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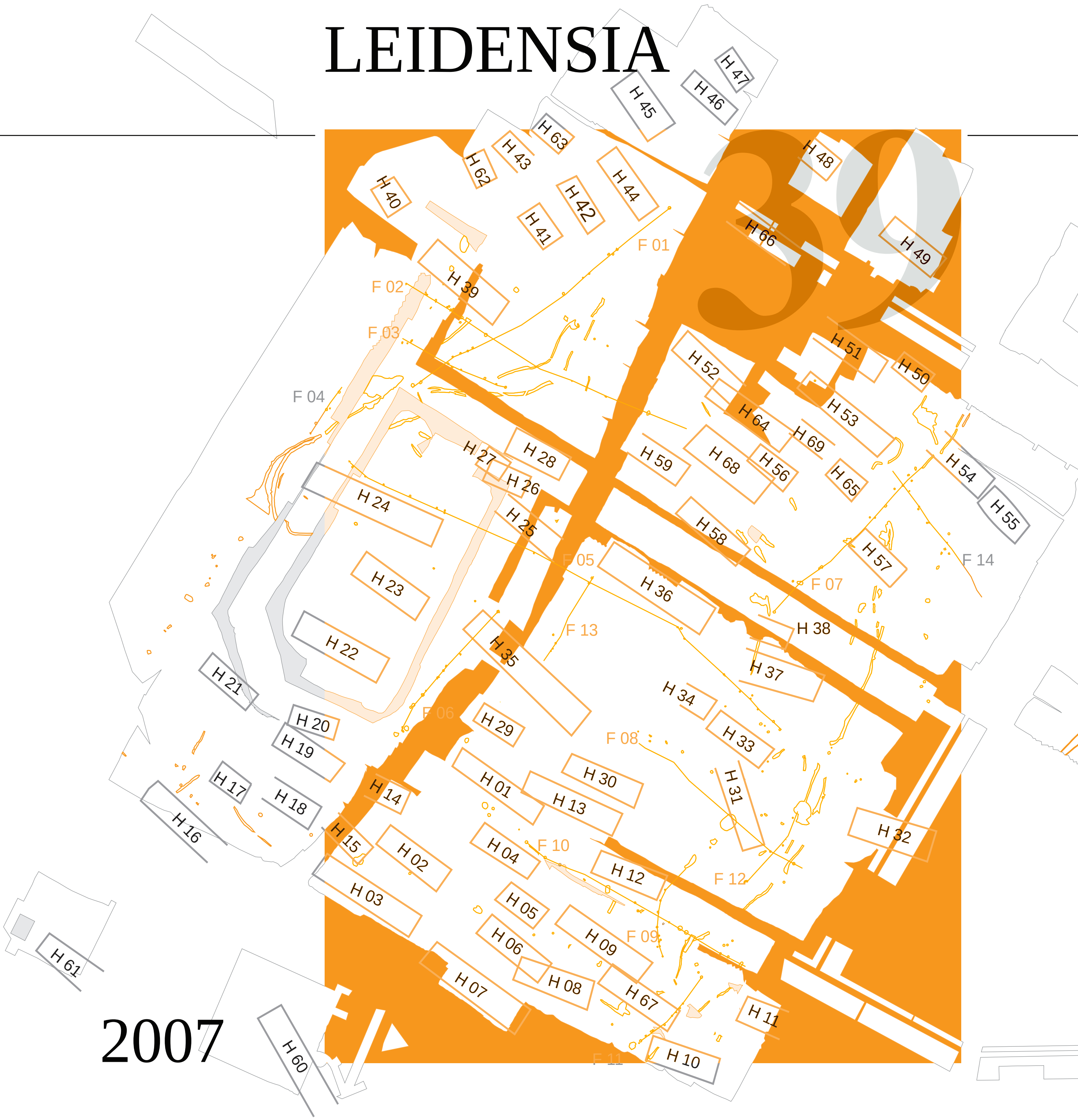

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EXCAVATIONS AT GELEEN-JANSKAMPERVELD 1990/1991

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1 The discovery of the “First Dutch Village”

