoed an already distant past, like long barrows whose continental precursors have been seen as commemorating LBK longhouses (*e.g.* Bradley 2007, 86-7). Others may have related directly to contemporary practice on the continent, like causewayed enclosures, which have plausible connections with their counterparts in the Michelsberg and northern Chasséen cultures. More precise chronology is beginning to elucidate the transformation of insular societies in this period.

The preliminary nature of the models presented here should be evident, but it is already apparent that we can begin to think in more subtle ways about the temporality of change. From more precisely modelled timings can be derived more precise estimates of duration, and from duration can come tempo. It has been tempting to suggest an overall accelerating tempo of change (Whittle 2007) over these three centuries but there is much that we still have to investigate before this can be established.

There is probably no single tempo of change across this period of three or more centuries in southern Britain. What we have presented above may suggest both gradual change – as in the regional models for the start of the Neolithic – and rapid change – as probably in the first appearance of causewayed enclosures. But these are not absolute contrasts. The first appearance of Neolithic practices in southeast England might have been as abrupt as the first appearance of causewayed enclosures nearly three centuries later. The uptake of both implies that indigenous beliefs and values were open to or ripe for transformation.

As the sample of properly dated long barrows and related monuments is so far so small, we simply do not know whether there are other explosive horizons of rapid innovation; was there, for example, a sudden burst of barrow construction from the late 39th century cal BC? If we can begin to see the possibility of defining the timing and tempo of change at the scale of lifetimes and even generations, region by region, we can also catch sight of the complexity of the wider explanatory tasks ahead.

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Notes

1 The three oak box-framed wells at Erkelenz were first dated as follows: I: wood felled in 5090, well built in 5089; II: wood felled in 5067; III: wood felled in 5050. Subsequent opinion is that II and III can be re-dated to 5057 ± 5 (Weiner 1998).

2 A user-friendly introduction to the principles of Bayesian statistics is provided by Lindley (1985). Buck *et al.* (1996) introduce the approach from an archaeological viewpoint, and Bayliss *et al.* (2007) more specifically provide an introduction to building Bayesian chronologies in archaeology. Details of the mathematical methods involved can be found in a series of papers by Buck *et al.* (1991; 1992; 1994a; 1994b), Christen (1994), Christen/Litton (1995), Nicholls/Jones (2001), Steier/Rom (2000), and in the papers relating to the program OxCal by Bronk Ramsey (1995; 1998; 2000; 2001; in press). Further details of sampling procedures are provided by Gelfand/Smith (1990) and Gilks *et al.* (1996).

3 Presently the uniform distribution is that most often applied to archaeological problems, simply because it is so uninformative. Research is underway, however, into alternative distributions which may be more appropriate in certain archaeological situations, particularly for producing age-depth models for sediment sequences (Christen *et al.* 1995; Karlsberg 2006; Blaauw *et al.* 2007; Bronk Ramsey in press).

4 The criteria for the inclusion of dates in our models for the early Neolithic will be detailed elsewhere (Whittle *et al.* in prep., chapters 12 and 14). But, as an example, the dates on hazelnut shells pits at the Saltwood Tunnel (NZA-20599-NZA-20600) have been included because they contained "plain and decorated Bowl pottery of Whitehawk affinities", whereas an oak charcoal sample from a posthole of a round structure from Penhale Round, with no associated artefacts or domesticated plants or animals, has not.

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4 The end of the beginning: changing configurations in the British and Irish Neolithic

Richard Bradley

4.1 Introduction: from iconoclasm to orthodoxy

It seems as if England has changed its position on the conceptual map of Neolithic Europe; that may not be so true of Scotland, Wales and Ireland. From forming an extension of Germany, France, Belgium and the Netherlands, England has shifted to the north, so that the first farming communities seem to be closer to those in Scandinavia. How did this change come about? And what are its implications? The new framework raises important questions of interpretation, but it also depends on a specific reading of Neolithic chronology. Those two aspects will be the subject of this paper. The relationship between them has been a concern of Leendert Louwe Kooijmans throughout his career in archaeology and is therefore a fitting subject for this contribution to his festschrift.

My starting point is Julian Thomas's *Rethinking the Neolithic* (Thomas 1991). This was an important book for it set out with exceptional clarity the ways in which the English Neolithic seemed to depart from views of the period that had been formed in the preceding decades. It developed out of a journal article 'Neolithic explanations revisited' which questioned Humphrey Case's account of the first farmers in Britain and Ireland (Thomas 1988; Case 1969). Eight years later Thomas's argument was amplified in a second edition, *Understanding the Neolithic* (Thomas 1999). The change of title was significant, suggesting that what had begun as a work of iconoclasm was becoming an orthodoxy. It also suggested that the English Neolithic typified wider developments in Britain.

Thomas emphasised a number of anomalies in the archaeology of the Early Neolithic period. Contrary to expectations, there was little evidence for the growing of crops on a significant scale, and wild plants made a major contribution to the food supply. There was evidence for the raising of domestic livestock, but there were few traces of houses. The excavated evidence suggested a mobile pattern of settlement. Most occupation sites were characterised by pits and small scatters of artefacts, and finds of carbonised plants were dominated by wild species. The implication was clear; the British Early Neolithic shared certain features in common with the Late Mesolithic period and there may have been some continuity in the pattern of movement about the landscape.

Thomas's 1988 paper carried the subtitle 'the Mesolithic-Neolithic transition in Britain and South Scandinavia' and compared the archaeological sequence in Britain with that in Northern Europe where, he suggested, a new way of life and a new system of belief were introduced across the agricultural frontier through archaeologically documented contacts between hunter gatherers and farmers. Thomas proposed that Britain may have 'become Neolithic' through a similar process of acculturation. During the early part of this period the settlement pattern was based on mobility and perhaps on the herding of domesticated animals. Cereals were of limited importance, and settlements were usually short-lived. At the same time, rituals of Continental inspiration assumed a growing significance, and changing beliefs were documented by the construction and use of monuments (Bradley 1998). It was an influential model, although it was not accepted by everyone (Monk 2000; Rowley-Conwy 2004).

These ideas were consistent with the results of fieldwork in southern England, for example in the Thames Valley (Hey/Barclay 2007), but the model put forward by Thomas was soon extended to other parts of Britain and even to Ireland. This interpretation provoked a critical reaction. One factor was the emphasis that has always been placed on the archaeology of Wessex. It is true that the latter area contains some exceptionally large monuments such as Avebury and Stonehenge, but it has also had a long history of investigation that began two hundred years ago. A large proportion of the results have been published. The process continued into the twentieth century as Wessex became the focus for a series of research excavations, like those at Windmill Hill and Durrington Walls. This is why so many British type sites are located in the south, but there is no reason to suppose that they epitomise developments in other parts of the country.

English archaeologists were careless in supposing that whatever happened in the rich and complex archaeology of Wessex must have typified the pattern of development throughout Britain and Ireland: the view taken by Richmond (1999), Pollard (1999) and Waddington (2000), among others. That interpretation is being questioned at a time when Scotland and Wales enjoy a measure of political autonomy. In particular, Scottish prehistorians have objected to the way in which a model developed in Wessex reflect a conception of the north as a peripheral area cut off from significant trends in society (Barclay 2001). Irish archaeologists have expressed the same reservations, for this notion reproduces, however unconsciously, the idea that Ireland has always been a dependency of Britain (Cooney 2000, chapter 1).

The reservations have been supported by newly-discovered archaeological evidence. Although few Neolithic houses had been found in Ireland when Thomas was writing in 1991, the situation soon changed, and as the number of developer-funded excavations increased, many more Neolithic buildings were found there (Grogan 2004). Similarly, a new generation of fieldwork in Scotland, particularly in lowland areas, led to the discovery of massive wooden structures ('halls') dating from the Neolithic period (Barclay *et al.* 2002). This new fieldwork also identified a number of timber and earthwork monuments that had not been recognised before. In the same way, houses of Irish type are now being found in the west of Wales. Yet few timber buildings have been discovered in southern England despite the expansion of commercial archaeology. It seems as if the archaeology of Wessex may have been exceptional.

4.2 Dating the Neolithic

Although Thomas had compared the British Neolithic sequence with that in Northern Europe, he did not discuss an important contrast between the archaeologies of those regions. Studies of pottery and axes in South Scandinavia have established a detailed chronological sequence (Malmer 2002), but this has yet to be achieved in Ireland and Britain. Either material culture changed at a slower pace in these islands or the most important sources of variation have still to be identified. At the same time, there are few deep stratigraphic sequences covering the Neolithic period to be compared with those that Leendert and his colleagues have studied in the Netherlands. The pioneering work of Grahame Clark at sites like Shippea Hill provides a model that has rarely been followed in England (Clark *et al.* 1935). Thus the two traditional mainstays of chronology – typology and stratigraphy – were deficient for the British Neolithic.

On the other hand, two important initiatives have improved our understanding of the Neolithic sequence in Britain and Ireland. The first is the use of single entity dating. Rather than amalgamating material of different species or ages, archaeologists have submitted individual seeds or bones to radiocarbon laboratories. Now it is possible to select small samples such as twigs where no allowance needs to be made for the presence of old material (Ashmore 1999). In addition, many more radiocarbon dates have been obtained from individual contexts where single determinations would have sufficed a generation ago. The use of AMS dating is becoming standard practice in commercial archaeology and has been encouraged by research projects in Scotland and Ireland. In England, the new approach has been extended by the use of Bayesian statistics which allow stratigraphic observations made in the field to influence the probability distributions of radiocarbon dates (Bayliss *et al.* 2007; see also Bayliss *et al.* this volume). In each case the result has been a significant improvement in chronological precision. This work has also influenced artefact studies so that certain styles of pottery are more exactly dated than had been the case ten years ago. The advance in dating has had two implications for understanding the Early Neolithic. Some of the features discussed in *Rethinking the Neolithic* have proved to be rather later in date than could have been imagined when the book was written. While other elements do belong to the first few centuries of the Neolithic period, they predate nearly all the material considered in Thomas's account.

4.3 Changing configurations

When Thomas was writing in the 1990s the clearest distinction in English archaeology was between an *Earlier Neolithic* and a *Later Neolithic*, although a threefold division could be observed in the development of ceramic styles (Gibson 2002). It meant that it was not really possible to distinguish between the chronologies of different forms of monuments or to relate them to the development of settlements or the natural environment. It seemed likely that the Neolithic period started around 4000 BC and that most long mounds, long cairns, causewayed enclosures and flint mines could be assigned to the period between the early fourth millennium and about 3300 BC (Malone 2001). What were lacking were more exact distinctions, and even today detailed regional sequences have been postulated for only two areas: the chalk downs around Avebury (Whittle 1993), and the Upper Thames valley (A. Barclay in Benson/Whittle eds 2007, 331-44). For the most part the anomalous features that Thomas had identified in the Earlier Neolithic period – in particular the evidence for mobility and the importance of monument building – seemed to characterise this phase.

Radiocarbon dating has shed new light on his scheme (Whittle *et al.* 2008; see also Bayliss *et al.* this volume). Somewhat unexpectedly, it suggests that in many parts of Britain and Ireland the beginning of the Neolithic did represent a radical break with the Mesolithic period. It had features in common with developments in Continental Europe and was characterised by a sudden change of diet, the adoption of domesticated resources, the construction of substantial houses and by the use of quarries and flint mines. This initial phase lasted approximately three hundred years (Sheridan 2007; Bradley 2007, chapter 2), and it is not clear how many monuments were constructed during that time. By contrast, most of the features that Thomas and other writers had attributed to the beginning of the Neolithic period actually developed *after 3700 BC*. They were not confined to the south of England and take a similar form in most parts of Britain and Ireland. All the elements discussed in Case's account of the agricultural colonisation of Britain and Ireland seem to be present in the earliest phase. Paradoxically, those features that Thomas had linked with a mobile economy are apparent several centuries later.

4.4 Rethinking the Neolithic sequence

The main characteristics of the earliest Neolithic period are the construction of substantial timber buildings (Darvill/Thomas 1996), the growing of crops (Bogaard/Jones 2007), the accumulation of substantial middens (Allen *et al.* 2004), forest clearance (O'Connell/Molloy 2001), and the large scale production of axes (Barber *et al.* 1999). In coastal areas there is also evidence for a reduction in fishing and for greater use of terrestrial resources (Richards 2004). There is nothing to indicate a gradual process of colonisation, as the earliest dates for Neolithic material culture come from most parts of these islands. Indeed, there is little evidence for the use of local styles of pottery during this initial phase (Sheridan 2007).

Some features are found very widely. There is evidence for forest clearance on a larger scale than had happened during the Mesolithic period. This may have been responsible for the rapid spread of disease. The Elm Decline, which is thought to result from that process, has a mean date of 3940 BC (Parker *et al.* 2002). It was around the same time that the cyclical burning of vegetation ceased, perhaps because land remained open for longer periods (Edwards 1998). Cereals are common within this early phase, and the oldest samples documented directly by radiocarbon date from about 4000 BC (Brown 2007).

Of course certain features occur over a smaller area than others. Substantial timber buildings are found mainly in Ireland and Scotland, although they differ in construction (Grogan 2004; Barclay 1996). The Irish houses share features with a small number of examples in Wales and England. Indeed, the rarity of well preserved houses in the latter area may be another regional pattern, for there are hints that domestic buildings did not employ earth-fast posts; the positions of these features are indicated by gaps in the distribution of excavated pits (Bradley 2007, 44); a good example is at Kilverstone (Garrow *et al.* 2005). Other patterns are still more local. Substantial middens associated with cereals and the bones of domesticated animals are recorded from the Thames valley and its hinterland (Allen *et al.* 2004). The only Neolithic field system so far identified is in the west of Ireland and may also date from this time (Molloy/O'Connell 1995). Similarly, those flint mines that have been assigned to the beginning of the Neolithic period were all on the Sussex downs, although it is possible that axes were made at highland quarries during the same phase (Barber *et al.* 1999).

4.5 Subsequent developments

Thirty years ago I suggested that some of the clearings created at the beginning of the Neolithic period reverted to woodland after several centuries (Bradley 1978, 105-6). The same idea was proposed, quite independently, by Alasdair Whittle (1978), but both our studies were criticised by Kevin Edwards because they lacked chronological precision (Edwards 1979). Edwards's comments were justified, but it is interesting that substantially the same idea has been advanced by pollen analysts working in Ireland (O'Connell/Molloy 2001). Their argument is more sophisticated, but its conclusions are similar and are based on a radiocarbon chronology. Throughout the island an early peak of land clearance provides evidence for cereal cultivation, but the same areas eventually reverted to woodland or were used less intensively. Once that had happened there is less evidence for the growing of crops in Ireland, and more indications of pasture. The pollen evidence from Britain needs to be studied in the same way, but it is already clear that finds of carbonised cereals become less common during the course of the Neolithic sequence (Brown 2007).

Archaeologists working in Ireland and Scotland have emphasised the discovery of timber houses and other buildings which are commonly associated with finds of grain (Barclay 1996; Monk 2004). So many examples have been found in Ireland that it is difficult to postulate a mobile pattern of settlement (Cooney 2000). The Scottish 'halls' pose other problems, for some of them, like the well excavated example at Claish (Barclay *et al.* 2002), share structural elements in common with the earliest monuments in the north (Thomas 2006). Again this evidence is confined to the beginning of the Neolithic period. After that time there are not many regions in which well preserved houses or settlements have been found.

Most of the occupation sites discussed by Julian Thomas seem to be later in date than the timber buildings excavated in recent years. In fact they date from a period from about 3700 BC onwards when settlement evidence is sparse. Thomas emphasises the special role played by pits which often contain formal arrangements of artefacts and animal bones, but even here there is a problem for it seems as if the earliest deposits of this kind were placed in the hollows left by fallen trees. At Eton in the Middle Thames Valley they are contemporary with the creation of large middens. There the digging of pits happened during a later phase (Allen *et al.* 2004; see also Evans *et al.* 1999). By that time few domestic buildings left obvious traces behind. The excavation of the pits has provided evidence for the collection of wild plants (Robinson 2000).

Thomas's radical view of the English Neolithic also emphasised the role of stone and earthwork monuments, many of which had parallels in Continental Europe. For that reason it was entirely logical to suppose that their construction began during the period of close contacts with the mainland at the end of the fifth millennium BC or the beginning of the fourth. That is probably true of the earliest megalithic monuments around the Irish Sea (Sheridan 2003; Bradley 2007, 49-50), but it no longer seems as if the structures discussed in *Rethinking the Neolithic* date from this early phase. A detailed study of the chronology of southern English long barrows concluded that the earliest examples were built during the 37th century BC, even though they were constructed in areas with evidence of earlier occupation (Whittle *et al.* 2007). Most of the earthwork enclosures were built a century or more afterwards (Whittle *et al.* 2008; see also Bayliss *et al.* this volume). Cursus monuments, which were an entirely insular phenomenon, most probably developed in Scotland in parallel with both these traditions (Thomas 2006). The examples that have so far been excavated in England are later in date than causewayed enclosures and sometimes cut across them, as they do at Etton and Fornham All Saints (Bradley 2007, 76-7).

The effect of these changes is not to weaken the patterns identified in *Rethinking the Neolithic*, but to suggest a different chronology for these developments. Many monuments were constructed at a time when settlement sites left little trace and domestic buildings were surprisingly insubstantial. Some areas may indeed have been characterised by a mobile pattern of settlement, and stock raising could have provided much of the food supply. There is no evidence of field systems, and fewer finds of cereals than might have been expected. Rituals involving the deposition of selected artefacts in pits do seem to have been important and are evidenced on a more public scale at causewayed enclosures like Windmill Hill (Whittle *et al.* 1999). The past was important too, and the countryside was increasingly dominated by conspicuous monuments to the dead. It seems quite reasonable to suggest that they were among the fixed points in a landscape where communities were often on the move (Edmonds 1999).

These features no longer seem to characterise the beginning of the Neolithic period. In terms of ceramic chronology they are a feature of the *Middle Neolithic*. The *Early Neolithic*, on the other hand, has assumed a distinctive character of its own, for this was when cereal farming was introduced to Britain and Ireland. Its adoption was more rapid than many scholars had supposed and is reflected by important changes in the pollen record. Moreover, the significance of the new economy is clearly illustrated by recent discoveries in Ireland where substantial houses were built for the first time (Grogan 2004). Here recent work in County Mayo has identified what must be the oldest system of field walls anywhere in Europe (Molloy/O'Connell 1995). These discoveries are consistent with what had been expected since the writings of Piggott (1954) and Case (1969). What was not envisaged was that after a few generations these developments appear to have faltered. The anomalies that Julian Thomas recognised in the insular record were a secondary development.

4.6 Conclusion: from orthodoxy to uncertainty

If the new dates have the implications suggested in this paper, the British and Irish Neolithic is more conventional, and the same time more anomalous, than had originally been supposed. It is more conventional because it began in the way that had always been suggested, with a period of sustained forest clearance, cereal cultivation and sedentary settlement. In that respect it is no longer appropriate to draw close comparisons with South Scandinavia, for the evidence for long term contacts between hunter gatherers and farmers is actually very slight. There is little to suggest a prolonged period of acculturation of the native population (Rowley-Conwy 2004).

On the other hand, the comparisons with Northern Europe would never have been made if such developments had continued without interruption. There would be no need to look for a Mesolithic background to the insular Neolithic if the new economy had maintained its initial impetus. But that did not happen, and the expansion of settlement that started around 4000 BC seems to have been curtailed after approximately three hundred years. There is less to indicate a sedentary pattern of occupation, the role of cereals may have diminished, and, instead of substantial houses and related structures, more specialised monuments were built. These are the features that gave the British and Irish Neolithic such a distinctive character. They pose an entirely new problem – why did this change occur?

It seems unlikely that there was a single cause. As long ago as 1971 Don Brothwell expressed doubts whether the expansion of farming communities would have continued for very long before their progress was checked by the spread of disease, soil erosion and the exhaustion of the land (Brothwell 1971). Other possibilities include climatic change, for the colonisation of these islands may have taken place in a period of warmer conditions. Bonsall and his colleagues argue that it encouraged the expansion of farming into new areas (Bonsall *et al.* 2002). If so, it is possible that this process was checked as conditions deteriorated during the 37th and 36th centuries B.C. (Macklin *et al.* 2005; Whittle *et al.* 2007, 135).

Other problems may have affected the earliest farmers in Britain and Ireland. Petra Dark and Henry Gent (2001) have made the interesting suggestion that the first cereals were exceptionally productive because they were protected from crop pests. Local predators would have taken some time to adapt to the new species, and there was an interval before others could extend their distribution from the Continent to these islands. This argument not only implies that the first crops were less prone to disease; it also suggests that they would have become more vulnerable over time.

Social factors may have been equally significant. If the earliest Neolithic period was a time of rapid expansion, that process could have led to conflicts over territory and other resources. Tensions could have developed between new settlers and the indigenous population, and there may have been other conflicts over rights to productive farmland. It has long been suggested that this is one reason why collective tombs were built: perhaps they emphasised claims to critical resources (Chapman 1981). Some of the bones found at these monuments show signs of injuries caused by arrows and clubs (Schulting/Wysocki 2005). There are also indications that a small number of enclosures were attacked and destroyed, including Carn Brea and Hambledon Hill (Mercer 1999). At present it is difficult to decide whether violence was common at this time or whether its occurrence was limited to particular areas. At all events it is obvious that during the Middle Neolithic period Britain and Ireland lost much of their original cohesion. Artefact styles, particularly those of decorated pottery, assumed an increasingly regional character, and the same is true of the monuments (Malone 2001).

This paper has traced the interplay between chronological studies and interpretations of the process by which farming communities were established in Britain and Ireland at the start of the fourth millennium BC. It has contrasted two very different models, each of which possesses a certain coherence. But only one of them can be right. The decisive evidence is provided by radiocarbon dating, a technique which has been employed with increasing sophistication during recent years. As Leendert's research has shown, the progress of prehistoric archaeology depends on establishing a reliable chronology, for it is through a detailed understanding of sequence that interpretations of the past will succeed or fail. If iconoclastic arguments eventually change into orthodoxies, the collapse of those orthodoxies often leaves a void. That is the point at which studies of Neolithic Britain and Ireland are now, and it is why they must be taken much further in the future.

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5 The Danubian-Baltic Borderland: Northern Poland in the fifth millennium BC

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5.1 Introduction

The establishment of agricultural communities in the basins of the major northward-flowing rivers of continental Europe late in the sixth millennium BC brought farmers into contact with indigenous foraging populations along the southern margins of the North European Plain. For over a millennium, during the fifth millennium BC, the edge of the territory populated by farmers hardly advanced further. While some might call this a frontier (Bogucki 1996), in truth the North European Plain was more of a borderland between the farming communities of riverine interior central Europe and the foragers of the Baltic and North Sea coastal zones. The goal of this essay is to explore the nature of the contacts between foragers and farmers across the part of this borderland that falls between the Oder and the Vistula basin, in the territory of modern Poland.

The application of the term 'borderland' to areas lying along the lower Rhine and Maas rivers can be attributed to Leendert Louwe Kooijmans in the 1970s (Louwe Kooijmans 1976), and it has been a recurring theme in his writing since then (*e.g.* Louwe Kooijmans 1993; Louwe Kooijmans 2005a). It encompasses far more than 'forager-farmer interaction' for it is fundamentally a geographical concept that recognizes that the spatial patterning of forager activity and farming settlement defines the nature of their relationship. Leendert's thoughtful reflections on the Neolithic borderland along the lower Rhine and Maas have stimulated my thinking for nearly three decades, and it is with sincere gratitude that I acknowledge my intellectual debt to him.

The chronological focus of this paper is the fifth millennium BC. As such it follows the initial Linear Pottery (*Linearbandkeramik* or LBK) expansion of farming settlements of the sixth millennium BC and predates the great transformation of the foraging societies of southern Scandinavia and the British Isles that occurred around 4000 BC. Contacts during this millennium between the farming communities of central Europe and the foragers of northern Europe have been discussed before. Fischer (1982; Pedersen *et al.* 1997) pointed out the many shaft-hole axes of central European origin in forager contexts in northern Germany and Denmark, while Klassen (2000, 2004) has renewed this discussion with the identification of other exotic products in southern Scandinavia, particularly jadeites axes from central Europe. Most recently, Zvelebil (2006) has discussed the external contacts of late foraging societies in the Baltic basin. Much of the focus of this discussion has been on the exotic Neolithic items that occur in Mesolithic southern Scandinavia. My goal here is to examine the borderland in the Polish lowlands between 5000 and 4000 BC as a two-way street, particularly from the vantage point of my own research on the southern edge of this area.

5.2 The Danubian world and the Baltic world

Northern Poland, the area lying above 52º N on the North European Plain, was part of two 'worlds' during the fifth millennium BC (fig. 5.1). By 'worlds' I mean distinctive cultural spheres within which intensive interaction produced commonalities in material culture and by extension in cultural practices and values. This construct is not original, and the reader will quickly recognize echoes of V. Gordon Childe's division of European Neolithic cultures into 'Danubian' and 'Northern' (Childe 1949). Here, I propose to differentiate between the 'Danubian World' and the 'Baltic World', both retaining and updating Childe's terminology but also extending it to include the late foraging populations of the Baltic basin and to use it as a way to characterize the frontier between foragers and farmers on the North European Plain. The distinctiveness of these 'worlds' was ephemeral, however, and here they really appear only in the sixth and fifth millennia BC before blending together. Thus the usage here is more limited that that of Childe.

The Danubian World was inhabited by the earliest farmers of riverine interior central Europe, beginning in the middle of the sixth millennium BC. Childe's Danubian terminology was criticized and fell into disuse on the grounds that these Neolithic cultures, the most prominent being the Linear Pottery culture, were found in areas outside the Danube drainage. Yet Childe had it right, for it is impossible to discuss these societies without reference to their initial dispersal into interior central Europe along the Danube corridor and its tributaries. Thus, even though the subsequent Neolithic societies of the fifth millennium BC may have developed locally, there remained a common heritage that connected them to their Danubian roots.

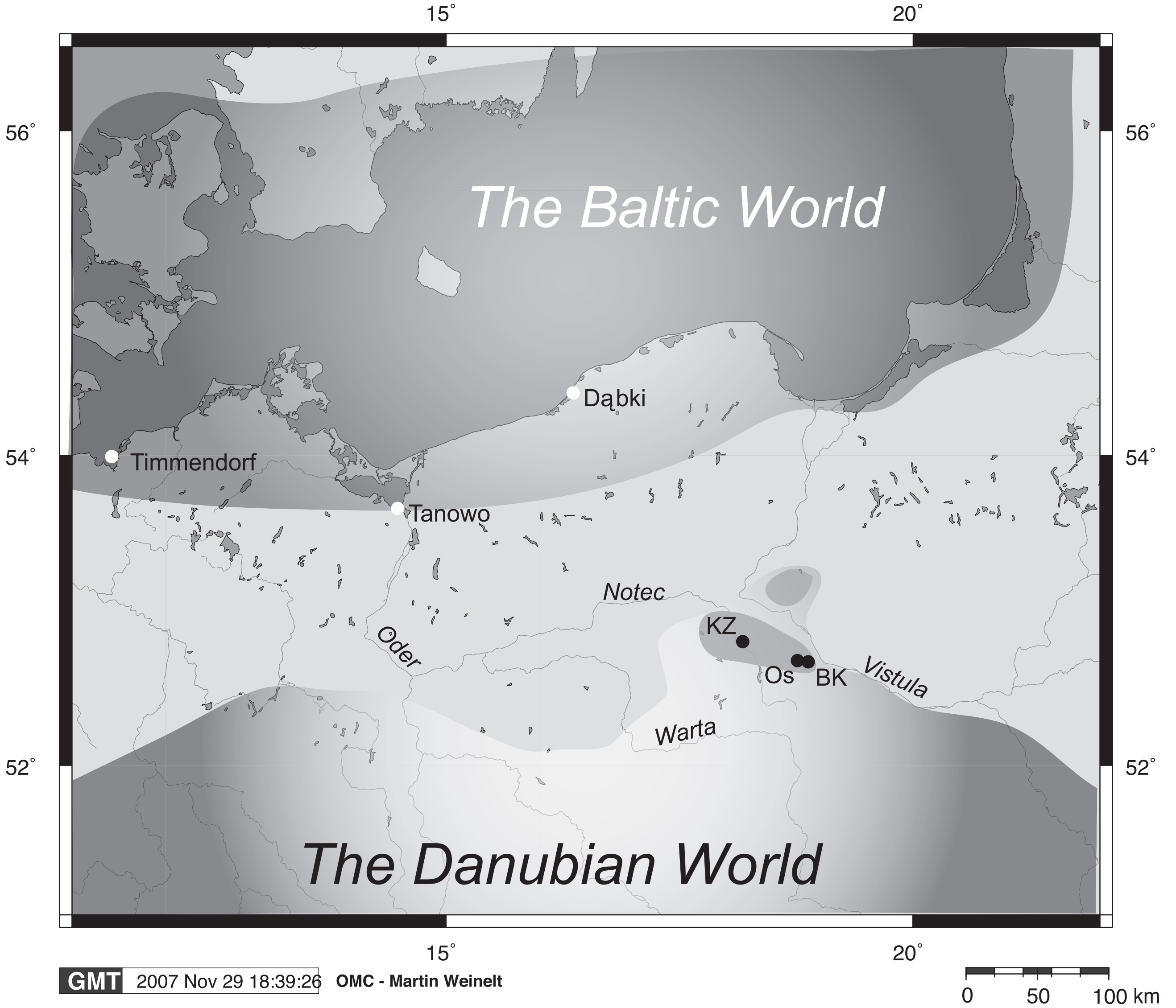

Figure 5.1 Map showing the proximity of the Danubian and the Baltic Worlds during the fifth millennium BC. Areas of Neolithic settlement in Kuyavia and the Chełmno Land are highlighted, along with major sites mentioned in text.
BK – Brześć Kujawski
KZ – Krusza Zamkowa
Os – Osłonki

This heritage is manifested in several ways in the archaeological record, the most visible of which involves longhouse architecture. Whether rectangular or trapezoidal, longhouses are a specifically Danubian signature during the sixth and fifth millennia in temperate Europe. A developmentally-coherent ceramic tradition is another characteristic, for it is possible to trace the evolving ceramic styles in interior central Europe between *c.* 5500 BC to 4000 BC with no major discontinuities, despite the fact that the beginning and ending states in any particular region might look very different. Stone tool technology is also developmentally coherent in the Danubian World, as are all other technological systems. The mature farming economy of interior central Europe late in the fifth millennium BC is clearly built upon earlier farming and stockraising practices.

The Baltic World during the sixth and fifth millennia BC was inhabited by foragers, specifically the Ertebølle culture and its congeners in the southwest Baltic basin but also by other Mesolithic peoples outside the southern Baltic basin. Over the last several decades, the astonishing cultural variability of the Baltic World has come to light, with the discovery not only of cemeteries containing elaborate burials but also of submerged and waterlogged settlements that reveal a complex technology beyond that preserved on terrestrial sites and a rich repertoire of decorative motifs. Of particular relevance here is the evidence for increased sedentism on one hand as reflected in settlements and burials and the technology for increased mobility on the other as reflected in watercrafts.

Agriculture did not come to the Baltic World until about 4000 BC. Thus, for about 1500 years, a borderland existed between the Danubian World, whose northernmost outposts were along the lower Vistula and lower Oder rivers, and the Baltic World, where settlement was primarily coastal. In many respects, this borderland bears a superficial similarity to the situation in the Netherlands during roughly the same period (Louwe Kooijmans 1993; 2005b), in which the Danubian settlements of the Limburg loess were separated from the forager settlements at the mouth of the Rhine and Maas by about 90-100 kilometres. The intervening zone was not particularly attractive to the early farmers nor did it attract the foragers to settle for long periods. But people did move through it, and eventually the worlds of the farmers and the foragers connected. This happened in northern Poland as well.

5.3 The Brześć Kujawski group

The principal representative of the Danubian World on the lowlands of northern Poland during the fifth millennium BC was the Brześć Kujawski Group of the Lengyel Culture, a descendant of the Linear Pottery Culture of the previous millennium. Settlements of the Brześć Kujawski Group are found primarily in the region known as Kuyavia, a low plateau between the two major glacal meltwater valleys that run east-west across the North European Plain anchored by the modern cities of Włocławek, Inowrocław, and Toruń and by the Gopło and Pakość finger lakes. It is a landscape of meandering streams in the remnants of subglacial channels, and lakes formed in glacial relic features. To the west of Lake Pakość, a settlement of the Brześć Kujawski Group is known at Biskupin. Recently, settlements of the Brześć Kujawski Group have been found north of Toruń (Czerniak *et al.* 2003), confirming their presence in an area that had been the scene of intensive Linear Pottery occupation during the previous millennium.

The Brześć Kujawski Group is dated between 4700/4600 and 4200/4100 cal BC, clearly persisting for several centuries. Its principal settlements include Brześć Kujawski (Jażdżewski 1938; Bogucki/Grygiel 1983), Krusza Zamkowa (Czerniak 1980; 1994), and Osłonki (Grygiel/Bogucki 1997; Grygiel 2004; 2008), but since 1990 many more settlements have been discovered, especially through aerial reconnaissance (Rączkowski *et al.* 2005). The discovery of so many new settlements indicates that Kuyavia and adjacent areas were fairly thickly settled during the fifth millennium BC rather than being the setting for a handful of several very large farming settlements separated by zones inhabited by deer, wild pigs, and hunter/gatherers.

Settlements of the Brześć Kujawski Group share a number of common features. The most visible is the presence of longhouses 20-30 metres long, narrow at the northern end and wide at the southern end (fig. 5.2). Many of these longhouses contain a single interior pit, oblong in plan and offset east of the central axis in the center of the house, whose function is unknown. Outside the longhouses are large irregularly shaped pits whose original function was to provide the clay for plastering the houses and which subsequently were filled with rubbish. Other pits were used for storage and eventually rubbish disposal. Among the longhouses are also graves, often in groups of 2-5 individual grave pits, occasionally double burials, in which the skeletons are typically (but not always) placed in a contracted position with their heads pointing toward the south and with men lying on their right side and women on their left. Grave goods include antler T-axes in some male graves and copper and shell ornaments in some female graves.

The economy of the Brześć Kujawski Group was decidedly agricultural. Crops included wheat and barley, along with weed taxa characteristic of arable fields (Bieniek 2002). The animal economy was almost entirely based on domesticated animals, with the hunting of wild mammals playing a subsidiary role (Bogucki 2008), although fishing, fowling, and turtle-catching were routine activities. On most sites, cattle were the most common species, followed by sheep and goats, with goats generally outnumbering sheep among the specimens that could be assigned to species. Pigs account for about 10-30% of each sample of mammal bones. In addition to deer and wild pigs, beavers were hunted for their pelts and almost certainly their meat (see Coles 2006: 55 for a discussion of the meat and fat yield of beavers.).

The settlements and economy of the Brześć Kujawski Group reflect its Danubian heritage. Although the longhouses are trapezoidal rather than rectangular in plan, they clearly use similar construction techniques, and the settlements are organized very similarly to the classic Linear Pottery settlements of the previous millennium. Ceramics and stone tools can be clearly traced to Danubian roots. The suite of crops is clearly in the Danubian tradition, as is the suite of livestock, although the Brześć Kujawski Group represents

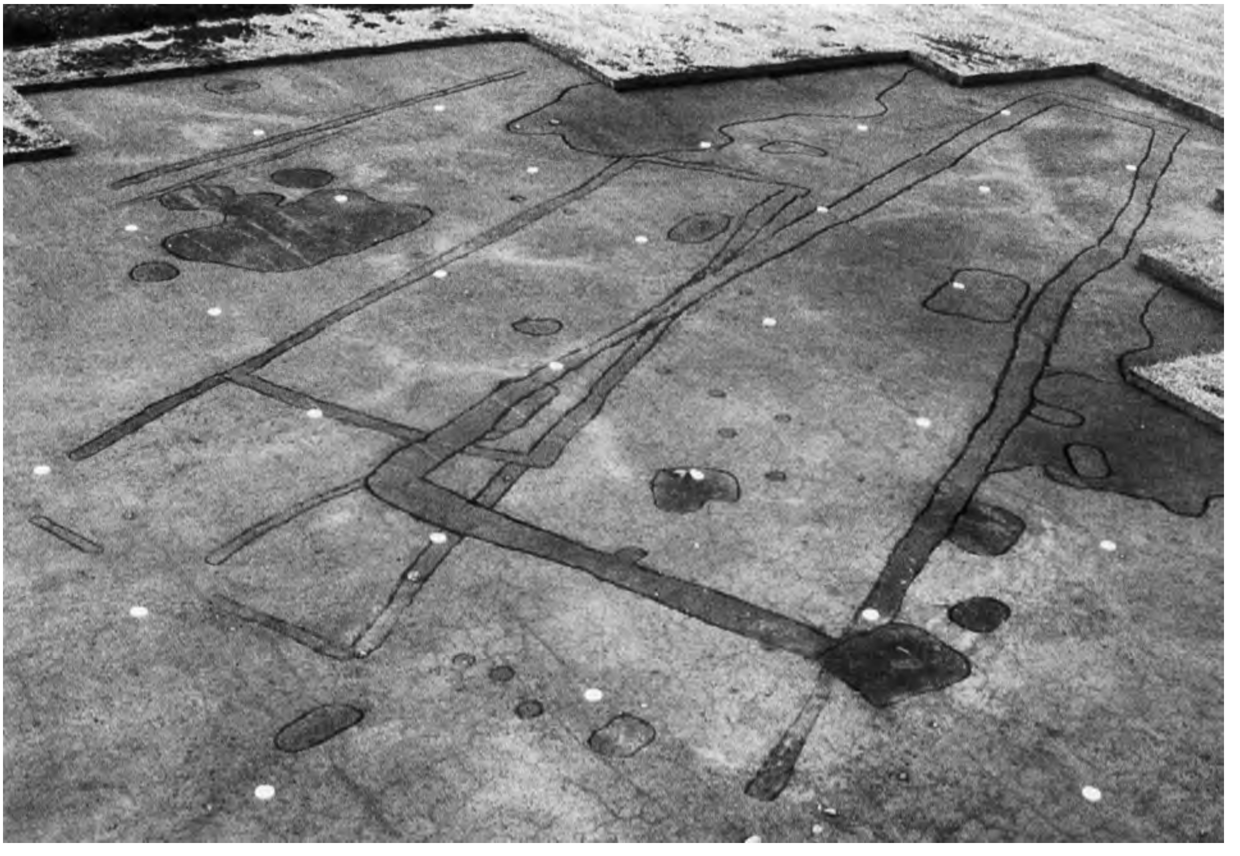

Figure 5.2 Longhouses of the Brześć Kujawski Group at Miechowice (Photo by Ryszard Grygiel; used with permission). Dots form a 5-meter grid.

a development from the cattle-dominated Linear Pottery animal economies toward a more mature diversified animal economy. In the burial rite, there is some divergence from the Linear Pottery practice of burying the dead in cemeteries set apart from the residential areas, although settlement burials are indeed also known from Linear Pottery sites and thus the Brześć Kujawski Group's practice of settlement burial is not entirely novel.

5.4 The Ertebølle foragers

The inhabitants of the southwestern part of the Baltic World during the fifth millennium BC are familiar characters in European prehistory, known from the kitchen middens of northern Jutland, the cemeteries of Zealand and Scania, and the submerged and waterlogged sites in and along lagoons and bays that collectively define the Ertebølle culture. There is no 'typical' Ertebølle site, and the variability and richness of Ertebølle finds continually bring new surprises and delights. Innovations such as industrial-scale fish trapping facilities, a diverse inventory of equipment for exploiting the maritime and terrestrial habitats, new approaches to mortuary ritual, and an interest in the decorative arts all testify to communities that were inventive, curious, and creative.

An important development over the last 20 years has been the discovery of a robust and sustained Ertebølle presence on the northern coast of continental Europe during the sixth and fifth millennia BC. Settlements with artifacts that fall within the range of variation of Ertebølle finds have been found along the southern Baltic coast in northeastern Germany and northern Poland (Czerniak/Kabaciński 1997; Ilkiewicz 1997, Kabaciński 2001; Lübke 2002; Lübke/Terberger 2002; Kobusiewicz 2006; Terberger 2006; Schmölcke *et al.* 2006 among others). Many of these sites are now submerged due to rising postglacial sea levels. Others lie in estuarine habitats now close to the coast but which were some distance inland during the fifth millennium BC.

Sites like Timmendorf-Nordmole in the Wismar Bay have yielded a large inventory of Ertebølle wooden, bone, antler, stone, and ceramic artifacts (*e.g.* Lübke 2002; Hartz/Lübke 2006). About 120 kilometres to the east, this presence is reinforced by additional Ertebølle sites on the island of Rügen and the adjacent mainland (Lübke/Terberger 2002). These finds are solidly dated to the fifth millennium BC and situate a significant Ertebølle community only 80 kilometres from the mouth of the Oder river, a major communication route into the interior of the North European Plain that connected with major rivers of north-central Poland including the Warta and the Notec. Indeed, there is potential evidence for Ertebølle settlement along the Oder estuary at the site of Tanowo 3 (Galiński 1992).

Finally, there is the site of Dąbki, located on the Polish Baltic coast about 200 kilometres east of Rügen. Excavations in 1979-1985 and beginning again in 2004 have revealed a late Mesolithic settlement dated to the fifth millennium BC that has yielded Ertebølle-type pottery and an array of other Ertebølle-type artifacts including antler T-axes (Ilkiewicz 1989). The significance of Dąbki was slow to be appreciated, but it is now clear that it marks a definite Ertebølle presence on the northern coast of Poland, reinforced by the nearby site of Koszalin-Dzierżęcino 7 (Ilkiewicz 1997, Kobusiewicz 2006).

Thus, during the fifth millennium BC, the fires of Ertebølle camps were visible all around the western Baltic along the shores of its bays, estuaries, and straits. It is only a matter of time before more Ertebølle settlements come to light along the Pomeranian coast of northern Poland and its adjacent seabed. The next 20-30 years will surely bring new revelations. For now, however, it is clear that there was an Ertebølle presence along the southern Baltic coast throughout the fifth millennium BC, separated by 200 kilometres from the Danubian settlements in Kuyavia. What might have happened across this distance during the fifth millennium BC?

5.5 Baltic Mesolithic elements in the Brześć Kujawski group

Evidence of contact between the Baltic and the Danubian Worlds across the 200 kilometres that separated them can be seen in the appearance of elements that could be argued to be fundamentally Mesolithic at sites of the Brześć Kujawski Group. Foremost among these are antler axes, often considered to be something that the Ertebølle foragers picked up from the Danubian farmers but which have no visible Danubian roots, the practice of geometric decoration on bone, and the production of chisels on the metatarsals of ungulates.

5.5.1 T-Axes (Antler-Beam Mattocks)

One of the most characteristic artifacts of the Brześć Kujawski Group are the antler beam mattocks, also known as ‘T-axes’ due to their presumed appearance when hafted through a hole drilled where a tine was removed (fig. 5.3). These are commonly found in male graves, and a pit containing manufacturing scrap and repaired axes excavated at Brześć Kujawski in 1982 points toward their production on-site and also their use in everyday activities (Grygiel 1986; Grygiel/Bogucki 1990). A skull of an old sheep excavated at Osłonki has a round hole 43 mm in diameter punched in the side, and it is tempting to suggest that an antler T-axe is the only implement that would have had the density and circular profile to punch a hole so cleanly in this skull (Bogucki 2008).

Antler T-axes are confined to the southern and western areas of the Ertebølle settlement. It seems to be an article of faith that the T-axe represents an introduction to the Baltic World of a Danubian artifact type (interestingly, along the coast of the southern North Sea, this type is often seen as having a Mesolithic derivation; see paper by Crombé and Sergant in this volume which views the T-axe as evidence for continuity between Swifterbant and Michelsberg). Specific Danubian analogs are usually not put forth, but often the fact that T-axes have been found at sites like Hüde am Dümmer in northern Germany (Deichmüller 1974; Kampffmeyer 1983) is sufficient to infer a bridge to the Danubian World. Andersen (1973, 36 reprinted 2002) referred to them as a ‘western’ form, although subsequently (1998) he characterized them as evidence of contact with ‘north Continental Europe’. Klassen (2002) points to their ‘wide European distribution’ as reflected in the map published by Zvelebil (1994, fig. 5) as evidence of their derivation from the Danubian World.

Yet antler T-axes are not a Danubian Neolithic form. The ones reported from sites in the Danube basin, as mapped by Zvelebil in 1994, are from Mesolithic contexts such as Lepenski Vir. The farmers of the Linear Pottery culture of the sixth millennium BC, and their Danubian descendants of the fifth millennium BC, did not typically make antler T-axes. This is not to say that the Danubian Neolithic people did not use antler as a raw material, but rather simply that they did not characteristically make the T-shaped antler beam mattocks. The only place in the Danubian World where antler T-axes were habitually made and used is in Kuyavia during the fifth millennium BC.

The T-axes or antler beam mattocks are a distinctly northern form, found both in the Baltic World and in the lands along the southern and eastern coasts of the North Sea. Many are found in the Netherlands and Belgium, notably at Spoolde (Clason 1983), Hardinxveld (Louwe Kooijmans 2004, 615), and along the lower Scheldt (Crombé/Sergant this volume), while in Germany an undated deposit has been found in the Leine river near Hannover (Riedel *et al.* 2004), plus the examples from Hüde am Dümmer have already been mentioned. But during the sixth and fifth millennia BC, they are most ubiquitous at sites of the Ertebølle culture in the

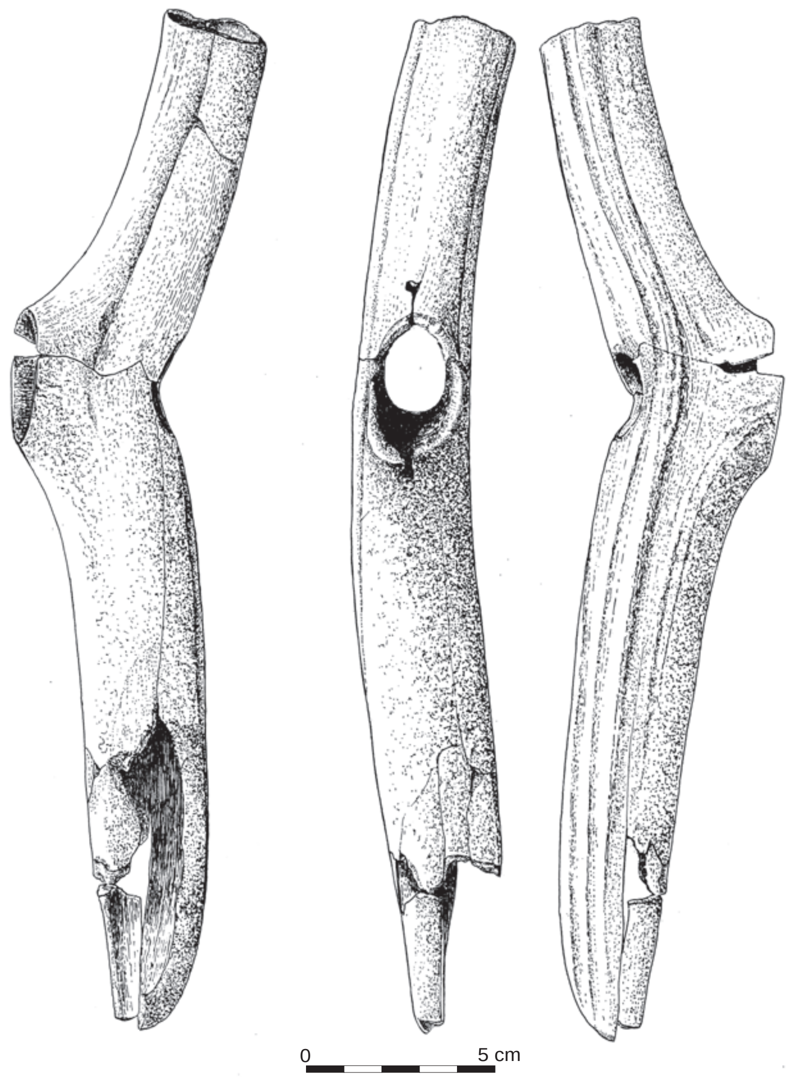

Figure 5.3 An antler-beam mattock (“T-axe”) from Brześć Kujawski (after Grygiel 1986).

western Baltic, where they are found in settlement contexts and have secure dating (Hartz/Lübke 2006, 64-65).

Thus the manufacture and use of antler T-axes is a cultural practice that spans the Danubian and Baltic world, with its particular touchstone in the former being the Brześć Kujawski Group of the Polish lowlands. The proximity of Kuyavia to the Baltic littoral and the contemporaneity between Ertebølle and the Brześć Kujawski Group means that this connection is unlikely to be accidental. At the same time, the incorporation of the antler T-axe into the burial rite of the Brześć Kujawski Group suggests that there was a translation of some sort between the functional and the symbolic domains. Antler racks and beams are common in the Ertebølle burial ritual at sites like Skateholm (Larsson 1993), whereas finished T-axes are uncommon as grave finds anywhere in the Baltic World and occur mainly in settlement refuse.

5.5.2 Ornament on Bone

Another potentially-overlooked connection between the Baltic World and the Danubian frontier in Kuyavia is the practice of decorating bone objects and making bone ornaments, again not something widely encountered in interior Danubian Europe during the fifth millennium BC.

At sites of the Brześć Kujawski Group, this ornamentation is displayed most vividly in the large bone armlets or brassards found in graves, mainly female burials (fig. 5.4). The surface of these brassards is covered, almost completely, with bands of incised chevrons and triangles. Although there are no analogues for such brassards in the Baltic World, the tradition of bone ornamentation is more a Baltic trait than a Danubian trait.

A piece of decorated bone excavated in 1925 at Ralswiek-Augustenhof on the island of Rügen (Petzsch 1928), whose surface is decorated very much like the brassards of the Brześć Kujawski Group (fig. 5.5), is often offered as evidence of contact with the Brześć Kujawski Group (Gramsch 1973, 63; Terberger 1999, 227). While it indeed points to a connection, it does not mean necessarily that it was an import from the Danubian World. Instead, it may be part of an indigenous Baltic tradition of bone ornamentation which then entered the Danubian World at its Kuyavian outpost and was employed on the bone brassards.

Of particular interest is a bone spatula found in 1990 at Osłonki (fig. 5.6). Close examination revealed two opposed triangles formed from regularly-spaced punctures made with

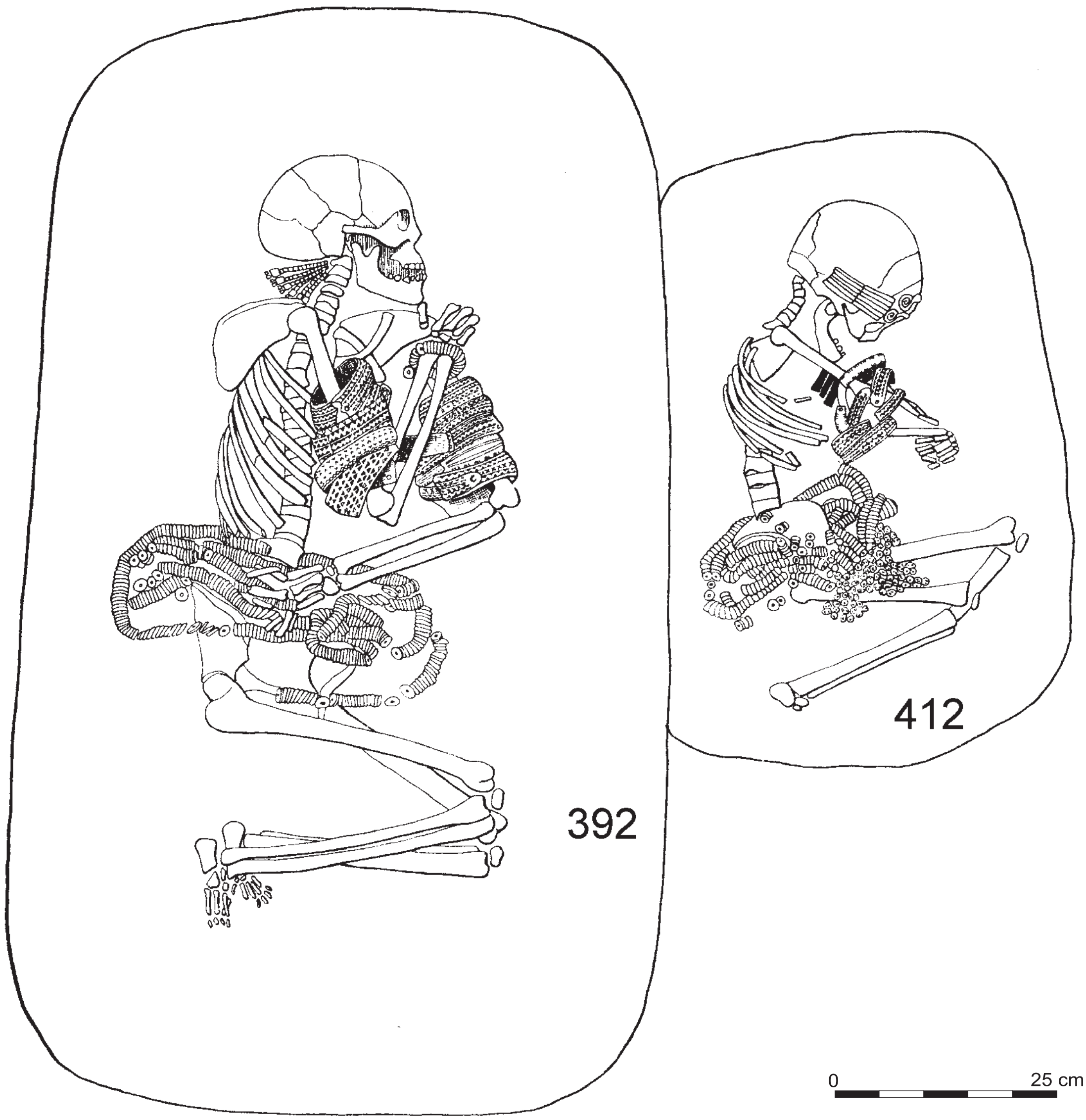

Figure 5.4 Burials at Krusza Zamkowa showing decorated bone armlets (after Czerniak 1980).

a very thin tool. Grahame Clark (1975) illustrated a variety of Mesolithic motifs of bone ornamentation from the Baltic zone, and such opposed triangles of dots are clearly shown. The ornamented spatula found at Osłonki fits well with the repertoire of Mesolithic ornamentation of the Baltic World, in my view, and I am not aware of an analog in the Danubian World.

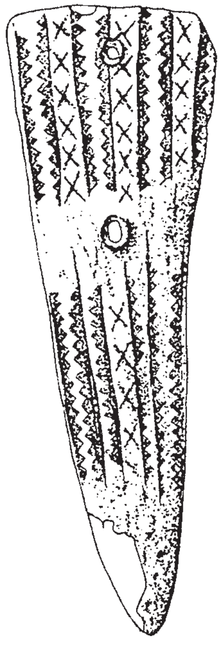

Figure 5.5 Decorated bone from Ralswiek-Augustenhof (after Terberger 1999).

Andersen (1973, reprinted 2002 with addition of fig. 15.2) characterizes similar dotted decoration on Ertebølle ceramics, which is illustrated in the 2002 version with a fragment of a pot from the Norsminde kitchen-midden. While not exactly composed of opposing triangles, the dotted decoration on the Norsminde pot does have a similar opposing pattern nonetheless. It appears that similar dotted decoration was found on a sherd from Lietzow-Buddelin on Rügen, which is said to point to contact with the Stroke-Ornamented Pottery Culture of the early fifth millennium in central Europe (Umbreit 1940 cited in Terberger 1999). Again, such dotted decoration does not look like the characteristic Danubian ornament, in my view. It is unlike the stab-and-drag ornament of Stroke-Ornamented Pottery, which is more of a stroke than a dot.

5.5.3 Metatarsal Chisels or Cleavers

Another indicator of a Baltic-Danubian connection can be seen in large bone tools made using the metapodials, usually metatarsals, of large animals, specifically cattle. In these tools, the broken proximal shaft is sharpened to a flat edge, leading to their characterization as chisels or cleavers, while the proximal articulation of the bone served as a handle or striking platform. In the German literature, these tools are called '*Tüllenknochenhacke*' for which I cannot devise an adequate English form, so I will refer to them as 'metatarsal cleavers or chisels'.

At Osłonki, two cattle proximal metatarsals from particularly robust individuals had been sharpened to a transverse working edge on their shafts (fig. 5.7). They weighed 147 g and 210 g respectively. In addition, in one of these specimens, the articular surface had been hollowed out down to the marrow cavity, an opening of over a centimeter

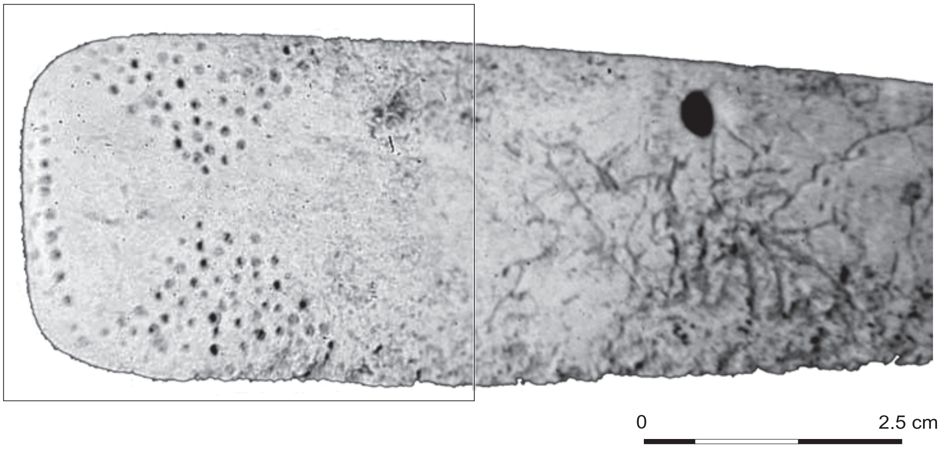

Figure 5.6 Decoration on bone spatula from Osłonki (edge of rectangle approximately 5 cm).

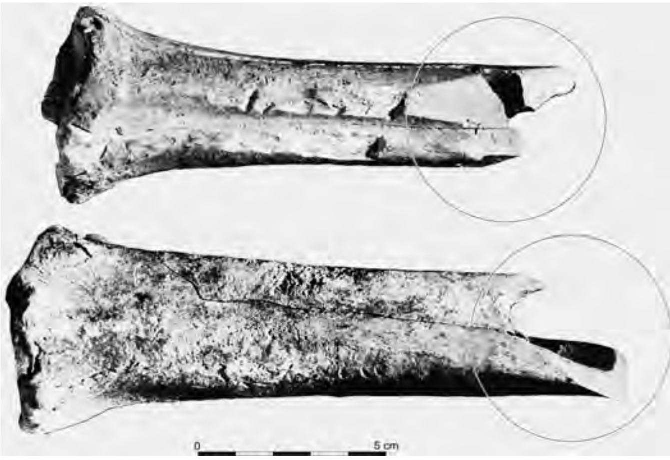

Figure 5.7 Chisels made from cattle metatarsals from Osłonki.

in diameter. Both were found in rubbish deposits in the large pits used initially for clay extraction.

Such metatarsal tools have very similar counterparts in the Baltic world, as well as in the Rhine-Maas Delta where they are manufactured from the metatarsals of wild cattle. Indeed, such tools have a long Mesolithic heritage, appearing first in Maglemosian sites like Hohen Viecheln (Dellbrügge 2002), where one specimen has a hole bored into its articular surface just like the one from Osłonki (fig. 5.8). From the North Sea basin, Louwe Kooijmans (1970, fig. 5) illustrates an aurochs metatarsal tool from the Brown Bank region, also with a hole in the proximal articulation, and during the fifth millennium BC, the inhabitants of Hardinxveld in the Rhine-Maas Delta made analogous tools (Louwe Kooijmans 2004). Later in the fifth millennium, after the floruit of the Brześć Kujawski Group, the inhabitants of early Neolithic sites in the west Baltic zone, clearly derived from the Mesolithic tradition, made similar tools.

Yet searching for such massive metatarsal cleavers or chisels among Danubian bone tools elsewhere in central Europe has not turned up any examples. They very much appear to be a characteristic of the Baltic World and its neighbours along the North Sea, with deep roots long before the fifth millennium BC. Along with antler T-axes, the metatarsal cleavers may represent another trait adopted along the Danubian frontier in northern Poland from the foragers to the north.

5.6 Danubian Neolithic elements in Ertebølle contexts

At the same time, various Danubian elements do appear in the Baltic World, even if we should no longer count the antler T-axes among them. These intrusive elements include domestic cattle and stone axes with shaft holes.

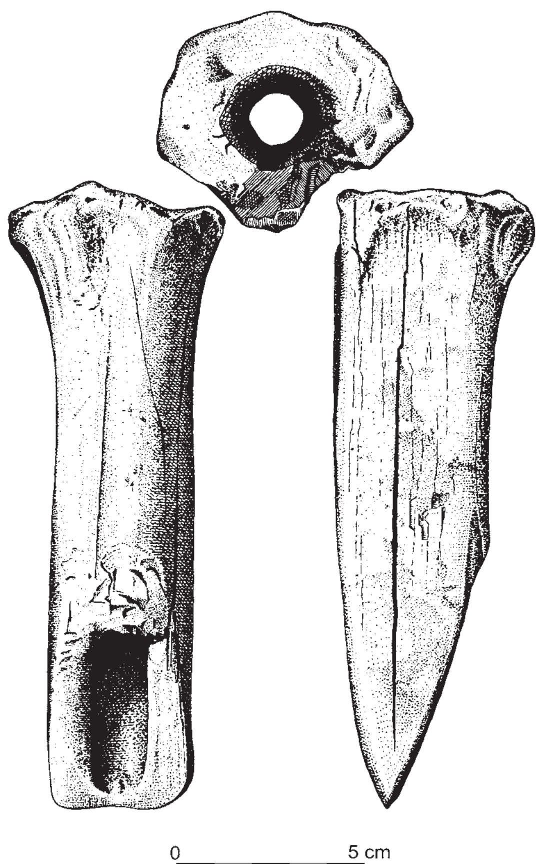

Figure 5.8 Chisel made from an aurochs metatarsal at Hohen Viechln (after Dellbrügge 2002, fig. 33). Long axis of tool approximately 16 cm.

5.6.1 Domestic Cattle

It appears that the earliest element of the Neolithic economy to reach the foragers of the Baltic basin near the end of the fifth millennium BC was domestic cattle (Noe-Nygaard/Hede 2006) The initial agricultural expansion of the Linear Pottery culture during the sixth millennium BC had brought domestic cattle to the North European Plain along the lower Oder and Vistula rivers, theoretically within reach of the Baltic World. Yet there is currently no definite evidence of domestic cattle in the south Baltic area contemporaneous with the Linear Pottery culture, despite its proximity. Apparently the passage of domestic cattle through the borderland between the Danubian and the Baltic Worlds did not take place until the second half of the fifth millennium BC. A recent summary of the evidence (Noe-Nygaard *et al.* 2005) points toward a fairly sudden and widespread introduction of domestic cattle to Denmark around 4000 BC, although there does appear to be a domestic cattle bone from Lollikhuse in northern Zealand dated *c.* 4600-4700 BC (Noe-Nygaard/Hede 2006). The Lollikhuse date is striking because wild cattle had been extirpated on Zealand by 6000 BC according to Noe-Nygaard and Hede, but at the moment it is the only domestic cattle bone in southern Scandinavia dated significantly before 4000 BC.

The case for *de novo* local domestication of wild cattle in northern Europe, heard so often in the 1970s and 1980s, appears to have collapsed (Rowley-Conwy 1995). Although the forests of central Europe did contain wild cattle (aurochs, *Bos primigenius*), recent studies have demonstrated that the mitochondrial DNA of European Neolithic cattle remains reflects a Near Eastern origin almost exclusively (Bollongino *et al.* 2006). Since mtDNA is passed through the maternal line, this indicates that the female breeding population of European Neolithic cattle was derived from Near Eastern stock. At the same time, this does not exclude the possibility of introgression of local aurochs genes from males, and indeed the analysis of Y-chromosomes from ancient and modern wild and domestic cattle in temperate Europe appears to support this (Götherström *et al.* 2005). Thus, while there appears to have been no bovine maternal line among Neolithic and later domestic cattle that was derived from aurochs, there is a strong possibility of local hybridization from occasional mating between aurochs bulls and domestic cows. This is much different from *de novo* local domestication from an exclusively indigenous population of wild cattle, however. Domestic cattle, or at least cows, must have reached the Baltic World sometime during the fifth millennium BC.

5.6.2 Shaft-Hole Axes

Anders Fischer (1982) was the first to call attention to the presence of non-flint ground stone axes, usually with drilled shaft holes, in Ertebølle contexts in Denmark and Scania (see also Pedersen *et al.* 1997 and map in Fischer 2002, fig. 22.1). Unlike the antler T-axes, such stone tools have a strong Danubian heritage, appearing ubiquitously on Linear Pottery, Rössen, and Lengyel sites during the sixth and fifth millennia BC. Moreover, the stone from which they are made is characteristic of the amphibolitic rocks of upland central Europe rather than the raw material available in the Baltic basin. Thus a very clear link can be made on the basis of these materials between the Danubian World and the Baltic World.

5.7 ROUTES THROUGH THE BORDERLAND

The foragers of the Baltic World present an apparent paradox of communities that were simultaneously highly sedentary yet at the same time capable of great mobility. Watercraft were the key to Ertebølle sedentism. Most foraging communities adjust to temporal and spatial variations and imbalances in resources by moving their settlements. Maritime foragers with watercraft, however, can paddle their canoes over a much greater territory than can be covered by terrestrial foragers and return to a base settlement in a timely fashion. At the same time, the base settlement and its environs can be developed into a multi-year installation with permanent facilities. In the Baltic World, the most evident permanent facilities are the large structures for trapping fish that have been documented along the bays and inlets of the Danish islands and dated to the sixth, fifth, and fourth millennia BC (Fischer 2007, table 5.2). Such structures would have required the presence of a long-term resident community to construct them, maintain them, and to assert ownership of their yields.

The numerous dugout canoes (cataloged by Christensen 1997 and Skaarup/Grøn 2004) and paddles (*e.g.* at Tybrind Vig) found in submerged and waterlogged sites in southern Scandinavia testify to the ubiquity of Ertebølle watercraft, and while no examples of hide or bark boats have yet been recovered, these were probably not beyond the reach of Ertebølle technology. It is easy to envision Ertebølle watercraft being used in the bays and inlets around the islands of the western Baltic, and for crossing straits between bodies of land. Yet there is no reason why these same watercraft could not have been taken into interior waterways, especially by the Ertebølle communities on the southern Baltic coast. Many of the rivers of the south Baltic coastal plain are short. In Pomerania, many only extend as far as the moraines that define the southern margin of the Baltic coastal plain. Yet large rivers, such as the Oder and the Vistula, would have provided points of entry into the vast hydrological network of the North European Plain.

The most important feature of this hydrological network, comprising not only rivers and creeks but also lakes and marshes, is that it is relatively flat in contrast to the streams of upland interior Europe. Its rivers and creeks would be considered to be 'low-energy streams' with their normal flow moving relatively slowly. These streams are very popular among recreational canoers and kayakers today, who are certainly not expert white-water adventurers! Over the last 6,000 years, many of the watercourses of the North European Plain have dried up, either naturally or due to modern drainage work, but during the fifth millennium BC there would have been a network of rivers, small streams, and lakes in which the obstacles would have been woody debris, shallows, and overhanging vegetation rather than rapids and cascades.

5.8 Ertebølle *voyageurs*

There would have been very little to prevent venturesome Ertebølle canoers from paddling up the languid streams of the North European Plain. After all, if they were capable of dealing with maritime currents, waves, and weather, journeys into the interior of northern continental Europe would not have been a problem. A more recent example of determined, purposeful canoers exploring interior rivers is known to us from the *voyageurs* of 17th and 18th century Canada (Podruchny 2006), who travelled immense distances each year collecting furs from inland trappers and bringing them back to the eastern coast for export. The bark canoes of the *voyageurs* were more sophisticated than the Ertebølle dugouts in their lighter weight, but nonetheless it is possible to draw some broad comparisons.

Ertebølle *voyageurs* would have been able to reach the Danubian communities of Kuyavia relatively easily and without any significant portages. After leaving their coastal habitat and traveling approximately 100 kilometres inland on the Oder River, they would have come to its confluence with the Warta River. Approximately 50 kilometres up the Warta, the Notec River branches off. From there, it is about 200 kilometres to the lands of the Brześć Kujawski Group and easy travel through the stream network of the Kuyavian Plateau. A short portage near the modern city of Bydgoszcz would have brought them to the Vistula River, but traveling further along to pass through the Bachorza tunnel valley (which probably contained a brook during this period) would have brought them to the Zgłowiączka River near Brześć Kujawski which connects directly to the Vistula. Of course, Ertebølle canoers could also have continued up the Oder and Warta Rivers and encountered other Danubian communities eventually but at a greater distance from the Baltic World.

All this is in the realm of fanciful speculation, but the point is that there were no significant geological or hydrological barriers to communication between the Baltic World and the Danubian communities of Kuyavia during the fifth millennium BC. We know that the Ertebølle communities of the Baltic coast had the watercraft. A search of recreational canoeing websites suggests that 5 km/hour on a flat stream is a reasonable assumption, so assuming 8 hours of paddling per day, it would be possible to cover 40 kilometres of river. Of course, Ertebølle canoers who were in good condition from paddling against sea currents may well have been able to exceed this distance. Indeed, accounts indicate that *voyageurs* in 18th century Canada could cover almost twice that daily distance in good weather and without much portaging (Podruchny 2006, 100). Nonetheless, it is clear that it would have been possible to cover the 350 or so kilometres of river between the Baltic Coast and the headwaters of the Notec in ten days or less in the spring, summer, or early fall.

5.9 A Neolithic presence on the Baltic?

The question then arises, if the Baltic foragers had the technology to travel long distances on water, would not the Danubian farmers also have had a similar capability? The evidence for Neolithic watercraft in interior Europe during the sixth and fifth millennia BC is virtually nonexistent. The principal factor in this is the unfavorable conditions for the preservation of wood in much of this region, and hence no Linear Pottery or Lengyel boats have been recovered. In interior Neolithic Europe, another constraint on watercraft would have been the nature of the rivers, in that their steeper gradients give them a faster current than the low-energy streams of the North European Plain. Thus going downstream would have been easy, but getting back upstream would have required considerable effort. For that reason, watercraft in the upland Danubian World may have functioned more as ferries, permitting the crossing of streams much in the style of the Venetian *traghetti*, rather than a means of transport along watercourses.

Still, once established on the North European Plain, Danubian communities in Kuyavia and elsewhere may also have adopted the practice of long-distance travel by water, and thus a Neolithic presence in the Baltic basin cannot be excluded. Such a presence would have left little trace archaeologically but it is fun to speculate nonetheless. It is likely that during the sixth millennium BC Linear Pottery farmers saw the estuaries of the Oder and the Vistula, perhaps even the Baltic itself. Their settlements were certainly close enough. During the fifth millennium BC, the inhabitants of sedentary foraging communities along the Baltic and the farmers in the large centres of Neolithic settlement in Kuyavia must have encountered each other as the former ventured upstream and the latter explored downstream in the Vistula drainage.

5.10 Feral cattle

The domestic cattle that were introduced into the Baltic World late in the fifth millennium BC must have come Danubian communities with substantial populations of domestic from the Danubian communities of the North European Plain, where the closest cattle were the settlements of the Brześć Kujawski Group of the Lengyel Culture. There are no other such large concentrations of Neolithic settlements with domestic cattle above 52° N latitude in continental Europe at this time. It thus seems likely that the starting point for at least some of the cattle that found their way north to the Baltic basin toward the end of the fifth millennium BC was the Kuyavian plateau.

In light of the fact that cattle appear to have passed through the borderland between the Danubian and the Baltic Worlds with relative ease, in 1995 I proposed that feral livestock that had escaped from the control of farming communities found congenial habitats in the artificial glades of the North European Plain that had been created by foragers. For me, the question was not 'if' Neolithic livestock escaped but rather 'how many?' Given a chance, cattle will often run away, and over several centuries of Danubian settlement in Kuyavia and adjacent regions, such escapes probably happened often. Numerous historical examples exist of cattle that wandered off into the wilderness in areas as disparate as colonial North America and Australia. Domesticated cattle that propagated and dispersed among the artificial glades of the North European Plain would have found their way to the Baltic World and into the hands of the foragers of the southern Baltic coast during the fifth millennium BC. From there, it did not take long before they were distributed widely among Ertebølle communities of the southwestern Baltic.

The idea that the dispersal of feral cattle on the North European Plain required anthropogenic glade habitats to flourish may be revisited in light of the Vera Hypothesis, which is that wild herbivores maintained the understory vegetation of the primeval European woodlands as a park-like habitat, very different from what it might have been in their absence (Vera 2000). It must be acknowledged that the Vera Hypothesis has been criticized by Mitchell (2005) and other reviewers, but nonetheless it provides an intriguing mechanism for the dispersal of feral livestock from the Danubian frontier settlement that does not require the intervention of foragers to create artificial glades. Instead, under the Vera model, the understory vegetation of the primeval forest was itself hospitable to escaped cattle, who then could spread far to the north of their Danubian homes on their own before reaching the southern edge of the Baltic World. Moreover, the landscape engineering of beavers would have created wetland habitats that would have been attractive to feral cattle (Brown 1997; Rosell *et al.* 2005).

Ultimately, the source of the earliest cattle in the Baltic World will have to be addressed through DNA analysis. The accumulating number of Ertebølle cattle bones dated very close to 4000 BC should provide some useful archaeogenetic material. When this research is undertaken, it will also be necessary to sample the cattle bones from sites of the Brześć Kujawski Group to see whether the speculation here can be substantiated.

While feral cattle are fully within the realm of possibility, feral grain certainly is not, and thus the introduction of wheat and barley to the Baltic World required direct human contact across this borderland. The earliest evidence for grain cultivation in the Baltic World comes from the first centuries of the fourth millennium BC, after the disappearance of the Brześć Kujawski Group from its Kuyavian settlements. It will probably be some time before we have a better understanding of the pathway for cereals between the Danubian and the Baltic Worlds.

5.11 Conclusion: the North European farming frontier

The goal of this paper has been to characterize the lowlands of northern Poland as a porous and interactive borderland between the worlds of the Danubian farmers and the Baltic foragers during the fifth millennium BC. During this time, the Ertebølle communities of the south Baltic coast and the farmers of the living on the Kuyavian plateau were separated by only a few hundred kilometres of sparsely-populated land, and connected by easily navigable inland waterways. Interaction would have been constrained only by cultural separation and by limits on individual initiative and curiosity.

The presence in Brześć Kujawski Group settlements of bone and antler tool types, particularly the T-axes and the cattle metatarsal chisels, along with richly decorated bone objects at settlements of the Brześć Kujawski Group provides a hint of this interaction, for these are all out of character with traditional Danubian finds but familiar elements in the Baltic World. Previously, more attention has been paid to what was going north from the Danubian World to the Baltic World, especially ground stone axes and the cattle. Yet as this paper has argued, the interaction across this borderland was a two-way street, and it may well have contributed to the distinctive character of the Brześć Kujawski Group and to the vigor and persistence of its settlements.

Over the next few decades, several things will probably occur. First, additional large settlements of the Brześć Kujawski Group will be discovered and excavated, amplifying the archaeological signature of these communities even more. Second, the south Baltic coast, particularly the Polish part, will be explored more thoroughly and additional Ertebølle sites will surely be found, some of them submerged. Finally, a comparison of the archaeogenetics of the earliest cattle of the Baltic World and those of the Brześć Kujawski Group may be illuminating. Eventually we will discover how the interaction between the Danubian and the Baltic Worlds led to a 'new Neolithic' that was acceptable both to the successors of the Brześć Kujawski Group and to the Ertebølle foragers around 4000 BC.

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6 The Mesolithic – Neolithic transition in Western Denmark seen from a kitchen midden perspective. A survey

Søren H. Andersen

6.1 Introduction

Despite many differences in geography, topography and cultural background it is fascinating to observe how similar tracks the development from the Mesolithic to the Neolithic has followed in The Netherlands and Denmark. In Denmark this transition is best shown by the so-called '*køkkenmødding*'.

Therefore, it is with great pleasure and respect that I offer Leendert Louwe Kooijmans this small synthesis on the first farming culture in Jutland.

The Danish '*Køkkenmøddinger*', (coastal shell middens) are one of the best – if not the best – source of information on the introduction of the first farming culture in Denmark. Of special importance within this group of sites are the so-called "stratified shell middens" (Andersen 2000a, 375-376), which contain cultural layers from both the latest phase of the Mesolithic Ertebølle culture (EBK) (*c*. 5400-3900 cal BC) and the beginning of the Early Neolithic Funnel Beaker culture (TRB) (*c*. 3900-3300 cal BC). The Early Neolithic is subdivided into EN I (*c*. 3900-3600 cal BC) and EN II (*c*. 3600-3300 cal BC).

In regards to the questions concerning the introduction of the oldest farming culture in Scandinavia and in contrast to other types of settlements (*e.g.* the inland, "bog" sites (Fischer 2004, 350 ff.)) the shell middens offer a series of advantages: Firstly, they are numerous, they have a readily discernible stratigraphy and a fast sedimentation rate with 'sealed' occupation horizons. Secondly, because of the good preservation conditions for organics, they are 'data banks' for environmental studies – especially of the marine biotope; the sediments offer excellent opportunities for ^{14}C dating based on charcoal, bone and shell. Finally, this type of settlement gives possibilities for pollen analysis of old land surfaces protected below the midden layers.

As the Mesolithic and Neolithic layers are located in the same environment, it is literally possible to describe and 'measure' any changes in the same biotope during the transitional phase – and compare all types of information before and after the transition.

In connection with new excavations in western Denmark, several stratigraphic series of ^{14}C dates have been performed through the thick midden layers, allowing for comparative studies between stratigraphy, ^{14}C dating and typology as well as analysing the Mesolithic – Neolithic transition in much shorter time segments than before (and at most other types of sites; fig. 6.1).

In general, the stratigraphy in the shell middens demonstrates long occupation phases from the younger Kongemose culture (*c*. 5700-5400 cal BC), though the Ertebølle culture (*c*. 5400-3900 cal BC) to the end of the Early Neolithic I, the Funnel Beaker culture (*c*. 3600 cal BC).

Of special interest in this connection is, however, the time span covering the latest Mesolithic and the earliest Neolithic.

6.2 History of research

During an excavation in the Krabbesholm I shell midden in 1889, it was observed that the cultural layer consisted of two different horizons: a lower one dominated by oysters and an upper layer characterized by cockles, ash and 'burned stones' (potboilers). The deepest layer contained thick-walled and undecorated pottery from pointed-bottomed vessels, while the upper horizon only had thin-walled, nicely decorated sherds (Andersen 2005; fig. 6.2).

Today – in retrospect – we know that this sequence is a nice example of a typical Danish, stratified shell midden with a succession of Late Mesolithic Ertebølle culture (bottom) covered by a horizon of Early Neolithic Funnel Beaker culture (top). In other words, the Krabbesholm I *køkkenmødding* demonstrates a stratigraphic sequence covering the transition from the Mesolithic to the Neolithic in Denmark.

Unfortunately, the insights from this small excavation were not understood at that time, and were not followed by other, supplementary investigations in the Danish shell middens.

Quite the contrary happened. Later, the main emphasis of studies on the introduction of the oldest farming culture in Denmark was concentrated on inland sites in the bog Åmosen on Zealand (Troels-Smith 1953; 1960), while the possibilities for further information from the shell middens were discounted.

Between 1970 and 2005, a series of new investigations of stratified middens was performed at several different locations in the West Danish area of Jutland, for example at Norsminde (Andersen 1991). This was the first modern excavation of a stratified shell midden, where the importance and scientific value of this type of settlement in relation to

Figure 6.1 The land-sea configuration of Denmark during the Late Atlantic – Early Subboreal (*c.* 4000 cal BC). Settlement sites mentioned in the paper are indicated.

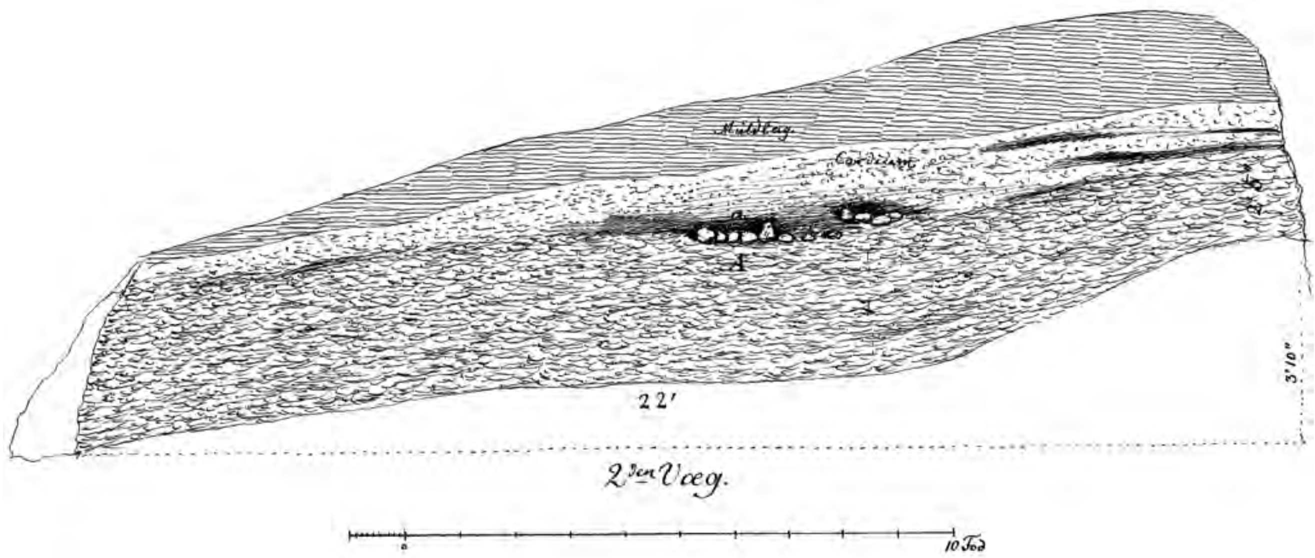

Figure 6.2 Section through the Krabbesholm I shell midden. The bottom layer (A) is the Late Mesolithic Ertebølle horizon dominated by oyster shells. On top of it is the Early Neolithic Funnel Beaker horizon characterised by cockles and thin ash layers and a hearth. The excavation revealed fragments of pointed-bottomed Ertebølle vessels in the bottom horizon and nicely decorated Funnel Beaker ceramics in the cockle-and-ash layer (the position of the Neolithic sherd is indicated by an "a" on the profile).

the oldest Neolithic was first understood (Andersen 1991). The Norsminde site was especially informative, because it contained thick deposits from both the Late Mesolithic (EBK) as well as the Early Neolithic (TRB) and because it had an undisturbed stratigraphy (fig. 6.3).

This investigation was followed by excavations at Bjørnsholm (Andersen 1993), Visborg (Andersen 2000b; 2001; 2002), Krabbesholm I (Andersen 2005) and finally Havnø (Andersen 2008).

6.3 Stratified shell middens

In general the deepest section of the shell layers are of a white-yellowish colour and are dominated by large, unbroken, oyster shells (up to 80 – 90% of the deposits) while the top layers are dark grey/black and are characterized by a dominance of crushed cockles and many thin layers of ash, charcoal and potboilers. However, it should be emphasized that there are also oysters in the upper layers, but in a much smaller percentage than in the lower horizons. This differentiation between midden layers is generally true in all stratified middens, although the composition and relationship between the shell species may vary somewhat.

Analysis indicates that this change in mollusc composition is a reflection of environmental change in the marine biotope (Andersen, 2007, 43-44).

Careful stratigraphic studies in the Norsminde, Bjørnsholm, Visborg and Krabbesholm shell middens all show a characteristic *c.* 2 – 3 cm sandy, grey/black humus horizon with shell fragments and cultural debris, between the lower (oyster dominated) and the upper (cockle dominated) horizons (*e.g.* Bjørnsholm; fig. 6.4). Unfortunately, this layer has not yet been chemically analysed, but its structure and composition shows that it represents a shift in the midden formation and sediment sequence, and most probably represents an open land surface; the cultural remains show that it is not a layer which had been flooded by the sea during a transgression.

At Bjørnsholm this horizon is dated to the time interval 4000-3710 (K-5817) cal BC and 4030-3790 (K-5516) cal BC (Rasmussen 1993) respectively. From Norsminde there are three dates of respectively 3940-3815, 3982-3944 and 4037-3959 cal BC (AAR-5364, AAR-7838 and AAR-7837), and at Visborg the dates gave time intervals of 4340-4080 – 3950-3770 (K-6875 and K-6876) and 4450-4260 – 3960-3800 cal BC. (AAR-7005 and AAR-7004).

At Krabbesholm I, a sample was taken *directly* from the horizon itself, which gave a date of 3970-3800 cal BC (AAR-9786).

All of these results (based on dates of both charcoal and shell) cluster around *c.* 4000-3800 cal BC and are in nice

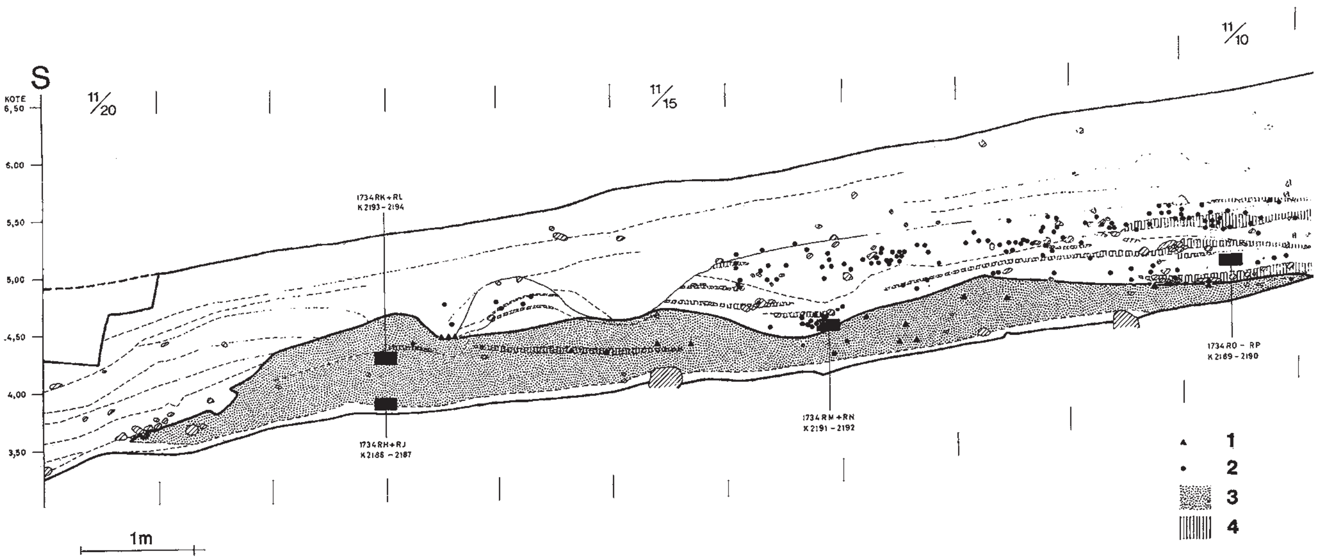

Figure 6.3 Section through the Norsminde shell midden with a plot of all Ertebølle (triangles) and Funnel Beaker sherds (dots) from within the nearest meter. The Ertebølle horizon is shaded, while the Early Neolithic is white.

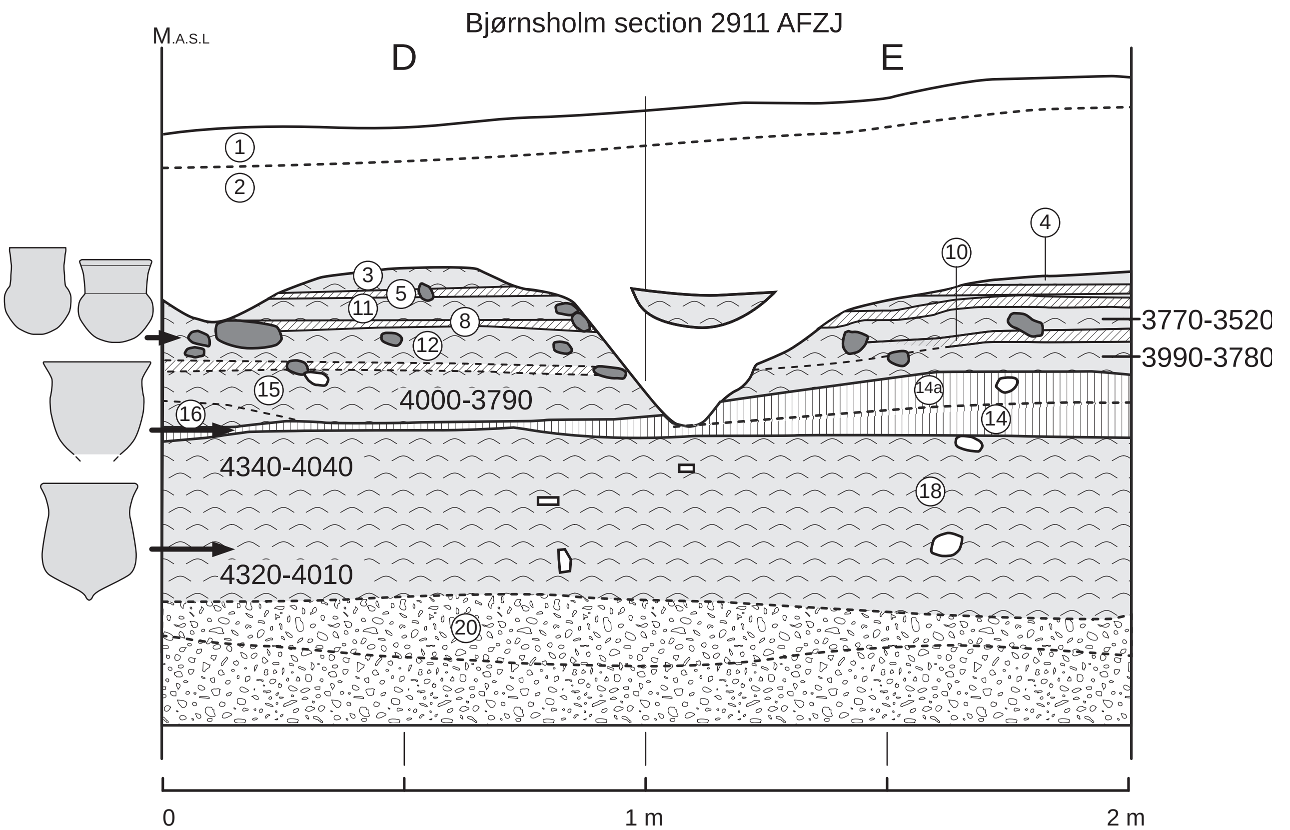

Figure 6.4 Section from the stratified Bjørnsholm shell midden. In between the thick EBK layer (number 18) and the TRB layer (layers nr. 3, 11, 12, 15 and 16) is a thin humus horizon (layer 14) representing the transitional period from the Late Mesolithic to the Early Neolithic on this site. Relevant ^{14}C dating from the profile is indicated as well as typical vessel types (left).

accordance with each other, the stratigraphic observations and the other ^{14}C dated sequences through the cultural deposits. These results also support the information obtained from the midden-stratigraphy, which indicate it was formed in a period of a very limited duration, possibly only *c.* 100 years.

If we turn our attention to the cultural remains from the midden sequences, this layer corresponds with a typological change in the material culture, of which the most marked is found in the ceramics, where we see a shift from thick-walled, undecorated and pointed-bottomed vessels to new types of thin-walled, round-bottomed beakers with a wide range of decorative motifs. Additionally, the quantity of pottery in the 'oyster layers' is much less than in the 'cockle layers', while the amount of flint artefacts and flint debris is clearly much higher in these 'oyster layers'

From the Norsminde, Bjørnsholm and Krabbesholm middens we have found vessels of typologically transitional forms between Ertebølle- and Funnel Beaker ceramics within this transitional horizon (fig. 6.4).

In flint technology there is also an abrupt change in style from a production based on blades in the lower horizon, to a production characterized by flakes in the upper layers (Stafford 1999). Next to that, a change occurred from flake and core axes to the first appearance of polished flint axes in the TRB. However, it is essential to underline that despite these changes in style and technique, basically it is the same flint types which continue.

Finally we have a few finds of domesticated animals (sheep/goat) and charred grains (wheat/barley) from the beginning of the upper, cockle dominated horizons onwards.

Taken together, the ^{14}C dating, next to the vertical (stratigraphic) distribution of characteristic types (especially pottery) and the first appearance of domesticates and cereals, demonstrate that this is a 'transitional horizon' from the Late Mesolithic Ertebølle culture to the Early Neolithic Funnel Beaker culture, and that it took place *c.* 3900-3800 cal BC on the coastal settlements in the Western part of Denmark.

The observations indicate that there was no break in the occupation – quite the contrary – all investigations indicate settlement continuity on the coastal sites.

This "transitional horizon" is not recorded in all stratified shell middens, a fact which can be explained either by its thinness or as a function of a horizontal shift in focus of habitation during longer periods of occupation. If we are dealing with an excavation of limited extent, it is more a matter of accident if the investigation cuts through such a transitional sequence or not. Besides, a short period of occupation will only result in a thin cultural horizon of restricted area and of slight archaeological visibility.

These problems are nicely illustrated in the totally excavated Norsminde midden, where the transitional layer was recorded in some areas and not in others.

The occurrence of a transitional layer is therefore most probably a general aspect in all these shell middens. Also on sites where such a horizon has not been recorded, the series of ^{14}C dates support the impression of continued occupation from the Mesolithic to the Neolithic (*e.g.* at the classical site of Ertebølle (Andersen/Johansen 1987, 50 – 51, 60; figures 16 and 17)).

The stratigraphy and the sedimentation of cultural debris and marine molluscs combined with the dated sequences shows a continued activity on the coastal sites from the Late Ertebølle and into the beginning of the Early Funnel Beaker (*c.* 3900-3600 cal BC), and if we compare the thickness of the layers with the ^{14}C dates, it is obvious that the sedimentation rate in the Early Neolithic was just as fast or faster than in the EBK.

Later on, from *c.* 3600 cal BC, the sequence of cultural horizons on the majority of coastal sites comes to a stop.

From the following period, the Early Neolithic II (*c.* 3600-3300 cal BC), we only have scattered and sporadic traces of site use on the '*Køkkenmøddinger*', and the investigations clearly show that the coastal activities in by far the most cases either stopped or decreased significantly after that time. Therefore, this date seems to mark a fundamental change or restructuring of the Early Neolithic settlement pattern along the coastline.

Coastal occupation was resumed at the transition from the Middle Neolithic A (Funnel Beaker culture) to B (Pitted Ware culture and Single Grave culture) *c.* 2800 cal BC.

That stratified coastal settlements with long occupational sequences are the norm rather than the exception, has recently been demonstrated by investigations of all Stone Age settlements in the fossilized Bjørnsholm Fjord in Northwestern Jutland (Andersen, 2001, 34); here *c.* 50% of all coastal sites belonged to this type of settlement – a number which probably originally was even higher, because the upper (Neolithic) layers have been in most danger of younger disturbances (ploughing).

In summary, the investigations show coastal occupation from *c.* 5700 to *c.* 3600 cal BC, after which the sequence of cultural horizons declined, or came to a general stop (fig. 6.4).

If we turn our attention inland in the same regions where we have the shell middens, the very small number of Funnel Beaker settlements from the first phase of the Early Neolithic (Early Neolithic I), is striking. Despite intensive campaigns of reconnaissance, we only have a very few inland sites, which are contemporary with the coastal middens (*e.g.* Mosegården (Madsen/Petersen 1984)) and we know of only *one* inland site with a comparable long occupational series covering the Mesolithic – Neolithic transition, which is Ringkloster (Andersen 1975; 1998). Also, the Early Neolithic inland sites are clearly smaller in area than the contemporary coastal sites, and at the same time all the inland sites are located by water (along river valleys or lake shores), environments more suited for hunting, fishing and gathering than farming.

In conclusion, one can say that our present information indicates that it most probably was on the coastal settlements of Jutland, that the Ertebølle – Funnel Beaker transition actually took place – an observation which fits nicely with the distribution of the Ertebølle network along the Danish coastline. The spread of new elements, technical, economical and ideological, must have followed this coastal-oriented network.

6.4 Locational stability, settlement stability, occupational continuity

A precondition for settlement stability in coastal regions is stability in the marine resources of these sites. From this follows, that we must assume that the basic economic elements must have been the same in Late EBK as in Early TRB.

All faunal and botanical evidence from the modern excavations demonstrates that the subsistence in the Late Mesolithic Ertebølle was based on fishing, hunting and gathering. In no case have traces of domesticates, excepting the dog, been recorded.

The zoological investigations from the Early Neolithic I horizons in these middens show, that we have the same species of mammals, birds and fishes (Andersen 1991; Bratlund 1993; Enghoff 1991), but also (albeit rarely) new types of domesticates. Sheep/goat, cow and pig appear, as well as sporadic traces of wheat, barley and other cereals.

This information supports the opinion that the basic subsistence was the same in the Late Mesolithic as in Early Neolithic I (Andersen 1991, 39 – 40; Bratlund 1993, 97 – 104). The economy of the Early Neolithic continued in 'the Mesolithic way' of life and was based on a mixture of hunting, gathering, fishing, with some additional livestock rearing and cultivation of cereals (Andersen/Johansen 1992, 91). The increased number of potboilers in the Early Neolithic demonstrates a change in settlement activities, and an intensification and change in food processing in contrast to the Late Mesolithic; taken at its face value it most probably reflects an intensified reliance on cooking of the food.

Rather than showing any signs of a marked economic change from the Late Mesolithic, the Early Neolithic settlements seem to have continued the Mesolithic way of economy: the basic elements in the whole subsistence pattern were (still) hunting, fishing and collecting, with the addition of a few potentially important domesticated elements ("extended broad spectrum economies"; Louwe Kooijmans, 1993, 131; Bratlund 1993, 104).

On all coastal sites from Jutland, the number of 'Neolithic elements' in the economy in EN I are so few, that they could not have played any significant role in the subsistence.

Series of ^{14}C dates of domesticated animals from the stratified shell midden sites seem to indicate that the number of species and total amount of individual animals increases in the earlier part of the Neolithic (*e.g.* at Visborg; Andersen, 2001; 2002).

In conclusion, the subsistence evidence on the oldest Neolithic settlements demonstrates a mixed and broad economic basis, and a reasonable characterisation for this population is therefore fisher – farmers.

6.5 Social, ritual stability

The locations which were the largest coastal settlements in the Late Mesolithic also continued to be the most important in the Early Neolithic I – not only as habitation sites, but also in a social and ritual context as illustrated by burials on Early Neolithic settlements (*e.g.* Bjørnsholm; Andersen/Johansen 1992). Prestigious artefact types occur, such as the stone skeuomorphs of a Central European copper axe (Andersen/Johansen 1992, fig. 10, 43-44) and a Central European shaft-hole axe from the Åle shell midden (Andersen 1995, fig. 25, 62).

Sites with a combination, in Neolithic levels, of a large settlement area and a rich grave, like the site of Bjørnsholm (Andersen/Johansen 1992; Andersen 1993), indicate that such coastal sites must have been essential and have had a high economic and social importance for the population and the society as a whole in the Early Neolithic.