Hans Kamermans & Pieter van de Velde

In the summer of 1991, the Dutch media featured extensively the excavation of an early Bandkeramik (LBK) village in Geleen, Limburg. The headlines in the newspapers read: “7000 years old farmers village”, “Oldest village of the Netherlands discovered in Geleen”, “Old farm village excavated”, etc. The discovery was mentioned in the news programmes on all Dutch TV channels. The Dutch radio called the site the oldest “Brandkeramische” (instead of “Bandkeramische”; the Dutch word ‘brand’ means ‘fire’…) site of the Netherlands. Not only the Dutch press was interested, even German and Belgian newspapers wrote about “The Earliest Dutch Village”. What was the case? The University of Leiden was excavating an almost complete prehistoric village once inhabited by the very first farmers in this part of Europe. If it was not the first village of the Netherlands, then it was at least one of a series of early villages.

1.1 Discovery

The site is now known as Geleen Janskamperveld (JKV) and was discovered by Harry Vromen from Geleen. Already in 1979 it became clear to Vromen – artist, amateur archaeologist and correspondent to the Monument Service – that an unknown Bandkeramik (‘LBK’, from German ‘Linearbandkeramik’) settlement was hidden in the south-western part of the Janskamperveld. While surveying the agricultural fields he found pottery, flint and sandstone artefacts. In the following years Vromen kept an eye on the area and discovered more evidence.

The site of JKV is one of many LBK sites discovered and excavated on the Graetheide plateau. This plateau was well-suited for the early farmers as it is covered with loess, a fertile and easy to till aeolian sediment. It lies about 20 km north of the present-day city of Maastricht (fig. 1-1 and 1-2). The names of some of the other LBK sites are well known among those who study the European Neolithic: Sittard, Elsloo, Stein and Beek (Modderman 1958, 1970, 1985, 1988). Most of these sites were excavated just after the Second World War as a result of the frantic post-war building activity.

From 1979 to 1989 Vromen collected many LBK finds north of the Geleenbeeklaan. He was able to trace the limits of what he thought was a LBK village of the earliest phase (5300-5100 BC) (fig. 1-3). In 1980 a sewer trench was dug near hotel Riche in the extreme south-western part of the area (fig. 1-4 no. 1), and 60 cm below the surface a dark brown coloured feature became visible. From this trench Vromen rescued flint and pottery. Some of the pottery was decorated so he could date the finds tentatively to Modderman’s phases 1b and 2c (Vromen 1985).

Four years later, the Cokoma building was constructed along the Geleenbeeklaan (fig. 1-4 no. 2). In the building pit Vromen discovered 19 dark coloured features. After consulting the provincial archaeologist Dr Willems and Dr Bakels of the Institute of Prehistory, University of Leiden, a small-scale rescue excavation was carried out. The main goal of this

Fig. 1-1 The Netherlands, with the position of Geleen indicated.

Fig. 1-2 Southern Dutch Limburg, with the position of Geleen-Janskamperveld (shaded: alluvial deposits)

excavation was to date the finds. Enough decorated pottery was collected from the pits to place the site in the older LBK phase lb-c. Three of the features (fig. 1-5, features 18, 19 and 20) constituted a three-post row characteristic of a Bandkeramik house (Bakels 1985). During the same construction works Vromen discovered a Roman burial cremation with five pieces of pottery, an iron knife and some iron nails. The finds date the grave to the 2nd century AD. Later, during surveys of the area, Vromen discovered more Roman graves.

Another three years later, in 1987, Vromen recorded an almost complete LBK house in the pit for the Intercai building (unpublished letter to Stoepker 1989) (fig. 1-4 no. 3). One of the associated features contained a few fragments of Limburg pottery. In the following years more offices were constructed along the Geleenbeeklaan and more traces of the Bandkeramik village were discovered: in 1989 in the construction trench for the office of architect Wauben (fig. 1-4 no. 4) and in 1990 in the enlargement construction trench for the Cokoma building of 1984 (fig. 1-4 no. 2).

1.2 The 1990 excavation

For a long time there was no reason to excavate the site, although since 1980 the expansion of the town of Geleen threatened the area. But all that changed in 1989 when the municipality finally decided to build villas on the farmland. They were planning to do this in two phases. Phase one would 'only' destroy the eastern part of the settlement. But the second phase, which would start in 1991, threatened the complete prehistoric village. Vromen sounded the alarm with a letter to the new provincial archaeologist Henk Stoepker. In 1990 Stoepker conducted a test excavation to establish the scientific potential of Geleen JKV. The Institute of Prehistory of Leiden University used this opportunity to hold its field course for first year archaeology students on the site. Ivar Schute, a graduate student, acted as field supervisor. From the end of May until mid-September 0.2 hectare was excavated and 10 well-preserved LBK house plans, five disturbed Roman graves, and a wealth of pits were discovered (Schute 1991).

Phase one of the municipal building activities had already started and the eastern part of the settlement was almost completely lost to the archaeologists. Amateur archaeologist Harry Vromen who regularly visited the training invited some of the teachers to one of the building plots, where for all to see a Bandkeramik house was being flushed with concrete by the contractor. The only thing Vromen and a group of students could do was to record the features and rescue finds in the sewer trenches in the Hovenweide, the Parcivalstraat and the Halewijnstraat, and in a construction trench in 'plot 20' along the Halewijnstraat (fig. 1-4 no. 5). Among the finds in the Halewijnstraat was a Late Medieval jar. Along a newly built service road parallel to the Geleenbeeklaan Vromen discovered several cremation graves dating from the Iron Age.

1.3 The 1991 excavation

The test excavation revealed that the site was well preserved. It looked extremely promising and in October 1990 Professor Louwe Kooijmans decided to excavate as completely as possible the still available three and a half hectares of the five hectares site. The municipality was not very enthusiastic, and feared a delay in the building activities. They were willing to postpone the work until September 1991 but had only a small budget available for the excavation. It was not easy for Louwe Kooijmans to raise the necessary 400,000 guilders. Leiden University, the Prins Bernhard Cultuurfonds and the Province of Limburg together provided the main part of the money.

Finally, on 2nd April 1991 the excavation did start and for 23 weeks Leendert Louwe Kooijmans, his co-worker Hans Kamermans, a field technician and almost 100 students worked very hard to finish the excavation before September. Ivar Schute again acted as field supervisor. As in the previous year the field training programme for the first year's students of the joint departments of archaeology of Leiden University (led by Pieter van de Velde) was held on the Janskamperveld. During the summer more then 60 LBK house plans, an enclosing ditch system and many other features were excavated. Most of the house plans are from long houses, but all the familiar LBK house types (*Grossbauten, Bauten* and *Kleinbauten*) are represented. The features range from cylindrical silos and pits along