Early Neolithic coastal settlements such as Norsminde, Bjørnsholm, Visborg, Krabbesholm and Havnø have hitherto been classified in the Danish archaeological literature as short term, seasonal "catching sites" in contrast to a group of "residential farming sites" (Madsen 1982, 203-205; Skaarup 1982, 39-42). A distinction very often purely based on the topographic positioning in the landscape, as by far the greatest number of these inland sites are without or with very few faunal remains (*e.g.* Mosegården (Madsen/Petersen 1984)). Quite the contrary is true; these sites are situated along the coasts, in the coastal region and in a few instances inland in river valleys and along lake shores.

The new investigations clearly show a strong difference both in number and settlement area between the coastal middens and the (lack of) inland sites with a pure 'Neolithic' economy at the beginning of the Neolithic. The new information on settlement patterns at the Mesolithic – Neolithic transition, demonstrates coastal stability and a very high degree of economic continuity. Furthermore, it shows that these coastal sites must represent settlements essential for the social and economic structure of the society. It seems reasonable, therefore, to argue that the above mentioned distinction between "catching sites" and "residential farming sites" is artificial and that we only have *one* type of Early Neolithic I settlement. This type of settlement is mainly based along the coasts and in a few cases inland along river valleys and lake shores, environments also well suited for hunting, fishing and gathering.

These sites are *the typical* West Danish, Early Neolithic I settlements based on a mixed economy.

6.6 Conclusions

There is a high degree of locational stability at coastal settlements in the Late Mesolithic EBK and Early Neolithic TRB cultures. This settlement stability continues from the Late Mesolithic Ertebølle and during the first 300 – 400 years of the Early Neolithic (Early Neolithic I) after which it ends *c*. 3600 cal BC; there are very few coastal sites with cultural debris from the following EN II. As in the Late Ertebølle period, the majority of people during the Early Neolithic Funnel Beaker I period, were living on the coastlines.

The transition from Mesolithic to Neolithic took place *c*. 3900-3800 cal BC over the whole of the Western part of Denmark. The large EBK sites continued as being the largest also in the EN I, and these sites also continued having an important ritual and social role in the Early Neolithic I as well. These Early Neolithic I coastal settlements are not seasonal hunting and fishing sites as claimed earlier, rather they are *the* settlements proper.

There is also continuity in the basic elements of the subsistence from the Mesolithic to the Neolithic. The Early Neolithic I was basically still Mesolithic with only a few Neolithic additions and could best be described as ’fisher – farmers’.

At the beginning of the Neolithic we can observe a series of cultural transformations of which some happened very quickly, while others were more gradual. The previous assumption that the introduction of a farming way of life was an abrupt and fast change defining the beginning of the Neolithic, needs modification. The changes within the material culture were numerous and happened within a short time span, while the introduction of the ‘Neolithic’ way of life was a much more gradual and prolonged process, which took *c.* 300 – 400 years, i.e. the Early Neolithic I was a phase where subsistence basically was a mixture of hunting – gathering with some minimal assistance from farming.

The Early Neolithic I is therefore to be considered as a period of adoption of ’Neolithic’ elements from a pure Mesolithic Ertebølle subsistence to a full ’Neolithic’ in the Early Neolithic II, *c*. 3600 cal BC, the time from which the settlement pattern and economy *do* seem to have changed towards an inland orientation, and a division into “residential farming sites” and “catching sites”.

This process corresponds well with the model of an availability phase (until *c.* 4000/3900 cal BC), an adaptation phase (until *c.* 3600 cal BC) and a consolidation phase (after *c.* 3600 cal BC) (Zvelebil, 1998). This model has also, been successfully applied to the Dutch Neolithic by Louwe Kooijmans (for instance in Louwe Kooijmans, 1993, 135).

Acknowledgements

My friendship with Leendert goes back 30-35 years when I was invited to Leiden to give a lecture on the new information on the introduction of the first farming culture in Denmark. This meeting was followed by a visit of Leendert and his students at the Norsminde ‘*køkkenmødding*’ with its thick Mesolithic-Neolithic shell layers, and I think it was the first time that Leendert literally saw the Mesolithic-Neolithic transition in an archaeological sequence. I don’t know if it was the impression from this visit or not, but during the following years he has shown a continued scientific interest in this essential issue.

I also take this occasion as a good possibility to thank him for many years of hospitality and interesting scientific as well as general discussions on issues of mutual interest.

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7 Tracing the Neolithic in the lowlands of Belgium: the evidence from Sandy Flanders

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Joris Sergant

7.1 Introduction

During his career Leendert Louwe Kooijmans has contributed tremendously to a better understanding of the neolithisation of the Netherlands and the entire Lower Rhine Basin. In various papers throughout his career he has developed a model of neolithisation in which he emphasises the role of the indigenous hunter-gatherers in the transition towards an agro-pastoral way of life. Many of his arguments are based on data coming from a series of well-preserved wetland sites in the Dutch Rhine-Meuse delta (fig. 7.1), such as Hazendonk, Hekelingen, Hardinxveld, Schipluiden, etc, which he has excavated over the last 25 years, sometimes on a large and extensive scale. This wealth of wetland data, however, contrasts sharply with the poor data available for the adjacent dry coversand area situated in between the Rhine-Meuse delta and the loess area of Middle Belgium and south-eastern Netherlands. Until recently Neolithic data from this lowland area was restricted to isolated finds, or assemblages which are badly documented due either to surface collection or to old excavations. These major differences in data quality posed limitations to Leendert's modelling, especially when dealing with possible interaction

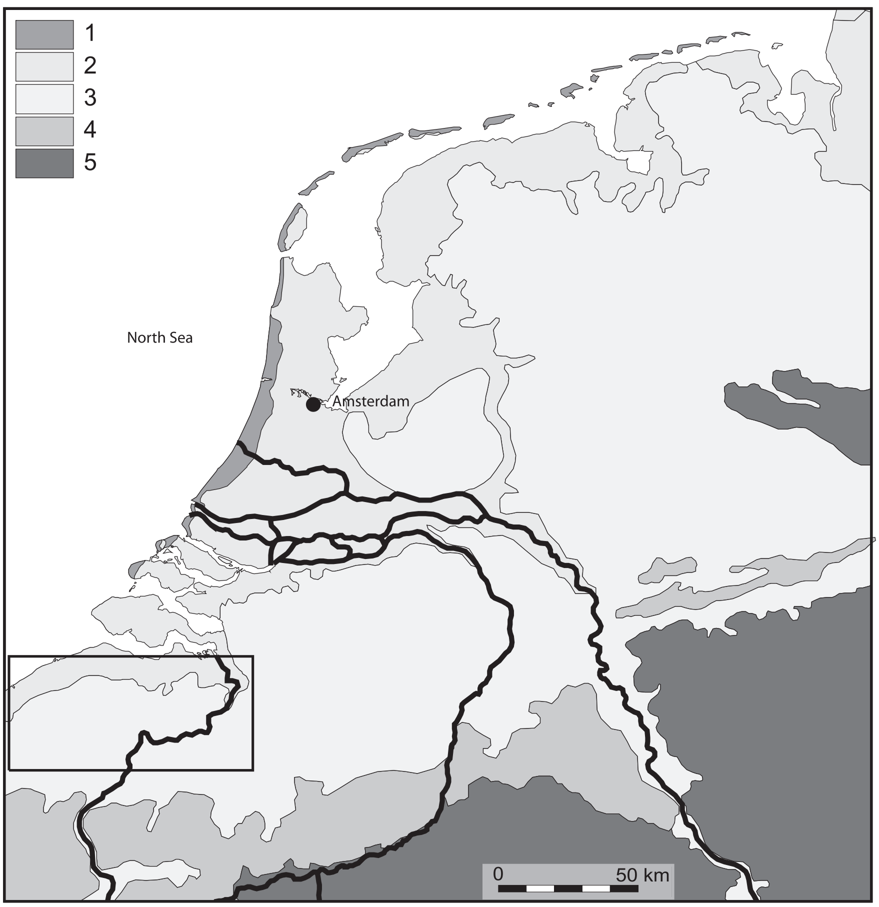

Figure 7.1 Location of Sandy Flanders (square box) within NW Europe (based on Louwe Kooijmans 1993).
1 coastal dunes
2 Rhine-Meuse-Scheldt delta
3 dry coversand area
4 loamy area
5 loamy upland area

and exchange between the first farming communities of the loess and the hunter-gatherers of the delta. Although it is very likely that indigenous groups living in the dry coversand area of northern Belgium and the southern Netherlands played a significant role in the transmission of knowledge and goods to the wetlands, until shortly this remained particularly difficult to assess as reliable data was missing.

Recently, however, new and better data has become available, in particular in the coversand area of north-western Belgium, known as Sandy Flanders or "Zandig-Vlaanderen" (fig. 7.1). In this large region of c. 3000 km^2, in the last few years new discoveries have been made as a result of extensive salvage excavations and intensive surveys using field walking, corings and aerial photography. These new data will be discussed below in the context of the neolithisation process.

7.2 The 5th millennium cal BC: the transition from the Final Mesolithic towards the Early Neolithic

Until now nearly all data related to the transitional 5th millennium cal BC originates from the floodplain of the Lower Scheldt River (fig. 7.2). Between 2000 and 2003 the presence of the Final Mesolithic Swifterbant culture, including pottery, was attested for the first time in Belgium, thanks to the discovery of three sealed wetland sites in the deep construction trenches of the "Deurganck" dock at Doel, situated in Antwerp harbour (Bats *et al.* 2003; Crombé 2005; Crombé *et al.* 2000; Crombé *et al.* 2004). Earlier however, in the 1980s, Swifterbant pottery had already been excavated in the nearby municipality of Melsele "Hof ten Damme" (van Berg *et al.* 1992), but due to the extreme fragmentation of the pottery and the admixture with older and younger settlement waste, its connection with the Swifterbant culture was not clear at the time.

All four sites display the same environmental setting: on the top of relatively narrow but elongated late glacial coversand ridges which, at the time of occupation, *i.e.* roughly in the second half of the 5th millennium cal BC, were situated in a marshy area close to open freshwater. The Swifterbant occupation in the Lower Scheldt valley seems to have coincided with the Wormer transgression phase of the sea, which backed up the freshwater and resulted in the deposition of organic clay deposits on top of the basal peat (Nieuwkoop Formation) and reduced the available occupation surface on the sand ridges to small stretches of relatively dry land.

Settlement traces are restricted to latent surface-hearths, invisible during excavations and only traceable through plotting of burnt artefacts and ecofacts, which yield charcoal

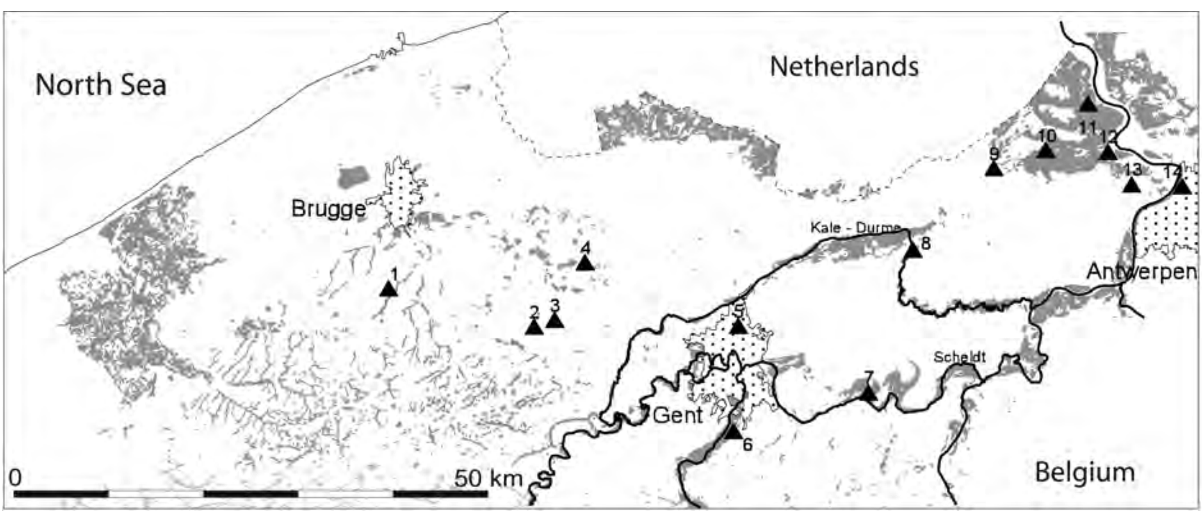

Figure 7.2 Sandy Flanders with indication of the Mesolithic and Neolithic sites mentioned in the text.

1 Waardamme
2 Aalter "Stratem"
3 Aalter "Oostergem"
4 Ursel
5 Gent
6 Merelbeke
7 Kalken
8 Eksaarde
9 Sint-Gillis-Waas
10 Verrebroek
11 Doel
12 Melsele
13 Zwijndrecht
14 Antwerpen

Grey shaded areas: river and (peri)marine deposits.

mainly from oak and alder, together with numerous burnt bones from mammals (wild boar and red deer mainly) and freshwater fishes (carp family mainly) as well as charred seeds and fruit remains (from hazelnuts, wild apples, sloe plums, acorns and hawthorn) (Bastiaens *et al.* 2005; Van Neer *et al.* 2005). Although partly biased by burning, these remains indicate an economy which was still entirely focussed on the exploitation of wild resources, and occupations which were most likely not year-round. At the Swifterbant site situated in sector B of the "Deurganck" dock the paleoecological evidence points to probable occupations at least during early and late summer, winter and early spring. Preliminary use wear analysis on flint artefacts (internal report V. Beugnier) also indicates rather short-term activities.

Based on the character of the excavated settlements, together with the strong Late Mesolithic affinities in the lithic industries (numerous trapezes, regular Montbani blades with irregular retouch, use of exotic raw materials such as Wommersom quartzite, emphasis on plant processing, etc.) it may be concluded that apart from the presence of pottery, these Swifterbant sites hardly differed from the Late Mesolithic occupations of the 7th - 6th millennium cal BC known in the same area (fig. 7.3).

Still, an important issue remains the extent of the territory of the Swifterbant culture in Belgium (and also the southern Netherlands). Based on the present information it might be concluded that this transitional culture was restricted to the Lower Scheldt floodplain, situated at the southern edge of the large prehistoric Rhine-Meuse-Scheldt delta covering the western Netherlands. However, the question has to be asked whether the Swifterbant culture did not extend further upstream along the Scheldt valley southwards into the (sand-) loamy area. It must also be asked whether the Swifterbant culture was confined to (river) wetland environments, or also extended towards the drier coversand areas of northern Belgium and the southern Netherlands.

In the present state of research these questions remain difficult to answer, yet there is indirect evidence which may shed some light on this discussion. Along the entire Scheldt River numerous finds of so called T-shaped antler axes or Tüllengeweihäxte are known, tools which are in fact more likely to have been used as mattocks; they come mainly from dredging in the second half of the 19th and beginning of the 20th centuries (Hurt 1982; 1992). A series of 15 of these finds has recently been dated by AMS, the results proving they belong to the 5th millennium and first half of the 4th millennium cal BC (*c.* 5000-3450 cal BC) (Crombé *et al.* 1999). Though it remains difficult to link these isolated finds with a particular culture, it is most likely that a number of these mattocks belong to the Swifterbant culture, as similar mattocks have been found, together with production waste, on several Dutch Swifterbant sites such as Hardinxveld (Louwe Kooijmans 2001), Almere (Hogestijn/Peeters 2001) and Swifterbant (Bulten/Clason 2001). So, a southern extension of the Swifterbant Culture along the Scheldt River is very plausible, but remains to be proven by in situ finds.

The question of whether or not the Swifterbant culture was solely restricted to wetlands is much more difficult to address. Most scholars, including Louwe Kooijmans, believe that the Swifterbant territory also included the dry coversands of Belgium and The Netherlands, claiming that the remains are difficult to locate due to taphonomic factors (degradation of poorly fired pottery due to soil acidity) and the absence of guide-fossils in the lithic inventories (Raemaekers 1999; Vanmontfort 2007). However, there is no reason to believe that Swifterbant pottery, which generally is of a much better quality than Michelsberg pottery found in the same area and dated to the beginning of the 4th millennium cal BC (cf. below), would not have survived. Regarding the absence of typical Swifterbant lithic tools, it should be emphasised that there is a big difference in size, morphology and technology between the trapezes found on Swifterbant sites and the Late Mesolithic ones from the coversand areas. Swifterbant trapezes (fig. 7.3) are generally much smaller, much more irregular and less standardised than Late Mesolithic specimens (Deckers 1979); a few examples rather resemble transversal arrowheads. Furthermore Swifterbant trapezes seem not to be made by means of the microburin technique any longer. Also the flat ventral basal retouch, typical for Late Mesolithic trapezes, is completely missing. In addition there seems to be a major difference in the blade technology between the Swifterbant and the Late Mesolithic, in the sense that the importance of blade technology is decreasing very much towards the 5th millennium. At least in Sandy Flanders there are currently no surface dryland sites known, which have yielded series of these small irregular Swifterbant trapezes, hence the existence of potential Swifterbant occupation sites in this particular area seems very unlikely.

On the other hand, the few irregular trapezes which incidentally occur in this area, mostly as stray finds, do indicate that late (Swifterbant?) hunter-gatherers marginally exploited the coversand area during the 5th millennium cal BC. This pattern of land use, characterised by a focus on wetland environments and a marginal exploitation of the dry interior, seemingly was not restricted to the 5th millennium cal BC but also characterises the Late Mesolithic in Sandy Flanders. The results of an exhaustive inventory project clearly indicate that sites from the 7th/6th millennium cal BC tend to cluster around former wetlands, such as the dry banks of the Kale/Durme River – an important tributary of the Scheldt River – and the borders of swampy depressions and mires (*e.g.* the Moervaart and Ede depression), while sites are almost completely absent from the dry "interior"

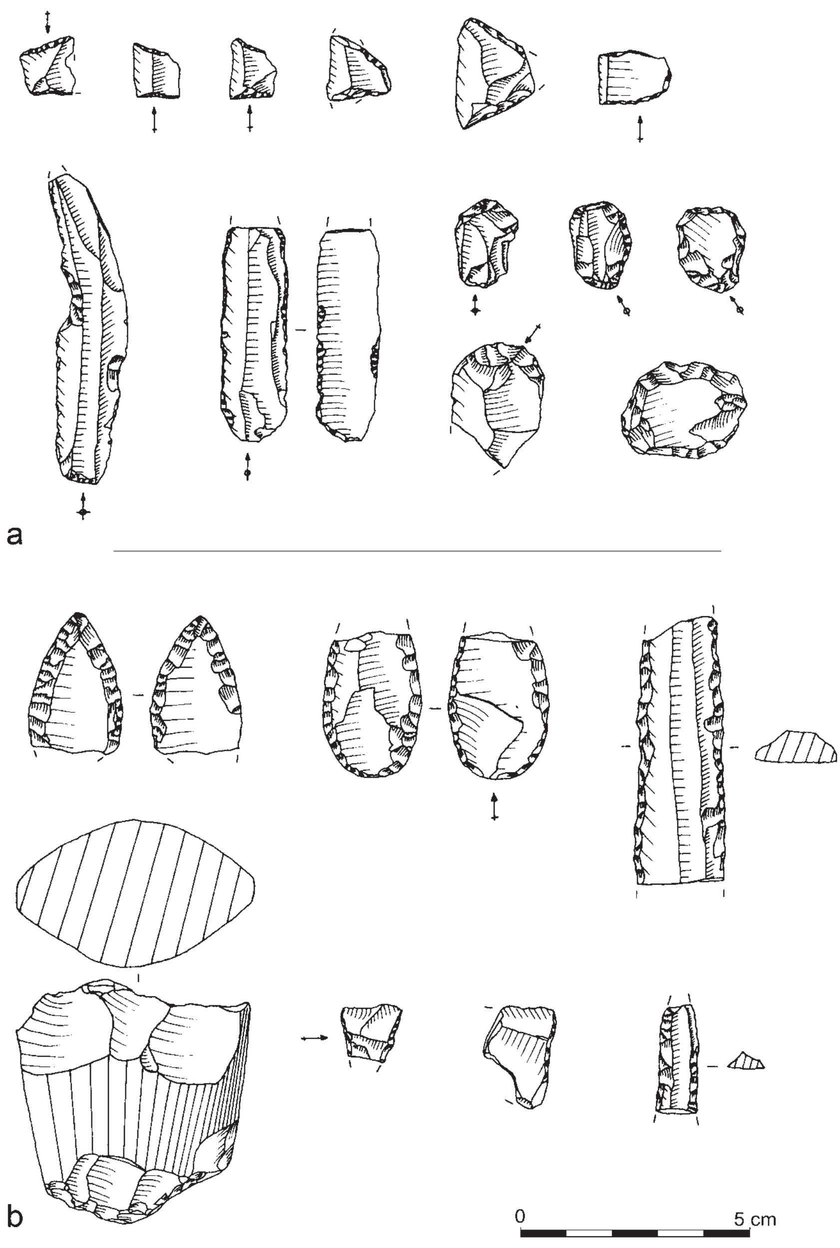

Figure 7.3 Comparison of the lithic toolkit between the Swifterbant Culture (a) and the Michelsberg Culture (b). Lithics are originating from research at Doel "Deurganck" dock, resp. sector B and C.

(Crombé *et al.* in press; Sergant *et al.* in press).[1] This pattern sharply contrasts with the earlier – Preboreal to first half of Boreal (9th and first half of 8th millennium cal BC) – occupation of Sandy Flanders, which is characterised by a more dispersed occupation covering the entire landscape.

Although the exact causes of the assumed "depopulation" of the dry coversand from the Atlantic period onwards are not yet known, it is thought that major environmental and/or social changes are the underlying factors. The general view is that the coversand area was decreasingly occupied as a

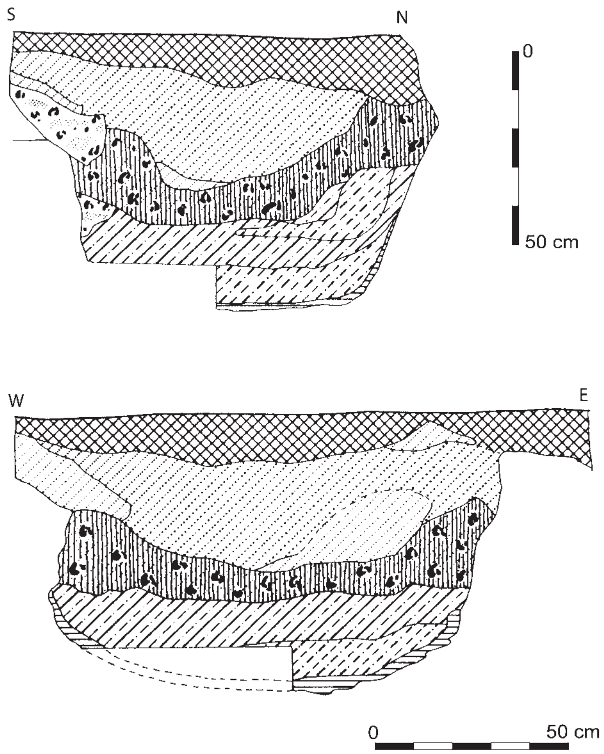

Figure 7.4 Transects from a (food?) storage pit excavated at the Michelsberg site of Melsele “Hof ten Damme” (after Van Berg *et al.* 1992).

result of the spread of dark and dense deciduous forest, which forced edible plant species as well as wild game to move to the borders of the main river valleys, leaving the forest interior unattractive for hunter-gatherers (Crombé *et al.* in press). Also, from the 6th and 5th millennium cal BC the appearance of ecologically very rich and varied peat fens might have had an impact on the settlement system and mobility of Late Mesolithic hunter-gatherers (Robinson 2007). These wetlands might have offered the chance, for the first time during the Mesolithic, to reduce mobility. The latter is also suggested by the observation that Late Mesolithic sites tend to yield larger lithic assemblages than Early Mesolithic ones.

7.3 The 4th millennium cal BC: the true start of the Neolithic?

It is not yet fully clear whether the marginal exploitation of the dry coversand interior of Sandy Flanders continued during the first half of the 4th millennium cal BC. At first glance, the evidence relating to the Michelsberg Culture shows an occupation pattern more or less similar to that of the 5th millennium cal BC. Indeed, up until now, it is from the Lower Scheldt floodplain that most Michelsberg finds have been reported (fig. 7.2). At Saeftinge (southwestern Netherlands) a handful of typical quartz-tempered Michelsberg potsherds (25 frag.), among which were fragments of horizontally perforated knobs (Schnurösen), were collected in 1998 (Jongepier 2002). A radiocarbon date on charcoal fragments situates these finds around 4955 ± 45 BP (GrA-19283; pers. comm. Jongepier) (fig. 7.5). Michelsberg pottery was also collected on and nearby the Swifterbant sites of Doel “Deurganck” dock (Crombé *et al.* 2000; 2002) and Melsele”Hof ten Damme” (Van Berg *et al.* 1992). Salvage excavations at Doel “sector C” led to the discovery of a small, but partially destroyed Michelsberg site, dated on foodcrusts to 5110 ± 35 BP (KIA-14334) (fig. 7.5). Besides flint-tempered pottery this site yielded a small lithic assemblage of c. 300 artefacts, including some typical Neolithic tools such as two leaf-shaped arrowheads, two transversal arrowheads, a robust retouched blade and a base fragment of polished axe (fig. 7.3). At Melsele similar tools (three leaf-shaped arrowheads, a sidescraper and a retouched blade) and pottery fragments were collected amidst older, Swifterbant occupation waste. However, this site also yielded a clear anthropogenic feature which, based on its radiocarbon dates obtained on samples of bark (OxA-3092: 4950 ± 80 BP;

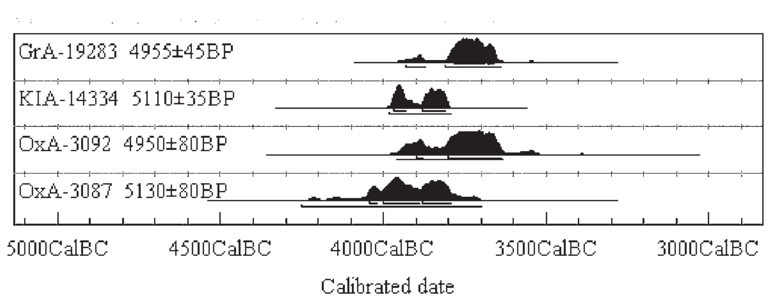

Figure 7.5 Calibration of the radiocarbon dates from Michelsberg sites in the Lower Scheldt floodplain.

OxA-3087: 5130 ± 80 BP) (fig. 7.5), is most likely connected with the Michelsberg finds. The feature (fig. 7.4) consists of a deep pit (depth c. 0.7 m; diameter c. 1.10 m) with almost vertical walls, the bottom of which was covered with bark. Based on the resemblance with Michelsberg silos, this feature may be interpreted as a (food?) storage pit.

Furthermore, in the same area there is the site of Verrebroek "Aven Ackers" (Sergant *et al.* 2007), where badly preserved flint-tempered pottery and a few arrowheads were found during recent salvage excavations. Further south along the Scheldt, at Zwijndrecht "Vlaams Hoofd" (fig.7.6), an almost complete Michelsberg Beutelbecher (Lüning type 12,1) was collected in 1903 underneath 3 to 4 m of peat, together with some bones and flint tools (Warmenbol 1987). An almost similar vessel (tulip shaped pot, Lüning type 7) was also found earlier on the right bank of the Scheldt, in the centre of Antwerp in the "Lombardenstraat" (Warmenbol 1987). Further upstream near Ghent, three locations are known which provided Michelsberg finds. A first site was detected in the First World War during the digging of a harbour dock, called "Port Arthur" (Otte *et al.* 1986). During these diggings an assemblage typical of the Michelsberg culture, consisting of triangular arrowheads (5), large flake scrapers (min. 6), flake axes or tranchets (7) and long regular blades, some of them manufactured from mined flint, was retrieved from the soil. More recently, flint-tempered pottery was also collected at Merelbeke (Janssens 2007) and Kalken (Bats/De Reu 2006).

Although similar Michelsberg finds are also known from the dry coversand interior, their interpretation is even more ambiguous as they all come from ploughed surface sites. The recent inventory project mentioned above resulted in the registration of typical Michelsberg tools, among which were mainly triangular (32 ex.) and leaf-shaped (38 ex.) arrowheads, clearly indicating some kind of exploitation by the Michelsberg Culture. Unfortunately, as most of these occur either as isolated finds on Mesolithic sites or as stray finds, it is difficult to assess their true meaning. Only a few sites (fig. 7.2), *e.g.* Eksaarde "Fondatie", Sint-Gillis-Waas, Aalter "Stratem" and Ursel "Wagemakersbeek" (Van der Haegen *et al.* 1999; Van Vlaenderen *et al.* 2007), yielded three to four such arrowheads together with many fragments of polished axes, some broken (un)retouched broad blades or even a few flake cores (*e.g.* at Aalter). Most likely these sites represent potential settlement sites, comparable to the ones excavated in the Lower Scheldt floodplain (*e.g.* Doel, Gent), though their number certainly is biased due to their small size and discrete character. Furthermore some isolated pottery finds, mostly consisting of small flint-tempered potsherds, are known from the dry interior, *e.g.* at Aalter "Oostergem" (De Laet *et al.* 1958). Here too some bias can be expected as a result of taphonomy.

Clearly these small assemblages of lithic artefacts and/or pottery found either in wetlands or on dryland contrast sharply with the large collections of finds from Michelsberg sites in the more southern (sand-) loamy area of the Scheldt basin. In the latter area Michelsberg sites tend to cover many tens of hectares, from which thousands of lithics are usually collected (Vanmontfort 2004). Most of these extensive sites, some of which are enclosed by interrupted ditches and palisades, are interpreted as permanent settlements and/or central foci within a fully agrarian system. Due to the major

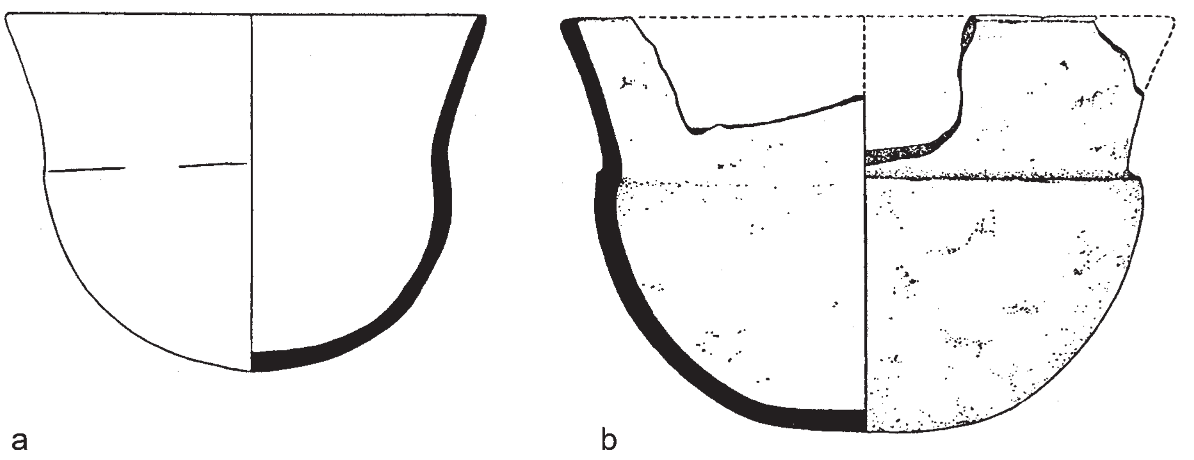

Figure 7.6 Two almost complete Michelsberg vessels from the Lower Scheldt floodplain (after Warmenbol 1987) (Scale 1:3).
a Zwijndrecht "Vlaams Hoofd"
b Antwerp "Lombardenstraat"

differences in size, most scholars do not associate the small assemblages found to the north/downstream in the sandy lowlands with real occupation by the Michelsberg culture. According to Louwe Kooijmans (2006, 493-494) they most likely do not represent actual expansion of the Michelsberg communities, but rather should be interpreted as objects that were exported to the north and were there deliberately deposited in burials. Some isolated finds, *e.g.* the almost complete vessels from Zwijndrecht, Aalter and Antwerp, may indeed have been burial gifts, but this interpretation definitely cannot be applied to all assemblages from Sandy Flanders, certainly not to those which also yielded knapping waste and highly fragmented pottery. Furthermore, Vermeersch (1990) argues that Michelsberg farmers-herders were not interested in occupying the "poor" coversands, which were not suited to agricultural activities. According to this interpretation, the limited Neolithic finds from the sandy lowlands were left by Michelsberg herders during long-distance transhumance activities, and certainly do not point at real occupation. Moreover, the fact that Neolithic finds are found on some coversand sites, mainly in the Campine area (*e.g.* at Weelde, Dilsen, Meeuwen and Opgrimbie) together with Mesolithic lithics, would indicate contact and interaction between indigenous hunter-gatherers and Michelsberg stock breeders. Vermeersch even postulates the idea that hunter-gatherers from the lowlands may have been "employed" by Michelsberg farmers-herders from the south in order to tend their cattle. However, the co-existence of late hunter-gatherers and Michelsberg farmers still has to be confirmed by secure data (Crombé *et al.* 2005; Crombé/ Vanmontfort 2007). The interaction model of Vermeersch is thus far based solely on ploughed sites, whose chronological integrity remains very questionable and difficult to evaluate. It is more likely that the sites discussed by Vermeersch represent mixed assemblages from Late Mesolithic and Michelsberg occupation phases. As it happens, the Late Mesolithic assemblages of Weelde, Dilsen, etc. do not show any affinities with the lithics (trapezes) from the Swifterbant Culture, but rather represent sites belonging to the 7th or 6th millennium cal BC, thus predating any Michelsberg activity. Moreover some sites (*e.g.* Meeuwen) yielded microliths typical of the Middle rather than the Late Mesolithic.

In our opinion there is no reason why the small Michelsberg sites in Sandy Flanders, as well as in other parts of the coversand region of Belgium and The Netherlands, should not be regarded as real occupation sites from the Michelsberg Culture. Sites such as Doel, Melsele, Aalter, Eksaarde, Sint-Gillis-Waas and Ursel (cf. supra) yielded lithic and/or ceramic assemblages which are perfectly comparable – both typologically as well as technically – with typical Michelsberg assemblages from the loamy area. They include the same standard tools and vessels, albeit their typological range may be less wide. Also the presence of ad hoc flint knapping and in one case a (storage?) pit feature also favours an interpretation as settlement sites. The only difference is the limited size of these sites, yet small sites do also occur in the southern loamy region (Vanmontfort 2004). For example, some lowland sites (*e.g.* Doel, Gent) can be compared to a certain degree with the small, albeit better-preserved site of Oudenaarde "Donk" (Parent *et al.* 1987) situated in the Middle Scheldt floodplain within the loamy region. Salvage excavations at the latter site revealed a Michelsberg occupation of less than 30 × 50m, situated on a small point bar. Based on the preserved faunal and botanical material, the site is interpreted either as a special activity site oriented towards hunting, fishing and herding and forming part of a settlement system including the surrounding large permanent settlements (Parent *et al.* 1987) or as a temporary site belonging to an autonomous more mobile group of Michelsberg members (Vanmontfort, 2004, 162). Regardless of which interpretation is the right one, both models view the site of Oudenaarde as a semi-agrarian (extended broad spectrum, as defined by Louwe Kooijmans) and semi-permanent site, probably occupied during specific times or seasons within a yearly cycle. Both models also imply that Michelsberg farmer-herders, or at least some of them, were more mobile than traditionally thought.

Therefore, based on the above arguments and contrary to current theories (cf. supra) we tend to view the small sites in the coversand lowland as clear evidence for Michelsberg occupation, probably by (semi-) mobile groups which operated in the wetlands and most likely also in the drier "interior" of Sandy Flanders. Unfortunately, the present data do not indicate whether or not there was a functional difference between the wetland and the dryland sites. However, it is not excluded that the latter represent more permanent settlements. Despite the limited size of the lithic assemblages recovered from these sites, the existence of timber houses is possible, and certainly can be expected in future excavations.[2] The presence of constructions on small sites already has been demonstrated for the Final Neolithic (1st half of 3rd millennium cal BC) within Sandy Flanders. Salvage excavations at the site of Waardamme (Demeyere *et al.* 2006), which yielded a lithic assemblage of barely 500 artefacts, revealed a completely preserved house plan measuring 20.2 m long. Future excavations will have to prove whether similar single house sites existed for the Michelsberg Culture.

To what extent the (semi-) mobile Michelsberg groups from the coversand area were part of the same settlement system as the loamy area or, on the contrary, represent independent groups with own territories, remains to be investigated. Furthermore, the question concerning how the Michelsberg Culture was introduced into the sandy lowlands, shortly before or after 4000 cal BC, has to be further examined. Are we really dealing with groups which migrated from the south, introducing the Neolithic culture as a package into the lowlands (demic diffusion) or is the appearance of the Michelsberg Culture the result of a sudden and abrupt acculturation of indigenous hunter-gatherers? In the former case, contact finds should be expected on both Swifterbant and Michelsberg sites, but solid and irrefutable prove for this has not yet been found (cf. supra). On the contrary, the evidence from the sealed Michelsberg site of Doel "sector C", being the most reliable context within Sandy Flanders so far, points at the complete absence of Mesolithic or Swifterbant artefacts, despite the proximity of several Swifterbant sites at Doel. On the other hand, the acculturation hypothesis implies that some Mesolithic (Swifterbant) affinities should be observable in the earliest Michelsberg Culture. However, the available evidence currently points rather at a rupture than at continuity in the material culture. Michelsberg lithics and ceramics differ substantially in morphology, technology and raw material from Late Mesolithic and Swifterbant material culture (Crombé *et al.* 2002). The only evidence of some kind of continuity is the use of T-shaped antler mattocks until the end of the Michelsberg period. Also the presence of some transversal arrowheads within Michelsberg contexts (*e.g.* at Doel) may be considered as a Swifterbant heritage, as similar, albeit less typical examples are known from Swifterbant sites.

7.4 Conclusions

Recent research has offered the opportunity for new insights into the neolithisation process in Sandy Flanders, situated at the contact between the well-documented Rhine-Meuse delta and the southern loess area. Albeit preliminary, the data suggest a gradual (?) depopulation of the dry coversand interior during the Late and Final (Swifterbant) Mesolithic followed at the start of the 4th millennium BC by a "re-occupation" by (semi-)mobile Michelsberg groups. Future excavations, which are planned for the coming years, will allow us to verify the validity of these findings and hopefully to refine our views on the neolithisation of the coversand lowlands of Belgium.

Notes

1 Research Programme of the Research Foundation - Flanders (FWO), entitled "Man and Landscape. Study of prehistoric land-use in three core regions of Sandy Flanders between c. 12,000 and 2000 BC" (2004-2007).

2 In the framework of a new project financed by the Research Programme of the Research Foundation - Flanders (FWO), entitled "The Neolithic in the sandy lowlands of Belgium: chronology, extension and character" (2008-2011), several Neolithic sites will be investigated by means of trial excavations and augerings.

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8 A southern view on north-south interaction during the Mesolithic-Neolithic transition in the Lower Rhine Area

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8.1 Introduction

During the past few decades, the neolithisation process in Europe has been recognised not to be a single and large scale process, but rather a mosaic of multiple regional processes (*e.g*. Tringham 2000; Whittle/Cummings 2007). In the wetlands of the Lower Rhine Area, recent data has yielded new insights in the nature of the process. It has become clear that the successors of the local Late Mesolithic gradually adopted typically Neolithic elements, and the entire process of *extending* the *broad spectrum economy*, as discussed by Leendert Louwe Kooijmans in 1993, first with pottery, and only later with domestic stock and cereals, spanned a period of at least a millennium. Still within the Lower Rhine Area (LRA), the loess region presents a different case to the wetlands. Here, after its first appearance the Neolithic displays several hiatuses, one of which occurs at around the mid 5th millennium cal BC (Vanmontfort 2007). This hiatus has been claimed to be merely one in knowledge, rather than corresponding to an actual lack of occupation, but whichever it was, the processes at work during this phase seem to have been crucial for the neolithisation of the region (*ibid.*). Until more evidence is uncovered, the gap can only be filled by indirect arguments, such as the one to be developed in this paper.

The indirect way taken here to approach the problem, and to confirm continuity in human activity in the southern LRA, is through the exploration of interregional exchange. First, I will outline the geographical and chronological context, followed by an introduction to the evidence for exchange, before a more detailed consideration of the changing patterns from before the arrival of farmers, through their arrival and the hiatus, to the time when neolithisation can be said to have occurred. In this way, the particular local character of the neolithisation process will, it is hoped, be revealed.

8.2 The Lower Rhine Area

The Lower Rhine Area as defined here encompasses the Lower Rhine basin as well as parts of the Scheldt and Meuse basins and the westernmost extension of the North European Plain (fig. 8.1). It is an area characterised by important differences in physiography and consequently also in the nature and resolution of the archaeological data. Three physiographic regions can be distinguished: the Holocene wetlands in the north and west, the hilly, loamy region of the loess belt in the south, and the flat coversand area in between. The boundaries between those regions are not abrupt: wetlands extend into the coversand region and even into the loess region in the form of floodplains, and the coversand and loess regions are connected through a substantial intermediate sandloamy region.

Different taphonomic and post-depositional processes are at work in these regions and result in contrasting archaeological records. By far the most complete picture is derived from the wetlands. Progressive deposition of Holocene alluvial and marine deposits makes the sites in this region difficult to identify, and research at those sites costly, but the data from the fairly low number of investigated sites is of a high resolution. Parts of these sites are well stratified and yield large quantities of secondary refuse (*sensu* Schiffer 1987, 47 ff.) in primary context, and the stone and pottery artefacts are associated with large amounts of organic remains, yielding important ecological data. Less information is known from the coversand and loess regions.

In the flat coversand region the surface has remained relatively undisturbed since the beginning of the Holocene period. As people repeatedly visited the same locations throughout the Mesolithic period, this resulted in the creation of enormous palimpsests of occupation debris and very few single occupation sites. Organic matter is generally not preserved. Charcoal and charred hazelnut shells are found intermingled with the artefacts, but the palimpsest situation often makes it difficult to reliably connect them with particular occupation remains.

The loess region presents a different problem again. Its more pronounced relief and more intense agricultural history has resulted in a significant amount of erosion and related footslope sedimentation. These processes progressively increased with the introduction of new agricultural techniques and the spatial extension of agriculture from the Neolithic onwards, especially since the early 20th century. Mesolithic sites, with generally only ‘surface remains’ and no features dug into the ground, are easily washed away or covered, while shallow features at Neolithic sites are often severely affected by the soil loss. Moreover, the acidity of

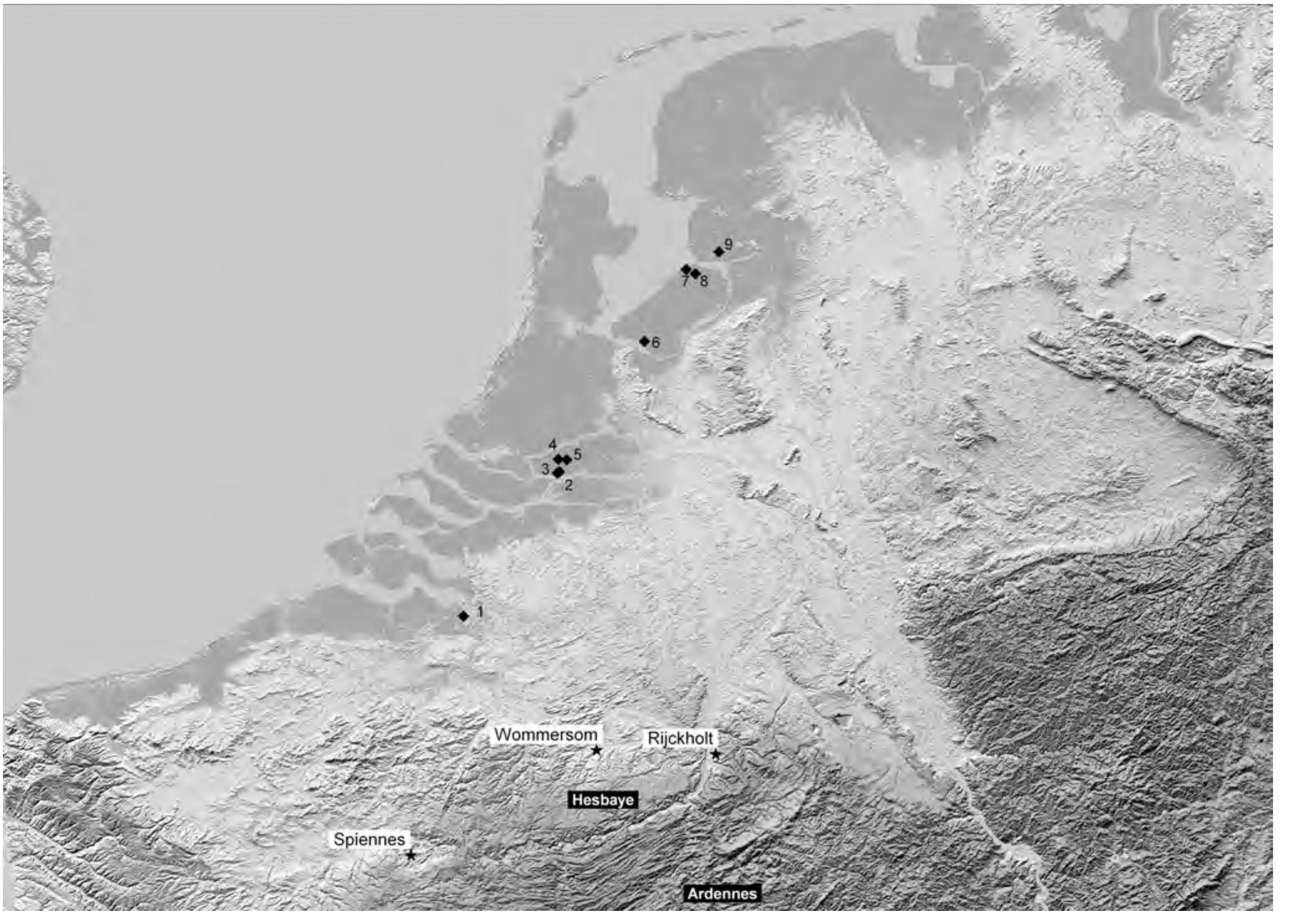

Figure 8.1 Map of the Lower Rhine Area with sites mentioned in the text.
1 Doel Deurganckdok
2 Hardinxveld-Giessendam Polderweg
3 Hardinxveld-Giessendam De Bruin
4 Brandwijk Het Kerkhof
5 Hazendonk
6 Hoge Vaart A27
7 Swifterbant S2
8 Swifterbant S3
9 Schokland P14

these loam soils does not allow for the preservation of organic remains, apart from charred macrobotanical remains.

Apart from these different processes at work and the variable resolution of the image derived from the archaeological data, the ecological conditions in these regions resulted in diverse human behaviour in the past, even in different worlds (Louwe Kooijmans 2006, fig. 27.15; Raemaekers 1999). Traditionally, the Neolithic in the south of the LRA has been regarded as a phenomenon of Central European origin without much hunter-gatherer influence, while in the north demographic continuity is more evident and the Neolithic is viewed as a local phenomenon.

In the wetland region of the north and west, the role of the Swifterbant culture in the transition process has become much more tangible in the last decade (Crombé *et al.* 2002; Crombé/Vanmontfort 2007; De Roever 2004; Louwe Kooijmans 2007; Peeters 2007; Raemaekers 1999; Sergant *et al.* 2006). In its origins very much a Final Mesolithic phenomenon, it gradually adopted elements typically associated with the Neolithic and extended its broad spectrum economy (Louwe Kooijmans 1993). Starting with the introduction of pottery around 5000 cal BC, domestic stock and cereals followed respectively a few centuries and a millennium later (Van Gijn/Louwe Kooijmans 2005a).

The situation is less clear in the neighbouring coversand region, from which a large number of Mesolithic sites are known but informative Early Neolithic sites are absent. The particular taphonomic processes in this region, namely the palimpsests, are responsible for the absence of unambiguous associations of Mesolithic and Neolithic elements (Amkreutz *et al.* forthcoming) and for the difficulties in dating and characterising the final Mesolithic occupation of the region (*e.g.* Crombé *et al.* 1999; Vermeersch 2006). Crombé *et al.* have shown that the Swifterbant extended at least to the Lower Scheldt and perhaps even more to the south (Crombé/Sergant, this volume; Crombé *et al.* 2005; 2002). Here on the coversand, the gradual uptake of Neolithic elements is most likely also the basis of the neolithisation process. As in the northern Swifterbant regions, however, it remains a question as to how far these Swifterbant communities ventured on the coversand regions, and to what extent groups other than Swifterbant populated these environments. This leaves a chronological hiatus between the 6th millennium cal BC Late Mesolithic and the Neolithic sites of the 4th millennium cal BC in much of the coversand region.

In the southern loess region, a Mesolithic presence is mainly attested by small surface scatters or isolated microliths. This exploitation can be visualised spatially and chronologically (Vanmontfort forthcoming), but it remains difficult to link the evolution with the Mesolithic-Neolithic transition. This is also due to the discontinuity, in the middle of the 5th millennium cal BC, in the Neolithic culture history of the region. The first farmers of the Linearbandkeramik culture (LBK) and their successors of the Blicquy/Villeneuve-Saint-Germain culture (BQY-VSG) were not immediately succeeded by any other known Neolithic tradition. In the eastern part of the LRA, remains of the Rössen culture connect the LBK and Michelsberg culture (see also Bakels, this volume) and to the southwest of the LRA the Cerny culture fills that space. Neither Rössen nor Cerny sites have been reported, however, from the south-western part of the LRA (Crombé/Vanmontfort 2007). Archaeological data for the presence of farming groups only reappears at the end of the 5th millennium, after a gap of *c.* 500 years (Vanmontfort 2007).

It is unlikely that the chronological and spatial gaps in the coversand and loess regions correspond to an actual lack of occupation, as the particular taphonomy of these specific regions can be invoked to explain the absence of data. The hiatuses are thus more likely to correspond to gaps in present-day knowledge. Unfortunately, the key to understand the neolithisation process in these regions lies within this chronological and spatial gap (Vanmontfort 2007). The Middle Neolithic occupation of the region, after the hiatus, may have been the result of a second influx of Neolithic (Early Michelsberg) communities from the northern Paris Basin (Jeunesse *et al.* 2003), but current ideas, developed on the basis of stylistic analysis of Ch/MK remains and on the spatial distribution of Late Mesolithic, Early and Middle Neolithic sites, suggest a local development of the Middle Neolithic on top of a native, Mesolithic-rooted substratum (Vanmontfort 2007).

Another way to confirm human activity in the southern LRA during the above-mentioned hiatus and eventually to determine the processes at work during those phases, is through scrutiny of the indications for exchange relations with the southern LRA in neighbouring regions. In contrast to the coversand region where particular artefact associations are often difficult to confirm, the wetlands north of the Scheldt basin seem particularly apt to such an approach. First of all, stone raw material was virtually absent in this region and had to be imported (Louwe Kooijmans 2006; Van Gijn/Louwe Kooijmans 2005b). Second, the resolution of the data allows a detailed recording of exchange indications. Thirdly, the existence of contact lines to the south from these regions has been observed at a number of occasions, on sites dated from the Late Mesolithic (Louwe Kooijmans 2003) to the Late Middle Neolithic (Louwe Kooijmans 2006). This is especially the case for sites of the Dutch River Delta, while sites located more to the north seem to have been orientated to the northern hinterland (*e.g.* Beuker 2005; Raemaekers 1999). Finally, during the hiatus on the coversand and loess, the wetlands are characterised by cultural continuity. Therefore, this paper focuses on the artefacts of southern origin that were found in Swifterbant contexts, mainly in the Dutch River Delta. The ultimate aim of this method is to approach the study of changes in human activity in the southern LRA on the basis of variations in the observed exchange networks of the broader region.

8.3 Interpreting the movement of goods

Identifying the nature of the exchange system behind artefact distribution patterns is impeded by several factors. First, the archaeological record is biased by taphonomic and (post-) depositional processes. In particular, objects in perishable materials will have been part of an exchange system (Zvelebil 1998), but are rarely preserved. Most archaeological indicators for interaction are imperishable, artefacts such as stone and pottery, or consist of more indirect elements such as stylistic influences on locally produced artefacts. Moreover, the way these artefacts entered the archaeological record depends upon their life-cycle and the value placed on them after exchange. Prestigious items, for instance, can only rarely be expected in domestic waste context.

Secondly, pinpointing the raw material sources is rarely possible. For the Lower Rhine Area, exchanged raw materials include flint and stone types that occur in primary position in the southern loess or Ardennes regions. Some of those raw materials, however, can also be found in secondary position more to the north and closer to the Swifterbant sites of the Dutch river district, in Meuse terrace gravels (*e.g.* Van Gijn/Houkes 2001). Rijckholt and grey Hesbaye flint (also known as grey Belgian flint) are also difficult to pinpoint to source, but their origin in the southern LRA seems beyond any doubt. The source of Wommersom sandstone or quartzite can be pinpointed to a single known outcrop in the Kleine Gete river basin near the present-day town of Tienen. Thirdly, the question may be raised as to what extent a single artefact or a mere handful can prove the existence of exchange and trade or illuminate the behavioural context of the exchange. As Peeters (2007, 198) rightly states, these artefacts confirm the transport of raw materials, but rarely shed a light on how they entered the archaeological record.

In an attempt to provide a framework for the analysis of exchange relationships, Zvelebil (2006) distinguishes between three spatial levels of exchange predominantly associated with particular modes of procurement or exchange: a regional level that is predominantly characterised by direct procurement of non-exotic utilitarian items of which the circulation is difficult to identify archaeologically, an inter-regional level with distances between 100 and 300 km and with socially contextualised exchange between reciprocal partners and, finally, a long-distance level over vast distances with specialised trade dominated by an elite or specialised traders. Within this framework, the modes of distribution are likely to be reflected in the quantities and dimensions of the artefacts and the distance and distribution pattern relative to the source (Louwe Kooijmans 2006), evidently taking into account the possible ways of transport (cf. Louwe Kooijmans/Verhart 2007). Other elements to be involved in the argument are the archaeologically deduced social boundaries, the nature of the item and the spatial expression of its *chaîne opératoire* (Bergsvik/Bruen 2003; Fischer 2003a;b). The combination of these elements can suggest whether artefacts reached a particular site as the result of direct procurement or of exchange. Unfortunately, even within this framework, it often remains difficult to distinguish between direct procurement or robbing and exchange, be it personalised exchange, down-the-line contact or specialised trade (Fischer 2003a; Verhart/Wansleeben 1997; Verhart 2000a).

Nevertheless, while accepting the difficulties in identifying the individual process at work in the movement of a particular artefact, in this paper the available data will be examined and interpreted within the above-mentioned framework.

8.4 A chronological analysis of interactions between the wetlands and the southern uplands of the LRA

Below, the analysis of the available data is structured in four phases, defined on the basis of the Neolithic developments in the south of the LRA. These phases coincide with a pre-Neolithic (mid 6th millennium cal BC), a Danubian Neolithic (5300-4850 cal BC), a Neolithic hiatus (4850-4300 cal BC) and a Middle Neolithic phase (*c.* 4300-3800 cal BC. Only data for which the chronological position is clear and that can be attributed to one of the defined phases are taken into account (fig. 8.2).

8.4.1 Phase 1: the pre-Neolithic

Before the arrival of LBK communities in the south of the Lower Rhine Area, the Mesolithic of the Netherlands is characterised by a rough northsouth division running north of the Dutch river district (*e.g.* Deeben/Van Gijn 2005). Whereas the northern Mesolithic was oriented towards the north, both in terms of raw material provision and in terms of technological affinities, the southern Mesolithic was part of a predominantly southern interaction sphere (*e.g.* Gendel 1984). In view of the scope of this paper, the focus thus lies on the southern wetland sites.

The southern interaction sphere of the southern Netherlands Late Mesolithic is shown by the data collected at Hardinxveld-Giessendam Polderweg. The first phase at this site slightly predates or coincides with the commonly accepted date for LBK arrival in the LRA of 5300 cal BC, and predates the newly proposed LBK arrival date of 5220 cal BC (Van de Velde, this volume). Objects from this phase found at Hardinxveld include Wommersom artefacts and a large precore in Rijckholt flint that must have been extracted in southern Limburg, pieces of pyrite possibly imported from the Ardennes, and some larger pieces of quartzitic rock mostly extracted in primary position in the Ardennes region (Louwe Kooijmans 2003; Van Gijn *et al.* 2001a).

Although direct procurement by special task forces cannot be excluded, the large stone blocks were most likely obtained by exchange: social boundaries had to be crossed in the procurement and the absolute distance between the site and the source of the raw material, exceeding 100 km as the crow flies, corresponds to the inter-regional level of Zvelebil's (2006) framework (see above). It is likely that the pyrite and some of the other raw materials were part of the same contact network.

The presence in the wetland Mesolithic sites of Wommersom sandstone or quartzite, a favoured raw material during the Late Mesolithic, suggests exchange with southern populations that were not part of the same cultural or social group. Arguments in favour of a different cultural attribution are for instance the general differences in lithic processing techniques and the differential occurrence of Wommersom at the Late Mesolithic sites of the intermediate coversand region (Amkreutz in prep.). Even if the nature of the exploitation is as yet unknown, it is likely that the few Wommersom artefacts found in wetland context were the result of exchange with these Late Mesolithic communities of the coversand region, directly exploiting the source. The distance of *c.* 100 km as the crow flies between Polderweg and the

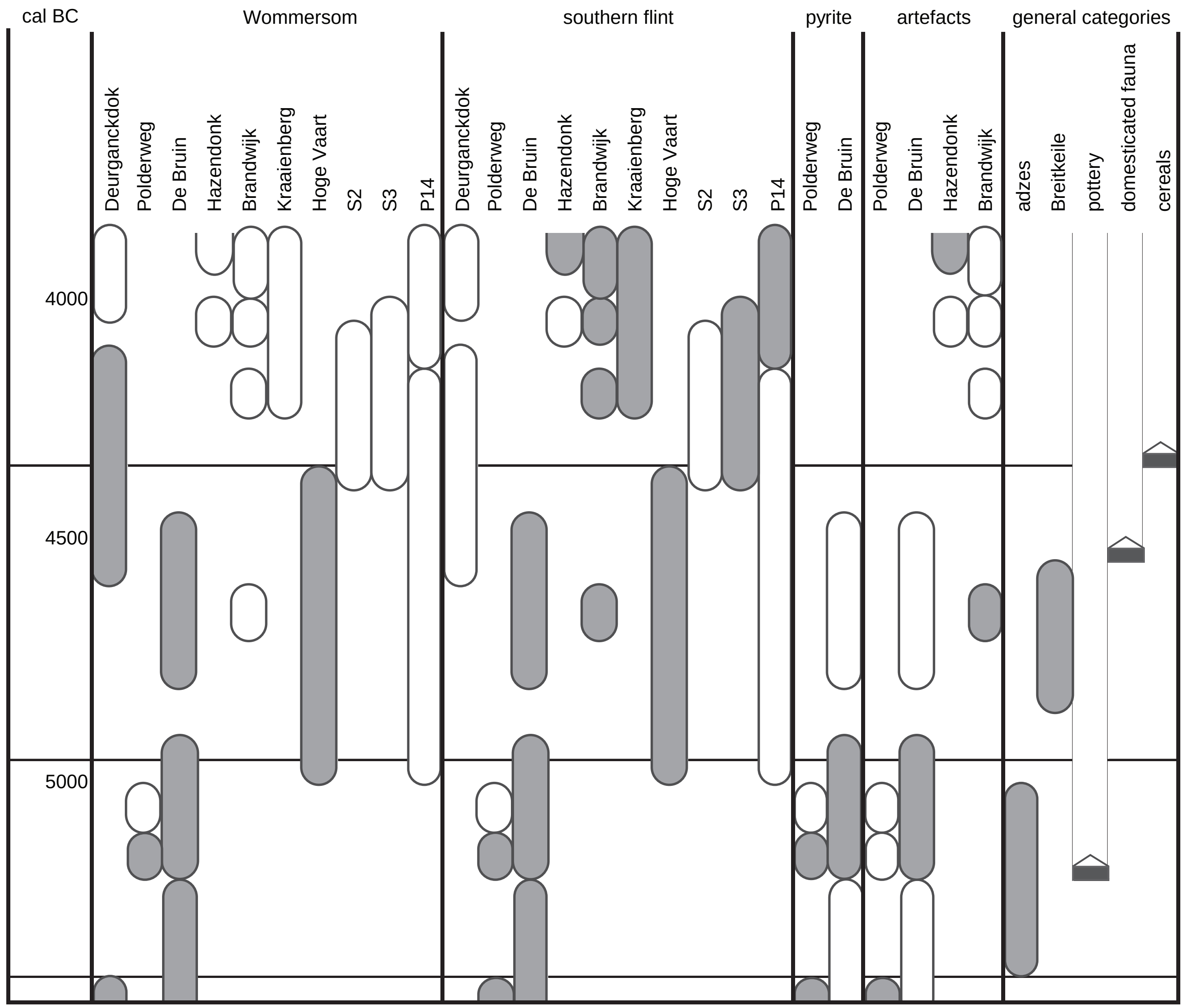

Figure 8.2 Indications for southern elements imported in wetland context. Per site the occupation phases are given as well as the presence/absence of exchanged items.

outcrop of Wommersom fits with the distances indicated by Zvelebil and the crossing of archaeologically known social boundaries (see above) and is also confirmed by the nature of the artefacts, in particular the absence of indications for a local processing of Wommersom at Polderweg (Van Gijn *et al.* 2001a). The low number of Wommersom artefacts at these wetland sites suggests the sporadic nature of their exchange, which fits with the peripheral position of the Dutch River delta to the known distribution of this raw material, but it could also be the result of the high value attributed to artefacts produced in this raw material, due to which few were deposited in domestic contexts.

It is reasonable to assume that these contacts and the related movement of people between the regions also resulted in the first indirect or direct contact with the farming populations of the LBK. This explains the presence of an LBK arrowhead around 5300 cal BC in Hardinxveld-Giessendam Polderweg.

8.4.2 *Phase 2: the Early, Danubian Neolithic*

During the subsequent, Danubian Neolithic phase, sites in the Dutch River delta are characterised by an increasing importance of so-called northern flint, that can have been found fairly close by in the Utrechtse heuvelrug region, at less than 50 km as the crow flies from Polderweg and De Bruin, but also the southern contact lines continue to be in existence. Data from Swifterbant sites located more to the north, such as the eponymous location of Swifterbant (Devriendt in prep. and pers. comm. Dec. 2007), include fewer indications for southern interaction and thus show the persistence of the general north-south distinction.

Unfortunately, no sites are known from the Lower Scheldt valley. A single hazelnut shell sample in Verrebroek Dok 1 yielded a reliable radiocarbon date between 5370 and 5080 cal BC, but no artefacts could be associated with this date (Van Strydonck/Crombé 2005). At Hardinxveld-Giessendam Polderweg and De Bruin (fig. 8.2), the southern interaction is indicated by the presence of some Wommersom, grey Hesbaye flint and Rijckholt artefacts and few pieces of pyrite found in the phase 2 deposits of both sites.

The Wommersom, pyrite and some of the southern flint was possibly imported through the same contact networks as those of the previous phase. Some of the southern elements can however also have been obtained through exchange with the newly arrived Neolithic communities, as Rijckholt flint, grey Hesbaye flint and even Wommersom were part of the LBK raw material spectrum.[1]

Adzes, found in particular in the eastern part of the LRA (Verhart 2000b; Verhart 2003; Verhart in prep), support the idea of indigenous contacts with LBK communities in the south. These are mainly stray finds and as yet no LBK adze has been found in unambiguous Swifterbant context, but this should not prove the absence of Swifterbant – LBK contact. Their absence may also confirm the high value of these artefacts due to which they are not frequently expected in a domestic waste context. There are other indications that suggest a direct Swifterbant – Danubian Neolithic connection. These include an LBK arrowhead from Polderweg's first phase, and pottery of the Groupe de Blicquy (BQY) and possibly also Grossgartach culture (GGK) (Lüning pers comm.; Feb 2007) in the second phase of Hardinxveld-Giessendam De Bruin (Raemaekers 2001).

LBK or LBK-like arrowheads are in fact often found north of the loess, up to 100 km from the nearest known LBK settlement. Whether these also result from direct interaction between Mesolithic and Neolithic people is open to debate. An ongoing study on late and final Mesolithic arrowheads alongside LBK arrowheads is expected to shed more light to this problem (Robinson in prep.). As it is, the morphological and technological characteristics of one arrowhead at Polderweg seem until further notice to confirm its LBK origin, in contrast to two other 'LBK-like' arrowheads from the same site (Van Gijn *et al.* 2001a). In the light of these Mesolithic/Swifterbant – Neolithic contacts, the appearance of Swifterbant pottery at the end of the 6th millennium cal BC should be mentioned. From the beginning onwards, Swifterbant pottery is a local tradition, not necessarily to be related to a southern, Neolithic pottery tradition. It may have been the westernmost extension of the Boreal pottery traditions that travelled west over the north European plain, but it can also have been inspired by Early Neolithic examples (Louwe Kooijmans 2003; 2007; Louwe Kooijmans forthcoming; Raemaekers/De Roever in prep.).[2]

8.4.3 *Phase 3: the Neolithic hiatus*

After *c.* 4850 cal BC, the provision in 'northern flint' (cf. *supra*) of the Dutch river delta continues, and at Hardinxveld-Giessendam De Bruin even gains in importance (Louwe Kooijmans 2003; Van Gijn *et al.* 2001b). In all phases of that site, flint imported from the fairly nearby Meuse terraces dominates the assemblage, and northern flint is better represented than raw materials imported from the south of the LRA. In this phase, the proportion of northern flint increases to reach a total of 47% of all the flint artefacts. A few Wommersom artefacts were found at the sites of Doel Deurganckdok (Crombé *et al.* 2000; Sergant *et al.* 2006) and De Bruin (phase 3, Van Gijn *et al.* 2001b), and even in the more northerly site at Hoge Vaart phase 3 (Peeters 2007, 112 ff.). At De Bruin, this material cannot entirely be excluded to be residual from previous occupation phases, but this is not the case for Doel and Hoge Vaart, where its presence confirms the continuation of Wommersom exploitation and exchange during this phase. As in the previous phases, and using the same arguments, the Wommerson finds are likely to represent an inter-regional and cross-cultural exchange rather than direct procurement.

Southern flint is also frequently found in the Swifterbant contexts of the River district. At Hardinxveld several long blades were produced in Rijckholt flint. At Brandwijk, the small flint assemblage dated to this period (stratigraphical phase L30, *c.* 4610-4550 cal BC) contains a single Rijckholt and a single grey Hesbaye flint artefact (Raemaekers 1999, 42 ff.; Van Gijn/Verbruggen 1992). The same context also yielded a small sherd decorated with a triple pointed spatula that could not be attributed with certainty to a known pottery tradition, but which does suggest a southern Neolithic connection (Raemaekers 1999, 44-45). No information on raw material or other networks is available as yet for other sites that have occupation phases dated in the mid 5th millennium cal BC, such as Bronneger (Kroezenga *et al.* 1991), Rommertsdonk (Verbruggen 1992) and Rotterdam Groenenhagen-Tuinhoven (Meirsman/Dorst 2005; Meirsman/Peters 2006).

North of the River district, there are fewer indications for southern raw material procurement networks. A few southern Limburg flint artefacts were found at Hoge Vaart, phase 3 dated between 4900 and 4300 cal BC (Peeters 2007, 112 ff.). In layer A of Schokland P14, another northern Swifterbant site with middle 5th millennium cal BC occupation, most flint artefacts were produced in a raw material that can be found in the local moraines (Van der Kroft 1997, Ten Anscher pers. comm. Jan 2008). At the eponymous Swifterbant sites, the importance of southern import seems much more restricted and the few southern raw materials found at these sites could well have been collected in secondary position from the Meuse terrace deposits of middle Netherlands rather than in primary position in the southern LRA (Devriendt in prep. and pers. comm. Dec 2007). No information is available for the raw material procurement at Nagele J112 (Hogestijn 1991; Raemaekers 1999); (see also site catalogue in Amkreutz in prep).

On a larger spatial scale, the continuation of interaction between populations on the loess and off it to the north is confirmed by the spatial distribution of Rössen *Breitkeile*, covering the Dutch coversand landscape and even extending to southern Scandinavia (Verhart 2000a, 39; 2000b; Verhart 2003; Verhart in prep). Their presence suggests the existence of at least indirect (Verhart in prep.) contact and exchange with the farmers of the Rössen culture. These contacts may have been responsible for the introduction of the first domesticated fauna in Swifterbant contexts. The first known cattle, pig, goat and sheep remains are those recovered from the occupation deposits of De Bruin phase 3 (Louwe Kooijmans 2003; Oversteegen *et al.* 2001) and they must have been obtained before 4450 cal BC.

Whereas these arguments remain indirect indications for southern Swifterbant interaction with the Rössen culture, the Breitkeil fragment found at Swifterbant S3 (Louwe Kooijmans 1976, note 110) presents a more direct argument for the northern Swifterbant.

8.4.4 Phase 4: the Middle Neolithic

By the end of the 5th millennium cal BC, people attributed to the Michelsberg culture occupied a dune top at Doel Deurganckdok (Crombé/Sergant this volume; Sergant *et al.* 2006), this being the first actual campsite of southern Neolithic communities in this environment. No contemporaneous Swifterbant occupation has yet been reported in this region. As can be expected, the lithic assemblage of the Michelsberg occupation at Doel fits well with that of what is known for the Chasséen/Michelsberg culture in the southern loess region. Apart from locally available raw material, a number of artefacts on high quality flint were imported from the south, most probably from one of the then active flint exploitation sites (*ibid.*). Wommersom exchange is no longer attested during this phase. Southern flint on the other hand is still present on sites in the Dutch River district, like Hazendonk (Louwe Kooijmans 1981). At Brandwijk (layers L50 and L60 the import of mined, southern flint and the typological affiliation with Michelsberg culture lithic assemblages have been confirmed (Raemaekers 1999, 42 ff.). While Raemaekers (*e.g.* 1999, 123 ff.) interpreted this affiliation as a reflection of Michelsberg influence in the southern Swifterbant, Peeters (2007, 230-231) leaves open the possibility of a palimpsest of Swifterbant and Michelsberg occupations, similar to the situation identified in Doel.

Contact and exchange between the southern Swifterbant people and Neolithic groups to the south can also be observed in the presence of polished flint axes northwest of the known Neolithic exploitation areas, for instance at Hazendonk (Louwe Kooijmans 1981). Again, the most likely interpretation is the existence of inter-regional and cross-cultural exchange rather than direct procurement. This is substantiated by the presence of elements typical of Michelsberg culture pottery, including both decoration types and vessel shapes and of Michelsberg type arrowheads in southern Swifterbant contexts (Raemaekers 1999, 111).

The northern Swifterbant sites again show a different picture, with a less firm southern exchange network. Southern flint is in general absent, except perhaps for a single artefact from Swifterbant S3 (Raemaekers 1999, 37), although it is not clear whether it was indeed produced on flint extracted in primary position, and some of the polished flint axes of variable raw material, including a Lousberg flint example, found in Schokland P14 (Van der Kroft 1997; Ten Anscher pers. comm.). In this region there seems to have been no Michelsberg influence on pottery morphology or arrowhead production, as is observed in the Swifterbant sites of the River district. The arrowheads of the northern Swifterbant sites are trapezes and transverse arrowheads.

The start of cereal use by people of the Swifterbant culture has been attested in this phase. Cereals appear from 4100 cal BC onwards (Out accepted; in prep), *e.g.* at Brandwijk, Doel Deurganckdok, Hazendonk (Bakels 1981), Schokland P14 and Swifterbant S3 (Van Zeist/Palfenier-Vegter 1981).[3] Evidence for local agriculture also dates from the same period, in the form of pollen data from Gietsenveentje on the Drenthe Plateau in the northern LRA (Bakker 2003) and perhaps even in pedological indications for a field that should be dated between around 4300/4000 cal BC (Raemaekers pers. comm. Dec. 2007).

The import of southern flint artefacts continues after 3800 cal BC, *i.e.* after the end of the local Ch/MK in the Scheldt basin (Vanmontfort 2004, 285 ff.) and after the start of the Hazendonk group in the Dutch River delta. It is observed in the coversand landscape east of the wetlands (*e.g.* Louwe Kooijmans 1980; Louwe Kooijmans/Verhart

1990; Verhart/Louwe Kooijmans 1989) and also in the wetland region, for instance in the recently excavated and very well documented site of Schipluiden (Van Gijn/Houkes 2006; Van Gijn *et al.* 2006). Southern flint mainly consists of Spiennes/Rijckholt type flint, but also Rullen, grey Hesbaye and Valkenburg flint occur. For the Rijckholt flint there are indications that it was at least partially imported as rough-outs and finished tools, produced on mined flint at source.

8.5 Discussion

The southern wetlands, including the Dutch river delta, were part of a southern interaction sphere during the entire phase under study here. Sites located to the north of the river delta seem to have been much more oriented towards the north. The data show that materials were transported over distances and across cultural boundaries, suggestive of the existence of inter-regional and cross-cultural interaction.

Such interaction took place well before the arrival of the first farmers of the LBK. The distribution of the Late Boreal invasively retouched points even suggests that the Dutch river district and the coversand region to the south were closely related culturally (*e.g.* Gendel 1984). As is shown by the distribution of Wommersom quartzite, a relationship persisted during the Early Atlantic period. Large blocks of flint and stone, extracted in primary position in the southern part of the Lower Rhine Area, were obtained by direct access or more likely through the integration of the south into the provision network of the River delta via an exchange relationship.

The arrival of farming communities in the south of the LRA from the late 6th millennium cal BC onwards had an influence on the interregional relations. The proportion of ‘northern flint’ in De Bruin increases, and large blocks of southern flint and stone are no longer attested. Wommersom and southern flint artefacts throughout the 5th and early 4th millennia cal BC confirm the continuation of inter-regional artefact transport, but overall the focus on the south seems to have become less firm following the arrival of farmers there. At the same time, finds from Polderweg and De Bruin confirm some level of interaction with the newly arrived LBK and especially later on with the Groupe de Blicquy and Grossgartach people.

During the subsequent phase, the distinction in exchange network between Swifterbant sites of the River district and those to the north of it persists. The River district sites are characterised by the presence of southern flint and Wommersom, but the absence of typical Rössen imports like Rullen flint. Contrary to Rullen, Wommersom and grey Hesbaye flint were not part of the Rössen raw material spectrum (Van Gijn/Louwe Kooijmans 2005a) and those raw materials must have been procured either directly from source or acquired from non-Rössen populations that did continue to exploit them. As no local processing of these raw materials is attested, the second option seems the most likely. The absence of Rullen flint even makes it unlikely that the Rössen culture intervened in the provision of Rijckholt flint at the Swifterbant sites, even if Rijckholt flint was part of the Rössen flint spectrum (Van Gijn/Louwe Kooijmans 2005a). The Rijckholt flint reported at these sites may even have been imported from the Spiennes region, since Rijckholt and Spiennes flint are difficult to distinguish. The northern sites, on the contrary, were not part of that southern exchange network.

From the late 5th millennium cal BC onwards, interaction with the Chasséen/Michelsberg culture has been attested in the River district sites but is absent to the north of it.

The long ‘availability phase’, when farming and non-farming groups were in contact but remained distinct, indicates the existence of a symbiotic relationship, chosen by the native populations and leading to a gradual uptake of selected Neolithic elements (Louwe Kooijmans 2007; Raemaekers 1999).

The question remaining is how to approach the processes behind the exchanged artefacts. According to Peeters (2007, 198) the archaeological particularity of the Wommersom spatial distribution area, for instance, is a reflection of its recognisability vis-à-vis other raw materials and is not very explicative a priori on the existence of exchange networks. Although this is certainly true with regard to the present-day identification of the raw material in archaeological context, it can be assumed that also during Mesolithic and Neolithic times artefacts produced in that particular raw material will have been easily recognised and valued. In this respect, the Wommersom distribution pattern may still be regarded as indicative for past exchange networks despite the fact that it should be regarded as “an aggregate of which the formational dynamics are unknown” (Peeters 2007, 198) and despite the need for more research on the cultural meanings of raw material and material culture distributions (Robinson 2007). What is remarkable is the presence on most southern Swifterbant sites of no more than a handful of southern flint and stone artefacts. These small numbers are an indication of the processes involved in the acquisition of these artefacts, and may also reflect their value. Apparently these raw materials were not transported to the site as part of the dominant raw material provision network, but their presence is more than coincidental and seems the result of sustained direct exchange relations. They should be envisioned as markers of (reciprocal) exchanges connected to established social networks.

To return to the question of the introduction to this paper: can variations be observed in the materials and artefacts exchanged, and what are the implications for the Neolithic hiatus of the mid 5th millennium cal BC (phase 3 of this paper) in the south-western part of the LRA? During this phase, continuity in the exchange of particular raw materials is apparent. The restricted numbers of such artefacts found in wetland context and the absence of indications for local processing, make it unlikely that they were obtained by systematic, direct access to the sources of those raw materials. As it is unlikely that the southern flint and Wommersom was obtained through contacts with the Rössen culture, the continuation of the interregional interaction that was at work before the arrival of the LBK farmers seems the best explanation. This assumption fits the hypothesis of a native, Mesolithic rooted population that occupied or exploited the south of the LRA during and after the passage of the LBK Neolithic. Eventually this indigenous population may have formed the basis of a subsequent regional variant of the Chasséen and Michelsberg cultures, previously labelled as 'Group of Spiere' (Vanmontfort 2001; 2007). A striking element in this respect is the absence of Wommersom artefacts at post 4300 cal BC Swifterbant sites, indicating the end of its exploitation or exchange, and the overall absence of Wommersom in Ch/MK context. What was once tentatively labelled as *ChasséoMichelsberg* (*e.g.* Louwe Kooijmans 1980) can in this vision be regarded as a new kind of Neolithic (*sensu* Thomas 1997), occupying a position much closer to the local Mesolithic substrate, and thus to the Swifterbant culture, than to the Danubian Neolithic (Vanmontfort 2004, 344 ff.). This newly formed Neolithic also had a more significant impact on Swifterbant material culture, as for instance shown by stylistic evolution in pottery morphology and in the leaf-shaped arrowheads of the southern Swifterbant group, which nicely fits the hypothesis.

The absence of clear indications for the reciprocal nature of these exchange relations can partially be due to the poor chronological resolution and unfavourable taphonomic conditions of the southern sites. Future research should focus on the improvement of this resolution and on the identification of northern imports and influences in the south, by means of a targeted survey for informative sites in the riverine wetlands of the southern LRA.

8.6 Conclusion

In this paper, the possibilities of interregional exchange have been explored in order to fill a gap in our knowledge of the Neolithic of the southern LRA. While acknowledging the problems related to characterising exchange processes on the basis of limited artefacts, some conclusions can be drawn based on an evaluation of diachronic changes in the nature of the exchanged items.

The data confirm the existence of interregional and cross-cultural exchange networks during the entire period under study. Contact between Swifterbant communities and the early farming communities of the south is confirmed, but in addition to this, older 'Mesolithic' exchange networks with this region seem to have persisted during and after the arrival of the LBK. Some raw materials, for instance, cannot have been obtained by exchange with Neolithic communities of neighbouring regions and do not seem to have been the result of direct procurement either. This confirms the continuation of human activity and raw material exploitation in the southern loess regions of the LRA, apparently independently of the Neolithic processes of that time. From the late 5th millennium onwards, however, the southern exchange networks of the Swifterbant communities do seem to be restricted to interaction with the Chasséen/Michelsberg culture. This fits with a previously developed model in which the latter culture developed on top of a native, Mesolithic rooted substrate.

In order to further develop this topic, and to verify this hypothesis, future research should focus on the discovery and investigation of sites that illustrate the development of the local substrate. In particular sites located in the riverine wetlands of the southern LRA, such as the Scheldt valley (Crombé/Sergant this volume; Crombé *et al.* 2002; 2005), are expected to yield valuable remains to feed the discussion. Such data should also allow us to identify the extension of the Swifterbant phenomenon, and to identify the impact of northern developments on the neolithisation process in the southern LRA. It would shed a light on the nature of the interaction of the local substrate with the earliest farming communities of the LBK and on the role of the BQY in that process.

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Notes

1 Wommersom was attested at the sites of the Kleine Gete settlement cluster, close by the source location of Wommersom (Lodewijckx/Bakels 2000).

2 Given the date of the earliest Swifterbant pottery, an LBK inspiration seems more likely than a later Rössen one as was suggested by Raemaekers (1999, 141) and Ten Anscher (in prep. referred to in Raemaekers 1999, 141) based on the technological similarities of the pottery.

3 In Doel a single grain appears in between the remains of sector B that was dated in the previous, pre-4300 cal BC phase. If the grain also dates from this phase, it would be the earliest cereal grain found thus far in Swifterbant context. No direct dating of the grain has been performed, however, and the only certainty seems to be a *terminus ante quem* date between 3960 and 3710 cal BC (2 stdev; Bastiaens *et al.* 2005).

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9 The foam that flies ahead of a wave of advance: thoughts on the early neolithisation of the Lower Rhine uplands

Pieter van de Velde

9.1 Introduction

In the summer of 1976 Leendert Louwe Kooijmans was in his second season on the Hazendonk digs, and he asked me to act as site assistant that season. Born and raised in Arnhem on the sand hills, Leendert was wondering how prehistoric people could have endured living in such a wet area as had been the marshes in between the several Rhine branches around the Hazendonk. When I explained from first-hand experience that people living in those low-lying areas were accustomed to regular flooding of the streets, and sometimes of their houses, too, (up to ten or fifteen times for a few hours at a time every winter) and had their houses prepared for that event, either with removable boards and sand bags, or by living on the first floor, Leendert was fascinated.[1]

For the most part, Louwe Kooijmans' research interests have been with the transition to agriculture of the hunters-and-gatherers of the Dutch River Area, living in the swamps fed by the Rhine, Meuse and Scheldt rivers. Off and on, though, he has written on the other two neolithisations in the Low Countries, too: that in the northern provinces (catch-words: Swifterbant, Funnel Beaker or Trichterbecher Culture), and that in the southern loess zone, the earliest one (catch-words: Bandkeramik Culture or LBK, Limburg Group). It is this latter transition that will be addressed in my contribution where I will attempt to find an answer to the first sentence of this quote of Leendert's:

"…how this culture spread across the whole of Europe is still poorly understood. The Bandkeramik farmers who lived in the Netherlands definitely came from elsewhere … There seems to have been no acculturation of the Mesolithic occupants of the Netherlands in this first phase" (Louwe Kooijmans *et al.* 2005, 205).

In an archaeological 'How' question, 'When' and 'Why' are almost necessarily implicated.

In the present article, I shall use two or three periodization schemes, which correspond to one another more or less as follows: '*älteste LBK*' refers to the Bruchenbrücken Phase (*c.* 5325-5150 cal BC) of what formerly was known as LBK-I in the Meier-Arendt scheme; '*Flomborn*' (*mittlere* LBK, 5300-5125 cal BC) was originally defined by Meier-Arendt as LBK-II (Lüning 2005). In the Dutch chronological system LBK-1b was thought parallel with the beginnings of the Flomborn phase in Germany (Modderman 1970). This on chronological grounds seems no longer tenable (Van de Velde 2008b; present text). The hypothetical LBK-1a is equivalent to the *älteste* LBK (Modderman 1970). Starting with Stehli 1994 the LBK chronology is often expressed in 'House Generations', the average length of which is still under discussion, but for the present text LBK-1b equates with House Generations I-III, and the Flomborn phase with the Generations I-IX (Lüning 2005).

9.2 The problem

Although probably a primitive idea, it is a nice feeling to be working with something which is 'oldest ever', or 'first to be found' and the like. Thus, while preparing the publication of the excavations in the LBK village on the Janskamperveld near Geleen (a village belonging to the Graetheide cluster of Dutch Limburg, the Netherlands; see map) it was quite gratifying to have the oldest ^{14}C AMS date of the LBK in the Netherlands from that site (Van de Velde 2008a; 2008b).[2] The arrival of the LBK on that spot could be established at within a decade of 5220 cal BC.[3] Comparing the ceramic inventories of the oldest phases of several neighbouring villages in the Graetheide cluster in the Netherlands, in nearby German Rhineland to the east, and in the Belgian-Dutch Heeserwater area to the southwest, it appeared that all were of similar if not the same age. Consequently I postulated a single colonization wave for the loess belt between the Lower Rhine and the Heeserwater, with several localised target zones (Van de Velde 2008b).

There is one problem, however, as precisely in or near this region there are still older LBK dates: far away from the loess, in the excavations at the Hardinxveld Polderweg-site in the River District (again, by Louwe Kooijmans), LBK arrowheads have been recovered which are clearly older than the earliest LBK finds from Limburg (Louwe Kooijmans, 2001). Similarly, in the excavation at Weelde-Paardsdrank in the cover sands of the Belgian Campine, LBK arrowheads have been unearthed in the company of other lithic implements of possibly non-local origins (Huyge/Vermeersch 1982). Then too, a modest harvest of undated and unaccompanied LBK arrowheads (over one hundred) and adzes (more than fifty) has been taken between the loess belt and the Rhine (Huyge/Vermeersch 1982; Van der Graaf 1987; Verhart 2000; Brounen, pers. comm. 2008). Even if the majority of these extra-loess LBK finds were contemporaneous with the LBK occupation on the loess, the earlier minority of the finds provides a case that the Janskamperveld LBK 'wave' was not the first to wash ashore in this comparatively outlying area.

The LBK is unquestionably the first culture to practice full farming in the region (agriculture, stock-breeding, complemented with a little hunting and a little gathering; Bakels 1978). Naturally, this accomplishment is important in the discussions regarding the later neolithisation of the wider area which includes the Dutch river district. The literature is replete with discussions of the process(es) of primary and secondary neolithisation (primary neolithisation: local and independent domestication of plants and animals; secondary neolithisation: adoption of agricultural practice after foreign stimuli) in general (*e.g.*, Dennell 1985; Rowley-Conwy 1983; Zvelebil 1986a; Whittle 1996; Scharl 2003; Barker 2007) sometimes restricted to the study of the secondary neolithisation within a region (Louwe Kooijmans 1998; Kind 1998; Gronenborn 1999; Verhart 2000; two thematic issues of the *Archäologische Informationen* – vols. 16 and 26; Amkreutz *et al*. 2007; *etc*.). With few exceptions (a.o., Dennell 1983, 175) little thought, however, has been given to the mechanisms *on the ground*, *i.e.*, the experiences and habits (to avoid the 'a-word', *agency*) of the people involved: "… many of the models are useful in constructing the grand narrative, but fail to offer an appropriate perspective for the study of interaction as it might have taken place…" (Amkreutz *et al*. 2007).

While of the natives of this general area it is said by some that they kept themselves 'available' for over a thousand years to be eventually converted to agriculture (Rowley-Conwy 1983; Zvelebil 1986a), by others the coming of agriculture has been depicted either as a gentle wave of agriculturalists steadily rolling out over Europe (Buttler 1938; Clark 1965; Ammerman/Cavalli-Sforza 1973; 1979), or framed as an incoherent set of local, small-scale colonisations, as if groups of migrants aimlessly had wandered around, and off-hand had decided to settle in the forest or on the hill they happened to find themselves (Childe 1929; Clark/Piggott 1965). 'Availability', even when used as a descriptive label substituting for the unspecific term 'acculturation' (Zvelebil 1986a), seems wide off the mark when modelling secondary neolithisation, just as much as gently rolling 'waves of advance' are (whether or not their speed is specified as 1 km/year: Ammerman/Cavalli-Sforza 1973 *vs*. 1979). And as far as colonisation is concerned, the many ethnographic and historical records of colonisation show accident and uncalculated risk to be irrelevant to any reasonable representation of what actually did happen in such endeavour: colonisation is a deliberately and carefully planned undertaking; understanding the stages of that process helps to explain some parts of the archaeological record. Below, I will outline the general process of colonisation and then attempt to fit that model to an as yet quite meagre selection of archaeological data on the LBK colonisation of the southern Netherlands.

9.3 On the Lower Rhine Uplands neolithisation

An early text on the prehistory of the Low Countries explained the coming of the 'semi-nomadic' LBK by their primitive agriculture (slash-and-burn), which without knowledge of manuring caused relatively rapid exhaustion of the soil and so forced the people to move on to new, fresh fields. In the region between Cologne and Brussels the LBK had gradually moved from the Rhine Valley on to the plateau westward, then to the Graetheide, and finally on to the Heeserwater area; a possible autochthonous population is not considered (De Laet/Glasbergen 1959, 44-46). This gradual spread in fact was echoing ideas originally formulated by Childe and Buttler (Childe 1929, Buttler 1938). Somewhat later De Laet observed that soon after the immigration of the Bandkeramians there were contacts with the autochthonous population, as witnessed by the frequent finds of shoe-last celts and LBK arrowheads in the sandy regions to the north, west, and southwest of the LBK settlements in the Hesbaye near Liège. To him (already in 1972!), the Limburg Group represented a part of the native population which "had acquired pottery production and therefore was on the road toward neolithisation" (De Laet 1972, 195).[4]

Regarding the area to the north of the loess zone as late as 1962 Waterbolk proclaimed that it was uninhabited before and during the LBK (Waterbolk 1962), but very soon excavations in the River Area (Hazendonk, *etc.*) obviated that picture completely (Louwe Kooijmans 1974, 1976). The discussion turned rapidly toward questions of acculturation, of discontinuity and continuity *within* the north-western European Mesolithic or Neolithic in general, and the role played by the LBK in particular (De Laet, ed., 1976). Yet how the LBK had arrived in this part of the world dropped from attention: in the 1991 handbook *Pre- en Protohistorie van de Lage Landen* [Pre- and Protohistory of the Low Countries] it is simply stated that "they settled on the loess in about 5300 BC" (Bloemers/Van Dorp 1991, 215).

Divergent ideas were also voiced. Modderman, in his synthesis of LBK archaeology, cautiously tended towards an LBK resulting from acculturation of the Mesolithic population (Modderman 1988, 130). By that time acculturation had come to seem more than likely for the Hungarian Plain and the regions immediately to the north-west of it (see for example Quitta 1960; Sielmann 1972). Of course, with the rise of the New Archaeology in those days, autochthonous developments were ever more emphasised, leaving migrations as suspect explanations (*e.g.* Dennell 1983). However, in the loess belt between Cologne and Brussels the problem was and remained that only very few Mesolithic finds were made: there were simply no prospective ('availing'?) candidates for acculturation. Some authors imputed this absence entirely to erosion (Vermeersch 1990; Gob 1990); yet the systematic field surveys and review of amateur collections and literature by Vanmontfort now seem to substantiate the empty loess proposition (Vanmontfort forthcoming). Outside or beyond the loess belt, after similar surveys of four sub-regions down the Meuse toward the River Area, Wansleeben and Verhart documented substantive Mesolithic presence, and they explored the ethnography of contact situations to elucidate their find distributions in terms of dealings between Mesolithic foragers and LBK cattle-drivers (Wansleeben/Verhart 1990, Verhart 2000).

Apart from mesolithic foragers, a few other contemporaneous groups are now known on the loess and in adjacent regions. Suspected already by Buttler (1932), from the 1970s on (ceramic) groups occurring in the same general area as the LBK but culturally distinct from them have been 'defined' or identified: firstly the Limburg Group (Modderman 1974), secondly La Hoguette (Jeunesse 1986). Elements of these groups are found sometimes in association with, sometimes independent of LBK features (Lüning *et al*. 1989; Vanmontfort *et al*., 2007). It is supposed that these groups pertained to (epi-, proto- or para-) Neolithic societies in the region broadly around the Upper and Middle Rhine, in time partially earlier than, partially contemporaneous with the LBK, possibly with Cardium affinities or antecedents which would indicate contacts to or influences from the Mediterranean Neolithic (Van Berg 1990; Jeunesse *et al*. 1991). Regrettably, independent settlements associated with these groups have not been found as yet, so their economic and social characteristics remain largely unknown; I am not aware of any publication that has sought to derive the LBK from either or both of these groups. There will have been interaction, though, but the question of how and why LBK expansion occurred is not affected. As I wrote in 1993:

"… we believe [that regarding the Dutch LBK] there is no reason to opt for acculturation instead of migration as an explanatory model for the Flomborn phase. The entire material culture was exported as a ready-made package and relations with relatives in the home country were maintained for generations…" (De Grooth/Van de Velde 2005, 237)

Below, I will attempt to ground that belief in archaeological data.

9.4 Chronology of LBK exploration and of settlement

The present text was occasioned by the chronological lapse between the oldest secure dates of the LBK within the Graetheide *Siedlungskammer* and those in the Dutch River District and in the Belgian Campine. The Graetheide date proposed here is younger or more recent by about ¾ of a century than most recent authors would be willing to assume: the most often quoted date for the coming of the LBK to these parts is currently 5300 cal BC (*e.g.* Vanmontfort forthcoming). That date is derived from a calculation that starts with the dendrochronological date of the Kückhoven well in nearby German Rhineland (5090 BC, for the oldest wooden frame of the well) and adds estimates of a total time lapse of 11 house or settlement generations prior to the building of the well, based on Petar Stehli's original reflections on their average duration (*c*. 20 years; Stehli 1989); that is, 5090 + 225 ≈ 5320 cal BC as the date of arrival of the LBK in these regions. Thus even Whittle, notwithstanding his valiant attempts to establish the time range of the LBK in his account of the coming of the New Age, in the end had to use Stehli's calculations, simply because no reliable direct determinations were available (Whittle 1990; 1996, 158). In other words, the generally accepted date for the coming of the LBK is substantially based on assumption.

Other views, however, are possible. Starting from the same baseline, the Kückhoven well and the few available AMS readings on charred grain (16 from the LBK-1a phase, 6 from LBK-2b/c), by means of wiggle matching Lanting and Van der Plicht posit the beginning of the German LBK-1a (*i.e.*, *älteste* LBK) in about 5325 cal BC. The arrival of the LBK on the Graetheide is then estimated at 5230 cal BC, and its demise at about 5000 cal BC (Lanting/Van der Plicht 2002).[5] Similarly Jadin and Cahen, in an extended discussion of the available chronological data and the associated methodical issues, do not arrive at an unequivocal date of entry, although one of their diagrams is suggestive of about the same moment in time as the date proposed here, 5220 cal BC (Jadin *et al*. 2003, 547-553, and fig. 6.1-4, taken from an earlier article by J. Lanting). There are some problems with these datings, though: it is tacitly assumed by the authors quoted that LBK-1b (or Flomborn) *succeeds* to LBK-1a (or *älteste* LBK). This is quite unlikely though, as there is a considerable overlap in time of the two phases, at least east of the Rhine (Lüning 2005) where the origins of the Flomborn floruit are sought. Also, the entry of the LBK into the area between Rhine and Scheldt at the beginning of LBK-Ib of the Dutch periodization is generally equated with the beginning of the Flomborn phase (Lüning 2005, following Modderman 1970).

Not based on assumption, four AMS readings have been taken on carbonised grain from the Janskamperveld LBK village by the Groningen and Oxford laboratories. The grain comes from side pits of two houses from the earliest settlement phase. The AMS results fall easily within each other's standard deviations (Van de Velde 2008b) which thus could be pooled to 6204 ± 22 BP, calibrating to 5214 - 5203 cal BC.

Considering their find context half way the pits' fillings the seeds were deposited perhaps 10 to 15 years later than the erection of the associated houses. That way, the event of first settlement can be set to a date of 5220 cal BC (with a ± of about one decade; Van de Velde 2008b). If Lüning's proposed chronology of the German LBK holds good some three or four generations had still to elapse until the expansion from the Main area into the Northwest, ample time for a careful exploration.

As regards the Hardinxveld Polderweg arrowheads, the layer they were found in has a *t.a.q.* of 6320 ± 50 BP together with six AMS readings to the three preceding centuries (Louwe Kooijmans 2001, 68, 135-137, and 466-468). The latter can be pooled to 5430 ± 90 – 5350 ± 100 cal BC (95% margins; Mol/Van Zijverden 2007). In other words the arrowheads are contemporaneous with the *älteste* LBK and earlier than the start of the Flomborn phase in Hessen (Lüning 2005). As for the Weelde-Paardsdrank finds, their dating is very much contested (Huyge/Vermeersch 1982; Vermeersch 1990; Gob 1990; Van Gijn *et al.* 2001) – anything goes, apparently.

A word or two should still be accorded to the presumed synchronicity of the first colonies on the Dutch Graetheide, the German Aldenhovener Platte and the Belgian Heeserwater *Siedlungskammer*. Grounds for synchronicity will be considered weak by many, firstly as they are based on pottery decoration, with 'scientific' dates only available for the Dutch area (as above), and secondly as the oldest pottery is taken to be contemporaneous with the first habitation.[6] It happens that the spectra and the structures of the pottery decoration of the earliest phases in those three regions are virtually identical, and can *therefore* be deemed contemporary: there is no rim decoration for *c*. 90% of the decorated ware from Geleen-De Kluis (Waterbolk 1959) long considered the oldest LBK settlement in the Netherlands (*e.g.*, Modderman 1985: 75-76), Elsloo-Koolweg (Modderman 1970; Van de Velde 1979), Sittard (Modderman 1959), Langweiler-8 on the Aldenhovener Platte (Stehli 1994; Münch 2005), and Maastricht-De Klinkers belonging to the Heeserwater settlement area (Theunissen 1990). Especially the absence of rim decoration is considered a strong characteristic of the beginnings of the Flomborn phase by Modderman (1970) and Münch (2005), as well as the present author (2008c). Then, too, if the oldest pottery is not simultaneous with first settlement, the latter is likely to be off by a similar number of years in all three areas.

9.5 On colonization and LBK remains in the Low Countries

Recently there seems to be general agreement that the LBK was intrusive into the world of foragers between the Rhine and Scheldt Rivers in the 6th millennium BC (latest, Vanmontfort forthcoming). As the latter author has scrupulously demonstrated, the areas or 'islands' of the loess, where the LBK was later to settle had in fact largely been avoided and only rarely visited by the autochthonous hunters and gatherers of the Later Mesolithic, although the foragers in the River Area apparently maintained contacts with regions in Belgium and France throughout the centuries under discussion (Louwe Kooijmans 2007). Vanmontfort could not find a plausible explanation for the Mesolithic avoidance of parts of the loess belt, except for the dense Atlantic forest growing on that soil, unfriendly to game and so unrewarding for hunters too. The preceding Mesolithic absence in what were to become the LBK domains is remarkable at least, and suggests knowledge on the part of the first LBK settlers of local Mesolithic groups' aversions (Vanmontfort forthcoming) in combination with their own preferences: chance begs the question, so it seems. An additional argument for this fore-knowledge can be found in the undefended character of the earliest LBK settlements in the region: Bandkeramians knew almost demonstrably that they were not impinging on existing habits. For instance, though Geleen-Janskamperveld and Sittard do show palisades in their earliest generations, those are fences of at the most man's height and with posts more than a metre apart, which would not even have retarded a dedicated attack; instead they are likely to have served as corrals for the children and pigs inside, or deterrents to spirits and animals in the forest outside (Van de Velde 2008c). There are heavier defensive LBK constructions with deep ditches in these regions such as at Beek-Kelmond, Erkelenz-Kückhoven, Darion, or Beek-Hoolweg (Brounen/Rensink 2007; Lehmann 2004; Cahen *et al.* 1990; Wyns *et al.* in prep.) but these all date to the younger phases of the LBK (Golitko/Keeley 2007).

This, then, brings to mind the occurrence of arrowheads and adzes of indubitable LBK provenance *in forager contexts* even before there were LBK settlers in the area, together with the 'imitation LBK arrowheads' as they have been called (Huyge/Vermeersch 1982), found in the same places. Arrowheads and adzes were found sometimes in mutual association, more often alone, and when farther than a day's travel from the settlements never in the company of pottery (Huyge/Vermeersch 1982; Van der Graaf 1987; Vanmontfort forthcoming; cf. Verhart 2000 on imitation in contact contexts). Arrowheads or adzes are not 'the same as' people, any more than pots are, and their presence in alien find spots and camps can be interpreted in several ways: obtained in exchange by the locals (in recognition of hospitality, down-the-line or what not), stolen or captured from lonely wanderers in the forest, visits to the foreigners or *vice versa*, *etc.*; all instances will apply, presumably. To my mind the imitative arrowheads are suggestive of a visit to the locals; it is as if someone has sought to establish friendly contacts across a wide language gap by simple and sympathetic gestures, perhaps by a local on the visitor's flint nucleus (rough-outs of adzes seem not to have been carried around, so it seems). That contacts were established is not controversial, as the ensuing (or contemporaneous) LBK avoidance of settlement in areas of autochthonous interest indicates.Similar non-inimical states of affairs slightly later in time are suggested by the presence of allogenic women in LBK villages (Van de Velde 2007).

Different types of sites can be distinguished in the areas outside the loess zone where local and non-local finds have been found together. There are sites which have, besides the local Mesolithic artefacts, either single or multiple occurrences of LBK arrowheads, their imitations, LBK adzes, and LBK pottery, or find groups with combinations of two or three of these categories both without and with pottery (Van der Graaf 1987; Wansleeben/Verhart 1990; Verhart 2000). The pottery-associated sites are generally found relatively near the loess areas and are commonly attributed to cattle transhumance in the later phases of Bandkeramik society, when the central regions had become ever more crowded leaving less room for grazing (Bakels 1978). Of the non-pottery sites with LBK arrowheads, their imitations, or LBK adzes the majority may tell of hunting expeditions; they occur both between the sites with pottery, and farther afield. Some of the finds, though, especially when associated with local (*i.e.*, Mesolithic, perhaps also including La Hoguette and Limburg styles) artefacts, can be interpreted as the visiting-cards of explorers gathering intelligence about or seeking relations with the locals.

Generally speaking, forays and planned reconnoitring of foreign areas belong to the first stages of colonization. For instance, the missionary trips from Christian Europe to Persia and China in the 13th century by André de Longjumeau, by Willem van Rubroek and by Nicolò, Maffeo and Marco Polo instigated by Louis the Saint can be interpreted as consciously explorative expeditions, in preparation of the expansion of direct trade between the Spice Land and Europe and the ardently desired subjugation of the East to the Catholic Faith. Another example, in the 15-thirties the north-west part of what later was to become Argentina was discovered by De Irala when based in Asunción, Paraguay. From there, he attempted to find the legendary Silver Mountains which in the end proved to be identical with Perú, then still to be conquered. After the fall of the Inca Empire a decade later the area, the future Province of Tucumán was further explored by several expeditions, both from Asunción in the East, and Chile and Peru in the West. Then, in the 15-sixties several 'cities' were founded in the area and with them the colony of Tucumán and the exploitation proper of the territory and its inhabitants started (Mandrini 2004, 19-21). And as a non-European instance, before the Polynesians settled on the Hawai'i Archipelago several voyages had been made to the islands, explored the possibilities of settlement there and mastered the hazards of the long trip from the Marquesas Islands (Graves/Addison 1995).

More generally, the exploration of future settlement areas consists in a sometimes accidental, sometimes deliberate *discovery* phase or event. When first impressions of the new land are positive that phase is sooner or later followed by a longer period of *exploration* proper, when the possibilities of the new environment are systematically gauged (*e.g.*, Burmeister 1996; Housley *et al.* 1997; Gronenborn 2003). Thus, when in the 1420s some unhappy seamen had sighted the Azores after being driven off their track by a gale and lived to tell their findings in Lisbon, some years later Henry the Navigator sent ships with cattle, pigs, sheep, vine and grain to establish their suitability under the conditions of the 'newly found' land (of which rumours had possibly circulated for centuries in South-European ports). Final settlement on these islands, the third phase of the process, or *colonisation* followed only after several years of testing (Melo Bento 1986). There is no reason to suppose that LBK people would have done differently in their days. The examples above imply that the duration of the phases of the colonisation process, and of especially the intervals in between, is different from case to case: oral tradition may easily span several generations as demonstrated by the colonisation of the Hawai'i Islands (Graves/Addison 1995).

To return attention to Neolithic times, in this context the massive presence of Lanaye flint – previously known by the names of Rijckholt, Maas Valley, or Maastricht flint (De Grooth 2008) – (incl. Vetschau and Lousberg flints) in *älteste* LBK sites in the Wetterau near Frankfort is telling of extended foreign contacts as well; the source outcrops are situated about 200 kms to the north-west (Gronenborn 1990). This presence, representing 80% of all flint employed in the Wetterau during the *älteste* LBK, has usually been explained as being the result of long-distance exchange via Late Mesolithic or La Hoguette intermediaries (*ibid.*).[7] Such almost complete dependency on foreign partners is highly improbable in almost any (not only Neolithic) situation. Rather, LBK mobility (Whittle 1996), or scheduled exploitation of the flint outcrops can be evoked and would better explain such quantity as well as why the majority of this flint still had some cortex (Brounen/Peeters 2001). It would also fit in with the occurrence of arrowheads and adzes even further afield, in a way illustrative of the setting up of the knowledge base needed for future migration to the area between Rhine and Meuse.

Discovery and exploration are different frames of mind, different ways of meeting unknown situations, and as such archaeologically difficult to perceive, if at all (Louwe Kooijmans 1993). Moreover, the chronological separation of first engagement and closer investigation would perhaps require too much of present dating methods in some cases. Worse even, arrowheads and adzes with LBK attributes are only conspicuous in non-LBK areas, whereas they will not be noticed as different in timing within a *Siedlungskammer* where, sometime later, permanent habitation has been set up. For that reason it is virtually impossible to archaeologically distinguish exploration from settling within a colony. However, in the present case flint obtained from non-occupied areas (as with the Lanaye flint in W German or Middle Rhine-Main *älteste* LBK contexts) and the presence of LBK armoury in non-LBK settlements do allow the archaeological recognition of an explorative interlude before colonisation. The geographical separation of markers of presence in both instances (LBK elements in foreign contexts, exotic flint in LBK areas) can be taken as an index of exploration, in probably unmeditated though necessary preparation for future colonising endeavour.

9.6 Why migration? Some models in context

People do not leave their homes, kindred and fields for no reason, and that brings up the question of why Bandkeramians expanded into the north-western area, the loess zone between Rhine and Scheldt. A comparatively ancient answer is it was not the LBK who left home to move into this area, but that the local Mesolithicians stayed put and adopted the idea of farming, permanent settlement, pottery and all things commonly associated with the Neolithic way of life, with societies from the Balkans and the Near East as their ultimate inspiration (Schuchhardt 1918; Childe 1929; Clark 1952; Hodder 1990; Whittle 1996; Barker 2007). That, however, is a teleological or evolutionistic answer to the why-question for it assumes a categorical superiority of settled life or agriculture over roaming and foraging. Starting with Schuchhardt, the origins of the LBK proper have been situated in the area between Bavaria and Transdanubia, up to and including Moravia, spurred either by immigration ('demic diffusion') or adoption of agriculture ('stimulus diffusion') *etc.* from the Balkans (Schuchhardt 1918; Childe 1929; Buttler 1938; Paret 1946). Such an origin was firmly corroborated by Quitta (1960), since repeated by Sielmann (1972), Tillmann (1993), Kind (1998), Gronenborn (1999) and others.[8]

But this only accounts for the Central-European situation, and leaves the expansion into north-western Europe unexplained. Two answers or mechanisms have been sought: one in the economic sphere, and another demographic, with or without acculturation of local groups. The economic explanation is based either on a selective reading of the ethnographic literature, or on the supposition that LBK agriculture was so primitive as to exhaust the soil in a few years, resulting in so-called *Wanderbauernwirtschaft* ('itinerant agriculture', only approximately translatable as 'shifting cultivation'; cf. Conklin 1961, or Sahlins 1968, 29-30). The ethnographic version is found in Sangmeister 1950, the *Wanderbauern*-version in Childe 1929, Buttler 1938, and still in Clark 1952 and 1965, Soudský 1962 and Bailloud 1968. Modderman firmly rejected the ethnographic analogue as well as the *Wanderbauern* thesis as being founded on insufficient and exotic data (Modderman 1970, 208-211; Bogaard 2004). Instead, he postulated stress between groups in the LBK heartland as driving force behind the expansion (Modderman 1988, 130).

Best known among the demographic explanations of the LBK expansion is the Wave of Advance Model of 1971 (Ammerman/Cavalli-Sforza 1973). Based on the then rapidly growing number of ^{14}C-dates, the diffusion of early farming into Europe as visualised in a map drawn by Clark (1965) was fitted to a population-genetics model. Though the authors admitted that the model cannot decide between 'stimulus diffusion' (or cultural diffusion) and 'demic diffusion' (or population migration), they held strong reservations about the former, and instead proposed population expansion as agricultural vector: "…people carry with them their own culture, and … if they … expand geographically, so does their culture" (p. 344). Geographical expansion, according to them, occurred because early farming permitted and caused population growth based on augmented food production (a similar argument is developed in Bakels/Lüning 1990). The budding off of groups of people, generally in random directions over *short* distances, then results in a '*wave of population expansion*' moving outwards at a constant radial rate. Being geographically contiguous and chronologically continuous such a wave is clearly distinct from 'colonisation', appropriately defined by them as the intentional settlement of a foreign territory by a coherent group of people (p. 344). Expanding from Near-Eastern centres, the linear speed of the wave front was calculated at approximately 1 km per year, with quite good fits for the then available ^{14}C dates throughout. In 1979 the same authors published a text with almost identical contents and purposes, now tuned to the West German Aldenhovener Platte LBK. In a simulation, they worked with an occupation or fallow cycle much reminiscent of Sangmeister's (1950) without, however, acknowledging this. It is highly questionable whether the Wave of Advance Model really constituted an advance in our knowledge of the historical neolithisation process for, as Zvelebil rightly observed: "… pattern can be seen to emerge [in the dispersal of agriculture into Europe] which is far from the uniform, unidirectional 'wave of advance' postulated by those favouring agricultural diffusion from the Near-East" (Zvelebil 1986b, 185-186). Yet, a few years later it was remarked that "… the population of this Bandkeramik core area grew so fast that people had to emigrate to the west and the north" (Bakels/Lüning 1990). They offered no suggestion of why the population would grow, probably implying the same argument as did Ammerman and Cavalli-Sforza.

It is my contention that the driving forces behind migration are situated first and foremost in the socio-economic sphere rather than in population growth pure and simple. So, instead of delving into evolutionistic axioms or demographic parameters, a look into possible social and economic factors might be of some help in the explanation of LBK expansion. On *a priori* ethnological grounds LBK society in all its historical phases will have been a rather decentralized society composed of fairly large family units, or lineages, with members of these families in several villages and hamlets.[9] Based on analyses of the archaeological evidence (Van de Velde 1979 and 2008c; Schwerdtner 2007), the LBK lineages were probably grouped in two, even larger bonds, so-called moieties. At the lowest level of society, in the villages, several families of distinct parentage, sub-units or segments of the larger lineages, made up everyday social and economic life. Lineages had customary, or traditional marriage arrangements for their members: certainly they had to marry outside their lineage-of-birth, and in all likelihood they had to obtain marriage partners from stipulated other lineages — most probably from the other moiety, and within that moiety from one or more particular lineages, and not from the others although that cannot be substantiated as yet. As also usual in most societies, the social system of the LBK was based on both male and female oriented structures: here, male members of the lineages stayed put in their birthplace, with sons continuing in the village or farmstead of their fathers. Female members of other lineages married in, either from another part of the village but apparently preferably from other locales (in anthropologese: *patrilocal* or *virilocal* arrangements), though not necessarily from outside Bandkeramia (as supposed by Bickle and Hofmann 2007). Additionally, some rights and duties, some kind of authority was transferred through female descent lines, from mothers to daughters (*matrilinear* arrangements). Based on the distribution of gifts in the LBK graves (there are more indicators) the two genders were more or less equal in status (Van de Velde 1979; 1990; 1995; parts of the picture have been confirmed by others: a.o., Strien 2000, Price *et al*. 2001, Eisenhauer 2003, Frirdich 2005, Claßen 2006, Schwerdtner 2007).

It is known from ethnology that the political structures of lineage societies are weak, as the lineages rather than society as a whole provide the basis of individual and group identities. On top of this, local lineage segments are likely to split on disputes, especially so since these family units are also economic entities. Thus younger men getting less than their older peers, or sons fed up with parental authority, may vote with their feet and set up affairs elsewhere; and discontented women return to their folks. Yet they keep on belonging to their lineage, and in case of need they may fall back on, even require their lineage's solidarity. Being socio-economic units, segments may compete with each other for resources, exchange partners and items, or prestige – which may result in tensions within the settlement (or between settlements), again leading to groups moving out.

As there are no signs of over-population or land-shortage for this (Flomborn) period of the LBK, precisely these aspects of lineage society, internal tensions, would be the major *push factors* behind the expansion across western Europe.[10] (Frirdich 2005 writing about the *älteste LBK*; cf. Hayden 1990) – and compare the branching off of Flomborn-style villages from älteste LBK settlement in the Lower Main area (Cladders/Stäuble 2003, 502; Lüning 2005). Individual and group power, status and prestige may not only be sought in the acquisition of valuables, or the outdoing of each other in feasts and similar ritual pursuits, they can also be secured externally, in braving dangers in the forest, in hunting, in travelling to non-kin groups to attain valuables for oneself, from high quality flint to an exotic beauty of Mesolithic, or far-away Bandkeramian stock. We simply don't know how high the stakes were in the internal status games, but they must have been mounting with time, given the violent character of especially the Younger LBK (Van de Velde 1995; Petrasch 1999; Golitko/Keeley 2007). Concomitantly, we could even suppose that the poppy seeds, available among the semi-Neolithic groups such as La Hoguette to the west and southwest of Bandkeramia, might have been wanted for their hallucinatory properties (Bakels, pers. comm.), of use in bravura and brawl at home. These attractions all can be interpreted as *pull factors*, to which the availability of empty, yet agriculturally fertile land should be added as soon as its existence became known, through explorative enterprises.

9.7 Summary and conclusion

I started out with the question *how* the LBK people migrated into the loess belt between Rhine and Scheldt Rivers and suggested as an answer that such an enterprise should have been a well-planned colonisation. On an analogue model, a colonisation process goes through three distinct stages: discovery, exploration, and final settlement or colonisation proper. This then, brought up the question *When* have these stages occurred, and the widely strewn arrowheads and adzes of unmistakably LBK make (sometimes accompanied by other artefacts) in the areas beyond the loess belt were set into a context of discovery and exploration, as some of the arrowheads clearly antedated the founding of the colonies. Also, the early presence of comparatively huge quantities of Lanaye flint in the Lower Main Area, the putative homeland of the future colonists, was set into this context of exploration. Exploration can also be evoked to explain the exclusive occupation by the LBK of areas which were rarely visited by Mesolithicians and their simultaneous avoidance of settlement in areas of Mesolithic interest. After generations of exploration, colonies were established between Cologne and Brussels in about 5220 cal BC, a date based on four ^{14}C readings that have recently become available. Finally an answer to the question of *why* this migration took place was tentatively sought in the segmentary character of LBK society, which ethnologically should have featured frequent quarrels because of economic competition and social striving, resulting in schisms or migration of the underdogs. They and their families went off to make new lives for themselves in previously explored, well-known target zones.

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Notes

1 I am referring to the years before the 'Deltaplan' (1950-1997) which resulted in the closure of the Rhine estuary to the spring tides of the North Sea which were often swept higher up by autumn and winter storms along the Dutch coast.

2 Excavations by Louwe Kooijmans and Kamermans (Kamermans *et al.* 1992; Louwe Kooijmans *et al.* 2003); I participated as one of the students' tutors.

3 Earlier ^{14}C readings from LBK sites in the Netherlands have all been on carbonized wood from house posts, and thus likely to be a century or so off (Lanting/Van der Plicht 2002). Three are seemingly 'older' than the Geleen-Janskamperveld date: 6370 ± 60 (Geleen-De Kluis), 6320 ± 90 and 6270 ± 85 BP (Elsloo).

4 Almost exclusively known from their pottery, which is quite distinct from LBK ware; see below.

5 A date of 5360 BC can also be inferred, but is rejected by them on *a priori* grounds, as that would imply a duration of the *älteste* phase of nine settlement or house generations.

6 However, especially in the case of the LBK pottery, decoration is probably as telling as written records: already in 1979 I had read the virilocal and matrilinear social structure of this society from it, only in 2001 corroborated by isotope analysis on skeletons (Price *et al.*, 2001). Recently, several authors have attained interesting results along similar (pottery) lines: Claßen 2006, Eisenhauer 2003, Frirdich 2003.

7 Another 15% was also obtained elsewhere, from similar distances of 200 kms (Gronenborn 1990).

8 However, archaeological evidence for a Proto-LBK (a neolithisising Mesolithic) is not available although there are many Mesolithic components in the local LBK technology.

9 Apart from thousands of ethno*graphic* examples, there is also a quite extensive body of ethno*logical* theory attempring to make sense of them.

10 Note that overall population increase would be a likely effect of this splitting off, not its cause.

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10 Maastricht-Vogelzang, the Netherlands, a Michelsberg site in the valley of the Meuse seen from a botanical angle

Corrie Bakels

10.1 Introduction

The lower terrace of the river Meuse south of the town of Maastricht in the southern Netherlands has surprises in store for those interested in Neolithic cultures. Some of these were revealed in recent decades, the site Vogelzang being one of them (fig. 10.1).

Maastricht-Vogelzang was discovered during survey of a newly ploughed field by B. Knippels, a local archaeologist, who found a concentration of flint artefacts belonging to the Neolithic Michelsberg Culture, that flourished between *c.* 4400 and 3600 cal BC. His discovery was followed in 1994 by an excavation, carried out by the archaeological service of the town of Maastricht in close cooperation with the Faculty of Archaeology of Leiden University. The daily work was directed by F. Brounen, and L.P. Louwe Kooijmans kept a watchful eye on the proceedings.

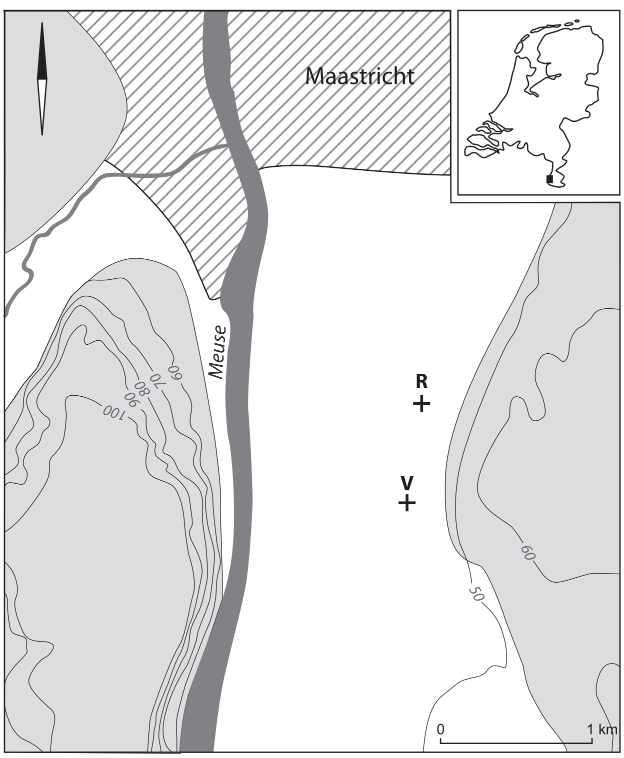

Figure 10.1 The situation of the sites Maastricht-Vogelzang (V) and Maastricht-Randwijck (R); white: valley deposits.

The site lies on the bank of an ancient channel of the river Meuse. Most of it has been destroyed by medieval activities, but a strip of land immediately bordering the channel has been spared. The area preserved had obviously been used by the Michelsberg occupants to dump all kinds of waste, and much of the pottery consisted of the failures of pottery manufacture (Brounen 1995), while another component of the rubbish consisted of household waste, including carbonised seeds. A radio-carbon dating of charcoal gave a date of 5310 ± 80 BP[1]. The style of pottery places the site in Michelsberg phase I / II (phases after Lüning).

The section of the main excavation trench showed that the waste layer ended sideways into a peaty fill of the former channel (fig. 10.2). Both the presence of carbonised seeds and the organic fill provided an opportunity for a botanical investigation, with the aim of looking for food plants and for the impact of the population on the vegetation surrounding their place of settlement. In view of the interest of Leendert Louwe Kooijmans in the Michelsberg Culture and in all kinds of botanical matters, it seems appropriate to present the results of this investigation in this volume dedicated to him.

10.2 Materials and methods

For macroremains analysis, the loamy fill of the dump was sampled in several spots and the resulting soil sieved in the archaeobotanical laboratory of the Faculty of Archaeology, Leiden University. The samples were processed under running tap water using sieves with meshes down to 0.25 mm. The residues were air-dried and sorted, and the retrieved seeds and fruits identified and counted. All this work was done by H.J. Goudzwaard and W.J. Kuijper.

For a reconstruction of the vegetation by means of pollen, the fill of the channel was sampled by driving a 50 cm long sample box into the section provided by the main excavation trench. Subsamples of 1 cm thick were cut out of this box and treated with 10% KOH, HCl, a Bromoform-Ethanol mixture with sg 2.0 and acetolysis. Sample distance was 2.5 cm. Prior to the laboratory treatment, a tablet with *Lycopodium* spores was added (Stockmarr method). The

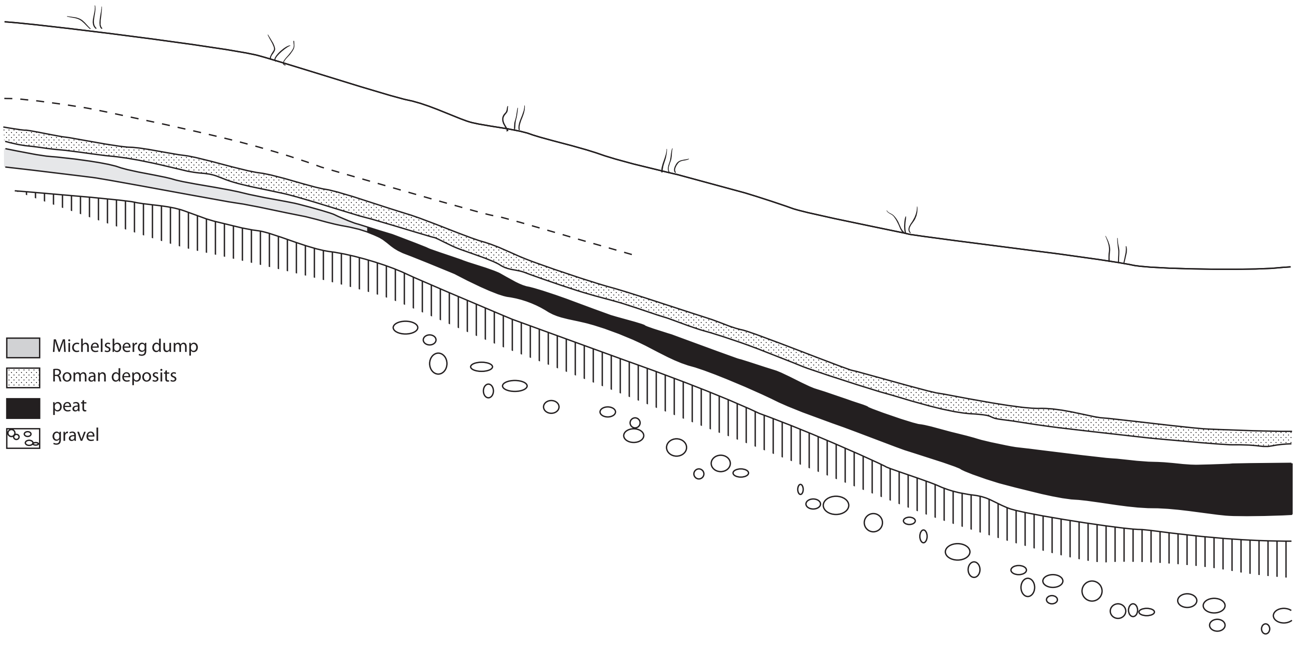

Figure 10.2 The section of the main excavation trench.

resulting pollen was preserved in glycerine. The pollen counts aimed at an upland pollen sum of 300 or more; this pollen sum excludes trees, shrubs and herbs which may have contributed to peat formation, such as *Alnus* (alder) and even Poaceae. Identification was done with the aid of the keys of Faegri and Iversen (1989), The Northwest European Pollen Flora (1976-1988) and the reference collection of the laboratory. Cereal-type pollen was identified by the criteria set down by Körber-Grohne (Grohne 1957). The pollen counts were carried out by G. Korf who wrote an MA thesis on the subject.

10.3 Results: seeds and fruits

The results of the search for seeds and fruits are presented in table 10.1. Most of the samples came from feature 1, the main layer of waste. The other samples came from features which could be discerned separately during the excavation, but are essentially part of the general dump. The species list is short: four crop plants, three kinds of nuts and fruits gathered from the wild, and three herbs which are considered to be field weeds. The crop plants comprise three cereals: naked multi-rowed barley (*Hordeum vulgare* var. *nudum*), a naked wheat (*Triticum aestivum* or *Tr. durum*) and emmer wheat (*Triticum dicoccum*). Grains of einkorn-type (*Triticum monococcum*-type) may represent a fourth cereal, einkorn wheat, but may also represent grains from one-grained emmer spikelets such as occur in the top of the ears, and the few occurrences do not permit a distinction.

One single fragment of chaff belongs to durum wheat (*Triticum durum*) and therefore the grains identified as naked wheat probably belong to this kind of wheat. As naked wheat is dominant among the identifiable cereal remains, most of the unidentifiable cereal fragments may have belonged to this wheat too.

It is surprising that cereal chaff is almost absent, as are other kinds of cultivated plants, which are restricted to one single pea (*Pisum sativum*). The gathered plants are hazelnut (*Corylus avellana*), sloe plum (*Prunus spinosa*) and blackberry (*Rubus fruticosus*).

In view of the near-absence of chaff, it comes perhaps as no surprise that the remains of field weeds are scarce as well. Representatives of this class of herbs are a fruit of possible false cleavers (*Galium* cf *spurium*), a grass with small seeds too damaged for identification (Poaceae) and a damaged seed of grey hairy tare or smooth tare (*Vicia hirsuta* or *V. tetrasperma*). Such herbs commonly enter a site together with the harvest, and end up in the waste of threshing and further processing of cereals. The scarcity of waste from cereal cleaning suggests that all the carbonised seeds and fruits represent kitchen waste, originating from the consuming household, not from farmyard activities. This does not immediately imply that the inhabitants of the Vogelzang site were not involved in farming, but shows that the dump is not a common farmers' dump. The seeds and fruits may represent the kitchen waste of the potters, who discarded their failures on that particular spot. As will be

trench	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	4
level	1	1	1	1	1	1	1	1	1	1	1	1	1	3	4	–	–
feature	1	1	1	1	1	1	1	9	9	10 A	10 A	10 B	7/10/11	13	4	5	16A
	A	A + B	A + C	C	C + D	C + E	D	upper 10 cm	bottom	upper 10 cm	–	–	–	–	–	–	–
sample volume, liters	3	3	10	2	9	5	27	5	10	8	5	5	7	5	7	5	5
Cultivated plants																	
Hordeum vulgare var. nudum	2	–	–	–	1	–	5	–	–	–	–	–	–	1	–	–	–
Triticum aestivum/durum	17	–	14	–	4	–	75	–	–	4	–	1	3	1	–	–	–
Triticum durum, rachis	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Triticum dicoccum	–	–	–	3	–	–	7	–	1	4	4	3	–	1	–	–	–
Triticum monococcum-type	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–
Triticum sp.	–	–	–	–	2	10	–	–	–	–	–	–	8	3	–	–	–
Cerealia fragments	22	5	24	22	24	–	128	–	–	24	12	11	22	17	–	–	–
Pisum sativum	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
Gathered fruits and nuts																	
Corylus avellana	–	–	2	–	3	1	8	–	–	6	7	1	5	7	1	–	–
Prunus spinosa	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–
Rubus fruticosus	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Weeds																	
cf Galium spurium	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–
Poaceae with small seeds	2	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–
Vicia hirsuta/tetrasperma	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
indeterminatae	1	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	1

Table 10.1 Seeds and fruits retrieved from the Michelsberg site Maastricht-Vogelzang.

explored further in the discussion, the plants found at Vogelzang are common for Michelsberg sites.

10.4 Results: pollen

10.4.1 The pollen diagram Maastricht-Vogelzang

The sediment in the bottom part of the sample box, 50-41 cm, consists of river loam (silt deposited by the river). What follows is a general transition through peaty loam and loamy peat, 41-39 cm, to peat. At 10 cm below the top there is an abrupt transition back to loam. The top of the box is equal to 120 cm below surface.

The ancient channel obviously was cut off from the main stream of the Meuse, after which river loam had a chance to settle, followed by local peat formation. At some time the channel became part of the main stream again, as is suggested by the abrupt transition from peat to river loam. Part of the peat may have been eroded, as there is definitely a hiatus between the formation of the uppermost peat and the deposition of the second river loam. Three conventional ^{14}C dates were obtained for the peat and the time-depth graph for the deposit shows a more or less regular accumulation rate (fig. 10.3).

The pollen diagram reveals that the sedimentation of pollen took place during a time when *Corylus* (hazel), *Quercus* (oak) and *Ulmus* (elm) contributed most of the tree pollen rain (fig. 10.4). *Pinus* (pine) may have played a minor role in the beginning, but as this was a period of river loam deposition this pollen may originate from vegetation upstream, possibly in the Ardennes. In the upper part of the diagram *Tilia* (lime) and *Fraxinus* (ash) appear, while *Fagus* (beech) and *Carpinus* (hornbeam) occur only after the hiatus. The upland (dryland) vegetation included *Hedera* (ivy) as well, but remains of other species are scarce. The conclusion is that the drier areas in the wide valley were covered with oak-elm-hazel forest during most of the period covered by the diagram.

The wetter parts of the valley were covered by a wetland herb vegetation and *Salix* (willow). Some *Alnus* (alder) may have grown there, but stands of true alder carr occur only from the time horizon when *Tilia* and *Fraxinus* appeared in the region. The ancient channel was covered by *Alisma* (water-plantain), Cyperaceae (sedges), *Sparganium erectum*-type (bur-reed or lesser reedmace) and the kind of ferns producing Monoletae psilatae type spores, with some willow

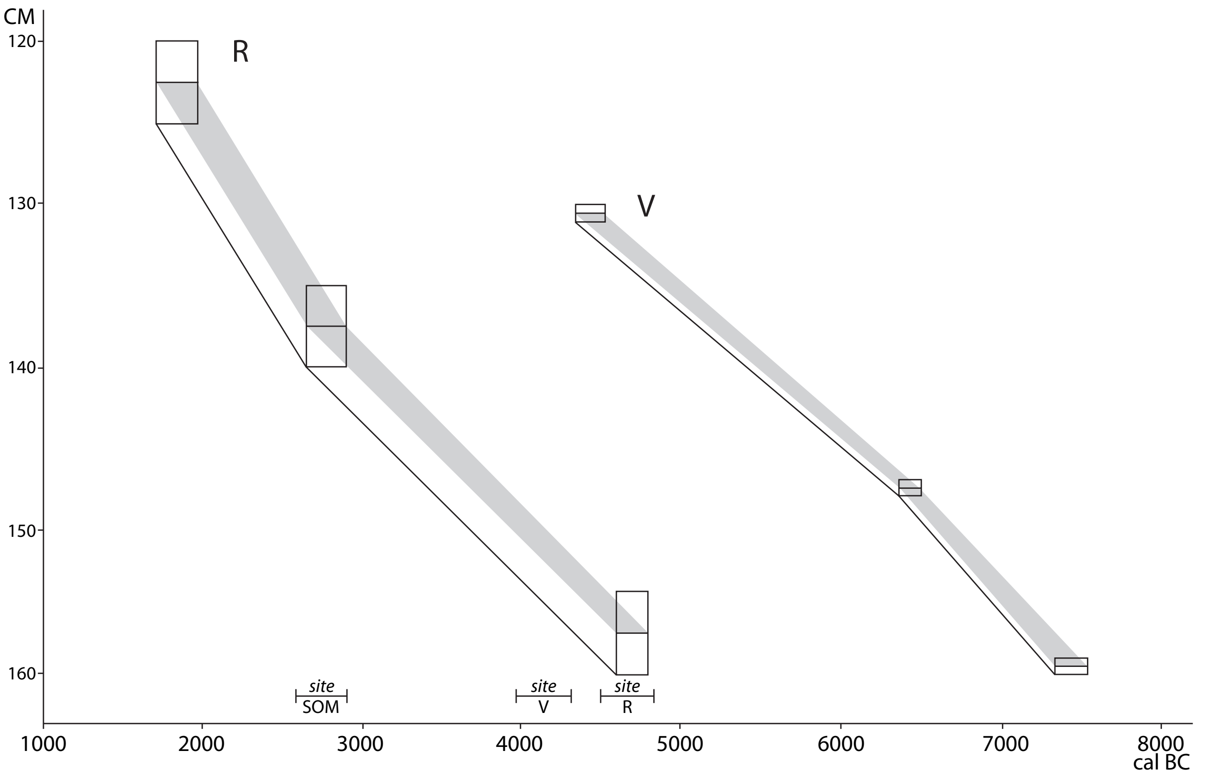

Figure 10.3 The time-depth graphs for the Vogelzang (V) and Randwijck (R) deposits, combined with the time span of the Rössen site (R), the Michelsberg site (V) and the SOM site (SOM).

at the edges. Plants from open water were very rare. During the period of peat formation the channel was obviously an eutrophic marsh.

As mentioned in the introduction, the Michelsberg dump ended sideways in the peat layer. This offered the possibility of looking for signals of the impact of the Michelsberg population on its environment, by looking for signals in that part of the diagram which represents the peat formed during human presence near the channel. There were no artefacts which could help in connecting peat to occupation. The ^{14}C date of the site is 5310 ± 80 BP, or 4330-3970 cal BC. Though the date is based on charcoal, not on seeds, it falls well within the range suggested by the pottery style. This implies that the dump, and with it the site, is younger than the top of the peat (fig. 10.3). However, the dates from the peat may be erroneous, since dates based on eutrophic peat can be too old due to the reservoir effect. Therefore, the credibility of these ^{14}C dates has to be checked, and the standard pollen diagram of the German Rhineland provides the means (Meurers-Balke *et al*. 1999). This diagram was made for a comparable environment in a region not too distant, namely 50 km to the east, and part of the standard consists of dates obtained for a diagram in the valley of the river Rur, a wide valley not unlike that of the Meuse (Kalis 1988).

The Vogelzang date of 8380 ± 40 BP, or 7540-7340 cal BC, belongs to a vegetation zone *Corylus*/*Quercus*/*Ulmus* without *Tilia*, *Fraxinus* and *Alnus*. The standard places this zone between 7300 and 6700 cal BC. The date may therefore be slightly too old. The next Vogelzang date, 7570 ±40 BP, or 6490-6370 cal BC, agrees with the standard for a vegetation with *Corylus*/*Quercus*/*Ulmus* and some *Tilia*, *Fraxinus*, *Alnus*, which gives a date of c. 6500 cal BC. When taking only the Rur diagram into consideration, the date should lie between 6400 and 5300 cal BC. Thus the second date seems to be broadly acceptable. The third date, 5630 ± 40 BP or 4540-4360 cal BC, belongs to a vegetation with deciduous trees, but still without *Fagus*. The standard provides a range between 5300 and 4500 cal BC, while the Rur valley diagram on its own provides a range after 5300 and well before 3500 cal BC. The lowest date is perhaps on the old side, the middle and the third are as expected, or, if anything, on the young side. The time-depth curve gives no reason to assume serious changes in sedimentation rate, and the Vogelzang series looks acceptable. Therefore, the age of the peat implies that the organic deposit, as far as preserved, is not of the same age as the site. The suggestion that the Michelsberg dump and the peat layer are contemporaneous, a suggestion based on observations made during the excavation, is therefore false. The layer of peat, as far as preserved, is older than the site.

This might have been the end of the story but for another pollen diagram. In 1993 M. Alkemade, C. Vermeeren and I published a pollen diagram from the location Maastricht-Randwijck (Bakels *et al*. 1993). It is based on an ancient channel of the Meuse, quite similar to the Maastricht-Vogelzang one and situated at a distance of only 600 m (see fig. 10.1). The diagram revealed an impact on the vegetation caused by the Neolithic Rössen Culture, which precedes the Michelsberg Culture, and we wondered at the time why we did not see an impact from the following Michelsberg Culture, as the famous Rijckholt-St. Geertruid flintmines of Michelsberg age are not far off. The diagram has to be reconsidered here.

10.4.2 The pollen diagram Maastricht-Randwijck

As mentioned above, the Maastricht-Randwijck diagram has already been published, and therefore only an excerpt of the diagram is presented here (fig. 10.5) showing the part with the peat deposit and the most relevant pollen curves. The deposit is dated by three ^{14}C dates. Because the ancient channel was sampled by coring, material from several centimetres of peat had to be sent in for conventional ^{14}C dating, resulting in a cruder dating of horizons than in the Vogelzang case. The time-depth graph based on the calibrated dates is given in fig. 10.3, and the dates are discussed in the same way as the Vogelzang dates.

The oldest Maastricht-Randwijck date, 5870 ± 50 BP, 4850-4590 cal BC, belongs to a vegetation zone with the combination *Corylus*/*Quercus*/*Ulmus*/*Tilia*/*Fraxinus*/*Alnus*, a phase identical with the last phase present in the Vogelzang peat. The Rhineland standard gives a date of 5300-4500 cal BC for this, and the Randwijck date is acceptable. The middle ^{14}C value, 4215 ± 45 BP, or 2910-2660 cal BC, provides the date for a vegetation of *Corylus*/*Quercus/Alnus* with less *Tilia* and *Fraxinus*, almost no *Ulmus* and no *Fagus*. Following the standard, the date should lie between 2500 and 2000 cal BC and may therefore be c. 500 years too old. However, this is debatable, since the behaviour of *Tilia*, *Ulmus* and *Fraxinus* plays a major role in the assessment and precisely these curves are commonly influenced by human action.

The uppermost date of 3500 ± 40 BP or 1940-1730 cal BC belongs to a similar vegetation, but now with some *Fagus* pollen. A match with the standard is difficult, because the first *Fagus* there occurs together with a rise in *Pinus*, and this combination is absent in Randwijck. Between the horizon connected with this date and the middle date lies a *Quercus* optimum. The standard shows a comparable optimum, associated with low values for *Tilia* and a minimum for *Corylus*. This falls between 2300 and 1500 cal BC. In view of this the Randwijck date seems to be reliable. Looking at the time-depth graph, the middle date would also not be very aberrant, and, if anything, rather too young than too old.

It may be considered hazardous, but I would like to proceed with seeking the signal of the Michelsberg culture in the Maastricht-Randwijck diagram by looking at the time-depth graph (fig. 10.3). The signal should be present between 156 and 146 cm, or, if sticking to the centre of the dated part of the core, narrowed down to 154-148 cm below surface. The latter zone has been indicated in the pollen diagram. This diagram was originally made with reference to a Rössen site situated on the edge of the ancient channel. The site has provided four ^{14}C dates, 5845 ± 45, 5835 ± 35, 5790 ± 35 and 5730 ± 35 BP, which calibrated give, all taken together, a date span of 4830-4490 cal BC. Plotted on the diagram, the Rössen occupation should be visible between 158-154 cm or, narrowed down, between 156 and 154 cm. This is just below the Michelsberg horizon.

A look at the pollen curves tells that the lower boundary of the Rössen horizon corresponds with a decline in the curves of *Ulmus*, *Tilia* and *Fraxinus*. These declines are offset by rises in the *Corylus* and *Quercus* curves. Except for the behaviour of *Fraxinus*, this points to an opening-up of the forest, and is rather tempting to attribute this event to actions of the Rössen population. The trend continues during the subsequent horizon, the one I have designated above as Michelsberg. What in the original publication has been described as a Rössen signal, is perhaps a combination of Rössen and Michelsberg. The vegetation of the area had possibly no chance to regenerate in the interval between these two occupations. People deforested the higher parts of the river valley, sparing *Quercus* and propagating *Corylus* in the mean time. They even cut down some *Alnus* according to its pollen curve. The decline of *Fraxinus* may possibly be attributed to an intensive use of this tree, not only for its wood but also for its leaves to be used as fodder. Normally *Fraxinus* reacts with a rise of its pollen curve as a result of the opening-up of the forest, as it is a light-demanding kind of tree. The *Ulmus* and *Tilia* declines may also, at least partly, have been due to use of leaves and twigs as animal feed. Herb pollen is scarce, and it is possible that there was insufficient herb vegetation to offer pastureland for the Neolithic livestock. Or, the lack of herb pollen will have to be attributed to grazing pressure on the existing herb vegetation, preventing the flowering of herbs. In both cases leaf fodder may have supplemented the animals' feed.

The most striking curve in the Randwijck pollen diagram is however the curve of Cerealia (cereals): both *Hordeum*

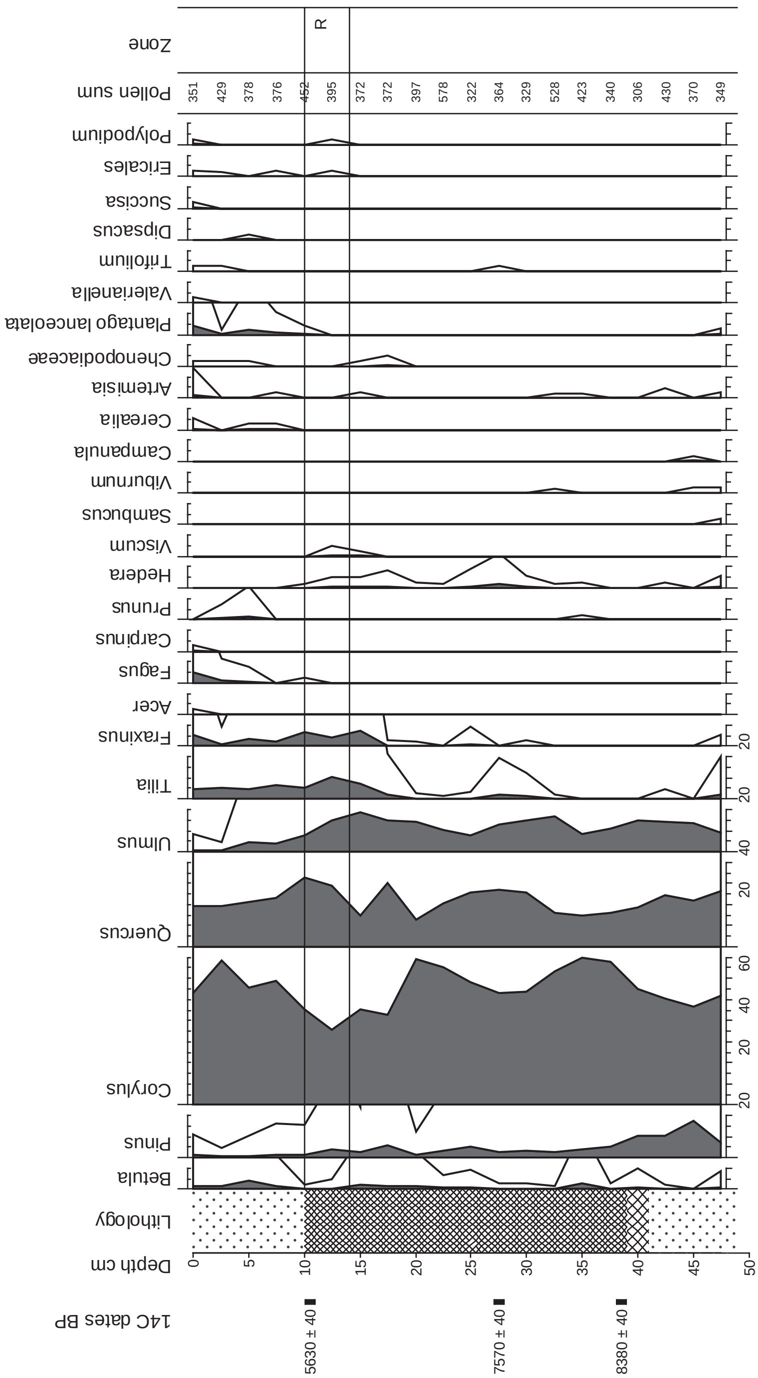

Figure 10.4a The pollen diagram Maastricht-Vogelzang, the upland part. Zone R stands for Rössen Culture. Exaggeration 10x.

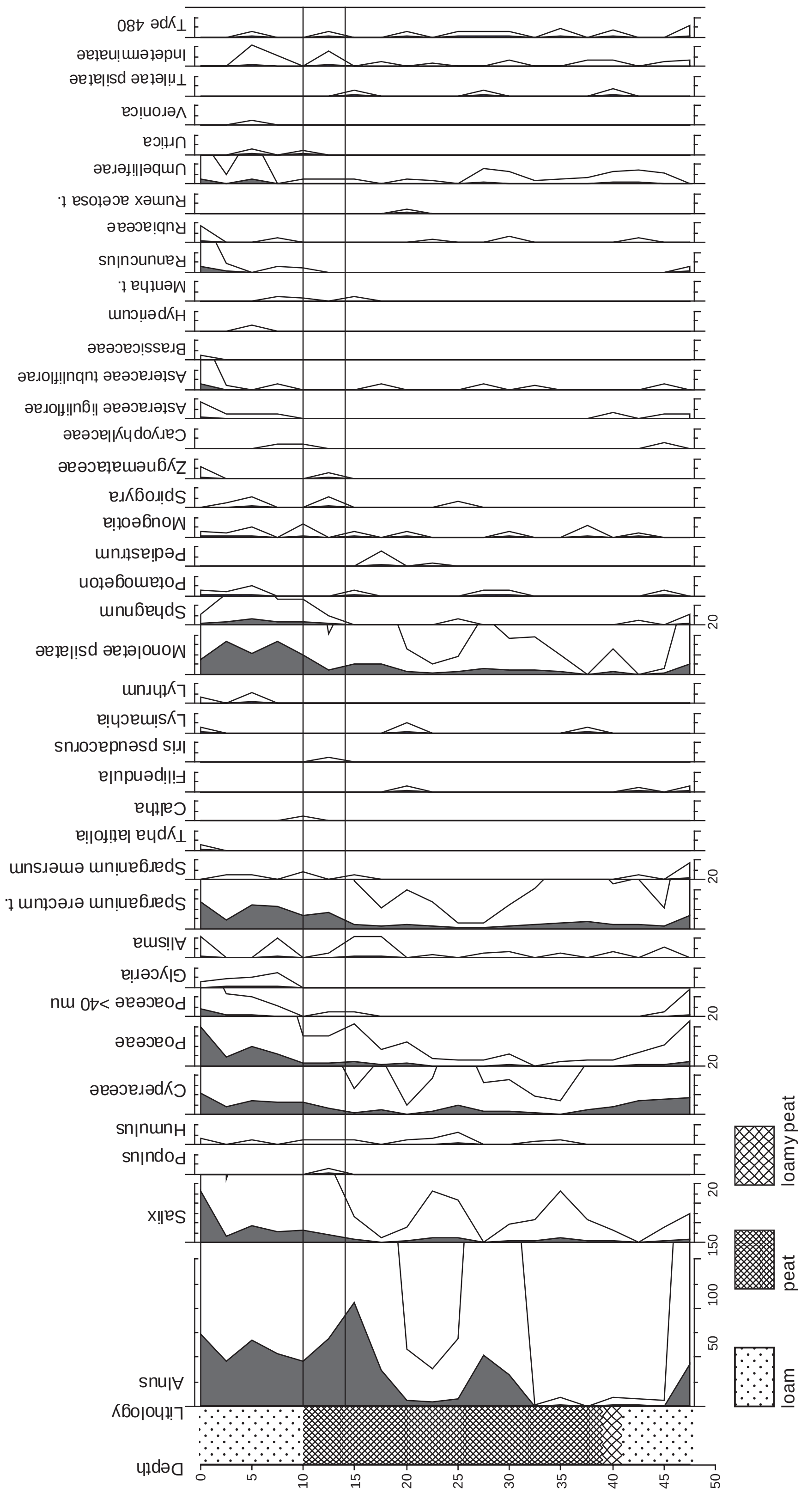

Figure 10.4b The pollen diagram Maastricht-Vogelzang, the wetland and ecologically indeterminate parts. Exaggeration 10x.

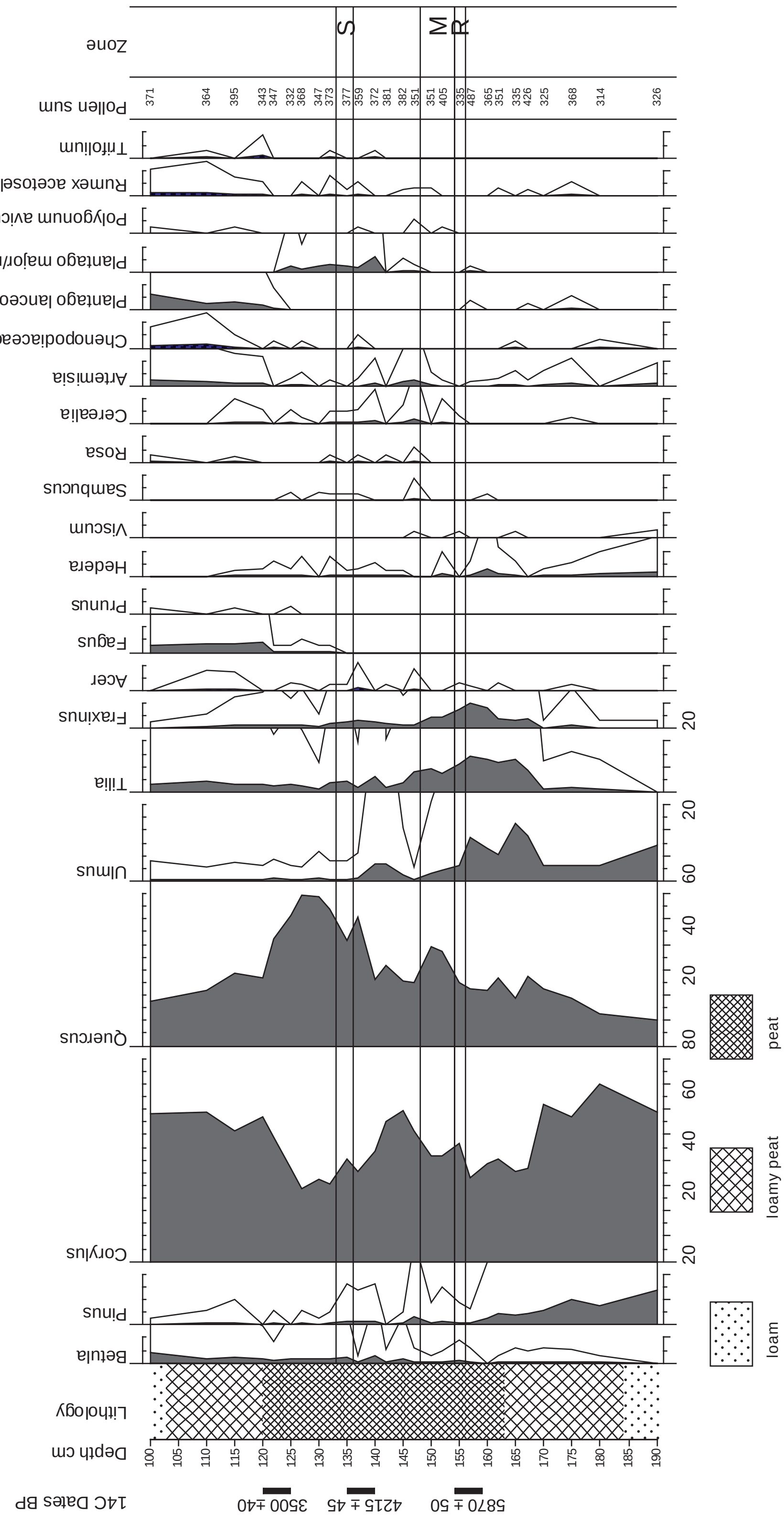

Figure 10.5a The pollen diagram Maastricht-Randwijck, the upland part. Zones R, M and S stand for Rössen Culture, Michelsberg Culture and SOM Group. Exaggeration 10x.

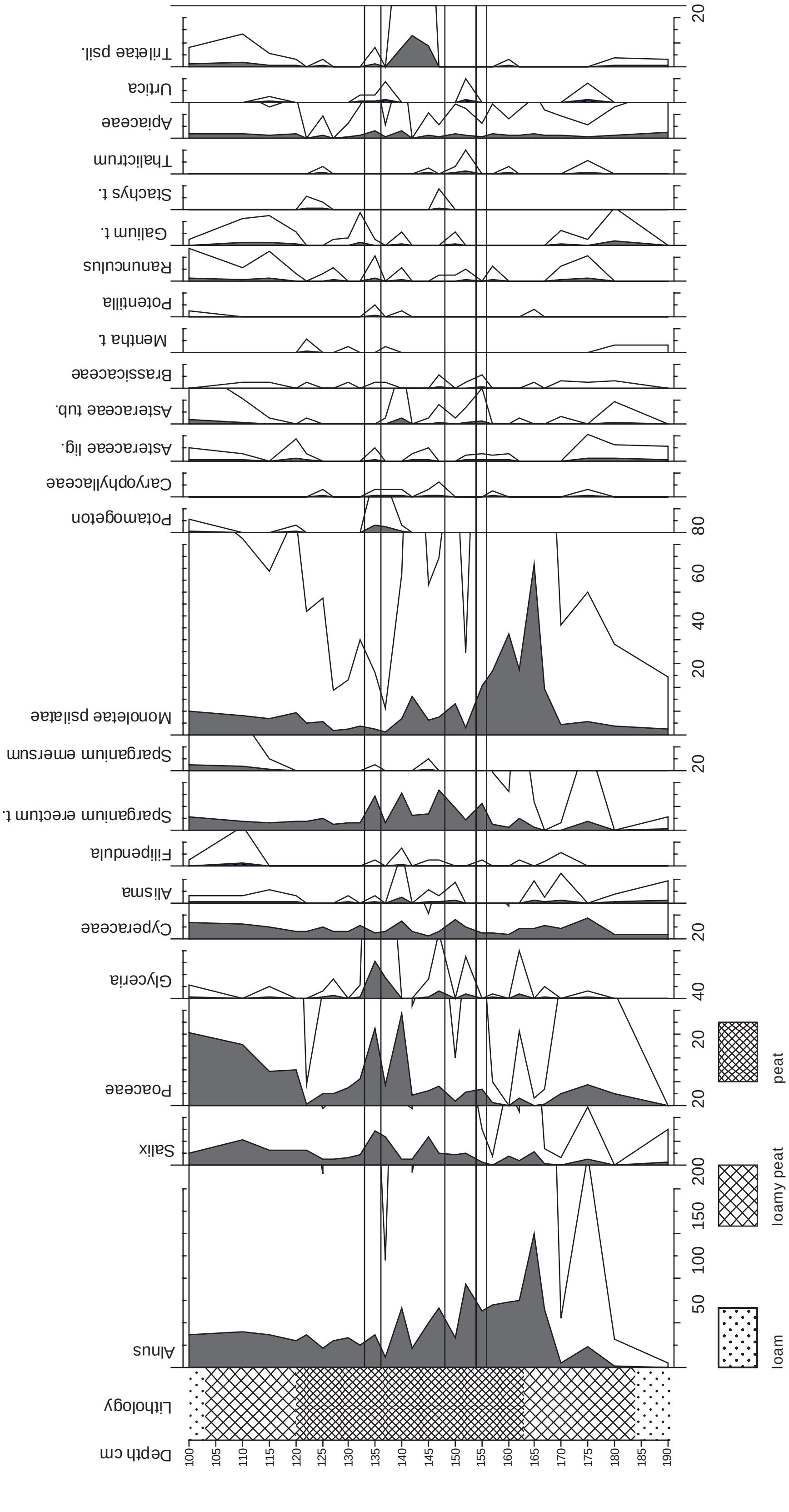

Figure 10.5b The pollen diagram Maastricht-Randwijck, the wetland and ecologically indeterminate parts. Exaggeration 10x.

and *Triticum* type are present and the curve is almost continuous, starting in the Rössen horizon. The cereal pollen may have entered the pollen rain because of threshing activities next to the channel, as already suggested for the period of Rössen occupation (Bakels *et al.* 1993). The Rössen site revealed naked multi-rowed barley, bread wheat and emmer wheat, all three being cereals which do not readily release their pollen into the air. Only during their processing the pollen is beaten out of the glumes (chaff). However, the continuous curve cannot be attributed to a continuous use of the local channel bank as a threshing site, because continuous occupation on this stretch of bank, or the opposite bank, has not been demonstrated. Cereals may, however, have been grown on the terrain closely bordering the channel, and not only during the Rössen period, but also in later periods. It is striking that some of the usual 'anthropogenic indicators', Chenopodiaceae (goosefoot family) and *Plantago lanceolata* (ribwort plantain) for instance, are absent during these zones and occur only later in the record. But the curve of *Polygonum aviculare* (knotgrass) indicates the presence of heavily trampled areas (another indicator of a wayside environment bordering the channel, but in a later period, is *Plantago major*/*media*, great plantain or hoary plantain).

The wide valley of the Meuse seems to have been continuously inhabited during the Neolithic, as traces of the Stein Group, a local version of the Wartberg Culture in Germany, have been discovered in the Vogelzang-Randwijck region as well. A ^{14}C date for this group, obtained on the basis of charcoal in the fill of a pit, gave 4180 ± 60 BP or 2900-2580 cal BC. This horizon has also been plotted on the diagram. Because the time-depth curve in this part is more difficult to interpolate, the horizon designated as Stein Group may have been drawn a little too high. One is tempted to attribute the second decline of the *Ulmus* curve, a decline after re-growth, and the following rise in *Quercus* percentages, to this Neolithic group but that is something for future research.

After this excursion to the Randwijck diagram I would like to return to the Vogelzang diagram, where the trend in the curves of the topmost centimetres of peat can be seen to be very similar to the trend in the start of the Randwijck peat. If the Rössen horizon, based on the calibrated ^{14}C dates, is projected on the Vogelzang diagram, the same declines in the curves of *Ulmus*, *Tilia*, *Fraxinus* and *Alnus* are observed, and the curves of *Corylus* and *Quercus* show a rise. It looks as if the Vogelzang peat stops where the Randwijck peat starts.

10.5 Discussion

The food plants and weeds discarded by the Michelsberg people living on the border of the former Vogelzang channel fit well into the current list of plants found on Michelsberg sites in the region. Two Dutch sites qualify for comparison: Maastricht-Klinkers and Heerlen-Schelsberg. Both are attributed to Michelsberg phase III and are therefore slightly younger than Maastricht-Vogelzang.

Maastricht-Klinkers is situated on the plateau above the Meuse valley, northwest of the town of Maastricht. The Michelsberg features consisted of several pits filled with domestic waste, which included carbonized grains of naked multi-rowed barley and unidentified naked wheat. In addition, some seeds of orache (*Atriplex patula*/*prostrata*), fat hen (*Chenopodium album*), black bindweed (*Fallopia convolvulus*) and a catchfly species (*Silene* sp.) were found (Schreurs 1992).

The site of Heerlen-Schelsberg is a causewayed camp on top of a plateau 25 km east of Maastricht (site unpublished, excavated by J. Deeben and J. Schreurs). Its various features contained naked multirowed barley, durum wheat (*Triticum durum*, both grains and the characteristic chaff), emmer wheat (*Triticum dicoccum*), a few grains of einkorn-type wheat (*Triticum monococcum*-type) and pea (*Pisum sativum*). The wild nuts and fruits identified were hazelnut (*Corylus avellana*), crab apple (*Malus sylvestris*, both pips and fruits) and lime (*Tilia* sp.). The finds also included weeds, the species present being fat hen (*Chenopodium album*), black bindweed (*Fallopia convolvulus*), cleavers (*Galium aparine*), nipplewort (*Lapsana communis*), dock (*Rumex* sp.), clover (*Trifolium* sp.), smooth tare (*Vicia tetrasperma*), drooping brome or barren brome (*Bromus sterilis/tectorum*), fescue or rye grass (*Festuca* sp./*Lolium* sp.) and scarlet pimpernel (*Anagallis arvensis*) (Bakels 2003). The presence of significant amounts of barley and wheat chaff together with the list of weed species suggests that crops were processed on this site. The kind of waste found in the Heerlen-Schelsberg causewayed enclosure has all the characteristics of ordinary waste as found in a farmyard setting. Though the plant species found here and at Maastricht-Vogelzang are comparable, the latter site is different in offering more of a consumer aspect.

The influence of the Michelsberg inhabitants of Maastricht-Vogelzang on their surroundings is reflected in a decline of lime, elm and ash and, in the wetter parts of the landscape, alder. It was a continuation of a development started by their predecessors, the people of the Rössen culture. The original vegetation would have been a mixed deciduous forest, consisting of oak, elm, lime and ash on the drier terrains, and a marsh vegetation with stands of sedges and other wetland herbs interspersed with willow and alder carr on the wetter grounds. How many openings were present in the higher areas is difficult to assess, but the high percentage of hazel pollen suggests a considerable amount of forest edge.

Turning to a comparison of the Meuse evidence with that known from the German Rhineland, the same effect of Rössen people on their environment is reported for the latter region as for the Meuse valley, but for one difference, namely that the curve of ash rises in the Rhineland (Meurers-Balke *et al*. 1999). This rise is attributed to the inhabitants' positive attitude towards ash, expressed as a sparing of the trees. The reason offered is that ash was a valued provider of fodder, the same explanation as is offered above for the decline of ash in the Randwijck and Vogelzang situation. The distance between the stands of ash and the place where people actually lived may play a role here. A decline close to the archaeological sites and a rise where the distance was greater is quite feasible, especially if ash close by was coppiced more frequently.

The Michelsberg occupation is not yet very well recognized in the Rhineland diagrams, but there are signs that the forest recuperated to some extent between the Rössen and Michelsberg occupation, in contrast to what we see for the Meuse. The part of the Meuse valley south of Maastricht was probably continuously occupied by people, which may possibly explained by the nearness of good sources of flint in the Rijckholt-St. Geertruid area at the valley's edge. It must have been a choice location for Neolithic people.

In its curve of cereal pollen the valley is rather unique.

10.6 Conclusion

The lower terrace of the wide valley of the river Meuse south of Maastricht seems to have been inhabited continuously or almost continuously from the Rössen period onwards. The cultivation of cereals and peas was part of the activities of both the Rössen and Michelsberg people. The impact on stands of trees like ash, a favourite provider of leaf fodder, suggests that their activities included the tending of livestock as well. The pollen diagram Maastricht-Randwijck suggests that this way of life was also shared by the subsequent Stein group, a cultural group still fairly unknown.

The analysis of both the macroremains and the pollen from the Maastricht-Vogelzang site has, once again, shown the importance of the Meuse valley south of Maastricht for the study of the Dutch Neolithic. It is to be hoped that it will have the attention of archaeologists also in the near future.

Acknowledgments

Archaeobotanical studies like this one are based on teamwork. Without the skill of Wim Kuijper and Johan Goudzwaard the friable carbonised seeds would never have been retrieved. Wim Kuijper helped me to sample the former channels of the river Meuse at the locations Vogelzang and Randwijck. Geertje Korf counted the Vogelzang pollen. The Randwijck diagram was made by Marjolein Alkemade-Eriks. I wish to thank them for their excellent work. And last but not least, the English of this compilation and integration of results was revised by Kelly Fennema.

Note

In this article the following ^{14}C dates are referred to:

Maastricht-Vogelzang site:	GrN-21043, 5310 ± 80 BP
Maastricht-Vogelzang diagram:	GrN-22478, 5630 ± 40 BP
	GrN-22480, 7570 ± 40 BP
	GrN-22481, 8380 ± 40 BP
Maastricht-Randwijck site:	GrN-16715, 5730 ± 35 BP
	GrN-16716, 5845 ± 45 BP
	GrN-16717, 5790 ± 35 BP
	GrN-16718, 5835 ± 35 BP
Maastricht-Randwijck diagram:	GrN-17121, 3500 ± 40 BP
	GrN-17122, 4215 ± 45 BP
	GrN-17123, 5870 ± 50 BP
Maastricht Stein group:	GrN-14237, 4180 ± 60 BP

Calibrations were carried out with the programme OxCal v3.10

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11 Phosphate mapping of a Funnel Beaker Culture house from Flögeln-Eekhöltjen, district of Cuxhaven, Lower Saxony

W. Haio Zimmermann

11.1 Introduction

From 1971 until 1986 the Lower Saxony Institute for Historical Coastal Research (NIhK) in Wilhelmshaven conducted the research project 'Evolution of an Inhabited Isle since Neolithic times with special regard to economic conditions'. It was funded by the German Research Council (DFG) in order to study the evolution of settlement and its economic background over five millennia on the inhabited isle of Flögeln, district of Cuxhaven, Lower Saxony (fig. 11.1) (Behre/Kučan 1994; Zimmermann 1992; 1994). As part of this project, three structures from the Neolithic Funnel Beaker Culture period (FBC) were excavated, two of them long houses and one a sunken-featured building. The function of the latter, which is not discussed here, is interpreted as to be cultic; we think it is comparable to the FBC-culthouses south of the Limfjord in Jutland, DK (Becker 1997). The excavation results for the Neolithic and Bronze Age features are being analysed, and they will be published in the near future, as will the Neolithic and Early Bronze Age pottery which has been analysed by Jan Albert Bakker (Bakker in prep.).

Figure 11.1 Map of location of Flögeln in the area south of the North Sea.

The two FBC houses from Flögeln-Eekhöltjen are quite similar. As the same characteristics were found for other FBC houses in the area south of the North Sea, we may use the term 'type Flögeln'. Some discussion of the FBC dispersed settlement structure and houses has already been published (Kossian 2007, 246; Zimmermann 1994; 1995) and we will deal with these aspects in greater detail in the final publication of the Flögeln-Eekhöltjen excavation (Zimmermann in press).

Full-scale reconstructions of the FBC-Flögeln houses have been built, in varying quality, in the Netherlands in the Themapark Archeon, Alphen, ZH and in the Hunebedcentrum in Borger, Drenthe, and in Germany in Schleswig-Holstein in the Museum für Archäologie und Ökologie Albersdorf as well as in the Steinzeitdorf Küssow in Mecklenburg.

During the Flögeln project, phosphate mapping was carried out. As the results of mapping of one of the Neolithic/Funnel Beaker Culture houses are of considerable interest, we have great pleasure in presenting them here to our colleague and friend, Leendert Louwe Kooijmans, who has followed all stages of the Flögeln project both in field and during analysis.

11.2 The phosphate mapping

Phosphate mapping (P-mapping) was applied by the Flögeln Project from 1975 onwards, at four different scales: 1) for prospection before excavation to map the areas of settlements and agrarian fields with a grid +/- 50 m, 2) to map the different functional areas in and around buildings with a grid of 1 m, 3) in smaller houses with a grid of 0.4 m and 4) to map a corpse silhouette in a grave *etc.* with a grid of a few centimetres (Zimmermann 1992; 2001a; 2001b; 2006a). During the excavation, samples were always taken from around the archaeological features. Choosing an appropriate method of analysis is also very important; one should select a method, which in practice tests all phosphates in the samples, or at least more than 90% (Zimmermann 2001a; 2001b; 2006a).

Many houses from the Roman Iron Age, Migration Period and Early to High Medieval times, a few from the Bronze Age and three FBC structures were P-mapped. The experience gained from working on the many first and second millennium AD buildings provides the basis for interpretation of the P-mapping results from the Neolithic features.

For the P-mapping in and around house 2, the samples were taken on a 0.4 m grid. The use of these short distances, coupled with analysis using software which demonstrates the presence of faint differences in P-values (OASIS montaj 4.1c from Geosoft Inc. 1 Toronto) provided a result in which details are clearly visible (fig. 11.3)).

The P-mapping of house 2 is a good example to demonstrate not only the advantages of this method but also its disadvantages. Possible disadvantages are that phosphates in any one area might derive from different times, and that only activities which produce no phosphates, some phosphates or a lot of phosphates can be differentiated. Which activities these were cannot be deduced directly from P-analysis. Other evidence, including that provided by archaeological features, has to be taken in consideration. For a room which has higher P-values than other rooms, for instance, several functions can be suggested. For example if characteristic internal features are present, the room can be interpreted as a byre.

The first step for interpretation of the P-mapping is to decide whether the higher and lower P-values really 'belong' to the house, *i.e.* to try to exclude P-distributions which might derive from earlier or later activities. In the case of house 2, the distribution of higher and lower P-values is bordered by the walls or runs parallel to them. As the areas of both house 2 and house 1 were probably not used for building houses at any other times, the P-values are probably the result of the FBC houses having been used. Only the higher P-values east of house 2 could theoretically be derived from some other activities.

The distribution of areas with high phosphates under houses, testifies that these houses were used intensively for some decades (Zimmermann 2006b). Phosphates normally remain at the very spot of deposition, and only seeps downwards a little (Gebhardt 1976). Therefore it seems to be a clear contradiction that some 20-30 cm beneath the FBC surface, in the excavated area, quite high P-values can be found. However, like under dung heaps where plenty of liquid serves as a carrier for the phosphates to seep down, this could to some extent be the case in the houses as well, where special humidity conditions may have developed as a result of the use of the building.

All three FBC structures and their immediate surroundings were sampled for phosphate analysis. In the sunken featured building, a hearth was clearly recognisable (Zimmermann 1986).

11.3 Flögeln house 2

House 2 was situated in a laminated fluviosol (*Bänderparabraunerde*); the foundation trenches of the outer walls and several internal walls were clearly visible (fig. 11.2). The house was aligned almost north-south. In contrast to house 1, which was rectangular, house 2 had a trapezoidal ground plan; it was *c.* 12.5 m long and 4.6-5.15 m broad, being slightly wider at the southern end. Like house 1, it was divided by wall trenches into several rooms; in the case of house 2 there were six. In principle the structure was two aisled, with central roof-bearing posts. There were no external posts like house 1 had, and roof bearing was based equally on the posts in the central axis and the outer walls (see the discussion about the reconstruction of the upright structure in Zimmermann 1979; 1980; 2002).

According to Bakker (in prep.) the pottery (almost 40 pieces) found in the foundation trenches of house 2 belongs to phase Bakker E1+E2, Brindley 5, Laux D; corresponding to MNA III/IV in Denmark (pers. comm. J.-A. Bakker). This dates it to *c.* 3000 BC. As there was no earlier settlement in the immediate surroundings, it is very probable that this pottery 'belongs' to the house.

11.4 Interpretation of the features and function of FBC house 2 from Flögeln-Eekhöltjen

During the excavation of house 1 in 1977 and house 2 in 1984, several proposals were made concerning the function of the structures; for example as a living house for several families, because of the different rooms, or not a house but a grave, the latter suggestion deriving from the Barkær discussion in Denmark (Liversage 1992).

The post-excavation analysis of a house plan for reconstructing the original different functions has to follow a certain strategy, combining the evidence of features and their associated finds on the one hand, with the interpretation of the distribution of higher and lower P-values on the other.

11.4.1 The evidence from excavation

During excavation, observations were made which are of importance for the reconstruction of the functions of house 2; they are described here from north to south.

On the northeast corner of house 2 a recent disturbance could be recognized. Such disturbances were frequently found during the Flögeln excavations, and came to be recognised as places where an erratic (*i.e.* a large stone left by glacial action) had been removed. The Eekhöltjen peninsula had been under the plough for a few decades before we began excavation. This fact is not detrimental to the P-mapping because the phosphates, like modern phosphate fertilisation, seep downwards only a little, remaining in the ploughsoil (Gebhardt 1976). More important is the fact that the erratics which hindered agriculture were cleared only a few years before the archaeological excavation started. The faint traces found beneath the recent disturbance at the northeast corner of house 2, from where an erratic was

Figure 11.2 Overview from the south of Funnel Beaker Culture house 2 from Flögeln-Eekhöltjen.

removed, can be interpreted as a bedding pit, dug during the construction of house 2, for erection of a standing stone just outside of the northeast corner of the house. This is reminiscent of the high guard stones at the end of (FBC) megalithic graves, as well of parallels in Denmark and Kujawien, Poland (see further discussion in Zimmermann forthcoming).

In the northernmost room, room 1, a pit was uncovered; it contained two undecorated FBC pots and two amber beads. Though it cannot be completely excluded that the pit functioned as a cellar, for storage, it is more likely to have been a grave. Kossian discussed two FBC houses from Pennigbüttel, district of Osterholz (Assendorp 2000), which are very similar to the Flögeln houses. He argued on the basis of a stone-lined pit in Pennigbüttel house A, possibly a grave, that this house could perhaps have been a ritual structure, if the pit was functionally associated with the building. He compares it with the FBC-culthouses south of the Limfjord in Jutland, DK (Becker 1997). However, since the practice of burying in houses and settlements was certainly not

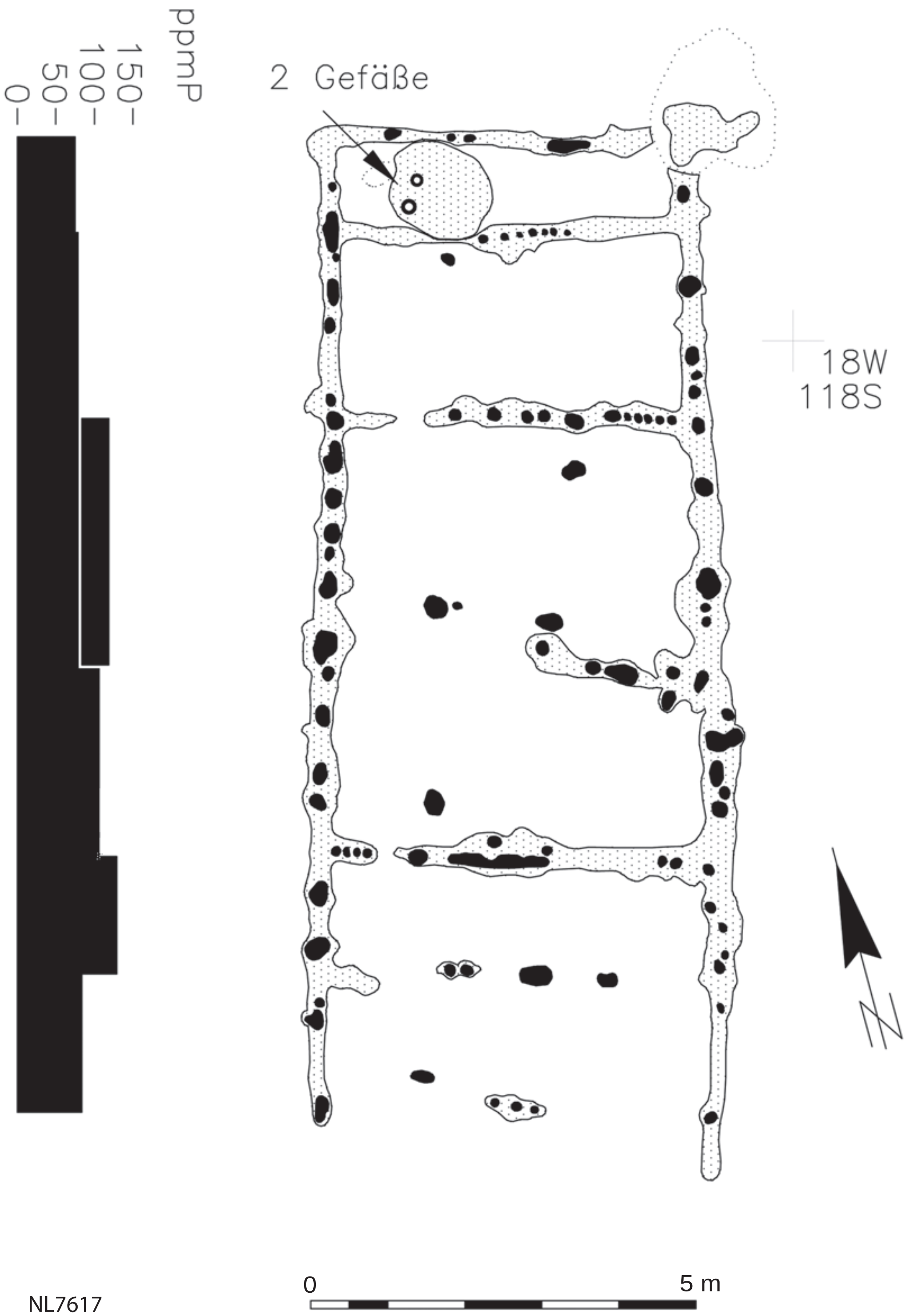

Figure 11.3 Plan of Funnel Beaker Culture house 2 from Flögeln-Eekhöltjen with bar chart of the average values on the left of the medium phosphate values.

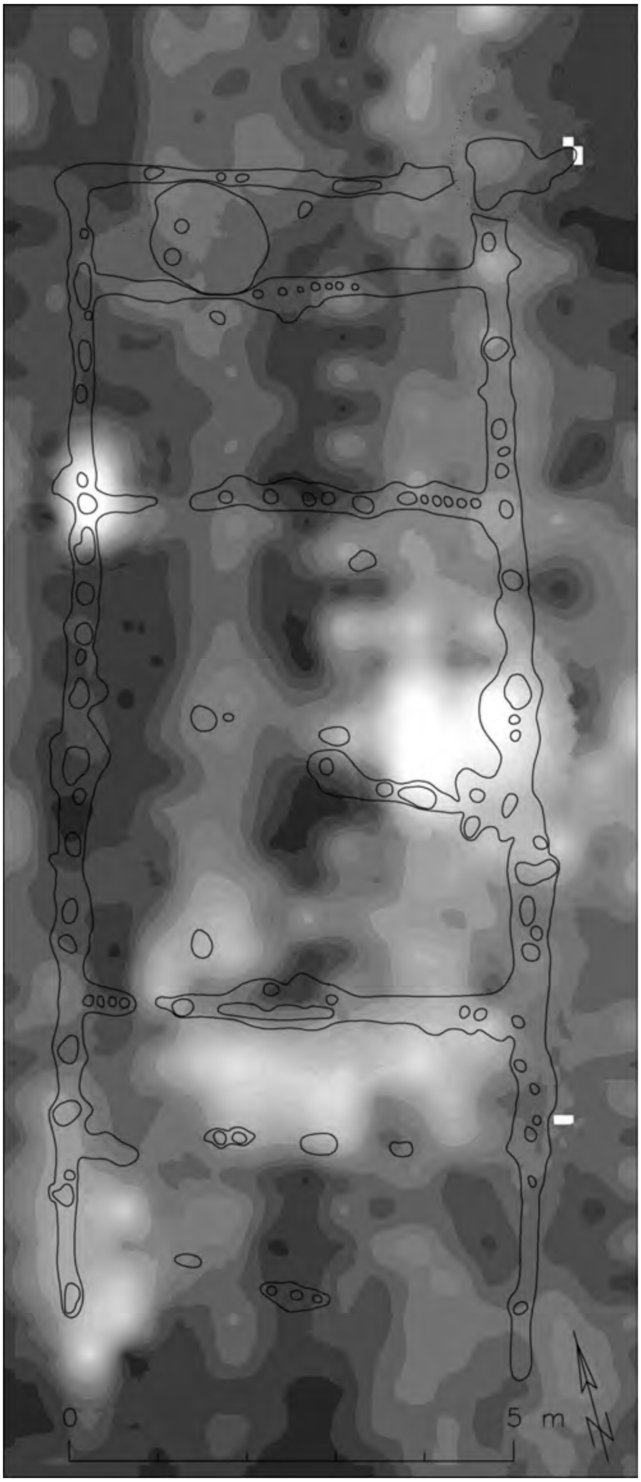

Figure 11.4 Phosphate mapping of Funnel Beaker Culture house 2 from Flögeln-Eekhöltjen (from dark = low to light = high P-values).

exceptional in Neolithic times (Happ 1991; Veit 1995), a grave cannot be a sufficient argument for interpreting a whole house as a cultic building. The same would be true for Flögeln house 2 as well. For Flögeln, the coincidence of grave and structure and the presence of the earth-set erratic, a standing stone, all close to each other, might suggest that the northern end of house 2 was a sacred area. Unfortunately we missed the chance to sample the base of this pit for phosphate analysis.

In the SE corner in room 3, infiltrations of charcoal were observed, clear evidence for the presence of a hearth.

11.4.2 Interpretation of the P-mapping results from house 2

In general, the spots and areas with the higher P-values cannot directly be equated with certain functions (fig. 11.4). It will be remembered that during excavation it was suggested that the Flögeln houses 1 and 2 might have sheltered several families, one per room, or that they might not have been houses for the living but a burial structure. However, the uneven distribution of phosphates within house 2 is a clear contradiction to the suggestion that this house was for several families. It seems clear that it was a farmhouse for one family, with rooms of different functions. This interpretation is further supported by the lack of evidence for a second or more hearths, although multiple hearths have been found in the contemporary Dümmer settlement, *c*. 130 km to the southwest (Kossian 2007). As for the interpretation of house 2 as a burial structure, although a possible grave was found in the northernmost room, once again the uneven distribution of phosphates throughout the structure suggests this interpretation is implausible.

Room 3

As with many other cases of houses of the 1st and 2nd millennium AD, the hearth in the SE corner of the third room shows high P-values. This hearth is unusual in being situated close to the wall, probably a wattle work and daub wall, which is but seldomly observed in early house building. This presupposes that the wall was protected from the fire by something like a thick loam layer, as has been found in some cases, for example in an early medieval house in Langwarden, Butjadingen, district of Wesermarsch (Brandt 1986).

Room 5

Room 5 was used for function(s) which resulted in higher P-values in the whole room, in contrast to rooms 3 and 4 where the higher P-values are concentrated along the eastern wall. The phosphate levels and distribution might suggest that room 5 could have been a byre, but this is unlikely as the room was only about 1.5 m wide; in addition, the results of palaeobotanical research indicate that, during the FBC period, cattle were kept in the forest and not in a byre (Behre/Kučan 1994).

Bands of high phosphate levels
In general, the distribution of areas of higher phosphates both within and external to house 2 can be interpreted as activity areas, but there is no clear evidence which allows any more detailed interpretations, except for the hearth. However, there are two narrow strips or bands of higher phosphate levels where more can be suggested.

With the houses of the 1st millennium AD, in many cases we could discern bands of medium-intensity phosphate levels along and outside of the long walls (Zimmermann 1992). For the FBC period, such a band can be observed outside of the western wall of house 2 (unfortunately outside the frame of fig. 11.4). This was possibly the same along the eastern wall, but less clearly so. We have interpreted such strips or bands as the space under the overhanging roof where small domestic animals searched shelter and where man performed the call of nature. At the later prehistoric site of Feddersen Wierde, clear traces of toilet pits were observed in the same situation under the overhanging roof (Haarnagel 1979). Because of observations from within houses from the 1st millennium AD (Zimmermann 1992), we also dare to give a proposal for the interpretation of a second example of a linear distribution of raised phosphate levels. Inside of house 2, to the west of the central axis, there is a north-south band of increased phosphates running from room 1 to room 4. Such traces could be recognized in the houses of the 1st millennium AD as the regular path that people took through the house. Here at house 2 of the FBC, we can see through the phosphate mapping what is probably the pathway from room to room. It is no contradiction, that it crosses the wall trenches in some places: at sites where wattle work is preserved, there are many examples to show that it is woven through under the sills (Haarnagel 1979). The position of this path in house 2 could be the reason why the hearth in room 3 was not situated centrally.

11.5 Conclusion
The results presented here show how P-mapping yields valuable information for understanding house features. They show that every house plan which is not overlapped by other features, and which is not P-mapped, is a lost chance. The often-heard argument, that in projects there are not the means for such additional analytical work, can be countered with the point that the samples taken can wait for examination many years. In all cases where the original surface is not preserved, P-mapping is the only method to find evidence for the possible functions a house had.

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12 The Schipluiden pottery: mobility, exchange and mode of production

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12.1 Introduction

Looking back upon the last fifty years of research on the Neolithic in the Netherlands it is easy to appreciate the enormous increase in data and insights. The Leiden institute of Prehistory (IPL) has been a major contributor to the field of Neolithic research, especially by means of the input of its two directors. The founder of the institute, prof. dr. P.J.R. Modderman, focused on the province of Limburg where he executed important work on LBK, Limburg pottery and the Middle Neolithic of Limburg (now Stein group). From the early 1970's the curator of the Dutch National Museum of Antiquities, Leendert Louwe Kooijmans developed an important research line in the Rhine-Meuse area. The Hazendonk river dune, excavated in the early 1970's, still stands out as a key site in our appreciation of the process of neolithisation in northwestern Europe. With Louwe Kooijmans's appointment at the IPL the wetland research became a hallmark of Leiden research, most recently illustrated by ARCHOL's major research at Schipluiden (Louwe Kooijmans/Jongste (eds) 2006).[1]

Within the framework of wetland-based research on the process of neolithisation Louwe Kooijmans' approach seems a perfect example of Dutch no-nonsense attitude to the theoretical debate. In his early years Louwe Kooijmans excavated important sites such as Hazendonk, Het Vormer and Kraaienberg (Louwe Kooijmans 1974; 1980; Louwe Kooijmans/Verhart 1990). These sites were then analysed with an approach focussed on the when, how and why of neolithisation (*e.g.* Louwe Kooijmans 1993; 1998). More recently, the relative wealth of data allowed him to consider new avenues of analysis of which gender roles in Swifterbant and Hazendonk societies is the most striking topic.[2]

In my contribution I would like to follow up this new line of research and focus on the production of pottery within the Hazendonk group. The intriguing presence of two pottery groups at the Middle Neolithic site of Schipluiden is the starting point for this paper. On the basis of intra-site and inter-site comparison the meaning of these pottery groups is approached. After introducing the Hazendonk group I will start my analysis with the pottery from Schipluiden. These results will then be studied in relation to the other Hazendonk sites. In my conclusion I will address the issue of pottery production in terms of mobility, exchange and mode of production ending with the question whether it is possible to relate the production of pottery in this society to a male or female gender.

12.2 Context: the Hazendonk group and its pottery

The traditional framework of research into the neolithisation of the Netherlands is that in which the occupation history of the Central-European loess zone is related to that of the extensive wetlands of western Netherlands. Within this framework the Hazendonk group holds a special position. On the one hand, it may be seen as the successor of the Late Mesolithic and Early Neolithic Swifterbant group in terms of subsistence and spatial distribution; on the other hand, its material culture, especially its flint industry, is clearly linked to the Michelsberg culture (Raemaekers 1999; Van Gijn *et al.* 2006; Louwe Kooijmans 2007). The Hazendonk pottery provides links to both cultural areas (see below). On the basis of a large group of ^{14}C dates the Hazendonk group is dated *c.* 3800-3500 cal BC (Lanting/Van der Plicht 2000): between the middle phase of the Swifterbant culture on the one hand and the Vlaardingen group and TRB Westgroup on the other.

The type assemblage of the Hazendonk group was excavated by Louwe Kooijmans in the early 1970's and presented in his PhD thesis as a new cultural group: the Hazendonk group. Later research at the site yielded two older occupation phases and prompted new terminology. The two oldest assemblages became known as Hazendonk 1 and 2, while the Hazendonk material was renamed Hazendonk 3. When the Hazendonk 1 and 2 assemblages were re-interpreted as Swifterbant assemblages (Raemaekers 1999), Louwe Kooijmans proposed to return to the original terminology (Louwe Kooijmans 2007; Raemaekers/Rooke 2006). This definition is followed here.

The spatial distribution of Hazendonk sites is to a large extent determined by site formation processes as most sites were covered with younger sediment. The near absence of sites in areas without younger sedimentation (*e.g.* the cover sand area of Noord-Brabant) should be interpreted with caution. If Hazendonk sites were to be found, little more than flint scatters would survive and it would be difficult to determine whether it concerns Hazendonk or Michelsberg sites. The spatial distribution (fig. 12.1) suggests that remains may be found in a triangular area between Maastricht, Nijmegen and The Hague.

The sites attributed to the Hazendonk group display a great deal of variability. It has to be realised that this variety is based not only on the character of the remains (systemic context), but also on the preservation and excavation conditions (archaeological context). Sites like Het Vormer and Meeuwen consist of a scatter of cultural debris without subsistence evidence or soil features preserved, while a wetland site like Hazendonk does yield subsistence evidence but the limited excavation area doe not provide us with features. For this reason, the observed variety in site characteristics is discussed in only general terms here. The subsistence base suggests that there were sites where wild animals constituted the predominant source of meat (*e.g.* Hazendonk; Zeiler 1997) and sites where remains from wild and domestic animals were more or less in balance (*e.g.* Schipluiden, Ypenburg, Wateringen: Zeiler 2006; De Vries 2004; Paalman 1997 respectively). Cereal remains are standardized: it always concerns remains from emmer wheat and naked barley. House plans have been demonstrated

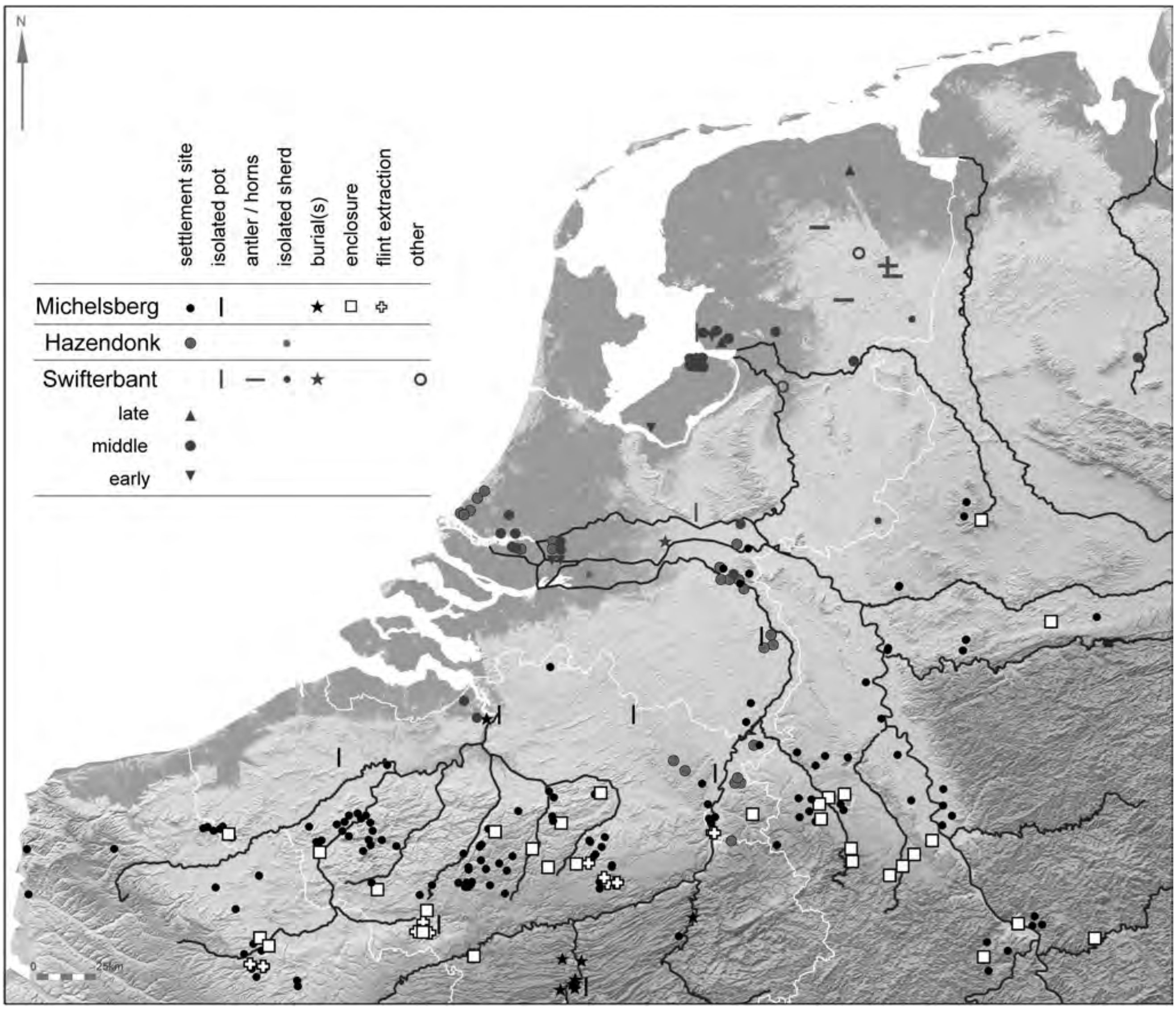

Figure 12.1 Distribution of Hazendonk sites in northwestern Europe (from Louwe Kooijmans 2006: fig. 27.4).

for Schipluiden (Hamburg/Louwe Kooijmans 2006), Ypenburg (pers. comm. J.H.M. Koot, Rijswijk) and Wateringen (Raemaekers 1997a). It concerns small two-aisled house plans. Schipluiden and Ypenburg also provide a number of human burials. A final characteristic of interest is the flint industry. All sites provide evidence of two technological categories. The first is that of local or regional available flint produced in a somewhat *ad hoc* technology; the second category consists of flint types that were transported from greater distance (Belgium, Limburg). From sites as Schipluiden and Wateringen the absence of cores is suggestive of the import of this second category of flint artefacts as finished tools (Van Gijn 1997; Van Gijn *et al*. 2006).

The Hazendonk pottery is a distinct group of prehistoric ceramics. It is characterised by the use of various tempering materials (most often quartz), coil-built, decorated with fingertips and/or spatulas in a random pattern covering the wall surface (but excluding the rim zone) and shaped into buckets, barrels and beakers (fig. 12.2). In some sites, these pottery types are accompanied by bowls (see below). In two sites in the coastal area the barrel and buckets may be divided into two groups defined on the basis of tempering agents, wall thickness and frequency of decoration.

12.3 The existence of two tempering styles

12.3.1 Site level: Schipluiden

Starting point in this analysis is my research of the Schipluiden pottery (Raemaekers/Rooke 2006). The large assemblage and well excavated site stratigraphy allowed a detailed analysis of the pottery and its development through the site's three occupation phases. The Schipluiden pottery was tempered with quartz (47.7%), other stone grit (19.5%), shell (19.3%), plant (12.1%) and grog (4.1%). As a rule (90.8%) only one type of temper was used. Using coils the clay was turned into relatively coarse pottery (average wall thickness 10.6 mm). The pottery forms include buckets (n=16), barrels (n=27), one beaker and one S-shaped pot. Decoration is found on 9.6% of the sherds and was carried out with fingertips (65.3%), spatulas (23.7%), with groove lines (8.7%) or other/undetermined techniques. Diatom analysis indicates that the pottery was produced locally.

The large assemblage allows an analysis in which the variables are cross-referenced. This resulted in the conclusion that there are two pottery groups at the site. These groups may not be identified on the basis of morphological characteristics such as size or shape, but are found in technological characteristics only. The first group consists of sherds

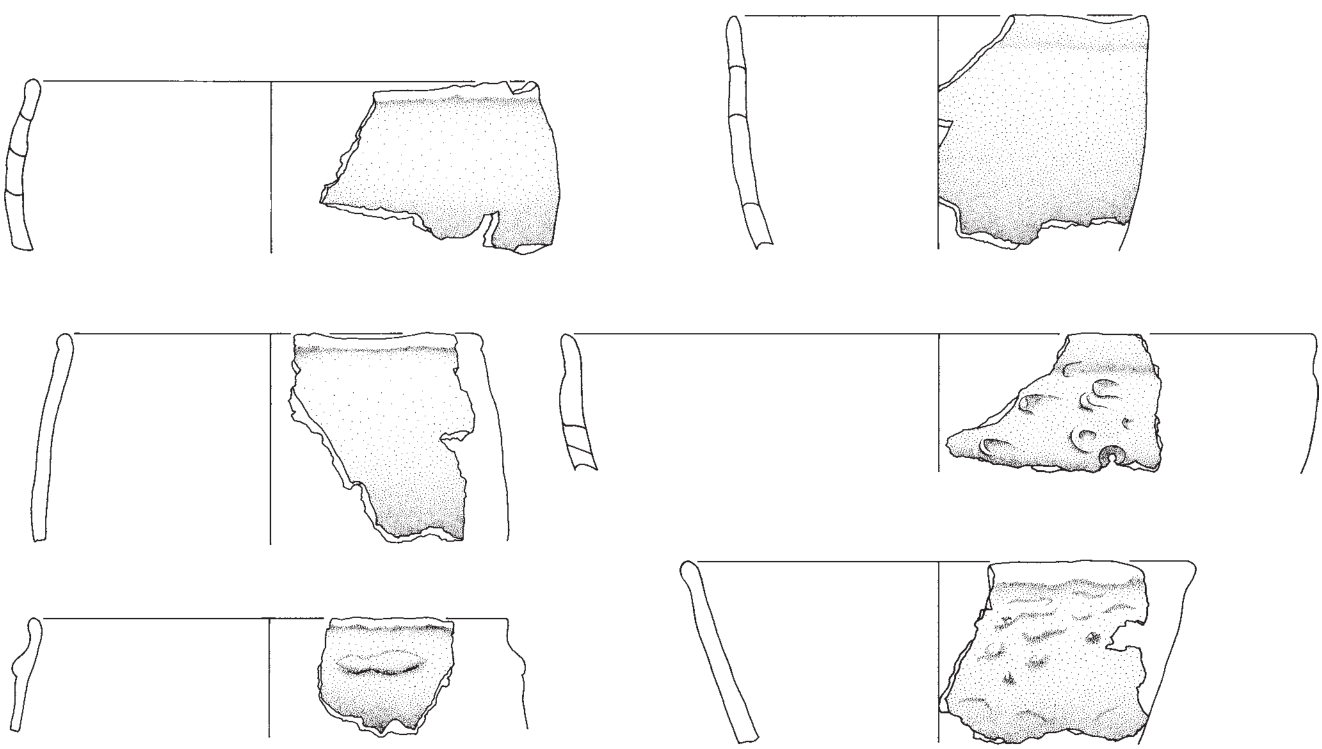

Figure 12.2 Schipluiden pottery. Left barrels and right buckets (after Raemaekers/Rooke 2006). Scale 1:3.

tempered with quartz, grit or grog. These sherds have an average wall thickness of 10.3 mm (median value 10 mm) and are frequently decorated (13.2%). The second group comprises the shell tempered sherds. These have an average wall thickness of 11.3 mm (median also 10 mm!) and are rarely decorated (1.1%). It is important to note that this difference between thin-walled pottery with frequent decoration and thick-walled pottery with virtually no decoration is found throughout the c. 250 years occupation history of Schipluiden (table 12.1). This makes clear that the two pottery groups were produced during many generations of pottery makers. Through time the proportion of shell-tempered sherds decreases from 47% (phase 1) to 10% (phase 3), indicating that the thick-walled undecorated shell-tempered pottery group became less frequently produced.