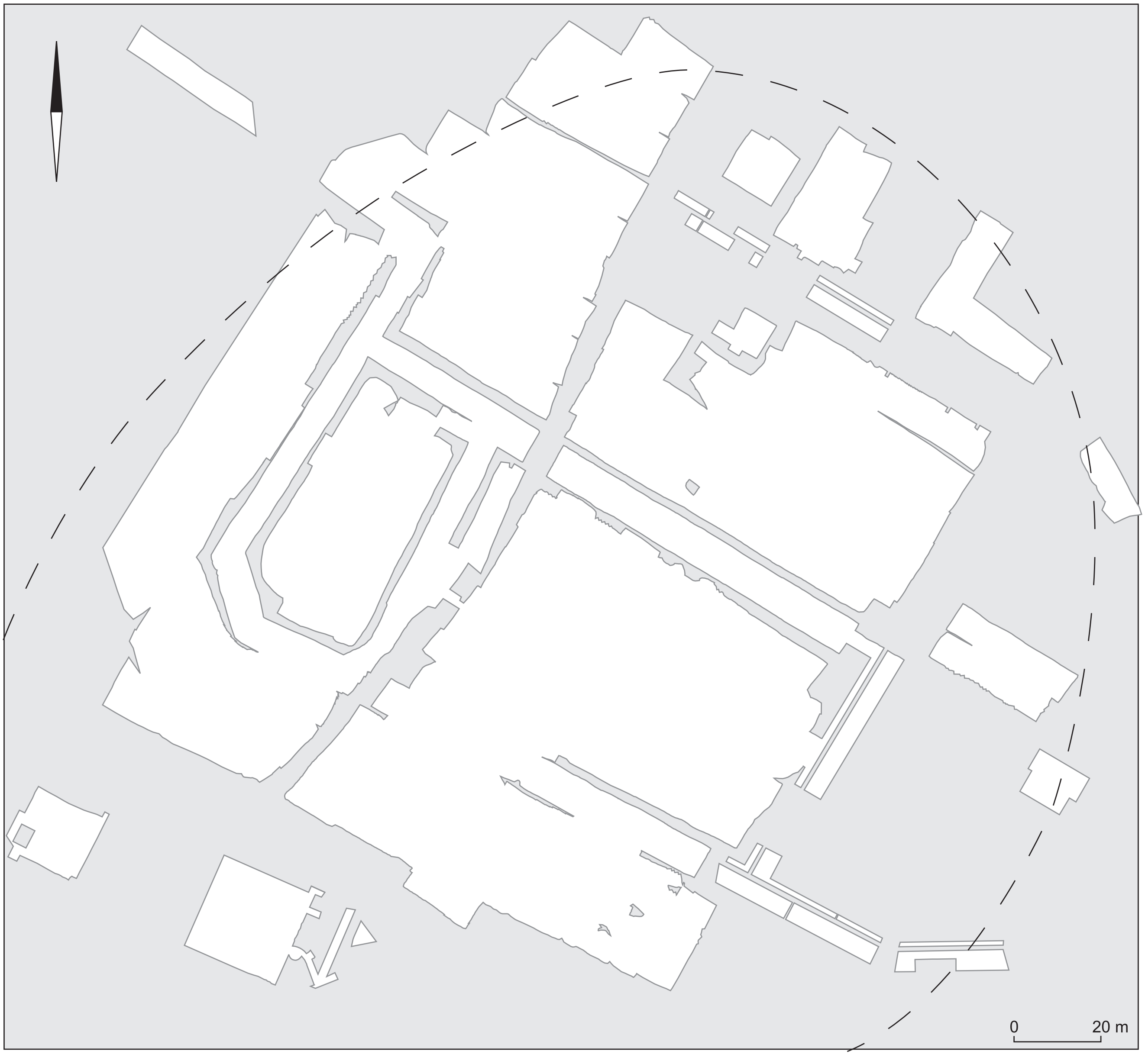

Fig. 1-3 Geleen-Janskamperveld: limits of surface finds and extent of the 1990-1991 excavations

houses to quarry loam, to detached pit complexes. The enclosing ditch system consisted of a multi-phased structure that most probably contained a palisade.

Most of the pottery belongs to the LBK culture and has the characteristic simple line decoration, although there are also some pottery fragments deriving from the contemporaneous Limburg culture. Most of the stone tools are made of eluvial nodules of Rijckholt flint. Remarkable is the scarcity of regular blades. Some fragments of adzes and sandstone hand querns were found. Among the charred botanical remains found during an extensive sampling programme were lentil (*Lens culinaris*), pea (*Pisum sativum*) and poppy seed (*Papaver somniferum*), all three the earliest examples in the Netherlands.

Other finds, dating from later periods, were a house plan of an Iron Age farm and a cemetery dating from the Roman

Fig. 1-4 Archaeological finds on the Janskamperveld from 1979 until 1990.
1 = sewer trench near hotel Riche (1980), 2 = construction trench Cokoma building (1984), 3 = construction trench Intercai building (1987), 4 = construction trench office of architect Wauben (1989), 5 = construction trench 'plot 20' (1990).

period (70 - 200 AD). The almost a hundred graves, mostly cremations, were situated on both sides of the Janskamperveldweg, suggesting an ancient origin of this field road. However, the archaeologists were not allowed to excavate the old medieval or perhaps even Roman road, nor the planned pavements of the projected roads. A number of historical loess quarries had further disturbed the archaeological features. This explains the 'holes' on the map of the excavation (cp. figs. 15-1 to 15-6).

On 15th August, well before the deadline, the fieldwork ended.

1.4 The post-excavation era 1991-2007, analyses and publications

Soon a number of preliminary reports were published (Louwe Kooijmans 1991; Louwe Kooijmans *et al.* 1992, 1993; Kamermans *et al.* 1992; Kamermans/Louwe Kooijmans 1994). The finds from the excavation provided datasets for student theses in the first years after the digs, especially for those who had taken part in the field work in Geleen[1]. Also, off and on the results of the excavation were used in synthetical texts (cf. Louwe Kooijmans *et al.* 2005) or *Festschriften* (Louwe Kooijmans *et al.* 2003).