The existence of two pottery groups defined on the basis of tempering agents, wall-thickness and decoration might be interpreted in two ways. First, it might be indicative of two different 'microstyles' related to two pottery producing households with their own slightly different technological traditions, that are reproduced from one generation to the next. This should be reflected in the spatial distribution of the pottery finds. The spatial analysis of post holes and cultural remains suggests the existence of four contemporary yards at the site (Wansleeben/Louwe Kooijmans 2006: fig. 4.5). The distribution of the pottery within those four yards makes clear that the two pottery groups do not correspond to household consumption: there is no difference in the spatial distribution of sherds tempered with shell or quartz. As the microstyles are not mirrored in the spatial patterns and household consumption cannot be proven, the explanation of these microstyles as resulting from household production is at this point difficult to prove. The second possible explanation is that the two pottery groups correspond to two functional groups unrelated to size and shape. The only evidence we have of the function of the vessels is the presence of food remains on many sherds (n=764; 16.8%). The abundance of food remains and the morphological homogeneity suggest that most, if not all vessels were used for cooking. The functional difference might then be found in the contents of the pot: were specific meals related to specifically tempered pots? Unfortunately, no chemical analysis of the food remains is available, but there are five ^{14}C dates on charred food remains[3], all with a reservoir effect (Mol *et al.* 2006: table 12.2.2; Raemaekers 2005: table 1), indicating that fish was prepared. One pot was tempered with shell, the other four with quartz or grit. At this moment there is therefore no evidence that the two pottery groups may be interpreted as being related to different functions. Is it possible to gain more insight in the meaning of the two pottery group by expanding our scope?

phase	1	2a	2b	3 Unit 10	3 Unit 11
av.wall thickness (mm)					
quartz	11.6	10.4	10.1	10.1	9.8
shell	12.8	11.6	10.8	11.1	10.6
wall decoration (%)					
quartz	15.0	14.8	16.2	20.0	13.7
shell	1.0	1.1	4.0	0.0	4.0

Table 12.1 Average wall thickness and percentage of wall decoration for sherds with quartz and shell per occupation phase (from Raemaekers/Rooke 2006: table 6.4).

12.3.2 At a micro-regional level: the coastal sites

In the coastal area of Schipluiden two more major excavations are of relevance. It concerns Wateringen 4, excavated by the Leiden University in 1994, and Ypenburg, excavated in several campaigns in the late 1990's by the archaeological service of the municipality of Rijswijk. The ceramics were studied with a similar descriptive system (Raemaekers 1997b and Raemaekers in press respectively) allowing a detailed comparison. Ypenburg is in many respects similar to Schipluiden as it concerns a large site, yielded both human burials and house plans, and its ceramics may also be divided into two groups on the basis of the correlation between temper, wall thickness and percentage of decoration. Again, there are no spatial patterns suggesting household consumption and the proportion of sherds tempered with shell decreases through time. Wateringen is a somewhat different site although it must be remembered that only c. 50% of the site was excavated. This half-a-site provided us with a single house plan, while the absence of stratigraphy puts the entire assemblage into one phase. There are no burials. The Wateringen ceramics can not be divided into two groups as shell temper was almost absent.[4]

How may these regional patterns be related to the two explanations proposed above? The first hypothesis that the existence of two pottery groups is related to household production is not corroborated by the spatial patterns in household consumption in Ypenburg. Yet, the absence of shell tempered pottery in Wateringen might be interpreted as the absence of a second potter: the pottery from Wateringen was then produced within one microstyle. The second hypothesis, that the pottery groups are related to a different function, might be evaluated by referring to the differences in site characteristics between Schipluiden and Ypenburg on the one hand and Wateringen on the other: the specific function of ceramics tempered with shell was then not present at Wateringen. This interpretation cannot be supported by extra ^{14}C dates from charred food remains from

Wateringen: there are none, while similarities in the bone assemblages from the three sites suggest a similar subsistence base. The inclusion of two contemporary settlement sites from the coastal area apparently does not help us to decide which of the two hypotheses explains the occurrence of two pottery groups at Schipluiden.

12.3.3 At a macroregional level: the Hazendonk group

The analysis may be undertaken at yet a larger spatial scale, that of the entire Hazendonk group. To this end, the coastal sites are compared with Hazendonk, some 50 km inland and Wychen-Het Vormer, near Nijmegen, some 120 km inland. Louwe Kooijmans' 1980 publication of the ceramics from Het Vormer should be discussed in detail. He carried out an extensive morphological and technological analysis and concludes that there are three morphological sub-assemblages present: bowls, beakers and buckets/barrels. The first group, the bowls, are found not only at Het Vormer, but also in other assemblages in the neighbourhood. While the Hazendonk and the coastal sites lack bowls, this group has its parallels in material from Belgium, northern France and Great-Britain (Louwe Kooijmans 1980; Vanmontfort 2004). Bowls are apparently a supra-Hazendonk group phenomenon. The beakers of the second group are found across north-western Europe in the Michelsberg culture (Vanmontfort 2004; Willms 1982), late Swifterbant (Raemaekers 2005: Schokkerhaven) and the contemporary early phase of the TRB in northern Europe (*früheste* TRB; *e.g.* Koch 1998). It appears that decoration schemes are more varied and elaborated in TRB beakers, while the late Swifterbant beakers are little and simple decorated. With the exception of one beaker from 't Klumke (Raemaekers 2007), beakers from Hazendonk sites are undecorated, as are the Michelsberg beakers. The third group encompasses the buckets and barrels that are so characteristic of Hazendonk pottery. With these three morphological groups from Het Vormer as starting point it becomes clear that the occurrence of various morphological groups at Hazendonk sites was the norm. At the coast two subgroups of buckets and barrels are found alongside some beakers, at Hazendonk the same groups are found, but shell-tempered pottery is absent, while the sites near Nijmegen may contain three morphological groups. Alongside the regional patterning in technology and morphology, there are also clear patterns in terms of decoration (table 12.2): groove lines appear to be a type of decoration favoured near Nijmegen and had decreasing importance to the west. The frequency of imprints with a hollow spatula and fingertips also shows inter-regional variation. Returning to the two ceramic groups found at Schipluiden (and Ypenburg) does the inclusion of the entire Hazendonk group assist us in determining whether their existence is evidence of microstyles or specific functions? It appears that this is not the case: the inter-site and interregional variability makes clear that these ceramic patterns cannot be explained by a monocausal argument. Instead, interpretations of the observed patterning should include explanations of both the similarities (i.e. what defines the Hazendonk group pottery) and the inter-site ceramic dissimilarities.

12.4 An alternative explanation: mobility, exchange and mode of production

This broader perspective starts with the observation that we are able to construct an analytical concept – the Hazendonk group – on the basis of specific ceramic characteristics (fig. 12.1). The Hazendonk group is relatively well distinguishable as prehistoric pottery on the basis of ceramic shapes (buckets and barrels), technology (poor quality, coil-built) and decorative schemes. This relative homogeneity needs explanation because it is not self-evident that small-scale pottery producing communities develop and maintain a common ceramic expression. The pottery however does vary in terms of the tempering material.

A first issue concerning the observed patterns is that of *mobility*. The coastal area of Schipluiden appears to have been a newly-settled area during the time of the Hazendonk 3 group as no older coastal sites are known. It is as yet unclear whether Swifterbant sites may ever be found due to coastal erosion (Raemaekers 2003). The new settlers of the coastal area may have brought their Hazendonk ceramic tradition with them, developing the coastal styles in the following generations.

	coastal area	Hazendonk	Nijmegen area
important types of temper	quartz, plant, shell	quartz, plant	quartz
wall decoration	low percentage	high percentage	low percentage
groove lines	present	frequent	dominant
hollow spatula	present	present	absent
fingertip	frequent	present	present

Table 12.2 A supra-regional comparison of the Hazendonk group pottery.

The second issue of relevance are the existence of *exchange networks*. The presence of flint artefacts made on exotic materials such as Rijckholt flints and quern stones indicate that in a network in which exchange and mobility are combined raw materials were transported to the coastal area. The proportional importance of Rijckholt flint decreases from the Nijmegen area *via* Hazendonk to the coastal area suggesting a down the line exchange instead of long (c. 300 km) expeditions to the Rijkcholt sources in the southern part of Dutch Limburg. Because of the lack of sites between the coastal area and Hazendonk one is inclined to identify the scale of the raw material exchange network on the basis of the distance between these two areas: some 50 km. The Hazendonk inhabitants in turn had exchange relations further inland.

The third issue to be discussed in relation to the observed pottery patterns is that of *mode of production*. Ethnographic literature provides us with various models in which degrees of production specialisation lead to notions of production at the level of a household, a family, *ad hoc* specialists or true specialists. It is difficult to relate these categories to the Hazendonk group as we are dealing with patterns in consumption rather than production. The lack of spatial patterning at Schipluiden at least indicates that there is no household consumption, but this does not indicate that household production should be dismissed. The most extensively excavated sites, Schipluiden and Ypenburg, suggest the existence of settlements in which a small group of households lived together. Diatom analysis suggests both local production and consumption. Another aspect of relevance here is the lack of stylistic development through time across the entire Hazendonk area. This conservative technological tradition indicates that the emblemic value of this category of material culture is very restricted and the pottery is foremost a functional artefact group.

One potential explanation of the observed pottery groups of Schipluiden might be proposed on the basis of these three issues (fig. 12.3) and is presented here. The coastal area was colonised by people of the Hazendonk group living further inland. After settling contacts between the potters in the coastal area and those beyond were restricted, resulting in regionally preferred decorative schemes. It appears that in the supra-regional exchange of marriage partners potters were not exchanged. Instead, a *ceramolocal* marriage system developed in which partners married into the potter's family. The occurrence of two pottery groups at Schipluiden and Ypenburg is evidence of two contemporary traditions – microstyles – providing pottery for all households at Schipluiden.

	Similarities	Dissimilarities
Mobility	Colonisation	
Exchange networks		Ceramolocal marriage system
Mode of production	Tradition	Little emblemic value

Figure 12.3 An overview of the issues concerning the patterning of Hazendonk pottery.

A final topic to be discussed is that of the gender of the potters. Although I have no problem accepting the existence of gender roles in these small-scale prehistoric societies, Louwe Kooijmans's suggestion that it was a female activity is in need of archaeological argumentation. As a rule, there is little direct evidence of gender roles. A singular exception is the male burial from Schipluiden with strike-a-light and pyrite (Van Gijn *et al.* 2006). It appears that a specific male role was expressed (Smits/Louwe Kooijmans 2006: 107) and making fire might be a male activity. On a more general level it is evident that whereas flint procurement is related to mobility and exchange due to the absence of raw materials in the coastal area, pottery production is a local activity. This suggests that gender roles may be related to degree of mobility. In my opinion, it is a matter of personal preference to identify the ceramolocal pottery tradition with a matrilocal exchange system in which 'mobile males' marry into their wives' family or the other way around.

Notes

1 ARCHOL is the excavation firm that is part of the Leiden University.

2 Symposium contributions by Louwe Kooijmans in Schleswig (2006) and Leiden (2007).

3 Mol *et al.* report GrA-26892 as a dated charred wheat (2006: table 2.2) contrary to Raemaekers 2005: table 1. A request at the Groningen Centre for Isotopic Research made clear it concerns a date of charred food remains.

4 The report does not mention that there are two sherds with bone or shell fragments.

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13 Hazendonk layers over and over again

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13.1 Introduction

In the flat western part of the Netherlands, small nuances in the relief point to older geological phenomena. Stream ridges indicate the presence of filled-up palaeochannels, levees may represent tidal creeks and small elevations point to former riverdunes, or *donken* as they are called in the Netherlands. In the past these elevations in the landscape have been favourable and dry locations for human settlement in a rather wet landscape. In the wetlands, settlements of the Late Neolithic Vlaardingen group had been discovered in the mid 20th century, but it was long thought that in the earlier Stone Age they were largely void of human occupation. However, incidental discoveries of earlier artefacts were already being made.

A small and enthusiastic group of amateur archaeologists in the Alblasserwaard documented Neolithic finds on the riverdunes in the 1960s. Their activities drew the attention of prof. P.J.R. Modderman and in time formed an opportunity for the young Leendert Louwe Kooijmans to delve into the prehistoric occupation of the western part of the Netherlands. This would prove to be the start of an exciting research career that included important excavations and spectacular new insights into the early occupation history of the Western Netherlands and its process of Neolithisation in specific. For over 40 years the area has remained his focus of investigation, yet the first riverdune site excavated in 1974-1976, the Hazendonk, remains of crucial importance. There is only one problem; it has not been published extensively (although papers such as Louwe Kooijmans 1987 brought the site to the attention of a wider audience). The lack of a final publication is not merely due to a lack of time on the part of the excavators. The Hazendonk excavation yielded very rich occupation layers and all artefacts were recorded individually in three dimensions. At the start of the computer age, the (mainframe) computer seemed to be a very capable instrument to manage these complex find distributions in a stratigraphical context. But things turned out to be not so simple, for a number of archaeological and methodological reasons.

In this paper we aim to discuss these difficulties and problems in more detail and explain how solutions were created in subsequent phases of computer development. However in the end, as you will discover, traditional archaeological skills and typology, one of Leendert's strong points, still remain crucial for the analysis. After a brief introduction to the research history we will first give a concise overview of the developments in techniques and methods of analysis that over the years have been unleashed on the Hazendonk data. We focus on the way in which these methods dealt with issues of stratigraphy, lithology and typology. Subsequently we present a case-study based on the ceramic assemblage, using the possibilities given by the digital dataset that has become available recently.

13.2 A history of the riverdune research

The site of the Hazendonk ('dune of the hare') (fig. 13.1) was discovered by the local group of amateur archaeologists mentioned in the introduction. Since the pottery recovered by them was of a completely unknown type, three small testpits were dug in 1967 in order to obtain additional information. This test excavation and consecutive augering campaign (including a pollen sample), pointed out the large potential of the site and indicated the presence of not less than seven Neolithic occupation layers, separated from each other by layers of sediment. The preservation conditions turned out to be excellent. Therefore the site promised the possibility to document a long occupation history of a single location with absolute chronological control. The Hazendonk seemed to be the ideal location to investigate settlement history and subsequent changes in material culture and economy.

Following the trial trenches and due to their promising results, it was decided to excavate part of the Hazendonk. The work did not start until 1974, when Leendert was curator of the National Museum of Antiquities. The site was excavated between 1974 and 1976 for two to three months each summer. For that time the excavations were of a considerable scale, in terms of the number of trenches, finds and personnel. In order to be able to process the bulk of information a computer was used, a novelty at that time.

The results of the excavation were stunning and yielded unknown pottery – soon labelled Hazendonk 1, 2 and 3 – as well as numerous other spectacular finds, such as wooden objects, a canoe, a palisade, tools of bone and antler, human bones and food remains. They shed new light on the process

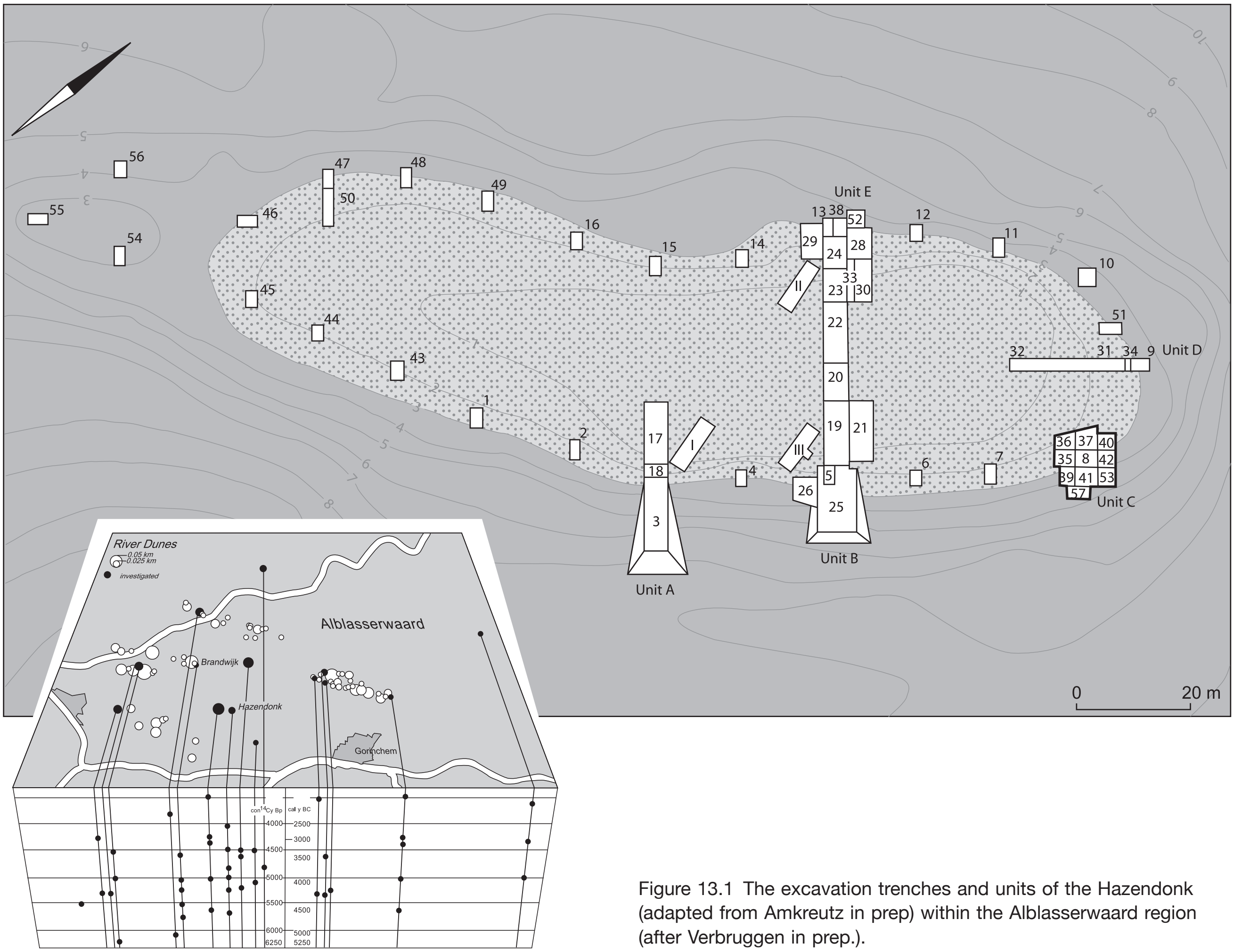

Figure 13.1 The excavation trenches and units of the Hazendonk (adapted from Amkreutz in prep) within the Alblasserwaard region (after Verbruggen in prep.).

of neolithisation by providing a first idea of the transition to agriculture in the wetland margins of the Lower Rhine area.

The excavations also proved to be the starting point for a series of new discoveries in the region. In the Alblasserwaard and Krimpenerwaard, PhD-research by M. Verbruggen led to the discovery of a total of 40 additional riverdunes which were subsequently surveyed by means of augering. Most of these proved to have been occupied in various Mesolithic and Neolithic phases and with differing intensity (Verbruggen 1992). A second riverdune was documented by a small excavation at Brandwijk (Van Gijn/Verbruggen 1992); however due to the depth below sealevel, and hence below the groundwatertable, the lowermost and oldest layers could not be documented. The financial and technical limitations with respect to pumping were solved at another location in 1997, when a unique opportunity occurred to explore Mesolithic levels. Two *donken* proved to be in the path of the projected Betuwe railroad and had to be excavated. These riverdunes, at Hardinxveld-Giessendam (Polderweg and De Bruin), became Leendert's first hands-on experience with the pros and cons of commercial 'Malta' archaeology and enabled him to excavate two Late Mesolithic and Early Neolithic sites at a depth of 10 m below Dutch ordnance datum (Louwe Kooijmans 2003). It also led to the successful start of ArchOL, the excavation firm related to Faculty of Archaeology of Leiden University. Leendert's most recent excavations in the coastal area near Schipluiden, continue his lifetime quest for settlements dated early in the Neolithic of the Western Netherlands (Louwe Kooijmans/Jongste 2006).

13.3 Technological optimism

Looking back, one becomes aware of the fact that recording and documentation of the stratigraphically embedded finds on and around riverdunes has continually been subjected to new techniques and innovations. The excavation strategy has been adjusted to face the existing complexity and to offer a better quality of recording and documentation. This not only relates to strategic decisions in the field but also reflects upon new technological innovations and computer possibilities.

Soon after the pioneering experiments at Swifterbant and Bergumermeer, where finds were recorded in three dimensions and analysed digitally (*e.g.* Price 1981), computers were also introduced to the Hazendonk excavation. Digital recording of the finds was seen as a big step forward. Contrary to the current powerful desktop machines, the mainframe computers of the seventies were little more than electronical filing cabinets. Data was recorded on field forms and later transmitted onto punched cards by data typists. Later on, this information was copied onto tapes and analyzed with statistical software packages. The 1970s optimism about the capabilities of computers tempted excavators to abandon the familiar excavation methods used on Stone age sites including square-based find recording, sieving and the documentation of find-contexts. Accurate recording of the 3D coordinate of each artefact was deemed sufficient. The effects of taphonomical disturbance and post-depositional processes soon proved to be too fundamentally related to find distributions to be solved electronically. The adverse effects of the absence of additional information with respect to the lithological context of finds was to become a hard-learned lesson. Moreover, apart from several methods of statistical analysis, there was little software available in terms of generating graphical distribution maps. The initial status of the computer as a means for documentation and analysis quickly lost some of its attributed glory.

This only changed at the end of the 1980s and the beginning of the 1990s when databases and spatial analysis became more readily available and better attuned to archaeological needs. Answering archaeological research questions involves managing extensive datasets and substantial amounts of graphical information (maps, diagrams, photos). Only recent multimedia desktop computers and powerful GIS-applications enable us to interact personally and directly with our data sources. It is now possible to view distribution maps from various angles and plot different themes almost instantaneously. The current possibilities are not endless, but computers have become an essential element in the analyses and interpretation of archaeological information.

It was not until 2006 when the full dataset of the Hazendonk became accessible again after a re-entering of all individual field records in Microsoft Access and their subsequent archiving in a data repository that the Hazendonk would also benefit from this development.

In the 1970s, however, this digital toolkit was only just a dream. In the following pages, the struggle between human and computer over these years will be outlined for the stratigraphy of the Hazendonk and its analysis.

13.4 Unraveling the Hazendonk

One of the big methodological challenges in the analysis of stratigraphical sites is determining a distinct sequence or phasing based upon the location of finds. The position of finds in relation to each other as well as in relation to geological or soil layers and anthropogenic features is visualized in order to attribute the finds to individual phases. For the Hazendonk this analysis has shown a distinctive development.

13.4.1 Stratigraphy

At first it was thought that the (manual) recording of X-, Y- and Z-coordinates of individual finds would suffice to arrive at a stratigraphical attribution. All find locations combined create what may be termed a ‘3D-cloud’ of artefacts, within which horizontal as well as vertical clusters of finds could be distinguished (fig. 13.2). These could subsequently be interpreted as discrete and individual moments of habitation. Visualizing the 3D-clouds, however, turned out to be a far from easy in the early days. Even though the available mainframe computers were able to plot the selected data on a vertical section, this only yielded satisfying results for trenches that were relatively small, situated exactly perpendicular to the contours of the dune and for which the lithological sequence of layers was simple and undisturbed. Frequently this was not the case, and these conditions were poignantly absent in Unit C, the most important and informative part of the excavation. In this unit the contour lines of the dune obliquely crossed the sequence of trenches. Furthermore several treefall features had been documented in the field, which seriously disturbed the spatial patterns.

In the early 1980s it was not possible to resolve this problem with the available software and the analysis was necessarily carried out manually, a rather time-consuming solution.

In the early 1990s continuous developments in computer applications enabled a second chance for digitally processing the finds from Unit C, including their attribution to individual occupation phases (Jonkers 1992). Taking the X-, Y- and Z-coordinates as a starting point, individual finds were now projected on a profile section situated obliquely within Unit C. The profiles, with an orientation of 36 degrees, crossed the contours of the dune (on average) perpendicularly. This automated projection was repeated in transects with a varying width of 70-100 cm. This yielded a sequence of sections that demonstrated an optimized stratigraphical differentiation in the distribution of 3D referenced points for consecutive sections of Unit C.

There still was a problem however, since the geological/pedological sequence had not been recorded in the field. During the individual campaigns it had become clear that the geological and pedological situation was unfortunately rather

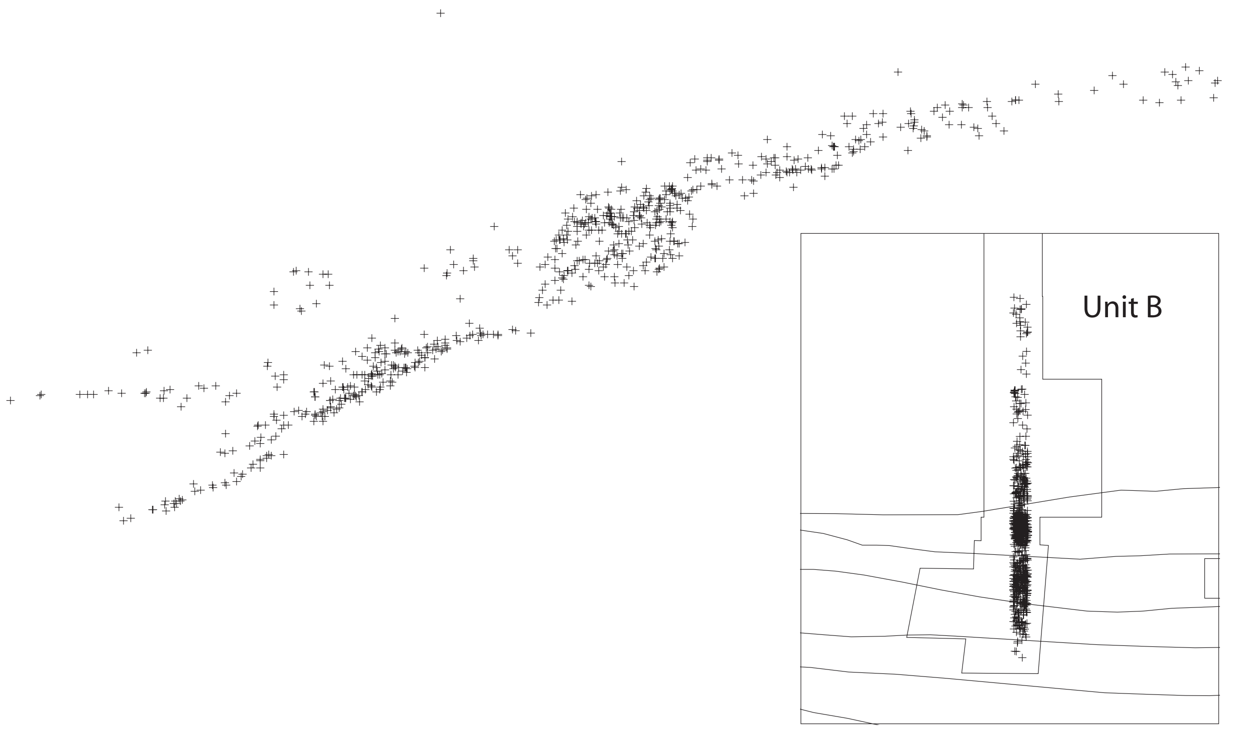

Figure 13.2 A section of the Hazendonk with individual finds plotted as a 3D 'point cloud'.

complex. Apart from clearly separated layers, treefall features, gullies and anthropogenic features disturbed the layers. The excavations also yielded numerous fine and thin layers of natural sediment and occupation remains. This fine lamination often turned out to be very important from a stratigraphical perspective (*e.g.* for Vlaardingen 1a and for a subdivision of Hazendonk 2 into a and b). The absence of these indicative layers in the obliquely projected computer plots limited the overall quality of attribution, yet the opportunity for recording this context had of course passed.

13.4.2 Lithology

The experience described above rather obviously confirmed the value of meticulously recording the lithological context in stratigraphical excavations. On comparable Mesolithic and Neolithic excavations in Denmark the often complex and fine layer sequence is very carefully established. There, it is common practice to set profile sections back in narrow strips. In the Netherlands this strategy was only incidentally adopted, for example in Den Bosch-Maaspoort (Verhart/Wansleeben 1991). Nevertheless, during the excavation of the Brandwijk riverdune in 1991 every artefact recorded in 3D was also given a code for the layer in which it was found. The use of infrared theodolites with an attached digital fieldbook, or total stations, made this easy and reliable (Kamermans/Verbruggen/Schenk 1995). Admittedly, this still left the issue of the precise boundaries between the layers in the Brandwijk section plot unsolved, but it was possible to visualize the finds from each (fine) layer (fig. 13.3). Positions within the 3D-cloud and the lithological layer could now be brought together in order to define the occupation phases.

Technically this would still be possible to perform for the Hazendonk as well, as Jonkers (1992) demonstrated for Unit C. The top and bottom of each layer was reconstructed in 3D by interpolation on the basis of section field drawings made every three metres, parallel to the site grid. All finds above the bottom and below the top of a specific layer were 'fished' out of the point cloud and assigned to that geological

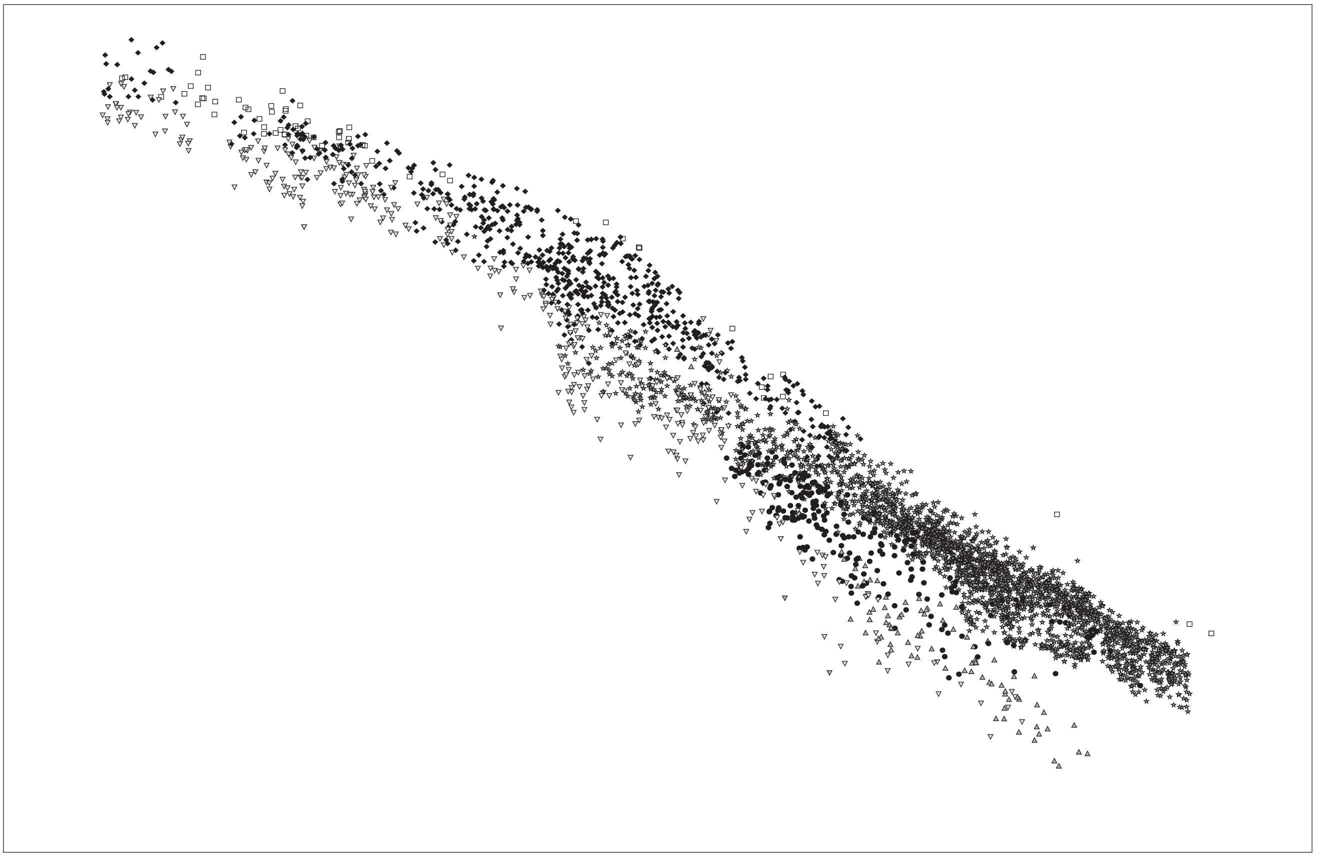

Figure 13.3 Artifacts plotted as points for the excavation at Brandwijk. Different symbols represent different lithological layers.

layer. Due to the great geological complexity, and erratic layer boundaries, this however never became a realistic solution for the existing situation.

On the riverdunes of Polderweg and De Bruin (1997-1998) (Louwe Kooijmans 2003) finds were no longer recorded as 3D-point locations. Based on the experience at the Hazendonk and Brandwijk, the very exact original position of artefacts was considered uncertain due to post-depositional processes such as trampling and colluviation. It was therefore decided to record finds in 50 × 50 cm squares, also efficient from a cost point of view. The finds density per square gave a good insight into the horizontal distribution of finds, but for the vertical component more control was needed. Thus the Hardinxveld excavations were executed stratigraphically, whereby the excavation levels precisely followed the geological/pedological stratigraphy (Louwe Kooijmans 2001). First, the upper layer was dug away in spits of at most 5 cm, before the layer beneath was started. The position of the units was measured with an infrared theodolite. The four corners of each square were recorded at the top and bottom. All squares with the same layer coding together formed the 3D appearance of a layer. On the basis of this documentation, automatic sections could be drawn, with the find density per layer (fig. 13.4) (Louwe Kooijmans/Mol 2001).

Even this approach still had its limitations, the most important of which is the fact that an occupation phase is not by definition the same as a phase of geological deposition. Two examples make this clear. There are situations in which a discrete point cloud, the finds from one occupation phase, is embedded in the top of a clay layer and the bottom of the overlying peat. A separation of the finds on the basis of a layer code does not necessarily correspond with the actual occupation phase. The influence of human occupation on soil formation forms a second example. It is precisely through human presence that mixing and churning up of older find material occurs (see Exaltus/Miedema 1994). Post-depositional plant and animal disturbances can also shift finds between older and younger layers. Finds embedded in

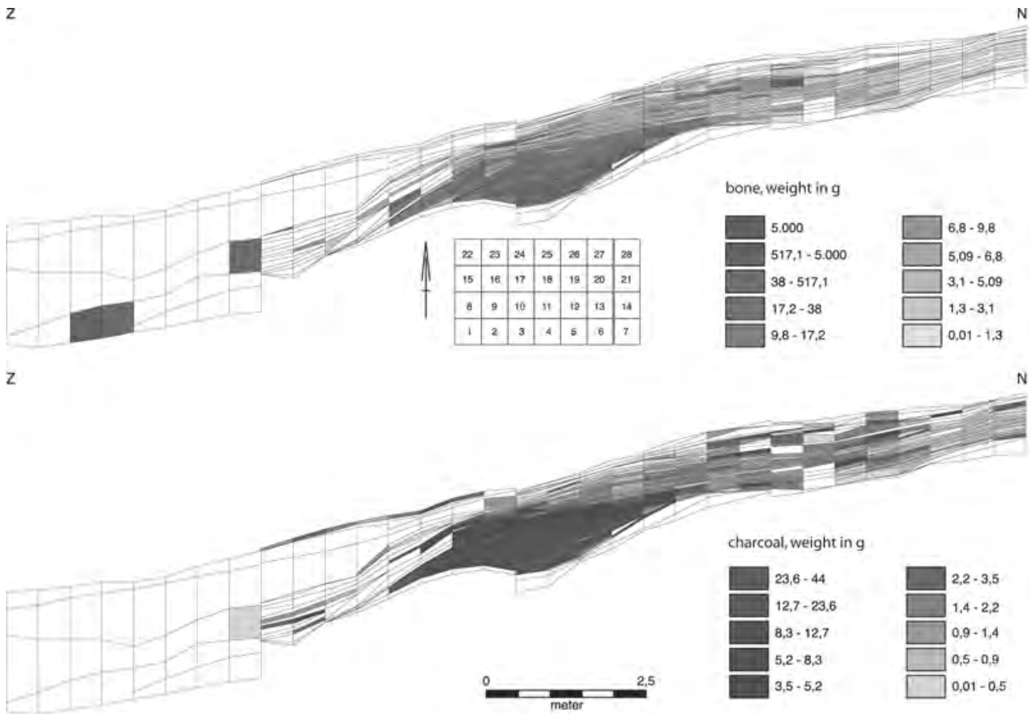

Figure 13.4 Find density (in weight) for bone and charcoal as recorded for a profile of Hardinxveld-Giessendam Polderweg (adapted from Louwe Kooijmans/Mol 2001).

one (anthropogenic) occupation layer are therefore not necessarily from one specific occupation phase, but often consist of different occupation periods.

So far, it appears that both the 3D-position and lithological embedding can be invoked to distinguish phases. Sometimes the position is decisive in this matter, sometimes the context. However another, third argument should be taken into consideration when analysing artefacts, that of the typological attribution itself.

13.4.3 Typology

In the original analysis of the Hazendonk data by the second author, only Unit C was studied because of the time-consuming manual approach. The procedure in this analysis involved a plotting of all finds in strips of 50 cm wide. The 3D-position of each artefact was projected on interpolated lithological sections, based on the section drawings documented in the field at 3 m intervals. In this way both the stratigraphical position and the lithological context could be taken into account. Despite this, many of the finds that were found in between layers or around treefall features still had to be given an 'indeterminate' phase attribution.

For all the pottery that could be attributed to an occupation phase the typological characteristics were documented. Occasionally sherds with an older or younger typological signature were part of an anachronistic phase, indicating that admixture had taken place. This is obvious for sherds with very characteristic features. Hazendonk 3 pottery, for example, does not have perforations underneath the rim, but this is a significant characteristic for pottery in the subsequent Vlaardingen phase. Sherds with these perforations located in a Hazendonk 3 layer therefore had to be a result of admixture.

The typological attribution of these 'outliers' was reviewed in a second round of the original analysis. Also, finds that in the first round had not received a typological attribution (*i.e.* 'indeterminate'), were given one, as far as possible. In this way it was attempted to arrive at find complexes that were as homogeneous or 'clean' as possible. There is however some danger in the fact that the renewed attribution on typological grounds eventually leads to a reaffirmation of the already existing typological phasing.

The last step in the original analysis was to attribute all the other categories of finds (flint, stone, faunal remains and organic material) to one of the identified phases. Only finds that were located in an uncontaminated, unmixed stratigraphical unit were given a date.

So the intensive analysis of Unit C, combining stratigraphical, lithological and typological arguments, has yielded a filtered dataset of rather high quality. Manual analysis of the other units, however, proved to be too time consuming.

In 2006 a non-manual analysis of the entire site became possible after all, when the full dataset was made digitally available again within the eDNA-project of the Faculty of Archaeology. This dataset of 35000 individual field records and an equal number of artefact descriptions was digitally preserved and subsequently made available for research through the data repository. Modern GIS applications enabled plotting of the finds, both horizontally and vertically, for all the excavation units. Furthermore, it was possible to plot individual categories of finds such as pottery, for various attributes such as temper, decoration, or surface finish. Sections were established per excavation unit at 1 m intervals. The finds were plotted with respect to these sections, either directly or after rotation (Units A and C), in order to arrive at a projection perpendicular to the elevation contours. The dateable pottery sherds and the knowledge of one of the original excavators about the lithological situation were both used to arrive at an attribution of the finds in each section (fig. 13.5). Eventually all the artefacts that could be attributed with a reasonable amount of certainty were assigned to a phase. This new attribution was tested against the manual attribution for Unit C and proved to be a little more conservative or cautious than the manual attribution. So a slightly higher number of artefacts was given the label 'indeterminate'.

The complete and integral digital availability of the Hazendonk data and modern software greatly facilitates answering some of the research questions. For example it is now possible to make a reliable estimate of the amount of anachronistic (older or younger) elements in the phases that have been distinguished. The highly characteristic sherds already provided a good means of determining the degree

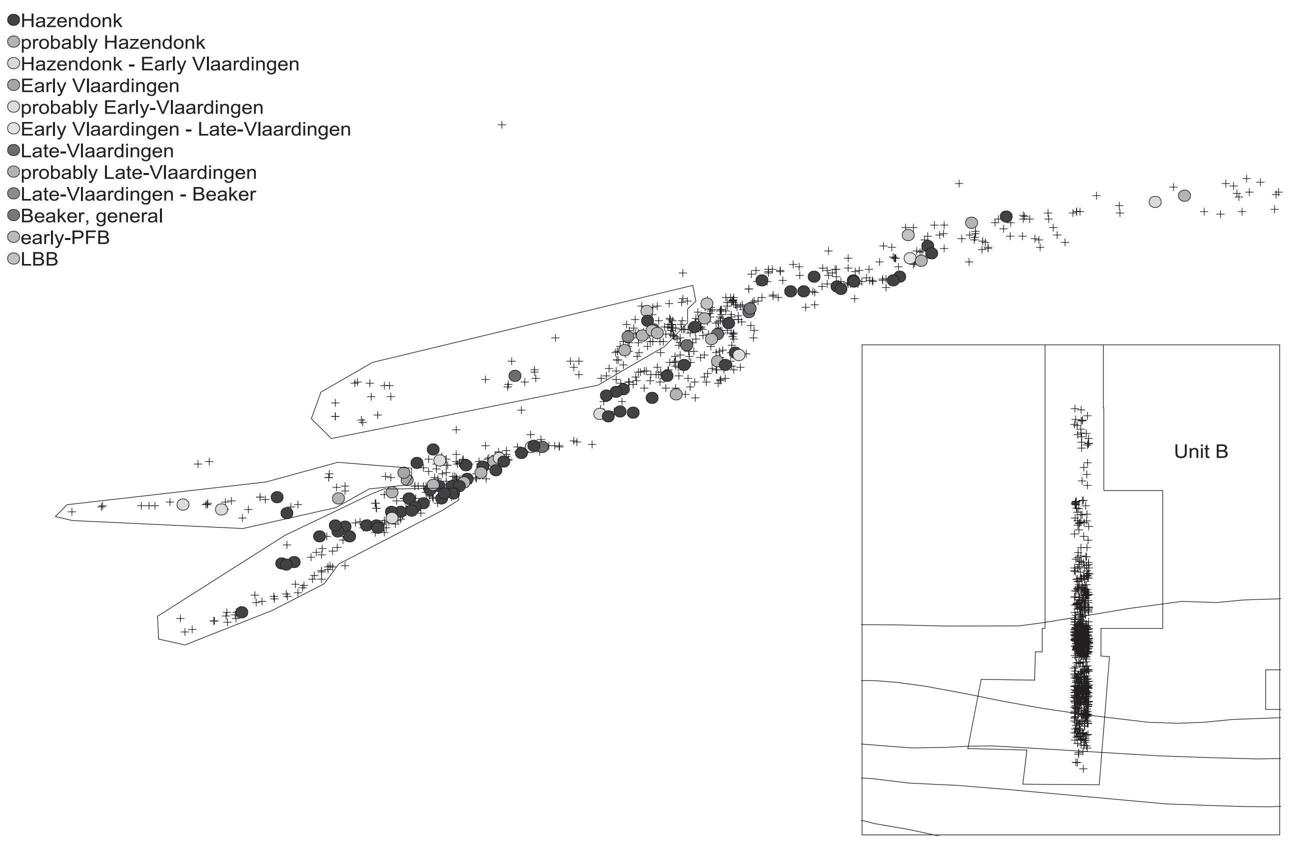

Figure 13.5 Section as plotted with the now digitally available dataset: the artefact positions and typologically dated pottery guided the original excavator in distinguishing phases (encircled levels).

of admixture, but a more solid clue for this is provided by sherds that originally belonged to one vessel, but have been found in different layers.

Refitting of sherds was performed for Unit C only. This resulted in 559 ‘fitting’ sherds forming 189 refitted series of in total 113 individual vessels. The results are present in table 13.1 showing the quantities of sherds dated typologically in combination with the attribution to the phases. As can be seen from this table there are quite a number of refit series, which are in fact distributed across various layers. Sherds from Hazendonk 1 vessels are found in a Hazendonk 3 layer, while sherds of the latter type are both found in Hazendonk 1 as well as in Vlaardingen 1a and b layers. While these results may still be partially influenced by an incorrect attribution to a certain phase, it is however more plausible that they indicate the existence of a considerable degree of admixture. On the basis of this information one could assume that the degree of admixture may amount to almost 15% of the sherds.

The effect of this admixture can best be illustrated with two heavily-debated vessels (fig. 13.6). Vessel a consists of 9 sherds. According to Verhart (pers. comm.) the vessel should typologically be attributed to the Hazendonk phase 2, while Raemaekers (1999) argues in favour of an attribution to the Hazendonk phase 2/3. On the basis of the new attribution to the phases, two sherds of the refit could be attributed to the Hazendonk phase 3, while the others could not be attributed at all, mainly favouring the dating by Raemaekers. Vessel b consists of 18 sherds. According to Raemaekers (1999) the vessel should typologically be attributed to the Hazendonk phase 3, while Verhart opts for phase 2. The refits indicate that two sherds could now be attributed to Hazendonk 2, while the others could not be attributed at all. In this case the attribution by Verhart would be favoured. These examples serve to show the relativity of the typological arguments over stratigraphical or lithological attributions. With respect to pottery, refits and typological

	stratigraphical phase						
typological phase	**Haz1**	**Haz2**	**Haz3**	**Vl1A**	**Vl1B**	**Vl2A**	**Vl2B**
Haz1	32	3	1				
Haz2	7	6	16				
Haz3	1		78	1	8		
Vl1A			9				
Vl1B				1	125		1
Vl2A							
Vl2B							

Table 13.1 Sherds belonging to ceramic refits and their position in individual phases for Unit C of the Hazendonk.

characteristics can be used to arrive at a correct attribution, but it is evident that for instance stone tools, faunal remains and botanical data often lack these opportunities. For those categories (see for example Zeiler 1997), there is no additional chronological characteristic that can be used for confirmation.

Having discussed the various methodological approaches used in unraveling the different phases at the Hazendonk, it is evident that the attribution of finds to a specific layer is fraught with difficulties. The evidence available for the Hazendonk does certainly indicate the existence of a robust stratigraphical sequence, while at the same time the degree of intermixing of finds can no longer be ignored. While the new digital availability of the Hazendonk data and modern computer applications open up many new avenues of research, it remains crucial to acknowledge the limited resolution and the problems of attribution touched upon above.

13.5 The possibilities for a ceramic case-study anno 2007

The long-term use of the Hazendonk for almost two millennia from 4020 to 2480 cal BC enables the observation of developments and changes in many artefact categories. Unlike other groups of material, such as flint, stone and faunal remains, pottery is often perceived as a more direct indicator of cultural change, whereby its technological and typological aspects act as archaeological denominators of both style and function (see Sackett 1985; 1990; also see Raemaekers 1999). For the Hazendonk, the general outline of this sequence was already provided in 1976, incorporating the successive ceramic characteristics of the layers Hazendonk 1, 2 and 3 and Vlaardingen 1 and 2 (Louwe Kooijmans 1976). Later on further refinements were made, the most important of which saw the attribution of the Hazendonk layers 1 and 2 to the Swifterbant culture (Raemaekers 1999; Raemaekers/De Roever in press). The overall sequence identified at the Hazendonk continues to form an important typochronological reference for the cultural attribution of sites elsewhere. As such, a renewed approach using the data that has recently become available might provide additional information. This is why the case-study below focuses specifically on the stratigraphical and cultural attribution of ceramic finds.

Until now several researchers have characterized the technological and typological aspects of the pottery sequence at the Hazendonk (*e.g.* Verharts’ processing of the field documentation; Jonkers 1992; Raemaekers 1999; Amkreutz/Verhart 2006). However, it is difficult to evaluate and compare these descriptions. First of all, these analyses were made at different moments in time, and are therefore based on differing sets of data with different attributions to phases. Secondly, the recording systems deviate from each other,

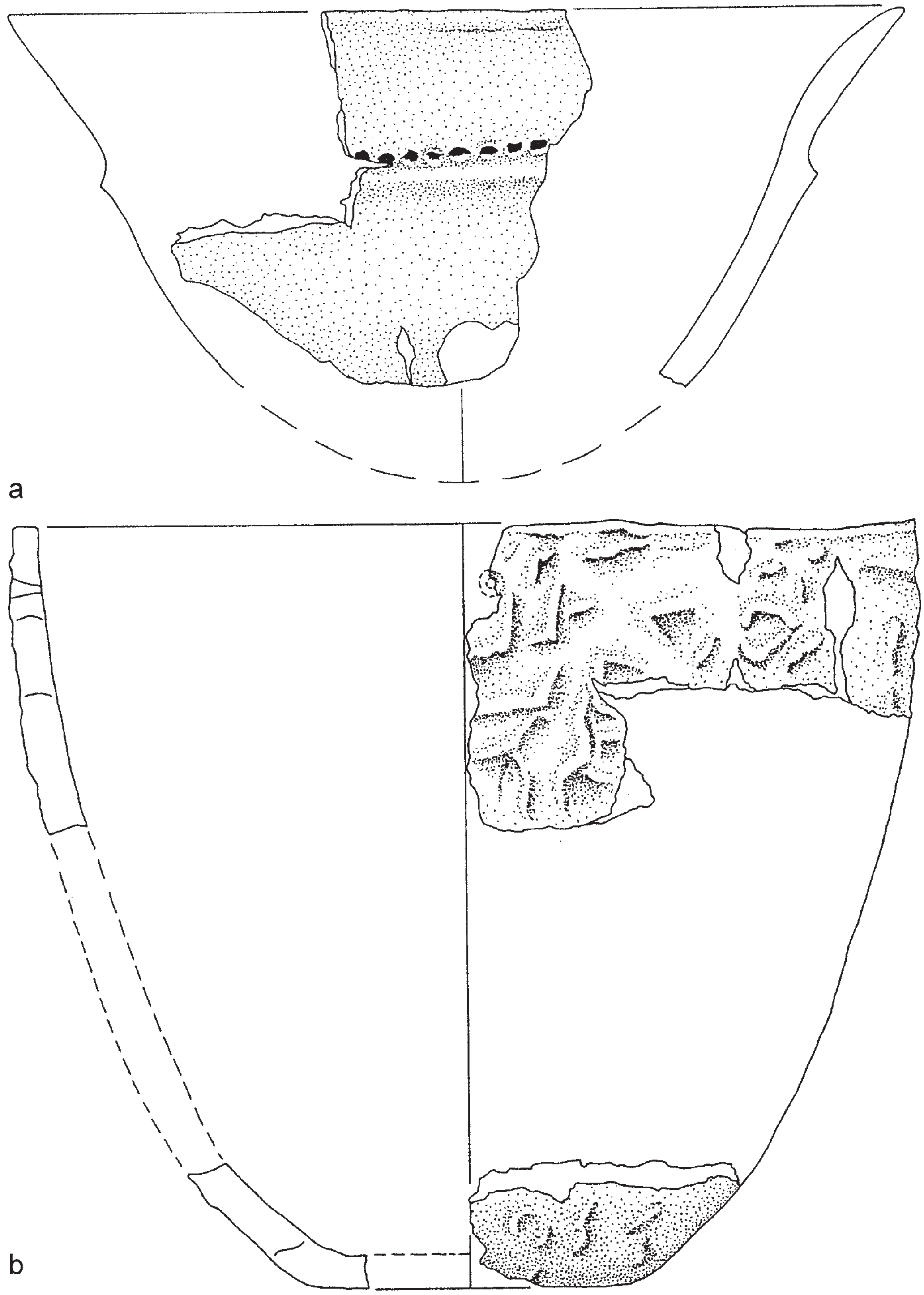

Figure 13.6 Heavily debated vessels for Units C of the Hazendonk: did they belong to the Hazendonk 2 or 3 phase? (scale 1:2)

leading to largely incompatible categories. The initial characterization of individual sherds took place during the fieldwork and therefore suffers from some ‘learning by doing’. A later qualitative analysis by Verhart was based on individual pots instead of sherds, whereas Raemaekers (1999) used individual sherds again. Apart from these choices in analytical approach, different variables and coding systems were also utilized, as will be demonstrated below. Furthermore, most pottery descriptions so far have often only been based on decorated pottery deriving from Unit C.

The pottery analysis below is based upon the new dataset made available within the eDNA repository. This dataset includes both the field data and the primary artefact descriptions made during and shortly after the fieldwork campaigns. Pottery is recorded by sherd and all attributes are coded as initially planned in an extensive coding scheme. This analysis uses the undecorated (category A) and decorated sherds (category X) that could be attributed to a specific phase from all five working units (A to E). It should be borne in mind that within this sample an admixture of almost 15% is to be expected. For the pottery from Units A to E, two chronologically important attributes were singled out for this case study: temper and decoration.

13.5.1 Temper

Temper has been used as an important determinant in characterizing the pottery from various layers at the Hazendonk. Based on the assemblage from Unit C, organic temper has been interpreted as a exclusive characteristic for Hazendonk 1, while sand, quartz and in due course grog (chamotte) gain importance in later phases (*e.g.* Louwe Kooijmans 1976). However, Raemaekers (1999) also documents a considerable presence of organic temper for Hazendonk 3 as well as some organic temper in the pottery of the Vlaardingen phases. Various methods have been used for analysis of the composition of the temper. The initial analysis in the field only documented the major tempering component per sherd (*e.g.* organic, quartz, quartz-pottery, pottery or rock). The subsequent qualitative analysis by Verhart scored the presence/absence of various tempers per pot. While this is more accurate in general, one sherd with a small amount of a diverging temper component will add this type of temper to the entire set. Raemaekers’ (1999) quantitative analysis used individual sherds. Temper composition was documented per sherd in ordinal classes (0-3), but only organic, grit and grog (chamotte) were distinguished. Sand was not documented separately, while no distinction was made between quartz and rock (combined into grit). Furthermore, all sherds were presented ‘multifold’ per temper type (*e.g.* Raemaekers 1999, table 4.1), making it difficult to assess the overall composition of the assemblage. Being aware of these incompatible datasets, it must be stated that the new dataset only provides an analysis of the most important temper type per sherd.

The importance of organic temper in Hazendonk 1 pottery is by and large confirmed by the new analyses of decorated pottery from Unit C. However, when all decorated and undecorated pottery from the other units is incorporated the trend becomes less distinct, as can be seen in table 13.2. On the basis of the information currently available it must be noted that there are no very clear, mutually exclusive patterns. Hazendonk 1 pottery is mainly tempered with quartz or organic material. Organic temper becomes less useful as a chronological marker because it is also present in pottery belonging to Hazendonk phase 3. While this would seem to be in line with the findings of Raemaekers (1999, 144), the actual importance of organic temper in Hazendonk 3 pottery is very limited. Building upon a trend starting during Hazendonk phase 2, quartz (in combination with grog) increasingly becomes the most important tempering agent for the Hazendonk 3 pottery, although grog over time forms a considerable contribution too. Grog is more or less present in all phases, but only gains significance during the Vlaardingen period. It forms the most important tempering agent at the end of the Vlaardingen occupation. However, on the basis of his analysis Raemaekers (1999, 171) argues that organic material was used during Vlaardingen 1a and was important during Vlaardingen 1b, while grog was supposedly rarely used during Vlaardingen 1b. This does not seem to correspond with the characteristics for Unit C, nor with the new analysis presented here. During Vlaardingen 1b organic temper is virtually absent while grog forms a substantial contribution.

phase	organic	quarz	quartz and grog	grog	rock
Haz1	47	74	8	28	16
Haz2	8	28	4	22	9
Haz3	22	1085	592	163	358
Vl1A	0	1	0	2	0
Vl1B	6	868	725	478	102
Vl2A	0	0	0	0	0
Vl2B	2	51	43	332	11

Table 13.2 Use of temper per phase for the Units A to E of the Hazendonk.

13.5.2 Decoration

Decoration is perhaps perceived as the best chronological indicator in pottery analyses. There seems to be a general agreement that a substantial part of the Hazendonk 1 and 3 pottery is decorated. This is less so for Hazendonk 2 pottery, and Vlaardingen pottery is mainly undecorated, although both Vlaardingen 1a and 1b pottery display the characteristic perforations below the rim. The dataset used in this analysis is based on a very detailed coding system, whereby decoration is coded for several variables (primary and secondary decoration type, decoration motif, primary and secondary special traits). Raemaekers (1999) also makes further distinctions with respect to the location of the decoration on the pot.

Given the new information presented in table 13.3, several trends may be observed. Decoration is present in Hazendonk 1 and 3, mainly in the form of spatula, fingertip or nail impressions. The spatula decoration is dominant in Hazendonk 1, whereas fingertips are in Hazendonk 3. Incised lines and grooves gain importance in the Hazendonk 3 phase along with occasional smeared surfaces and *Besenstrich* surface finish (patterning reminiscent of broom-strokes). Rim impressions on the other hand, mainly seem a feature of the earliest phase. The Hazendonk 3 sherds in almost all units are predominantly decorated by fingertip and nail impressions, followed by spatula decoration. It is noticeable that spatula impressions are most dominant in Unit C, pointing out that localized differences on the Hazendonk do occur.

Decoration is obviously less important for the Vlaardingen pottery, but not absent. In general, the percentages of decorated sherds drop from c. 25% before the Vlaardingen occupation to 3% during the Vlaardingen occupation. These low numbers of (diversely) decorated sherds may be attributed to admixture from older phases, but they should not be ignored. There are sherds with nail, fingertop and spatula impressions, as well as impressions and lines. Very remarkable is the fact that there are no less than 23 Vlaardingen 1b sherds with line decoration originating from Unit C, which in general is not considered a regular decoration type for Vlaardingen pottery. Other features classified as decoration are more typical for Vlaardingen pottery and thus more easily explained. These include the well-known perforations underneath the rim and the occasional presence of fragments of collared flasks, baking plates and occasionally *Tiefstich* decoration on TRB(-like) sherds.

In conclusion it can be stated that the general trends with respect to decoration seem confirmed by the material presented here. On the other hand it appears that the differences between layers are less distinct. This is for example evident in the presence of decoration on Vlaardingen pottery. The differences in importance of spatula decoration for Hazendonk 3 pottery in different locations within the site is a new perspective.

13.6 Conclusion

Overall the patterns and trends present in pottery technology and decoration confirm previous analyses. The supposed absence of decoration in the Vlaardingen phases, or the ratio between types of decoration in other phases was not confirmed by the dataset used here however. One could say that the perceived trends have become less distinct in the new analysis, patterns have become more fuzzy than previously assumed. Certain traits and traditions seem to have been practiced across various phases of occupation. This may indicate continuation of traditions and represent a slow pace of change, but it is undeniable that there has been a certain degree of intermixing of (supposedly) stratigraphically separated layers. Taphonomy and processes of site formation have been the major agents responsible for this. The slope of the dune, in combination with the character of the vegetation and the human activities performed, have caused the formation of lithologically distinct layers more than occasionally combining artefacts from various phases of occupation.

It should be concluded that every interpretation of the archaeological remains at the Hazendonk is influenced by this attested degree of intermixing, or contamination. This especially might endanger the analyses of the faunal and botanical remains and the determination of changes in food

	Beaker	*nail*	*fingertop*	*spatula*		*impression*	*line*		*other*
phase				**smooth**	**angular**		**shallow**	**deep**	
Haz1	0	5	2	4	17	3	1	0	29
Haz2	0	1	1	0	1	1	0	0	5
Haz3	1	163	263	162	87	58	32	16	90
Vl1A	0	0	0	0	0	0	0	0	0
Vl1B	0	17	17	12	11	9	12	12	9
Vl2A	0	0	0	0	0	0	0	0	0
Vl2B	6	2	3	5	3	1	1	0	5

Table 13.3 Decoration characteristics per phase for the Units A to E of the Hazendonk.

economy during the Neolithic. In future research, especially when dealing with archaeological remains without distinct intrinsic chronological markers, we should be aware of these repercussions. The end results of the Hazendonk analysis will be less robust than expected, but none the less significant.

The wealth and amount of detail provided by the archaeological data of the Hazendonk have at one and the same time proven to be a strength and a weakness. Over the past years several researchers have repeatedly analyzed and interpreted limited parts of the available dataset (one excavation unit or only decorated pottery). Differences in the methodologies used often led to largely incomparable results and sometimes conflicting conclusions. The recent complete and digital availability of the Hazendonk data may, however, offer a window for improvement. The preliminary analysis of two aspects of the pottery assemblage, as demonstrated above, forms a first case in point. Continuing the (electronical) analysis and interpretation of the Hazendonk data forms an important task for a new generation of archaeologists. A task Leendert once set for himself, not knowing the required technology was not there yet. More importantly, however, the above analysis demonstrates that despite all the progress in computer capacity and applications over the past decades, it is eventually the input and insight of the archaeologist in the field that remains crucial to an understanding of the past. This undoubtedly is a conclusion that quite befits Leendert's exemplary career.

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14 The scale of human impact at the Hazendonk, the Netherlands, during the Late Neolithic

Welmoed Out

14.1 Introduction

This paper is concerned with the archaeobotany of the Hazendonk, a site that has played an important role in Leendert Louwe Kooijmans' research on neolithisation. The site is located on one of many river dunes in the Dutch Rhine/Meuse river area (fig. 14.1). The top of the dune was located at 0.10 m +NAP (Dutch Ordnance Datum), emerging *c.* 10 metres from the surrounding Pleistocene subsurface during the Early Holocene. The rise of the Mean Sea Level and of the ground water level resulted in the continuous formation of peat and sedimentation of clay under calm conditions in the river area from *c.* 6000 cal BC onwards (Van der Woude 1983), and in a decrease in the dune's dry surface over time from 1.2 to 0.4 hectare during occupation. Preservation of organic material was good due to continuous waterlogging around the dune.

The Hazendonk was occupied repeatedly between 4020 and 2470 cal BC and at *c.* 2000 cal BC (Verbruggen 1992). The excavations, under direction of Louwe Kooijmans between 1974 and 1976, revealed features such as postholes, pits, hearths, and a palisade. Refuse layers (fossil anthropogenic horizons) along the slopes of the river dune moreover revealed flint, stone, pottery, human remains, bone remains of wild and domestic animals and other organic material. The precise function of the site for each of the phases of occupation is not clear; it could have been a supportive special activity site, but occasional permanent occupation cannot be excluded either (Louwe Kooijmans 1993, 131; 2007a, 170; Raemaekers 1999, 117). The similarity of the finds assemblages suggest however that site function remained stable over time (Louwe Kooijmans 2007a, 170). The economy of the site was semi-agrarian during all phases, and subsistence was based on a combination of hunting, gathering and agriculture. Hunting, fowling, fishing and gathering played an important role in the economy, and predominantly beaver and otter were hunted during all phases in combination with wild boar, red deer and roe deer. The importance of domestic animals decreased over time (Zeiler 1997, 108), and throughout the practise of local arable farming on a large scale is unlikely (Bakels 1986). For more information, see the various publications of Louwe Kooijmans (*e.g.* 1974; 1987), Raemaekers (1999) and Amkreutz *et al*. (this volume).

The Hazendonk is a good location to study neolithisation since the site is characterised by a long sequence of occupation in the Neolithic, with the Swifterbant Culture followed by the Hazendonk Group and then the Vlaardingen Group, corresponding to the period of neolithisation in the southern central Netherlands. The semi-agrarian Swifterbant Culture and the Hazendonk Group have their roots in the Late Mesolithic and represent the substitution phase of the neolithisation process (cf. Zvelebil 1986). The Vlaardingen Group, rooted in the earlier Swifterbant Culture and Hazendonk Group, is considered as a Late Neolithic group in the European context, and it is contemporaneous with the fully Neolithic Funnel Beaker Culture that was present in the northern part of the Netherlands from *c.* 3400 cal BC onwards. At the regional scale, the subsistence mode and apparent degree of neolithisation of the Vlaardingen Group vary strongly between ecological zones (Louwe Kooijmans 1993, 133; Raemaekers 1999; Van Gijn/Bakker 2005). At some sites hunting and gathering remained important subsistence strategies even in the Late Neolithic, while more agrarian sites could be considered as representing the consolidation phase of the neolithisation process (Louwe Kooijmans 1993, 1998, 420; Raemaekers 2003; cf. Zvelebil 1986). The continuous site function of the Hazendonk and the stable, restricted role of agriculture at the site, which are in contrast to more developed neolithisation in other parts of the Netherlands, can probably be explained by the environmental conditions at the site on the one hand, and choices of local populations on the other hand.

In this paper the neolithisation process at the Hazendonk will be studied by analysis of human impact on the vegetation, focussing on the occupation phase Vlaardingen 1b. This phase has been selected in the expectation that the presence of people of this Late Neolithic group would have resulted in clear evidence of human impact, a hypothesis based on the generally observed pattern that human impact gradually increased after introduction of agriculture. Phase Vlaardingen 1b, which dates to 3260-2960 cal BC (Verbruggen 1992), was one of the major occupation phases at the Hazendonk, although it is not precisely known whether occupation was continuous or intermittent. The Vlaardingen 1b refuse layer has a surface spread of 760 m^2 (fig. 14.2). It is

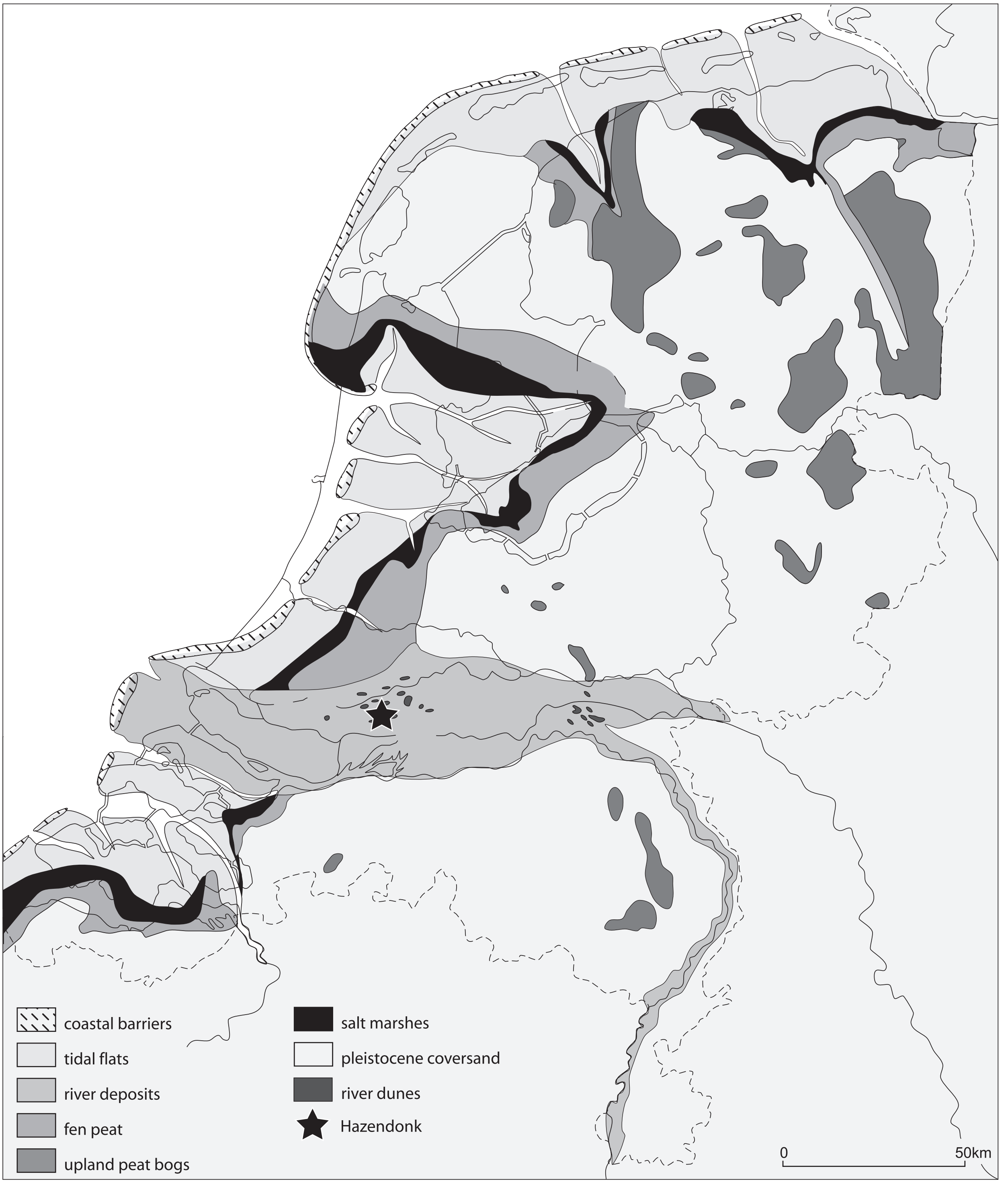


Figure 14.1 Location of the Hazendonk plotted on a palaeogeographical map of the Netherlands (*c.* 4200 BC).

assumed that the distribution of refuse corresponds to the zone of major anthropogenic activity, although refuse deposited on the top of the dune was not preserved. In addition to the refuse layer, a considerable trampling zone extended up to several metres from the dune edge into the peat. A palisade consisting of pointed posts of *Alnus glutinosa* was furthermore present at the southeastern top of the dune (fig. 14.2), presumably enclosing an area of *c*. 1000 square metres if representing a closed structure (Hamburg/Louwe Kooijmans 2006, 58). This palisade may have functioned as a border of the domestic space to exclude domestic animals, as a corral for domestic animals or as an enclosure around an arable field. The presence and distribution of refuse supports the first explanation, which is comparable with the interpretation of fences at the Middle Neolithic site of Schipluiden (Hamburg/Louwe Kooijmans 2006; Louwe Kooijmans 2007b). Wild animals dominate the bone assemblage of phase Vlaardingen 1b, especially red deer, and there are indicators of occupation during spring, summer, autumn and winter (Zeiler 1997).

The long occupation during phase Vlaardingen 1b, the potential year-round occupation, the size of the refuse layer, and the presence of a trampling zone and a palisade all indicate that people must have had a considerable impact on the natural vegetation during this phase. It is expected that such impact should be visible in the pollen and seed diagrams. Several archaeobotanical studies that discuss the Vlaardingen 1b occupation phase at the Hazendonk are already available (Bakels 1981; Louwe Kooijmans 1974; Van der Wiel 1982; Van der Woude 1983), which indicate that the river dune was covered with deciduous woodland vegetation, surrounded by alder carr and eutrophic marshes. There are indeed indications of human impact. For instance, the diagram of Voorrips (Louwe Kooijmans 1974, 138-143; fig. 14.2) indicates human impact consisting of a decrease in *Fraxinus*, presence of Cerealia-type pollen and high percentages of grasses and both upland and wetland herbs. From this, it was concluded that people lived on the slope of the dune without disturbance of the vegetation on the top of the dune (Louwe Kooijmans 1974, 139). The diagram of Van der Wiel (1982; fig. 14.2) clearly shows human impact during phase Vlaardingen 1b as well, including a decrease in *Quercus* and increase in cereal pollen, 'weeds' and pioneers growing on nitrogenous wet soils (Van der Wiel 1982, 79). The pollen cores of Van der Woude (1983), sampled at greater distances from the river dune up to several kilometres away, do not give precise information on human impact during phase Vlaardingen 1b. Bakels (1981) has published a selection of macro-remains from one of the same sample boxes that will be presented below (M86). She has concluded that human impact resulted in eutrophication of the environment and development of open patches. The excavation yielded a small quantity of carbonised crop plants from this phase, including grains and chaff remains of emmer wheat (*Triticum dicoccon)* and naked barley (*Hordeum vulgare* var. *nudum*) (Bakels 1981).

The archaeobotanical analysis presented here is supplementary to the earlier archaeobotanical studies. It is based on analysis of pollen and seed diagrams from two sample series from the Vlaardingen 1b refuse layer, M86 and M87, taken near to the sample location of Van der Wiel. An additional single sample collected next to M86 will also be discussed. The relative high location of the sample series on the slopes of the dune enables to investigate the human impact nearby the actual activity zone in better detail than most other studies. The comparison of samples located at increasing distance away from the dune moreover enables to investigate how distance influences the evidence of human impact. The research questions to be addressed are: how did people influence the natural vegetation, how strong is the evidence of human impact, and how does human impact relate to the neolithisation process and site function.

14.2 Materials and methods

The sample series M86 and M87 (boxes measuring 20 (l) × 20 (w) × 10 (d) cm) were collected during excavation from the eastern section of unit B, trench 25 (fig. 14.3). M86 is located 3 to 4 metres higher on the slope than M87 and is located in the middle of the refuse layer, while M87 is located near its outer edge (fig. 14.2). During phase Vlaardingen 1b, the lower edge of the dry surface of the dune was located *c*. 2.5 metres higher than M86 at *c*. 2.55 m -NAP. Analysis of the samples took place in the middle 1970's. W.J. Kuijper prepared pollen samples with a volume of 1 cm^3 and a sample interval of 2 cm according to the standard methods (Fægri/Iversen 1964), and A. Louwe Kooijmans-Bouhuijs identified pollen and spores. The pollen data were converted into percentages. The pollen sum consists of 300 to 400 upland pollen grains (upland trees, shrubs, herbs, spore plants and crop plants). W.J. Kuijper also analysed samples of macro-remains with a volume of 50 cm^3 after sieving on a 0.25 mm sieve.[1] Sample M49 was collected near sample M86. Botanical macro-remains from this sample were retrieved from residual material that remained after sieving of an unknown volume of soil (mesh width unknown). Data of both pollen and seeds of M86 and M87 were analysed with the software programs Tilia (2.0.b.4) and TGView (2.02) (Grimm 1991-1993, 2004). Species names are according to Van der Meijden (1996). The classification of taxa in ecological groups is based on Schaminée *et al.* (1991-1995) and on interpretation of the vegetation. Complete information on the materials and methods of archaeobotanical research at the Hazendonk will be published in the future (Out in prep.).

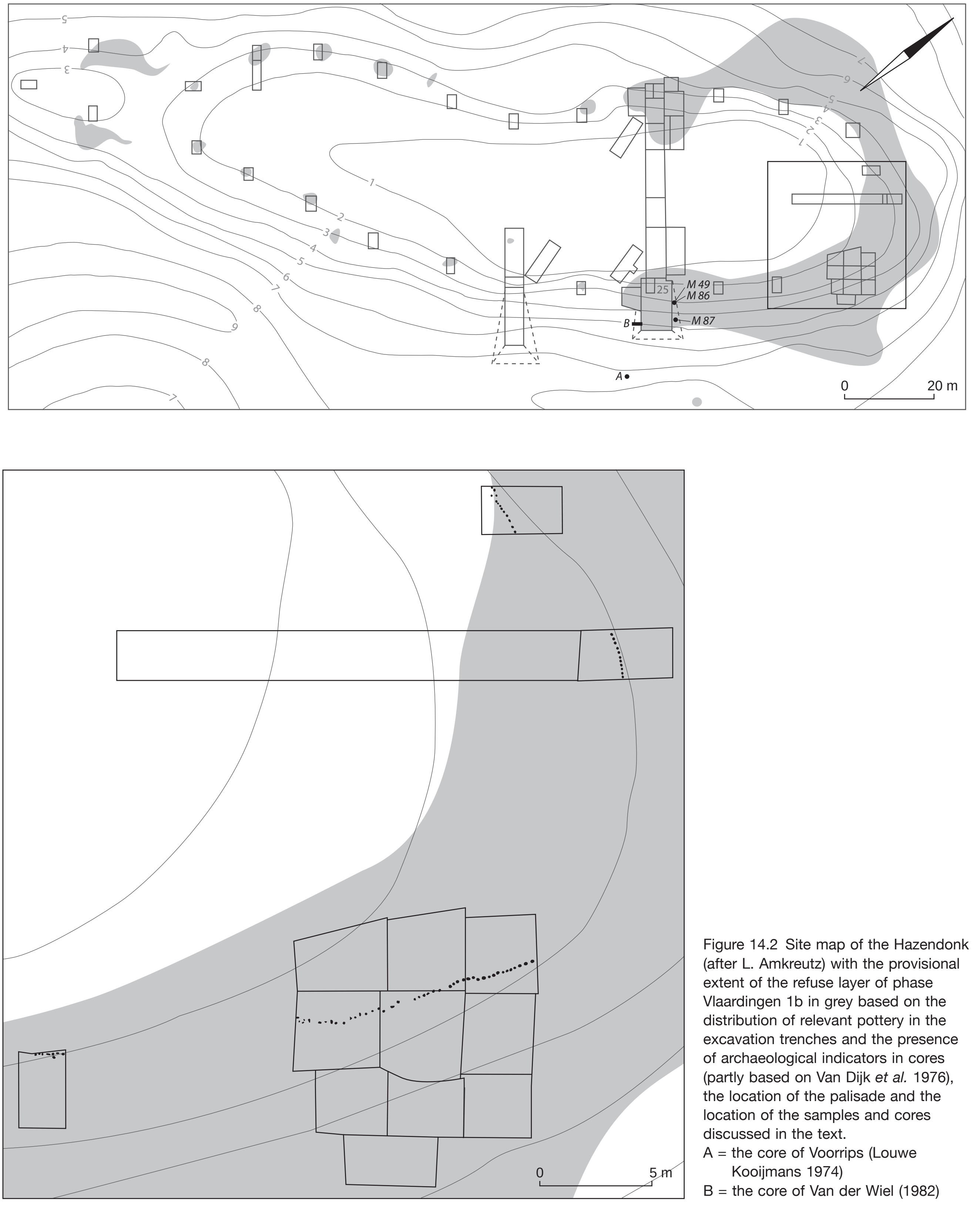


Figure 14.2 Site map of the Hazendonk (after L. Amkreutz) with the provisional extent of the refuse layer of phase Vlaardingen 1b in grey based on the distribution of relevant pottery in the excavation trenches and the presence of archaeological indicators in cores (partly based on Van Dijk *et al.* 1976), the location of the palisade and the location of the samples and cores discussed in the text.
A = the core of Voorrips (Louwe Kooijmans 1974)
B = the core of Van der Wiel (1982)

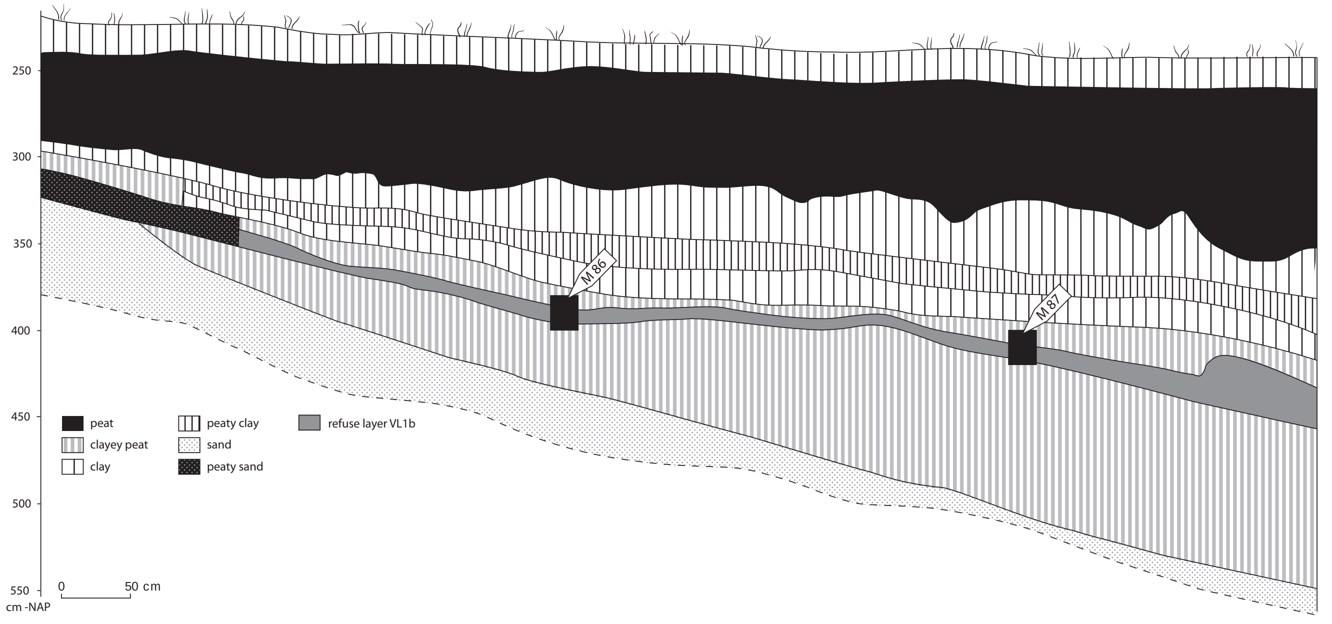
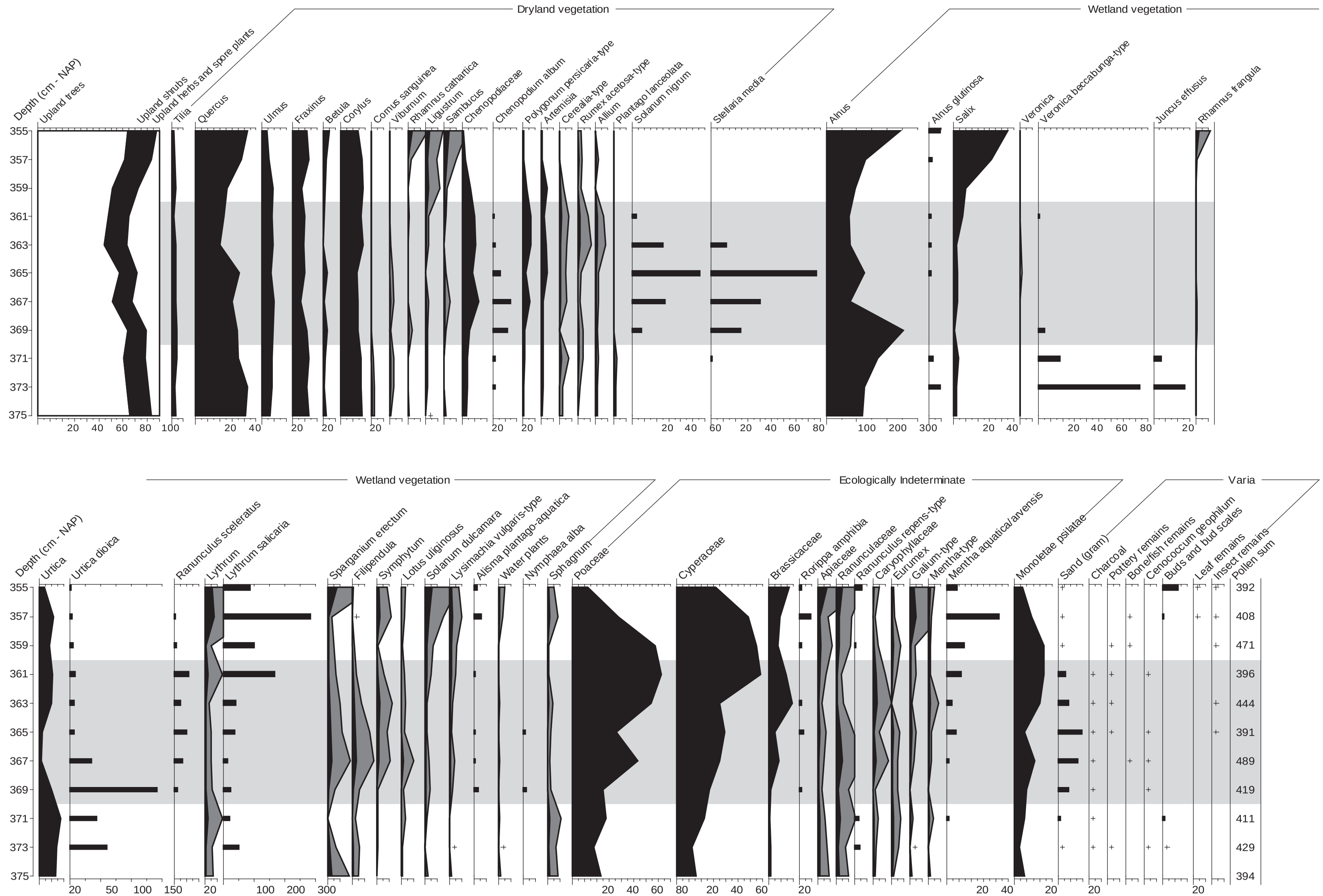


Figure 14.3 Simplified drawing of the eastern section of trench 25, showing the location of the sample series M86 and M87. The upslope sediments are sandier than the downslope sediments. The lower clayey peat represents a complex of more or less peaty clay deposits, of which the upslope sediments are relatively peaty.

14.3 Results

Table 14.1 shows the lithostratigraphy of M86 and figure 14.4 shows a selection of pollen and seeds from M86 (cf. Bakels 1981).[2] The local vegetation at the sample location during phase Vlaardingen 1b probably consisted of alder carr with *Viburnum opulus* and *Cornus sanguinea*. Well-represented herbs are *Veronica beccabunga*-type, *Juncus effusus* and *Urtica dioica*. Human impact resulted in decrease in *Quercus*, *Fraxinus*, *Alnus glutinosa*, *V. beccabunga*-type, *J. effusus*, *U. dioica* and *Plantago lanceolata*, and in a strong increase in dryland anthropogenic indicators (cf. Behre 1981) including Cerealia-type, *Chenopodium album*, *Solanum nigrum* and *Stellaria media*. The diagram also shows a moderate increase in ferns, grasses, sedges and wetland taxa, including *Sparganium* spec., *Filipendula ulmaria*, *Symphytum* spec., *Ranunculus sceleratus* and *Rorippa amphibia*. Together, these changes indicate disturbance of the oak vegetation and of the alder carr, increased presence of open patches, and eutrophication that was probably caused by human dumping of waste. The macro-remains do not include crop plants or carbonised food plants. The only carbonised finds are two seeds of *Mentha aquatica/arvensis* (sample depth unknown).[3] Poaceae and Cyperaceae show a strong increase at the end of occupation, which was probably the result of initial recovery of the vegetation as well as of the rising ground water level. After occupation, *Quercus* increases, certain shrubs increase (*Rhamnus cathartica*, *Ligustrum* and *Sambucus*) and the upland herbs decrease or disappear, indicating recovery of the vegetation. In the wetland vegetation, *Alnus*, *Salix*, *Lythrum salicaria* and *Mentha aquatica/arvensis* increase strongly, and *Sparganium erectum*, *Solanum dulcamara* and *Galium*-type increase as well, while Poaceae and Cyperaceae gradually decrease. The changes of these wetland taxa can be explained by the decrease in human impact and the increase in the water level, as indicated by the presence of clay.

Table 14.2 shows the lithostratigraphy of M87, and figure 14.5 shows a selection of pollen and seeds from M87. The local vegetation probably consisted of alder carr. The amount of sand and archaeological refuse is smaller in M87 than in M86, indicating that M87 is located further away from human activity. At the start of occupation, *Quercus* decreases and *Fraxinus* shows a peak. *Ulmus* was probably more common nearby M87 than at M86, since the percentage of *Ulmus* is higher in M87. Chenopodiaceae, *Artemisia*, Cerealia-type and *Solanum nigrum* clearly indicate the period of human occupation of the dune, although the upland herb signal is weaker than in M86. In the wetland vegetation, *Alnus* decreases while Poaceae, Cyperaceae, *Urtica dioica*, *Lythrum salicaria* increase strongly. After occupation,



Analysts: A. Louwe Kooijmans-Bouhuijs and W.J.Kuijper

Figure 14.4 Selected taxa from M86. Curves show percentages of pollen and spores while histograms show numbers of other remains. Exaggeration of curves, if applied, is fivefold. The grey zone shows the occupation layer as recognised by changes in the diagram.
+ in pollen curves = present
+ in non-pollen curves = 1-5/few
++ in non-pollen curves = 5-10/several

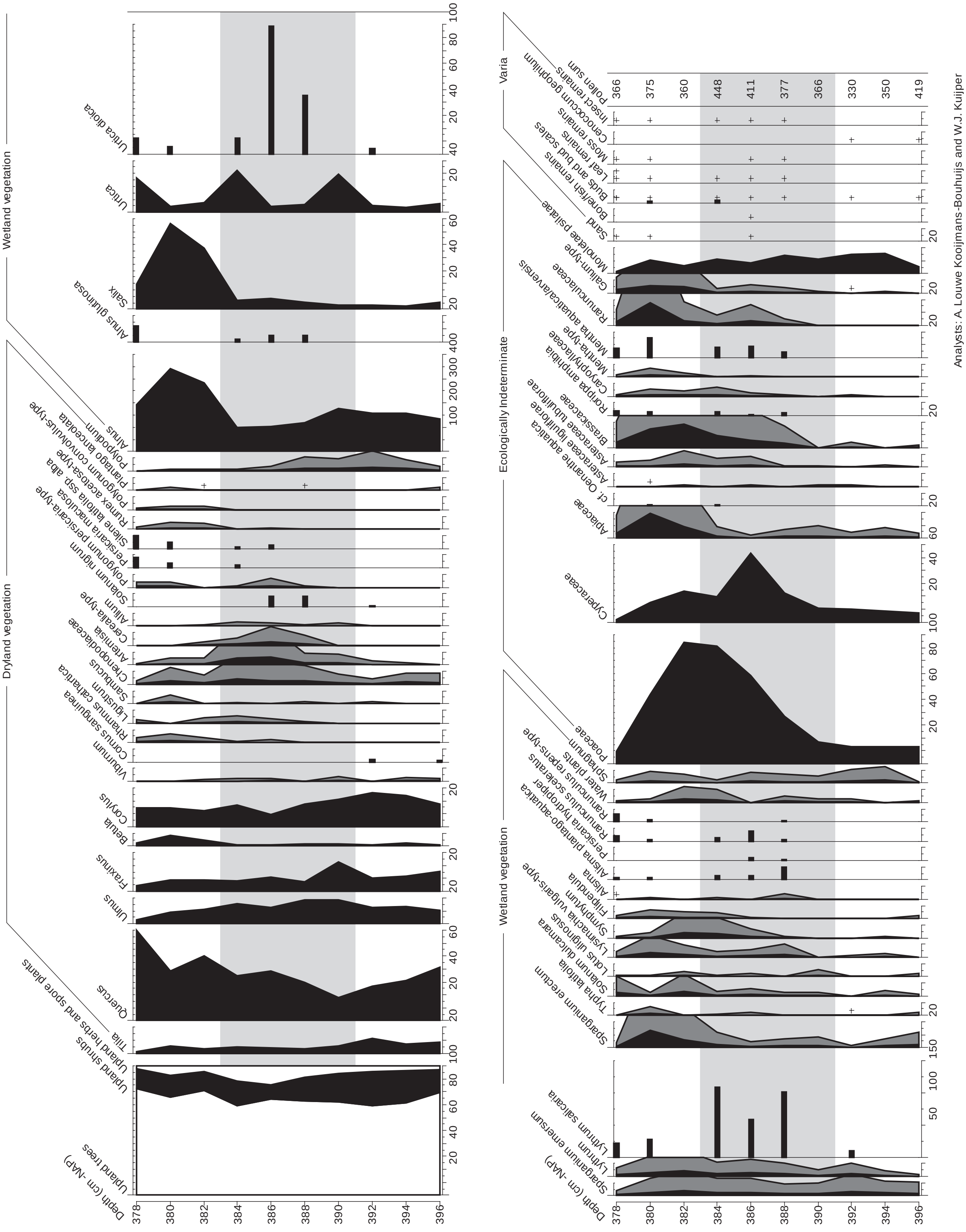


Figure 14.5 Selected taxa from M87. See figure 3 for legend.

depth (m –NAP)			sediment
3.59	–	3.56	slightly clayey peat
3.62	–	3.60	peat rich in charcoal
3.70	–	3.63	sandy peat
3.75	–	3.71	peat; charcoal at 3.73 to 3.72 m -NAP

Table 14.1 Lithostratigraphy of M86.

depth (m –NAP)			sediment
3.83	–	3.78	clayey peat
3.89	–	3.84	peaty sand with charcoal and a bone fragment
3.91	–	3.90	sandy peat
3.97	–	3.92	peat with Phragmites remains

Table 14.2 Lithostratigraphy of M87.

Quercus and *Betula* increase, some of the upland shrubs increase (*Rhamnus cathartica*, *Ligustrum* and *Sambucus*), and herbs that showed high percentages during occupation decrease. In the wetland vegetation, *Alnus*, *Salix* and various herbs such as *Sparganium erectum*, *Lysimachia vulgaris*-type, Apiaceae, Brassicaceae, Ranunculaceae and *Galium*-type increase after occupation, reflecting the end of occupation and the sedimentation of clay.

The macroremains from sample M49 (table 14.3) contain 24 taxa representing upland and wetland trees and herbs as well marsh vegetation, similar to the vegetation represented in M86 and M87. Interestingly, M49 provides new information as well, since it contains many seeds (*s.l.*) of *Quercus* spec., *Prunus spinosa*, *Cornus sanguinea* and *Rubus fruticosus,* probably indicating the nearby presence of these taxa. Collection of these taxa by people or animals cannot be excluded, even as consumption followed by excretion, but these are considered as less probable explanations here due to the large variation of taxa in the sample.

The diagrams, clearly showing the start and end of occupation, do not give any indications that phase Vlaardingen 1b represents a multi-phased occupation period. This preliminary conclusion however needs confirmation from further archaeological research since pollen and seed diagrams do not necessarily indicate sub-phases of occupation (see Out 2008 where the diagrams of the comparable site of Brandwijk-Kerkhof do not allow distinguishing the sub-phases of a multi-phased refuse layer). Some of the archaeological refuse was found below and above the occupation horizon as distinguished in the diagrams, which could indicate that occupation lasted longer than assumed. The refuse distribution could alternatively be explained by local vertical transport of refuse (cf. Amkreutz

taxon	number
Quercus spec., cupulae	20
Quercus spec., cupulae with content	17
Quercus spec.	3, 2 j.
Prunus spinosa	1
Cornus sanguinea	4
Rubus fruticosus	3
Urtica dioica	7
Chenopodium album	1
Persicaria maculosa	3
Silene latifolia ssp. album	1
Solanum nigrum	59, 1 c
Stellaria media	4
Alnus glutinosa	19
Alnus glutinosa, cones	21
Alnus glutinosa, fragments of catkins	2
Alisma plantago-aquatica	2
Carex acutiformis	4
Carex riparia	31
Hypericum cf. tetrapterum	1
Oenanthe aquatica	2
Solanum dulcamara	6
Sparganium erectum spp. erectum	18
Stachys palustris	8
Persicaria hydropiper	2
Ranunculus repens-type	24
Ranunculus sceleratus	1
Nymphaea alba	2
Mentha aquatica/arvensis	6
Buds	72
Moss remains	+
Charcoal	+
Bone/fish remains	+
Pottery remains	+
Insect remains	++
Cocoons	++
Trichoptera, cases of larvae	+

Table 14.3 Macroremains from sample M49, trench 25, phase Vlaardingen 1b.
+ = 1-5
++ = 5-10
j. = juvenile
c = carbonised
x, y = x includes y

et al. this volume). This vertical transport could have affected pollen and seeds as well, but the curves in the diagrams, likely to represent the succession of the vegetation, do not give any reason to assume that vertical transport played a key role in the formation of the pollen and seed assemblages in the soil.

14.4 Discussion

14.4.1 Natural vegetation

The diagrams of M86 and M87, both of which cover the period before, during and after the Vlaardingen 1b occupation phase for the southern end of the river dune, give very similar results. The natural vegetation before occupation consisted of deciduous forest vegetation dominated by oak on the higher parts of the slope, alder carr with *Viburnum* and *Cornus sanguinea* on the lower parts of the slope and marshes surrounding the river dune (fig. 14.6a). The data do not precisely clarify whether oaks were part of the alder carr on the slope of the dune or not. The diagram of M87 shows relatively few macro-remains, possibly due to the presence of dense vegetation resulting in low seed production. After occupation, a small channel probably became active at close distance to the dune, as indicated by the deposition of clay, local presence of *Salix* and high values of wetland taxa.

14.4.2 Human impact

The diagrams reveal that human activity led to a number of changes in the local vegetation. It is highly likely that people deliberately felt trees of *Quercus* and *Alnus*, which resulted in the development of secondary vegetation, as shown by a change in the composition of the shrub vegetation that shifts from *Viburnum opulus* and *Cornus sanguinea* to *Rhamnus cathartica*, *Ligustrum vulgare* and *Sambucus nigra*. Furthermore, human activity resulted in an increase in taxa in the dryland and wetland herb vegetation indicative of clearance, disturbance and eutrophication, in an increase in Poaceae and Cyperaceae indicative of more open vegetation, and in the presence of cereal pollen (fig. 14.6b). The cereal pollen does not necessarily indicate the presence of fields, but may instead represent processing of cereal products, since most pollen of the two autogamous taxa that are involved, emmer and naked barley, is released during threshing (Robinson/Hubbard 1977; Zohary/Hopf 2000). The end of occupation is characterized by peaks of *Alnus*, *Salix*, *Sparganium erectum*, *Solanum dulcamara*, *Mentha aquatica/arvensis*, Apiaceae, Ranunculaceae and *Galium*-type (fig. 14.6c). Some of these peaks clearly indicate recovery of the vegetation (*e.g. Alnus*), while others are related to changing environmental conditions (*e.g. Salix*, as discussed above). Interestingly, *Plantago lanceolata* is best represented before and after occupation instead of during occupation (cf. Louwe Kooijmans 1974, 139). Instead of representing an anthropogenic indicator, it here represents the natural vegetation of unstable environments such as a riparian zone (cf. Groenman-Van Waateringe 1968). Overall, the results on human impact confirm those from earlier investigations (see introduction).

The four metres distance between M86 (relatively close to the river dune) and M87 (relatively far away) influence the anthropogenic signal. For the upland vegetation, the signal of anthropogenic influence is stronger in M86 than M87, as can be clearly observed by comparing the percentage of upland herbs and spore plants, which is 20-25% in M86 and 15% in M87. This difference reflects the shorter distance from M86 to the assumed location of human activities. This result is confirmed by the diagram of Voorrips (Louwe Kooijmans 1974), showing an even smaller upland herb percentage of 10%.[4] In addition, in M86 seeds of upland herbs are also better represented during occupation than in M87 (*Chenopodium album*, *Solanum nigrum* and *Stellaria media*). In contrast, the diagram of M87 shows higher values than M86 of *Urtica*, *Lythrum* and *Sparganium emersum*-type that prefer relative moist conditions. At the lower part of the slope human activity thus comes to expression in the wetland herb vegetation. The decrease in the evidence of human impact on the upland vegetation over a distance of only several metres indicates that the human impact must have been restricted. Furthermore, the presumably small size of the pollen catchment basin (as indicated by the local presence of trees and shrubs) and the presence of local vegetation that would have prevented spread of pollen no doubt played a role as well (Bunting *et al.* 2005; also discussed in Out in prep.). In contrast to the Hazendonk, the evidence of human impact at Brandwijk, a similar Middle Neolithic dune site, remained equal over a distance of 20 metres, presumably caused by the fact that the vegetation was more open than at the Hazendonk (Out 2008, 37).

The extensive spread of the refuse layer, the trampling zone and the presence of the palisade, as well as the short distance between the zone of human activity and the sample series, gave rise to the expectation that the evidence of human impact during the Vlaardingen 1b phase would be considerable. However, the diagrams of M86 and M87 give only moderate indications of deforestation. A core sampled at approximately the height of M86 at the southeastern side of the river dune shows similar evidence of slight human impact on the upland vegetation (up to 15% of upland herb pollen and fern spores).[5] The moderate strength of human impact during this phase is furthermore approximately comparable to the two other main occupation phases at the site, phases Hazendonk 1 and 3 dating to the Middle Neolithic (Out in prep.). The percentages of upland vegetation together with the macro-remains in sample M49 indicate that woodland vegetation remained present on the

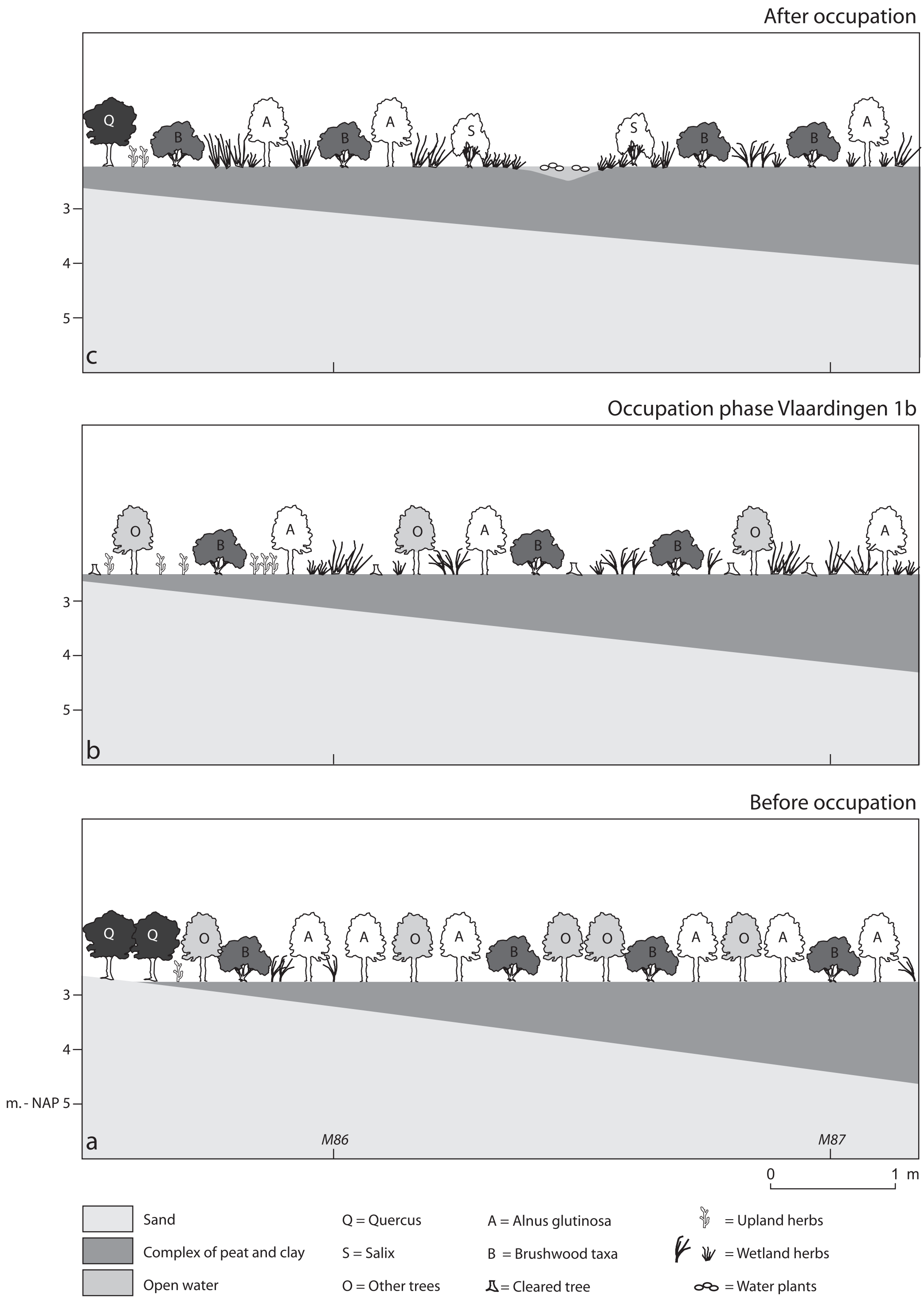


Figure 14.6 Reconstruction of the vegetation on the southern slope of the Hazendonk near the sample series M86 and M87 before, during and after occupation phase Vlaardingen 1b. The vegetation symbols are not scaled. Other trees include *Fraxinus excelsior*, *Ulmus* spec. and *Acer campestre*. See the text for brushwood taxa (shrubs). The upper figure, representing the situation after occupation, shows nearby presence of open water. Open water was not present at the precise given location, but at a location slightly further away from the dune.

top of the dune during phase Vlaardingen 1b (cf. Louwe Kooijmans 1974, 139). It is however not possible to precisely reconstruct the scale of deforestation on the higher parts of the slope or within the palisade.

It is not sure whether arable farming was practiced on the Hazendonk itself during phase Vlaardingen 1b or indeed most other occupation phases. The presence of Cerealia-type pollen can be explained by processing activities, while the presence of cereal macro-remains can be explained by the import of cereals from elsewhere. There is as yet no evidence of flint artefacts with sickle gloss (cereal gloss in a longitudinal direction caused by cutting cereal stalks, Van Gijn pers. comm. 2007), an absence that could be interpreted as an argument against local crop cultivation, especially as other flint tools are present.[6] However, the use-wear results are difficult to interpret, and do not altogether exclude sickle gloss (*ibid.*). The significance of sickles-absence can furthermore be doubted since crops could have been harvested in other ways than with sickles. There are no features indicative of tillage, but this does not represent any evidence against local arable farming since absence of such features can be explained by soil formation processes such as colluviation and flooding, and possibly by erosion of the dune due to recent disturbance of its top.

The pollen diagrams, with evidence of only limited deforestation during most phases including phase Vlaardingen 1b, at least strongly indicate that the presence of fields with a surface of several hundreds of square metres is very unlikely. Instead, small arable plots up to tens of square metres could have been present, with limited economical importance compared to other food sources, as was implied as a possible scenario for the Hazendonk already in the early stages of research (Bakels 1981, 1986). A comparable suggestion about small-scale cultivation has been made recently too, for the Middle Neolithic sites Brandwijk-Kerkhof and Swifterbant (Cappers/Raemaekers in press; Out 2008, 38). Crop products could alternatively have been imported from southern Pleistocene sand soils (cf. Bakels 1986), which is also a possible scenario for Brandwijk-Kerkhof. Import of crop products implies that clearances at the Hazendonk were used for purposes other than arable farming. The available evidence does not enable a distinction to be made between small-scale local arable farming and import. Future research may give more information on the function of the enclosed area and the possible presence of a small field within it. A more detailed discussion on arable farming at the Hazendonk will be published in Out (in prep.), with special attention to the material of phase 1 that stands out from the other phases.

14.4.3 Relation to the neolithisation process

There is clearly recognisable evidence of human impact on the vegetation on and around the southern slope of the Hazendonk during phase Vlaardingen 1b. However, the impact appears to have been relatively slight, and as sampling took place in the refuse layer indicative of local human activity, which is to say in or very near the zone of strong disturbance, we can assume that the effect which the humans had on the dune vegetation really was restricted. This is supported by the rapid decline in the indicators of human impact on the upland vegetation, which decrease noticeably within only four metres of the refuse spread. Sampling at certain locations at the western side of the river dune, where refuse of phase Vlaardingen 1b is scarce, would therefore probably not have yielded a recognisable signal at all. The indications of deforestation in the main diagram of M87 are nevertheless stronger than at the earlier, Late Mesolithic/Early Neolithic non-agricultural sites Hardinxveld-Giessendam Polderweg and Bruin, and the early phases of the semi-agricultural site Brandwijk-Kerkhof that are located on dunes in the same region. The late phases at Brandwijk-Kerkhof show evidence of human impact that is comparable with the evidence at the Hazendonk (Bakels/Van Beurden 2001; Bakels *et al.* 2001; Out 2008). The data thus show a trend that deforestation increases with ongoing neolithisation. However, other factors than neolithisation clearly influence the signal of human impact as well, such as site function, sample location and occupation intensity (cf. Out in prep.).

The limited scale of human impact during phase Vlaardingen 1b, and the similarity in the degree of disturbance with the earlier, Middle Neolithic occupation phases at the Hazendonk, is unexpected when considering the small distance between the sample series and the zone of human activity. The results are also unexpected when taking into account that the Vlaardingen Group represents the Late Neolithic and is considered as corresponding with the consolidation phase of the neolithisation process (Louwe Kooijmans 1998). The restricted evidence of human impact is however no surprise at all in view of the subsistence strategy of the occupants of the Hazendonk, the considerable indications of a specific site function as a specialised hunting camp, and the limited role of agriculture (see introduction). Thus, even well-established Late Neolithic occupation at Dutch wetland sites can give limited evidence of human impact, so limited that it could well remain undetected when sampling too far away from the activity zone. In other words, the Hazendonk studies discussed here highlight that there is probably much low-level human impact taking place during neolithisation that we are not detecting, something which we should take into account in a wider research context.

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Notes

1 *Ranunculus repens*-type represents *R. acris/lingua/repens* but it probably concerns *R. repens* here. *Veronica beccabunga*-type represents *V. anagallis-aquatica*, *V. beccabunga* and *V. catenata*.

2 The complete results of both sample series will be published completely in Out in prep.

3 The seeds were found in the material that remained after preparation of the pollen samples.

4 The diagram of Voorrips (Louwe Kooijmans 1974) has been recalculated based on an upland pollen sum (Out in prep.), which makes the percentages comparable with the diagrams presented here. The diagram of Van der Wiel (1982) that is based on the same pollen sum would also be suitable for comparison, but does not contain a main diagram with a curve of the upland herb percentage.

5 Core 2, to be published in Out in prep.

6 This conclusion is based on analysis of all the flint except for the material from unit C.

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15 An eagle-eyed perspective. *Haliaeetus albicilla* in the Mesolithic and Neolithic of the Lower Rhine Area.

Luc Amkreutz
Raymond Corbey

15.1 Introduction

Next to his successful career in archaeology, one of Leendert Louwe Kooijmans' various less conspicuous qualities is that of being a talented amateur-ornithologist. On numerous occasions he has outmatched others in specifying what flew by, or sang unseen. His interest in birds, however, is not confined to the present. One of his archaeological pet-tricks is to ask his audience to guess what species of bird ranks second in presence-absence counts on Mesolithic and Neolithic sites in the Lower Rhine Area after the wild duck (*Anas platyrhynchos*). The answer, the white-tailed eagle, has almost always puzzled his audience and often sparked discussions on an aspect of hunter-gatherer or early farmer life in the Lower Rhine Area of which we know little: the symbolic connotations of objects and animals. Such exchanges have never failed to be inspirational, and were sparked off by an animal with inspirational qualities. The white-tailed eagle has almost always taken center-stage wherever it occurs.

The consistent presence of bones and claws of white-tailed eagles at many Mesolithic and Neolithic sites in the Lower Rhine Area may offer a window not so much onto this raptor's importance to diet as onto less tangible aspects of past life. We would like to take this opportunity to investigate the existing archaeological evidence and try to elucidate some of this bird's symbolic meaning for past communities with the help of ethnographic and archaeological sources.

15.2 An ornithological profile of *Haliaeetus albicilla*

The white-tailed eagle is an impressive bird of prey, its fingered wings spanning *circa* 225 cm. Its massive in-flight profile led the Dutch to lend it the rather befitting popular name of 'flying door' (*vliegende deur*) (fig. 15.1). Young birds are of an overall brown colour, tail included. Adult animals have a dark brown coat of feathers with slightly lighter ochrous colours around the neck and head. The short and wedge-shaped tail of adult animals is white, the large beak bright yellow, and the talons are uncovered. The white-tailed eagle can also be recognized by its loud, high-pitched call, a sound akin to *kjicklickleak-tjegjegow*, or, when agitated, *kra* or *krau*. The bird is indigenous to Europe as well as large parts of Asia, both as a migratory and local

Figure 15.1 Young white-tailed eagle in flight. Photo and courtesy René and Marianne Wanders.

species. Couples only start nesting at the age of 5 or 6, once a year between March and July. Nests are built on rocky cliffs or in trees with a flat crown and usually contain two white eggs. The same nests may be used for up to several years in succession.

The hunting territories of the white-tailed eagle are usually close to water and include rocky coasts, coastal plains, river mouths, marshes and estuaries, as well as more inland riverine settings. Prey is captured by diving and clawing and comprises larger fish, both living and dead, waterfowl, marine birds, rodents and other small mammals. Dead animals are scavenged on land (Elphick/Woodward 2003; Cramp 1977, cited in Oversteegen *et al.* 2001, 255; Rohm 1970; Van Wijngaarden-Bakker *et al.* 2001, 220) (fig. 15.2).

In the Netherlands the white-tailed eagle is very rare nowadays and mostly encountered when migratory from December to February. This is why the species is used by archaeologists as a seasonal indicator for occupation, as demonstrated at the Late Mesolithic Hardinxveld sites (Oversteegen *et al.* 2001, 256; Van Wijngaarden-Bakker *et al.* 2001, 223). This winter presence does not exclude the possibility that in the past the white-tailed eagle may also have nested in the Lower Rhine Area (Van Wijngaarden-Bakker *et al.* 2001, 221). In 2006 and 2007 a pair of white-tailed eagles nested in the region of the Oostvaardersplassen

Figure 15.2 White-tailed eagle on top of prey (young red deer). Photo and courtesy Martijn de Jonge, Amsterdam.

(Flevoland). A webcam placed next to the nest by Staatsbosbeheer, the Dutch national forestry service, registered how in March 2007 several eggs were laid in the nest and how one female bird survived and left the nest in July. Therefore it should be realized this bird can only be used with caution as a seasonal indicator species.

15.3 Mesolithic and Neolithic eagles in the Lower Rhine Area

As was remarked already, remains of white-tailed eagle are found in many faunal assemblages dating to the Mesolithic and Neolithic in the Lower Rhine Area (table 15.1 and fig. 15.3). Its contribution to the avian faunal assemblage is mostly limited. In a few cases it surpasses 5%, but this is mainly due to overall low numbers of bird bones encountered. Sometimes, however, bones of the species are found in higher numbers and form a considerable contribution to the overall assemblage, most notably at Vlaardingen, Hardinxveld-Giessendam Polderweg phase 1, and Hüde I in Germany. At such sites these eagles seem to have been targeted more specifically.

Were these birds primarily hunted for subsistence or for other reasons? Many authors argue at least partially in favour of the latter, often referring to their impressive appearance (*e.g.* Laarman 2001; Van Wijngaarden-Bakker *et al.* 2001; Zeiler 2006). Albarella (1997, 348) adds that the meat of cranes and large birds of prey is not very tasty and quotes a seventeenth century English writer, who dismisses it as "tough, gross, sinewy and engendering a melancholic blood." Clark (1952, 38), on the contrary, remarks that the flesh of eagles was regarded as a delicacy by both the Ukranians and the natives of Kamchatka during the eighteenth century. He deems it unlikely, however, that Mesolithic man caught white-tailed eagles with the primary aim of eating them, given the availability of birds more prone to capture. Both Albarella (1997, 348) and Reichstein (1974, 124) point out that the meat of *young* eagles and cranes was regarded a delicacy, and there are historic records of its use in wedding feasts in England (Stewart 2001, 142) At the site of Hüde I several bones of young sea eagles have been found (Boessneck 1978, 164).

Unfortunately there is little archaeological evidence that may shed light on the use of white-tailed eagle in the

site	period	N	% total bird	% total id.	MNI	reference
Mesolithic						
Hardinxveld-Polderweg phase 0	LM	1	8,3	14,3	1	Van Wijngaarden-Bakker et al. 2001
Hardinxveld-Polderweg phase 1	LM	30	2,7	5,7		Van Wijngaarden-Bakker et al. 2001
Hardinxveld-Polderweg phase 1/2	LM	1	0,5	1,4	1	Van Wijngaarden-Bakker et al. 2001
Hardinxveld-Polderweg phase 2	LM	1	1,7	2,7	1	Van Wijngaarden-Bakker et al. 2001
Hardinxveld-De Bruin phase 1	LM	–	–	–	–	Oversteegen et al. 2001
Hardinxveld-De Bruin phase 2	LM	9	1,6	2,3	–	Oversteegen et al. 2001
Hardinxveld-De Bruin phase 3	LM	2	0,6	1,6	–	Oversteegen et al. 2001
Neolithic						
Hoge Vaart-A27	SWB	8	–	2,9	–	Laarman 2001
Brandwijk-Het Kerkhof	SWB	1?	3,45	4,3	–	Lauwerier et al. 2005; Robeerst 1995
Bergschenhoek	SWB	3?	–	6,8	–	Clason/Brinkhuizen 1993
Swifterbant-S3	SWB	6	0,2	–	–	Zeiler 1997
Hüde I	SWB	62	22,5	23,7	9	Boessneck 1978
Ypenburg	Haz-3	23	0,2	1,5	–	De Vries 2004
Rijksweg A4	Haz-3	1	2	5	1	(Laarman in:) De Vries 2004
Schipluiden-phase 1 handpicked	Haz-3	2	–	5	–	Van Gijn 2006; Zeiler 2006
Schipluiden-phase 1-2a handpicked	Haz-3	4	–	2	–	Van Gijn 2006; Zeiler 2006
Schipluiden-phase 2a handpicked	Haz-3	14	–	1	–	Van Gijn 2006; Zeiler 2006
Schipluiden-phase 2b handpicked	Haz-3	5	–	< 0.5	–	Van Gijn 2006; Zeiler 2006
Schipluiden-phase 3 handpicked	Haz-3	2	–	< 0.5	–	Van Gijn 2006; Zeiler 2006
Hazendonk	VL	1	0,1	–	1	Zeiler 1997
Hekelingen III-M1	VL	2	3,1	6,4	–	Lauwerier et al. 2005; Prummel 1987
Vlaardingen	VL	23	–	17,8	8	Lauwerier et al. 2005; Clason 1967
Zandwerven	VL	1	–	7,1	1	Clason 1967
Hellevoetsluis	VL	1	–	–	1	Van Hoof in prep.
Bouwlust	TRB	+	–	–	–	Lauwerier et al. 2005
Emmeloord-J97	SWB-LN	1	12,5	25	1	Bulten/Van der Heijden/Hamburg 2002
Mienakker	LN/SGC	+	–	–	–	Lauwerier et al. 2005
Molenkolk 1	LN/SGC	+	–	–	–	Lauwerier et al. 2005
Keinsmerbrug	LN/SGC	+	–	–	–	Lauwerier et al. 2005
Aartswoud	LN/SGC	1	< 0.01	–	1	Van Wijngaarden-Bakker 1997
Kolhorn-Noord	LN/SGC	6	c. 0.9	–	–	Zeiler 1997/Lauwerier et al. 2005
Kolhorn-Zuid	LN/SGC	2	c. 0.2	–	–	Zeiler 1997/Lauwerier et al. 2005
total/mean		**207**	**1,95**	**4,43**		

Table 15.1 Numbers of bones and percentages of overall and identified species of birds for white-tailed eagle on Mesolithic and Neolithic sites in the Lower Rhine Area. - = absent; + = present; ? = *Aquila* sp., *Haliaeetus* sp., or *Accipitridae* sp.

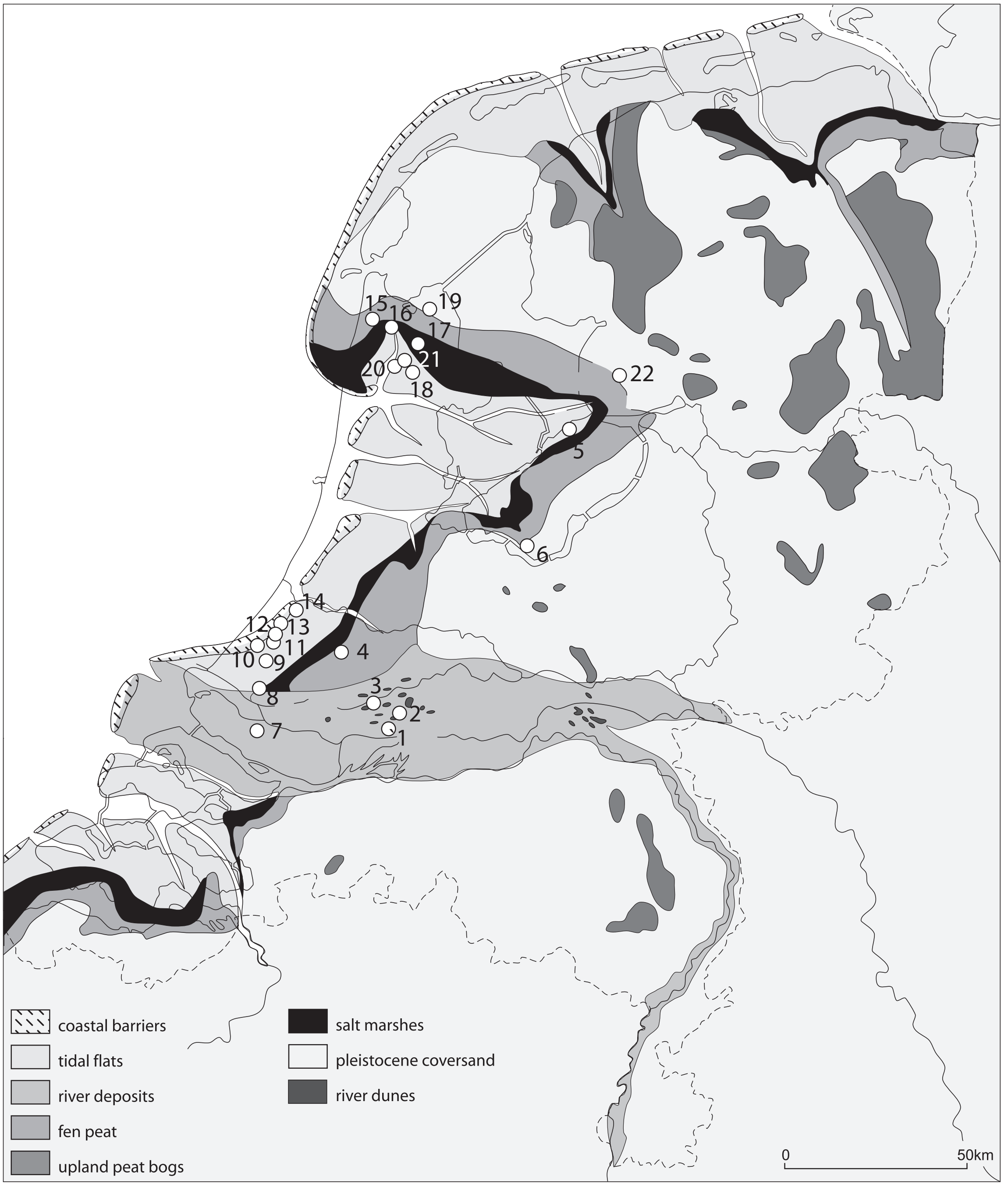

Figure 15.3 Map of the Netherlands around 4200 cal BC depicting sites with bones of white-tailed eagle, except for the German site of Hüde-1.

1 Hardinxveld
2 Hazendonk
3 Brandwijk
4 Bergschenhoek
5 Swifterbant-S3
6 Hoge Vaart-A-27
7 Hekelingen-3
8 Vlaardingen
9 Schipluiden
10 Wateringen-4
11 Ypenburg
12 Rijswijk-A4
13 Leidschendam
14 Voorschoten
15 Keinsmerbrug
16 Kolhorn
17 Aartswoud
18 Zandwerven
19 Slootdorp
20 Mienakker
21 Molenkolk
22 Emmeloord.

Mesolithic and Neolithic communities under study here. If organic remains are preserved these may not represent the initial composition, due to differential taphonomic processes at the sites. Elements such as feathers are usually not preserved, while complete wings or claws are often no longer in association. Furthermore, species-specific spatial information, indicating how and where bones of sea eagles were found, and which thereby might shed light on functional (waste) or symbolic deposition practices, is generally absent.

15.3.1 Frequency analysis

Some information on use may be gleaned from the frequencies of certain skeletal elements. Drawing on Ericson (1987), Van Wijngaarden-Bakker *et al.* (2001, 222) argue that for birds a specific ratio between wing and leg elements may point to consumption. While natural complexes would be characterized by a more or less equal ratio, consumption waste would be indicated by a predominance of wing over leg elements, with the exception of flightless birds. Predominating quantities of wing bones are here regarded as waste from consumption (Livingston 1989; Zeiler 2006).

Others (*e.g.* Reichstein 1974; De Vries 2004) argue that a predominance of wing elements may point to the use of feathers or even complete wings. It should be noted that Reichstein founded his opinion on an analysis of nine sites spanning some three millennia, from the Late Neolithic to early historic times. Evidently the reasons for the predominance of wing bones need not have been the same in all cases. In addition to this, bone frequencies are contingent upon robustness of bones, differing per species, as is stressed by Livingston (1989, 545-546). The picture is further complicated by butchering and waste disposal practices, taphonomic regimes, and the overall area excavated, as well as socio-cultural attitudes towards specific species, cuisine and food preparation.

The analysis of bone frequencies is thus fraught with methodological problems. Nevertheless it may shed some light on past behaviour towards specific species of birds. Of the sites with remains of white-tailed eagle presented above, several have yielded information regarding bone frequencies (table 15.2).

The ratio between leg and wing elements can be seen to differ strongly per site. This contradicts Reichstein's (1974, 124-126) argument that procurement was specifically targeted at obtaining wings. On the other hand the alternative of regular consumption is equally questionable. Reichstein (1974, 126) argues that in a natural assemblage the ratio between wing and leg elements should be 93:70, or 4:3. If we take into account the arguments presented by Van Wijngaarden-Bakker *et al.* (2001) and Ericson (1987), there should be an overrepresentation of wing elements. This is the case at just five sites, while the overall counts closely approximate the natural population.

Furthermore, the ratio varies strongly. While there is a slight overrepresentation of wing elements at Ypenburg, this is far more extreme at Vlaardingen and especially at Polderweg phase 1, possibly implying that wings or feathers may have been important after all. Conversely, at six sites, leg elements dominated over wing elements, most convincingly at

	legs					**wings**									**other**	**leg/wing ratio**
site	fe	tit	tmt	lbl	other	hu	ra	ul	mc	cmc	cor	sc	lbw	other		
Hdx-Polderweg phase 0											1					-/1
Hdx-Polderweg phase 1	1	1				1	8	7		4	1	1		1	5	2/23
Hoge Vaart-A27			2					1							5	2/1
Brandwijk			1													1/-
Hüde I	3	11	12		1	4	4	11		3	2	2			9	27/26
Hazendonk					1											1/-
Schipluiden				4	13								8		2	17/8
Ypenburg		1			8	4	3	6			1					9/14
Rijswijk A4	1															1/-
Vlaardingen	1	2				8	5	3	2		1				1	3/19
Zandwerven								1								-/1
total	**6**	**15**	**15**	**4**	**23**	**17**	**20**	**29**	**2**	**7**	**6**	**3**	**8**	**1**	**22**	**63/93**

Table 15.2 Wing and leg elements per site and the ratio between leg and wing elements. Abbreviations: fe: femur; tit: tibiotarsus; tmt: tarso-metatarsus; lbl: long bone leg; hu: humerus; ra: radius; ul: ulna; mc: metacarpus; cmc: carpometacarpus; cor: coracoid; sc: scapula; lbw: long bone wing. For references see table 1.

Schipluiden and Hüde I. Remarkably, Schipluiden yielded a similar pattern for the common crane (*Grus grus*), diverging from for example the assemblage of crane at Ypenburg, where, again, wing elements dominate (De Vries 2004; Zeiler 2006, 440). The site of Hüde I indicates that this pattern is not unique, as its ratio cannot be aligned with consumption or preferential selection. It is possible that at these sites the talons or claws of the white-tailed eagle were sought-after elements. This may be evidenced by the predominance of phalanges at Schipluiden (Zeiler 2006, 428), or the burnt talon of *Haliaeetus* at the Hazendonk (Zeiler 1997), and is further substantiated by cutmarks on a claw-joint of white-tailed eagle from the Mesolithic site of Hallebygaarde and four eagle claws in a south-Swedish grave dating to the transition from the Late Neolithic to the Early Bronze Age (Clark 1952, 39).

Although the numbers of bones at some sites are very limited, some preliminary conclusions can be drawn. First of all, while wings and feathers may have been important this does not seem to be an exclusive pattern. Secondly, the overall ratio between wing and leg elements does not represent an evident dominance of wing elements in light of the natural ratio. The ratio per site fluctuates strongly, while at some sites leg elements clearly dominate. This confirms neither the natural situation nor a consistent consumption spectrum. Therefore, despite the limited number of sites and bones and taking into account the problems mentioned above, the bone ratio presents secondary evidence indicating that the white-tailed eagle was indeed not merely hunted for subsistence, but at least partially if not significantly for other reasons. The fluctuation in ratio may relate to site or period-specific preferences. Unfortunately, further archaeological evidence for the nature of this use is limited.

15.3.2 Artefacts

Several sites have yielded artefacts made of bones of white-tailed eagle (table 15.3).

Clearly long wing bones were most often used to make awls or needles, although in two cases legbones were used. Van Wijngaarden-Bakker (1997) analysed the birdbone artefacts from several Neolithic assemblages in the western Netherlands. She concludes that bones of larger bird species – mainly swan, crane and white-tailed eagle – were specifically targeted for the production of artefacts. While it may seem self-evident that these species were used because of their longer bones, at Aartswoud and Swifterbant the remains of these species were conspicuously lacking from the food remains (Van Wijngaarden-Bakker 1997, 342-343). This seems to be related to the importance of duck hunting for subsistence. At other sites, such as the Hazendonk, Hekelingen III, Bergschenhoek and Vlaardingen, these larger species of bird did occur within the consumption assemblage. Here, hunting was more strongly targeted at species such as swan and goose.

Nevertheless at several sites there thus seems to be some evidence for a more specific use of a number of the larger species of bird for the production of artefacts. At Bergschenhoek this was further evidenced by the find of a partial skeleton of Bewick's swan (*Cygnus Bewicki*), lacking head, wings and legs, *i.e.* specifically bones used for artefact production (Clason/Brinkhuizen 1993). The awls were usually made by removal of at least one of the epiphyses and in some cases a splitting of the long bones. One of the ends was subsequently rounded or worked to a point (Louwe Kooijmans *et al.* 2001b, 356). The subsequent polishing may have been done by means of hide or leather (Van Gijn 2006). Some of the awls are perforated at the opposite end. Usewear analysis of the often rounded points indicates a working of soft materials, rather than a tool for repairing nets (Louwe Kooijmans *et al.* 2001b, 356). Van Wijngaarden-Bakker (1997) suggests that they may have been used to pierce bird skins.

Next to more domestic functions awls may have been used for tattooing, as is suggested by ethnographic evidence

site	findnumber	phase	element	artefact	surface
Hdx-Polderweg	24,069	1	hu	–	polished, scratched
Hdx-Polderweg	14,299	1	ra	awl	polished, scratched
Hdx-Polderweg	20,246	1	ul	awl	polished
Hdx-De Bruin	9,110	2	tbt	pendant?	perforated, polished
Hdx-De Bruin	7,002	2	ul	awl	polished
Hdx-De Bruin	8,037	2	ul	awl/needle	
Hdx-De Bruin	5,147	2	ul	tool	polished around point
Schipluiden?	8091		lb	beads	cutmarks
Aartswoud	E34:XLI:17.29		tmt	awl	polished, scratched

Table 15.3 Artefacts of bones of white-tailed eagle on Mesolithic and Neolithic sites in the Lower Rhine Area. For references see table 1.

(*ibid.* 1997, 343). The beautifully decorated awl made from a longbone of a mute swan (*Cygnus olor*) found at Hardinxveld-Giessendam De Bruin (Louwe Kooijmans *et al.* 2001b, fig. 10.15, 355), may indicate that these tools were more than just everyday domestic objects. The same may go for for the pendant found at De Bruin and the beads documented at Schipluiden, although the latter are not indubitably derived from *Haliaeetus albicilla*. Van Wijngaarden-Bakker (1997, 343) further mentions hollow tubes of bird bone. While none of these could be specified as *Haliaeetus* they may have been used for such activities as the sucking, sniffing, blowing of powdered substances, or blow painting.

Besides bone ratios and artefacts there is no direct archaeological evidence for the use of body parts of white-tailed eagle. It is very probable, and indeed widely assumed, however, that its feathers, especially the elegant pinions and tail feathers, were used for the manufacture of arrows as well as for decorative or symbolic purposes, not least on the basis of ethnographic evidence (*e.g.* Clark 1952; Van Wijngaarden-Bakker 1997 Zeiler 2006; Dove *et al.* 2005; see below). No feathers have been found in the Lower Rhine Area. However, the site of Hüde I yielded a peculiar case of trauma, *periostitis ossificans*, found in the area of the quill knobs of an ulna of a female white-tailed eagle. According to Boessneck (1978, 165) this could have developed due to the pulling of feathers. Boessneck also argues that for multiple 'harvests' the bird would have had to be held in captivity. This again brings Kazakh (Central Asia) hunting with tame eagles to mind, but alas, here we end up in pure speculation.

15.3.3 Other species

It is evident that, besides white-tailed eagle, other rare bird species were also actively pursued by Mesolithic and Neolithic hunter-gatherers. While this does not provide any additional information on their actual use, it is a further case in point that beside 'staple species' rarer species were also actively targeted. It concerns quite a few species of birds of prey (Boessneck 1987; Lauwerier *et al.* 2005; Oversteegen *et al.* 2001; Prummel 1987; De Vries 2004; Van Wijngaarden-Bakker *et al.* 2001), such as the sparrow hawk (*Accipiter nisus*), the common buzzard (*Buteo buteo*), the eagle owl (*Bubo bubo*), the long-eared owl (*Asio otus*), the osprey (*Pandion haliaeetus*), the goshawk (*Accipiter gentiles*), the falcon (*Falco peregrinus*) and the marsh harrier (*Circus aeroginosus*), whose wing bones were found at Schipluiden (Zeiler 2006). Other more or less rare species which hypothetically may have been hunted for other purposes besides, or rather than, subsistence include the common crane (*Grus grus*) (De Vries 2004, 33-34), the grey heron (*Ardea cinerea*), the ruff (*Philomachus pugnax*), the great spotted woodpecker (*Dendrocopos major*), the blackthroated diver (*Gavia arctica*), the greater flamingo (*Phoenicopterus ruber*) and the long-tailed duck (*Clangula hyemalis*) (*e.g.* Van Wijngaarden-Bakker *et al.* 2001; Lauwerier *et al.* 2005; Zeiler 2006). It should be mentioned that such species may represent background fauna, especially when occuring in low numbers.

15.3.4 Preliminary conclusions

While the evidence provided here is not exhaustive some preliminary conclusions may be drawn. The white-tailed eagle indeed seems to provide a consistent, though limited, contribution to the avian faunal spectrum at Mesolithic and Neolithic sites. While it is not unlikely that the species was hunted for meat, the bone ratios of wing and leg elements indicate strikingly varied assemblage composition, most of which represent neither a natural nor a subsistence pattern. In some cases, the composition provides secondary evidence for specific targeting of wing or leg elements.

It should be stated once more that the value of this conclusion is dependent on often small assemblages, and site-specific preservational circumstances and excavation methods, as discussed already. Further evidence of non-subsistence use of *Haliaeetus albicilla* is provided by bone artefacts. Awls point both to use in various domestic tasks as well as perhaps more sporadic symbolic uses, while pendants or beads may have had a specific symbolic function. The presence of other rare species may point to non-subsistence motives for hunting certain species of bird too. Unfortunately, archaeological evidence enabling further clarification of such motives is largely lacking for the Lower Rhine Area. This is why, in the second part of this paper, we will draw on other archaeological and various ethnographic sources that may further elucidate the specific meaning *Haliaeetus albicilla* may have had for the communities under consideration here.

15.4 The archaeology of eagles beyond the Netherlands

At the Italian Middle Bronze Age site of La Starza in Campania, bones of crane and vulture suggest that these species were mainly hunted for their feathers, since other wildfowl, which must have been present in region in much larger numbers, are largely absent (Albarella 1997, 347). Similarly to eagles, both cranes and vultures are known for their huge feathers which may have had symbolic, ceremonial or aesthetic value. Another example of the importance of birds is provided by Bronze Age hollow ceramic bird statues from the Lausitz culture. Although the species are often not identifiable it is evident that waterbirds are most often the subject of this type of imagery (Quietzsch-Lappe 2007).

This image is further substantiated by burial finds from Middle Neolithic Ajvide in Sweden and Mesolithic and Neolithic Zvejnieki in Latvia. At these sites birds played an important role in mortuary practice (Mannermaa 2008).

Beads and pendants were fashioned from the wing bones of waterbirds and decorated the body or burial dress. Figurines were also found. Apart from these species the jay (*Garrulus glandarius*) may have been used regularly and might even have been a totem animal. Water birds seem to have played an important role possibly indicative of their symbolic status of travelers between both worlds (water and air). Ethnographically the ability to fly and dive is central to the tripartite universe of sky, earth and underworld of circumboreal belief systems and certain species of birds were even regarded as shaman's helpers (Mannermaa 2008). At the well-known Mesolithic burial site of Oleniy ostrov, the osprey (*Pandion haliaeetus*) is most often found in burials (*ibid.*). At the Estonian Early Neolithic site of Tamula golden eagle and capercaillies were more important. The site also yielded a bird figurine that was found in the grave of a child. Wing bones of cranes were placed at both hands (Kriiska *et al.* 2007, cited in Mannermaa 2008).

Specific evidence for white-tailed eagle is very abundant from various Neolithic monuments in Britain. Bones of large birds were discovered in the early 19th century already, for example in the King Barrow longmound, the Knook pavement and the Old Ditch Long barrow in Wiltshire. More recent excavations and better means of identification suggest that these bones, sometimes identified as heron in the past, probably belonged to crane or white-tailed eagle (Field 2006, 5). The southern ditch at Coneybury Henge near Stonehenge contained the deposition of part of a white-tailed eagle (*ibid.*) and the Orcadian chambered tombs of Midhowe and Knowe of Ramsay yielded eagle bones too. Furthermore a sea eagle was placed spread-eagled in the closure deposits of the Links of Noltland settlement, also in the Orkneys (Jones/Richards 2003).

Most suggestive of the importance of white-tailed eagle however is the well-known Neolithic tomb of Isbister, also known as 'Tomb of the Eagles'. In this tomb the remains of at least fourteen white-tailed sea eagles sat among the remains of both humans and animals (Hedges 1984; Jones 1998). Some remains of white-tailed eagle were found in the foundation deposit of the Isbister tomb as well as other tombs. While initially interpreted as midden material, it now appears that specific parts of animals were selected for these foundation deposits. In the case of the eagles, this mainly concerns skulls, wings and claws. Quite a number of sea eagles were placed fully articulated in the central chamber (Jones 1998, 311-312).

Instead of regarding these deposits as sacrificial offerings, funerary feasting or totemic practices secondary to the main function of the tomb, Jones (1998, 309) ascribes a more primary function to them, related to the location of the tomb. Remarkably, sea eagles are almost exclusively deposited in chambered tombs located in high coastal and cliffside locations. This indicates that animals may be linked to places according to topographic and symbolic principles. Within a specific conceptual map, birds may represent 'sky' and can be associated with flight and the metaphysical status of the soul. Furthermore, the difficulty in obtaining species such as the white-tailed eagle may act as a statement on the power relations involved in their procurement (Jones 1998, 315). This Late Neolithic example thus draws out further connections between sea eagles, the dead, high places and the spiritual, whilst simultaneously stressing the importance of place and the difficulties and skill involved in their capture.

In addition to the aforementioned Late-Neolithic examples, the importance of eagles and other birds of prey is evidenced from older archaeological sites. One remarkable example is the recovery of ancient feather fragments, mainly used in fletching arrows or darts, from melting ice patches high up in the mountains of southern Yukon, Interior Alaska. While these feathers, including those of bald or golden eagles, date to *c.* 2500 cal BC, other artefacts go back as far as *c.* 6500 cal BC (Dove *et al.* 2005). The specific use of non-food birds such as falcons and eagles for these artefacts indicates not only functional, but also symbolic or decorative use, and specific evidence for notched and worked specimens does so too. In recent times, Salish and Tlingit hunter-gatherers of the Pacific North-west Coast singled out specific species such as eagles for their supernatural and ceremonial significance. Eagle feathers were specifically used on arrows intended for big game, while feathers of hawk or raven were used for smaller game and waterfowl (O'Brien 1997, cited in Dove *et al.* 2005). It is likely that by doing so the hunter in this way endowed the arrow with some of the death-dealing qualities of the bird. Fletchings thus appear not to have been purely utilitarian, and recent symbolic practices may have been rooted in the ancient past (Dove *et al.* 2005, 42).

A final example takes us back even further, to the Late Palaeolithic Magdalenian occupation of southern France. The avifauna of the Grotte de Bourouilla in the Pyrénées Atlantiques included the bones of over 53 Snowy owls (*Nyctea scandiaca*). In contrast with bones of other species many of these bones showed signs of skinning and other modification. The scraping, cutting and scorch marks were not aimed at obtaining the meatier parts of the birds but seemed to focus on the procurement of skins, feathers, tubular bone shafts and claws, as was also evidenced by assemblages from other caves (Eastham 1998, 103). There seems to have been a preference for female birds at Bourrouilla, which may be related to differences in plumage (*ibid.* 99). The culling of these animals therefore seems to have been mainly for non-subsistence purposes. As with eagles, this may have involved a combination of functional and symbolical roles, richly documented in ethnography and comprising for instance feather decoration, the fabrication of various containers, flutes, beads, tubes and needles, as well as the use of skin, claws, wings and beaks (cf. *infra*; Clark 1952; Dove *et al.* 2005).

15.5 An ethno-ornithological note

Ethno-ornithology, like ethnozoology and ethnobotany, is a branch of ethnoscience, the study of indigenous systems of classification. It may seem slightly preposterous to use this concept in connection with archaeological material because archaeologists do not have the same richness of data at their disposal as field ethnographers do. Gregory Forth, for example, studied in minute detail over a period of some fifteen years how the Nage people of Flores (Indonesia) classify birds and give them a chosen place in their cosmovision and social practice (Forth 2004; cf. Boomert 2001 on Amazonia). Yet, as we show below, ethno-ornithological analogies do provide useful circumstantial evidence, and can be quite helpful in elucidating the uses of the Dutch sea eagle remains.

When one delves into the available literature on eagle iconography and symbolism it becomes immediately apparent that various eagle species have played major roles in many cultural contexts throughout history. Let us first consider the European tradition, in which eagles loom large symbolically. In the *Odyssey* and the *Iliad*, both dating to *c.* 800 cal BC and describing events taking place some 500 years earlier, the eagle is interpreted as the messenger and envoy of upper God Zeus. It is associated with thunder and lightning (referring to its capacity for speedy dives) and the sun (related to its ability for flying at high altitudes, sharp sight and capacity for staring directly into the sun). The eagle also figures at least twenty times in the Bible and later on resurfaces several times in the Christian tradition, associated with God himself. It fulfilled a comparable role in the lore, religion and myths of the Babylonians, Assyrians, Hittites and Phoenicians between 2400 and 500 cal BC. The eagle, the king of birds, was the bird of kings, gods and rulers (Lemaire 2007, 81 ff.).

Eagle imagery was also adopted by Roman legions and emperors, and appears in Vergil's epic *Aeneis* as well as in the *Physiologus*, a second-century didactic and moralizing text on animals and nature. Vikings, medieval aristocrats, Russian tsars, Prussian emperors, and German National Socialists adopted the eagle. It occurs in Medieval bestiaries, Dantes' *Divina Commedia* and Nietzsches' *Also sprach Zarathrustra* (cf. Kularov/Markovets 2004) and is still used – not least printed on money – by present-day states such as Poland, Mexico, Austria and the United States (*e.g.*, Śmiełowski 2000). Britain's Barclays Bank was urged to drop its distinctive eagle logo by employees from a Dutch bank it was trying to take over in 2007. For these employees it evoked too strongly the eagle symbol used by the Nazi occupants of the Netherlands during the Second World War.

While eagle symbolism has clearly figured prominently in the Old World from the classical era onwards this need not necessarily be informative on the meaning of eagles in the much earlier, small-scale communities of hunter-gatherers and, subsequently, farmers of the Lower Rhine Area. Therefore a brief look at ethnographic data regarding recent small-scale, non-state societies is in order.

The prominence of eagles in (north-) American-Indian cosmovisions is attested to by the number of references to this bird in the – electronically available – *Annual Reports of the Bureau of American Ethnology* between 1881 and 1933: the eagle occurs 3970 times in 54 articles. The hawk, by comparison, occurs 968 times in 51 articles, the crow 1097 times in 46 documents, and the owl 854 times in 50 articles. Symbolic dealings with eagle claws, beaks, feathers and images are frequent all over the Americas, from the far north to the far south.

Possibly the most famous of these dealings is eagle-trapping by human males hidden in pits among the Hidatsa and other Plains Indian peoples along the Missouri. "If only one or two eagles were caught, they might be released after the tail feathers had been plucked. If a larger number were caught, some of them would be killed for the wings to make fans and plume arrows", Gilbert L. Wilson, an ethnographer and Presbyterian minister who live several years among the Hidatsa, wrote in 1928. "Three eagle tails yielded enough feathers to make one good war-bonnet, or *maicu-mapuka* (eagle-hat)" (Wilson 1928, 213). As it happens a much less well-known and less ritually formalized but striking parallel was buzzard trapping for prestige by adolescent males of St.-Geertruid, the Netherlands (Limburg), in the mid-twentieth century. They hid in concrete animal rearing troughs underneath wooden shelves upon which a dead rabbit was positioned. Maybe Leendert came across similar activities in Arnhem, where he grew up. In recent decades, the eagle has acquired pan-Amerindian significance as a symbol of brotherhood among the autochthonous peoples of the North-American continent. On the other side of the Bering Strait, eagles are equally important. Among Siberian peoples like the Yakut, Tungus, and Buryat, for example, the eagle is associated with spring, fertility and shamanism.

The widespread and emphatically positive symbolic role of eagles almost certainly has to do with perceived attributes which make the eagle a "natural symbol" in the sense of Mary Douglas (1970), or not so much "good to eat" as "good to think with" (Lévi-Strauss 1962). The first phrase points to the phenomenon that people tend to select suitable, obvious entities from their environment with which to express meanings. The second expression more specifically stresses the articulation of one's personal, family or group identity as different from that of other individuals or groups in terms of the different animals or plants with which one claims kinship or which one flaunts as emblems. In pre-state societies such articulations of identity in terms of favoured species usually carry strong animistic connotations, with the animal as ancestor and kin, while in more complex state societies they function as totems, symbols and emblems in a usually looser, but comparable sense. Of course, this valuable analytic viewpoint somewhat reductionistically singles out just one aspect of a rich, moral and reciprocal relationship with other spiritual beings in nature.

In a case study on pigeon and friar bird among the Nage of central Flores, Gregory Forth stresses the formative role of empirical properties – morphological, behavioural, vocal – in the attribution of symbolic value to species, quite frequently in contrasting pairs, such as eagle-snake in the casuistry under consideration here. This may well explain the remarkable similarities in animal symbolism the world over (Forth 2007). Eagles soar high, display agile flight, have sharp vision and strong claws, hunt and kill skillfully, and impress by their visual splendour and sheer size. It is clearly these attributes which have promoted them to their prominent symbolic roles which, in our view, provide strong circumstantial evidence that the Dutch eagle data fit within the pattern displayed by so many cultures. In the Rhine delta, *Haliaeetus albicilla's* territoriality, monogamous pairs and huge nests also may have provoked cultural meanings, the specifics of which are forever lost. More often than not in non-sedentary and pre-state sedentary societies, specific significant animals are connected to places in the – perceived, mythical, storied – landscape, and this may well have been the case in the Dutch Mesolithic and Neolithic, in which case the identity of spirits/birds, humans and places must have been interconnected.

In view of ethnographic evidence it is probable that not only aerodynamical properties but also metonymical associations of feathers used for fletching arrows were important. “Their efficiency was not merely mechanical,” J.G.D. Clark plausibly suggests in *Prehistoric Europe* (1965, 39), “it was also magical. The archer wished to direct the aim and increase the force of his arrow by appropriating something of the eagle’s power and keenness of vision”. Real and perceived attributes of eagles may well have been exploited by hunters in the Lower Rhine Area by their carrying claws and beaks as amulets. The Unangan of the Aleuts, for example, used to wear elegant, polychromous *chagudax*, wooden hats, decorated with bird-of-prey motives to make themselves appear as birds of prey and adopt their speed, agility and keenness of sight (Black 1991). Among the Swazi of southeast Africa, a society with a strong male rank order, only the *ingwenyama* (“king”) is entitled to wearing eagle feathers. The eagle is spoken of locally as “king of birds” and one of the local species is used in medicines to sanctify the king (Kuper 1973).

15.6 Discussion

The foregoing consideration of archaeological, historical and ethnographical sources has highlighted the near-universal importance of that mighty predatory bird, the eagle. While this is highly suggestive as to the symbolic prominence of white-tailed eagle in the Late Mesolithic and incipient farming communities of the Lower Rhine Area, the specifics of that role are hard to come by. Recovering past ideological motivations empirically is rather problematic. In this respect the frequency analysis presented above only reveals part of the story. Analogies do not really offer ‘a way out’ of this impasse because of their lack of qualitative scrutiny. Nevertheless analogical reasoning remains germane to all archaeological interpretation, as a heuristic framework for linking mute artefacts and remnants of the past to the dynamics of past communities (*e.g.* Van Gijn/Zvelebil 1997; Hawkes 1954). In the absence of an ideal ethnographic parallel for these Mesolithic and Early Neolithic communities analogies are drawn from peoples such as the Alaskan Nunamiut, the Ojibwa of the Great Lakes, the Northwest Coast communities and the New Guinea Papuan peoples. There are, however, numerous geographical, economical and cultural arguments that limit the relevance of these comparisons (*e.g.* Louwe Kooijmans 2001a, 67). This is why we believe it is necessary to arrive at a more integrated analogical model, seeking out structural resemblances that, although their implementation and cultural expression remain highly specific, connect these communities.

One element that clearly stands out in the prehistoric communities studied here and in many ethnographic case studies such as the aforementioned is the importance of hunting. For the Lower Rhine Area it has been widely documented that despite the increasing availability of domesticates and cultigens during the process of neolithisation, wild resources such as game mammals, fish and fowl continued to form a staple element in subsistence (*e.g.* Louwe Kooijmans 1993; Raemaekers 1999). Hunting, including its social and ideological repercussions, therefore was a rather conservative central element in such societies. While other motivations should not be ruled out, it would seem to make sense to interpret the presence and importance of *Haliaeetus albicilla* at these sites from the perspective of hunting and the hunter. From this perspective, the specific qualities of the white-tailed eagle that set it apart from other birds and underline its specific treatment are of paramount importance. It is these aspects that hunters may have admired, revered or identified with.

Shooting such an animal would have greatly added to the status of the hunter and so to speak placed him and his skill on par with that of the eagle. The ethnographic and – limited – archaeological evidence for the decorative and symbolic use and display of feathers, claws, beaks, bones, skins and wings

Figure 15.4 Example of a wooden early 19th-century Unangan hunting hat (National museum of Finland). The bone ornaments on both sides are shaped after the head of a bird and represent wings. Wearing a hat like this would enable a hunter to adopt the speed, agility and keen eye of a bird. The decorations furthermore warded off evil spirits and magical powers and enabled the hunter to lure out prey (Black 1991). Photograph by L. Amkreutz.

also points in this direction. Such trophies flaunt the hunter's status and capabilities and augment his reputation. It may have been the specific qualities of the white-tailed eagle that were much sought after by the Mesolithic and Early Neolithic inhabitants of the Lower Rhine Area. Its keen eye, superior speed, stealth and agility were acquired by proxy and subsequently objectified in the use of specific eagle elements. In this way the hunter may have assumed control over these qualities metonymically, as suggested by the ethnography of the *chagudax* wooden hats and the eagle fletchings.

While these ethnographically inspired interpretations necessarily remain suggestive, they do seem to tie in with the prominent position of eagles in communities of hunter-gatherers and early farmers in the Lower Rhine Area. Identification with the qualities of eagles was possible in various, non mutually exclusive ways, and need not necessarily have precluded consumption of eagles. What does stand out is that they specifically draw on an analogy between the hunter and its quarry. In this light it is perhaps understandable that the presence of eagles and wildfowl in general seems to diminish dramatically in the course of the Late Neolithic and Early Bronze Age in the Lower Rhine Area, in synch with the diminishing importance of other game animals in favour of domesticates (Louwe Kooijmans 1993, 82). At the end of the Late Neolithic hunting was no longer a central element in everyday food procurement and community life and had probably lost a great deal of its symbolic value. In any case the white-tailed eagle no longer figures as prominently among the faunal assemblages of this later age.

15.7 CAUDA

In this paper we have tried to somewhat constrain speculations on the possible symbolic roles of *Haliaeetus albicilla* in communities of hunter-gatherers and incipient farmers in the Lower Rhine Area, by combining archaeological data and ethnographic parallels. We have procured, and zoomed in on, our prey, the eagle remains, and subsequently had to soar high to come to an ethnographically informed understanding. This offers a suitable analogy with Leendert Louwe Kooijmans' work over the past decades in unraveling some of the mysteries surrounding neolithisation in the Lower Rhine Area. While excavating several pivotal sites in minute detail he never failed to soar a bit higher every now and then. It is this delicate balance between the target on the ground and his eagle-eyed perspective which is most characteristic of his contribution to the understanding of our prehistory.

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16 Were beavers aware? A change of perspective on the neolithisation of Britain

Bryony Coles

16.1 Introduction

Prehistorians, I think rightly, tend to assume that in northwestern Europe the outcome of neolithisation led eventually to a very different way of life to that known in the Mesolithic, even if the processes of change happened in different ways and at varying speed from region to region. In the course of his career, Leendert Louwe Kooijmans has made major contributions to our knowledge and understanding of this period of transformation, not least through a series of exemplary excavations which have been research-led and aware of, yet unconstrained by, the archaeological theories of the day. He has shown how, in different environments, we can detect different human responses to the prospect of the new, and thereby see the process of neolithisation in a different light. In this paper, I would like to look for another new perspective, to see where we might arrive by examining the effects of neolithisation as seen by an indigenous population, but not a human one.

For the last ten years or so, much of my research has focused on the archaeology of European beavers, *Castor fiber* (Coles 2006). Initially designed to recognize beaver presence in the archaeological record from Britain, the research has involved, amongst other things, fieldwork in present-day beaver territories in western Europe, to record and analyse the physical signs of beaver presence and to investigate how these signs might decay and which might survive for an archaeologist to discover in the future. When puzzled colleagues and other visitors questioned the field team's purposes, we legitimised this somewhat unusual archaeological task with the name ethnozooarchaeology, but what was at first something of a jest is in fact an appropriate descriptive term for what we were doing: living in beaver territory and recording the aspects of archaeological interest.

Another strand of the research was more traditional, gathering together evidence for beavers from museums, excavation reports and all other possible sources. The period covered was from the Late Glacial to the time when beavers became extinct in Britain, which was thought to be in the Middle Ages, but moved closer and closer to the present as the research proceeded.

In the course of both field and desk-based work, the focus on beavers led to a number of comparisons with the archaeology of humans, and a realisation that in archaeological practice we take many things for granted. So my new perspective for this paper is that of beavers (fig. 16.1), and I doubt that this will be a surprise to Leendert who once rashly co-authored a short note with me on a beaver artefact (Coles/Louwe Kooijmans 2001).

16.1.1 Presence

The ice sheets of the last glaciation drove most mammalian species out of what is now Britain. As conditions began to ameliorate, the different species spread northwards at varying rates, depending primarily on the availability of their food sources and other necessities of life such as shelter. In theory, humans could have re-colonised what was then the northwest corner of mainland Europe ahead of beavers: the latter would have needed to build up large food stores of twigs and branches to survive cold winters, a difficult task when woody vegetation was scarce, whereas humans could probably have survived the winter months on a diet of other animals.

In fact, the archaeological evidence currently available suggests that both humans and beavers re-colonised the southwest of Britain during the Windermere interstadial.

Figure 16.1 A beaver swimming along a stream in Brittany. Photo Lionel Lafontaine.

During the succeeding Loch Lomond cold phase both species retreated southwards through Europe, but probably no great distance as their presence is attested again early in the Holocene, at the classic site of Star Carr in northeastern England (Coles 2006, 76-78). From this time onwards, we assume that humans have always been present in Britain, and that beavers were here until their extinction in historic times.

I do not know whether anyone has made a detailed check of the British record for human presence, but for beavers it is patchy in time and space. For the Mesolithic, there is good evidence from England, a little from Scotland and none from Wales. For the Neolithic, the record from England remains good, from Scotland there is one possible site, and from Wales none. Yet because Britain became an island at some time between the Mid Mesolithic and the Mid Neolithic, and beavers rarely cross salt water, it is reasonable to assume that between the first and the last of the Holocene records they were present in Britain, and ubiquitous, though not always captured in a recognisable way by the archaeological record. As for Ireland, as far as we know, beavers were never part of the indigenous Holocene fauna (Woodman *et al.* 1997).

16.1.2 Beaver self-defence

Beavers live in families, alongside water, and they exploit water and earth for their defence. They often stay underwater for five to six minutes, and occasionally up to 15 minutes, and they can dig underwater and swim along flooded tunnels. So their safe haven is an underground den in the bank of a lake or watercourse, reached by a burrow with an underwater entrance, proof against most of the predators. Figure 16.2 shows how these dens can develop over time.

Where bank height is insufficient for a den that is above the water table but still underground, the beavers build a heap of wood, mud, uprooted tussocky plants and stones on the ground surface, and hollow out a chamber-like den, well-protected by the thickness and solidity of the mound. These are the structures known as lodges in North America, and '*huttes*' in France, and most are reached by more than one burrow, and grow over the years into sprawling heaps of considerable size.

Where the depth of water is insufficient to cover and protect a burrow entrance, the beavers build a dam of wood, mud, uprooted plants and stones to raise the water level. Dams are built only across relatively narrow watercourses, from less than one metre up to 14-16 m wide, but with time some may be extended onto the adjacent land surfaces. Thus, for defence, beavers adapt their surroundings through building, and predators have either to catch them away from these defences or to dig into dens or break down the lodges and dams. Out in the open, the beavers' massive sharp incisors provide their main defence, used as much on other beavers as on predators, for the species is highly territorial and an adult pair does not tolerate visitors.

16.1.3 Being hunted

Beavers of all ages are preyed upon by humans, bears, wolves and wolverines, while youngsters may also be taken by foxes, pike, and the larger birds of prey. Of these predators,

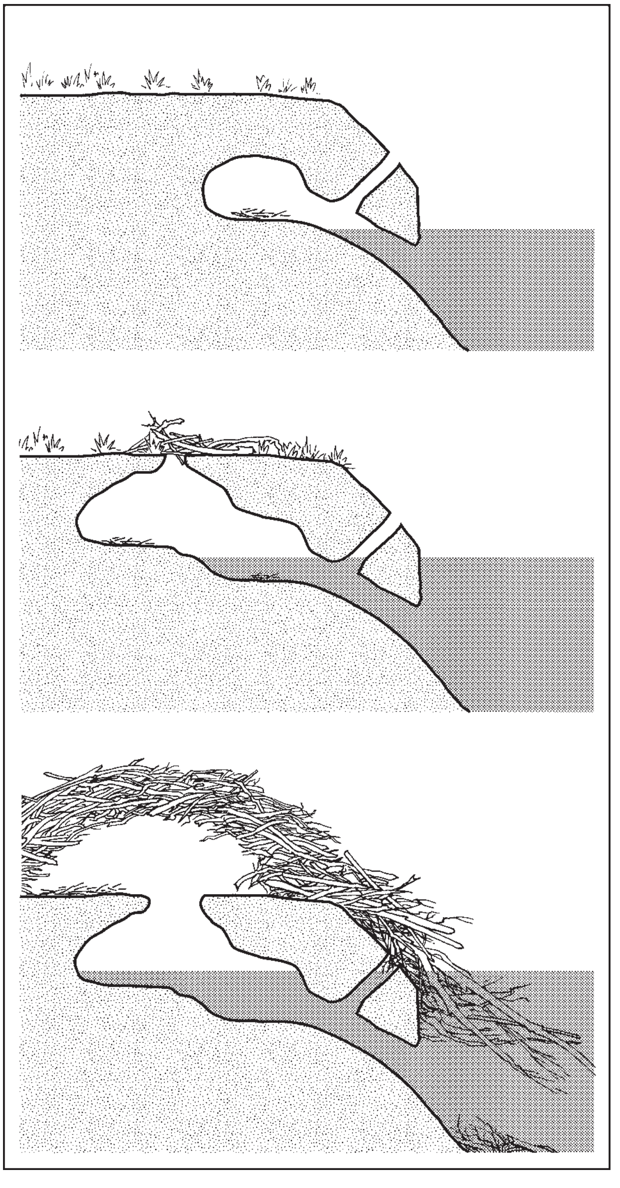

Figure 16.2 Top: a burrow with entrance underwater, leading up to a dry below-ground den. Middle: over time, beavers dig out new den floors at higher levels, mainly in response to rising water levels. Bottom: as water levels continue to rise, the den becomes too high to be concealed and protected underground, so the beavers build a lodge.

humans were perhaps the most persistent, wily and dangerous. Humans would quite likely have broken into a lodge using a stone-bladed axe, or broken a dam with the help of an elk-antler mattock, tool-using giving them an edge on their competitors. Furthermore, control of fire enabled humans to smoke out the beavers from underground dens, once the entrance was exposed, while an axe was perhaps the most efficient means of slaughter.

Humans may have snared beavers, either on their regular overland paths, or with difficulty underwater, a tricky job but maybe worth trying as a snared beaver would soon drown. Setting a wooden foot-trap, as for deer, was perhaps less likely, as a beaver's incisors rival or surpass most human tools for cutting through wood. Beavers are vegetarian, and would not be lured by a lump of meat, but their strong territorial instincts lead them to investigate the smell of strange beavers, and human hunters use castoreum taken from dead beavers' scent glands to lure further victims. All of these techniques were available to humans of the Mesolithic and Neolithic alike, though the details of the equipment varied regionally and through time.

Whatever the methods used, beavers were hunted within their own territories or home range, which for a family usually extends for between 500 m and 2 km along a watercourse or around a lake, the length depending on food supplies, while the width of land in regular use is normally up to 20 m or so from the water's edge. Beavers could have been profitably hunted at all times of year, not just in the late autumn when their thick waterproof fur was in peak condition and their teeth at their sharpest, for the beaver has much more than its skin and teeth which are of value to the humans amongst its predators.

16.1.4 Before death

Humans, both deliberately and without realising it, make use of the changes brought about by beavers living alongside watercourses; this is not surprising, as in ecological terms beavers are a key-stone species of great significance, and this is true of *Castor fiber* as well as *Castor canadensis*. I have discussed elsewhere the attractions of beaver territories for humans, who come to exploit the results of the beavers landscape manipulation (Coles 2000), and the considerable effect of beavers on local hydrologies (Coles 2001), so these aspects of beaver-human interaction are not the subject of this paper, although they deserve further research.

However, in the present context, we should note that neolithisation involved human imitation of beavers in several respects: in the felling of trees, in the creation of small clearings in the woodlands, and the encouragement of re-growth from felled stumps to produce a harvestable supply of shoots for weaving into hurdles and traps, and browse for cattle. In these respects, beavers may have found humans becoming more active within their own territories, and sometimes providing more food whilst also causing various disturbances. Humans may have observed that the sediments in and around former beaver ponds, rich in moisture and organic matter, encouraged early and vigorous plant growth. They may have learned water control from beaver dams and canals, and realised the advantages of building causeways from using dams as routeways across marshy ground. These potential imitations are not specific to Britain nor to the Neolithic, but it is in the Neolithic that we see some of their first manifestations.

16.1.5 After death

Figure 16.3 illustrates some of the uses that humans make of beavers. Humans eat beaver meat, and in the late winter when many other prey species and domestic animals were lean, the fat stored in a beaver's tail would be particularly valuable. Beaver bones, being chunky and strong, could be used for making tools, and their wood-working teeth were put to just the same use by humans: incisors to cut wood and molars to grind or rasp down a surface, naturally hafted in the mandible or else in wood. For some purposes, humans

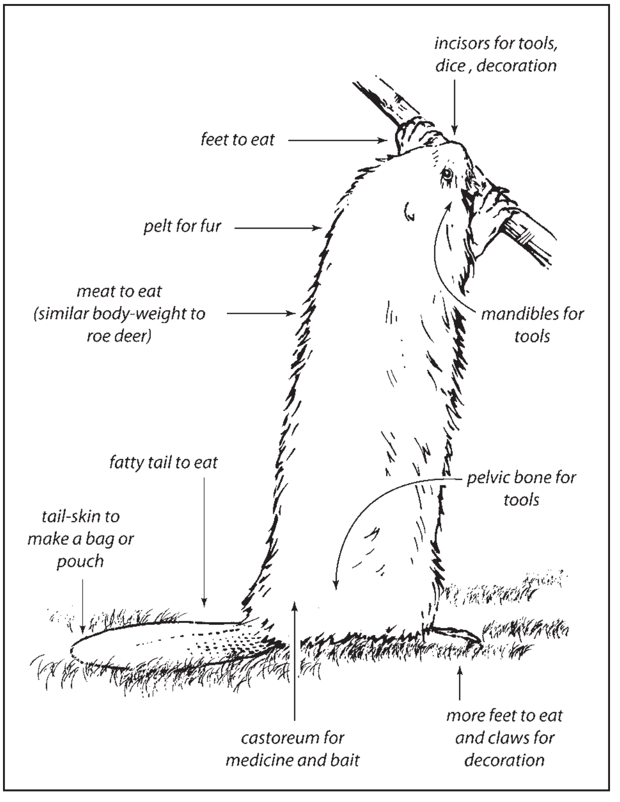

Figure 16.3 The resources which a human predator might gain from a dead beaver.

may have preferred the bones of a young adult beaver, old enough for strength, young enough to take the skeleton apart with moderate ease (Osgood 1940). Both male and female beavers are worth hunting for castoreum, since both sexes have the requisite glands; this was probably a fortunate characteristic as far as human predators were concerned, for beavers show no external visual signs of their sex except when females are lactating. As well as providing bait to catch more beavers, castoreum could be used as medicine, effective thanks to its aspirin-like qualities derived from the willow bark and meadowsweet (*Filipendula ulmaria)* that beavers feed on (Kitchener 2001, 76-77). Beaver fur is very dense, warm and waterproof, and a pelt is about 50 by 70 cm, making one beaver pelt equivalent in size to about five or six marten pelts.

In Britain, we can assume that a dead beaver was put to many of the same uses by humans of the Neolithic as in the Mesolithic. As far as we know, fur was not supplemented by wool until a later date, and beaver fur remained of value to the humans of Britain long after beavers had become locally extinct (Coles 2006, 165-166). Fat in late winter was as necessary for farmers as for hunters, and the domestic plant crops grown in neolithic Britain were not major fat providers to the extent of replacing beaver tails as a welcome late winter source. Nor were the known domestic plants and animals of the Neolithic major sources of human medicine. The Opium Poppy, *Papaver somniferum,* was to become used in ways similar to castoreum but never replaced it, and castoreum was being imported for pharmaceutical use in the twentieth century, falling away only with the development of aspirin (Kitchener 2001, 114). Nor did the lithics repertoire, change though it did from the Mesolithic to the Neolithic, develop anything to equate to a beaver's teeth (fig. 16.4), which in Britain are known to have been used by humans into later prehistory at least.

Figure 16.4 The skull of a beaver showing its large, sharp incisors set in robust jaws. When gnawing wood, beavers pause to sharpen their incisors one against the other.

16.2 The archaeological evidence

Much of our knowledge of beavers in prehistory comes from the identification of animal bones, and some of it from the recognition of beaver gnawed wood, from archaeological sites. Therefore what follows is primarily about beavers once dead, although elsewhere I have endeavoured to reconstruct some aspects of their lives (Coles 2006).

16.2.1 Mesolithic

For Britain, it is difficult to discuss whether or not, from the perspective of a hypothetical beaver, the pattern of events after death at the hands of a human predator changed from the Mesolithic to the Neolithic. This is because there is still relatively little evidence to shed direct light on how human settlement patterns differed between the two periods (see Bayliss *et al*., this vol.; Bradley, this vol.). However, we can approach the question by looking at the evidence for where and how human predators processed the corpses of their victims. Primarily, this means looking for well-dated beaver bones from secure contexts, and there are not many.

In general terms, a beaver corpse must have been close to the weight limit for a human to carry home in one piece rather than processing at or close to the kill site, for the younger adults weigh 20-25 kg and older individuals are usually heavier, occasionally close to 40 kg. This weight range is similar to that of roe deer, or prehistoric sheep. But there are factors to consider in addition to weight: mesolithic and neolithic humans may have been stronger than those of today, and the distance from kill site to hunter's home may have been short, for beavers and humans often live in close proximity, while if there was a journey to be made it could have been by water, making transport of a number of corpses relatively easy. However, the archaeological evidence for processing suggests it generally took place at or near the kill sites, as it comes mainly from locations suitable for beaver habitation.

In looking for sites with evidence for humans having hunted, killed and processed beavers, in other words procurement sites, the vagaries of archaeological preservation are striking. Beavers and humans were widely distributed through Britain from the early Holocene onwards, if thinly at first, but the evidence for their presence and interaction

Figure 16.5 Beaver evidence from Britain, 13500 BC – 4000 BC (for site codes, see Coles 2006, Appendix 1).

survives only patchily (fig. 16.5). For the Mesolithic, the Thames catchment is the most prolific area, and it remains significant through the Neolithic when Yorkshire and the Fens of East Anglia also have relatively abundant evidence.

Along the Thames and its tributaries the Colne and the Kennet, beaver bones have been found in the course of excavating sites where mesolithic humans had settled. A small cluster of sites in the Colne valley, immediately west of Heathrow airport, suggests that from time to time humans had settled on a gravel island in the marshy valley, or perhaps on the banks of a river channel. The debris of occupation, at sites such as Three Ways Wharf, and the Sanderson Factory, Denham, indicates that the humans sometimes came as family groups, sometimes in smaller parties, for a few days or for longer spells (Lewis 2000; Lakin/Halsey 2004). Amongst hearth remains and burnt flint, the majority of the animal bones are from deer and wild pig, with just a few molars and rare limb bones to show that beavers were also taken. Either most of the beaver corpses were taken away for processing elsewhere, unlike the deer and pig, or the humans had less desire for beavers than their other prey.

The Kennet, a river of considerable archaeological renown, joins the Thames at Reading. The river is also well known to beaver enthusiasts, as many beaver bones have been found in the valley peats and clays over the centuries, most of them unfortunately not dated. A number come from around the town of Newbury, where human sites of mesolithic date such as Thatcham, Faraday Road and Marsh Benham, provide evidence of predation (Churchill 1962; Wymer 1962; Healy *et al.* 1992; Ellis *et al.* 2003; Reynier 2006). As in the Colne valley, there are hearths and worked flints and animal bone, and again the evidence is suggestive of variety in the size and duration of human settlement, with repeated visits to favoured locations.

Beavers were clearly not the main prey here, either, but there is more evidence for local processing, with chopped and probably cooked beaver from Thatcham. The range of prey species includes wild cat and pine marten, suggestive of hunting for furs, in which case the beaver corpses were almost certainly skinned and the pelt taken for curing and use; indeed, it is hard to imagine any human hunters leaving a beaver pelt behind, and one site where skinning is suggested is Faraday Road, upstream of Thatcham.

At both of these sites, it seems that the humans settled themselves firmly within a beaver territory, for at Thatcham there are indications in the sediments for still water, possible lakes or beaver ponds, and gullies that were probably beaver exit paths or canals, while at Faraday Road gullies were also noted. In fact, at all of these mesolithic sites the marshy valleys, scrub vegetation, side channels, still and flowing water, and occasional disturbance of vegetation and of sediments, on the Kennet as along the Colne, all point to beaver activity. Both adult and young beavers fell prey to the humans; at Thatcham, there were bones from at least six adults, indicating that at least three beaver families were affected, either separate generations of one resident family or the resident family and others taken from further afield.

From northern England in the early Holocene there is a further example of mesolithic humans settling in beaver territory and preying on the local fauna including the beavers, and here too there appear to have been repeated human visits of varying intensity and duration. In this case the beaver territory was along the shores of a lake, and may have extended to one or more of the offshore islands, and the humans appear to have taken over a beaver bank lodge as a convenient platform for waterside activities. As at Thatcham, more than one beaver family suffered losses when the human predators were around, maybe in the course of several visits, with absences allowing the beavers to re-establish their social order. Human activity, like that of the beaver, extended along the lake shore, the two species probably alternating in their use of shore-line heaps of wood, each adding material during their spells of occupation. The beavers brought in mud and stones as well as bits of wood, while the humans contributed wood, antler and animal bone and worked flints. Thus, over the generations and with maybe three to four beaver generations to every human one, the evidence accumulated for several centuries of the early Holocene, to be preserved by waterlogging. In the late 1940s AD, a local amateur found flints exposed in the soils just above the waterlogged zone. Then Grahame Clark, the leading archaeologist of the Mesolithic in Britain, came to excavate, and the site became known to the world as Star Carr (Clark 1954; Mellars/Dark 1998; Conneller/Schadla-Hall 2003). Humans being what they are, the beaver input to the origins and development of the site has on the whole been neglected, although their presence as prey has been recognised.

There is one rather different context where beaver bones have been found in association with human activity, and that is in caves. At Gough's Old Cave in the Mendips, for example, a beaver bone has been dated to the 9th millennium BC (Hedges *et al.* 1987). However, many caves open onto a watercourse, in addition to which beavers frequent cave systems of their own volition, especially those with streams, and they may even make their dens in a cave. It is quite possible, therefore, that the cave finds derive from beavers hunted close by, and some may even represent natural deaths (Coles 2006, fig. 5.3).

Overall, the mesolithic record for beavers is biased towards places of human activity, because that is where archaeologists work, and where most resources for identification and dating are directed, but there are also stray finds of beaver bones dated to the earlier Holocene. They range geographically from Abbotsbury in Dorset, close to the present coastline, to southeastern Scotland where bones have come from Middelstot's Bog, West Morriston Bog and Linton Loch. The Scottish finds date between about 6500 and 5000 cal BC, and represent the first evidence for beavers living in northern Britain, although if they had reached Star Carr by about 9000 cal BC it is likely that they had spread into what is now Scotland within a few centuries at most.

16.2.2 Neolithic

From 4000 cal BC onwards, as farming became established in Britain (see Bayliss *et al.*, this vol; Bradley, this vol.) were beavers at greater or lesser risk of predation by humans? Were there any changes in the ways they were caught and killed? Just asking these questions underlines that we do not as yet know much, from a beaver perspective, about the pre-farming days: how did humans kill beavers in the supposed heyday of hunting, prior to neolithisation? All we have are some of the places and approximate times that the remains of the corpses came to rest. Nor do we have much detail of the uses humans made of their prey, just the occasional hints of cooking or skinning. During the Neolithic, the evidence becomes more diverse, but still leaves plenty of room for speculation (fig. 16.6).

Humans continued to settle in beaver territories, and they continued to prey on beavers. Sometimes, it is the evidence for human and beaver presence in the same waterside territory that is strong, for example from a side channel of the Thames at Dorney, now turned into the Eton Rowing Lake. The co-existence seems to have endured here for more than half a millennium, from the early Neolithic onwards, and in the first decades of human presence it seems people were most active precisely within the main land zone of beaver activity, that is within 50 metres or so of the channel edge (Allen *et al.* 2004). Runnymede, a short distance downstream from Dorney (Needham 1985; Needham/Trott 1987) has also revealed the comings and goings of beavers and humans, as has West Cotton in the Nene valley in Northamptonshire (Harding/Healy in press). At all of these sites, the presence of both beavers and humans is evident, possibly but not necessarily contemporaneous, but with little to show that the humans were hunting the beavers.

A different picture emerges from around the East Anglian Fens, an area that was relatively well-drained earlier in the Holocene, but increasingly marshy and fen-like as sea-level rise caused the inland rivers and streams to back up. Both before and after the spread of fen conditions, there were beavers and humans in the area, but it is from the mid to late Neolithic that predation becomes apparent, from Burwell Fen and Babraham in the southeast and from Barholm in the west. In the nineteenth and early twentieth centuries numerous beaver bones were acquired by the Sedgwick Museum and the Zoology Museum of Cambridge University from the Burwell Fen turbaries, mostly without any detail of context. However, there are hints of possible accumulations of bone, and a couple of instances of skinning and butchery marks, suggesting that perhaps the nineteenth century peat cutters had dug their way through a base camp of prehistoric beaver hunters (Coles 2002). Recent dating of some of the Burwell bones indicates beavers dying in the late 4th to later 3rd millennium BC (Coles 2006, 219). At Babraham, late twentieth century excavations ahead of development revealed human occupation debris from several pits and a hollow, dating to the mid 3rd millennium BC (Hinman 1999, 2001). The animal bone included several beaver teeth and a couple of forelimb bones, as well as bones from other fur-bearers such as marten. The marten appeared to have been skinned and the corpses discarded whereas one beaver at least was apparently chopped up as if for cooking a stew. At Barholm (Simpson 1993), a site similar in character and date to Babraham, there were just two beaver teeth amongst remains of both wild and domestic animals, and here too it is thought the human hunters were after furs as well as meat.

For procurement sites, therefore, the archaeology of the Neolithic is really very similar to that of the Mesolithic, in that we can say humans preyed on beavers, and sometimes that they skinned and cooked them. One difference is that the neolithic humans dug pits and hollows, which subsequently acted as traps for some of the remains of their activities. This has enhanced the archaeological record compared to that of the Mesolithic but probably had little effect on beavers at the time, unless any of the pits were suitable as dens once the humans had gone. Another difference lies in the humans' use of pottery, which required digging for clay, and foraging for fuel; this may have led the humans to interfere more directly than before with a beaver family's organisation of its surroundings, though not to the extent of driving them away. A third difference is a modern one, the tendency of archaeologists to have different expectations of the Mesolithic as compared to the Neolithic, which colours both their research designs and their interpretations. In this respect, Leendert's excavation and publication of sites such as Bergschenhoek, Hardinxveld and Schipluiden have been most valuable, in opening our eyes to the nuances of neolithisation and the possibilities of continuity alongside change (Louwe Kooijmans 1987, 2001; Louwe Kooijmans/Jongste 2006).

However, procurement sites are not the only types of places with evidence for the human exploitation of beavers, and that is perhaps the big development of the Neolithic, that we have a wider range of evidence for how and where humans made use of the beavers they had killed. Before the Neolithic, there is little evidence for humans taking dead beavers away from their kill sites. After 4000 cal BC, there

Figure 16.6 Beaver evidence from Britain, 4000 BC – 2000 BC (for site codes, see Coles 2006, Appendix 1).

is a marked expansion in the diversity of types of site where beaver remains have been found, although the quantities remain on the low side. Away from the procurement sites, beaver remains have been found in long barrows, in causewayed enclosures, in and around henge monuments and at 'one-off' sites, all of which can be termed 'consumption' sites as far as the beavers were concerned.

The examples chosen all come from southern Britain, where beaver evidence as a whole is more abundant than in the north; a reflection of geology, soils and bone preservation, and of the scope and intensity of recent development activity and associated archaeological investigations. It is not a true reflection of the past situation, for we know that beavers occurred as widely in Britain as humans. The gaps in the record for their exploitation by humans, from Wales for example where the first Holocene beaver finds are of Bronze Age date, serve to underline the patchy nature of the archaeological record in general. This question of bias is further discussed, from another angle, by Bradley (this vol.).

At the Coneybury Anomaly, a large pit near Stonehenge with no clear function (hence its name), the lower fills included red deer and roe deer, fish and bones from two young beavers, and at least one more beaver was found in the upper fills (Richards 1990). The site is not far from the River Avon, and the beavers most probably came from there. Further up the Avon valley, at the huge henge monument of Durrington Walls, the excavations of the late 1960s revealed a greater variety of wild animals: red deer, roe deer, wild cattle, and just a few bones each from badger, fox, pine marten and beaver (Wainwright and Longworth 1971). In the early 1990s a few more beaver bones were found in a pit to the north of the henge (Cleal *et al.* 2004). At Silbury Hill, beside the River Kennet and close to the enormous Avebury henge, deposits from the top of the massive mound included bones from a young beaver, and from red deer, fox, hare and frog; these finds are most probably of neolithic date (Whittle 1997). A few minutes walk down the valley from Silbury, at the West Kennet palisaded enclosures (Whittle 1997), one beaver bone was found and a few from red deer and roe deer. The Kennet flows through and around these two enclosures, which may well have been imposed on a beaver territory. At all of these sites, the remains of wild animals could be the debris of daily life and residues of hunting, while some of the smaller animals may have been hunted by children. Nevertheless, there is a close association with major monuments.

Elsewhere, the beaver remains seem to be more deliberately included within monuments, a perception coloured by our understanding of the sites as places to do with death. At Duggleby Howe in East Yorkshire, in the smaller of two graves cut into the ground and subsequently covered by a large mound, an adult human was buried along with various objects including flint arrowheads, a bone pin, 12 tusks from wild pig and two beaver incisors (Mortimer 1892). A token of beaver to associate with the dead person? At Hambledon Hill in Dorset, by contrast, diverse beaver bones have been found in all the major areas of the complex of causewayed enclosures and defences, including the areas with strong mortuary associations, and from early to late in the neolithic use of the hilltop (Mercer/Healy in press).

There are further finds of beaver remains from 'consumption' sites, but not many and none of them occur north of Yorkshire.

16.3 Discussion

Readers may wonder if it really mattered to beavers, that following neolithisation their skeletal remains came to rest in a greater diversity of places than in the Mesolithic, sometimes removed from their natural habitat. I would argue that it did, for the species if not for the individuals concerned, because the more uses humans had for them, the more frequent and intense their predation of beavers became. It is also likely that some of the uses went beyond subsistence exploitation of the corpse. At a number of the sites mentioned, the bones of wild animals are much less common than those from domestic species, and there tends to be just one or two bones from several species, as if each species had a distinct value which did not lie simply in its fur or meat or teeth, or other quantifiable physical property.

Neolithisation involved, amongst other things, a development in subsistence based on domestic plants and animals. However, none of the evidence from these 'consumption' sites relates directly to farming, to the places where domestic animals and crops were tended, nor as far as we know to where they were stored and processed once harvested. This gap in the record may be a reflection of the paucity of neolithic settlement sites known from Britain, and where they are known (principally from mainland Scotland and the Islands) either bone preservation is poor or, in the case of the Orkneys and Shetlands, beavers were not present. The consumption sites are places which archaeologists traditionally associate with ritual and ceremonial and death, places additional to the procurement and settlement sites of daily life and the acquisition of basic necessities. Humans took beavers, albeit most probably dead ones, into these new places, and that is one of the contrasts between the Mesolithic and the Neolithic, that we have evidence for beavers from outside their own habitat.

In both procurement and consumption sites, one element of newness in the Neolithic record for human activities is digging, on a much bigger scale at the consumption sites than the procurement ones, but present at both. And, in contrast to the procurement sites, the digging at consumption sites is accompanied by construction using earth and stone and wood.

From a beaver perspective, humans had begun to imitate some of their own activities, digging pits not unlike their own dens and gully-like ditches and building lodge-like mounds.

One consequence of this development was an increase in the opportunities for preservation of archaeological evidence, both within dug features and under or within mounded earth. If one feature of neolithisation was an enhanced archaeological record, giving an increased chance for activities to become archaeologically visible, it is not so surprising that what we know of the past becomes more varied than for the Mesolithic. But to what extent we are right to assume the variety reflects a more complex life is another matter. Beaver archaeology emphasises how many gaps there can be in our archaeological knowledge, due both to variable preservation of the potential record and to the way archaeologists treat the recovered evidence, as for example with their choices over what to study in detail.

Therefore, to conclude this attempt at a beaver perspective on the changes that took place from Mesolithic to Neolithic, I would suggest that it emphasises two things in particular. Firstly, it highlights some of the ways in which changes in past human behaviour can influence the whole of the potential archaeological record, beyond the aspects directly related to the new behaviour. Secondly, rather than the traditional themes of changes in settlement or material culture or subsistence, the beaver perspective identifies digging and building as the major change in human activity following neolithisation; what is more, the relevant earth-moving was not in the context of farming. It was the veritable explosion of digging and building by humans in the Neolithic that led to the significant enhancement of the potential archaeological record, which leads us now to interpret the Neolithic as a more complex period than the Mesolithic. This may be valid in terms of enduring physical manifestations, but not necessarily so in terms of the conceptual lives of humans.

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17 Exotic flint and the negotiation of a new identity in the 'margins' of the agricultural world: the case of the Rhine-Meuse delta

Annelou van Gijn

17.1 Introduction

In the late 1980s microwear studies of flint tools were abandoned in most European countries (with the notable exception of France and Spain), due to a critical article by a renowned archaeologist (Newcomer *et al.* 1986). In Leiden however such studies were further pursued and it was possible to consolidate a laboratory for use-wear and residue studies that, as one of the few, has a permanent post attached to it. This was largely due to Leendert's continued commitment to this field of expertise, a field he believed could contribute to his quest for a better understanding of the occupation of the Rhine/Meuse delta and the neolithisation process in this 'marginal' area. Through the years use-wear studies formed part of all of Leendert's field research, including the large wetland excavations of Hardinxveld and Schipluiden. In the early years research was almost solely geared towards solving questions regarding the activities that took place at a site. As a consequence, such studies, in their attempt to contribute to questions regarding subsistence base, the detection of activity centres and so forth (Van Gijn 1990), were almost another ecological approach. However, use-wear and residue studies can contribute in rather unexpected ways to more elusive issues as well, like 'ideology' or 'identity', areas which Leendert had not anticipated when he first supported and endorsed this methodology. In this paper I would like to illustrate this by means of a small example of specific tool use deriving from the Neolithic sites of Brandwijk and Schipluiden, two sites that are instrumental in our understanding of the gradual 'going over' (Whittle/ Cummings 2007) of the wetlands from a hunting-gathering-fishing existence, via an extended broad-spectrum economy (Louwe Kooijmans 1993) to a predominantly agricultural way of life.

This gradual adoption of a new way of life, and hence the negotiation of a new identity, is also reflected in the way simple flint tools are used and treated. Flint is often seen as a mundane material, forming the predominant raw material for the production of much of the everyday tool repertoire of Stone Age societies. Obviously, a social or ideological significance has long been accepted for flint objects that are either very large, rare or beautifully made. It is however much less obvious that also inconspicuous flint implements, found in settlements and contributing to everyday tasks, have a social significance and may give us a clue about past identities. Usually this significance cannot be deduced from morphology and tool type alone. Additional data from the use-wear traces visible on them are crucial: it is 'the hidden choices of tool use' so to speak that tell us about the technological choices made and the significance attributed to flint objects. In other words, simple flint tools have materiality too and contribute to the construction and perpetuation of the *habitus* and they are likely to be reflective of long term traditions.

17.2 The 'specialness' of flint objects

Due to the pioneering work of for instance Lemonnier, there is a growing awareness that tools, being part of a technological system, are imbued with cultural and social values (Lemonnier 1986). Objects thus form an integral part of social life. Not only do they symbolize the social and cultural identity of their makers, they also, through their role in daily life, structure and reinforce relationships between different actors or between these actors and their ancestors. This is no different for objects made of flint, however mundane such objects may seem. The introduction of the concept of a tool's biography (Kopytoff 1990) further contributed towards a different way of studying objects. Use-wear and residue studies of tools can play a key role in reconstructing and understanding this biography: it allows an interpretation of the uses to which an object is put, and the treatments it has undergone during its life and deposition or discard. Such inferences can be related to the raw material chosen to make the object with (differences in the way exotic and local raw materials were used) and the amount of skills and knowledge invested in its production (a skilfully made dagger versus a simple unretouched flake). For example, some flint objects are not used at all, and, for that matter, were never meant to be used, like the TRB axes made of non-local Scandinavian flint (Wentink 2006), or they 'lived a very special life' like the daggers of the Late Neolithic and Bronze Age (Van Gijn in press a).

Flint has several inherent properties that cause it to be less insignificant than we tend to think. First of all, it can appeal to our senses: it has a colour, sometimes a mottled appearance of contrasting hues. Colour is a feature that many archaeologists, shaped as we are by black and white photographs and line drawings, tend to overlook. Recently, colour has been included in archaeological discourse, producing some striking examples of the special significance of the colour of stone for prehistoric peoples (Cooney 2002; Jones/MacGregor 2002). Flint also has a texture that can be felt and experienced. The translucency of flint is also likely to be a feature that added to its attractiveness. Flint may also have appealed to our auditory senses: it produces a nice ringing sound when knapped and everybody who ever attended a 'knap-in' (Whittaker 2004) knows the characteristic sound of flakes dropping on top of each other. It can well be imagined that such knapping sessions were undertaken not for the production of usable end-products or for learning how to knap, but for the very experience of knapping in a ritual or festive context. Another physical property of flint is its capacity to make fire when flakes of flint are struck against each other: flint is thus linked to an element that is highly significant in domestic and ritual context.

Flint also signals its origin. Because of the characteristic colours and textures it is often clear to any knowledgeable observer where the material derives from. It is certainly apparent when a flint material comes from afar: the honey-coloured flint from Grand-Pressigny in Central France is a good example. Although flakes with cortex on them are often interpreted as a sign of raw material shortage, the presence of cortex may also contribute to conveying information about the origin of the piece of flint: Rijckholt flint with chalky cortex simply had to originate from the south-eastern parts of the Netherlands and could not have been obtained from the gravel beds or terraces along the rivers (then the cortex would be rolled and hard). Exotic flint can thus make reference to places far removed from the daily interaction sphere. This may also include allusions to the world of the mythical ancestors or to the spirits, a realm that is just as unreachable (and thus potentially threatening) as places that are spatially remote (Helms 1988). The same pertains to flint objects in which much knowledge and expertise is invested: the know-how of a skilled craftsperson is often perceived as being bestowed by the ancestral spirits (Helms 1993). Flint objects in which a lot of skills are invested and which are made of exotic raw material, are thus likely to have a special meaning extending beyond the daily domestic sphere of local communities. Such objects are often easily recognizable by a larger audience and can be considered as inalienable goods, materializing collective values.

A last important property of flint is its longevity. Stone is less likely to deteriorate and has a permanency beyond most other materials that 'things' can be made of such as plant fibres and bone. It can thus be inscribed with symbolic information, linking the past and the present and the present to the future. Flint tools, as inalienable objects, can therefore have a life of their own and can play a role in negotiating social relationships and processes of change. One such important process is the gradual incorporation of a new way of life by the inhabitants of the wetlands of the Rhine-Meuse delta.

17.3 Context

Around 5300 cal BC the first Bandkeramik farmers settled in the south-eastern part of the present-day Netherlands, whereas the northern and western areas remained settled by hunter-fisher-gatherers (Van Gijn/Louwe Kooijmans 2005). The distribution of LBK adzes indicates that some sort of exchange occurred between the two groups from the very start, although these implements have not been found in wetland context so far (Verhart 2000). The large nodule of Rijckholt flint and the LBK point found at the late Mesolithic site of Hardinxveld-Polderweg phase 1 (*c.* 5500-5300 cal BC) suggest that both groups must at least have been aware of each others existence. The character and intensity of their interaction is difficult to ascertain and will depend on the actual mechanism (exchange, actual mobility) by which these objects reached the wetlands (Vanmontfort, this volume; Louwe Kooijmans/Verhart 2007). Certainly interaction continued in subsequent periods and even seems to intensify, considering the distribution of the Rössener *Breitkeile* (Verhart 2000). In the western wetlands such evidence for contact is however scarcer (Vanmontfort, this volume).

It is not until the start of the Michelsberg period, around 4200 cal BC, that the neolithisation process in the wetlands really takes shape. Excavations at Hardinxveld-Polderweg and De Bruin have shown that the use of pottery and the keeping of livestock date to a much earlier time, (testified respectively at Hardinxveld-De Bruin phase 2 (5100-4800 cal BC) and phase 3 (4700-4450 cal BC) (Louwe Kooijmans 2001), but cereals are prominently absent. Also, the old traditions of hunting, fishing and gathering persisted. The first occurrence of cereals in these wetlands dates to *c.* 4200 cal BC, although recent data suggest that this date may have to be pushed back and it is still a matter of debate whether or not they were locally cultivated (Out, this volume). It is clear however that the Middle Neolithic A (4200-3400 cal BC) is the period during which the gradual neolithisation process, started in the preceding Early Neolithic B, is consolidated in the Rhine-Meuse delta. It is during this time that the inhabitants, under the influence of the Michelsberg culture, gradually change their life-style, but fishing and gathering continue to be very important in their subsistence pattern (Louwe Kooijmans 2006) and their technology continues to display 'Mesolithic' features (Van Gijn 2006a).

The two sites discussed in this paper date to the period of this gradual adoption of a new way of life by the wetland inhabitants. The site of Brandwijk has produced a series of strata, the earliest of which, Layer 30, dates to 4610-4450 cal BC (the Early Neolithic B). However, in this paper I will concentrate on the finds from Layer 50 (top and base) with dates from 4220-3940 cal BC (Swifterbant culture, Middle Neolithic A) (Raemaekers 1999). The later site of Schipluiden, also dated to the Middle Neolithic A and belonging to the Hazendonk culture, was continuously occupied from 3650-3400 cal BC (Louwe Kooijmans/Jongste 2006).

17.4 Brandwijk

The site of Brandwijk is situated to the east of Rotterdam in an old riverine landscape and has been attributed to the southern group of the Swifterbant culture (Van Gijn/Verbruggen 1991; Raemaekers 1999). This a period for which we assume a subsistence pattern that has been labeled as extended broad spectrum: hunting, fishing and gathering, and domesticated animals with no or only very limited access to cereals. The excavation of the site encompassed the slope of the river dune and revealed a stratified series of refuse layers in the lower part of the slope and mostly colluvial sediments further up. The top of the dune has not been investigated so we know nothing of possible traces of habitation.

The flint industry of Layer 50 is characterized by the use of small rounded pebbles from which flakes and the incidental blade-like flake were struck. Many of these flakes still display cortex, indicating that the nodules were of limited size (fig. 17.1). Where exactly this flint could be obtained is not clear, but it resembles the material constituting the majority at the earlier sites of Hardinxveld-Giessendam (Van Gijn *et al.* 2001a; Van Gijn *et al.* 2001b) and the later site of Schipluiden (Van Gijn *et al.* 2006). Use-wear analysis of these implements shows that the flakes were predominantly used for scraping silicious plants, most likely reeds (fig. 17.1). A substantial amount of waste from the so-called metapodium production (Van Gijn 1990) has also been found here, as well as a number of bone awls, made with this technique. It is thus clear that bone tool production was performed locally, an inference supported by the fact that several flakes from local flint displayed traces from contact with bone. The bone awls were also studied microscopically and were used on plants, most likely grasses or reeds. Along with the flint flakes with transverse traces from scraping silicious plants, it is safe to conclude that the occupants of this location spent time making baskets and wickerwork.

In addition to the local flint technology we also found a number of tools made of mined Rijckholt flint (fig. 17.2). It concerns characteristic macrolithic Michelsberg tools such as large pointed blades, end-scrapers and triangular points. No production waste of these exotic flints was found so they must have been brought to the site as finished products. They are also substantially larger than the tools made of local flint. Remarkably many of these import tools displayed traces of

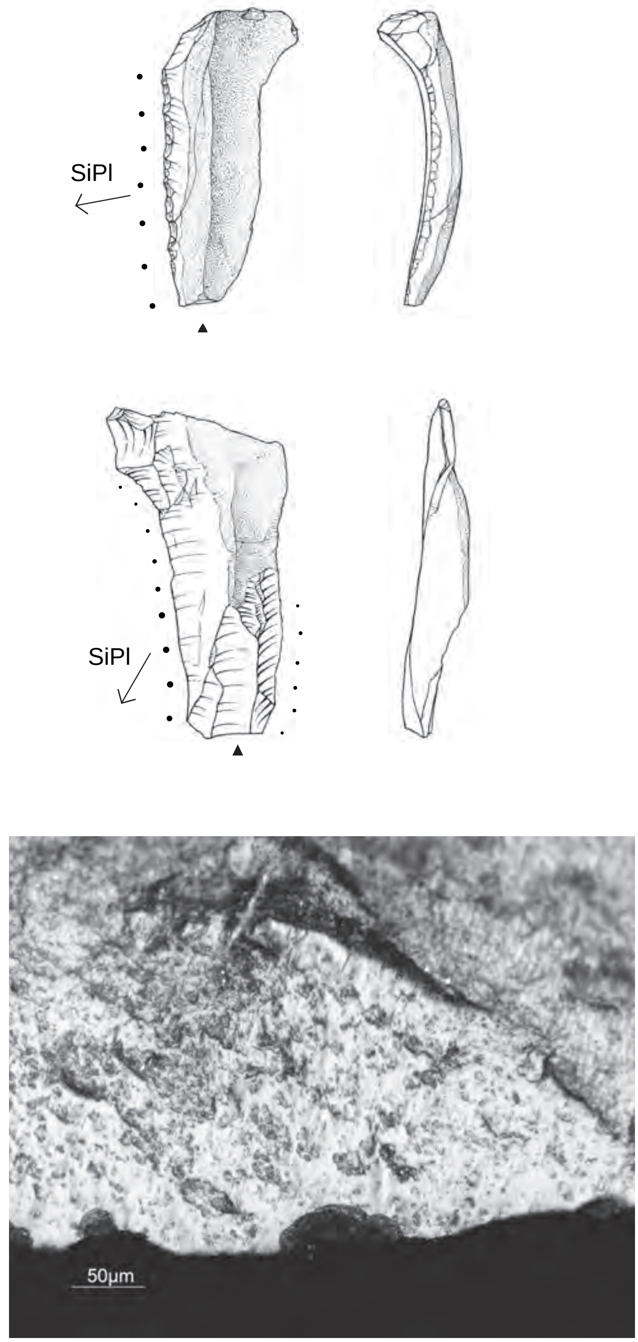


Figure 17.1 Brandwijk: tools of local flint (scale 1:1) (drawing C. Dijkstra), displaying traces from scraping silicious plants like *Phragmites* (original magnification 200×).