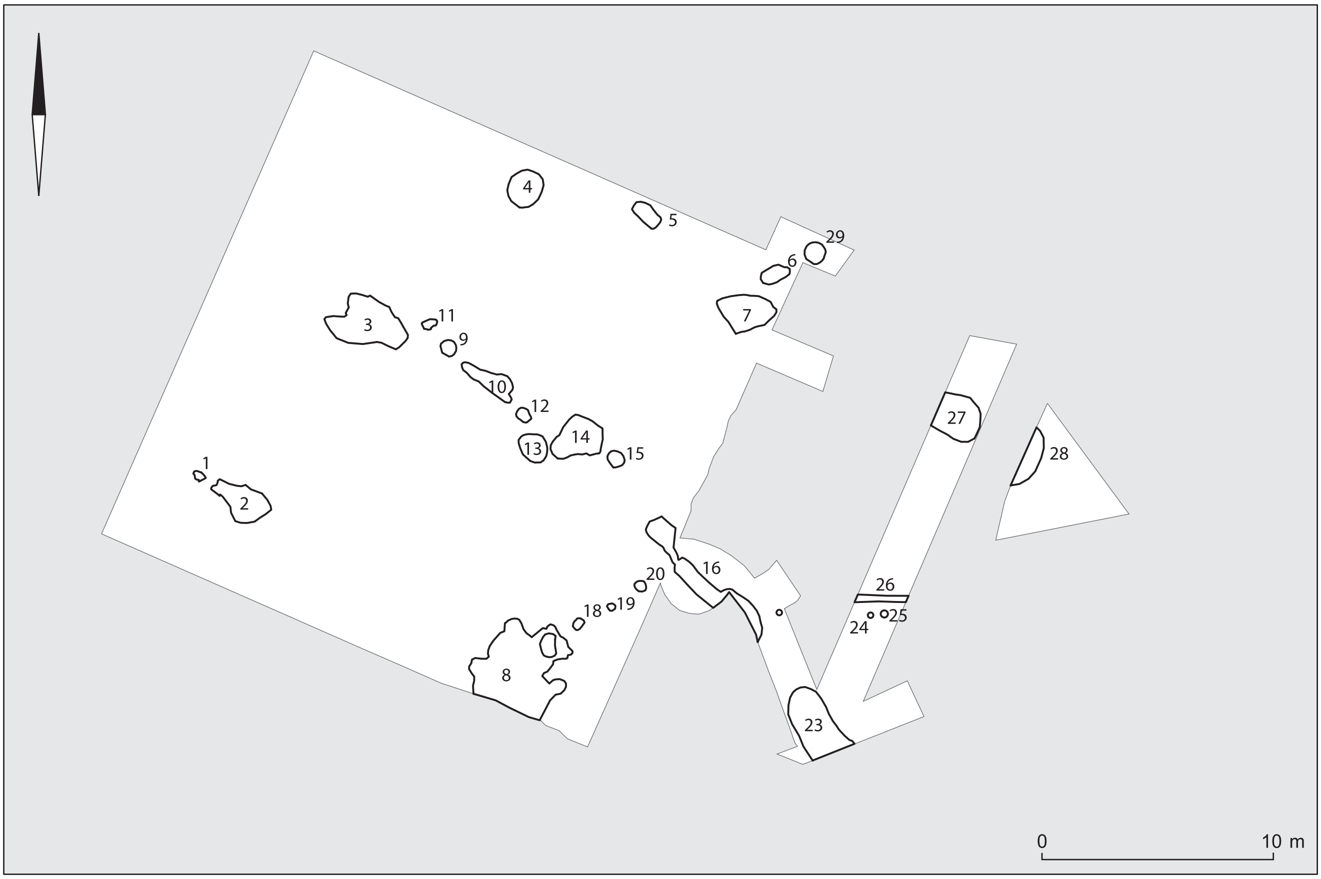

Fig. 1-5 LBK features in the Cokoma construction trench.

Unavoidably however, the finds, the field notes and the drawings gradually disappeared from sight and mind, as other, to some more interesting, excavations came along in subsequent years. Moreover, already a few years before the JKV excavations, when Modderman had left the chair of Prehistoric Archaeology, understandably the focus of the Faculty's research slowly shifted away from the Bandkeramik to other pursuits, only to return temporarily on the occasion of these (what were essentially) rescue excavations.