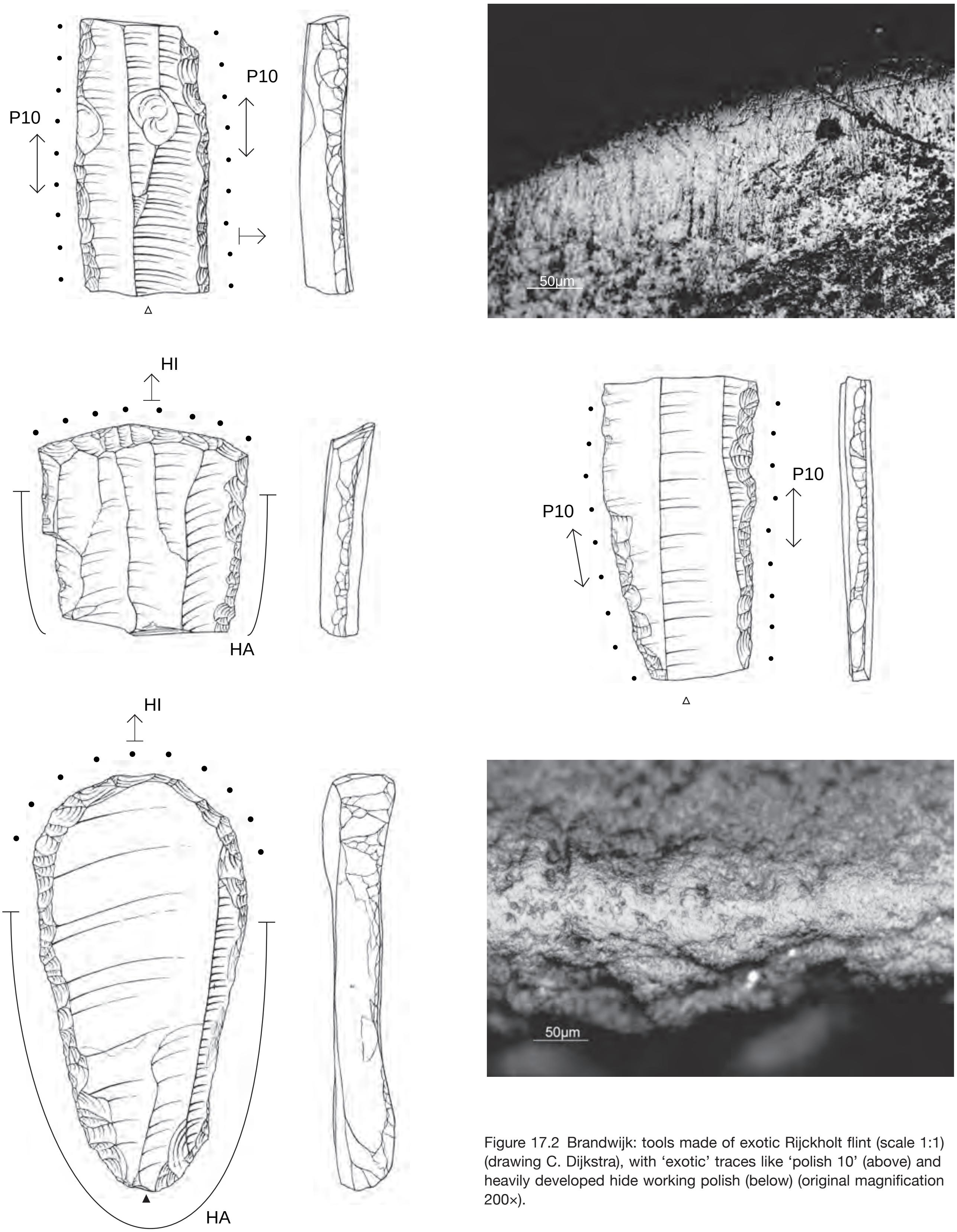


Figure 17.2 Brandwijk: tools made of exotic Rijckholt flint (scale 1:1) (drawing C. Dijkstra), with 'exotic' traces like 'polish 10' (above) and heavily developed hide working polish (below) (original magnification 200×).

use that are normally only found on tools in the loess zones and the Pleistocene uplands. This includes 'polish 10', a type of polish that displays attributes that resemble both hide and plant-working traces (fig. 17.2, above). This type of polish was first established for the Michelsberg site of Maastricht-Klinkers (Schreurs 1992), but has also been found on LBK artefacts (Verbaas/Van Gijn 2007b). Another tool, a large scraper, was probably heavily used for hide processing (fig. 17.2, below). The kind of hide-working traces suggests that it concerns the processing and currying stage of the hide working process, something we rarely see in coastal assemblages.

Because these 'exotic' traces only occur on the import material and because the tools do not seem to have been re-sharpened or used subsequently, it seems that the Rijckholt tools were brought to the delta in already used form. It is remarkable that no attempt was made to modify in any way these exotic implements. There is no evidence that they were put to some other secondary use once they arrived in the wetlands. Their functional life had occurred in their place of origin in the south-eastern part of the present-day Netherlands. Why had the inhabitants of Brandwijk not used these very usable tools for their own purposes, tools that (at least from our point of view) were much more apt for all kinds of tasks than the 'crappy little flakes' made of the locally available nodules?

I would argue that these tools of Michelsberg signature were not imported as used tools to *use*, they were imported as used tools to *keep*. The fact that these tools had a use-life before they were exchanged in it self may have had a significance. They probably were the possession of either a person or a specific group in their south- eastern place of origin. As such these tools can be seen as exchange items commensurable with their previous owners or users. The tools had already acquired a history that was relevant to the inhabitants of the wetlands: they link the occupants of the wetlands with the users of these tools in Michelsberg territory. The fact that the objects were preserved in the state in which they were received indicates that it was not so much the practical properties of the tools that were of concern to their recipients in the wetlands, but their value as exchange items. It seems like the inhabitants of the Brandwijk site wanted to affiliate or associate themselves with the agriculturalists of the Michelsberg culture. These stones were a token of this affiliation, but did not form part of the actual technological system of the wetland inhabitants.

17.5 Schipluiden

Around 3700 cal BC the wetlands were settled by people with pottery of the Hazendonk culture. We find a number of their sites in the well-researched microregion of Delfland, situated close to the present-day town of The Hague. Here three sites have been extensively excavated during the last 15 years: Ypenburg, Wateringen 4 and Schipluiden (Raemaekers *et al.* 1997; Koot /Van der Have 2001; Louwe Kooijmans/Jongste 2006), but additional traces of habitation from this period are present throughout this area (fig. 17.3).

The flint assemblage shows a similar pattern as the material from Brandwijk. At Schipluiden the majority of the flint artefacts were made on relatively small rounded pebbles, with occasional evidence for the use of a bipolar reduction strategy (Van Gijn *et al.* 2006, fig. 7.5). The same was observed for Wateringen 4 (Van Gijn 1997). Again, it is not entirely clear where these small nodules could be obtained but it must have been relatively close by. Just like in the preceding period we see, in addition to the local technology, the import of macrolithic tools of southern flint. This flint derived from various sources, such as Rijckholt/Spiennes (these two are difficult to distinguish), Obourg and sources in the Hesbaye in Belgium (Van Gijn *et al.* 2006, fig. 7.3). These imported flint implements have a very clear Michelsberg signature and include triangular and leaf-shaped points, pointed blades and pointed scrapers. In contrast with the earlier site of Brandwijk, these exotic tools seem to have been imported in unused state, probably largely as finished implements. However, the presence of waste flakes and

Figure 17.3 Retouched flake of southern mottled flint deriving from a test trench at Rijswijk A4 (scale 1:1). This tool was clearly curated, with several used zones along the edges and evidence for intermittent re-sharpening (photograph J. Pauptit).

an incidental core of exotic flint indicates that exotic flint was also knapped on the Schipluiden dune (Van Gijn *et al.* 2006, table 7.2).

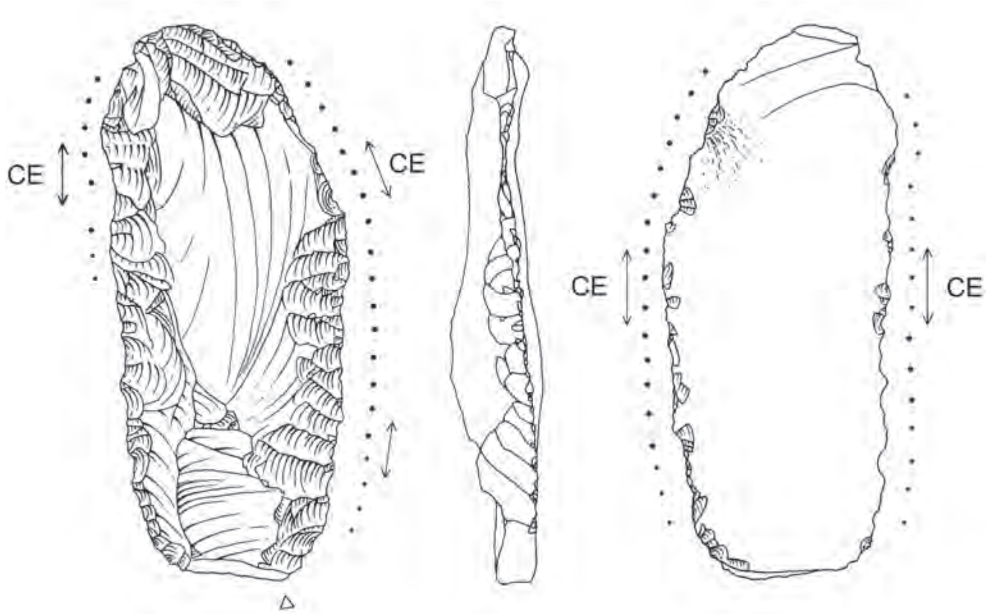
Use-wear analysis of the material from Schipluiden shows that the locally produced tools were used for a variety of tasks, including woodworking, plant cutting and cutting unidentified soft materials. In contrast, the exotic tools are all heavily used and frequently display traces of rejuvenation, although they are rarely exhausted (fig. 17.3). Remarkably enough however, they seem to have been selected for carrying out 'special activities' like the production of ornaments, making fire and harvesting cereals (Van Gijn *et al.* 2006). These three activities are labelled as 'special' because we have evidence for them to be so, either because of their special find context, or because of the treatment the tools have undergone before deposition.

Ornament making can be considered as special because beads and pendants constituted the predominant burial gift at the cemetery of Ypenburg (Koot/Van der Have 2001; Van Gijn in press b). In Schipluiden only one child burial contained ornaments: two unworn beads made of bird bone (Van Gijn 2006b). At this site we have found products from the complete production sequence of the making of jet ornaments, from unworked blocks of jet, to a beautifully polished bead (fig. 17.4). Four flint implements displayed traces resembling experimental jet-working traces. All four tools were made on exotic Belgian flint, the large reamer made of very mottled material being the most evocative example (fig. 17.4, below left).

Figure 17.4 Schipluiden: toolkit for producing jet ornaments containing a large reamer of mottled southern flint, a retouched knife used for cutting jet and several small borers (photograph B. Grishaver).

Another special activity is the making of fire. A large number of strike-a-lights was encountered at Schipluiden, many of which were made on exotic flint. The special significance of this type of tool is indicated by their presence in a remarkable grave found within the settlement area of Schipluiden. Grave 2 contained the skeleton of a 46-49 year old man, buried on his side with his legs flexed tightly to his body. In his hands, which were positioned in front of his face, he held three strike-a-lights and a nodule of pyrite (Louwe Kooijmans/Smits 2006; Van Gijn *et al.* 2006; Van Gijn/Houkes 2006), evoking the image of someone blowing a spark. This individual was given such a deviant burial ritual compared to other burials at this site and at the nearby cemetery of Ypenburg, that he must be interpreted as a person with a special role or position in society. Considering the presence of a fire-making tool kit in his hand, he may have been a religious specialist, maybe akin to present-day shamans. However, it should be noted that the strike-a-lights in the grave did not differ from the large number of such items found in the settlement: they displayed no evidence for special treatments. They were however, rather small compared to many other such tools, suggesting that it may concern personal items with a long use-life behind them. In the context of this paper it is also significant to note that this particular type of burial also occurs in LBK context, at the Aldenhovener-Platte and in Bavaria (Nieszery 1992). This further underlines the predilection of the Hazendonk people versus southern contacts.

The last 'special' activity exotic flint was involved in, is cereal harvesting (fig. 17.5). Only a handful of such tools have been found at Schipluiden, and the same pertains to Ypenburg (Van Gijn/Verbaas in press). The special significance of cereal harvesting is indicated by the evidence that implements involved in this activity seem to have undergone a very special treatment prior to their deposition: after their use as harvesting tool, the sickles were burned. Subsequently, their functional edges were damaged by intentional flaking. Last, the edges of some sickles were rubbed with an unknown red substance. Unfortunately we have long dismissed burned flint as being unsuitable for use-wear analysis, so we may have missed many more such examples. The intentional fracturing of objects usually has a ritual significance (Chapman 2000) and may be related to the wish to 'kill' an object that constitutes a danger for the community. In the case of the Hazendonk inhabitants of the dunes of Schipluiden and Ypenburg this wish may be related to the fact that these harvesting tools were involved in an activity that may still be circumspect to some extent: in order to harvest, the natural vegetation first had to be destroyed. It is these natural surroundings that still provided much of the food sources and raw materials needed to survive and which may also have been the residing place of spirits and



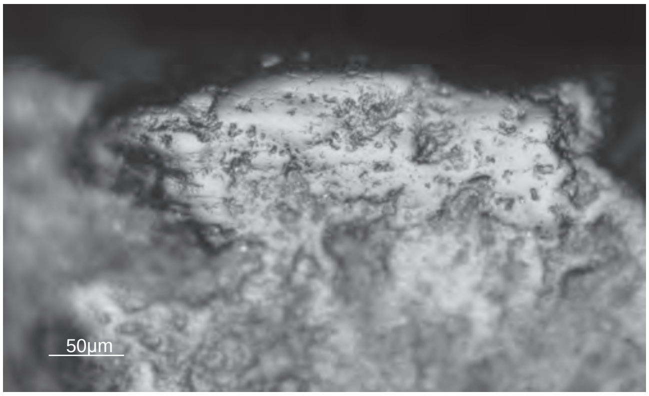


Figure 17.5 Schipluiden: cereal harvesting tool made of exotic flint and use-wear traces observed (original magnification 200×) (drawing R. Timmermans).

ancestors. Returning these harvesting tools to nature by ritually killing them, may be seen as a way to appease the ancestral spirits. This particular life cycle of harvesting tools indicates that they were surrounded by rituals and had a special significance to the society. We can observe a similar attitude to agricultural tools, notably the querns, in the LBK culture (Verbaas/Van Gijn 2007a).

The macrolithic Michelsberg tools were thus treated in a special way by the Hazendonk inhabitants of the wetlands. They were specifically selected for three activities that probably had a special significance to the past society. The tools were used intensively and displayed evidence for re-sharpening. It is important to note that they did not display traces that could be considered 'foreign': they had not been used previously for typical inland or 'Michelsberg' activities like hide scraping or the task responsible for the occurrence of 'polish 10'. Instead, they played a crucial role in activities that were highly important in the social fabric of the Hazendonk agents. These exotic tools thus formed an integral part of the technological system of the Hazendonk inhabitants of the wetlands.

17.6 Conclusion

Exotic flint tools of Michelsberg signature appear in the wetlands around 4200 cal BC. They reflect the continued exchange contacts between the inhabitants of the wetlands and the agricultural communities in the uplands, contacts that probably date to the first colonization of the loess areas by LBK farmers. There is however a substantial difference in the way these exotic tools were treated between the earlier and the later phases of the Middle Neolithic A, represented by the sites of Brandwijk Layer 50, attributed to the Swifterbant culture, and Schipluiden (Hazendonk culture). The earlier, Swifterbant occupants of the wetlands obtained the macrolithic exotic tools as used objects. The objects were previously used for tasks that were typical for the uplands such as heavy hide processing and the activity responsible for the development of 'polish 10' (Van Gijn 1998). Such traces were prominently absent on the flint tools of local origin. The latter functioned in plant processing and bone tool manufacture. It is remarkable that the high quality exotic flint tools were not used in the wetlands (at least we see no evidence for this) and were also not re-sharpened. They were kept separate from the local technological system. It was argued above that the Swifterbant people kept this exotic flint as tokens of their affiliation or allegiance with the Michelsberg influence sphere.

The later Hazendonk agents also obtained exotic macrolithic tools from the south. Yet, they apparently no longer just kept Michelsberg implements as a gift or token of their allegiance to the larger Michelsberg identity sphere, but actually appropriated these implements and gave them a place in their own technological system. It is highly significant that they used these foreign tools for a very new activity like cereal harvesting and not for just any task. Other activities the imported tools were used for were fire making and the production of ornaments. These exotic tools evidently had a special status, to be used for activities that were ideologically significant. This indicates a change in attitude towards the Michelsberg farmers in the southeast: one from an affiliation with, to the appropriation of, a new identity. Flint constituted an important means of negotiating this new identity. To us as archaeological observers the use of exotic flint may thus be seen as reflective of the extent to which the neolithisation process had affected these wetland communities.

Hence, flint tools, even inconspicuous settlement material, played a role in the expression, negotiation and construction of a new identity. Because it can be obtained from afar, can easily be transported and is highly recognizable as exotic and thus special, it played an important role in symbolizing the long-distance networks of local groups. Flint is thus one of the materials that brought together communities from far and wide and was used to represent and structure the social relationships between these widely separated communities.

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18 Engaging with stone: making the Neolithic in Ireland and Western Britain

Gabriel Cooney

18.1 Introduction

"There is no 'Neolithic culture' but a limitless multitude of Neolithic cultures" wrote Gordon Childe in *What Happened in History* (1942, 62) and recent discussions of Neolithic material culture in different parts of Europe and the Near East have emphasised this diversity. Indeed as Louwe Kooijmans (2000, 328-9) has commented there were at least six major culture spheres in the European Neolithic world. The concept embraces widely different societies with only a few things in common, such as agriculture and stone axe technology. At the same time however there has been recognition that it may be useful to think in terms of a number of 'focal material resources' (Boivin 2004a, 67) utilised by Neolithic societies. Such resources would have been critically important in establishing and sustaining the particular character of different Neolithic cultural spheres. As Boivin (2004a, 65, 69) points out the physical properties of materials influence the way in which they are used socially and symbolically. Focal resources facilitate people to do things in new ways and simultanously may constrain social action towards particular directions and thus contribute to different ways of engaging with and inhabiting the world.

The central theme of this paper is that in Ireland and western Britain, and more widely in the Atlantic cultural sphere of the European Neolithic, stone was such a focal material resource. If we think of the way in which the Neolithic was realised as a particular series of engagements between people and their material world (*e.g.* Renfrew 2007, 120-1), then the argument here is that stone was central to the process of that engagement in this particular geographical area and that it played a key role in what makes this expression of the Neolithic culturally distinctive. Discussion of the multiple, varied ways and scales in and at which stone was used offers us an opportunity to understand the material world of Neolithic societies.

18.2 Materialization and stone

It might be useful to say something firstly about the materiality of the Neolithic world. As DeMarrais *et al.* (1996, 16) put it materialization of culture can be seen as:

"The transformation of ideas, values, stories, myths and the like into a physical reality that can take the form of ceremonial events, symbolic objects, monuments and writing…speaking of materialisation we emphasise the ongoing process of creation and do not assume the primacy of ldeas. In fact, ideas and norms are encapsulted as much in their practice and in the conditions of daily life as in individuals' minds. To materialize culture is to participate in the active, ongoing process of creating and negotiating meaning."

In a later paper DeMarrais (2004, 20) commented that: "The materiality of the world of things and settings plays a key role in generating *habitus*, producing the embodied dispositions that allow spontaneity and creativity but also orient agency along the lines of a collective logic embedded in history and precedent."

The reason for dwelling on materialization is because it emphasises the active interplay between people and the material world. They act on it, change it and those changes in turn affect how they act in the future (Wolf 1999, 288-9).

In this engagement stone is important for a number of reasons. Firstly it survives very well and abundantly in the archaeological record, of which it forms the most durable component (*e.g.* Hurcombe 2007, 146). More critically the permanency of stone materials that facilitates the long survival of stone artifacts is also the reason why it has such a critical role in materialization. The enduring character of stone allows for the construction of meanings and symbolism that can have stability and a persisting relationship with the past, but also facilitates it being open to inscription with new meanings over time, as the past is re-read for the present (Bradley 2002; Earle 2004, 154). As the Scottish poet Hugh MacDiarmid (1994, 180) recognised in his poem *On a Raised Beach*: "There are plenty of ruined buildings in the world but no ruined stones."

Secondly I would argue that in approaching the use of stone in prehistoric societies we need to move away from our ingrained view of stone as neutral and inert but rather to see it as animate, alive, with potential power and sacredness (*e.g.* Taçon 1991; Boivin 2004b, 4). The permanence that it carried may have spoken of a persisting relationship with the ancestoral forces who guided life in the present (Helms 2004, 124). Stone embodies the enduring and the incorporal (*e.g.* Tilley 1996, 323). Stone objects could come to resemble the ancestors in having histories that could be recounted, stretching back over many human generations and with the potential to actively intervene in the present (*e.g.* Kahn 1996, 180).

Thirdly in terms of potential utilisation, the sheer variety and diversity of rock types, lithologies, texture, colour and physical characteristics meant that there was enormous potential for stone to be worked and used in a very wide range of ways and contexts. This would have increased the symbolic potential of particular objects. They could be seen and placed in comparison with other stone materials; the local could be compared with the exotic, white with dark, large with small and so on, comparisions that would have enhanced the importance of stone in the material world (*e.g.* Cooney 2002).

It is clear from any examination of the material world of the Neolithic that stone was rarely used in isolation. Objects in other media such as antler and bone were used in the process of producing stone artifacts. Stone artifacts were used in combination with other materials, notably handles, for example stone axeheads in wooden axe hafts and of course stone was used to work a variety of other materials. Indeed it might be argued that rather than looking at stone in isolation a broader definition would incorporate other durable materials that share some of the properties of stone. Hence they could be seen as possessing some of the same life energies, which in traditional knowledge systems all things of the earth have (Helms 2004, 124). Evans (2003, 71) saw soil and land texture as the critical point of interplay between people and the land. He suggested that different textures, in sand, clay, rock and vegetation were understood not just in terms of their functional attributes but also as a means of communicating knowledge.

Recently Boivin and Owoc (2004) have edited an important volume which recognises the breath and significance of the materiality of the mineral world but focuses (for practical and methodological reasons) on stone and sediments, while recognising other important aspects of the mineral world, such as water and metal. This approach allows Boivin (2004b) to draw comparisons and contrasts between stone and other materials. For example, it seems to be widely recognised that shell and stone are related. Both are frequently regarded as referring in their hardness and durability to bone, to people and to the notion of material as being or containing a genealogical presence (Battaglia 1990, 134; Weiner 1992, 60). By contrast clay and earth are seen as an animate, sacred, all-encompassing creative force. In terms of personification the identification of earth as female is also common (see discussion in Boivin 2004b, 5). It is tempting to move easily from this to categorise different aspects of the material world as being engendered; for example, axes from stone being male-related; pots from clay being female-related. But signification in cultural worlds and practices is of course much more complicated in reality and context and complementarity are vital. For example, Taçon (1991, 204-5; Taçon 2004) relates how in Aboriginal belief and practice in Western Arnhem Land the placing of ochre pigment from the earth onto rock to create what we call rock art makes a very powerful image for Aboriginal people; mixing male and female symbols and radiating with ancestral power. However, by contrast in hunting male and female-related materials have to be kept apart to ensure success.

Another way of approaching the study of the material world is to think of the contrasts in permanency, power and impact that different objects and constructions had. In relation to artifacts reference is often made to Weiner's work (1985; 1992) and her distinction of alienable and inalienable. Alienable objects are those made in everyday contexts, produced and exchanged by most people of suitable age and gender. By contrast inalienable objects tend to be rare, often of unusual material and produced by specialists and to be associated with an individual. Their distinctive character facilitates recognition and the recall of their place of origin, production and events they were associated with (see discussion in Wentink 2006, 78-85). They may have a key role to play as objects of prestige and social power. However, it may be hard to draw a hard and fast boundary between these categories as we know from archaeological contexts that simple, sometimes unmodified objects can be placed in special contexts, for example with the dead. Ethnograpically it has been shown (*e.g.* Hampton 1999, 199) that a simple object, such as a naturally rounded pebble, can have sacred and social power.

As with our interpretations of artifacts, approaches to the built material world sometimes tend to differentiate between the ceremonial, monumental world and the everday domestic world (see discussion in Bradley 2005, chapter 1). It is important to emphasise however that it is the *changing relationships* between these different materials and contexts linked by human action that provides particular, lived social and cultural worlds. I want to explore below how can this help us understand the particular importance of stone in the Neolithic of Ireland and western Britain.

18.3 An explosion in material expression and the role of focal material resources

A long time ago Gordon Childe (1942, 50) recognised "how enormously Neolithic equipment was richer than that of any Palaeolithic or Mesolithic savagery". Now this terminology is very outdated and we recognise how complex the material world of prehistoric hunter-gatherers could be. However, what Childe did capture in his discussion of what he called 'Neolithic barbarism' was the inter-related character of change in the material world with a new attitude to the landscape and environment and the social and economic changes that this brought about. In a key paper that sparked much subsequent discussion Colin Renfrew (2001) talked about what he called 'the sapient paradox'. The paradox is that the major elaboration of material culture happens not with the emergence of *Homo sapiens* 150,000 years ago in Africa or the first apperance of *Homo sapiens* 40,000 years ago in Europe, but much later, with what Renfrew (2007, 82-4) refers to as the sedentary revolution in western Asia and Europe which was often accompanied by early farming. "It was then that humans entered int o a series of new relationships with their material world. It was then that they built houses, fashioned images of deities and constructed shrines. As we know, they soon came to build tombs and monuments." (Renfrew 2003, 115).

What Renfrew argued was that this allows an elaboration of Donald's (1991) scheme of human cognitive revolution by recognising the importance of what he (Renfrew 2003, 116) termed the *material-symbolic* stage. This was when materials were utilised to develop a store of knowledge outside the human brain – or external symbolic storage. The thesis is that sedentism paved the way for new forms of engagement between humans and the material world. This built shared understandings or *institutional facts* which worked in practice through material symbols (Renfrew 2007, 120-6).

There are shortcomings to the model. For example, it underplays both the very active symbolic role of artefacts in the engagement of hunter-gatherers with the world and the ways in which the transition to new processes and activities actually happened, considering the complex and varied relationships between sedentism and farming across Europe and in Britain and Ireland (*e.g.* Whittle/Cummings 2007). However, a key point about the changes highlighted by Renfrew is that they were worked through by oral societies. As Ong (2002, 8-9) has pointed out oral societies have a very different way of managing knowledge and verbalisation compared to written modes of expression. Writing allows us to structure knowledge at a distance from lived experience, but in oral cultures knowledge is conceptualised with reference to the world of actions, things and the senses (Ong 2002, 42). Hence the critical role of the material world. It both embodied knowledge and was the key reference point in communicating and passing on knowledge.

Renfrew' s thesis about the impact of sedentism concurs with the views of Hodder (1990), Cauvin (2000) and Watkins (2004) and others on the changes in society in the Near East at the start of the Neolithic. It also acknowledges the impact of Wilson's (1988) work for our understanding of the consequences of sedentism for the human species. Others, such as Bradley (2004, 107), have situated the explosion in material symbolic culture in the changed relationships between people, animals, plant and land as a result of domestication. Gamble (2007, 272-4) eschews the term 'revolution' in relation to the impact of agriculture and sedentism. Rather than giving rise to the modern mind or society he situates their impact in terms of the much longer-term development of human identity (Gamble 2007, 230). Humans made and reproduced identities by bringing 'sets and nets' of materials into association through the processes of accumulation and enchainment and the acts of fragmentation and consumption.

At the same time Gamble does recognise the changes brought by sedentism and agriculture in prompting new institutions and architecture and in particular new processes and contexts in which children grew up and social knowledge was passed on (Gamble 2007, 257-8). Writing about northern Europe Bradley (2004, 113) suggests that while Mesolithic societies participated in and were integrated into the natural world, 'the giving environment' as Gamble has phrased it (2007, 78; after Bird-David 1992, 29-30), Neolithic communities acted on it, distancing humans from animals, bringing about notions of ownership, property, a new sense of time and new sets of social practices (but see discussion in Ingold 2000, chapters 3-5; Whittle 2003, 80-1). For Bradley (2004, 110) the key elements of the Neolithic use of material cultures are complexity, abundance and longevity.

This brings us back to the concept of 'focal material resources' introduced above. Boivin (2004a, 67) suggests that soil (or clay) was such a focal material resource in the eastern Mediterranean region (southeast Europe and the Near East) during the Neolithic. The malleability and use of clay not only facilitated an increase in the number and range of objects, portable and fixed that could be made from it, but also created a more complex, bounded and compartmentalised social world in the form of houses, rooms, furniture, storage containers, pots and figures (*e.g.* Kuijt 2000). This central role of soil and clay and the adoption of a sedentary lifestyle involved mutually reinforcing practices rather than any one preceding the other. Bailey (2000, 113) has argued that in the Balkans fired clay technology and the creation of representational and symbolic artifacts (including human figurines, many of them in clay – see Bailey 2005) was a key new technology that marked the Neolithic world which was also characterised by the building of permanent and semi-permanent structures.

Whittle (1996, 171) describes the world of the Linearbandkeramik Early Neolithic farmers of central Europe as one in which there was much uniformity. Longhouses, settlements, graves and cemeteries were placed and organised in a similar way over very wide area. Alongside this it is clear that there was considerable fusion and diversity in lives and lifestyles (*e.g.* Whittle 2003, 135; Bentley 2007) There is a range of media represented in the artifacts; flint, stone axes and adzes, pottery, shell. Here however thinking about a 'focal material resource' it it hard to escape the forested landscape that these people were inhabiting. The longhouse, the iconic centre of LBK life was made of oak, transforming the forested landscape as it was also being transformed by the adoption of crops and domesticated animals. Wooden framed or lined wells have been found, providing the critical resource of water for people and animals. As Whittle (1996, 176) puts it: "For forest farmers life was framed by the longhouse settlement, set in small clearings in selected zones in the sea of woodland:artificial lagoons of productivity." Furthermore Whittle (2003, 136-43) argues that the longhouse may have been very important as a symbolic form that promoted social integration. As they were made of oak timbers, the relative frequency with which longhouses would have been replaced served, through material action, to perpetuate the concept of the house standing for social permanence and continuity.

Contemporanously with the woodland world of the LBK , it could be argued that for hunter-gatherers in adjacent areas and indeed across western and northern Europe wood and woodland would have been a focal resource also (*e.g.* Warren 2003; 2005, chapter 3). For Ireland and western Britain and indeed for much of what has come to be called Atlantic Europe stone was also important in the Mesolithic and the use of wood of course continued (and changed) in the Neolithic, for example in the construction of buildings (*e.g.* Noble 2006, chapters 3 and 4; Smyth 2007a). But what I wish to argue is that stone became a focal material resource in defining the Neolithic. The acts and processes of engagement with the material world by which this happened constitute a critical and central part of how the Neolithic was established and reproduced. This of course is not just about a passive reflection of the landscape and topography that people encountered, although twenty first century versions of the old determinist notion of dividing Britain and Ireland into a Highland and Lowland zones can still be found. Bellwood (2005, 81), for example, draws a distinction between lowland Britain (England) as a fertile region likely to have been attractive to agriculturalists and the fastnesses of Scotland, Wales and Ireland where Mesolithic adoption of agriculture was more likely, their resistance to intrusive ways of life paralleling what happened in the Roman period! Stone was a focal material resource in the region during the Neolithic because its use was a key, central component in the material construction of a new social world, by people living in and engaged with areas of complex and varied geology (*e.g.* Holland 2001).

Drawing on passage tombs of the Middle Neolithic, particularly those of the Bend of the Boyne, Lewis-Williams/ Pearce (2005) placed stone at the centre of their explanation of Neolithic religious and cosmological belief and experience. This idea needs examination and can also be linked to other recent explorations of the symbolic significance of stone. In the spirit of Lewis-Williams and Pearce's call (2005, 288) for archaeologists to consider emic or thick explanations, that is written from the point of view of what made sense in the context of Neolithic peoples' understanding of how the world worked (Geertz 2000, 15-6), I want to discuss how and why the focal role of stone was materialised.

18.4 The cosmology of stone

In approaching the explanation of why Neolithic people built megalithic tombs Lewis-William and Pearce (2005, 25-6, 193 ff.) set their construction and use in terms of what they refer to as the three interlocking dimensions of religion. They suggest that *religious experience* is the result of our neurological hard wiring: people interpret certain mental experiences in terms of the existence of other realms and supernatural beings that can impinge on daily material life. *Religious beliefs* derive from attempts to understand and codify religious experiences and *religious practices* embody these beliefs and can lead to further religious experience. They argue, in common with others such as Helskog (1999) and Bradley (2000), that people would have seen the cosmos in terms of three tiers, zones or worlds; water and the underworld, land as the level of daily life and the sky as the heavens. In Early Neolithic societies it became critical that people marked their relationship to ancestral figures and to the land. Hence the founding ancestors, the 'legitimizing' dead as they put it (Lewis-Williams/Pearce 2005, 194), had to be placed so that they could have continued contact and influence over the living. For this reason the dead became central to religion and society.

In Helms' phrase (2004, 124) "new means of material representation were required to make temporal ancestors manifest and real for the living". We can phrase this in terms of the inter-related dimensions of religion which Lewis-Williams and Pearce identify. The architecture of monuments enhanced the religious *experience* of the sense of journeying, dis-connectedness and entering another realm of the cosmos, – both in the case of the dead and the living who had contact with them. *Religious belief* would have been underpinned by the materiality and design of the tombs. The creation and use of the tombs embodied *religious practice*. These acts naturalised the social order, which may have been built on people having different levels of knowledge and hence some social distinctions, and on occasion reinforced religious experience.

One could see the Lewis-Williams and Pearce view as both an outsider's and an insider's view. They present a convincing case of the centrality of religion to every aspect of life, but they of course do so from a perspective that would be both incomprehensible and objectionable to people of religious belief. The critical point I want to draw attention to is their focus on the centrality of stone in Neolithic religion. It was through the working of and engagement with stone as an architectural material that monuments were created. This provides a approach to take with stone, as a significant substance with potency (Lewis-Williams/Pearce, 217). What I want to examine is how this cosmological and social world was established. What is the evidence to support the broader view that stone was a key active social component in the making of the Neolithic world?

18.5 Materialising identities in stone

I have argued elsewhere (Cooney 2007a, 544) that it may be useful to think of Ingold's (2000, chapter 8) formulation of genealogical (with a focus on origins) and relational constructions of identity as complementary. Small-scale societies are always concerned to a greater or lesser extent both with ancestral origins and how the activities and relationships of the living in the present, including the treatment of the dead, fit with the past (Helms 1998, 23-54). The materialization of the links between people and things provides the context for the material construction and re-negotiation of genealogical origins. One way of thinking about the changes that happened around 4000 cal BC, the start of the Neolithic, is to see them in terms of the establishment of new relational identities (*e.g.* Jones 2005) which led to a re-thinking of genealogies.

There are signs of continuity across the transition to the Neolithic, as in the continued use of places, both for habitual and sacred purposes, the continued use of wild food resources and the continued use of lithic sources. But much is different and new. There are strong suggestions from a number of sources for climatic change around this time, although its impact is debated. Connected with this are indications of change in the woodland cover, which is also impacted on by the appearance of domesticated species of plants and animals. The recent surge of evidence from stable isotope analysis indicate a shift in diet around 4000 cal BC and of course brings us back to the issue of the potential scale and impact of small-scale filtered colonisation and inter-action with the indigenous population (Cooney 2007a, 546-51).

In the construction of identities that we see in peoples' lives and use of material culture there are references to local contexts and background. However, if we think of the range of changes sketched above that resulted in different kinds of engagement by people living in particular social and geographical settings, it is not surprising that in the Neolithic we see quite different kinds of relationships between people, animals, plants and things. I would suggest that stone was the medium that most clearly demonstrated these changes. We can see this in the working of stone at a range of different scales, for different purposes. In turn this would have been woven into other strands of change. In Bradley's (2004, 110) terms stone was a key material because things, big and small, made from it would have had *longevity*. They could be produced in *abundance* and depending on the time and skill invested in them objects of considerable *complexity* could be made from different types of stone. Crucially stone mattered because of the range of inter-related new ways in which it was acted on as part of the material engagements through which the Neolithic world was formed.

In the Early Neolithic 'landscape of habit' (Gamble 2007, 258) in Ireland it is striking just how varied and widespread the use of stone is. It is used in the foundation trenches of buildings as post-packing, as part of the flooring and for the provision of paths within and outside structures and to mark thresholds. Outside houses there are frequently scatters of stone or more formal areas of cobbling. These may be renewed or deliberately laid to provide a sealing or covering of earlier activity (see discussion in Smyth 2007a). Part and parcel of the engagement with the land itself would have been stone clearance from cultivated areas. Chapman *et al.* (1996, 284) have suggested that such an act may have been not just utilitarian but also perceived as part of the harvest from the ground. Hence the creation of clearance cairns or stone walls from this material can be seen not only to be practical, but also as a material manifestation of a particular farming '*habitus*' and the social mobilization and leadership involved. This is a point illustrated by the Céide Fields landscape in northwest Ireland (Molloy/O'Connell 1995; Caulfield *et al.* 1998; Cooney 2000, 25-9).

Stone would have become more visible not only as collected and laid lines across the landscape but also because at another, smaller scale it was dispersed more widely in the form of worked lithic material *on* land surfaces, resulting from recurrent production and use. This is recovered today through systematic field survey (*e.g.* Brady 2006). Of course the utilisation of flint and other lithic resources is a material engagement that was a feature of the Mesolithic as well. However, not only are there significant differences in the lithic traditions of the fourth millennium cal BC compared to earlier times (*e.g.* Nelis 2004; Warren 2004), but the character and distribution of worked material across the landscape also appears to become much more marked from the beginnings of the Neolithic (Kimball 2000, 39; Woodman *et al*. 2006, 268; Brady 2007, 217). Stone was also put *into* the ground. The digging of pits was a central part of the activities at a range of different site types and in different locations (Smyth 2007b, 169-78; Noble 2006, 62-8). One of the recurring features of these pits is the deposition of stone artifacts and pottery. Stone that is clearly worked is recorded in detail but other stone is treated as 'fill'. But it is striking how frequently stony fills occur. We often tend to exclude the possibility that the inclusion of such stone could have been a cultural choice. On the other hand it appears that the incorporation of this material was often deliberate and in some cases structured. For example, on the small island of Dalkey off the Dublin coast where there was recurring Mesolithic and Neolithic activity there are a group of five large Neolithic pits, all but one positioned beside glacial erratics (Leon 2005, 15). In the pits were stone artefacts and pottery with many stones in the fill (Liversage 1968, 64). Without diminishing the cultural significance of the modified artefacts, it seems very likely that the 'mundane' stone (and other materials) were also important and deliberately chosen, as indeed were the glacial erratics marking the pits.

There were then a new series of engagements by people with stone at different scales, material engagements through which sets of new relationships were formed. To take the discussion further I want to focus on two areas that conventionally take us to two supposedly very different types and scales of engagement with stone; stone axe production and the construction of megalithic monuments.

18.5.1 An axe to grind

Ground stone axe technology is still widely seen as one of the few agreed criteria for identifying the Neolithic. However, in an Irish context it has long been known that ground stone axes formed part of the Mesolithic tool-kit, from early in that period (*e.g.* Woodman *et al.* 1999; Collins/Coyne 2003; 2006). Indeed what seemed to a clear distinction between the use of only secondary sources in the Mesolithic and the beginnings of the quarrying of primary sources in the Neolithic (Cooney 2004a) needs reassessment in light of Kador's work on the products from the Monvoy, Co. Waterford rhyolite quarry (Kador 2007; see also Green/Zevebil 1990, 68-70 on the Powers site). Significant changes do occur around 4000 cal BC. The range of lithologies used as sources increases alongside the continued use of those used in the Mesolithic. Organised axe production takes from early in the Neolithic (see discussion in Cooney 2007a, 559). Not only that but products from specific sources are found on Early Neolithic sites.

For example, a porcellanite axe from the quarries at either Tievebulliagh or Rathlin island, Co. Antrim in northeast Ireland (Cooney 2000, 202-4) was found as a formal deposit in a ditch segment at the causewayed enclosure at Magheraboy, Co. Sligo, over 180 km to the southwest, where activity started in 4115-3850 cal BC (Danaher 2007, 113; Bayliss *et al.* 2007; Mandal 2007). The axe is best dated by sapwood from a burnt oak plank at the base of the ditch to 3965-3810 cal BC (GrA-31961). This indicates that porcellanite was in circulation across the northern part of Ireland by the 40th or 39th centuries cal BC (Whittle *et al.* in prep.). There are significant quantities of porcellanite at some of the early rectangular buildings in Ireland dating to 3800-3600 cal BC, as at Ballyharry (Moore 2003), and Thornhill (Logue 2003). Cumulatively this evidence clearly indicates that the exploitation of one or both of the known porcellanite sources began very early in the Neolithic. There are indications that production at the Great Langdale, Cumbria volcanic tuff quarries in northwest England began at the same time and again axes from this source turn up in Early Neolithic contexts (*e.g.* Hind 2004, 141). Sheridan (2007a; 2007b, 464) has argued that one important genealogical component in these new material engagements was the presence of jadeite axes in the Early Neolithic. Coming from two principal Alpine sources (*e.g.* Pétrequin *et al.* 2006), the jadeite axes found in Britain and Ireland from at least 3800 cal BC are of forms that appear to have been made several centuries before their deposition (Pétrequin *et al.* 2002). Furthermore it would appear that some of these forms were then copied in axes made from Irish and British lithological sources (Pailler, pers. comm.; Sheridan 2007a). It would not be surprising then that objects such as these played an important role in demonstrating and materialising the genealogical origins of a new way of thinking about and working with the world.

More broadly it may be interesting to think of axe quarrying and use in a number of different ways. It could be argued that what we see in the Early Neolithic working of stone at quarries, and flint mines in southern Britain (see Barber 2005, 96) is analogous to deploying the ancestral forces of the land in the new material world. The grinding and polishing of stone in many cases serves to highlight colour differences, for example in the case of the porphyry or porphyritic andesite quarried on Lambay (Cooney 2005) and the relative whiteness of the phenocrysts in a green matrix was enhanced by polishing. Speckles, flecks or streaks of white or yellow are common in many of the stone axe sources (Cooney 2002). White is widely associated with life, power, fertility and the ancestors. In this sense a link with the enduring was materially embodied through the working of rock and the production of axeheads in which the whiteness of the stone was emphasised through its transformation. Metaphoric connections with changes in the land might have been made stronger by the frequent association of axes with activities associated with agriculture.

As Ray (2004, 171) suggests it may also be useful to think of such sources as nodes in a pattern of exchange involving stone objects and other items and in a network of social relations that extended over land and sea. The contrast between axes made from what would have been perceived in many parts of Ireland and Britain as non-local sources with axes of locally available stone (see discussion in Cooney 2000, 197-205) is something that was present from very early in the Neolithic. This inter-weaving of the local and the distant can be seen in other aspects of the use of stone, for example in the local exploitation of pitchstone on Arran in the Clyde estuary during the Mesolithic and its more widespread occurrence, including Ireland during the Neolithic (Cooney 2004a, 194; Ballin 2006) and the circulation of visually distinctive flat, green serpentine beads across the island of Ireland around 3800-3600 cal BC (Sheridan 2007b, 463). These objects may have been of particular importance in the development, maintenance and re-ordering of relationships within and between communities. The key point is that quarrying and procurement of axes and other stone objects may have been involved from the start, defining what it was to be 'Neolithic', as opposed to being an aspect of life that developed over the course of the period.

Ray (2004, 166) also pointed out that one of the notable aspects of major places of axe production in the Irish Sea zone is their location on islands or close to the coast. That island sources and coastal zones would feature in this world is not surprising. These are places where the tiers of the cosmos, the zones of the natural world, meet (see Scarre 2002). Given the background of the use of islands in the Mesolithic they were certainly places of broad and bounded continuity. On the other hand, islands and coastal zones with their potential connection with distant places (Cooney 2004b; Noble 2006, chapter 2) may have conveyed something of the mythology of the background of the Neolithic. So they may have been places that gave a basis for the dialectic between the immediate and the distant that Warren (2004, 98) sees as an integral part of the formation of identities in the Early Neolithic. In terms of the occurrence of early passage tombs in coastal areas noted by Sheridan (2003; 2004) and the continued use of islands like Dalkey with a prolonged history of at least episodic use in the Mesolithic (Leon 2005), the coastal zone may also have become a very important place for the re-negotiation and re-imagining of genealogical identities (Schulting 2004, 26).

18.5.2 Making megaliths

Mention of megalithic tombs in coastal locations brings us back to these monuments, often regarded as the defining and iconic feature of the Atlantic Neolithic (*e.g.* Daniel 1958; Renfrew 1981). These monuments certainly rhyme with the notion of new architectural settings being a key element of the sedentary revolution (Renfrew 2007, 82-3) and indeed are often regarded as a transformation of the domestic world (Hodder 1990, 220; Sherratt 1990) in the particular setting of Atlantic Europe. However, recent programmes of analysis of the dates of such monuments indicate that in general they appear to date to a couple of centuries after the beginning of the Neolithic (cf. Scarre *et al.* 2003; Whittle *et al.* 2007, 127; Whittle *et al.* in prep.). If we refer back to Lewis Williams and Pearce (2005, 94) and their idea that in Early Neolithic societies megalithic monuments mark the relationship of the living to founding ancestral figures and to the land it might be useful to look at this in context of other, already established ways of working stone.

As Cummings and Whittle (2004, 76) and Richards (2004) have written, one way of thinking about megalithic monuments is to see them as raising stone out of the ground, celebrating large stones as ancestral presences. Often the stone for the monument is quarried and not only are the 'products' of this process, the orthostats and roof stones, used as an integral part of the monument, but also the 'debitage'. To take one example, at the court tomb at Annaghmare, Co. Armagh (Waterman 1965; Jones 2007, 148-52), a sandstone rock outcrop surrounded by wet, boggy ground was transformed into a megalithic tomb. Deposits were placed in hollows in the rock and the sandstone outcrop was made into the monument. In effect what we see is the translation of stone through quarrying into large blocks and smaller pieces used in dry stone walling, the cairn and as blocking layers. In terms of engagement there are important parallels with the quarrying of stone for axe production. Both are drawing on and deploying the active, symbolic power of the stone, allowing for its rearrangement into new configurations with other materials and places. As archaeologists we tend to concentrate on the 'products' in both cases, but for Neolithic people the actual process of working and changing the stone would been the focus of that material engagement (Sennett 2008, 120). From that perspective we could understand why the 'debitage' is often carefully treated, incorporated as part of the makeup of monuments and/or carefully placed back in the ground in pits (see discussion in Cooney 2005; 2007b).

We can point then to important linkages in the use of stone in the Neolithic that we tend to archaeologically separate through categorisation, analysis and use of scale. Of course there are links back to the Mesolithic way of life and thinking about how the world worked, but because of these new engagements things had literally become different. For example early megalithic tombs in western Britain and Ireland can be seen in the context of regional indigenous identity, as a materialization of creation myths by people long familiar with the local landscape (Cummings/Whittle 2004, 90), but their realization seems to indicate a new way of thinking about engaging with the material world (Cummings 2007, 507-8). Helms (1998; 2004, 119) argues that hunter-gatherers give primacy to animals as the cosmographical other and by contrast agricultural or pastoral sedentary people emphasise the cosmographic significance of the ancestral human dead. The very act of working and raising stone of monumental scale is a new practice which seems to sit with and reflect a new way of thinking about the world and the ancestors.

18.6 Conclusion

Stone acts as a conduit for contact with the world of the underground, the dead and the ancestors. The stone for monuments is taken from the underground, the other world. The dead, or selected remains of the dead, are in effect returned to the underground, in rock when they are placed in tombs. In peoples minds and mental maps objects such as axes of distinctive form and shape may be seen as coming from away, potentially from places across the sea, but perhaps because of this also coming from a parallel realm to that of the ancestors. Disturbing the ground to dig pits or quarry for stone, or indeed even picking up stone, all had the potential to bring people into the world of ancestral beings and had to be done with due respect. Depositing objects back in the ground returned them to whence they had come. As religion was an integral component of everyday life there would have been constant iterations and references to these beliefs in daily practice.

As Robb and Miracle (2007, 107) put it for prehistoric people "living out their history meant continually evaluating and reinventing traditions and choosing from a repertoire of available possibilities, whatever the historical source of this repertoire was." The reason why stone was a focal material resource in the Neolithic was because it was central to those processes of engagement, evaluation and reinvention. It was used in a variety of inter-related ways and in combination, iteration and re-iteration. Through peoples', daily engagement with stone new social relationships and conventions were created and sustained. For example, the distinctions that emerged in society between stone as a material particularly redolent of the ancestors and other materials, such as timber, being more symbolic of the living (*e.g.* Parker Pearson/ Ramilisonina 1998) took place in an environment in which people had visual, tactile and auditory knowledge of a stone-rich world.

It would be wrong of course to suggest that use of stone as a focal material resource was always used for the communal good or that the changes in meaning referred to above always came about peacefully. One of the aspects of stone axeheads not discussed above is their potential to be very effective weapons. This is a point confirmed by the occurrence of human skeletal remains with injuries consistent with axe blows both in Ireland and Britain and further afield (*e.g.* Raftery 1944; Guilaine/Zammit 2005, chapter 2). Extending this to other stone artefacts it should be noted that one of the classic tools of the Neolithic in Ireland and Britain is the leaf and lozenge shaped arrowhead (*e.g.* Green 1980; Woodman *et al.* 2006, 127-32). The point here is that we should perhaps consider the possibility of low-level, but persistent conflict as a tradition in Neolithic communities. Indeed we might recognise that the use of stone weapons would have provided another layer of symbolic meaning to this material, arising from this socially important role.

Stone was a focal resource then because it was encountered and acted on in so many different spheres of Neolithic life. If we accept the centrality of religion in that life the notion of a divide between daily and ceremonial life would have been meaningless. Every action of engagement and transformation of this enduring, richly symbolic and potentially powerful material carried overtones and resonances; the ritual in the domestic, the mundane in the routine. It was both the material and intangible qualities of stone that made it so important. There is no reason why we should see a difference between pecking a stone in the process of making an axe from a medium or course grained stone and the pecking of similar lithologies that was used to make rock art or megalithic art motifs. Both were meaningful, repetitive acts, connecting with the stone as a material, seeing into it and releasing or activating the potency of some form or force within the stone. It was in and by such acts that the Neolithic was made in Ireland and western Britain. Perhaps to paraphrase a description of another kind of Neolithic 'it was a fairly exceptional and original trajectory in the mosaic of cultural change processes that together constituted the neolithisation of Western and Northern Europe (Louwe Kooijmans 2006, 514)

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19 Points of contact. Reflections on Bandkeramik-Mesolithic interactions west of the Rhine.

Marjorie de Grooth

19.1 Introduction

Shortly before the end of the second millennium AD, two well-preserved Late Mesolithic wetland sites were excavated at Hardinxveld-Giessendam, in the western part of the Netherlands (Louwe Kooijmans 2001a; 2001b). In his synthesis, Leendert Louwe Kooijmans ruminated on possible connections between the seasonal visitors of these river dunes (*donken*) and Bandkeramik farmers in Limburg and adjoining regions, such as might be deduced from the presence of arrowheads and flint nodules with a south-eastern origin. Some years earlier, the Early Bandkeramik settlement of Geleen-Janskamperveld (JKV) had been excavated in precisely that region (Louwe Kooijmans *et al*. 2003; Van de Velde *et al*. in press). As the JKV flint assemblage comprised a few microliths (De Grooth 2007), I thought it might be a good idea to explore the possibilities of such contacts, and thus maybe contribute to the never-ending debate on Mesolithic-Neolithic interactions, a theme that forms the essence of Leendert Louwe Kooijmans' research interest (cf. Louwe Kooijmans 1974). Of necessity, I shall do so from the perspective of one firmly rooted in Bandkeramik research traditions (De Grooth 1977; 2005). Thus, my view may be biased, overemphasizing the diversity its *aficionados* observe in the LBK, and missing out on the subtleties of Mesolithic lifestyles (and microliths). I may thus mistakenly perceive the two millennia of Late Mesolithic seasonal mobility, with its systematic and long-term use of specific locations in the landscape as a period of marked uniformity (cf. Modderman 1988). Although microliths, especially arrowheads inevitably will play a role in this story, I hope to achieve a broader scope of interpretation, involving an evaluation of raw material procurement strategies and flint working technology (cf. Allard 2007).

19.2 Chronological framework

Despite a large corpus of radiocarbon dates, the absolute chronology of the Linearbandkeramik is still controversial (Lanting/Van der Plicht 2000; Lüning 2005, Stäuble 2005; Stöckli 2002). The ongoing debate has partly to with the nature of the samples ('old wood' effects for charcoal samples; reservoir effects as the result of fish consumption affecting human and canine bones; lumping together of several fragments of carbonized grain to get a sufficient sample). Other factors are the relationship between the dated material and its surmised archaeological context, (cf. the AMS dates for the Merzbach valley discussed below), the place of isolated dated events in a settlement's history, and the integration of absolute dates and relative chronologies based on archaeological interpretations of settlement structures and pottery styles. Matters are not helped by the unfortunate fact that the INTCAL 04 calibration curve shows two important plateaux in the relevant period. The first is located between 6.300 and 6.250 BP (or *c*. 5.300-5.220 cal BC); the second from 6.200 to 6.140 BP (or 5.210-5.060 cal BC). Thus, radiocarbon dates falling within the ranges of these plateaux, after calibration show a wide range of possible calendar ages. Moreover, while a considerable number of dates on samples from short-living species have been published for the Earliest LBK (ELBK), very few such dates are available for the Flomborn and younger periods. The eight AMS dates recently performed on carbonized seeds from Geleen-JKV (Van de Velde 2007) are thus extremely important, especially as this settlement was mainly inhabited during the Flomborn phase.

19.2.1 Geleen-Janskamperveld

The Geleen-JKV dates range from 6.260 ± 50 BP to 6.110 ± 45 BP. In his interpretation, Van de Velde (2007) pooled the four dates for houses 12 and 13, thought to represent the earliest habitation at the site, with a weighted average of 6.204 ± 22 BP, converting to a wide range between 5.214-5.078. Then, assuming that this average could be some ten to fifteen years younger than the beginning of the two houses, the start of the Bandkeramik habitation in the Graetheide region was placed in the decennium around 5.220 cal BC. Although this fits rather well with the ideas expressed by Lanting and Van der Plicht (2000) and Stöckli (2002), the two older JKV dates should be taken into consideration as well. The sample from pit 20.027, belonging to house 49, has a date of 6.260 ± 50 BP or 5.310-5.205 cal BC, and one of the dates for house 12 reads 6.240 ± 70 BP, converting to a range between 5.303 and 5.076 cal BC. Even if the first date does not quite fit with the expected age of the decorated pottery found in the same pit, it should, in my opinion, be taken at its own value, which indicates that settlement at JKV may have started at least some fifty years earlier, and perhaps even as early as *c.* 5.300 cal BC.

19.2.2 Younger LBK Rhine-Meuse region

The six dates on carbonized grains published from the Aldenhovener Platte, presumed to be associated with the house generations XI to XIII, *i.e.* Modderman IIb-IIc, range between 6.290 ± 70 BP and 6.160 ± BP (Lanting/Van der Plicht 2000 referring to Hedges *et al.* 1993). Thus, they all overlap with JKV's Flomborn dates. As the three settlements in question, Langweiler 2, Langweiler 8 and Langweiler 9, were inhabited during a long time span (Stehli 1994), this discrepancy in itself can be explained, but that does not make it less unsatisfactory. Thus, the only reliable figures for the Younger LBK are dendrochronological dates for two construction phases of the well at Erkelenz-Kückhoven: 5.090 and 5.057 ± 5 cal BC (Weiner 1998). Although habitation at this settlement is thought to have started during the Flomborn period, the ceramics associated with the well clearly belong to the Younger LBK (Lehmann 2004). The two AMS dates 6.165 ± 45 BP and 6.115 ± BP for Liège-Place St. Lambert, S.D.T. sector, bridge the gap, but the associated sherds have not yet been stylistically dated (Van der Sloot *et al*. 2003). Older finds, from the eastern zone of the site, belong to Modderman's phases Id-IId (Rousselle 1984). The S.D.T. sector is of special importance, as here for the first time a clear stratigraphical succession of Late Mesolithic, Final Mesolithic, and Early Neolithic (LBK) could be documented and dated. Unfortunately, the stratigraphical position of the La Hoguette and Limburg sherds is still unclear. The Place Saint Lambert site as a whole is located on alluvial deposits of the river Légia, and its formation and post-depositional history were not only influenced by the dynamics of this river, but also by important building activities, notably the erection and demolition of Liege's Medieval Saint Lambert cathedral (Otte 1984b; Van der Sloot *et al.* 2003).

19.2.3 Earliest LBK

The dates procured from samples from short-living species (mainly carbonized grains, food remains and bones) currently available for the Earliest LBK (ELBK) in Austria and Germany range between 6.460 ± 80 BP and 5.970 ± 105 BP (Stäuble 2005). While a good many fall between 6.400 BP and 6.300 BP, a whole number of dates fall in the Flomborn range of Geleen-JKV. This is not only the case at Friedberg-Bruchenbrücken, where they partly may result from intrusion of younger LBK material into the ELBK pits, but also at Goddelau and Schwanfeld, where only ELBK was found. The dates for Schwanfeld fall between 6.380 ± 100 BP and 6.240 ± 55 BP, those for Goddelau between 6.370 ± 35 BP and 6.260 ± 40 BP.

19.2.4 Hardinxveld-Giessendam

The chronology of the Hardinxveld-Giessendam sites seems comparatively unproblematic, as it is based on a considerable number radiocarbon dates of samples from short-living species, in combination with lithostratigraphical observations (Louwe Kooijmans/Mol 2001; Mol/Louwe Kooijmans 2001). At Polderweg three phases are distinguished. Phase 1, a complex of refuse layers formed on the slopes of the dune as the result of colluviation, is dated between 5.500-5.300 cal BC. After a hiatus, inhabitation continued in Phase 2/1 (*c.* 5.100 cal BC) and Phase 2 (*c.* 5000 cal BC), known from material recovered from peat layers covering the higher parts of the slopes. Use of the other river dune, De Bruin, also started at *c.* 5.500 cal BC. Here, the first Late Mesolithic phase lasted till 5.100 cal BC. In the second phase, dated between 5.100-4.800 cal BC, very early Swifterbant pottery of northern Late Mesolithic tradition, was used alongside some pottery assigned to the Blicquy group. The makers of this pottery had a fully agrarian subsistence system, documented in settlements in the Hesbaye and the upper Dendre regions of Belgium. During the final phase, between 4.700-44.50 cal BC, Swifterbant pottery was still being used in a fishing/hunting/gathering setting.

19.2.5 Rhine Basin Group

Radiocarbon dates comparable to those from Polderweg and De Bruin have recently been published for the Final Mesolithic at Liège-Place Saint Lambert, S.D.T. sector (Van der Sloot *et al*. 2003). They range between 6.485 ± 80 BP and 6.220 ± 45 BP. No dated Late Mesolithic sites are known from the vast area between Liège and Hardinxveld-Giessendam, *i.e.* in the southern part of the Netherlands and lowland Belgium. Vanmontfort (2007) recently succinctly has summarized the situation: "These sites are often palimpsests and even if they are excavated, their absolute dating is confronted with major problems. Bad or doubtful spatial associations between dated samples and archaeological assemblages, dislocation of artefacts and samples caused by bioturbation, and problems related to the nature of samples are frequently mentioned obstructing factors. (…) As a consequence (…) there are no well characterised and well dated sites that can be used as a reference to relatively date the later Mesolithic" (Vanmontfort 2007, 106).

19.2.6 La Hoguette and Limburg

Finally, to conclude the chronological positioning of the protagonists of this story, the single reliable radiocarbon date currently available for the La Hoguette group must be mentioned. Carbonized food remains on a La Hoguette sherd recovered from a trial excavation in the Wilhelma Zoo of Stuttgart-Bad Cannstatt yielded a date of 6.353 ± 45 BP or between 5.380 and 5.300 cal BC (Kalis *et al*. 2001). The dates for layer 5 of the Bavans rock shelter in my opinion are not suitable to date La Hoguette. They range between 7.130 ± 70 BP and 4.310 ± 90 BP (Aimé 1987), indicating that the layer contained intrusive material from both older and younger periods (cf. Allard 2005).

For Limburg pottery only indirect data are available, through their being found in refuse pits of settlements west of the Rhine from the Flomborn period onwards, and in RRBP and Villeneuve-St. Germain contexts in more westerly regions (Constantin 1985; Allard 2005). The sites where Limburg pottery was found on its own, unfortunately, must all be regarded as palimpsests. As they are located in cover sand areas, bioturbation makes it impossible to separate assemblages in terms of time and space (Bubel 2003). At Kesseleik, the site where Limburg pottery was first found outside a LBK context, the sherds were found to be mixed not only with flints dating between the Early Mesolithic (an Ahrensburg point) and the Late Neolithic, but with Michelsberg and Beaker pottery as well (Modderman/Deckers 1984).

19.2.7 Discussion

In the end, which absolute chronology for the western LBK is favoured depends pretty much on one's appreciation of the value of the 'house generations' relative chronology developed for the middle Merzbach valley in the Rhineland (Stehli 1994), and on one's willingness to accept the possibility that ELB and Flomborn LBK partly co-existed (Lüning 2005). The 'house generation' scheme is quite practical for establishing relative chronologies and links between settlements on a regional (*e.g.* Claßen 2006; Kerig 2005), and even super-regional scale (Stehli/Strien 1986). Ultimately, however, it is a statistical construct, developed in the nineteen seventies, based on the seriation of decorated pottery found as secondary refuse in construction pits, educated guesses on the lifespan of Bandkeramik longhouses and on the overall duration of the LBK inhabitation.

Given all these considerations, I think it not unreasonable to adhere to the chronological framework recently proposed by Lüning (Price *et al*. 2001; Lüning 2005; 2007). In this view, the ELBK first appeared in Hungary, around 5.700 cal BC. Afterwards, it spread east, north and west, reaching the Rhine and Neckar valleys at around 5.500 cal BC. The subsequent Flomborn LBK is thought to have developed in the Upper Neckar valley and northwest Bohemia (Strien 2000), at *c*. 5.375 cal BC. Again spreading to the west, the Alsace and the Rhineland were reached *c*. 5.300 cal BC, where the expansion halted for a short time. Meanwhile, at some settlements, notably Friedberg-Bruchenbrücken and Goddelau, ELBK habitation continued till *c*. 5.180 cal BC (Stäuble 2005). West of the Rhine, Geleen-JKV was a 'first generation' settlement, as were Geleen-Kluis, Sittard, Elsloo and Stein. In other words, inhabitation west of the river Rhine was not a gradual, tentative step-by-step process, but started with a great leap westward, followed by filling-in of the areas in between. Several sites in this hinterland were settled in the same early stage as well, the best-studied one being Langweiler 8 on the Aldenhovener Platte (Boelicke *et al*. 1988). This interpretation corresponds nicely with the 'frog leap' models propagated in recent discussions on the expansion of both the ELBK and the Flomborn LBK (cf. Lukes/Zvelebil 2004; Whittle/Cummings 2007).

The first habitation phase at the Hardinxveld-Giessendam river dunes thus would have been contemporary with the Late Mesolithic at Liège-Place St. Lambert, with the early part of ELBK and the La Hoguette visits to Stuttgart-Bad Cannstatt, and with the start of Flomborn. Possibly, at that time the Graetheide already was part of the Flomborn LBK world, but this remains open to debate. Geleen-JKV certainly was contemporary with the second habitation phase at Hardinxveld-Giessendam, with the Final Mesolithic of Liège-Place Saint Lambert, and with the later ELBK of Friedberg-Bruchenbrücken and Goddelau. At the end, it may overlap with the start of LBK settlement at Liège-Place Saint Lambert.

19.3 Procurement strategies

One of the ways to establish possible contacts between different groups is to investigate to what extent they shared lithic resources. The inhabitants of all settlements under discussion knew wide-ranging networks through which raw materials circulated. Yet, present evidence suggests little or no overlap between them.

19.3.1 Geleen-Janskamperveld

At Geleen-JKV, little or no use was made of flints available in the immediate vicinity of the settlement: only seventeen out of almost 8.000 artefacts – including three cores but no retouched tools – originate from gravels deposited by the Pleistocene river Meuse, three of them could be classed as Oligocene or Miocene beach pebbles ('Meuse eggs', see below). Almost 98% of the raw material seems to originate from a single source, located at Banholt (Margraten, NL), some 25 km to the south of the settlement. Here, flint nodules from the western facies of the Lanaye member of the upper Cretaceous Gulpen Formation – commonly called 'Rijckholt flint' by archaeologists – occur in residual loams (Felder 1998; Brounen/Peeters 2001; De Warrimont/Groenendijk 1993). The Banholt eluvial variety may be distinguished from Lanaye flints from primary and slope deposits, because many nodules display considerable alterations as a result of their long stay in the residual loams – notably a higher translucency, the presence of a glass-like reddish-brown zone underneath the cortex, and of yellowish-brown streaks penetrating into the originally dark to light grey flint matrix (De Grooth in press c).

Other flint types outcropping in the region between Maastricht (NL), Liège (B) and Aix-la-Chapelle (D) were used only sporadically by JKV's inhabitants. The majority (n=33) have their origin in the Hesbaye region near Liège in Belgium (cf. Löhr *et al*. 1977; Cahen *et al*. 1986, Allard 2005). Fifteen of them are blade tools (45%). Not all this material reached JKV as blades or tools however, as is witnessed by the presence of one core on which a hammerstone fragment and a flake could be refitted, and of an end-scraper made on a crested blade. Flints from the Emael member – known to archaeologists as Valkenburg flint (*e.g.* Brounen/Ploegaert 1992) – are mainly represented in the waste material, one retouched flake and one hammerstone fragment being the exceptions (n=27). Only five artefacts, four of them tools, were identified as flint of the Rullen type. Finally, four tools – one of whose LBK age is dubious – were made of the very dark grey, glossy and highly translucent flint originating from the Late Campanian Zeven Wegen member (Felder/Felder 1998). Flint types from the eastern part of the limestone area, notably Lousberg, Vetschau and Simpelveld flint, were absent. For a detailed description of these flint types refer to De Grooth (in press c).

The inhabitants of the Bandkeramik sites at Elsloo and Beek-Kerkeveld also mainly used Lanaye flint of the Banholt variety (observation by the present author). Given the mention of transparent reddish-brown zones as typical for the so-called 'Rijckholt' flint encountered in the Rhineland (*e.g.* Deutmann 1997; Löhr *et al*.1977; Zimmermann 1988, 606), it seems plausible that most of this material mainly originated from Banholt as well. The 'Bandkeramians' from the Hesbaye region in Belgium, at sites such as Liège-Place St. Lambert, Darion, and Verlaine, predominantly used the locally available vitreous 'fine grained Hesbaye' flint – '*silex à grain fin d'Hesbaye*' (Allard 2005; Cahen *et al*. 1986; Caspar/Burnez-Lanotte 2006) or '*hellgrauer belgischer Silex*' in the terminology of Löhr *et al*. (1977). This was either collected from a secondary depositional position in river gravels (Liège, Otte 1984a), in residual loams (Verlaine, Petit Paradis, Allard 2005), or from primary deposits (Vaux-et-Borset, Caspar/Burnez-Lanotte 2006). At these sites a small amount of less fine grained flint – '*silex grenu d'Hesbaye*' (Allard 2005) was found as well, which could either derive from Lanaye deposits west of the Meuse, and thus be of local origin, or be considered imports from the Dutch outcrops (Otte 1984a).

19.3.2 ELBK

In most Oldest Bandkeramik settlements in southern, south-western and central Germany (Bavaria, Baden-Württemberg, Hessen) a variety of different flint and chert types were worked. Even if material of reasonable quality was locally available, considerable amounts of 'exotic' imported materials were used as well (Gronenborn 2003, Mateiciucová 2004). The most important of these were radiolarites from Szentgál, close to lake Balaton in Hungary, Jurassic cherts from the Franconian and Suabian Albs (in Bavaria and Baden-Württemberg), with cherts from the Wittlinger Chalks to the south of Stuttgart forming a special subtype (Strien 2000), and northern erratic flints, occurring in ice-pushed deposits, *e.g.* in Lower Saxony and Thuringia. A good example of this raw material variety is offered by the Bavarian site of Schwanfeld (Ldkr. Schweinfurt, Lower Franconia), to the north of Würzburg (Gronenborn 1997b). Here, 50% of the assemblage consisted of cherts from the Franconian Alb, 60-80 km to the south; 30% were probably erratic northern flints, which occur some 150 km to the north. Finally, 1% of the assemblage was formed by Szentgál radiolarites, outcropping some 650 km tot the east. This pattern clearly indicates the existence of stable long-distance exchange networks.

For the present study, the ELBK raw material procurement practices in Hessen are of special interest, as here flint types originating in the Aix-la-Chapelle/Maastricht/Liège area played an important role beside the northern and south-eastern varieties. This was especially the case at Friedberg-Bruchenbrücken (Wetteraukreis), where over 81% of *c*. 200 flints from the first excavation campaign are of the Lanaye/Rijckholt and of the Vetschau type (Gronenborn 1997a; 1997b). The fact that blanks of both raw materials display similar knapping characteristics supports the idea that both were produced locally. Given the low numbers recovered, the absence of Lanaye/Rijckholt cores is not surprising. At least two artefacts made of the Banholt variety were identified among the Oldest Bandkeramik material from the second excavation campaign by A.L. Fischer and the present author (Fischer 2005; De Grooth in press c). Interestingly, local materials were all but absent from the Bruchenbrücken assemblage, although good-quality quartzite abounds in this part of Hessen (Sommer 2006). At Steinfurth (Wetteraukreis), too, over half of the 45 artefacts were of western origin. Here, even though the vitreous Hesbaye flints appear to be quite numerous, Lanaye/Rijckholt and Vetschau material was identified as well, as were northern erratic flints and south-eastern Jurassic cherts (Gronenborn 1997b). At Goddelau (Kr. Groß Gerau), finally, the majority of the material that could be sourced consisted of Jurassic cherts (especially Wittlinger chert), and only two probable western artefacts were present (Gronenborn 1997b).

19.3.3 Hardinxveld-Giessendam

Polderweg and De Bruin are situated in an area where flints and other flakable stones do not occur locally (Van Gijn *et al.* 2001a; 2001b). At both sites the vast majority of flint artefacts were made from a special type of small flint nodules (Polderweg 80% in the first two phases; 56% in the youngest one; De Bruin: phase 1 :82%; phase 2: 57%, phase 3: 46%). These so-called 'Meuse eggs' possess heavily abraded, glossy dark grey or sometimes red or yellow natural surfaces. They originate from the limestone area of the provinces of Limburg (NL and B) and Liège (B), and had been part of an Oligocene or Miocene pebble beach before being transported northwards by the river Meuse during the Pleistocene (Felder 1998; Berendsen 2004). Other flints from river gravels were the second most important source at Polderweg (between 16% and 14%). At De Bruin, however, erratic flints with a northern origin were increasingly important: from 13% in phase 1 to 39 and 47% in phases 2 and 3 respectively.

For all three varieties, the occurrences nearest to Hardinxveld would be at a distance of some 60-80 km to the east, in the vicinity of Arnhem and Nijmegen, either in the northernmost extension of the terraces of the Meuse and Rhine, or in ice-pushed deposits such as occur in the Veluwe and the Rijk van Nijmegen, to the north of the Meuse and Rhine river valleys. Although the southern flints were originally transported by the river Meuse, they may be found in Rhine deposits as well, because during the Pleistocene Rhine and Meuse repeatedly changed their course and thus alternately cut into each other's deposits (Berendsen 2004). The preference for 'Meuse eggs', however, seems to indicate that southern material may have been collected further upstream the Meuse. According to Arora (1979) such pebbles are only rarely found to the north of a line connecting Venlo (NL) on the Meuse and Krefeld (D) on the Rhine, whilst concentrations of 'Meuse eggs' may be found at an outcrop at the Süchtelner Höhen, near Viersen (D), *i.e.* just to the east of Venlo (Löhr *et al.* 1977). Their small size may have had one advantage, in that they may be more stable than other gravel flints, showing fewer hidden cracks and thus causing fewer unpleasant surprises when being reduced.

Among the less frequently used materials, two are of special interest to the present study. At Polderweg, in all phases a small amount of Lanaye/Rijckholt flints was found, whose primary and eluvial outcrops are located some 120 km to the southeast of the site. The presence of cortical flakes and especially of a pre-core with a weight of *c.* 4 kgs (Phase 1) indicates that not only blanks and tools were brought into the site, but that this material was worked locally. The amount varies from 3.4% in phase 1 to almost 30% of all artefacts whose raw material could be determined in phase 2. This type of flint was of less importance at De Bruin, although some specimens of 'Hesbaye' flint from the Liège area were documented. At both sites, Wommersom quartzite is found in only very low numbers – at Polderweg eight artefacts, all but one belonging to the first habitation phase; at De Bruin 7 artefacts (Van Gijn *et al.* 2001a; 2001b). This material originates from an outcrop close to Tienen (Flemish Brabant, B), some 90 km to the southeast (Gendel 1982).

19.3.4 Rhine Basin Group

In general, the inhabitants of Late and Final Mesolithic sites of the Rhine Basin Group – or Rhine-Meuse-Schelde B (RMS B) complex (cf. Gob 1985) – for which data on raw material procurement have been published, are thought to have collected their flints at the closest possible source. Thus, the majority of them used pebbles and rolled nodules from local (or regional) river gravels, even if it was of poor quality. This even holds true for sites located at a similar distance to the limestone area as was Geleen-JKV, such as Dilsen-Dilserheide (De Bie *et al.* 1991) or Opglabbeek-Ruiterskuil (Vermeersch *et al.* 1974). Even at Mesch-Stenenberg (Eijsden, NL), a Late Mesolithic site only three to four kilometres distant from the Lanaye flint extraction points at Rijckholt, Banholt, and Mheer, a different type of flint was used (De Warrimont/Wouters 1981). Interpreting this assemblage is not altogether unproblematic. Most of the published microliths actually cannot be linked reliably to the site (De Warrimont pers. comm. November 2007), and the Mesolithic date of core and flake axes in the southern Netherlands is recently under discussion (Verhart/Groenendijk 2005). Moreover, the original raw material identification should be revised. According to A. Wouters the material, a vitreous, translucent very dark grey or black flint with few light inclusions, was of northern, erratic origin (and thus suggested the presence or influence of northern Mesolithic traditions in the southern parts of the Netherlands). Nowadays, the material is thought to be local, originating from the Zeven Wegen member of the Gulpen Formation (Felder 1998), and collected from a secondary depositional context in the slopes of the river Voer valley (De Warrimont pers. comm. November 2007).

The flints worked in the Late Mesolithic occupation of the S.D.T. sector at Liège-Place St. Lambert had the same source as those described earlier for the LBK habitation: they were transported nodules from vitreous Hesbaye flint, collected locally in deposits of the river Légia (Van der Sloot 1999). Material from bedrock (or slope) deposits in the Vetschauerberg/Lousberg area was of regional importance, being mainly used at sites located within 35 km from the outcrops, although it was transported to the other side of the Rhine, up to 100 km from the source, where it made up 1-2% of some Early Mesolithic assemblages (Arora 1979).

Merselo-Haag (Venray), in the north Limburg Meuse valley seems an exception to this general pattern (Verhart 2000). Although the majority of flints are made from nodules collected from local gravels, some material is thought to derive from residual loams or from slope deposits in the Dutch/Belgian limestone area. It is not easy, however, to determine the proportion of primary and residual material from Verhart's (2000) descriptions. This problem is caused by ambiguities in the way material originating from primary and secondary depositional contexts was differentiated. It should be noted that the cortex of flints from terrace deposits close to the limestone area may be very little altered (Löhr *et al*. 1977), whilst the cortex of most Lanaye nodules from residual loams is still rough (De Grooth in press b). However, I do not doubt that some of the Merselo flints indeed originate from the limestone area, and I even think it plausible that some of the material described as having a reddish or brownish zone under the cortex may have been collected at the Banholt extraction point.

At almost all Late Mesolithic sites, however, varying amounts of imported material were worked and used as well, notably the characteristic quartzite outcropping only at Wommersom, near Tienen in northern Belgium (Gendel 1982). It is ubiquitously present in Belgium and the southern part of the Netherlands, but becomes rare north and east of the Rhine. The percentages vary from almost 50% to less than one percent.

19.3.5 La Hoguette

To my knowledge, at present only two sites exist of which something may be said about lithic raw materials associated with La Hoguette pottery or its *Begleitkeramik* (cf. Jeunesse 1994; Brounen 1999): the Wilhelma site of Stuttgart-Bad Cannstatt in Baden-Württemberg (Strien/Tillmann 2001) and Haelen-Broekweg in middle Limburg (Bats *et al*. 2002). At Wilhelma, the predominant material (nine out of 16 artefacts) is Wittlinger chert (from Jurassic outcrops in the Suabian Alb, some 40 km to the south of Stuttgart). Other Jurassic cherts may originate from the Suabian or Franconian Alb. At least two artefacts are made of a vitreous, translucent Upper Cretaceous flint called 'pseudo-Baltic' or 'Tétange' flint in German literature (Zimmermann 1995), whose origin is controversial. Finally, the raw material of one artefact resembles that used at the Bavans rock shelter in the French Jura. At Haelen, the artefacts associated with La Hoguette *Begleitkeramik* in all probability were made from Lanaye flints (Bats *et al*. 2002). As they lack cortex or other natural surfaces, the depositional context cannot be assessed. Their somewhat bleached aspect, however, suggests an eluvial origin.

19.4 Knapping styles

In this section, I shall not try to reconstruct precise knapping techniques applied, because it is well-known that different techniques may be used to obtain identical results (Newcomer 1975; Tixier 1982; Inizan *et al*. 1992). My purpose is rather to describe the characteristics left on cores and blanks by whichever technical procedure was used in the reduction process. Differences in these procedures are thought not to be a matter of technical necessity, but of choice, and thus ultimately they reflect technological and cultural traditions (Lemonnier 1993). The most important, and best observable, variables are the desired angle between striking platform and core face – visible directly on cores and in the *angle de chasse* between butt and dorsal face on blanks (Inizan *et al*. 1992), and the ways striking platform or core face were readjusted during knapping, so as to maintain the required angle between them.

19.4.1 Geleen-Janskamperveld

Despite the presence of flake cores and of a great many flakes, Geleen-JKV's assemblage may be described as a blade industry, because the majority of tools were made on blades and there is evidence that partially reduced blade cores were exported from the site to be further reduced at other LBK settlements (De Grooth 2007; in press a).

Most blade cores are cylindrical in shape and possess only a single striking platform. Striking platforms were made by the removal of one or several large decortication flakes. The desired flaking angle was *c*. 90°. This angle was maintained in different ways. Firstly, a somewhat perfunctory type of dorsal reduction was commonly practiced. Subsequently, larger flakes were removed centripetally from the striking platform (resulting in faceted core platforms and flat or dihedral butts on the blades). The final and most drastic stage of readjustment consisted of the detachment of a rejuvenation tablet. The same core face remained in use, but the blades produced were 1-2 cms shorter.

In general, the blades are rather short and stocky: the average length of entire blades is 40.3 mms (range between 17 and 81 mms), and the length and width of complete blade tools – other than arrowheads – averaged 39.8 mms (range 16-86 mms) and 22 mms (range 8-39 mms). The mean Length:Width index of complete blades is 2.6. As a result of the way striking platforms were prepared and maintained, the surface of the butts was plain (52%) or dihedral (46%). The majority of butts are oval in shape (63 %), the others mostly semi-oval or ribbon-like (16% and 17% respectively). Linear or point-like butts are virtually absent. The butts are comparatively large (platform width mean 10.6 mms, sd 3.1; platform thickness mean 4.3 mms, sd. 1.4). Their width, however, is always considerably smaller than the maximum width of the blade. The bulbs of percussion mostly are diffuse (75%), and often a slight ventral lip is present (66%). Lance scars and pronounced *eraillures* (bulbar flakes) occur quite often too (59%).

A knapping style very similar to the one described for JKV was practiced at other Flomborn sites, *e.g.* Elsloo

(De Grooth 1987), Langweiler 8 in the Rhineland (Zimmermann 1988) and Gerlingen and Vaihingen in Baden-Württemberg (Strien 1999; 2000). Moreover, this general knapping style was widely spread in the subsequent LBK of Central Europe, *e.g.* at Hienheim in Bavaria (De Grooth 1977). By and large, this style continued to be used in the younger sites of the Graetheide cluster and in the Hesbaye, although some subtle differences are apparent. The inhabitants of Beek-Kerkeveld also used the Banholt raw material source, but produced considerably longer blades. The amount of dorsal reduction decreased too, as did the practice of platform readjustment through the removal of centripetal flakes (De Grooth 1987). This trend is even more marked in the Hesbaye settlements Liège-Place St. Lambert (Cahen 1984) and Verlaine, Petit-Paradis (Allard 2005). Platforms preferably were rejuvenated by means of the systematic, almost exuberant removal of whole series of tablets, a method highly wasteful in terms of raw material economy (but quite nice for modern refitters). However, according to Allard (2007), centripetal flaking to prepare platforms was widely used in the LBK of the Paris Basin.

19.4.2 ELBK

In the last two decades a great deal of information on the ELBK knapping style has become available (Tillmann 1993; Gronenborn 1997b; Mateiciucová 2004). In Bavaria, Baden-Württemberg and Hessen the favoured angle between striking platform and core face was *c.* 90°. Preparation by dorsal reduction was practically unknown. Fine-tuning instead took place through the removal of tiny chips from the striking platform before each blade was detached. This preparation was performed to such an extent, that the faceted part was almost as wide as the blade to be. This procedure resulted in blades with a ‘primary faceted’ butt, *i.e.* a butt on which complete negatives of chip removals are present. Intermittently, a number of blades was produced without readjustment of the angle, resulting in butts with secondary facets, *i.e.* incomplete negatives. The butts were wide, reaching 50-70% of the maximum width of the blade, and most blades had both a ventral lip and a pronounced bulb of percussion. The blades are long and slender with straight, parallel edges and with a Length:Width index of at least 1:3. This knapping style is indistinguishable from the one practiced by Late/Final Mesolithic groups in southern and south-western Germany (Tillmann 1993; Gronenborn 1999).

Once more Bruchenbrücken is exceptional, and again, it should be noted that evaluation and interpretation of its data are problematic, as most ELBK refuse pits contained important amounts of younger, intrusive, Bandkeramik material as well (Gronenborn 1997a). However, many regular blades and tools made of ‘western’ Cretaceous flints (from the Meuse region) possess the pronounced bulbs and wide, primary faceted butts characteristic for the ELBK. In addition, a few (n=9) blades with diffuse bulbs, dorsal reduction and small butts were found in pits assigned to the ELBK. These are seen to represent a (north-)western European Late Mesolithic knapping style, and hence to document the coexistence of two different cultural traditions in the settlement (Gronenborn 1999). Alternatively, they could be the result from contacts with the ELBK settlement cluster around at Eilsleben (Kr. Wansleben, Saxony-Anhalt) and Eitzum (Ldkr. Wolfenbüttel, Lower Saxony), where cores with acute detachment angles, and sometimes with alternately worked opposed platforms were worked according to northern Mesolithic traditions, producing blades with small plain or punctiform butts (Wechler 1992).

19.4.3 Hardinxveld-Giessendam

The knapping performed at the Polderweg and De Bruin sites resulted mainly in irregular flakes. This happened especially when the bipolar (or ‘hammer-and-anvil’) technique was used on ‘Meuse egg’ flints, and the assemblage accordingly is described as a flake industry (Van Gijn *et al*. 2001a; 2001b). However, a small number of regular blades and blade tools were present at the sites as well. It is impossible to determine whether they were made by the river dunes’ inhabitants, at one of their other seasonal camps (perhaps located in the vicinity of extraction points), or were acquired from others through some form of exchange. Although no detailed technological analyses were performed, the knapping style displayed by these artefacts fits into the general flint knapping tradition of the Rhine Basin Group/RMS B complex, described below.

19.4.4 Rhine Basin Group/RMS B Complex

In this tradition, the desired angle between striking platform and core face is acute. The initial striking platform was formed by the removal of one decortication flake. The preferred way of readjustment of the flaking angle consisted of dorsal reduction, *i.e.* the removal of tiny chips off the proximal part of the core face. This resulted in blades with either a plain or a dihedral butt, and an acute *angle de chasse*, generally speaking between 75°and 85°. Occasionally, the striking platform was rejuvenated by centripetally removing short, wide flakes, or by the detachment of a rejuvenation tablet. The majority of cores possessed a single platform, or two opposed or orthogonal platforms that were used consecutively.

Within this general tradition two knapping styles are distinguished. The first, the so-called Coincy style, as defined originally by Rozoy (1968a) for the French Middle Tardenoisian (Middle Mesolithic), is characterized by short, stocky blades. Dorsal reduction was careful and extensive, resulting in butts that are both markedly narrower than the width, and thinner than the thickness of the blade. The blades are sinuous in longitudinal section, especially in the distal part, although not really plunging. The second, the Montbani style (Rozoy 1968a), connected to the recent phase of the Tardenoisian in which trapezes are present (Late and/or Final Mesolithic), has slender, very thin, regular blades, with parallel sides and dorsal ridges. The thickness is constant over their entire length, and Montbani-style blades are less sinuous than their Coincy counterparts. Dorsal reduction is less pronounced than in the Coincy style, resulting in butts that are thinner than the thickness, but not narrower than the width of the blade. In several cases, however, blades with really small, thin, and narrow butts too are described as displaying the Montbani knapping style – *e.g.* at Weelde-Paardsdrank (Huyge/Vermeersch 1982) and Haelen-Broekweg (Bats *et al*. 2002). Obviously the criteria 'slender', straight', 'with parallel edges and arises' are deemed sufficiently characteristic.

Both styles are found not only in the area of the Rhine Basin Group, but also further to the south. The Montbani style occurs for example in the Mesolithic layers of the Bavans rock shelter (Aimé/Jeunesse 1986). In Belgium and the southern part of the Netherlands, both styles were practised at broadly coeval sites. At some sites, such as Weelde-Voorheide (Verbeek/Vermeersch 1995), artefacts made from locally available flint display the Coincy style, whilst most of the Wommersom artefacts were made in the Montbani style. At others, such as Weelde-Paardsdrank 5 (Huyge/Vermeersch 1982) flint and Wommersom blades alike are described as being Montbani-like in knapping style; the *angles de chasse* are *c.* 75° (Gronenborn 1997b). At Merselo-Haag (Venray), a number of long, regular blades of Wommersom quartzite in Montbani-style, are thought to have been imported and not produced locally (Verhart 2000).

The site of Liège-Place St. Lambert, sector S.D.T., again is of special interest, because of its proximity to Geleen-JKV both in time and in space. This assemblage is characterised by Van der Sloot (1999) as resembling the 'style de Coincy'. This holds true for both artefacts made from locally collected Hesbaye flint and for artefacts made of imported Wommersom quartzite. At this site the majority (52%) of butts are linear or punctiform in shape. 34% Of the blades have a plain butt. Dihedral or faceted butts are the exception (4%). The blades are stocky, with irregular, sub-parallel edges and arises. The length of entire blades lies between 20 and 50 mms, and their width mainly between 10 and 15 mms. The Length:Width index varies between 2 and 3, but the majority of blades has an index close to 2.

19.4.5 La Hoguette

The blades and tools found associated with *Begleitkeramik* at Haelen are slender and regular (Bats *et al*. 2002), with a width between 15 and 25 mms. Their butts are plain, relatively narrow and thin, with extensive, careful dorsal reduction. The bulbs of percussion are diffuse, with few (and then tiny) bulbar scars. Most blades carry a clear ventral lip. They rather bring the 'imported' blades of Merselo-Haag (Verhart 2000) to mind. The few blades found at the La Hoguette site of Stuttgart-Bad Cannstatt (Strien/Tillmann 2001) possess small, plain or dihedral butts. The negatives on the dihedral butts are relatively large, and some dorsal reduction is present. In size, they are considerably larger than the blades known from regional LBK settlements. They are thought to resemble French Late Mesolithic assemblages. For neither of these two La Hoguette assemblages data on the *angle de chasse* are at present available, but both could have been made in the Montbani style.

19.5 Arrowheads

Recent discussions on Mesolithic-Bandkeramik interactions west of the Rhine, and on the possible relationships existing there between the LBK and the La Hoguette and Limburg groups focus almost exclusively on arrowheads (*e.g.* Löhr 1994; Gronenborn 1990; 1999; Jeunesse 2002; Gehlen 2006; Heinen 2006; but see *e.g.* Allard 2005; Hauzeur 2006 for a critical view). They are seen as markers for cultural identity, providing an insight into regional and supra-regional traditions and connections (Gehlen 2006). Focal in these discussions are the so-called Bandkeramik arrowheads (Danubian points or *pointes Danubiennes*), and a group of points known as 'Bandkeramik-like points' or 'points of Danubian type', such as found in a Late Mesolithic context at Weelde-Paardsdrank 5 (Huyge/Vermeersch 1982). Unfortunately, despite the frequent use of these labels, and especially in view of the far-reaching interpretations based upon their occurrence, these types are not very well-defined.

Defining characteristics for the 'classic' Bandkeramik points originally were an asymmetric triangular outline and one obtuse basal angle (Bohmers/Bruijn 1958). Considerable variation was allowed in the shape of the base and the ways base and long sides were retouched. Thus, the base could be unretouched or carry a flat ventral retouch, that may or may not be combined with steep retouch on the dorsal face, resulting in a slightly hollow base. Additionally, one of the long sides usually carries more intensive retouch than the other one. In recent literature, the flat ventral basal retouch is commonly called '*retouche inverse plate* (RIP)' (Rozoy 1978; Löhr 1994), or '*retouche plate inverse* (RPI)', according to Jeunesse (2002). For Newell (1970), the basal angles were of no interest. He insisted on asymmetry and the shorter of the sides being shaped by a burin scar on the tip, combined with flat dorsal retouch on the rest of that side, whilst the longer side remained unretouched. Nowadays, both the obtuse basal angle and the burin scar seem to have lost definitional importance. Instead, slight asymmetry (with acute basal angles) suffices, but a base shaped by flat retouch on the ventral site, preferably combined with steep retouch on the dorsal face, is a *conditio sine qua non*. Ideally, the base should be concave, but straight ones are acceptable as well. Additionally, one of the long sides should be left unretouched. Unfortunately, no clear definitions are offered that would lead to unambiguous, replicable distinctions between symmetric and asymmetric triangular points. Thus, some perfectly symmetrical points are included too, such as the three points found at the ELBK settlement at Goddelau in Hessen (Gronenborn 1997b). Even quadrilaterals, especially those with flat ventral basal retouch sometimes are included among the 'Bandkeramik points' (*e.g.* Brounen/Peeters 2001).

Matters are even more confusing because asymmetric triangular points with flat ventral retouch on the base found in a Late Mesolithic context commonly are called 'Bandkeramik-like' points (*e.g.* Huyge/Vermeersch 1982), or even 'Danubian point' (*pointe danubienne*, Rozoy 1968b). Originally, the label 'Bandkeramik-like' seemed to make sense, because these points were thought to have been made under the influence of true LBK examples, such as were often found outside the areas settled by Bandkeramik farmers. Nowadays, an entirely different argumentation prevails, and the 'Bandkeramik-like' points are regarded as the prototypes. Their origin is sought in (south-)western European Mesolithic traditions (Löhr 1994; Jeunesse 2002; Gronenborn 1999; Gehlen 2006) and they would have been introduced to the incoming farmers by local hunter-gatherers, or even be evidence for a profound involvement of those indigenous groups in shaping the western Bandkeramik world. Thus, this point of view returns to the one already formulated by Newell (1970), but with different arguments, and involving different Mesolithic groups (*e.g.* Heinen 2006).

The argumentation is based on several typomorphological observations. The first of these has to do with the occurrence of flat ventral retouch (RIP) on the base of both symmetric and asymmetric arrowheads. This trait is encountered on many Late Mesolithic trapezes, and its origins are sought in central and south-western France (Gehlen 2006), where it is commonly found on both trapezes and triangular points belonging to the Early Neolithic Rocadourian Culture (Roussot-Larroque 1990). The second observation considers regional traditions in the lateralisation of trapezes and asymmetric triangular points. To assess this lateralisation, the artefact is observed with the dorsal face up, the base closest to an imaginary X-axis and the longest side parallel to the Y-axis. The location of the shortest parallel side (for trapezes and quadrilaterals) or of the angle between base and shortest side (for triangles) determines whether the point is regarded as right-winged or left-winged (Löhr 1994). According to Löhr (1994) and Jeunesse (2002), left-winged arrowheads prevail in Alsace, along the Neckar and the Moselle river area, whilst right-winged arrowheads are predominant in the LBK of Dutch Limburg, Belgium and north-western France. This east-west dichotomy is thought to have its origins in Late Mesolithic traditions, where right-winged asymmetric trapezes are found mainly in the area between the river Seine and the Lower Rhine (as well as on the northwest European Plain and in Denmark). Left-winged trapezes have a more southerly distribution, with concentrations in southern France, Switzerland and northern Italy.

The combination of these two phenomena, on many arrowheads found in the flint industry of both western Bandkeramik groups and their successors such as the Rubané Récent du Bassin Parisien and the Villeneuve-Saint-Germain group (Allard 2005) is seen as evidence for interactions between the LBK newcomers and a local substrate. Moreover, both Löhr (1994) and Jeunesse (2002) see a connection between the distribution areas of asymmetric arrowheads and the Early Neolithic non-Bandkeramik pottery groups La Hoguette and Limburg: left-winged points mainly occur in the area where La Hoguette pottery prevails, whilst right-winged points have a similar distribution as Limburg pottery. Finally, the use of the microburin technique too is seen as evidence of Mesolithic influence.

Additionally, it should be noted that triangular points with a retouched base (and with RIP) are found only rarely in a Late Mesolithic context in the southern part of the Netherlands and lowland Belgium. In this region, mistletoe leaf points (*feuilles de gui*), and other points with surface retouch are thought to be characteristic for the Middle Mesolithic (Rhine-Meuse-Schelde group A), with trapezes and backed bladelets marking the start of the Late Mesolithic (Rhine Basin group or RMS B) (Gob 1985, Otte/Noiret 2006). In the Upper Danube Valley, the Jura and northern Switzerland, however, triangular points with basal retouch have a long tradition, going back to the Early Mesolithic (Gehlen 2006; Thévenin 1992). Thus, the triangular points with RIP in the Rhine-Meuse-Schelde region would point to southern connections.

Finally, it is often assumed that the Middle Mesolithic types with surface retouch continued to be used during the Late Mesolithic (Gob 1985; Heinen 2006). This claim is difficult to assess, because of the lack of well-dated, briefly occupied or well stratified sites mentioned in an earlier section (cf. Vanmontfort 2007; Vermeersch 2006). Anyhow, here as in almost every part of Late Mesolithic Europe, trapezes, mostly made of standardized, regular blades, were the most common type of projectile point.

Besides the similarities, there also exist clear differences between 'Bandkeramik' points from a direct LBK context, and their Mesolithic counterparts (Huyge/Vermeersch 1982; Allard 2007). Belland *et al*. (1985) have sought to outline these differences through the comparison of a group of asymmetric triangular points with bifacial basal retouch ('points with Bandkeramik affinities') from the Himeling surface site (Moselle department in northern France, just south of Luxembourg) with points from a secure LBK context in Lorraine. They found that the Mesolithic specimens in general were smaller and narrower and less intensively retouched. By definition all the bases carried flat ventral retouch (RIP), and mostly steep dorsal retouch as well. In the Himeling sample most points had only one retouched long side, and bifacial retouch of the long sides occurred less frequently too than in the Lorraine sample.

19.5.1 Geleen-Janskamperveld

Given its Early LBK date, a study of the Geleen-JKV arrowheads may provide a valuable contribution to the present discussion, especially as this settlement is located in a region where La Hoguette/*Begleitkeramik* and Limburg ceramics are found not only in Bandkeramik refuse pits (Brounen/Vromen 1990; Van de Velde 2007), but also independently (Modderman/Deckers 1984; Modderman 1987; Brounen 1999; Tol 2000; Bats *et al*. 2002).

Among the *c*. 7000 flint artefacts excavated at Geleen-Janskamperveld, three microlithic points were found. One of these was incomplete, two could be identified as B-points, *i.e.* microliths with an oblique, partial dorsal retouch along one of the edges; one of them had some slight retouches on the base as well.

Initially, following existing typomorphological sequences (*e.g.* Verhart/Arts 2005; Verhart/Groenendijk 2005; Wansleeben/Verhart 1992) I readily assigned them to the Early Mesolithic and thought them to represent activities predating the LBK by some millennia (De Grooth 2007). Given the Hardinxveld-Giessendam evidence for B-points still being used at the time of JKV's Bandkeramik habitation, this conclusion was somewhat premature. The points are unweathered, and made of Lanaye flint from an unspecified depositional context. Moreover, the same pit contained several bladelets that would not have been out of place in a Mesolithic context. At present, I see no possibilities to decide whether the microliths indeed predate JKV, or are proof of contacts between Bandkeramik settlers and local hunter-gatherers. In general, the idea still prevails that LBK settled in areas that were only marginally exploited by hunter-gatherers. Microliths found at western LBK-sites are presumed to be considerably older, especially as they include Middle Mesolithic types that are assumed to have been out of use since the middle of the 7th millennium cal BC (Vanmontfort 2007).

Of the 48 other arrowheads that could be described in typomorphological terms, 21 were asymmetric triangles, and three asymmetric quadrilaterals, thus 50% may be described as asymmetric (table 19.1). Ten of the asymmetric triangles are left-winged, the other eleven and the three quadrilaterals were right-winged. The intensity of retouches could be assessed for 42 of the points. Quite a number of bases are unretouched, not only on the symmetric points, but also on three out of 14 right-winged ones. RIP, with or without accompanying steep dorsal retouch, is found on 50% of the left-winged points and on even fewer of the other two varieties (35-39%). 90% Of the left-winged points had retouches on both long edges, as have 76% of the symmetrical points, but only 10% of the right-winged ones display such retouch.

Finally, a slight majority of JKV's points (55%) does not display bifacial retouch on either one or both of the long sides. This especially holds true for the right-winged asymmetric group, and to a lesser extent for the left-winged ones. For the symmetric ones the situation is reversed: two thirds are bifacially retouched on either one or on both long sides. Pronounced asymmetry, characterizing 'Bandkeramik points *sensu* Bohmers/Bruijn' (1958), with an obtuse angle between the base and one of the long sides, however, is found on only ten of them (21%), equally divided among the right- and the left-winged specimens.

19.5.2 Hardinxveld-Giessendam

The points from Hardinxveld-Giessendam, too, are of special interest, because they were found in a stratified, well-dated context (Van Gijn *et al.* 2001a; 2001b). Four of the triangular points thought to posses Bandkeramik affinities – two from each site – strongly resemble the 'Bandkeramik-like' points from *e.g.* Weelde-Paardsdrank 5 (Huyge/Vermeersch 1982), Merselo-Haag (Verhart 2000) and Himeling (Belland *et al*. 1985). The two others, however, from a typomorphological point of view really would not be out of place in a LBK context. The first one, from Polderweg phase 1 (5500-5300 cal BC), is a left-winged asymmetrical point, its basal angles are acute, the base is concave and shaped by RIP and steep dorsal retouch. Both long sides are retouched too, the left one more intensely than the right one. One of the De Bruin phase 2 points, too, would on the basis of the Himeling criteria rather fit into an Early Neolithic than a Mesolithic context.

19.5.3 ELBK, La Hoguette

The characteristic projectile points found in ELBK settlements are small, mostly symmetric, trapezes. They are very similar to the ones used during the Late Mesolithic of southern and south-western Germany (Gehlen 2006; Gronenborn 1999). Although some associations between left-winged asymmetric points and La Hoguette ceramics are documented (Gehlen 2006), trapezes were present at both Stuttgart-Bad Cannstatt and Haelen-Broekweg. The triangular

		left-winged	right-winged	symmetric	?
lateralization		10	14	18	6
basis					
	RIP+Dorsal	3	4	3	
	RIP	2	1	4	
	dorsal	5	6	3	
	no retouch	0	3	7	
long sides					
	one side retouched	1	8	1	
	two sides retouched	9	6	17	
	bifacial retouch	4	3	12	
dimensions (mean range stdev)					all (N=48)
	length	31.0	24.9	27.9	27.2
		26-34	22-34	19-44	19-44
		3.8	3.8	6.3	5.3
	width	16.5	15.9	17.1	16.6
		14-18	11-22	11-23	11-23
		1.9	2.8	4.0	3.3
	thickness	4.3	3.8	3.7	3.9
		3-5	3-5	3-5	3-6
		1.0	0.8	0.8	0.9

Table 19.1 Geleen-Janskamperveld, characteristics of arrowheads.

point found at the latter site resembles the Himeling sample; both it and one of the trapezes are left-winged. The few triangular points found at Bruchenbrücken and Goddelau are often presented as evidence for Late Mesolithic or La Hoguette influences (Gronenborn 1990; 1999; 2007). As all but one of them are symmetric, and given the partial contemporaneity of these sites and Flomborn settlements, I think it more plausible that they are the result of ELBK and Flomborn interactions.