In 2002 Louwe Kooijmans and Kamermans, and Van de Velde were invited to contribute to the *Festschrift* for Jens Lüning's 65th birthday, and they decided to write collectively one essay on a topic that would please the celebrator, on the very excavations at JKV (Louwe Kooijmans *et al.* 2003). Of course, there were differences in emphases and view points between the three; yet, the resulting text which did not hide the differences, was much appreciated by the addressee and the wider audience. This, too, became the occasion to initiate a full analysis of the JKV data. The work load associated with the Deanery of the recently founded Faculty of Archaeology, plus the editorship of the large scale *Prehistory of the Netherlands,* and a number of large rescue excavations in the Dutch peat area, prevented Louwe Kooijmans to partake in the analyses – although he kindly contributed an essay on the geology and geomorphology of the region around JKV (Chapter 3, below).

In a traditional vein it was decided that previous to the analyses of the different categories of finds, a (relative) chronological framework was to be constructed to which the other studies were to be appended. That frame was to be derived from the changes in the decoration on the pottery; in fact, a remake of the chronological scheme published in the 2003 text, and Van de Velde set out to do that job. When that part-project was near to its end, collaborators were sought and found to analyse and describe the other find categories. By that time the digitalization of the field drawings had got under way: for in the field virtually all trenches had been drawn by hand in a traditional way (later to be digitized in the office as part of students' training programs); features had also been recorded by Total Station and SDR, again as part of a field training program. A full check and completion of the digitized plans by Kamermans resulted in the final digital record of the excavation which was later enhanced with MAPinfo tables[2]; in the next chapter he will deal with this subject. As far as analysis and description of the JKV Bandkeramik data are concerned, flint procurement was assumed by M.E.Th. de Grooth, use wear and tool analyses both on flint and other stones by A.L. van Gijn (later joined by her assistant A. Verbaas), and adzes as well as macro remains of seeds by C.C. Bakels; pottery (all of it), the houses, the settlement and the chronology were to be elaborated by Van de Velde.

Apart from the Bandkeramik village on the Janskamperveld, there were also remains of an Early Iron Age farmstead situated almost in the centre of the excavation, remarkable because of the extensive area that had been uncovered around it (albeit for other, LBK purposes), as yet exceptional on loessic soils where only houses and not their yards had been excavated; L. van Hoof was willing to take this part of the data to an end. The Late Iron Age/Roman graveyard which had been analysed by Wesseling in her MA thesis (1992) did not fare so well afterward. Wesseling herself had moved to an administrative job which did not leave sufficient time to write a new and shorter text on the topic. Several other colleagues in the Provincial Roman Archaeology field were approached, but they all were too busy to conduct an analysis and write down the results. Which is a pity, as the nearly one hundred graves seem to span the Late Pre-Roman Iron Age and the early decades of the Roman conquest of the country.

Eric van Driel and Medy Oberendorff, draftspeople at the Faculty of Archaeology did much to render the illustrations in this *Analecta* clear and pleasing to the eye as well.

Field drawings and databases will be made available through the *e-depot*.

Notes

1 Van Amen 1993, Boulonois 1996, Van den Burgt 1992, Gumbert 1996, Houkes 1996, Kneepkens 1993, Lawende 1992, Mietes 1991, Molenaar 1991, Prangsma 1993, Schute 1992, Van der Veen 1991, Wesselingh 1992.

2 These plans will be made available on the web: http://edna.itor.org.nl

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2 Digital applications in the early 1990s[1]

Hans Kamermans

LBK excavations have often triggered innovations in archaeological excavation and recording techniques. For example, in 1958 the nearby site of Elsloo was the first archaeological site in the Netherlands to be excavated with the aid of mechanical equipment (Modderman, 1970, 2f). During and after the Geleen JKV excavations, digital applications played an important role. For the first time in the Netherlands a total station was used for recording the location and outlines of trenches and features. The Geleen JKV project was also one of the first archaeological projects in the Netherlands to use a GIS like program for intra-site spatial analysis.

2.1 Registration

It has often been stressed that excavating an archaeological site is a non-repeatable exercise. Archaeologists destroy a site while excavating it. This means that the registration of the observations done during this fieldwork is very important. Archaeologists try to do this as accurately as possible. The introduction on excavations of sophisticated instruments to register the position of finds and features with millimetre accuracy was an important step forward.