19.6 Interpretations

Before discussing the possible connections between JKV and its Mesolithic contemporaries, a closer look at the development of the Flomborn LBK is called for. The data on procurement strategies, knapping techniques and projectile points alike suggest that indigenous hunter-gatherers were notably involved in the development of the ELBK in southern and central Germany. If the new chronological framework is accepted, such an involvement seems inevitable, because the spread of the new lifestyle was too rapid and extensive to be explained in terms of migration.

Instead, models combining demic diffusion and acculturation are discussed (Frirdich 2005; Lüning 2007; cf. several contributions in Lukes/Zvelebil 2004 and Whittle/Cummings 2007). Small groups of farmers continuously split off, moving – in a ‘leap frog’ action – a considerable distance away, to the next favourable settlement area, where they successfully tried to convince neighbouring hunter-gatherers that theirs was the real life. The incentive for this action would have little to do with environmental factors or population pressure, but is seen as one way of acquiring prestige (Frirdich 2005).

Recent research on both ELBK and Flomborn-time settlements, suggests that the two traditions differed in many, fundamental ways (Sommer 2001). ‘Becoming Flomborn’, in this view, necessitated doing as many things differently as was possible without alienating the ancestors, or lead the preceding generations to severe the supply chains of *e.g.* adzes. The changes concerned fundamental habits of behaviour and thought, ways of grouping and organising people, the way the members of a community were brought up, and through which they – usually unconsciously or semiconsciously 'reproduced' themselves and which were transmitted to the next generation (De Grooth/Van de Velde 2005). Animal husbandry and crop cultivation remained the subsistence basis, although some new species apparently were adopted. Houses still should be long, of sturdy construction and necessitating the felling of a large number of huge trees, and adzes continued to be used in such lumbering and building activities. The architecture of the houses, however, underwent notable changes (Stäuble 2005). Not only did the trenches outside the house wall disappear, but a much higher number of posts were placed in the interior, creating the impression of living inside a domesticated version of the forest outside (Hodder 1990). Additionally, changes occurred in the temper of pottery (from chaff to grog and mineral tempers), in the shape of vessels and in details of ornamentation (Sommer 2001).

This entire process in many cases was accompanied by a change of settlement location as well (Cladders/Stäuble 2003). The majority of Flomborn LBK settlements were newly founded, and even when they succeeded the ELBK on place, a habitation hiatus occurred – *e.g.* at Bruchenbrücken (Kloos 1997), Gerlingen (Neth 1999) or Vaihingen a.d. Enz (Strien 2005). Often, however, in such newly established Early Flomborn settlements, a few ELBK decorated sherds are still present, or the oldest house plans show architectural details reminiscent of ELBK traditions, notably the presence of the stabilization trench outside the house wall (Stäuble 2005). A good example of this phenomenon is offered by Niederkassel-Uckendorf, lying just to the south of Cologne on the east bank of the river Rhine (Heinen 2005; Heinen *et al.* 2003).

Evidence based on the strontium isotope analysis of Flomborn-time skeletons, moreover suggest a marked demographic heterogeneity (Bentley 2007) and a high degree of mobility. Many people buried in the Flomborn cemetery, men and women alike, had spent considerable parts of their lives in other regions. (Price *et al*. 2001).

This change of habits at the start of the Flomborn LBK included a change of knapping style. In contrast to what may have happened in the ELBK, I think this new knapping style was not directly derived from Mesolithic techniques. Although the primary platform preparation (with southwest German Mesolithic roots) popular in the ELBK was abandoned in favour of dorsal reduction, the approximately right angles between striking platform and core face were retained, and were not replaced by the acute angles common in the Coincy or Montbani styles such as practised west of the Rhine.

The Flomborn LBK flint working style thus is an amalgamation of two traditions, resulting in a distinctive own style. Such a change should not be simply regarded as a matter of fashion change. It rather is a drastic transformation because it involved the abandonment of the traditional way of doing things, that one had practiced since childhood, and that had proved its worth for generations, and the mastering of a whole set of new skills and kinetic patterns (cf. Sommer 2001).

The background of this change may be understood through the situation at Bruchenbrücken. There two different styles existed alongside each other. One ultimately derived from southern and south-western Late Mesolithic traditions, but was incorporated in the ELBK, the other was of northern or north-western origin. Conceivably, elsewhere in the region, the process of 'becoming Flomborn' resulted in an amalgam of both the previously practiced styles. This probably happened in the Flomborn core region, where it is present at an early stage in settlements such as Gerlingen (Strien 1999) and Vaihingen (Strien 2005). Its continued use during later Central European LBK stages is documented at *e.g.* Hienheim (De Grooth 1977). The need to do thing differently also affected the archers' equipment. ELBK projectile points were small, mainly symmetrical trapezes, in the indigenous Late Mesolithic tradition. The Flombornians, in contrast, chose a triangular shape. Available evidence suggests that Flomborn points originally may have been symmetric, because that is the shape found almost exclusively among Flomborn and later Bandkeramik sites east of the Rhine (Davis 1975; De Grooth 1977) and in the Alsace (Hauzeur 2006; Allard 2007). Then, they may have been retouched more intensively on the long edges than their Mesolithic counterparts. Their concave bases and RIP would indicate that people having their roots in eastern and central France could have participated in this transformation (Gehlen 2006; Thévenin 1992). Their influence or presence may also have resulted in the slightly left-winged points found in the Flomborn assemblage.

'Becoming Flomborn' was also connected with a change in flint supply networks. In the Flomborn core region, the Neckar valley and northern Bohemia, the established raw material sources went on being exploited. Contrastingly, the westernmost settlement that showed ELBK reminiscences, Niederkassel-Uckendorf (Heinen *et al.* 2003), used Meuse flints of the gravel variety (cf. Weiner 1997), although a few Jurassic cherts from Bavaria had been brought into this settlement as well – covering a distance of at least 350 km. Thus, the change to eluvial Lanaye/Rijckholt flints may have occurred some generations later, after the western Rhineland and Graetheide region became settled. It seems plausible that right from the beginning the inhabitants of Geleen-JKV not only extracted Banholt flint for their own use. They may also have acted as suppliers of partially worked cores that were exported to contemporary settlements in the Rhineland, and finally even reached Flomborn sites in Hesse, *e.g.* Griedel (Wetteraukreis), some 10 km north of Bruchenbrücken (Zimmermann 1995). This distribution network was not unidirectional: adzes made from amphibolites travelled west. Actually, the major incentive to maintain alliances with eastern neighbours and kin may have been the western settlers' need of a continuous supply of amphibolite and basalt adzes (De Grooth 2007; in press a).

When the Flomborn LBK arrived at JKV, all its characteristic elements were already present, the new flint knapping style included. The availability of seemingly unlimited amounts of good quality flints may have helped its full development, but the improvement in blade quality seen at sites such as Beek-Kerkeveld, Liège and Verlaine suggests that fully mastering it may have taken some generations. The symmetric arrowheads found at JKV would represent an original Flomborn element. The intensely retouched long sides of the left-winged points may be regarded as evidence of longer lasting interactions between Flomborn 'Bandkeramians' and 'La Hoguettians', suggesting that their association had taken place before Graetheide was settled. Some 'La Hoguettians' thus may indeed have been incorporated in the Flomborn Bandkeramik society, before it reached the Graetheide region.

19.7 Possible connections between Geleen-JKV and the Rhine Basin Group

Despite the shared application of dorsal reduction, and the occasional occurrence of centripetal flakes and rejuvenation tablets, important differences in knapping style existed between Geleen-JKV and the Rhine Basin Late Mesolithic. The lack of slender, regular Montbani blades, generally thought to be connected to the later stages of the Late Mesolithic (Otte/Noiret 2006) is not crucial, because stocky, Coincy-like blades were still being produced at *e.g.* the S.D.T. sector of Liège-Place St. Lambert. In my view, the real importance lies in the differences in the core shapes. At JKV we find *c.* 90º angles between platforms and core faces, whereas Late Mesolithic cores have acute ones. Another feature is the lack of linear or punctiform butts at JKV, compared to their preponderance at Liège-Place Saint Lambert. Additionally, the exuberant use of tablets as a means of rejuvenation at JKV could be mentioned.

The strategies in raw material procurement, too, have little in common. The Rhine Basin Late Mesolithic groups basically made do with the closest sources of raw material, even if better-quality resources would have been available at only slightly longer distances. On the other hand, they all participated in the network distributing Wommersom quartzite (Gendel 1982). This is thought to be based on a shared notion of group identity, perhaps on the level of belonging to the same dialectic tribe (Louwe Kooijmans 2001b). The small amount of Wommersom quartzite recovered from the Hardinxveld-Giessendam sites shows their inhabitants too were included in the Rhine Basin social interaction sphere, which to the east just reached the Rhine (Arora 1979). On a more mundane level, they had connections with north Limburg and adjacent parts of the Rhineland (where Meuse eggs and other gravel flints could be collected, possibly in the framework of seasonal mobility). There are several ways they could have acquired their Rijckholt/Lanaye nodules: firstly through contacts in north Limburg, with people such as used the Merselo-Haag site. Alternatively, they could have collected them in passing on extraction trips to the Ardennes, or they may have been the result of incidental meetings with Graetheide 'Bandkeramians', who also used rocks to be found in the Ardennes (Bakels 1978).

Neither the good quality vitreous Hesbaye flints, nor Rijckholt/Lanaye flints from primary or eluvial deposits, nor flints from the Vetschau/Lousberg area had a structural role in the Late Mesolithic exchange network. Nor were JKV or its LBK contemporaries connected to the Wommersom circuit. Of course, the small amounts of Hesbaye and Zeven Wegen flints could be the result of links with indigenous hunter-gatherers, but independent acquisition seems just as likely, assuming open access to the extraction points (De Grooth 1997).

In this context, some comments on the Bruchenbrücken situation should be presented. Originally, the presence of western flints at this settlement was seen as evidence for the existence of cross-cultural exchange networks, linking the ELBK with either hunter-gatherers of the Rhine Basin Group or with people making La Hoguette and/or *Begleitkeramik*. The use of Rijckholt/Lanaye flints at Haelen-Broekweg, may support this notion, but other considerations contradict it. Those Late/Final Mesolithic groups that used Vetschau and Lousberg flints, did not exploit Lanaye/Rijckholt flints, so their combined presence at Bruchenbrücken would need additional explanations. This same problem arises, when the Flomborn inhabitants of the Graetheide and the western Rhineland are seen as suppliers at the beginning of a down-the-line exchange system, because Vetschau flint was not one of their favoured raw materials.

An alternative explanation could be based on the notion of mobility, inherent in the way Bandkeramik expansion is now modelled. The 'Great Leap Westward' model is unthinkable without extensive scouting expeditions, which would not only have looked for suitable arable land, but for raw material sources too. In that scenario, the presence of Vetschau flint suddenly makes sense: the Lousberg and the Vetschauerberg are located opposite the north-westernmost spurs of the Eifel foothills. Being the first hills containing chalk in their subsoil, they would have been easily recognisable, not only by their shape and location but also by their vegetation. They would have marked the beginning of 'Flintland' for expeditions coming from the southeast. One can imagine them to have collected a few nodules as a souvenir of this landmark. Although Lousberg flint is the better recognizable and more attractive of the two, it is utterly unsuitable for making blades. Therefore Vetschau would have been chosen as material reminder of this special location.

Nevertheless, with due effort, some Rhine Basin Mesolithic influences may be detected on the Graetheide. The less intensely retouched right-winged arrowheads, still strongly resembling Mesolithic examples, could indicate that contacts with locals belonging to the right-lateralized world (*i.e.* people belonging to the Rhine-Basin Group/RMS B complex), started only after JKV and its contemporaries were settled. Perhaps the B-points and bladelets found at JKV are the result of such contacts too. In subsequent LBK stages Mesolithic influences would be discernible in the increased proportion of right-winged points at the Elsloo graveyard (Modderman 1970), and in the LBK of the Hesbaye and Hainault (Allard 2007). Some important, active involvement may be seen in the introduction of the microburin technique of blade breaking in some Hesbaye sites (Eloy 1963). Also worth mentioning is the Kleine Gete LBK settlement cluster (Lodwijckx/Bakels 2000). These outlying sites, located very close to the Wommersom outcrops and dated to the Younger LBK, are remarkable because of the production of adzes made from phtanite d'Ottignies, a preferred Mesolithic raw material, which then circulated through the Bandkeramik world (Bakels 1987).

Last but not least, the Hardinxveld-Giessendam points play a role too. As mentioned earlier, most of the triangular points with RIP found at the Hardinxveld-Giessendam sites display clear affinities with the 'Bandkeramik-like' points like those known from Weelde-Paardsdrank (Huyge/Vermeersch 1982), Merselo-Haag (Verhart 2000) or Himeling (Belland *et al.* 1985). They, therefore, would not be indicative of contacts with Bandkeramik groups, but rather be the result of inter-Mesolithic relationships. Two points, in my opinion, fit much better into a true LBK context. The oldest one, from Polderweg phase 1, is described as being of 'Rijckholt' flint, but in the absence of cortex nothing definitive can be said about the ultimate depositional context of the material. Given its shape and its raw material, this artefact could be seen to be the result of real contacts between the Polderweg hunter-gatherers and JKV (or its neighbours) – if one is willing to accept that the Graetheide was already settled at that time. If not, two possibilities remain. Firstly, that the point was intrusive to the phase 1 deposits, and actually was discarded at some later time, but this may be too easy an explanation. Secondly, it could derive from contacts with 'Flombornians' such as inhabited Niederkassel-Uckendorf, who used Lanaye/Rijckholt flints from a gravel context and made triangular arrowheads. The second suspected Bandkeramik arrowhead comes from De Bruin's phase 2, *i.e.* the period in which Blicquy pottery occurred. Its left-winged lateralization, however, would be rather out of place in the Blicquy Group, whereas such points were still being used on the Graetheide and the Hesbaye during the Younger LBK.

A re-evaluation of points called 'Bandkeramik' or 'Bandkeramik-like' found outside the LBK settlement zone is clearly called for. In my view, it would be premature to throw them all out by simply assigning them to the Mesolithic instead (Lanting/Van der Plicht 1998). This holds true especially in view of the similar distribution pattern of a great number of LBK adzes (Verhart 2000), that had not been made locally from local or regional raw materials, but were imported as finished objects from Central Europe (Bakels 1978; 1987).

19.8 Final remarks

All in all precious little evidence for linking JKV to the Late Mesolithic sphere of the Hardinxveld-Giessendam sites has come to light. They may have been aware of each other's existence, and may even have met occasionally on raw material collecting trips in Limburg or in the Ardennes, but that is it.

The new models for the spread of the LBK (and thus for neolithisation) are much more plausible than either the idea of acculturation or of demic diffusion (De Grooth/Van de Velde 2005). Nevertheless, in some aspects, they smack conspicuously of a reinvention of Europe's modern colonial past: the omniscient newcomers doing it all for the benefit of the natives, but in the meantime creating a position of power because of their privileged knowledge on *e.g.* agriculture, herding, or house building. Therefore I am glad to conclude with the observation that the hunter-gatherers west of the Rhine were much less inclined to 'go over' than their Central European counterparts. As Leendert has known al along (Louwe Kooijmans 2007), they obviously were not impressed by the new lifestyle and continued to live as hunter-gatherers, happily, if not ever-after.

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20 On the production of discoidal flint knives and changing patterns of specialist flint procurement in the Neolithic on the South Downs, England

Julie Gardiner

20.1 Introduction

In the greater part of the British Isles a large proportion of our evidence for the material culture of the Neolithic resides – largely forgotten and certainly unloved – in the stores of countless museums. Many tonnes of surface recovered flint artefacts, many of them completely uncatalogued, have been deposited over the last couple of centuries by innumerable flint collectors but only rarely has any of this vast resource been studied in any systematic fashion or alongside more ‘scientifically’ recovered assemblages from controlled fieldwork. In 1980 the present author began researching into surface flint scatters from the English South Downs for a PhD supervised by Richard Bradley. Richard introduced me to Leendert Louwe Kooijmans (at a conference appropriately dedicated to the subject of flint; Sieveking *et al.* 1986) and an earnest but convivial discussion ensued as to the value and importance of such collections on both sides of the North Sea. This led to an invitation to visit Leiden where I spent a month studying comparative assemblages and discussing with Leendert and his colleagues methods and approaches to the recording, evaluation and analysis of surface assemblages. Together with the many museum visits, introductions to Dutch archaeologists, quantities of Old Genever and highly competitive games of table tennis, this proved to be a formative sojourn in my early career.

Despite the acknowledged difficulties in working with such unsystematically recovered material, any detailed study of surface assemblages over a large area quickly reveals marked disparities in the range and variety of objects present, both spatially and between the surface collected material and that from most excavated sites. Such differences can be examined and explained in a variety of ways (see for instance Gardiner 1984; 1987; Healy 1987) and the arguments will not be rehearsed again here.

It was, of course, the identification of recognisably distinct toolkits that led to the adoption of the eponymous sub-divisions of the Stone Age in the first place, and our vastly increased and refined understanding of the many and varied components of the Neolithic toolkit (lithic and otherwise) has been the result of more than a century of detailed study by a host of scholars. We should not forget, however, that the earliest, and some of the most influential, of these scholars were working almost entirely with unstratified finds (most obviously and importantly Evans (1872; 1897)) and that their work remains, in large part, entirely valid today.

It goes without saying that we now have a reasonably good idea of the chronology, sequence, spatial distribution and cultural associations of Neolithic flintwork assemblages among many classes of site and in many contextual situations at local, regional and national scales. But one result of our greatly expanded knowledge is that we can now see that some lithic objects fall *outside* the ‘normal’ run of Neolithic flintwork, in terms of their technological attributes, raw material and/or distribution, yet cannot be neatly accommodated in any close spatial, temporal or contextual ‘package’. We might, for instance, be able to distinguish (up to a point at least) and predict the components of a ‘Beaker package’ or a ‘Wessex 1 burial’ or a series of ‘Grooved Ware pits’ incorporating lithics but some distinctive classes of artefact continue to defy such neat categorisation. Moreover, they may cross-cut, or be entirely absent from, such ‘structured’ deposits, but in so being they may make an important contribution to our understanding of the development of Neolithic society.

Such artefacts can be seen to contribute to the suggestion of a new concept of Neolithicisation. Like decorated pots or monuments they may have become ‘special’ in their own right. They may not appear prominently in the burial record, or exclusively in unusual or specific contexts, but they may have attained a recognised relative value or status beyond any (to us) obvious attribute other than, perhaps, their distinctive appearance. One such candidate is the polished discoidal knife.

20.2 Discoidal knives

In 1928 Grahame Clark, drawing on earlier descriptions by Evans (1872; 1897) and research by Clay (1928), published one of a series of seminal artefact studies on the definition and classification of polished discoidal flint knives. A simple typology was recognised, consisting of essentially circular, triangular, lozengic or rectangular forms up to 10 mm thick with maximum dimensions ranging between *c*. 50 mm and 100 mm. Clark’s description has not been bettered, the knives are “flaked on both faces so as to remove both bulb and striking platform, the edges being further bevelled by polishing. The faces are also smoothed down to remove sharp intersections of flake scars. One edge was usually blunted either by flaking or polishing to allow a grip” (1928, 41; fig. 20.1)

Clark catalogued 133 British examples and noted their markedly clustered distribution, with a large concentration (41 examples) around Grimes Graves in Norfolk, and smaller clusters in Scotland (13), Northern Ireland (9), East Yorkshire (12), Derbyshire (8), the Thames Basin (13), and the Sussex Downs (16). A few other examples were spread across the South Downs with a few outliers in Wales and elsewhere (fig. 20.2). He suggested that there were clear regional preferences in form and commented on the close association between the knives and the chalk and noted a string of finds along the Rivers Thames and Kennet.

Remarkably, the number of these conspicuous and distinctive objects has probably no more than doubled in the 80 years since Clark’s publication, in spite of the exponential rise in flint artefacts that have accumulated through archaeological work of all types. Furthermore, whereas our understanding of most classes of Neolithic artefact has improved dramatically over that period, the more recent finds of discoidal knives have done little to elucidate their depositional, social, or functional contexts and have served mostly to reinforce the distribution pattern observed by Clark rather than to dilute it. As a result, they remain somewhat enigmatic and, indeed, have been largely ignored in the literature. This paper does not aim to present a comprehensive review (or catalogue) of discoidal knives but will concentrate on a consideration of their distribution, associations and possible mode of production in one particular area (East Sussex) in order to suggest a social context and implications for the procurement, use and dissemination of specific raw materials and objects in the later Neolithic. However, before focusing on one region we first need to look again at the wider pattern and consider some previous observations.

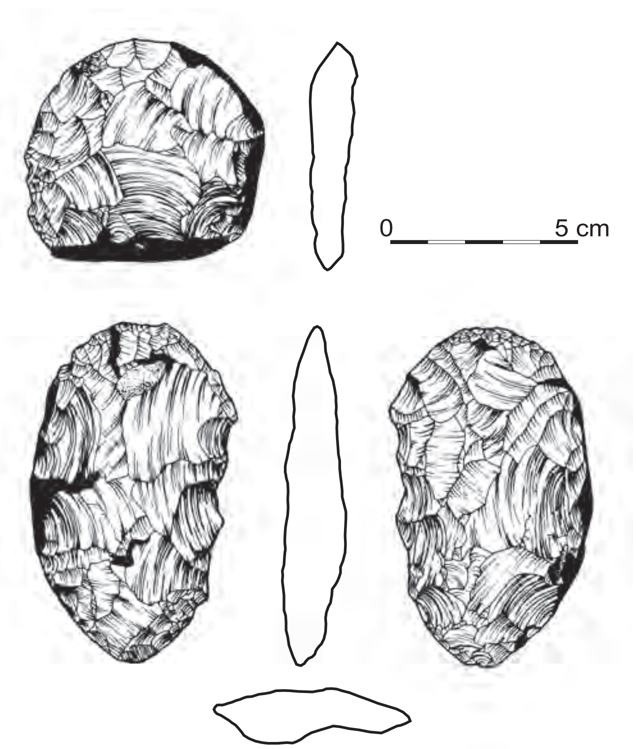

Figure 20.1 Part polished discoidal knives from (top) Hampstead Park, Southampton and (bottom) Eastbourne, Sussex.

20.3 Distribution

Clark’s basic observations still hold good, though it is clear that some parts of the British Isles are, and probably were in 1928, considerably better endowed with discoidal knives than he appreciated (there are, for instance, around 50 recorded from the Irish mainland (Woodman *et al.* 2006, 177-178) rather than just the nine he catalogued from Northern Ireland in Co Antrim). He recorded 16 examples from the Sussex Downs whereas 33 are plotted in figure 20.3 – the majority of which were already extant in museum collections that were well known to Clark (Gardiner 1987). For the South Downs as a whole there are at least 56, over twice as many as are shown on figure 20.2.

In bald statistical terms Clark’s comment on the apparent association between these objects and the chalk is hardly borne out – only 55% of his total are definitely from chalkland locations and 45% of those are from one tight cluster in East Anglia. On the other hand, given the comparatively small area of the total British mainland that comprises chalk, it is a striking correlation that has not been compromised by more recent finds.

On the South Downs generally, while the largest number of knives occurs in a very small area inland of Beachy Head in East Sussex, there is a rather wider scatter of finds than in 1928, with examples reported both on the Chalk and on the Lower Greensand that fringes it in Surrey and increased numbers on the northern Hampshire Downs, where several roughouts are recorded (Gardiner 1988). Finds along the Thames have also increased in number but, unlike some other classes of later Neolithic artefact (such as axes), where any contextual information is available the implication seems to be that the knives are from the floodplain, not from the river itself – and they occur on both sides of it.

In Wiltshire, most of the handful of examples occur in the Avebury region, several of them close to the River Kennet.

Figure 20.2 Clark's (1928) map of discoidal knives (reproduced by permission of the Prehistoric Society).

Figure 20.3 Distribution of discoidal knives in southern England.

This introduces a second aspect of the distribution, namely the types of depositional contexts in which these objects occur, and their date.

20.4 Context and date

Both Clay (1928) and Clark commented that the majority of knives were known only as surface finds with little more than circumstantial evidence to associate them with any particular type of pottery or category of Neolithic or Early Bronze Age site. Their fine workmanship and the obviously high level of skill required to produce them, led Clark to assume that they formed a small but distinctive element of the 'Beaker Package'. The few close or definite associations that he could establish involved barbed and tanged arrowheads and at least one dagger, while their greatest concentration, in East Anglia, lay in the midst of a correspondingly large population of Beakers. Only at the Arbor Low henge, in Derbyshire, did there seem to be any direct link with a monument.

These knives undoubtedly reflect the high level of workmanship that we would tend to associate with high status objects and this led the present writer to place them among a class of 'fancy' knives alongside plano-convex knives, daggers and sickles (Gardiner, 1988, table 2). By analogy with other types of 'prestige goods' of the later Neolithic we might expect that possible status to be reflected in their overall distribution in relation to the major monument complexes of the period, even if actual contextual information proved lacking (Bradley 1984; Gardiner 1988). Edmonds (1995, 96-97) comments on "a group of elaborate flint and stone axes, plano-convex, discoidal and polished knives, specialized arrowheads, carved stone balls, polished or finely flaked chisels, laurel leaves and maceheads", observing that some of these "occur as exotica in areas remote from their sources, and many appear to have been accorded a measure of special treatment … for the majority … a special status can be inferred from the circumstances attending their deposition".

Unfortunately, there remain very few clear depositional contexts for discoidal knives. Two examples are from East Yorkshire. One is from a grave at Aldro Barrow (C75) while the unusual Neolithic round barrow at Duggleby Howe contained, among other burials, a crouched inhumation (burial 6) accompanied by a very fine rectangular polished discoidal knife. Re-assessment of the burial sequence (Kinnes *et al.* 1983; Manby 1988; Loveday 2002) indicates that this belongs to the same phase as another inhumation burial (burial 5) of an adult male with a lozenge arrowhead, an antler macehead and a Seamer type flint adze. The macehead has recently been radiocarbon dated to 4597±35 BP or 3500-3130 cal BC at 2 sigma (OxA-13327; Loveday *et al.* 2007 with caveats). Although there is no direct association with pottery Kinnes *et al*. suggest that, stylistically, the knife is more comparable to examples found in Yorkshire with Peterborough Ware than with Grooved Ware. A few other 'special' deposits can be recognised, for instance in hoards with flint and/or stone axes, as at Great Baddow in Essex (Varndell 2004) or Banham in Norfolk (Gurney 1990).

Unpolished examples were recovered from the mineshaft excavated at Grimes Graves, Norfolk in 1971 (Saville 1981, 36) and also from surface workings (Varndell in prep), which also produced Grooved Ware (see also below). Other specific cultural associations are few but include apparent co-occurrences with Grooved Ware and Beaker (*e.g.* Manby 1974, 29-30; 1999). Few records are unequivocal; they certainly indicate that the type was long-lived and not associated exclusively with any particular mode of deposition or type of pottery.

Viewed at this level, the distribution too seems confused and contradictory. In some respects it may be where knives do not occur that is as telling as where they do. For instance, while Clark's observation that the East Anglian group was focused around Grimes Graves is certainly true, and some examples were clearly made there (see below), a closer look reveals a predominantly fen-edge distribution in an area which is now known to contain numerous small henge-like structures, so the situation may be more complicated than first appears. Similarly, the trail of knives along the Kennet all happen to be within a few kilometres of Avebury, the Yorkshire Wold knives are concentrated around the Rudston monumental complex and those in Derbyshire cluster around Arbor Low.

On the other hand, apart from a single example from Durrington (close to the river Avon; Clay 1928), discoidal knives are simply not a feature of the Stonehenge landscape and are significantly absent from the spectacular, Grooved Ware associated, lithic assemblages recovered in the ongoing programme of excavations inside and close by Durrington Walls and Woodhenge (Parker Pearson pers. comm.). Cranborne Chase, with its ostentatious and complex patterns of monuments and specialised object deposition has produced just four discoidal knives, all stray surface finds: not a single example has been recovered in the extensive fieldwalking and excavation programmes reported in recent years (Gardiner 1988; Barrett *et al*. 1991a; 1991b; Green 2000; French *et al.* 2007). Nor were any found by General Pitt-Rivers – a point of some significance given that many of the finds from the Beachy Head area were made by him. Similarly, despite the presence of a complex and varied group of Late Neolithic monuments and an extensive history of excavation and surface collection, there are none from the Dorchester/Dorset Ridgeway area.

The Cranborne Chase scenario amply demonstrates a further point, namely that discoidal knives are not part of the material culture repertoire of Late Neolithic pits. We cannot escape the fact that the majority are surface finds. As Varndell summarises (2004, 121) they are not found in burials and "henges were not a context for their use". It is very clear from the associated assemblages that these objects belong firmly among the extensive family of later Neolithic flintwork and are not members of the more exclusive suite of items that experienced highly structured depositional practices focused on monumental complexes, accompanied later Neolithic ceramics (especially Grooved Ware) or that occurred in Beaker burials. In fact, David Clarke (1971) does not cite a single example of an associated polished discoidal knife in his entire Beaker corpus. It seems that both Grahame Clark's Beaker context, and Edmonds' special circumstances of deposition are simply not characteristic of this particular class of apparently high status object.

So how might we account for them? What might their very localised distribution but apparently unstructured mode of deposition imply about where, how and why they were produced? Could this indicate any wider implications concerning the procurement and use of quality flint resources for the manufacture of specific items alongside that of 'everyday' flintwork? What kind of social context might be inferred?

2.5 Raw material and sources

There are few considerations of the source of discoidal knives or of the raw materials from which they were made. Whether or not Clark took it for granted that knives found in the area of the Late Neolithic flint mines at Grimes Graves in Norfolk were made there is not clear. The focus of his discussion was on their 'diffusion' outwards from East Anglia by Beaker Folk. In fact, roughout discoidal knives, including the sub-triangular form that features large among the East Anglian examples, occur at Grimes Graves and it is pretty certain that this was the source for a number of the local knives (Saville 1981; Varndell in prep). In central Sussex, the mines had long since ceased axe production though there is considerable evidence for the use of nodules gleaned from surface dumps in the later Neolithic and Early Bronze Age (Gardiner 1988). There are half a dozen discoidal knives in the surrounding area, at least three of which are probably made from this 'mined' flint (pers. obs.). Intriguingly, three of the axes in the Great Baddow hoard in Essex were sourced to Sussex (Varndell 2004; Craddock *et al*. 1983) and the accompanying knife is in visually identical flint.

On the Yorkshire Wolds, a principal source of flint was the nodules incorporated in glacial tills outcropping in the cliffs at Flamborough Head and occurring in nearby beach deposits. A number of flintworking sites have been identified and excavated on the clifftops here (*e.g.* Sheppard 1910; 1921; Moore 1964; Manby 1974; Durden 1995) and Henson (1982 cited by Durden *op cit.*) confirmed that flint from this source was used for the manufacture of high status artefacts. Cotton (1984), in his examination of a small number of knives from Surrey, noted the use of predominantly chalk-derived flint for those examples occurring on the Downs and Lower Greensand, with more varied sources indicated by examples from the Thames floodplain.

Knives from the northern Hampshire Downs and the majority of those from Sussex are manufactured from flint nodules obtained from localised Tertiary deposits known as clay with flints. In this respect they are entirely in keeping with the extensive assemblages of Late Neolithic flintwork that cover many parts of the Downs. The first conclusion that we can draw, therefore, is that the majority of knives occurring on or close to the chalk were made from resources that were local to their place of deposition.

2.6 Local contexts

Because so many of the finds are 'old', unstratified and poorly provenanced it is very difficult to establish even a local context for their manufacture, use and deposition in most areas. The most detailed study, by Tess Durden (1995), centred on analysis of two fieldwalked flint scatters on the Yorkshire Wolds, one of which appeared to be a primary knapping site (South Landing) in a clifftop location close to Flamborough Head, and the other a fairly extensive hilltop scatter 15 km inland, that had produced a range of high status flint objects amongst a spread of knapping debris (North Dale). The latter site produced two rectangular polished discoidal knives (the most common form in East Yorkshire) and several possible roughouts, as well as very fine ripple-flaked oblique arrowheads and a Seamer type polished axe (Durden 1995, fig. 1). Here there were two major clusters of flintwork that included a range of cores and waste products indicative of tool manufacture, including possibly of discoidal knives, as well as a range of 'everyday' items such as scrapers and simple flake knives. Discoidal cores – a type used for the manufacture of transverse and oblique arrowheads and possibly also for discoidal knives, were unusually well represented and rejuvenation flakes were common. South Landing, in contrast, produced very few retouched forms and most of the material recovered was associated with nodule testing and core reduction.

Detailed statistical analysis showed that the level of skill employed at the clifftop site was much lower than that at North Dale, that discoidal cores were much less well-represented, and that little more than the basic roughing out of forms was taking place. Durden was further able to distinguish at least three separate workshop areas within the North Dale scatter that exhibited clear evidence of skilled, specialised tool manufacture and she concluded that South Landing was one of probably several extraction and primary working sites that supplied flint to more specialist flintworkers at North Dale and, presumably, other locations inland. A range of high status objects then circulated amongst communities in the region of the Rudston complex, some of them ending up in structured deposits and some as burial accessories – though, as we have already seen, such deposits rarely included discoidal knives.

On the East Sussex Downs, 27 discoidal knives are record as 'old' surface finds over an area of only 25 km^2 between Brighton and Eastbourne (Clark 1928; Gardiner 1988). Circular forms dominate but D-shaped, rectangular and sub-triangular forms also occur. The block of downland east of the River Cuckmere is covered with extensive flint scatters of broadly Late Neolithic to Early Bronze Age date (hereafter referred to as the Beachy Head group), most of which echo the distribution of clay with flints deposits (fig. 20.5). Even within this small and apparently densely occupied area, however, the distribution of the knives is markedly clustered and this cannot be put down to collection bias (see Gardiner 1987 for an explanation). Some are 'stray' finds, others come from the major assemblages. Thirteen knives are provenanced to Beachy Head and at least eleven to around the head of a dry valley known as the Bourne Valley, which faces east over Eastbourne and the East Sussex coastal plain. Yet no further examples were produced during extensive field survey and excavation at Bullock Down (Drewett 1982) and Kiln Combe (Bell 1983; Allen 2005), just west and inland of Beachy Head, nor by excavations at the Beaker settlement site at Belle Tout, at the western end of Beachy Head (Bradley 1970; 1982), nor by excavations through colluvial deposits within the Bourne Valley (Allen 2007).

Moving slightly west, there is barely a 5 km gap between the eastern edge of figure 20.4 and the western edge of figure 20.5 but there is a distinct lacuna in the occurrence of major flint scatters in that gap. To the north of Brighton there are again extensive scatters of Late Neolithic flint, again concentrated on clay with flint deposits (hereafter referred to as the Saddlescombe group), but there are only four discoidal knives and some distinctive differences in the compositions of the assemblages between the areas of the two illustrations that might begin to provide a social context for the knives.

2.7 Discoidal knives and the flint assemblages on the East Sussex Downs

The Saddlescombe group of flint scatters concentrates on the high downland spurs, especially where these are capped by clay with flints. Lower down the dipslope they occur at the heads and on the upper slopes of dry valleys and combes. Most of the material was collected in the later 19th and early part of the 20th century and many thousands of objects were deposited in local museums and private collections (Gardiner 1987). The scatters are dominated by lightweight flake tools and there are noticeably high numbers of fabricators, chisels and related implements and piercing tools by comparison with other areas of the South Downs generally, and with the Beachy Head sites in particular (Gardiner 1988, chapter 9; 1990). There are few flake tools that demonstrate skilled workmanship, apart from plano-convex knives which are fairly numerous among the flint scatters (more than 30 were recorded by the present author (1988)) though scarce as stray finds. While flint axes are numerous and include many stray

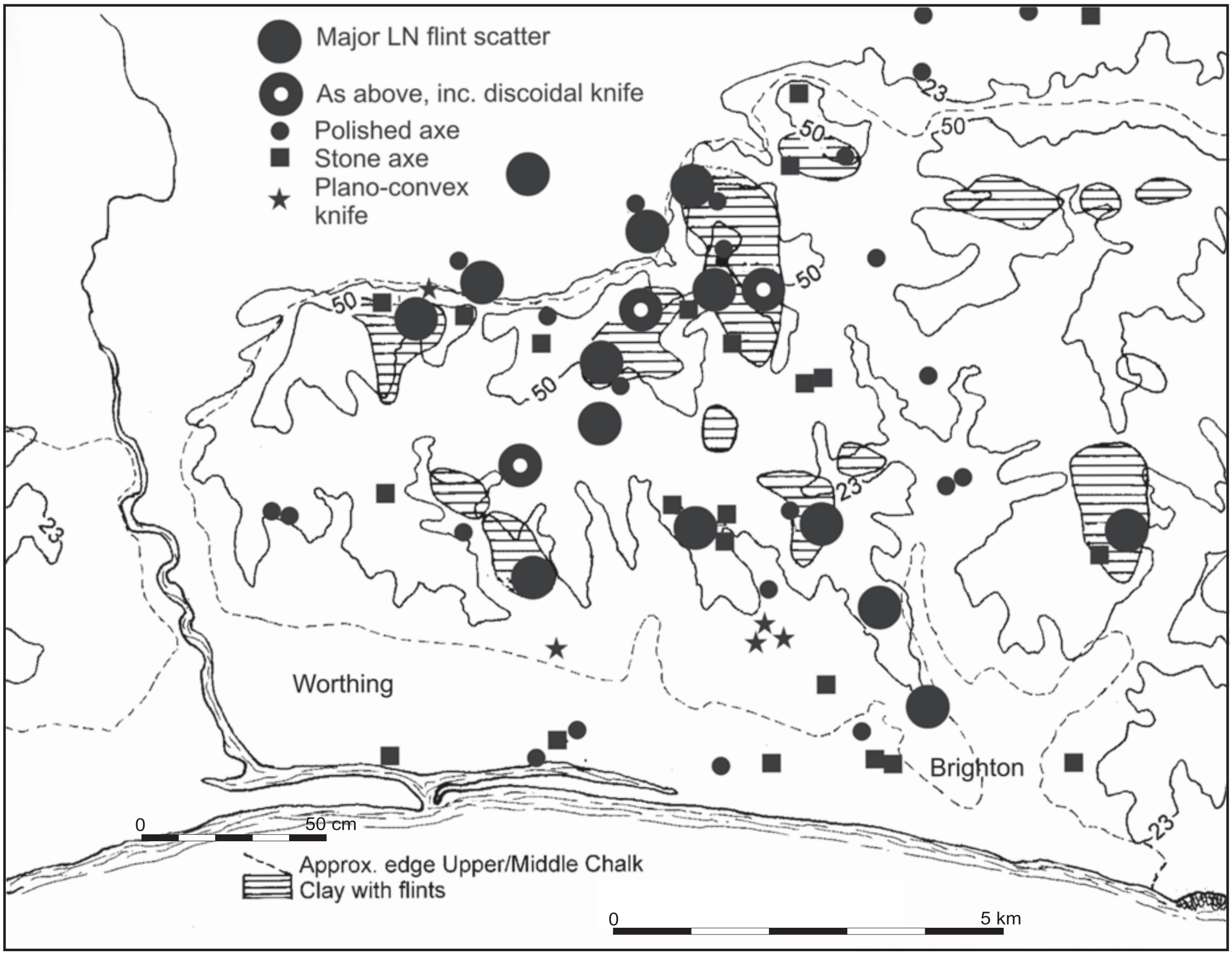

Figure 20.4 Late Neolithic-Early Bronze Age flint scatters of the Saddlescombe Group, Brighton, E. Sussex with distribution of discoidal knives and other selected objects (see text).

finds, they account for an average of 5.7% of implements within each assemblage, which is relatively low for the South Downs as a whole (excluding the flint mine sites), and there is an unusually high proportion of polished axes and fragments among them. In fact, the ratio of unpolished/roughout to polished axes is almost 1:1 and this ratio is reflected among the stray finds as well as within the major assemblages. The comparatively low frequency of unpolished axes is accompanied by an equally low proportion of heavyweight core tools, even though they are numerically common.

Major flint scatters among the Beachy Head group occur at intervals of 0.25-4.0 km (average 1.6 km) and their distribution emphasises clay with flints deposits at the dry valley heads and especially hillsides with views over the sea or rivers. Although most assemblages comprise more than 50% flake tools, the overall composition of this element is generally less varied than for the Saddlescombe scatters and there is a greater emphasis on cutting and scraping tools. The Beachy Head sites have produced vast quantities of flint axes which account for an average of 17.4% of assemblages and here the ratio of polished to unpolished examples is 1:3.3. The proportion of heavy duty core tools (average 16.4%) is more than twice that for the Saddlescombe group. We should bear in mind that both areas were investigated by the same cohort of flint collectors, including Pitt-Rivers and Grahame Clark himself, and the differences noted are consistent across all the major collections (Gardiner 1988; 1990).

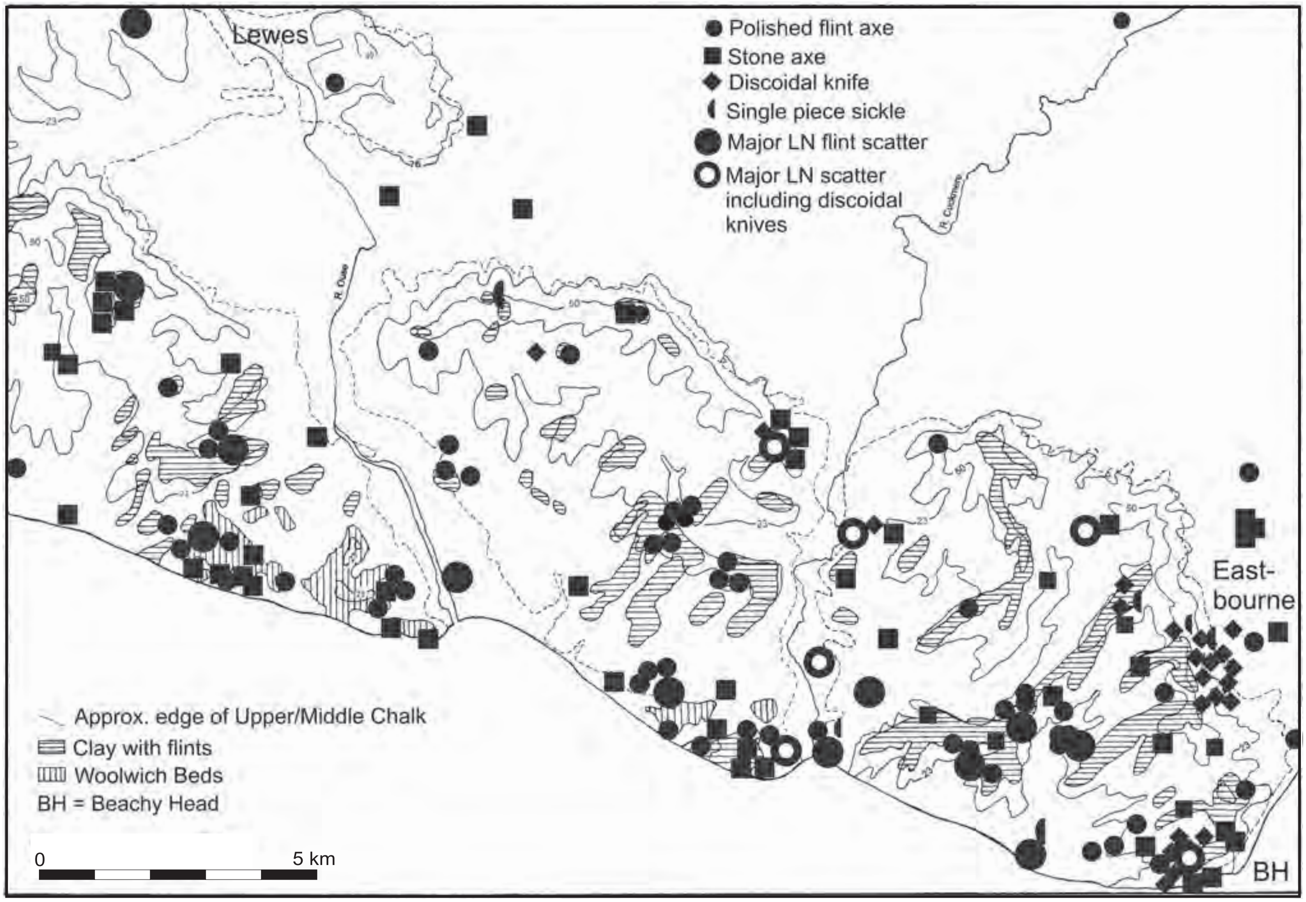

Figure 20.5 Late Neolithic-Early Bronze Age flint scatters of the Beachy Head Group, Eastbourne, E. Sussex with distribution of discoidal knives and other selected objects (see text).

On the face of it, there seems to be no obvious reason for the compelling differences in assemblage composition between the two groups of flint scatters. The distribution of flint sources is similar; the distribution of flint scatters in relation to those sources is also similar; and the overall nature of the scatters suggests nothing more elaborate than intensive domestic occupation during the later Neolithic, probably into the Early Bronze Age. There are no monuments, no relevant structured deposits, no pottery assemblages worthy of note, no burials, and both areas have access to major rivers, adjacent lowlands and the sea.

As discussed in a previous paper (Gardiner 1990), it is obvious that most of the flint axes in the Beachy Head area are made from locally available flint and that flint axe manufacture was an important activity in this small area of the Downs. There is a strong suggestion that communities here were supplying those in the Saddlescombe group with axes. Perhaps, as in the Yorkshire example described by Durden (1995), the Beachy Head sites were primary producers of roughout forms that were then worked up and polished by more skilled flintworkers based around Brighton. The differences in assemblage composition between the two almost contiguous areas of downland indicate that, despite the presence of essentially the same flint resources north of Brighton, communities of the Saddlescombe group were not primary producers of these implements, though they were certainly consumers. This might suggest that communities of the Saddlescombe group exercised some control over the acquisition and use of specific flint resources occurring at a small but discrete distance, with the intention of investing time and skill in turning everyday tools (flaked axes) into finished, polished forms. This implies a relatively sophisticated level of social organisation and an acknowledged system of relative values.

Because of the nature of the old collections, which generally include very little debitage and few cores, we lack the means to test this theory by detailed technological and metrical analysis. The size and range of the flint scatters in the Beachy Head area suggests that these are more than just primary knapping sites anyway, but two assemblages stand out among them that might contain clearer evidence of this dichotomy. Many hundreds of flint implements have been recovered from Alfriston Down, from a chalk spur on the escarpment overlooking both the River Cuckmere and the Weald. Another large spread of material comes from less than 2 km downstream, above the opposite bank of the Cuckmere, at Litlington. Methods of collection are unknown but both sites were visited by the same principal collectors, each of whom was very experienced. The surviving assemblages each include more than 100 roughout/flaked axes and dozens of core tools such as picks but only three and six polished fragments respectively. Flake tools are dominated by fabricators and chisels rather than by scrapers and cutting tools (nearly 200 in total) and though few cores have been recovered, both include discoidal types. Each scatter has also produced two discoidal knives (including a finished but unpolished example from Litlington) and a couple of less well-provenanced stray finds are also reported.

But it is the discoidal knives, of course, that undermine the argument. Not only are there more than five times as many knives around Beachy Head than there are around Saddlescombe, but this small area has also produced notable concentrations of other 'fancy', finely-worked cutting tools including at least four flint daggers, nine sickles and over 20 plano-convex knives – all of them from among the major scatters rather than being stray finds or, in the case of the daggers, possible grave-goods. When last examined in detail by the present writer (1988) this constituted 90% of known sickles and 25% of surface collected daggers from the South Downs, and the numbers are unlikely to have increased dramatically since (Clark recorded five sickles in 1932). Just to throw an additional spanner into the works, we might also note that there are many stone axes, including perforated forms, in this area. Such items are not uncommon north of Brighton but there are only one-third as many.

Clearly then, skilled flint knappers were at work in the Beachy Head area too. So perhaps a different scenario presents itself whereby it was communities in this part of the Downs that were able to manipulate control over local surface flint resources and supply *finished* products to their neighbours. In order for such a scheme to work a concomitant restriction on the use of flint from equally adequate sources around Saddlescombe would somehow have to have been imposed. This again implies quite a high level of social organisation and the development of some kind of (perhaps fledgling) prestige goods economy. If such a scenario seems unlikely, a similar situation seems to be apparent in Cranborne Chase, Dorset, where abundant suitable surface flint sources occur but most polished axes are made of non-local flint (Gardiner 1988; 1990).

In that area, of course, there is a concentration of monumental and non-domestic sites focused upon the Dorset Cursus that exhibit many forms of highly structured deposition, whereas in East Sussex there are no known Late Neolithic monuments or concentrations of, for instance, 'Grooved Ware' pits. If we are suggesting that there are indications of relative status between two groups of communities living at close quarters and with access to similar resources, then we probably need to look beyond the objects themselves for some underlying reasons. These may, or course, be matters of symbolism and perception that we cannot now observe.

One possibility is that these two areas of subtle but significantly different topography in terms of the orientation of dry valleys and upland plateaux areas presented significantly different environmental profiles in terms of the nature and distribution of soils, their hydrological properties and their supported vegetation. In combination with the noted differences in the flake tool components it is tempting to suggest that the Beachy Head group – with an emphasis on cutting tools including elaborate knives and sickles – was engaged in a range of activities that included the processing of arable crops, while the Saddlescombe group – with much higher proportions of scraping, piercing and fabricating tools, was more engaged in the processing of animal products. This is speculation, but such a scenario opens the door for all manner of social relations and inter-actions. However, such a proposition also takes us far beyond the available environmental evidence, though Allen's recent consideration of dry valley bottom deposits at several locations within the bounds of Figure 20.5 has demonstrated the presence of considerable depths of hillwash containing, or overlying buried soils incorporating Beaker deposits (Allen 2005). At Ashcombe Bottom, near Lewes (the most north-westerly flint scatter marked on Figure 5), ardmarks were recorded on a Beaker soil contained within one metre of largely decalcified colluvium (*ibid*., 227-228, figs 7 and 8).

There seems to be sufficient evidence from the lithic material alone to indicate that later Neolithic communities in these two virtually contiguous areas of downland operated a closely connected but also complimentary system of social interaction. One area (Beachy Head) was producing high quality, high value flint objects whose distribution and use were differently directed and restricted. Polished flint axes were provided quite widely to the Saddlescombe settlements and we might assume that their utilitarian function was overwritten (or underwritten) by symbolic meanings that we cannot now witness or demonstrate but that were sufficient to prevent the largescale production of similar artefacts from similar resources in the immediate area. There seems to have been no obvious restriction in their use on settlements in the area where they were produced. The occurrence of large numbers of stone axes among the Beachy Head sites is also interesting in this respect. Axes from Cornwall, Langdale in Cumbria and Wales occur widely among the Beachy Head sites as well as many in non-local stones; all materials that had, by one means or another, travelled considerable distances. It seems that the axe producers of Beachy Head were involved in trading their products well beyond the confines of the Sussex Downs in exchange for exotic items. Were they then passing on some of these to the Saddlescombe settlements?

In addition, extremely well-made, skilfully pressure-flaked knives were produced in apparently small numbers but few of these, other than plano-convex forms, were passed on and, even within the production area, their use was very restricted, implying a markedly high status and special character. In addition to the discoidal knives there are a small number of single-piece sickles, a type once again originally described from a handful of finds by both Evans (1872; 1898) and Clark (1932, who lists 52 examples from England). Nationally these remain even fewer in number than discoidal knives but their known distribution is remarkably similar, with the notable addition of several on the north Kent coast and a small cluster in Essex around the Naze (not, sadly, around Great Baddow!). These objects were defined as sickles partly because of their morphology but also because of the occurrence of invasive surface glosses on the cutting edge (Clark 1932), though van Gijn's work has indicated that examples in the Netherlands were used to cut sods rather than cereals (1988). Once again, they are nearly all surface finds with few unambiguous associations. One was found in an upper layer of the inner ditch at the Abingdon causewayed enclosure in a context associated with Peterborough Ware (Avery 1982). Other possible examples from both causewayed enclosures (*e.g.* Windmill Hill; Smith 1965, fig. 43, F69; see also Saville 2002) and henges (*e.g.* Durrington Walls; Wainwright/Longworth 1971, 174, fig. 76, F80) are generally fragmentary (and not always convincing) and from secondary or unstratified layers. There is, also, an unusual concentration of daggers in the Beachy Head area which do not seem to come from burials (indeed there are comparatively few Beaker burials in the area). We might suggest, therefore, that specialist flint production was continuing in this area after the introduction of metalwork – adding another small piece to the fragmentary jigsaw of Beaker occupation of the South Downs. But thereby hangs another tale.

2.8 Changing patterns of specialist flint procurement in the Neolithic on the South Downs

There is a very clear distinction in the use of flint sources on the South Downs between at least the Middle and the later Neolithic. Although Neolithic monuments of any sort are few in number on the chalk from Hampshire to East Sussex, there was clearly a sufficiently large and well organised population by the Middle Neolithic to be building both long barrows and causewayed enclosures of closely comparable forms and at the same time as they were appearing in the rest of southern England (Bayliss/Whittle 2007; Whittle *et al*. in prep.). Flint assemblages of this period are notoriously difficult to identify, especially when they are unstratified, and while there are many undated flint axes around made from surface flint, the most notable aspect of the specialist acquisition is the occurrence of the flint mines. There is not space here to re-examine the many implications of the axe trade (see, for instance, Gardiner 1991; Bradley/Edmonds 1993; Edmonds 1995 among others) but suffice it to say that the primary product of the mines was axes and that their dissemination was very widespread, extending far beyond the southern chalk. There is no particular evidence that the actual mining was undertaken by specialists or that the finishing of objects and their distribution was closely regulated but the probable symbolism attendant on the procurement of the raw material and in their production and dissemination has been well rehearsed in the literature.

Precisely when and why mining ceased on the South Downs has not yet been elucidated but the later Neolithic saw not only a vast increase in the production of flintwork generally but also of core tools, including axes, produced from surface deposits that had already witnessed Neolithic activity during the currency of the flint mines. Although hardly ubiquitous, these deposits are quite widely spread and co-incide with major concentrations of surface flint scatters that obviously indicate domestic activity. It is difficult to envisage how any form of restriction or specialist organisation could be imposed on the production or movement of flint artefacts yet this seems to have been the case in certain areas. We have already discussed East Sussex in detail but there are also indications in Cranborne Chase, as mentioned, and also on the coastal plain around Bournemouth, where local flint resources are restricted to small but good quality gravels. Here, unusual quantities of very fine plano-convex knives and arrowheads were made from the gravel flint while flint axes were imported from the chalk and at least one hoard of axes is recorded (Gardiner 1988, 411). At least one polished discoidal knife is reported (*ibid*.) and there are several large assemblages of Grooved Ware.

It is hard to escape the conclusion that the later Neolithic saw a much more controlled pattern of flint exploitation and, in particular, of the restricted procurement of raw material for the manufacture and use of specialist forms, than has hitherto been apparent. Even today scholars are busy searching for the monuments whose presence must be implied by any such possibility on the South Downs. But, this brief study of one poorly understood category of flint knife has demonstrated not only that surface flint assemblages have much still to offer in terms of elucidating the nature and distribution of the material culture of the Neolithic but also that some quite subtle aspects of social organisation and context can be gleaned from their detailed study where other, more obvious, symbols of status and structured deposition are lacking.

Many hours of my study tour in Leiden were occupied in conversation with Leendert Louwe Kooijmans, pondering on the underlying patterning and hidden meanings of the numerous flint assemblages we examined together. He taught me not to take anything (in flint) at face value but to look for what might be missing, and why, and to think hard about what artefacts meant to the people who made and used them rather than just what we might make of them, and why and how they came to leave them where they did. I hope that this paper will convince him that I am still thinking about it!

Acknowledgements

I would very much like to take this opportunity to thank Leendert Louwe Kooijmans for his many years of support and encouragement and Harry Fokkens for inviting me to contribute to this festschrift. I must also thank Richard Bradley for nagging me once again to write a paper on this topic and for commenting on the draft. Matt Leivers and Mike Allen also kindly commented on it for me and Rob Goller produced Figure 3.

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21 Upper Largie and Dutch-Scottish connections during the Beaker period

Alison Sheridan

21.1 Introduction

The recent recognition of a Dutch-style Beaker grave, excavated in 2005 in advance of gravel quarrying at Upper Largie in the Kilmartin Valley, in the west of Scotland, refocuses attention on the nature of the links between Scotland and the Netherlands during the Beaker period – links that had long been recognised, as part of a broader north British phenomenon (*e.g.* Abercromby 1912; Case 1977; 2001; Childe 1935; Clarke 1970; Crichton Mitchell 1934; Needham 2005; Shepherd 1986; Sheridan 1997; Watkins/Shepherd 1980. The question of Dutch links with parts of southern England will not be considered here). The description of the Upper Largie grave, and the subsequent brief discussion of Dutch-Scottish Beaker period links presented here, are offered to Leendert Louwe Kooijmans with affection and warmest thanks for three decades' friendly correspondence and encouragement.

21.2 The Upper Largie Beaker grave

The gravel quarry at Upper Largie lies at the northern end of the Kilmartin Valley in Mid Argyll (fig. 21.1), an area famous for the abundance of its Neolithic and Bronze Age monuments (RCAHMS 1999). The fluvioglacial terrace in which the quarry is located is a well-defined topographic feature: a flattish area, terminating in a sharp escarpment, overlooking the rest of the valley and itself overlooked by hills to the east and west. Quarrying activity, from the early 1980s, has necessitated several episodes of archaeological intervention and it was during the latest episode, in 2005, that a large sub-rectangular pit, surrounded by a ring-ditch with post-holes in it (fig. 21.2) and containing three Beakers and two flint artefacts, was discovered by Martin Cook of AOC Archaeology Group (Cook *et al* in prep; Pitts 2008). A second large pit, surrounded by a ring of post-holes, had been found around 80 metres to the south in 1993; this will be described below.

The pit discovered in 2005 (053 on fig. 21.2) measured 3.2 m × 1.75 m and was up to 0.63 m deep, with straight sides and a flat base; it had been cut through a pre-existing tree-throw hole, and was aligned NE–SW. Its primary fill comprised a dark brown, damp organic silty deposit – probably the remains of a plank-built wooden chamber – in which the artefacts were found. Above this was a 0.2 m thick layer of rounded cobbles, each 0.1–0.25 m in diameter, covered by a 0.5 m thick layer of larger, flattish stones 0.2–0.7 m in length; the upper fill consisted of a mid-grey sandy clay with some stones. The positioning of the stone layers, and the fact that the larger stones tilted towards the centre of the pit, suggested that these had originally formed a small cairn over the timber chamber, and had collapsed into it when it decayed. This cairn might originally have been covered by an earthen barrow, but no traces of one were noted (except perhaps as the sandy clay overlying the large stones). The pit lay eccentrically within a partly truncated subrectangular 'ring'-ditch, measuring 5.8 × 5.7 m; the ditch width varied between 0.45 m and 0.8 m, and its maximum depth was 0.4 m. Fifteen post-holes were found within the fill of the ditch, mostly at its outer edge and cut into it, spaced between 0.1 and 0.9 m apart; there may well have been more in the truncated north-western segment of the ditch. The posts that had originally stood in these holes had been 0.2–0.5 m across; their holes were up to 0.4 m deep. Immediately to the south was an arc of four larger post-holes, 0.46–0.9 m across, which echoed but were not quite concentric with those in the ring-ditch. It is unclear whether these had formed part of the original monument, or whether they had been associated with a secondary sub-rectangular pit that had been dug immediately to the east of the ring-ditch, cutting it (132 on the plan, and see below).

The artefacts were found at the bottom of the pit, along its east and southern sides (fig. 21.2); all the pots had originally been deposited upright. The collapse of the putative timber chamber had damaged all of the pots, but to differing degrees. Pot 1 (SF 4 on fig. 21.2), found roughly mid-way along the pit on its eastern side, had had its upper part knocked in on itself as it toppled over, and had been crushed flat (fig. 21.3.1). Only around two-thirds of the pot survived. Such was the weight of (presumably damp) material on it that it warped, making physical reconstruction impossible (fig. 21.3.2), although it was possible to extrapolate its original shape on paper (fig. 21.3.3). Pot 2, found in the southwest corner of the pit, was the least damaged: its rim and much of its neck had been knocked off, and the rest of the neck experienced some abrasion, but it remained upright

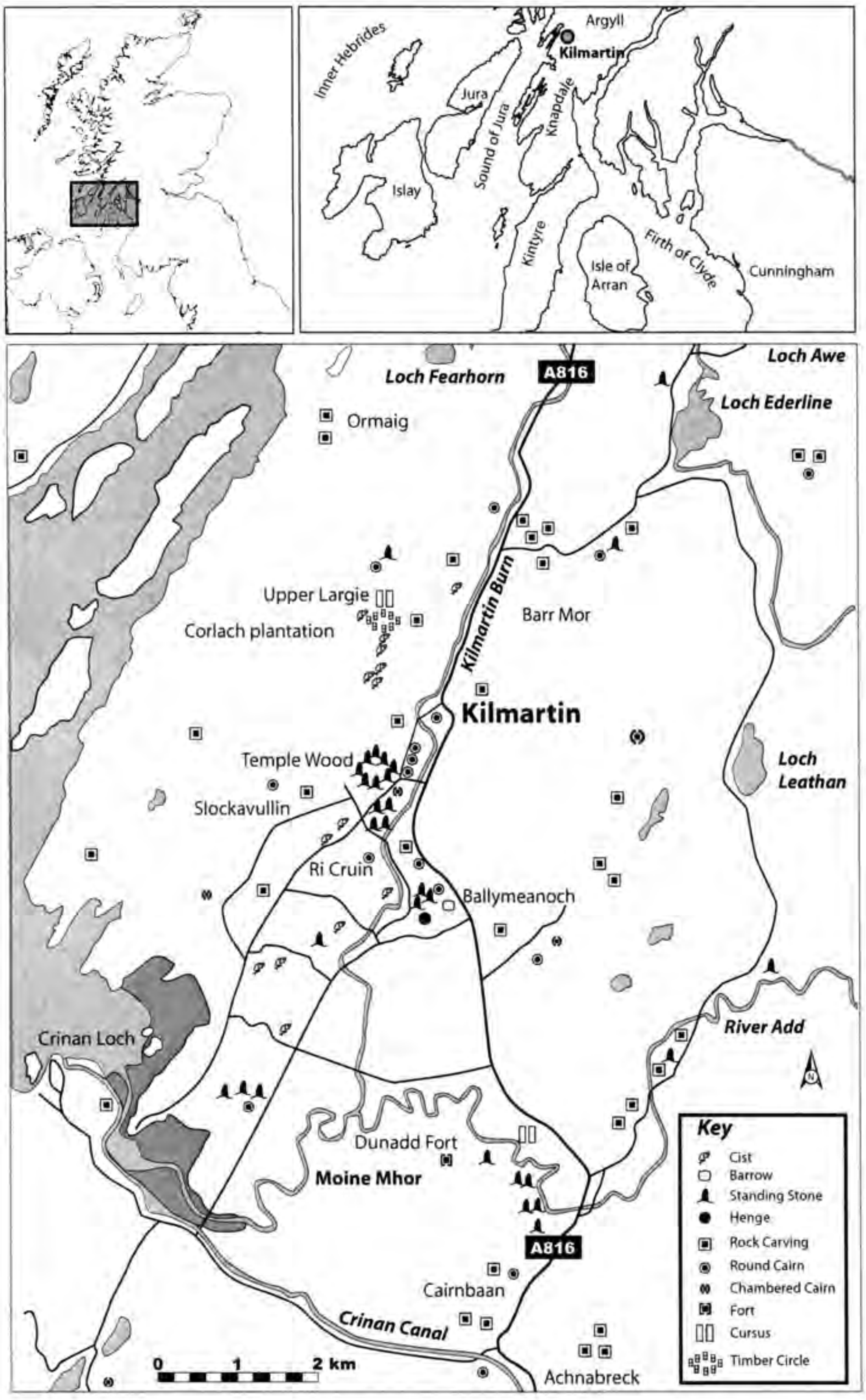

Figure 21.1 Map showing location of Upper Largie (Image: AOC Archaeology Group).

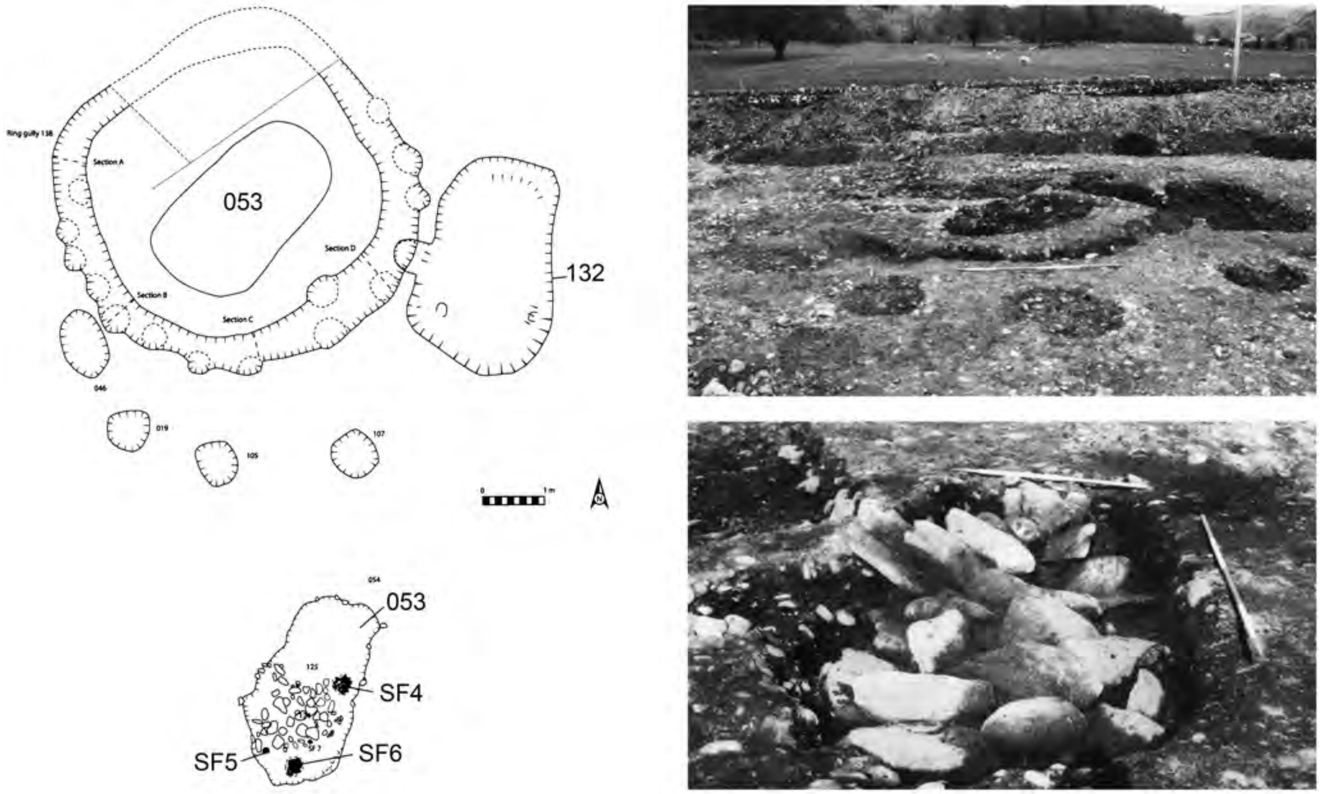

Figure 21.2 The Beaker grave at Upper Largie, and the secondary Early Bronze Age grave to the east of it. Top: overall plan and site photograph; bottom left: detailed plan of the destroyed grave chamber pit; bottom right: photo showing stones over burial chamber pit (Images: AOC Archaeology Group).

(fig. 21.2, SF 5; fig. 21.4). Pot 3, in the southeast corner, had been knocked over and crushed flat, but the sherds refitted to form the original shape of the pot (fig. 21.2, SF 6, fig. 21.5). Summary descriptions of the pots are as follows:

Pot 1 (fig. 21.3)
A fairly large, thin-walled, fine-textured vessel with an S-profile, a low belly around a third of the vessel's height, and a flat base, minimally concave on its exterior. Dimensions: estimated height *c.* 250 mm; estimated rim and belly diameters *c.* 180 mm and *c.* 210 mm respectively; base diameter 96 mm; wall thickness *c.* 6–10 mm. The exterior is decorated with 13 bands of horizontal comb-impressed lines, made with a short comb (*c.* 7.5 mm long); all except the bottom two bands comprise three lines, the band just above the base comprising a single line and the one above that, three to four lines. A pair of discrete comb impressions lies between the topmost two bands. The exterior colour is basically reddish, with buff and grey areas. Inclusions are very sparse and generally under 5 mm long; they comprise locally-available stone plus a very little grog. Extensive organic residue traces hint at the pot's former contents and are currently being analysed. Stylistically, this pot is in the Maritime Bell Beaker tradition, although not a 'classic' example. According to the latest typological scheme for British Beakers (Needham 2005), it could be described as a Low-Carinated Beaker (with Maritime-Derived decoration), although it also resembles his 'low-bellied S-profile' Beakers (*ibid.*, 179). It would arguably fall within 'step 1' or 'step 2' of Lanting and Van der Waals' scheme for British Beakers (1972), and within their type 2^{Ia}, according to their 1976 scheme for Dutch Beakers (Lanting/Van der Waals 1976).

Pot 2 (fig. 21.4)
A smaller, slightly squatter vessel than Pot 1 but nevertheless thin-walled and fine-textured, with an S-profile, a low belly at a third of the vessel's height, and a flat base, minimally concave on its exterior. Height 128 mm; estimated rim and belly diameters *c.* 130 mm and *c.* 123 mm respectively; base diameter 68–70 mm; wall thickness *c.* 5–10 mm. The exterior

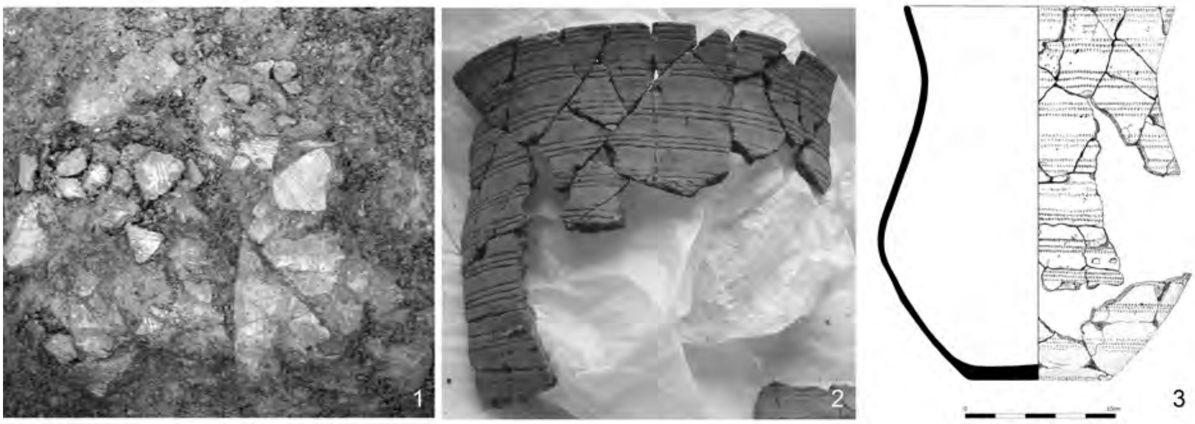

Figure 21.3 Upper Largie Pot 1: in the ground, partly reconstructed and reconstructed on paper (Images: Roddy Regan; Alison Sheridan; Graeme Carruthers).

Figure 21.4 Upper Largie Pot 2: in the ground, partly reconstructed and reconstructed on paper (Images: AOC Archaeology Group; Alison Sheridan; Graeme Carruthers).

is decorated with four bands, each comprising short diagonal lines of comb impressions in a herringbone arrangement, and with thin horizontal lines of twisted cord impression at the top, bottom and middle of each band. The exterior is orange-buff and grey-buff. Inclusions are similar to those found in Pot 1, including sparse grog; there are also three accidental impressions of barley grains. This pot is a Cord-Zoned Maritime (CZM) Beaker (a low-bellied S-profile Beaker, according to Needham's scheme; Lanting/Van der Waals 'step 1'/type 2^{Ia}). According to Lanting and Van der Waals' Dutch Beaker scheme, the use of cord for the horizontal lines is an early feature of this type of Beaker (1976, 9). Needham concurs, adding that CZM Beakers represent "an early horizon after the initial corded Ware/Maritime Beaker fusion…probably around the middle of the 3rd millennium BC" (Needham 2005, 200).

Pot 3 (fig. 21.5)
Intermediate in size between Pots 1 and 2, this vessel shares with them its thin walls, fine texture and S-shaped profile; its low belly just below a third of the vessel's height, and its flat base, minimally concave on its exterior. Height 165 mm; rim and belly diameters *c.* 180 mm and *c.* 210 mm respectively; base diameter 96 mm; wall thickness *c.* 6–10 mm. The exterior is decorated with horizontal lines of twisted cord impressions, extending from immediately below the rim to immediately above the base. The exterior is a light brick-red colour with buff patches; inclusions match those of Pots 1 and 2. This is an All-Over-Cord Beaker (Needham: low-bellied S-profile; Lanting/Van der Waals: step 1/type 2^{IIb}).

The two flint artefacts, found near Pot 3, comprise a small knife of yellow-brown flint (mistakenly described as a hollow-based arrowhead in Pitts 2008) and a double-ended

Figure 21.5 Upper Largie Pot 3: in the ground, partly reconstructed and reconstructed on paper (Images: Roddy Regan; Alison Sheridan; Graeme Carruthers).

fabricator or strike-a-light of light grey flint (fig. 21.6); both had been used (Saville pers. comm.).

Although no trace of human remains was spotted during the excavation, and it had not been deemed worthwhile to undertake phosphate analysis due to the freely-draining nature of the gravels, there seems little doubt that this had been a grave. As to the likely disposition, age and sex of the body, all that can be said is that the pit was sufficiently large to have accommodated an adult and that since, in the Netherlands, strike-a-lights and knives appear to be associated with men in Bell Beaker-associated graves (Drenth/Lohof 2005, 443), it may well be that this had been the grave of an adult male.

A piece of hazel charcoal from the organic-rich fill at the bottom of the pit (*i.e.* at the level of the artefacts) produced a radiocarbon date of 3915 ± 40 BP (SUERC-15119, 2470-2340 cal BC at 1σ, 2570-2280 cal BC at 2σ, calibrated using OxCal v.3.10). Similar dates were obtained from oak charcoal found in one of the post-pipes within the ring-ditch, and from the fill of the ring-ditch: SUERC-15120, 3900 ± 35 BP, 2470-2340 cal BC at 1σ, 2480-2280 cal BC at 2σ, and SUERC-15121, 3880 ± 35 BP, 2460-2300 cal BC at 1σ, 2470-2210 cal BC at 2σ respectively. This dating of the grave to the 25th or 24th century BC makes this one of the earliest Beaker findspots in Britain and Ireland.

21.3 The secondary grave and a nearby *comparandum* for the Beaker grave

Cutting into the eastern edge of the ring-ditch was a second sub-rectangular pit (132 on fig. 21.2), measuring 3.5 × 2.1 × 0.76 m and aligned NNE–SSW. This, too, is believed to have contained a plank-built wooden chamber or coffin; once again, no traces of human remains were found, but the presence of a pot in its primary fill strongly points to its having been a grave. The pot, which contained ten pebbles that may well have been deposited as amulets, is a footed Food Vessel, unique in showing a combination of features typical of both Irish and Yorkshire Food Vessels (see fig. 21.7 and Cook *et al*. in prep and Pitts 2008 for details). Although the pit produced no radiocarbon-datable material, it is most likely to date – on the basis of a recent comprehensive study of Irish Food Vessel chronology (Brindley 2007) – to 2160-2080 BC. Its significance is discussed below.

Around 80 m to the south of these graves was found a large sub-circular pit, 6.8 m in diameter and up to 1.8 m deep, orientated NE–SW and surrounded by an irregular ring, around 11 m in diameter, of at least 17 definite and probable post-holes (fig. 21.8). Although larger than the Beaker grave, this shares many features in common, including the suspected former presence of a wooden chamber. The function of the pit as a grave can only be conjectural, although the discovery of a deposit of cremated remains, presumably human, beneath a slab in one of the ring-pits indicates the use of at least part of the structure for burial. The only artefactual finds comprise pieces of chopped wood, found with unworked waterlogged wood (mostly roundwood) in the fill of a re-cut of the pit; these provided a radiocarbon *terminus ante quem* for the pit of 3350 ± 45 BP (AA-43010, 1730-1530 cal BC at 1σ, 1750-1520 cal BC at 2σ). Oak charcoal from two of the posts in the ring produced *termini post quos* dates around and shortly after the turn of the millennium (AA-48050–1, 3570 ± 45 BP and 3645 ± 45 BP, 2020-1820/2040-1770 cal BC at 1σ and 2σ and 2130-1940/2140-1890 cal BC respectively). *Prima facie* these dates suggest that this pit and ring was

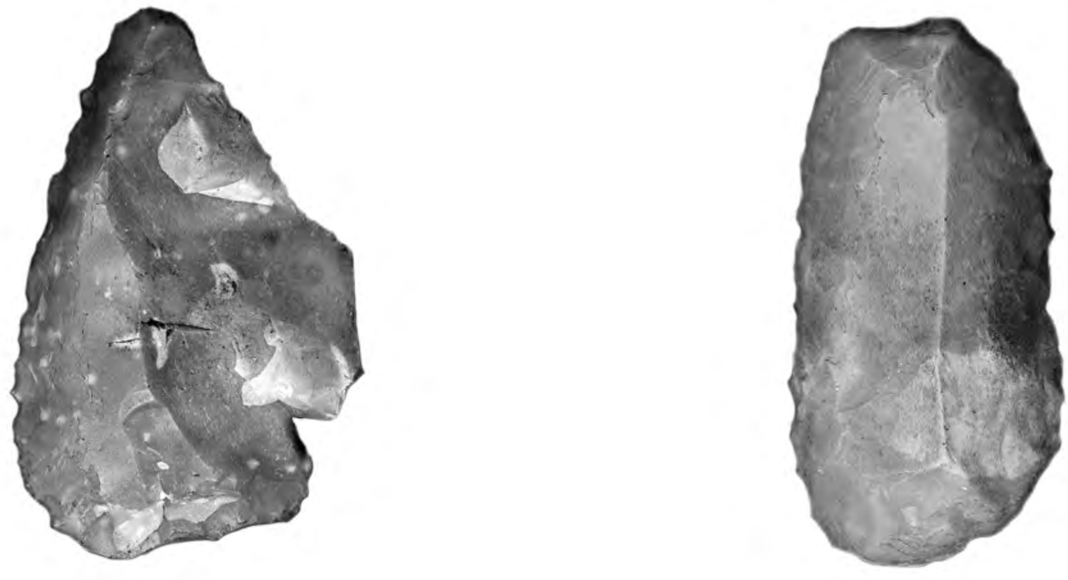

Figure 21.6 Flint artefacts from the Upper Largie Beaker grave: left, knife; right, fabricator or strike-a-light (Images: AOC Archaeology Group)

constructed several centuries after the Beaker grave, and, as with the Food Vessel grave, they indicate a continuity (or revival) of the practice of using timber funerary structures at a time when burial in stone cists had become the norm, both in the Kilmartin Valley and elsewhere in northern Britain.

21.4 The Upper Largie Beaker grave as a Dutch-style grave

The Beaker grave at Upper Largie represents a striking novelty in funerary practice and associated material culture, owing nothing to pre-existing traditions in Scotland. While it stands out as being different from most Scottish Beaker graves – insofar as it is not a stone cist grave – several of its features immediately recall Dutch funerary practice of the mid-third millennium BC (cf. Drenth/Lohof 2005, fig. 19.7; Lanting/Van der Waals 1976). The practice of burying the deceased in a timber chamber or coffin in a pit, and surrounding that with a ring-ditch, with posts in its fill (probably to screen the grave prior to the erection, in some cases, of a covering round barrow: Drenth/Lohof 2005, 440), is characteristic of the Single Grave Culture which preceded the Bell Beaker Culture, but whose traditions persisted into the latter, in the Netherlands. While individual elements of this rite are known from other parts of the Beaker-using world – individual inhumation within a grave pit, sometimes in a wooden structure and sometimes with a surrounding ring-ditch, is widespread in central Europe and along the Rhine, for example (Heyd 2007) – nevertheless the specific combination of features seen at Upper Largie, along with the ceramic association, points forcefully to the Lower Rhine Basin (see Lanting/Van der Waals 1976 for examples, including two AOC-associated graves at Anlo. Here, the ring-ditches and post-rings had not been covered by a barrow). The only difference seems to lie in the orientation of the grave pit: the NE–SW orientation at Upper Largie differs from both the E–W orientation of ‘classic’ Single Grave Protruding Foot Beaker (PFB) graves and from the NW–SE (± 45°) orientation of All Over Ornamented and early Bell Beaker graves (Lanting/Van der Waals 1976, 44-45). However, NE–SW orientated graves are not unknown, as the PFB grave from Hijkerveld indicates (*ibid.*, fig. 30).

As indicated above, the ceramic assemblage also finds strong parallels in the Lower Rhine. Close parallels can be cited for individual vessels – with the CZM Pot 2 resembling those from Mol and Grossenbornholt, for example (*ibid.*, figs 22 and 24) – and for the techniques of manufacture, which included scraping, wet-smoothing, adding modest amounts of grog, and slapping the base to prevent sticking and cracking (cf. Hammersmith 2005; Van der Leeuw 1976). In origin, all three of the Upper Largie Beakers can be regarded as the product of interaction between users of Maritime Beakers and Corded Ware, with the Middle and Lower Rhine forming a key area for this interaction (Needham 2005, 178-179 and fig. 3). While similar combinations of the general types are attested elsewhere (*e.g.* in Brittany: *ibid.*, 179), the closest parallels are to be found in the Lower (and

Middle) Rhine. Furthermore, the practice of interring multiple Beakers with a single individual is also attested in the Netherlands, as at Mol; Lanting and Van der Waals have observed that “Deposition of two or more vessels in PFB graves is to our knowledge limited to the later PFB graves… The tendency increases with AOO graves but seems to decrease already in early BB times (too few finds are really known from this period)” (1976, 63). This practice is rare in Britain, with almost all examples belonging to the earliest period of Beaker use, as at Biggar Common, South Lanarkshire (Sheridan 1997). In terms of the chronological relationship between the Upper Largie assemblage (and grave) and its Dutch *comparanda*, a date in the 25th century BC for the latter – and therefore broad contemporaneity with Upper Largie – seems plausible. This holds good irrespective of whether one follows Lanting and Van der Plicht in dating the first use of Maritime Bell Beakers in the Netherlands to between 2500 and 2400 BC (2002, 3.6.1.1), or accepts Drenth and Hogestijn’s view that they were already in use – alongside late PF Beakers and All-Over-Ornamented (including AOC) Beakers – during the final phase of the Single Grave Culture, 2600-2500 BC (2001, 312).

It is hard to resist the conclusion, therefore, that the Upper Largie grave is a Dutch-style grave with an assemblage of Beakers that could easily be ‘lost’ among those found in the Netherlands. We shall, regrettably, never know whether its putative occupant had been a Dutchman, since no trace of the tooth enamel that could (through strontium and oxygen isotope analysis) have indicated his origin has survived. However, this grave is not the only Dutch-style Beaker grave in Scotland. The following sections will briefly describe other ‘exotic’ early Scottish Beaker graves, plus other evidence for Dutch links during the centuries of Beaker use in Scotland.

21.5 Other ‘exotic’ early Scottish Beaker graves

While most Beaker graves in Scotland take the form of stone cists set into the ground, with or without a covering mound, a small number feature cist-free pits, with traces of a wooden coffin or chamber having been noted in some cases. The Beakers found in these have almost all been of early types, with clear international characteristics; and, as with the Upper Largie grave, a Dutch connection can be proposed for most or all of these.

The most similar of these to the Upper Largie grave was found at Newmill, Perth & Kinross, in east central Scotland, in 1977 (fig. 21.9; Watkins/Shepherd 1980). Here, a thin organic coffin, round-ended and U-shaped in section, was found in a pit orientated roughly E–W (actually ESE–WNW), and surrounded by a penannular ring-ditch around 6.3 m in internal diameter; there was no sign of any barrow (or of the upcast from the ring-ditch), although a heap of very large pebbles overlay the grave pit, forming a modest cairn. Several post- and stake-holes were found in the general vicinity, but did not form a ring and may well post-date the grave. No sign of the body had survived; here, as at Upper Largie, the grave had been cut into gravel. The grave goods (fig. 21.9) comprised an S-profiled All-Over-Ornamented Beaker (type 2^{IIc}) with herringbone decoration, made by stabbing and dragging a spatula across the surface, together with a fabricator and a flake knife, both of flint and both used before deposition. Although undated, this grave may well have been roughly contemporary with the Upper Largie grave, falling within the late Single Grave Culture (Drenth/Hogestijn 2001, 313).

A further grave with strong Dutch connections was found dug into an existing Early Neolithic long barrow at Biggar Common, South Lanarkshire, in the early 1990s (fig. 21.9; Johnston 1997). This, too, was orientated roughly E–W; the shallow pit was edged with boulders, and had been covered with small to medium-sized angular stones. Again, no human remains survived, and there was no radiocarbon-datable material. Within the pit was found a crushed Low-Carinated Beaker, with bands of horizontal comb-impressed and incised lines (Sheridan 1997). This vessel (labelled ‘1’ on fig. 21.9), with its clear Maritime-influenced design, is comparable with Lanting and van der Waals’ type 2^{Ia} Beakers. Fragments of a small undecorated dish (‘3’) were found both within the grave pit and among the stones covering it; and a small cord-decorated vessel (‘2’) was found in pieces on this ‘cairn’ at its western end. This last vessel, with its cord-impressed decoration over the upper half of its body, is reminiscent of some PF Beakers; however, according to Lanting and van der Waals (1976, 5), by the time that Beakers comparable to the Low-Carinated vessel had begun to be used in the Netherlands, cord-decorated PF Beakers had fallen out of use, their place being taken by herringbone or diagonal-line designs executed using a spatula. Nevertheless, the assemblage could be expected to date to around the 25th century BC, on the basis of Dutch *comparanda* for the Low-Carinated Beaker. Lithic finds comprised a small stone axehead, a scraper, three flakes and one fragment of flint, a flake and a fragment of chert, a possible quartz core, and two pebbles of white quartzite and agate.

Off the west coast of Scotland, at Sorisdale on the isle of Coll (Inner Hebrides), a further E–W orientated shallow grave pit was found in 1976 (fig. 21.9; Ritchie/Crawford 1978). This contained the partly-disturbed skeleton of a young adult (aged 17-25) of indeterminate sex, with a Low-Carinated AOC Beaker beside his/her head. This grave lay beside the remains of a house, of which only the curved east end survived; a discontinuous midden beside the house produced sherds of a later style of pottery, of a kind seen in Early Bronze Age settlements elsewhere in the Hebrides.

Figure 21.7 Footed Food Vessel from the secondary, Early Bronze Age grave at Upper Largie (Image: National Museums Scotland).

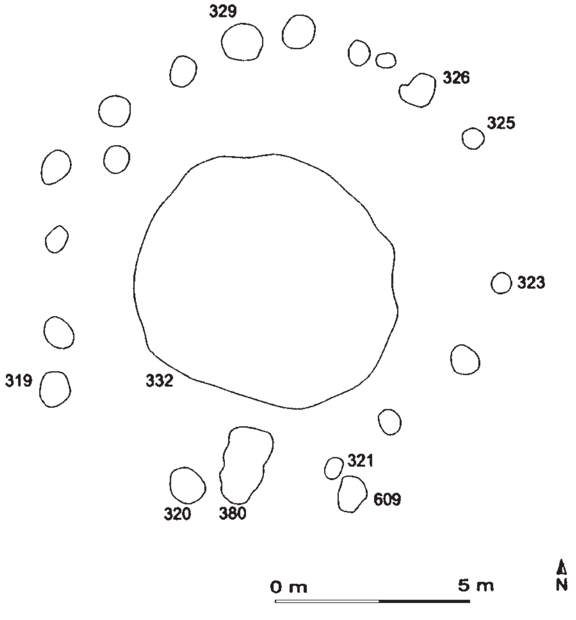

Figure 21.8 The second possible Beaker grave at Upper Largie (Image: AOC Archaeology Group).

The excavators reported that the stratigraphic relationship between the grave, the house and the midden could not be ascertained. The skeleton has recently produced a radiocarbon date of 3879 ± 32 BP (OxA-14722, 2460-2280 cal BC at 1σ, 2470-2230 cal BC at 2σ: Sheridan 2007), which is closely comparable to the dates obtained for the Upper Largie Beaker grave. Recent isotopic analysis of tooth enamel from this individual, undertaken as part of a nationwide research project, the *Beaker People Project* (Jay/Richards 2007; Parker Pearson *et al.* 2007), has revealed that the person had not spent the first few years of his/her life on Coll, but had come from an area of young Cenozoic or Cretaceous geology; the Netherlands cannot be ruled out as a possibility, and this is currently being investigated (Janet Montgomery pers comm). If the imminent oxygen isotope analyses confirm a Dutch origin for this individual, this would constitute the first direct evidence for a Beaker period immigrant in Scotland, comparable in age (although not in ultimate origin) to the 'Amesbury Archer' in Wiltshire, southern England (Fitzpatrick 2002).

The other sites to be considered in this regard (fig. 21.10) – all lacking human remains, but suspected to have been

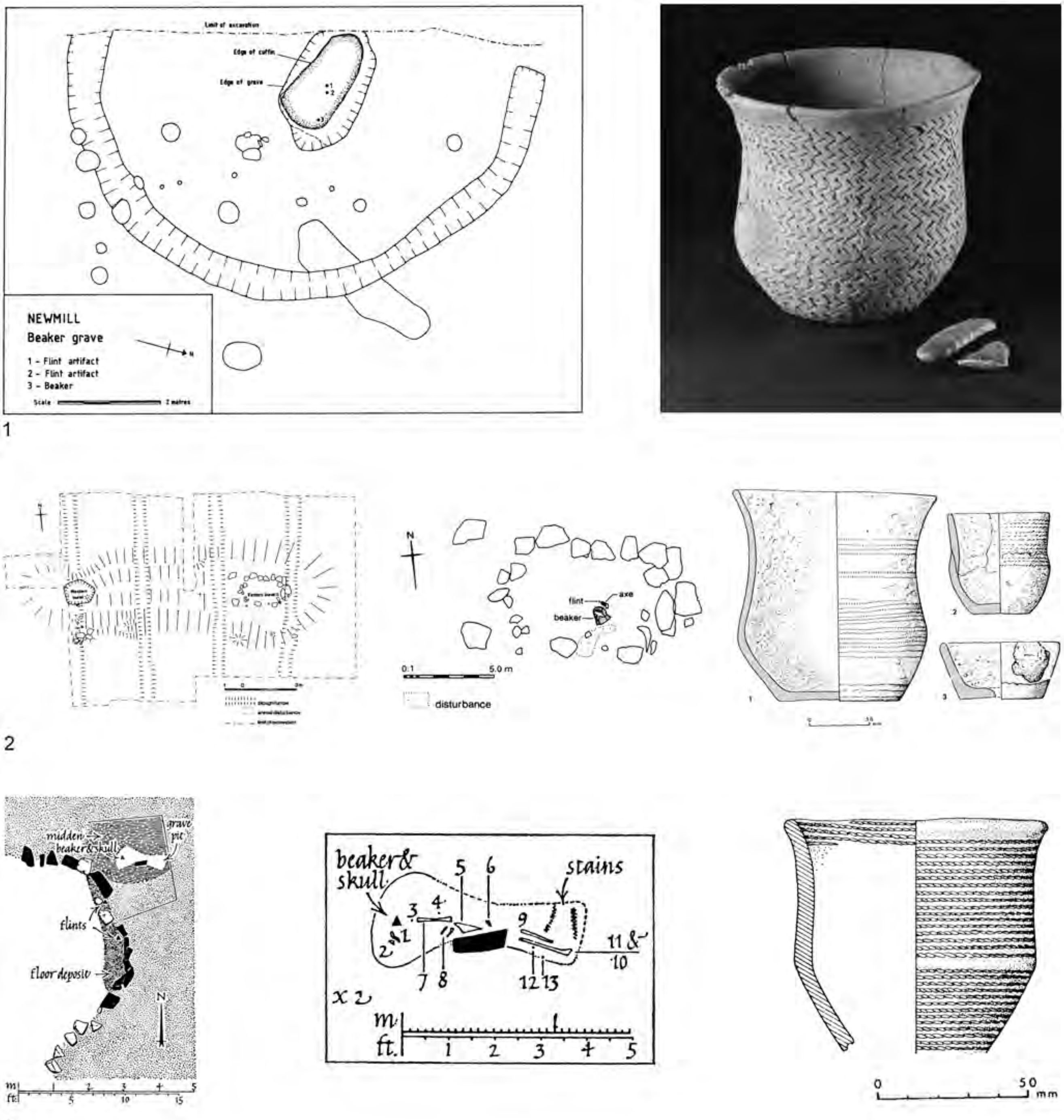

Figure 21.9 Other Scottish early Beaker graves with possible Dutch connections (Images: Society of Antiquaries of Scotland and NMS):
1 Newmill, Perth & Kinross
2 Biggar Common, South Lanarkshire
3 Sorisdale, Coll.

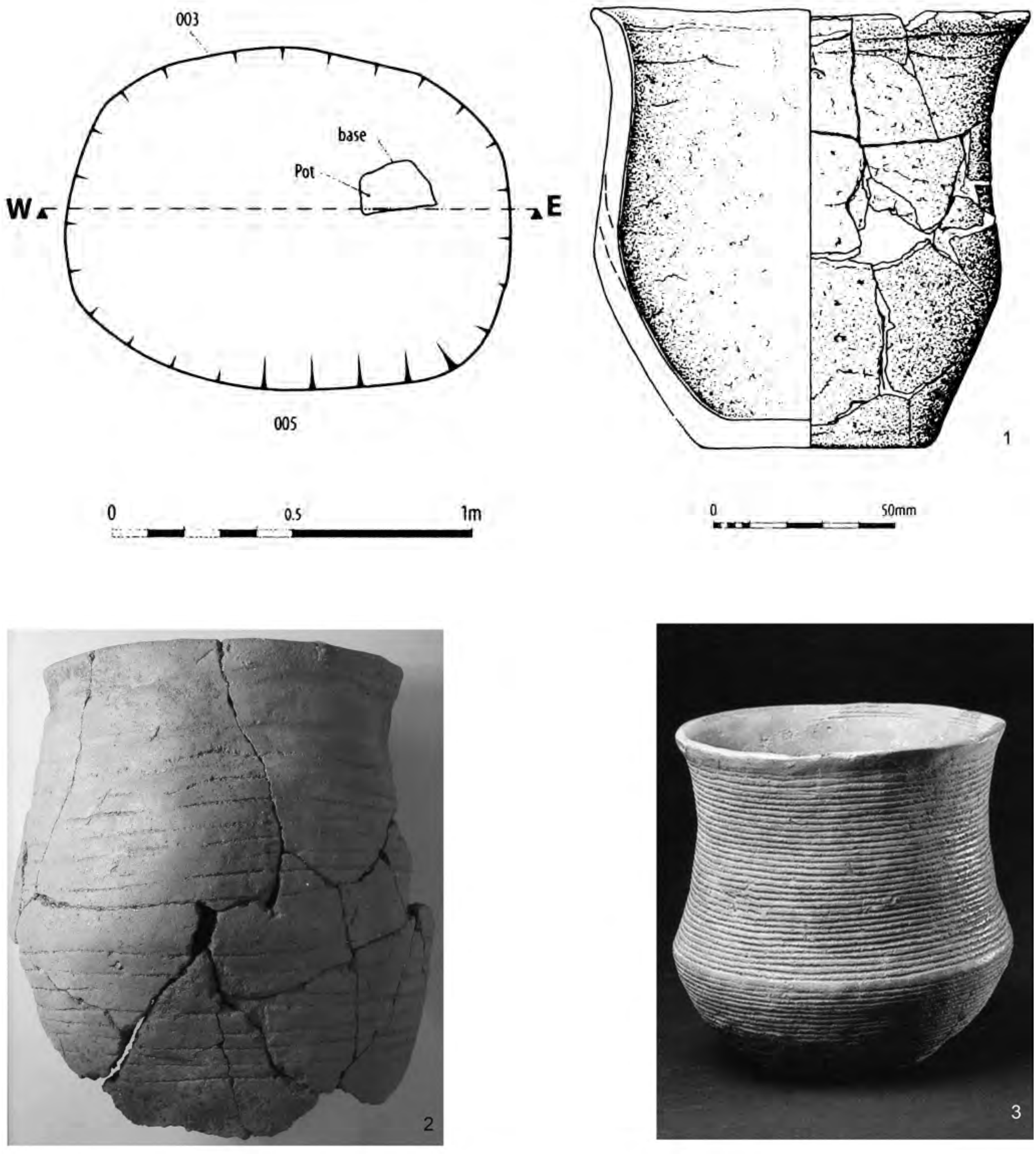

Figure 21.10 Further Scottish early Beaker graves with possible Dutch connections:
(Images: Society of Antiquaries of Scotland and NMS)
1 Beechwood Park, Highland
2 Rhynie, Aberdeenshire
3 Bathgate, West Lothian.

graves – comprise an E–W orientated pit containing an undecorated Low-Carinated Beaker at Beechwood Park, Inverness, in northeast Scotland (Suddaby/Sheridan 2006) and a mostly-destroyed pit containing a sinuous-profiled, loosely-decorated AOC Beaker at Barflat, Rhynie, Aberdeenshire (again in northeast Scotland: Cook/Scott 2005). It is likely that two Low-Carinated AOC Beakers (fig. 21.10), found in a sand quarry at Bathgate, West Lothian, in the Central Belt of Scotland, had also come from grave pits, which would have been unrecognised at the time of the pots' discovery (Mann 1906, 369-71).

This brief review does not purport to cover all the finds of early Beakers in Scotland, or to go into the question of the evolution of Beaker funerary practices; a brief review of the evidence, highlighting the very wide distribution of AOC Beakers in Scotland, has already been presented elsewhere (Sheridan 2007). Suffice it to say that, thanks to campaigns of radiocarbon dating in Scotland (*ibid.*), it is clear that the practice of burial in a stone cist was adopted soon after the appearance of these non-cist graves (*e.g.* at Dornoch Nursery, in the far northeast of Scotland: *ibid*., 109); and that, as indicated above, the practice of using timber chambers or coffins persisted after cist burial had become popular (*e.g.* at Kintore, Aberdeenshire: here a timber chamber had been covered with a stone cover: Cook pers comm).