A total station is such an instrument (fig. 2.1). It is a combination of an electronic theodolite and an electronic distance-measuring device. A theodolite measures both horizontal and vertical angles. Most modern total station instruments measure these angles by means of electro-optical scanning. Measurement of distance is accomplished with a modulated microwave or infrared carrier signal that bounces off a glass prism placed on the position to be measured.

In Geleen JKV the location and outlines of trenches and features were recorded with a Sokkia total station set 4B[2], and, along with extra information like the trench and feature numbers, were stored on a survey data recorder (SDR), thus forming the first part of the excavation database. Information gathered with the total station was first transferred to a laptop computer and then processed with the program SDRmap. The feature information was later transferred to the database program dBASE to form the first part of the attribute database. The outlines of the trenches and the position of the midpoint of the features, indicated by a point with a feature number, were transferred to the drawing package AutoCAD.

The excavation plans were made by hand in the traditional way and subsequently digitized on a laptop computer with AutoCAD. In the field we experimented with directly digitizing the features using the total station, but this approach proved to be ahead of its time and did not become common practice until recently (Kamermans *et al.* 1995).

The work procedure for the experiment was as follows: We followed the contour of the trenches and the features and made the site plan without tape, measuring stick, paper and

Fig. 2.1 A Sokkia total station set 4B with a survey data recorder (SDR).

pencil. In order to get an accurate drawing we needed to take lots of measurements in the field and to enter lots of codes to tell the computer program SDRmap how to draw the lines. There were codes to start a curve, end a curve, close a loop, etc. SDRmap connects points with the same code; to be precise it connects a point with the previous point with the same code, unless you tell the program specifically not to do so. We used this procedure in Geleen for the most western trenches. Consequently there are no conventional field drawings for these trenches[3].

Fig. 2.2 gives a fictitious example. Start measuring the southwest corner of the trench and enter the codes P ST N1. P stands for 'put' which means trench in Dutch, ST = Start, N1 = trench number 1. The next point is the start of the first feature so the code is SP for feature, SNC = Start New Curve and P for trench. Next are two points for the feature and add to one of them the feature number. Back to the trench for measure number 5 with the code ENC = End New Curve. Do exactly the same for the other feature and more or less the same for the feature in the northeast corner of the trench. Here start a curve, but end the line with an ES = end sequence. Close the trench with a CL in the northwest corner. Other instructions include SL = Start Loop if it is a closed curve and EL = End Loop to close the loop.

Obviously the most important person with this kind of work is the person holding the prism. Only he or she can see the start of a new feature or the intersections between different features, and he or she gives, by means of a radio-telephone, the codes to the person behind the total station. The whole process from positioning the total station to a finished AutoCAD map took, for a trench with relatively few features, less time than the conventional method. The conventional method included laying out measuring tapes, making a drawing with pencils and measuring sticks and digitizing the field map in order to get an AutoCAD drawing. However, for trenches with many features the coding became so complicated that it was easier to make a plan by hand.

Nowadays on many excavations all the drawings are made with a total station, either a robotic or a conventional one[4]. A robotic total station is a total station with automatic tracking and radio communication to a radio and data collector at the prism pole. No person is required at the instrument only at the pole. In the (near) future the total station will be replaced by a differential GPS (Global Positioning System) or make use of Micropower Impulse Radar (MIR). This will eliminate some of the disadvantages of a total station such as the requirement of a line of sight between instrument and target and the fact that the total station must be setup over a known point or within line of sight of two or more known points.

In Geleen JKV the two data streams, excavation plans and trench and feature information were merged in AutoCAD. We now not only had at our disposal a digital graphic representation of the site, but also the administration data of the features. The data from the analyses of flint and pottery were later added to the dBASE attribute database.