21.6 Other evidence for Dutch Beaker period links

Previous commentators have argued for Beaker period links between Scotland and the Netherlands on the basis of metal finds, as well as ceramic finds (*e.g.* Case 1977; Coles 1969; Cowie 1988; Shepherd 1986; cf. O'Connor 2004). Here a distinction needs to be made between the introduction of individual copper items during the earliest period of Beaker use, and the introduction of the practice of metal *working* – involving both copper and gold – at a later date. The latter implies a maintenance, or re-establishment, of connections across the North Sea. (The question of the introduction of bronze metallurgy will be touched on briefly below.)

Regarding the earliest, 'pioneering' period of Beaker use, the artefact which has been cited as having strong (albeit not exclusive) links with the Netherlands is the tanged copper 'dagger' (*e.g.* Lanting/Van der Plicht 2002). (As Humphrey Case has pointed out (2004, 205), these objects are generally more likely to have been used as knives than as daggers; henceforth they will be referred to as 'blades'.) Ian Shepherd has emphasised the marked similarity between the broad tanged blade from East Pitdoulsie, Auchterless, Aberdeenshire, and Dutch examples including those from Exloo and Ede – the latter associated with a Maritime Bell Beaker of 2^{Ib} type (Shepherd 1986, 8; cf. Cowie 1988, fig. 6 and Lanting/Van der Waals 1976, fig. 25). Compositional analysis of the Auchterless blade, along with another Aberdeenshire blade from Inverurie, has shown it to have been made of high-nickel 'Bell Beaker-metal', whose ultimate source may lie in the copper mines of Asturias; importation of these blades from the Netherlands, where 'Bell Beaker-metal' artefacts of similar (but not identical) composition have been found, is a possibility (Needham 2002; 2004; see these references for other finds of 'Bell Beaker-metal' in Scotland). A further early Beaker find may be that of a fragmentary tanged copper blade, found in a cist along with an AOC Beaker at Salen, on the Hebridean island of Mull (Ritchie 1997, 54). However, this evidence must be treated with caution as it is clear that AOC Beakers continued to be made for some time after their initial appearance (as demonstrated by a date of 3775 ± 35 BP, SUERC-5299, 2280-2130/2300-2040 cal BC for a non-funerary find at Eweford, East Lothian: Sheridan 2007, 116). That these blades continued to be made or used for some considerable time is indicated by the fragmentary example from Tavelty, Aberdeenshire, dated (from the associated skeleton) to 3710 ± 70 BP (GU-2169, 2210-1980/2300-1890 cal BC: *ibid*., 114; O'Connor 2004, 206).

That the users of early Beakers in Scotland did not rely solely on Continental imports of metal objects is suggested by the presence of flat axeheads made of Irish copper, almost certainly from the Ross Island mine in County Kerry, southwest Ireland (Needham 2004, fig. 19.4). While none is directly dated, and while the use of copper artefacts is known to have continued after the inception of bronze metallurgy in northeast Scotland around 2200 BC (*ibid.*), some, at least, may have been imported during this initial, 'pioneering' phase of Beaker period activity. Given the pivotal location of the Kilmartin Valley during the Neolithic period and from the 22nd century in the movement of Irish artefacts up the Great Glen into northeast Scotland (Cressey/Sheridan 2003), can one envisage the Upper Largie 'pioneer' as a very early entrepreneur, facilitating the import of Irish axeheads into Scotland? If this had been the case, it begs the question of how the links with the early Beaker metalworkers in southwest Ireland had been forged.

As far as the introduction of metal *working* (as opposed to imported metal artefacts) to Scotland is concerned, Shepherd has argued (1986) that a second episode or phase of immigration from the Netherlands was responsible, with Dutch metalworkers settling in specific parts of northeast Scotland. He cites evidence such as the resemblance between the pair of copper neck rings or diadems from Lumphanan, Aberdeenshire, to the Veluwe Beaker period gold diadem from Bennekom (Shepherd 1986, fig. 8; cf. O'Connor 2004, 207). If Shepherd is correct, then the earliest date at which this could have occurred is *c.* 2300 BC, since this is believed to be the earliest date at which metalworking commenced in the Netherlands (Butler/Fokkens 2005). Support for this is given by O'Connor and Needham's reconsiderations of Scottish Chalcolithic metalwork (2004); and indeed this is a time when a large number of Beakers were deposited in northeast Scotland (Sheridan 2007). However, whether the ceramic evidence supports this view of a strong link with the Netherlands at this time is a question that needs further consideration, including a detailed comparison of Beakers in this part of Scotland and the Netherlands. At present, although certain vessels from northeast Scotland (and indeed elsewhere in northern Britain) approach classic Dutch Veluwe Beakers in their form (*e.g.* Shepherd 1986, fig. 20), the similarity is unconvincing; instead, close attention to possible links with *early* Veluwe Beakers needs to be paid.

Whatever was the case as regards the Chalcolithic introduction of metalworking to Scotland, it appears that subsequent North Sea links – probably with central Europe, whether or not mediated through the Netherlands – may well have stimulated the development of Scotland's earliest bronze manufacturing 'industry', the 'Migdale-Marnoch' phenomenon, around 2200 BC (Needham 2004). This is strongly suggested by the style of some artefacts in the hoard from Migdale in northeast Scotland, which echoes Straubing Culture fashions in Bavaria. This hoard has been dated, from wood inside one of its constituent tubular sheet bronze beads, to 3655 ± 75 BP, OxA-4659, 2140-1930 cal BC at 1σ, 2300-1750 cal BC at 2σ (Sheridan *et al.* 2003).

21.7 Conclusions

The fact that the early Beaker period graves described above represent such a striking novelty within mid-third millennium Scotland, and point so forcefully towards the Netherlands as the place of origin for their occupants, raises the very real possibility that we are dealing with Dutch immigrants during or around the 25th century BC. Of course, the idea of incoming 'Beaker people', for so long unfashionable in Britain, has been revived by the evidence from the famous 'Amesbury Archer' in Wiltshire, who appears to have been an immigrant from central Europe, possibly Bavaria (Fitzpatrick 2002). The isotope evidence from another Wessex grave, the so-called 'Boscombe Bowmen' collective Beaker grave in Wiltshire, also indicates that the three adults that were present had been immigrants. Although Wales has been suggested as a place of origin, Brittany seems equally or more plausible (Montgomery/Evans pers. comm.; Evans *et al.* 2006; www.wessexarch.co.uk/projects/wiltshire/boscombe). Furthermore, the evidence from the copper mine at Ross Island in southwest Ireland (O'Brien 2004) points to expert metalworkers having moved from continental Europe to prospect, then exploit, the rich copper resources of southwest Ireland. Clearly, then, Beaker immigrants to different parts of Britain and Ireland seem to have come from different parts of Continental Europe. New discoveries and research will no doubt clarify, and perhaps complicate, the picture. Needham's model (2005) of an initial phase around the mid-third millennium, when a few immigrants were present and when the beaker 'package' of novelties represented a rare and exotic opportunity to find new ways of gaining and expressing power, seems plausible.

The question of why these Continental immigrants came remains hotly debated. Metal prospecting seems the most plausible explanation in the case of the Ross Island miners; but, as Stuart Needham has pointed out (2007), metal prospecting need not have been the only reason why people came. While the multi-faceted funerary identity of the 'Amesbury Archer' had included 'metal worker', to judge from some of his grave goods, it is a moot point whether he had come to Wessex looking for metal. It has been suggested (by Timothy Darvill) that he had been drawn to the area by the fame (and alleged healing properties) of Stonehenge. The undertaking of dangerous, long-distance journeys by the elite has long been acknowledged as a means of enhancing one's power, and Needham has argued (2007) that this, rather than some nebulous *Wanderlust*, may have lain behind some of the journeys undertaken at this period.

Whether Dutch people came to Scotland (and elsewhere in Britain) to look for metals, or as a strategy to enhance their power 'back home', or for some other reason, will continue to be debated. Similarly, the question of whether we are dealing with more than one episode or phase of Beaker period contact with the Netherlands needs to be investigated further as a distinct possibility. As far as the Upper Largie individual is concerned, however, we can say that he was not alone. Quite apart from the fact that other similarly-minded people must have been responsible for burying him in the traditional Dutch fashion, and for making the pots that accompanied him, we can point to a couple of other finds of similarly-early Beaker pottery in the area (namely sherds of a Maritime Bell Beaker with cockle-shell impressions, and an AOC Beaker: Clarke 1970, fig. 80 and p. 529). Was Upper Largie Man drawn to the Kilmartin Valley by the fame of the pre-existing sacred sites there? Or by rumours (well-founded) of copper deposits in the area? Was he involved (through some unknown means) in establishing the northward flow of southwest Irish copper artefacts (*e.g.* axeheads) to other parts of Scotland? We simply do not know. However, what we can say is that this individual was sufficiently notable, within the Kilmartin Valley, for a subsequent important person – who almost certainly *was* involved in the northward movement of Irish copper – to be buried immediately beside him, in a similar wooden chamber, during the 22nd century. And the changes that were wrought in Britain and Ireland by the introduction of the 'Beaker package' were to have a profound influence on subsequent developments there.

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22 Neolithic Alpine axeheads, from the Continent to Great Britain, the Isle of Man and Ireland

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Michel Errera
Estelle Gauthier
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22.1 Introduction

Within the source area from which Alpine axeheads circulated around western Europe, two groups of quarries and of secondary exploitation sites close to the outcrops have recently been identified in Italy. One lies in the massif of Mont Beigua, to the north of Genoa; the other lies at the foot of Mont Viso between 1800 m and 2400 m in altitude (Pétrequin/Pétrequin *et al.* 2007a; 2007b). From the end of the sixth millennium BC, to the beginning of the third, this exploitation of mountain sources provided most of the axeheads made of eclogite, of omphacitite and of jadeitite that have been found in Neolithic Europe, together with those made of other Alpine rocks (such as certain retromorphic eclogites, amphibolites and serpentinites) whose provenance is harder to establish (see note 1 for the use of the term 'jadeitite', and for an explanation of the convention used to cite axehead findspot place names). From this central source zone, Alpine axeheads – which range from small examples just 3 cm long to massive examples, of which the most impressive (from Locmariaquer/Mané er Hroëck in Brittany) is 45.6 cm long (Herbaut 2000) – travelled to the outer fringes of Europe, to Sicily, Spain, Ireland, Scotland, Denmark and Bulgaria (Damour/Fischer 1878; Pétrequin *et al.* 1998). The furthest-flung example is some 1700 km as the crow flies from the source area.

We have discussed elsewhere the probable reasons for this remarkable diaspora, which extended throughout the whole of Europe, except for the east where, during the Chalcolithic period, copper and gold dominated (Pétrequin *et al.* 2002). The force with which these polished axeheads managed to 'penetrate' diverse Neolithic groups is striking. We choose to explain this in terms of their social function (which pertained not only to the large specimens, but to small axeheads as well), which has long been masked by the use of conventional, obsolete and ethnocentric terms to describe the axeheads as 'ceremonial' and 'prestige' objects. In fact, from our point of view as 21st century 'technicians', once the axeheads had passed beyond the geographical zone of their first users, located to the northwest and west of the Alps, they took on a socially-determined role over and above their primary function as forest-clearing tools. In fact, it seems likely that this deviation from the axeheads' original function and meaning probably began in the quarries themselves, where the importance of ritual during the process of extraction is suggested by the deliberate deposition of a pair of large unpolished roughouts on the ground surface at the rock shelter of Paesana/Madonna del Fo (Cuneo, Piedmont), just at the foot of Mont Viso (pers. comm. M. Venturino Gambari). One can thus think of the axeheads as symbolic artefacts, charged with myths and with their own life-histories, belonging to the realm of sacred objects, like the well-known ethnographic examples from New Guinea (Godelier 1996; Pétrequin/Pétrequin 1993; 2006). Such sacred objects could be deliberately planted in the ground in prominent positions, or at the edge of a river, or at the entrance to caves; or they could equally be deposited in marshy areas, as offerings to supernatural beings. Similarly, they might be hidden and only taken out on ritual occasions, when they would be unwrapped solely for the purpose of honouring them, before being re-wrapped and returned to their hiding place (see also Wentink (2006) in his discussion of hoards of Danish flint axeheads in the Netherlands). Finally, some of these axeheads were deposited, sometimes in a deliberately broken state, inside monumental tombs such as the giant tumuli of the Gulf of Morbihan in Brittany (Cassen 2000a), where they appear as inalienable insignia of high-ranking individuals.

It is therefore not surprising that the majority of Alpine axeheads have been discovered as stray finds, without any archaeological context. They are mostly single finds, but occasionally pairs or larger numbers have been found together, deposited in the ground sometimes in a leather container, and sometimes splayed out like rays of the sun.

The fact that such axeheads – rarely broken, and with a particularly careful polish – are almost always found as stray finds ought to have attracted the attention of researchers; instead, many of these exceptional objects have ended up relegated to cabinets of curiosities, to private collections, and to museum stores. They were ignored but for the attention of mineralogists who used them to prove, for the first time, that European jadeitite had been used in prehistory (Damour 1865), or to test out new analytical methods (Ricq-de Bouard 1996; Compagnoni *et al.* 1995; D'Amico *et al.* 2003). Axeheads found in settlements are rare, except for those dating to the initial and final stages of the phenomenon of diffusion, and for those in the zone of production in Italy, where they are most often found as broken roughouts. Similarly, axeheads found in funerary contexts are rare, except for a few inhumation graves in Italy, in southern France and in Catalonia. It is for this reason that one cannot overstate the exceptional nature of the presence of these axeheads in the Morbihan tumuli. This phenomenon occurred at a time, during the middle of the 5th millennium BC, when the social usage of Alpine axeheads was very intense: here, these sacred objects were effectively destroyed by being buried in the tombs of men whose status must have been associated with the possession of supernatural powers.

Thus we can view the axeheads as non-utilitarian objects and as rare and immensely valued items, and use this perspective to approach the question of Alpine axeheads in Great Britain, the Isle of Man and Ireland (fig. 22.1), and of their geographical and chronological relationships with the Continent (particularly with the Atlantic coast, the Channel and the North Sea).

22.2 Typology and problems of dating

22.2.1 Developing a typology

Following Giot's observation (1965) that there were formal differences between the examples found in the Morbihan region and those found on the Rhine and in Italy, little was done to create a typological classification of Alpine axeheads prior to our own 1998 contribution (Pétrequin *et al.* 1998). Campbell Smith (1963) had attempted to describe the British and Irish axeheads during his study of their mineralogical composition, but we have had to reconsider many of his attributions to types, because the types themselves overlapped too much in their definition. Regarding formal classification, the most pertinent contribution was made by Woolley *et al.* (1979), who focused on length/breadth ratios, and included some Continental examples in their survey. Their resulting diagram showing the range of formal variation was interesting, even if their insistence on the existence of a continuum of forms (ranging from short and squat to long and slender) was ineffectual in terms of defining specific types.

In 1996-1997, some of us returned to the task of typologically classifying axeheads made from Alpine rocks. We worked on a series of around 450 long specimens, and tried out various approaches; our work was informed by our prior experience with ceramic classification (Pétrequin *et al.* 1988), by a pilot investigation of the axeheads of the southern Vosges (Pétrequin/Jeunesse 1995), and by our observations of contemporary ground stone axeheads in New Guinea (Pétrequin/Pétrequin 2006).

Prior to our research we agreed to the following seven points.

First of all we would not accept preconceived ideas – entertained by some others working on Alpine axeheads (Ricq -de Bouard 1993; D'Amico *et al.* 1995) – that implied that all these axeheads, of whatever form, were contemporary and could thus be shown on overall, typology- and chronology-free, Europe-wide distribution maps. Second, we decided to abandon the hypothesis, which had principally emerged from stone axehead studies in Britain and Brittany (largely due to the high incidence of uncontexted, stray finds), that petrological groupings took precedence over typological and chronological classification. Third, we determined not to believe – unless proved otherwise – that symbolic or sacred objects were impervious to the kind of changes that occur with all human actions, and which are brought about by the social interpretation of innovations (Pétrequin/Pétrequin 2006). Fourth, we agreed not to accept, unconditionally, the hypothesis that these very precious objects constituted treasures that were systematically transmitted from one generation to another, thereby producing a mixture of types that would hinder the creation of typo-chronological classifications (Herbaut 2000). Fifth, we would adopt a broad, Europe-wide perspective, in order to avoid creating regional classifications that cannot be applied at a broader scale, as is the case in the Alps themselves (Thirault 2004). Sixth, we would not work with examples less than 14 cm in length, so as to avoid the problems relating to the reworking of old and broken polished axeheads (Buret 1983; Buret/Ricq-De Bouard 1982). Finally, we accepted that it might be necessary to create detailed typological entities, then to re-group them if it seemed that confusion might arise between several similar types which evolved in the same ways (Pétrequin *et al.* 1988).

22.2.2 Results: the typology

After adapting our approach to suit the growing Europe-wide inventory of Alpine axeheads, and to take into account new discoveries bringing fresh contextual and stratigraphic information – in particular our discoveries in the quarries of Mont Viso (Pétrequin/Errera *et al.* 2006) – we realized that the typological propositions we had made in 1999 seemed to be finding their own route. The best demonstration of this came from the discovery, at the pan-European scale, of oppositions, of complementarities and of logical successions between

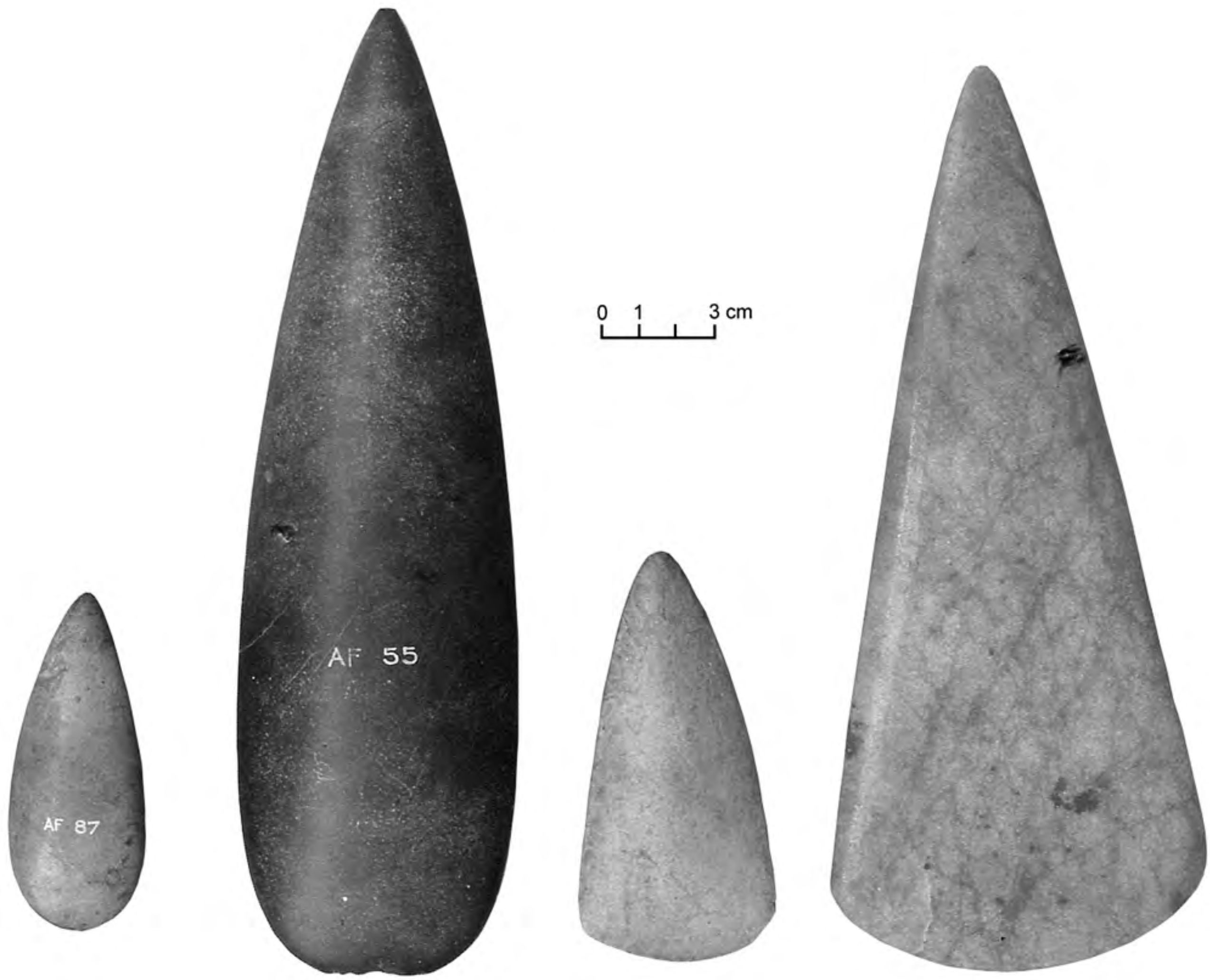

Figure 22.1 Four examples of polished Alpine axeheads from Scotland and the Isle of Man. From left to right: Caithness (Durrington type); Berwickshire (Durrington type); Glencrutchery (Chelles type); Greenlawdean (Greenlaw type). Spectroradiometric analysis has shown that these are all very probably from the extraction sites on Mont Viso. Photo: P. Pétrequin.

certain types. The most important of these are shown in fig. 22.2. We can detect the following logic among the various types (whose names derive from the find spots of representative specimens):

First, there is an opposition between 'southern' and 'northern' types, separated by a line running from Geneva to Caen. This suggests the existence of two modalities of exploitation and two networks over which the axeheads diffused. The 'southern' types can be readily distinguished from the northern types by their shape: narrow, sometimes plump, and with a blade that merges gently into the sides, in contrast to the broad, flat, triangular shape of the Altenstadt/Greenlaw axeheads, whose blade-side junction is markedly angular.

Second, there are distinctive types, unique to the Carnac area, whose epicentre lies in the Gulf of Morbihan on the southern coast of Brittany. These were produced by the deliberate reworking of imported Alpine axeheads: their shape was changed, they were thinned, and they were repolished. This was so that the elite of the area could differentiate themselves from their neighbours through a veritable re-creation of sacred objects. Third, there are some ubiquitous types, represented virtually throughout western Europe. Their ubiquity suggests that they cannot be contemporary with the aforementioned types.

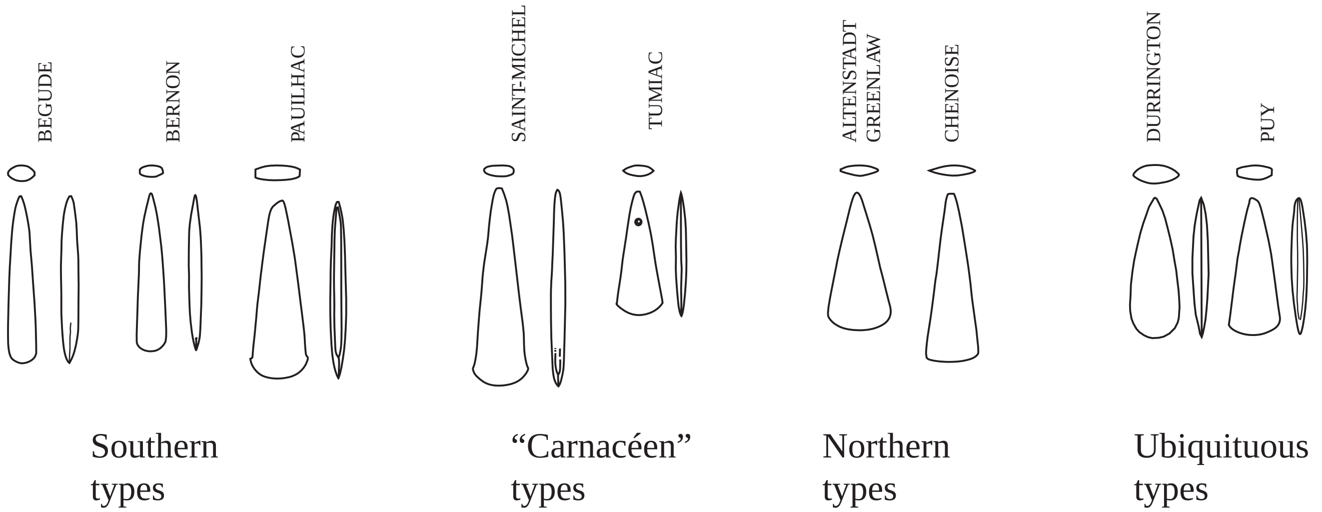

Figure 22.2 The typological classification of Alpine axeheads, and the distribution of the various types at a Europe-wide level, allows us to distinguish four groups. A geographical axis Geneva–Caen (see figs 22.4 and 22.5) marks the frontier between northern types and southern types. 'Carnacéen' types, centred in Brittany and in particular the Gulf of Morbihan, illustrate the classic forms of repolished Alpine axeheads. The fourth group comprises widespread types that are found virtually over the whole of Europe, from the Mediterranean to the Baltic. Drawing: P. Pétrequin.

This, then, is the basic typological classification, which is relatively uncomplicated. Still, the process of arriving at it was time-consuming, since it involved making a typological judgement on an axehead-by-axehead basis, then returning repeatedly to past attributions to check their consistency with the parameters for each type. To date, some 1600 Alpine axeheads from the whole of western Europe have been inventoried in this way.

22.2.3 Developing a relative chronology

Research on the chronology of the Alpine axeheads is strewn with past misapprehensions, such as the belief that the large examples with expanded blades were a copy of flat copper axeheads, and therefore datable to the Beaker period. We ourselves have been guilty of this error (Pétrequin *et al.* 2002).

The establishment of a relative chronology of Alpine axehead manufacture and use is hindered by the fact that the large axeheads have mostly been discovered as isolated, stray finds. We can say nothing about the relative chronology of these context-less items. We can only work with the following sources of information:

Absolutely-dated settlement sites

There are a dozen absolutely-dated settlements in Italy, a dozen in Switzerland and seven in France), where fragments of axeheads of recognizable types have been found. In nearly every case, these sites have been either early (5400-4800 cal BC) or very late (3800 BC and later), corresponding to the beginning and the end of the social 'cycle' in which Alpine axeheads were accorded special value close to their zone of production. The information from these dated settlements indicates that the Bégude type is among the earliest (if not the earliest) to have been produced, and the Puy type is the latest.

Extraction areas at the sources

Our latest excavations of September 2007 at Oncino/Bulé (Cuneo, Piedmont), at the southeast foot of Mont Viso, have revealed a sequence in which material relating to Bégude-type axeheads is mostly found at the bottom of stratigraphic sequences; material of Durrington and associated types is found mid-way up; and Puy-type material is mostly found at the top. This indicates a general sequence, in which Bégude-type roughouts were still being produced by the 'Durrington phase', and a few of them were even being made as late as the 'Puy phase'. The total absence of roughouts for northern-type axeheads from these extraction sites in the Bulé valley suggests that they were produced elsewhere, by other groups; an inference which is supported by their distribution pattern (fig. 22.6). The people who were exploiting the Bulé valley sources were supplying networks of contacts in Italy, and they continued to do so for over a millennium (Pétrequin *et al.* in press). (Incidentally, as regards the radiocarbon dates that have been obtained from charcoal from the production sites, we must bear in mind that the sediments in which the charcoal occurred had been subject to water-washing and other erosion.).

Well-dated tombs
Even though the Morbihan tumuli may not have been constructed in a single episode, the presence of axeheads buried with other extraordinary objects in closed chambers, within the mounds, is a particularly reliable source of information.

Hoards of two or more axeheads found together
Here, we have taken the risk of assuming that where, on different occasions in recent times, two or more large axeheads have been found at the same findspot, they originally belonged to a hoard.

These definite and presumptive examples of closed assemblages, from tombs and hoards, theoretically allow us to construct typochronological seriations.

22.2.4 Regional relative chronologies
Evidence from four areas of Europe has been used to create regional relative chronologies for Alpine axehead types. The overall patterns are as follows:

In North Italy the oldest axehead is a large version of the Durrington type, but one which is thin in cross-section, because it has been made using mediocre quality raw material. Bégude-type axeheads come next, followed by Durrington-type axeheads of teardrop shape, and with a thick cross-section. The latest type is Puy.

In France (except for Brittany), with the evidence coming principally from hoards, the Bégude-type (found in the south of France) comes first. Then come Altenstadt/Greenlaw-types (in the Paris Basin) and finally the Puy-type. There is only one example in France where a Puy-type axehead has been found in association with one of Altenstadt/Greenlaw type.

In Belgium and Germany the sequence starts with Altenstadt/Greenlaw/Chenoise, and then these three types associated with those of Puy-type (implying a later date for Altenstadt and Greenlaw axeheads here than in the Paris Basin). The Puy-type closes the sequence. Puy axeheads are sometimes found associated with those made of flint (as at Dave in Belgium), copper (as at Großheubach, Bavaria), or non-flint stone (other regional types). The association with flint axeheads shows that, for Belgium, the latest Puy axeheads appear at a time when the manufacture of flint axeheads had already begun.

In the Gulf of Morbihan the tombs and hoards constitute an extraordinary record which complements the sequences seen in the other areas (fig. 22.3). The earliest axeheads are of Bégude and Bernon type (with the latter often being reworked and thinned-down Bégude specimens); these have sometimes been associated with stone rings that are attributable to the Villeneuve-Saint-Germain (VSG) culture (and/or to the Early Neolithic of Italy: Herbaut/Pailler 2000; Pailler 2007). Following these came the Saint-Michel and Tumiac types, which are unique to the Morbihan (figs 22.4 and 22.5). Towards the middle of the fifth millennium BC, the Altenstadt/Greenlaw types appeared in the tumulus of Saint-Michel at Carnac. Thereafter, one finds an association between axeheads of types Tumiac, Altenstadt, Durrington and Puy at Plomeur/Kerham (Morbihan); and finally, and farther afield in Brittany, between a Puy-type axehead and those of imported flint, repolished to produce faceted edges, at Plomeur/Kerdrafic (Finistère).

Before using these regional chronologies to construct an overall relative chronology for Alpine axeheads, there are one or two points to consider. The axeheads were well-travelled and may well have been old by the time they were deposited far from their original source (900 km from Italy to the Morbihan, or the 700 km, on average, between Italy and Germany). Nevertheless, according to the known associations (at least in Italy, France and Germany), they were deposited in the same chronological sequence as that known for the source areas in the Alps. The idea that there was a long-lived transmission of axeheads across the generations, which would have led to the mixing of types that had not been made at the same time, does not seem to be borne out by our seriations. In these areas of Europe, at least, it seems that single or multiple axeheads were deliberately withdrawn from circulation. This is especially so when they are discovered in places where they must have been deposited without any hope of passing them down to successive generations, or intent to retrieve them: in special landscape settings, in ‘sacrificial’ hoards, and in monuments where they were buried hafted but deliberately broken, putting them beyond human use (Cassen 2000a; 2000b; Cassen/Pétrequin 1999; Herbaut 2000).

The depositional contexts for the Alpine axeheads, together with our chronological sequencing, lead us to conclude that these sacred objects were destined, in the short to medium term, to be presented to external partners, thereby implying a centrifugal movement from the source areas to peripheral areas (cf. Van de Velde’s discussion, this volume, of similar movements of material culture in the context of Mesolithic-Neolithic contacts in the Netherlands). Alternatively, their destiny was to be sacrificed to those with special powers, be they human (as in the case of the tomb finds) or non-human (*i.e.* supernatural powers, a term that we prefer to use in order to avoid the baggage attaching to the terms ‘god’, ‘divinity’, or ‘spirit’ in the West).

Having argued for a short to medium-term use, we do not claim, however, that this was universally the case. From Denmark comes evidence that one particular axehead type had a very long currency indeed: a very late copy of a Bégude axehead was found there, made of copper from the Mondsee in Austria, and dating to around 3500 BC (Klassen/Pétrequin 2005).

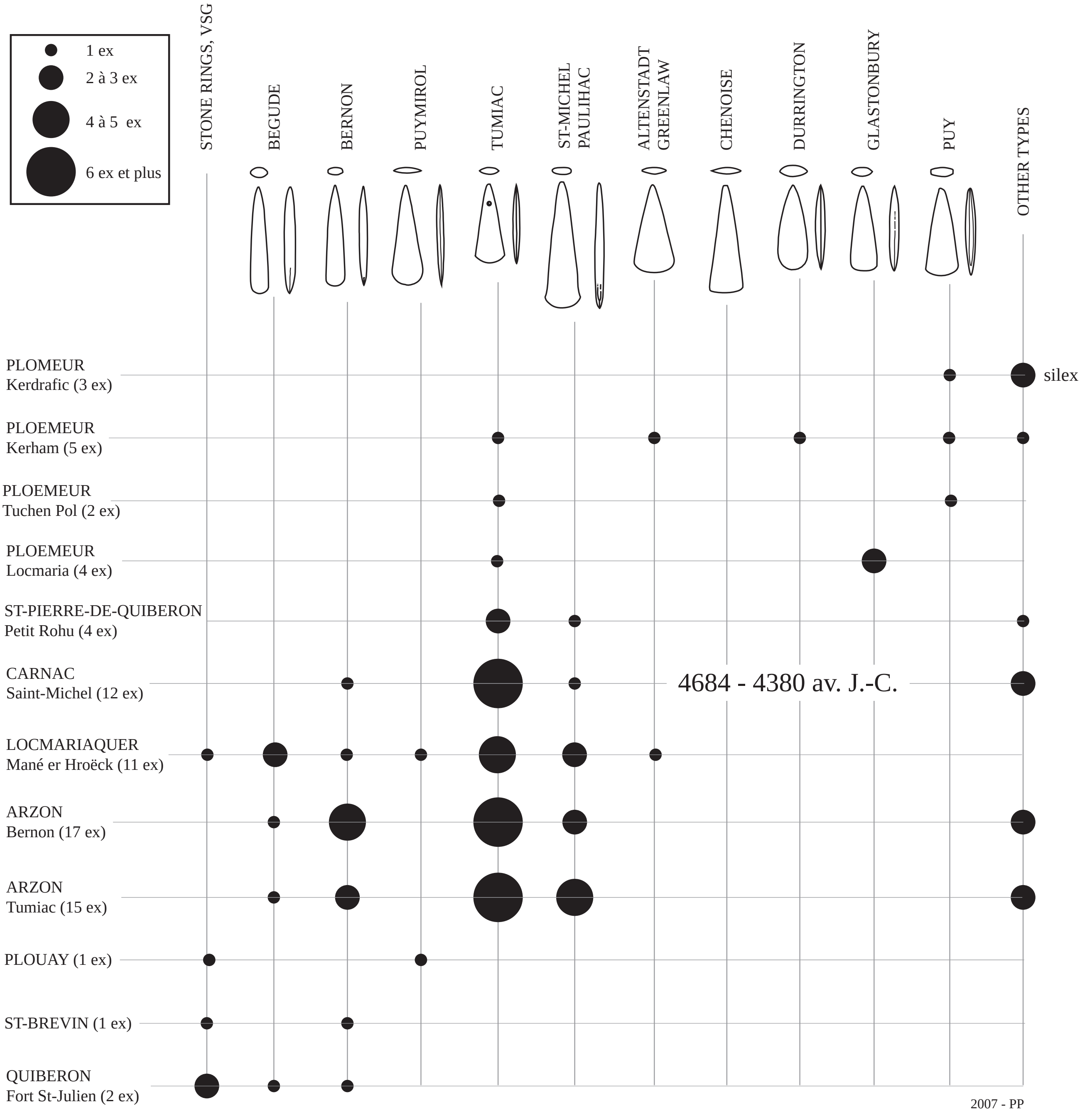

Figure 22.3 Chronological classification of hoards and other closed finds containing Alpine axeheads in Brittany, especially around the Gulf f Morbihan. The funerary assemblage from the Tumulus Saint-Michel, Carnac, has been dated to 5665 ± 54 BP (Tucson AA 42784, 4684–4380 cal BC at 2σ). Drawing: P. Pétrequin.

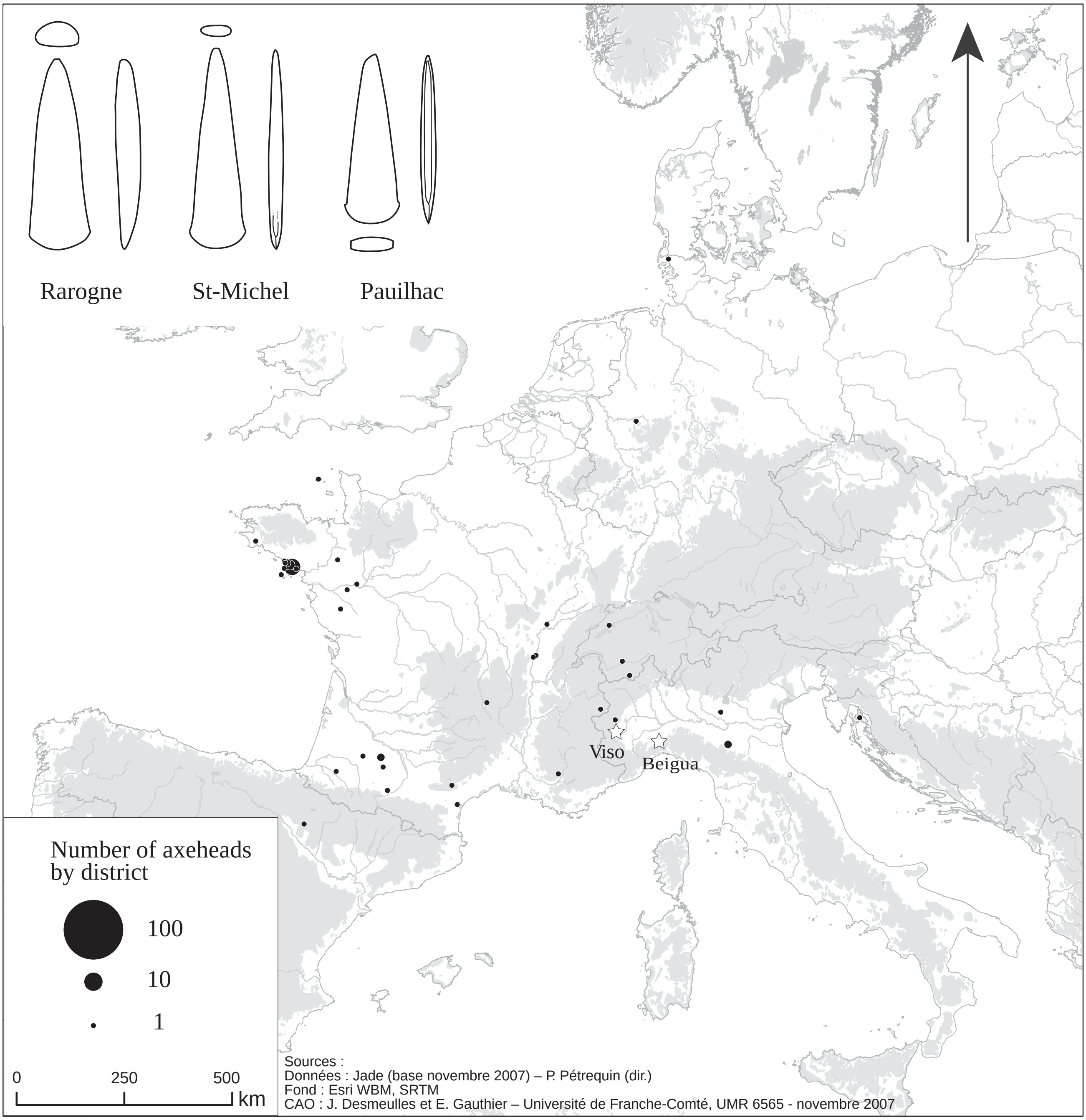

Figure 22.4 Distribution of polished axeheads of Rarogne, Saint-Michel and Pauilhac types. The Rarogne type represents massive axeheads that are close in shape and size to their Alpine roughout forms; the Saint-Michel type displays a type of repolishing that is peculiar to the Gulf of Morbihan; and the status of the Pauilhac type is as yet unclear; it is not impossible that it, too, represents a 'Carnacéen' variant of Alpine axeheads. These three types have a distribution that is almost exclusively southern, focusing in mid-fifth millennium Brittany.
Drawing: J. Desmeulles, E. Gauthier and P. Pétrequin (note: fig. 22.4-22.7 show only examples over 14 cm in lenght).

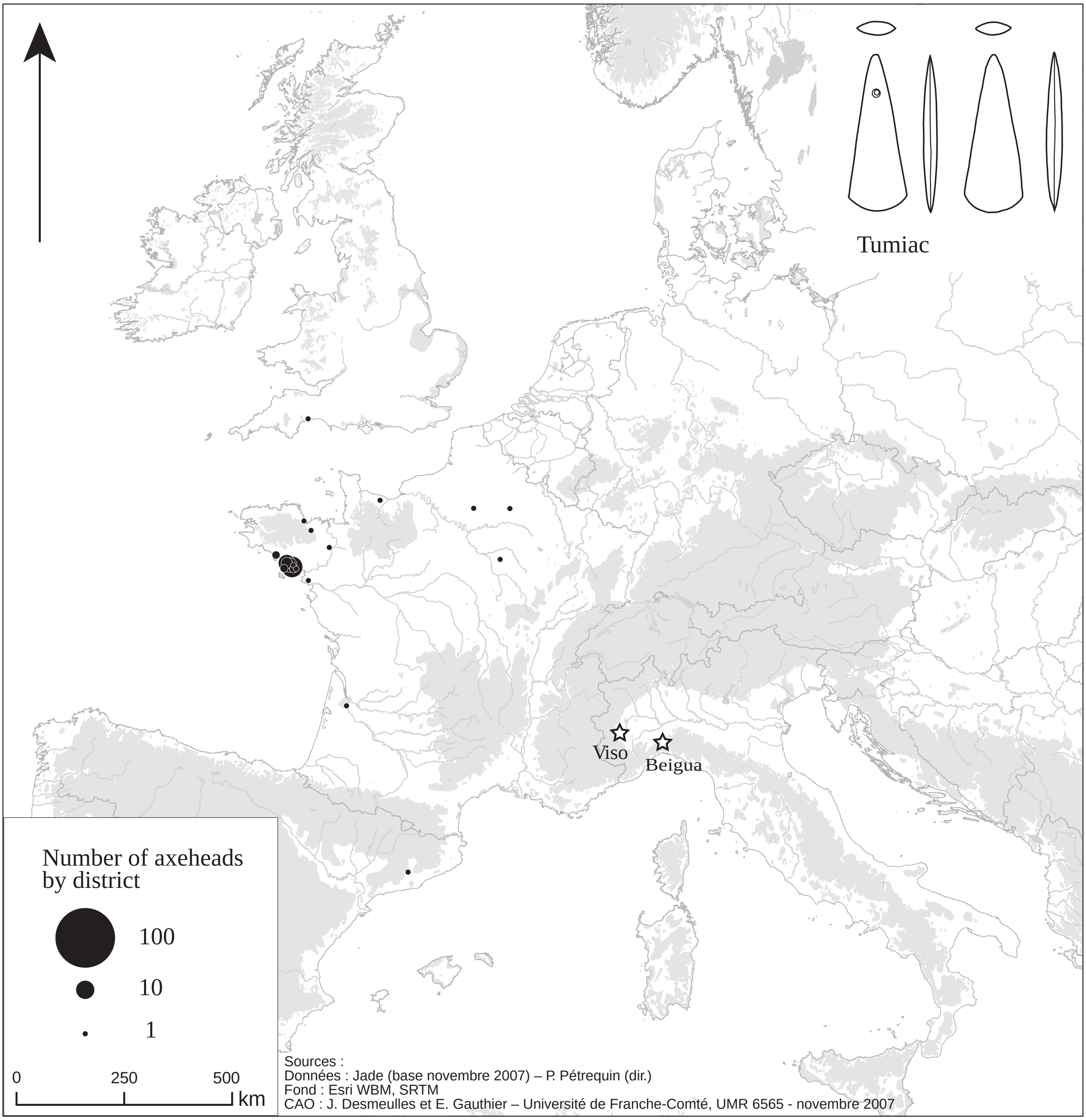

Figure 22.5 Distribution of an axehead type peculiar to the Gulf of Morbihan: the Tumiac type, corresponding to axeheads whose form has been altered by thinning and repolishing around the middle of the fifth millennium. After their transformation into 'Carnacéen' axeheads, some Tumiac specimens left Brittany to travel towards the Paris Basin and the Pyrenées. Drawing: J. Desmeulles/E. Gauthier/P. Pétrequin.

22.2.5 *Absolute chronology and the movement of axeheads through Europe*

Several factors militate against translating the relative chronology outlined here into an *absolute chronology*, valid for the whole of Europe, among which is an uncertainty regarding the currency of the various types. Let us take one example, which at first sight seems very well dated: that of the Glastonbury-type axehead found beside the Sweet Track in Somerset, southwest England (Coles *et al.* 1974). This wooden trackway is known, through dendrochronology, to have been constructed in 3807/3806 BC, and its excavators have argued that it had been abandoned by 3791 BC, around 15 years later (Coles/Coles 1996, 28). This gives us an impeccably tight chronology for the *deposition* of this axehead. However, it does not tell us when the axehead was originally made, or when it crossed the Channel. Regarding the former, the sequence of exploitation on Mont Viso suggests a manufacture date between 4500 and 4200 BC. For the latter, our only clue is the fact that pots of the Carinated Bowl tradition, and an axehead of mined flint, were also found beside the Sweet Track; the 'Carinated Bowl Neolithic' (and the practice of mining for flint) arrived in Britain and Ireland no earlier than 4000 cal BC, and probably within the first two centuries of the fourth millennium BC (Sheridan 2007). This case shows how complex the issue of constructing a chronology for Alpine axeheads can be. It also shows that it is unwise to extrapolate, arbitrarily, from the chronology for one region to the rest of Europe.

Furthermore, various routes of Alpine axehead movement can be traced from the quarries to the peripheries of Europe; these routes passed through varied cultures, and the axeheads themselves were probably subject to many different social interpretations on their journeys.

One approach is to examine the routes travelled by individual axeheads through various regions of Europe, and to try to understand the logic involved in the dynamic of their journeys. As the axeheads moved through various regions of Europe, they probably went through a complex series of transfers, physical modifications, and changes of meaning (Pétrequin/Cassen *et al.* 2006).

22.3 Alpine axeheads in Britain, the Isle of Man and Ireland

22.3.1 *Crossing the sea*

Turning to Britain, the Isle of Man and Ireland, the contexts are insular, separated from the Continent by at least 33 km of sea (at the Channel's narrowest point, the Strait of Dover/Pas de Calais). We should not be surprised that people were voyaging by sea: other evidence indicates that long-distance maritime journeys were being undertaken during the fifth and early fourth millennia, between Galicia and Brittany (Cassen/Vaquero 2000); from Brittany, up the Atlantic façade to as far as the west coast of Scotland and the northwest coast of Ireland (between *c.* 4400/4300 and 4000 BC: Sheridan 1986; 2003; 2004; 2005); and from northernmost France to places as distant as Caithness in northern Scotland and Sligo in northwest Ireland (around, or very shortly after, 4000 BC: Sheridan 2007).

In order to understand the Alpine axeheads found in these islands, we must evaluate them in detail and assess them against the background of the typo-chronology that we have proposed for the Continental fringe between Brittany and the Low Countries, from where the axeheads must have been brought.

22.3.2 *Typology*

Out of the 70 axeheads longer than 14 cm, the Altenstadt/Greenlaw types are by far the commonest. Next is the Durrington type then Puymirol, Puy and Glastonbury, Bernon, Chelles and Tumiac. Among the *c.* 70 further Alpine axeheads from Britain and Ireland that are shorter than 14 cm, a significant proportion are of the Durrington teardrop-shaped type. From first impressions, the range of types present in Britain, Ireland and the Isle of Man does not encompass the full chronological range of Alpine axehead types as seen on the Continent. The oldest type (Bégude) is missing, and the latest type (Puy) is only represented by a few examples.

There are a significant number of southern-type axeheads (23 – Durrington and Puymirol), readily distinguishable from the northern types. The discovery of two probable hoards in southern Scotland, each containing a mixture of southern and northern types, suggests that these types were indeed in contemporary use in Britain. At Oxnam/Cunzierton Farm (Scottish Borders), an Altenstadt axehead was found with one of Durrington type, while at Glenluce/Glenjorrie Farm (Dumfries and Galloway), an Altenstadt axehead was found with one of Puymirol type. This kind of association is very rare on the Continent, having been found only twice in France: once in Brittany (fig. 22.3) and once at Bennwihr (Haut-Rhin: Pétrequin/Jeunesse 1995). It seems to be unknown in Germany and Italy.

22.3.3 *Confirming an Alpine origin*

In order to double-check whether the axeheads from Britain, the Isle of Man and Ireland are indeed of Alpine rock, we undertook non-destructive mineralogical analysis using spectroradiometry (Errera 2002; 2003; 2004; Errera *et al.* 2006; 2007). The advantage of this technique over others that had previously been used (such as petrological thin-sectioning: Jones *et al.* 1977; Smith 1963; 1965; 1972; Sheridan 2003; Woolley *et al.* 1979) is that it allows direct comparison with a reference collection of over 2000 specimens gathered from the source areas themselves, making it theoretically possible to pinpoint an axehead's geological origin. The results of our analyses of an initial batch of 20 axeheads from Britain (mostly from the collections of the National Museums Scotland) and from the Isle of Man have confirmed that all are of Alpine rock, with 13 likely to have come from Mont Viso (table 22.1) and 6 from Mont Beigua (and more specifically the high valley of the Erro; table 22.2). A further specimen, from Berwickshire (reference No. SCTL_050,_051) could have come from either of these massifs, although to the naked eye the material most closely resembles the omphacitite of Mont Viso.

These results reveal that the southern-type axeheads are mostly of eclogite, omphacitite or jadeitite from Bulé, at the southeast foot of Mont Viso, while the northern-type axeheads are mostly of the light green jadeitite from Porco in the Mont Viso massif or from Mont Beigua. The two principal strands of axehead production overlapped in time but were undertaken by different communities. Southern-type axeheads were made at Bulé by groups from Italy, for distribution southwards to Italy and the south of France; while northern-type axeheads were produced between Mont Viso and the Val de Susa, with the products travelling towards the French side of the Alps. It was in Great Britain and Ireland that the products of these two forms of technical and cultural expression were finally brought together: the crossing of the sea may have involved a 'sea change' in the interpretation of these sacred objects.

axehead findspot	spectra nos. (all prefixed by SCTL)
'Scotland' (I?)	_000,_001
Glenluce/Glenjorrie	_004,_005
Dunfermline	_012,_013
Fortingall	_014,_015
Cunzierton/Oxnam I	_016,_017
Glencrutchery	_022,_023
Breamore	_024,_025
near Douglas Castle	_032,_033
Caithness	_034,_035
Greenlaw	_038,_039
Rattray	_040,_041
Stirling	_044,_045
River Spean near Fort William	_111,_112

Table 22.1 List of analysed axeheads probably from Mont Viso.

axehead findspot	spectra nos. (all prefixed by SCTL)
Lochearnhead	_002,_003
Cunzierton/ Oxnam II	_006,_007
Monzievaird	_010,_011
Llangua	_020,_021
'Scotland' (II?)	_026,_027
Cornwall	_047,_049

Table 22.2 List of analysed axeheads probably from Mont Beigua.

22.3.4 Chrono-typology and routes from mainland Europe

Taking a chrono-cartographic approach, we can examine the British, Manx and Irish axeheads against the evidence from the Continental coastal zone between Brittany and Frisia, including the Channel Islands (of which Jersey was still attached to the Continent at the beginning of the fifth millennium BC: Renouf/Urry 1986). We shall follow the chronological order set out in figure 22.3.

As noted above, the oldest type of axehead, Bégude, is absent. However, there are two examples of Bernon type, which may represent Bégude axeheads that have been thinned and repolished. One is from the southern coast of England at Breamore (Hampshire); the other is from north-central England at Coddington (Nottinghamshire). Neither would be out of place in the giant Morbihan tumuli at *c.* 4500 BC. It could be argued that these are isolated pieces and thus of limited significance; but equally, the thinning and repolishing are well-known practices of the Carnac area in the Gulf of Morbihan (Pétrequin *et al.* 1998), and the presence of these Breton-style axeheads in England requires an explanation. A third, fragmentary axehead has recently been recognized as a Breton type, most probably of Tumiac type: this is the butt fragment, with abortive perforation, found at Sidmouth/High Peak (Devon), on the southwestern coast of England. Whether it was associated with the use of the High Peak Neolithic enclosure is unclear. With two out of the three Breton-style axeheads being found on the southern English coast, might this indicate direct contact from Brittany?

The absence of other Breton types of Alpine axehead (Saint-Michel and Pauilhac), and of VSG-culture stone rings from Insular contexts, suggests that the date of any such contact, and thus of the introduction of the earliest types of Alpine axehead from across the sea, cannot have been earlier than 4300-4200 BC.

The northern-style, Altenstadt/Greenlaw axeheads are, as noted above, very well represented (fig. 22.6). On the Continent, the earliest examples of these axeheads (at Locmariaquer/Mané er Hroëck: fig. 22.3) date to around the middle of the fifth millennium BC. In Britain, as noted

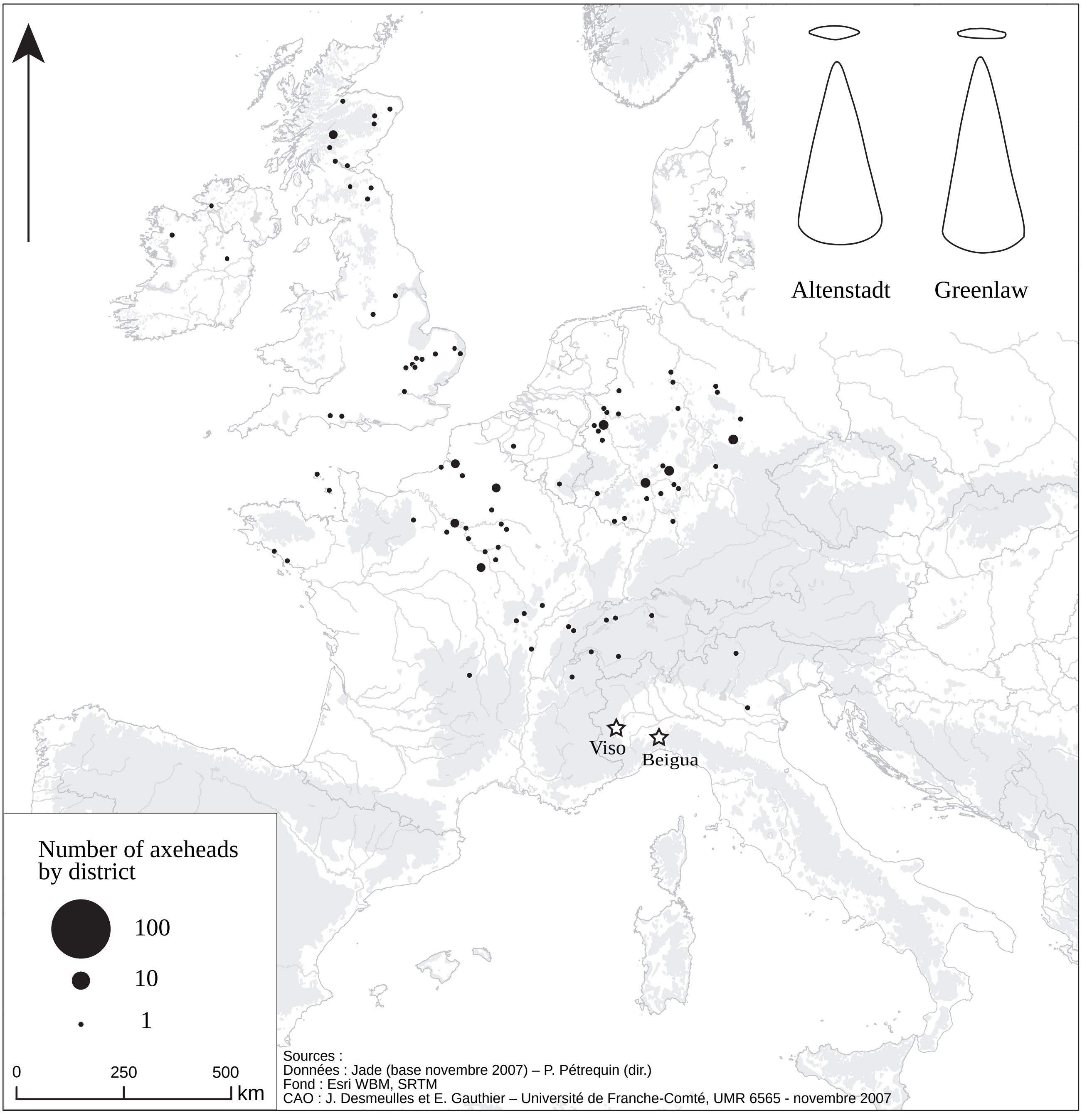

Figure 22.6 Distribution of northern axehead types. The Altenstadt and Greenlaw types are virtually confined to the northeast of a line running between Geneva and Caen. Note their quasi-absence from Italy, even though the jadeitites and eclogites from which they are made came from Mont Viso and Monte Beigua in Italy. The oldest Altenstadt axehead comes from the Gulf of Morbihan and dates to the mid-fifth millennium. In France, these northern types were replaced by Puy-type axeheads which arrived from the southeast from the 42nd century BC. Drawing: J. Desmeulles/E. Gauthier/P. Pétrequin.

by Murray (1994), two concentrations have been found, one in the north, the other in the south. No obvious explanation for the gap between these two concentrations suggests itself. Judging from the overall Continental distribution of Altenstadt/Greenlaw axeheads alone, the most likely area from which they were taken to Britain is the coast between Normandy and the Somme estuary. Two possible routeways suggest themselves from the distributional evidence: the Channel Islands and the Pas-de-Calais. It is unlikely that the axeheads arrived via the German route, because there are no examples close to the Rhine estuary region and because they were a late arrival along this overall route, appearing only shortly before the Puy type. In the centre of the Paris Basin and in Brittany, Altenstadt/Greenlaw axeheads are only once (at Le Pecq, Yvelines) associated with those of Puy type, which appeared in the Saône valley during the course of the 41st century.

While more than one possible route could theoretically have been taken by the Altenstadt/Greenlaw axeheads on their way to Britain and Ireland, the situation is less complicated when it comes to the teardrop-shaped Durrington type of Alpine axehead, one of the 'southern' types (fig. 22.7). Produced in the Italian Alps, where many roughouts have been found (especially at Mont Viso), Durrington-type axeheads followed different routes on their journey west- and northwestwards: via Languedoc and Velay, to the Vendée and Breton coasts; via the Saône valley to the Paris Basin and Normandy; and finally via the Moselle valley to Germany and Denmark. In Britain, the association between a Durrington axehead and an Altenstadt axehead at Glenluce/Glenjorrie Farm in southwest Scotland indicates that both types were circulating together there. For an area on the Continent from which both types could have been brought *together* to Britain and Ireland, the route Alps-Val de Suse-Saône valley-Paris Basin-Normandy offers the greatest chance of convergence before crossing the sea. This is in contrast to Germany, where the distribution of Durrington axeheads seems to 'avoid' the area with the highest concentration of Altenstadt/Greenlaw, as if in that part of Europe the circulation patterns for these two types were mutually exclusive.

22.3.5 The declining circulation of Alpine axeheads

The Puy type is the latest to cross the sea to Britain and Ireland, being represented by just three examples over 14 cm in length (fig. 22.8). The paucity of Puy specimens contrasts with the situation on the Continent, where they are well represented from Catalonia to Brittany to Denmark. The paucity of Insular specimens may signal a reduction in, or temporary cessation of, links with the Continent early in the fourth millennium cal BC.

Alternatively, it may be that, after 4000 BC, other kinds of special axehead were taking the place of Alpine examples, and perhaps even devaluing them. We do not know when the long, all-over-polished flint axeheads, with a surface finish comparable to that seen on the finest Alpine examples, started to be used in Britain (Pailler in press; Saville 1999; Sheridan 1992); nevertheless it is clear that, from as early as the beginning of the fourth millennium, flint was being mined, and stone was being extracted from several locations including Great Langdale in Cumbria and Tievebulliagh in Northern Ireland (as part of the 'Carinated Bowl Neolithic': Sheridan 2007).

On the Continent, there seems to have been a progressive replacement of Alpine axeheads with the production of other special artifacts, although this did not happen simultaneously across Europe. In the Netherlands, the special treatment accorded to large imported Danish flint axeheads (as described by Wentink, 2006) is probably the successor to the earlier ritual use of Alpine axeheads. Another example may be the cores and blades of heat-treated flint that are typical of Chasséen production in the Vaucluse, and which were travelling as far as Catalonia at the beginning of the fourth millennium (Léa 2005). Furthermore, there was increasing use of mined flint and quarried stone for axehead production in several areas: mined flint in Normandy and the Paris Basin; pelite-quartz and nodular schist in the Vosges; metadolerite at Plussulien (Côtes-du-Nord); cinerite at Réquista (Aveyron), *et cetera*.

All of this heralded the end of the exploitation of Alpine sources. The extraction sites at Mont Viso were now only being used to supply the needs of 'local' communities up to 200 km away as the crow flies, in the Savoie region of France, in western Switzerland and in the French Jura. During the Middle Neolithic II period at Clairvaux-les-lacs (Jura), Puy axeheads had ceased to be used by the end of the 39th century BC, even though at Concise (Vaud, Switzerland), they continued to be used, as workaday axeheads (and as just one type of axehead among many locally-manufactured specimens), during the 37th century and down to the dawn of the 36th century BC.

22.4 Discussion: proximal origins and chronology

By applying a purely typological approach to the study of large Alpine axeheads in Great Britain, the Isle of Man and Ireland, and comparing them with identical specimens found on the Continent, especially in Brittany and the Netherlands, we can recognize two possible proximal geographical origins for these sacred objects, and we can also establish some *termini post quos* and *ante quos* for the dates when the axeheads could have crossed the sea. Precisely when, and under what circumstances, they were imported remains debatable; indeed, the authors are actively engaged in such a debate and many questions still need to be resolved.

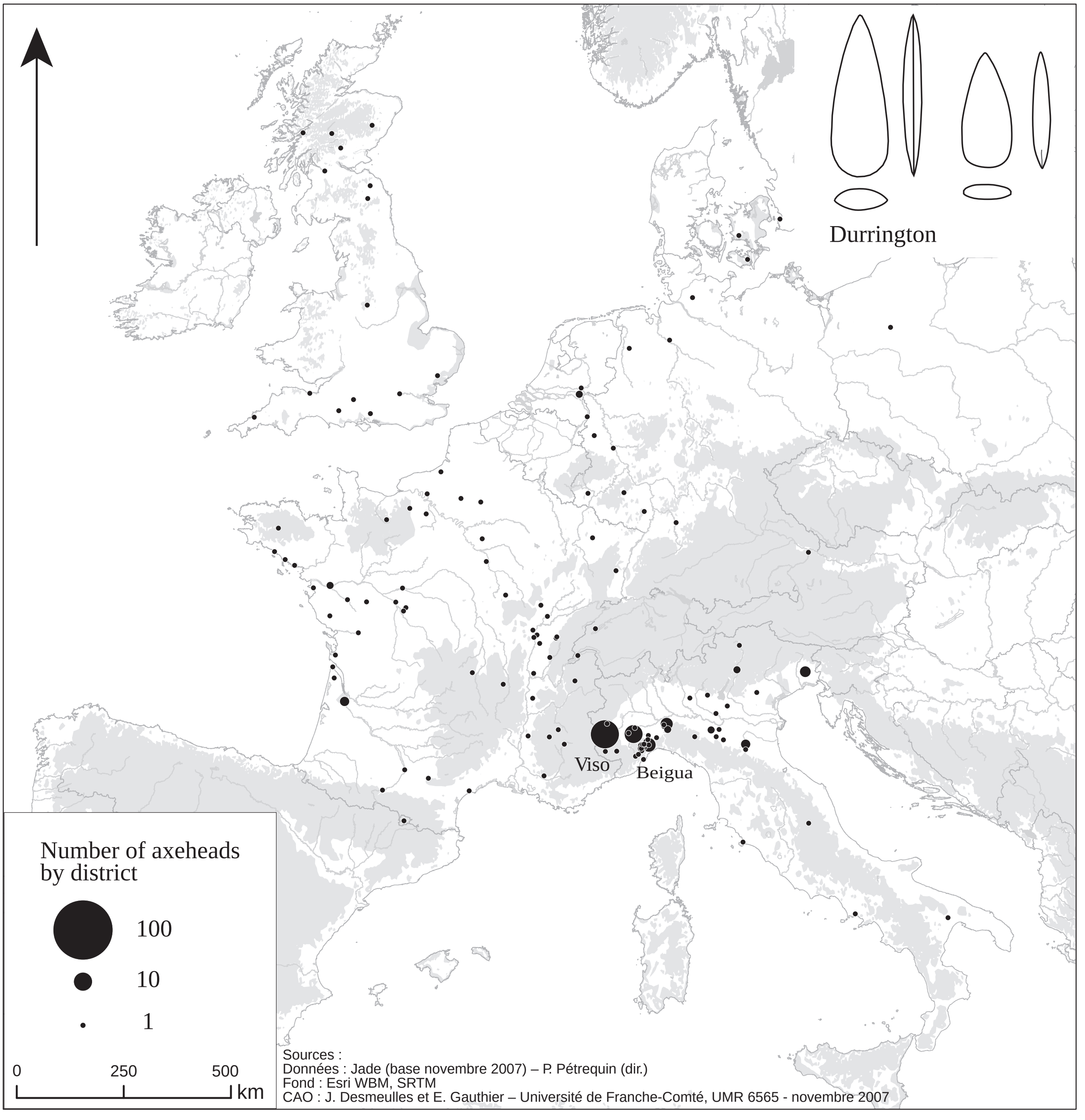

Figure 22.7 Distribution of Durrington type axeheads. This axehead type marks the broadest geographical distribution of Alpine axeheads in Europe, with examples found as far away from the source as Scotland and Denmark. Its chronological position within the quarries of Mont Viso is clearly anterior to that of Puy type axeheads. There are several cases where Durrington type axeheads have been found associated with northern axehead types (Altenstadt, Chenoise). This allows us to propose, for the axis Alps–Morbihan, a probable date range for their use within the second half of the fifth millennium. Drawing: J. Desmeulles/E. Gauthier/P. Pétrequin.

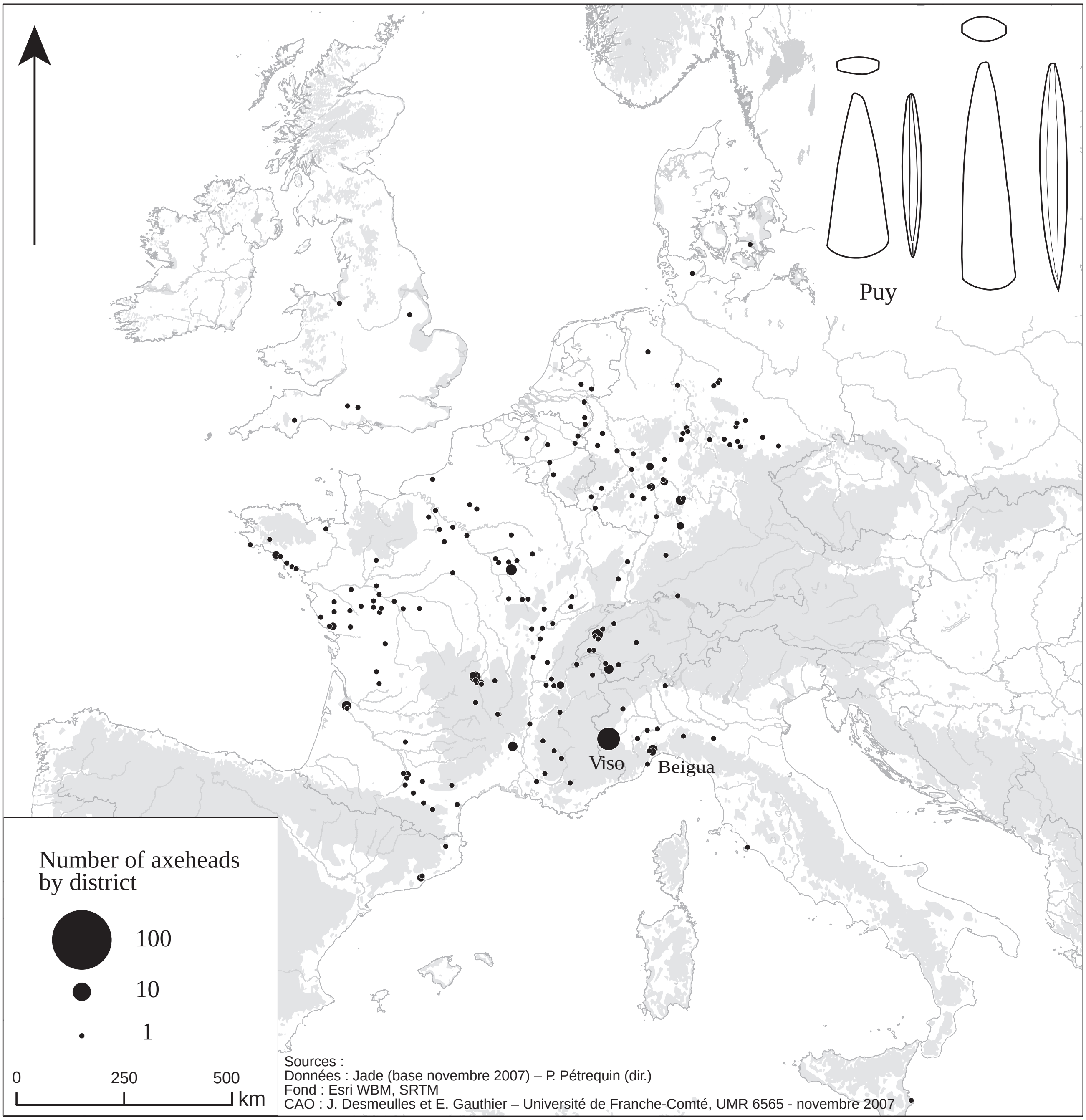

Figure 22.8 Distribution of Puy type axeheads. (Note: two British examples 13 cm long are included.) These are the latest type of axehead to have been made in the Alps. Their diffusion began around the 42nd century, in the Chassey Culture in Provence, and ended around 3650 BC in the Cortaillod Culture in western Switzerland. Note their marked rarity in Britain (and absence from the Isle of Man and Ireland) comparative to the relative abundance of the older types (Altenstadt and Durrington). This could indicate, for these insular milieux, an early interruption in the arrival of Alpine axeheads. Drawing: J. Desmeulles/E. Gauthier/P. Pétrequin.

22.4.1 Southern Brittany

The first area of proximal origin to consider, suggested by the two Bernon-type axeheads and by the fragment of a Tumiac-type axehead, is the Gulf of Morbihan. We know that there must have been some northward movement of people from this region between 4400/4300 and 4000 BC, because Breton-style funerary monuments have been found scattered along the Atlantic façade of Britain and Ireland, and distinctive Late Castellic pottery has been found at one such monument at Achnacreebeag, on the west coast of Scotland (Sheridan 1986; 2003; 2004; 2005). The time frame for this movement fits with the *terminus post quem* of 4300-4200 BC proposed above for the importation of the Breton-style Alpine axeheads into England.

However, the findspots of these axeheads are not at all close to the Breton-style tombs and pottery, and other possible routes need to be considered. It is known that Carnacéen Alpine axeheads – that is, axeheads originally made in the Alps but thinned-down, re-shaped and re-polished in the Carnac region – travelled outwards from the Morbihan: southwards across the Bay of Biscay to Galicia (Cassen/Vaquero 2000), and eastwards, in a 'reflux' movement, to the Paris Basin and Burgundy, on their way to the upper Rhine valley and to western Switzerland. The latter was probably part of a broader movement, over which the *idea* of carving stele and engraving motifs of Morbihannis type travelled as far as Morvan (Lagrost/Buvot 1998). The dates obtained for the menhirs of Saint-Aubin/Derrière-la-Croix (northeast Switzerland), of between 4300 and 4000 BC, show how early this expansion of Carnacéen rituals took place (Wüthrich 2003). It is not known whether the Breton-style axeheads found their way to England from this 'Paris Basin' axis.

A further alternative, albeit requiring that the axeheads were at least a century old when they crossed the Channel, is that they came over as part of a movement from Normandy to southwest England during the 39th or 38th century BC: the evidence for such a movement consists of drystone closed chambers and simple passage tombs, including one recently dated to the 39th century at Broadsands in Devon, not far from High Peak, and containing pottery comparable to Norman Middle Neolithic II pottery (Sheridan 2004; 2005; 2007). Yet another possibility – and one not favoured by the principal author, because there are so few of the late Puy-type axeheads in Great Britain – is that they were imported yet later, during subsequent contacts between Normandy and south-west England during the 38th or 37th century BC (Sheridan 2004; 2005). It must be admitted, however, that none of these explanations accounts for the Bernon-type axehead found at Coddington, in the northern English midlands.

22.4.1 Northern France

A second, and much more obvious proximal origin for Alpine axeheads, is northern France, and in particular the Bay of the Somme. It is from here that the axeheads of Altenstadt/Greenlaw and Durrington type could have arrived in Britain and Ireland, as the distribution maps clearly suggest (figs 22.6 and 22.7). These types constitute some 68% of all the large Insular Alpine axeheads, and if one adds Puymirol-type specimens (whose period of production overlapped with that of Durrington-type axeheads), this figure rises to 80%. Associations between Altenstadt/Greenlaw (*i.e.* northern types) and Durrington and Puymirol axeheads (southern types) are very rare on the Continent, with just three examples known from 34 recorded hoards. By contrast, in Britain the only two hoards (Oxnam/Cunzierton and Glenluce/Glenjorrie) both contain a combination of northern and southern types. As mentioned above, this phenomenon might correspond to a reinterpretation of these sacred objects once they had crossed the Channel.

When did these axeheads – Altenstadt, Durrington, Puy – circulate as far as Britain, the Isle of Man and Ireland? It is easier to propose *termini post* and *ante quos* rather than suggest more precise dates (although some of the authors are tempted to be more specific, in the light of what we already know about the neolithisation of these islands). The *termini post quos* are provided by the Breton evidence (fig. 22.3). The mid-fifth millennium closed assemblages from the giant tumuli of the Gulf of Morbihan provide a *terminus post quem* for the Altenstadt/Greenlaw types; we may note that these types continued in use through the rest of that millennium, as shown by their presence in the hoard from Ploemeur/Kerham in the Morbihan, which also includes a Puy-type, the latest Alpine axehead type in Europe. Teardrop-shaped Durrington axeheads probably appeared a little later than the mid-fifth millennium, since they are never represented in the giant tumuli of the Morbihan; for their arrival across the sea, a probable *terminus post quem* of 4300-4200 BC can be suggested.

The earliest example of an association between Durrington, Altenstadt/Greenlaw, Tumiac and Puy-type axeheads in Brittany is the hoard from Kerham (Ploemeur, Finistère). Discovered in 1861, it contained 11 axeheads, but only four of the Alpine examples are still available for study (Le Rouzic 1927; Harmois 1928). This hoard is vital for establishing the period of the appearance of Alpine axeheads in Britain, the Isle of Man and Ireland. Puy-type axeheads appeared in the Alps with the Chasséen culture, at Grotte de l'Eglise, Baudinard (Var) (Courtin 1974), probably around 4200 BC. By around 4100 BC, the form of the axeheads produced at the quarries of Plancher-les-Mines (Haute-Saône) was clearly being influenced by the Puy form (Pétrequin/Jeunesse 1995). Judging from the rate of this progression, one could estimate that the Puy type would not have reached the Atlantic fringe of Europe before the end of the fifth millennium. However, until well-dated assemblages have been discovered, this remains only a suggestion.

Flint axeheads have been found in association with Puy-type axeheads in two hoards: at Plomeur/Kerdrafic (Finistère) and Dave/Rocher de Neviau (Belgium). The currency of Puy axeheads would thus seem to correlate (at least partly) with the period when flint mines for axehead production were being opened in the Paris Basin, Normandy and Belgium. At Spiennes (Belgium), the earliest date for a shaft (no. 79.3) associated with an early Michelsberg settlement is 5510 ± 55 BP (Lv 1566, 4459-4228 cal BC at 2σ, calibrated using OxCal v.4.0) (Collet *et al.* 1997). From Jablines/Le Haut Château (Seine-et-Marne) comes the slightly later date of 5220 ± 80 BP (Gd 4663, 4259-3914 cal BC at 2σ) (Bostyn/Lanchon 1992). On this evidence, the potential date for the association between a Puy-type axehead and a flint axehead is later than 4300-4200 BC. An association, in northwest and northern France, with the Michelsberg and Chassey cultures is thus plausible, even though this has not yet been demonstrated through the association of a Puy axehead and pottery of these types.

22.5 Conclusion

In seeking a proximate origin for the Alpine axeheads that crossed the sea to Britain, the Isle of Man and Ireland, the most likely area for the majority of them – if we set to one side the three examples of early, Breton-type axeheads (Bernon and Tumiac) found in Britain, which may well have arrived due to contacts with Armorica/Normandy – is the coast between Normandy and Pas-de-Calais. Alpine axeheads may have started to circulate in this area from the middle of the fifth millennium cal BC, and the contacts that brought them from the Alps to this part of France seem to have intensified from 4300-4200 BC. Indirect evidence, relating to the spread of Puy-type axeheads from the Alps to Burgundy, allows us to suggest that the transfer of Alpine axeheads across the sea was interrupted shortly after the Puy specimens reached the French coasts, at the end of the fifth or very beginning of the fourth millennium cal BC. Thus the most likely period within which the axeheads crossed the sea is between 4300/4200 and 4000/3900 BC.

In the opinion of one of us (Sheridan), this corresponds perfectly with the evidence relating to the neolithisation of Britain, the Isle of Man and Ireland, where the rapid appearance of the 'Carinated Bowl' strand of the Neolithic over a large part of these islands around 4000 BC seems to have represented a short-lived episode of contact with the Continent (Sheridan 2007). The most likely source for this 'Carinated Bowl Neolithic' is Nord-Pas de Calais (possibly extending into Picardie), although a precise area of origin has been hard to prove, not least because this part of France is one of the most poorly-documented regions for the period around 4000 BC.

Evidence that Alpine axeheads had indeed crossed the sea by the early fourth millennium is provided by two finds in particular. The dendrochronological date bracket of 3807/3806 BC to 3791 BC for the construction and use of the Sweet Track (Coles/Coles 1996, 28) provides us with a firm date for the deposition of one Alpine axehead in Britain. It has been argued elsewhere (Sheridan 2007; Sheridan *et al*. 2007) that the deliberately burnt, deliberately-broken fragment of another Alpine axehead, found in the megalithic funerary monument at Kirkmabreck/Cairnholy I (southwest Scotland), was probably deposited there around the same time. By this time, in France and Belgium, the use of Alpine axeheads had already ceased, although Alpine axeheads were still circulating elsewhere in northern Europe (Klassen/Pétrequin 2005). This apparent conservatism in use (from an Italian and French perspective) and reinterpretation of these sacred objects in their new, Insular context is a question that demands further study.

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Notes

1. The term 'jadeitite' is used here in preference to the more commonly-used term 'jadeite', as it more accurately describes the rock in question. Regarding citation of axehead findspot place names, the convention used here – as in *Projet JADE* – is as follows: 'commune (or equivalent)/local place name', followed (where appropriate) by country (or equivalent) and/or regional name.

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23 A note on prehistoric routes on the Veluwe and near Uelzen

Jan Albert Bakker

23.1 Introduction

In 1964 I visited the excavation of a settlement of the Funnel Beaker or TRB culture at Beekhuizerzand bij Harderwijk (Modderman *et al.* 1976), which was undertaken by Jan Verwers, Professor Modderman, and students of the Leiden Instituut voor Prehistorie. I remember the sand storms, the finds and the friendly reception. Besides there was an alert student in a khaki overall, who inquisitively joined in the conversation. That was Leendert Louwe Kooijmans.

Since then Leendert has hardly at all occupied himself with the TRB culture, but I will not leave unnoticed his two important observations concerning the TRB culture: he completed the unique footed bowl (*depas amphykupellon*) from hunebed D19-Drouwen, excavated in 1912 and often illustrated in incomplete form, with two handles and turned it upside down (Bakker 1979, 59, fig. 26a), and he found a collared flask and *Tiefstich*-decorated TRB sherds in the Vlaardingen layers around the Hazendonk, of which he illustrated the sherds upside-down (Louwe Kooijmans 1976, fig. 23; Bakker 1979, 165, n. 3:10).

I would have liked to continue here with a study on recent developments in TRB West Group research, but because this became too unmanageable I present here instead a note on rows of prehistoric barrows and megaliths to my esteemed colleague and dear friend. These rows were placed along important on-going routes, like Roman sepulchral monuments along the Via Appia, to display to as many people as possible that locally important personalities were buried and venerated there, and to show the traveller that he entered the territory of active residents who were proud of their ancestors and country. They allow us to reconstruct such ancient routes. The first research of ancient routes happened around 1900 (Krause/Schoetensack 1893; Müller 1903; 1904; Belloc 1904), and further detail is given in my synoptic articles on the subject (Bakker 1976; 1991; 2004; cf. Jager 1985; 1993). Beside rows of funeral monuments and later on other features, that were directly connected to roads, the lie of the land is an important indicator: routes took their course from pass to pass through boggy or otherwise 'traffic-unfriendly' areas and avoided slopes and difficult terrain wherever possible. Routes in northwest Jutland, for instance, preferred courses along the border line of sandy and loamy soils, passable in winter as well as in summer, that also avoided steep slopes (Mathiassen 1948). Cart traffic in sandy areas tended to take parallel courses between the passes, however, when the tracks had become too loose. Although four and two-wheeled wagons were in use since 3400 cal BC (Anthony 2007; Burmeister 2002; Bakker *et al.* 1999), the massive destruction of the sandy road surfaces and the ensuing large expansion of drift-sands on the Veluwe and in the northern Netherlands and north-western Germany started in the Bronze Age (Van Gijn/Waterbolk 1984).[1] Good routes usually lasted for ages. Several even derive from the paths of Mesolithic hunters and remained in use until the present day. Alignments of TRB tombs (3400-2800 cal BC) were later often reinforced by earthen barrows (2800-700 cal BC).

Because modern and sub-recent roads often still coincide with prehistoric routes, 16th to19th-century maps are indispensable for the study of the latter (see the excellent introduction to the use of old regional maps of the Netherlands by Horsten 2005).

23.2 Routes on the north-eastern Veluwe

The Veluwe is an area of sandy hills in the centre of the Netherlands between Amersfoort and Apeldoorn. Most of it is 'traffic-friendly' because wetlands and other barriers are rare. Large patches of drift sand developed in essence after the Neolithic. Megalithic TRB tombs (hunebeds) are unknown here, but earthen barrows from 2800 cal BC onwards abound. A 6 km long alignment of barrows occurs between Niersen in the SW and Epe to the NE. A detailed map, based on P.J.R. Modderman's fieldwork in 1948 and to a lesser degree that of J. Butter and others, was published by me (1976) and by Louwe Kooijmans (Bloemers *et al.* 1981, 51, much reduced). Later work by Klok (1978-9; 1982; 1988) showed, however, that 26 barrows should be added to the picture, which is here given in its updated form (fig. 23.1).

These barrows were doubtlessly placed along a path or un-metalled road, which has now disappeared for the greater part. Only in the NE a road still follows the barrow line; it continues to the village of Epe and, almost exactly in the same direction but without accompaniment of barrows, to the village of Heerde in the NE. The middle and south-western parts of the barrow line lay in a treeless heath until it was afforested in the 1910s. This changed the road system completely, but no sandy tracks along the barrow line are shown by earlier topographic maps either.

Two or three side tracks branched off. One 2.5 km long barrow alignment runs E-W and coincides with the present Lange Weg, an ancient sandy road still in use. Another, 2 km long alignment runs N-S through the large Celtic Field of Vaassen (Brongers 1974). Another barrow-aligned track did perhaps branch off in WSW direction, to the left margin of the drawing. The earliest known date of one or more of these barrows reaches back to 2500 cal BC (AOO Beaker graves), but several were still used for interment during the Bronze Age or Early Iron Age, up to 700 cal BC or perhaps even the Roman period. The Celtic Field of Vaassen (Brongers 1974) and the four other, smaller, Celtic Fields may be dated from the Early Iron Age to the Roman Period (Harsema 2005, 543). These consisted of square arable plots (*c.* 30 × 30 m wide) separated by low earthen banks. They are here also clearly connected to the barrow routes, but because no road track was left open in the Vaassen Celtic Field, it may ultimately have blocked the N-S route. Possibly this occurred also with the other Celtic Fields on the map. Very little is known about the settlements of the barrow makers – unfortunately no systematic investigation of these has been performed.

The long SW-NE 'barrow' route follows the main eastern slope of the Veluwe hill ridge tangentially (fig. 23.1). It crosses five steep-sided dry periglacial valleys, while avoiding their bifurcations (geomorphological map by G.C. Maarleveld in Brongers 1974). It crosses one of these at co-ordinates 193.5/481.7 (fig. 23.1) near the hamlet of Schaveren ('sheep-ford'?). The E-W barrow line and Lange Weg are situated on a low spur, and they keep clear of a W-E dry valley directly to the south.

Probable continuations of the barrow routes of figure 23.1 have not yet been traced in detail. The SW-NE route may have connected the dry southern flanks of the lakes Uddeler Meer and Bleke Meer, and the stream Leuvenumse Beek, to the north-eastern flanks of the Veluwe hills at Heerde-Hattem, and possible crossings of the river IJssel/Isel. Several other barrow alingments on the Veluwe (maps in Klok 1978-9; 1982; 1988; Fokkens 2005, fig. 16.7) give an impression of the original road pattern (Lange 1996).

P. Garwood studied the barrows of the north-eastern Veluwe with the help of R.H.J. Klok and myself in 1988/9. Unfortunately he did not publish his findings, but stressed the enormous raw scientific potential of Veluwe barrows in conversation. He did not think in terms of road networks, but compared these aligned barrow 'cemeteries' to those in Wiltshire, England, which, admittedly, seem not to indicate on-going routes, and seem to lead from nowhere to nowhere. Garwood found that the long NE-SW barrow alignment of figure 23.1 pointed exactly to the Midwinter sunset and the Midsummer sunrise (or to the southernmost moonset and the northernmost moonrise).[2] I am not yet convinced that this barrow-aligned route was a purely sacral one, without practical use for traffic. And what about the other barrow alignments of figure 23.1, those elsewhere on the Veluwe and in the other sandy regions of the northern Netherlands and Germany?

23.3 Hunebed alignments in Landkreis Uelzen

P.B. Richter documented the localities of the TRB culture in the *Landkreis* Uelzen, a roughly circular region with a diameter of 42 km, halfway between Hannover and Hamburg in Germany (Richter 2002, figs 55, 88).[3] She analysed the distribution patterns of tombs and settlements in all possible detail. No less than 287 former or extant megalithic tombs were inventorised in *Landkreis* Uelzen on basis of the work of Von Estorff (1846) and other 19th-century sources (fig. 23.2). I call them briefly 'hunebeds' here. Their original number she estimated at about 350. East of the river Ilmenau the hunebed distribution seems fairly representative, in contrast to the area west of it, where hunebed destruction and stone trade may have started before the tombs were documented.[4] Only 22 settlement sites and one flat grave are known. Like those from Mesolithic to Early Bronze Age, the settlements are usually situated along the river valleys (Richter 2002, figs 50-51, 55). Figure 23.2 shows the contrasting distribution of both categories. Several alignments of hunebeds are visible, the majority of which coincide with still-existing roads along them. The most conspicuous is a 9 km long S-N alignment from Uelzen to Haassel, which prefers high terraces and watersheds and avoids rivers. Its northern part is 1.5-2.15 km removed from the river Ilmenau and its settlements to the west. To the east it keeps a distance of 0.5 to 1 km from the Röbelbach stream, but no TRB settlements are known yet from that valley. More routes on watersheds are also present, but other, generally E-W, hunebed alignments follow the river valleys at some distance (*e.g.* along the river Wipperau). Wet soils were avoided, but as with barrows on the Veluwe and hunebeds in Drenthe (Bakker 1980; 1982; Bakker/Groenman-van Waateringe 1988), there is no further relation to specific soil types (Richter 2002, 194 *vs.* Schirnig 1979). There is also no relation to relative or absolute altitudes and although the tombs were usually situated on slopes and elevations for local visibility, there was no dominant preference for summits and spurs.

Apart from the alignments, Richter discerns two other typical hunebed distributions. Several apparently unstructured concentrations are difficult to explain, but perhaps they were connected to crossroads. At first sight and on the small scale of figure 23.2, the hunebeds to the east of Uelzen seem quite randomly distributed, but this is due to the fine dispersion

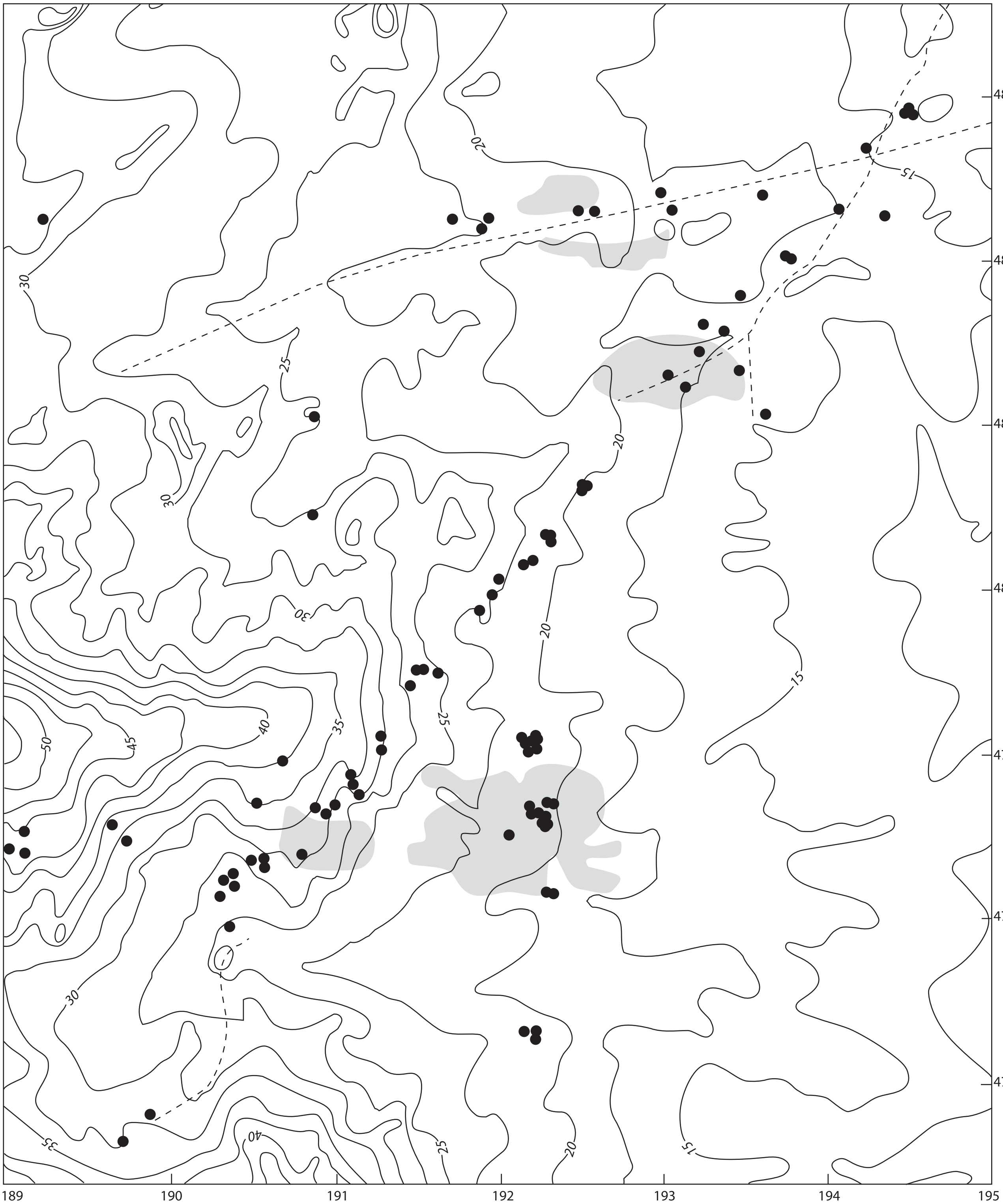

Figure 23.1 Prehistoric roads marked by earthen barrows (dots) between Niersen, Epe and Vaassen in the Veluwe. Celtic Fields are shaded. A few modern roads are indicated by interrupted lines. The numbered grid of 1 km squares and the contour lines are based on Dutch Ordnance Survey maps (update of Bakker 1976, fig. 11).

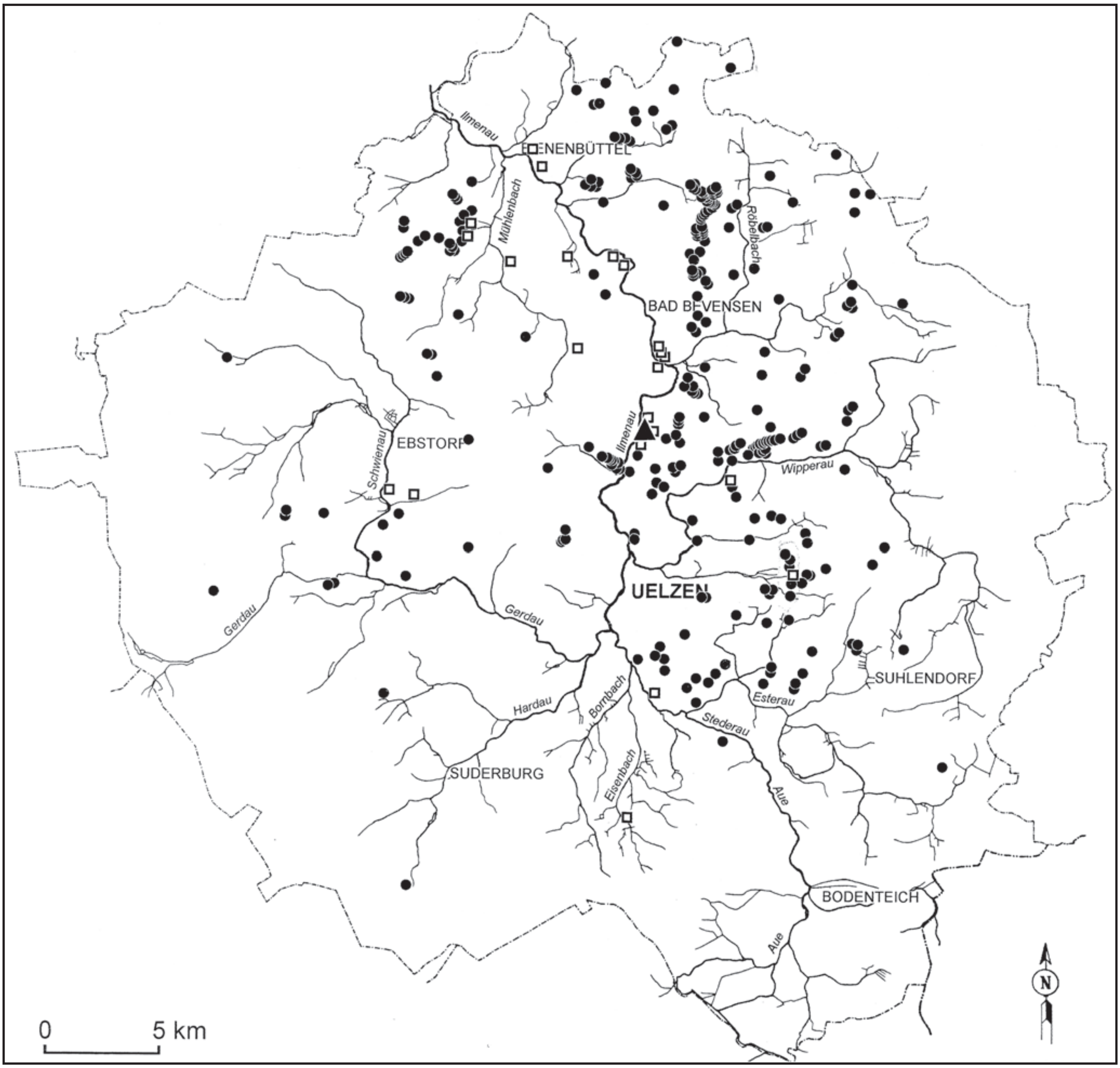

Figure 23.2 Distribution of hunebeds (dots), settlements (squares) and the Walmsdorf banked and ditched enclosure (triangle) in Landkreis Uelzen, Germany (Richter 2002, fig. 88).

of streams and ridges. The only known settlement here, at Rätzlingen, lies at the ford through a rivulet, within an almost 2 km long hunebed aligned N-S route. The only other settlement site, at some distance to the east of the Ilmenau, is at Masendorf on the southern bank of the Wipperau, from which part of the W-E hunebed alignment behind the northern bank could have been clearly visible, according to the author. Two tombs south of the settlement may indicate that it was also situated at a river ford. I note here that the often supposed intervisibility of hunebeds – which is not discussed by Richter – was non-existant, as I noted for the hunebed cluster at Borger in Drenthe (Bakker, in prep.).

A similar absence was found in the Altmark region to the SE of Uelzen (D. Demnick, pers. comm. 2006).

There are no other obvious connections between settlements and hunebeds. This is due to the much too small number of known settlements, and to the small number of hunebeds and settlements that have produced enough typical ceramics to even think of relating them, as Richter concludes. But I wonder, whether a much better knowledge of the pottery would give an answer to such questions. In Drenthe, where many large ceramic hunebed assemblages have been excavated, ideosyncratic traits can be discerned in the pottery decoration (Bakker/Luijten 1990). It appears that products of the same female potter or the same local type ('L1, K3, K1') were dispersed no further than 1-3.5 km, and that a small cluster of hunebeds showed a predilection for such particular decorations. No direct relation between a tomb and a distinct type of pottery was apparent, however. Pots with a directly related type of decoration ('K2') were found up to 24 km apart. Identically decorated pots made in the Kornerup settlement in Denmark travelled 11.5 and 9.5 km to two passage graves (Ebbesen 1975, 129-131, fig. 110) and almost identically decorated pots occurred 6 km apart at Kleinenkneten and Hogenbögen in Oldenburg, Germany (Steffens 1970, 18; Fansa 1982, pls. 3:28, 42:2672). Although decorated sherds were collected from many settlement sites in Drenthe, no systematic study of them has been undertaken. Besides it is questionable if the small size of these sherds would allow for recognising ideosyncraticism in decoration patterns. Although this approach would seem a fruitful subject for further study in Drenthe, it might display rather the pottery exchange between different small communities, than demonstrate one-to-one relationships between hunebeds and contemporary settlements. Were the same pottery exchange to have taken place near Uelzen, and were enough pottery to be found to show ideosyncratic features, even then probably no simple relationships between tombs and settlement sites may be expected to be found. Neither can much be expected from an as yet non-existing great number of radiocarbon dates, because these are not enough precise.

Notes

1 All given dates are approximate, calibrated radiocarbon dates.

2 Pers. comm. P. Garwood 1989. I have forgotten which of both lines was involved about 2500 cal BC. Cf. figs 189-190 in Chippindale (1983).

3 Comparable geographical studies on the TRB Westgroup (3350-2800 cal BC) are almost absent.

4 Stone export to Holland was interdicted by the Hannover government as early as 1728 (Richter 2002, 179), *i.e.* before the teredo catastrophe manifested itself in 1730-33 in the Netherlands. All wooden dike fences in salt water were demolished and the then invented stone covered dikes required huge amounts of erratic stone from wherever possible.

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