One of the great advantages of the localization of the features with a total station was the fact that mistakes made in the field while drawing the features would immediately show up. With the total station we measured the midpoint of all features and overlaying in AutoCAD, the digitized excavation maps with a layer with these midpoints would show inconsistencies. One of the mistakes made by the not

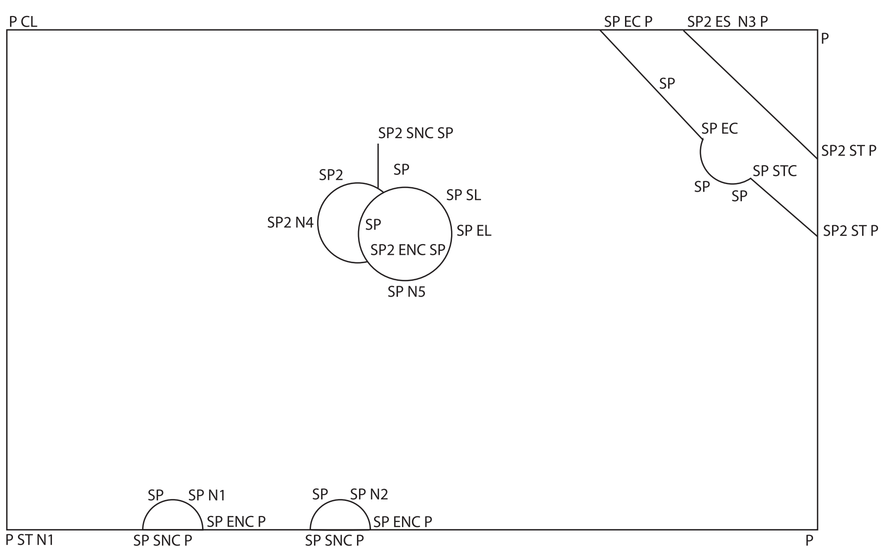

Fig. 2.2 SDR codes in an imaginary trench.

very experienced fieldworkers (often first or second year students) was that they marked the position of the beginning of the measuring tape on the excavation plan as 1 instead of 0. Consequently the position of all the subsequently drawn features would be one metre off.

2.2 Analysis

The gap between excavated information and the understanding of a prehistoric society is huge. In order to bridge this gap, modern programs for digital spatial analysis are a welcome addition to the repertoire of tools archaeologists are using to reconstruct the past. In the first half of the 1990s, commercial Geographic Information Systems (GIS) software for desktop computers had become available. At this early stage, archaeologists used GIS mainly for landscape studies (Gaffney and Stancic 1991; Kvamme 1989; Lock and Harris 1991; Wansleeben 1988) and not for the management and analysis of site-based datasets. Nowadays an excavation without a GIS on the field computers is unthinkable. Geographic Information Systems now play in important role in nearly all archaeological interpretations (Wheatley and Gillings 2002, Conolly and Lake 2006). What is still missing is the integration of time in a GIS: a tool for the management and analysis of spatio-temporal data (Ott and Swiaczny 2001).

In 1996 the Geleen JKV data was transferred to MapInfo 3.0 in order to deal with the information of the 1990 and 1991 excavations in a more sophisticated way. The MapInfo Company calls its software "a powerful Microsoft Windows-based mapping application that enables business analysts and GIS professionals to easily visualize the relationships between data and geography". So technically speaking it is not a GIS but the program has more possibilities for manipulating and analysing spatial referenced data than most archaeologists need. Maps have to be imported in MapInfo using AutoCAD DXF (Drawing Interchange Format, or Drawing Exchange Format) files. For the attribute information the program uses the original database (dBASE, Access or even a spreadsheet in Excel).

To facilitate computer-aided spatial analysis of Geleen JKV, the features were split up into distribution maps stored in different layers according to their age: the LBK settlement, the Iron Age house, the Roman cemetery and the recent disturbances. As we suspected that a large part of the analysis of the settlement would focus on the Bandkeramic structures, we combined the features from one structure (for instance a house) into one so-called object. In this way you can select in one go all features of an individual house.

The excavators used a local coordinate system to register the features and finds. The transfer of this system in MapInfo to the Dutch National coordinate system was not without its problems. The then current version of MapInfo could not transfer polylines from one coordinate system to another without distortion. This could only be solved by saving the Geleen JKV MapInfo file as an MIF/MID file and with the help of a text editor manually altering the first lines of this file in: 'CoordSys Earth Projection 20, 109, "m", 5.387638889, 52.156160556, 0.9999079, 155000, 463000 Bounds (0, 0) (300000, 650000)'. After that the MIF/MID file had to be imported back into MapInfo[5]. The Bounds were the ones that created the problems.

The eventual solution was to add a Dutch coordinate system in mm to the MapInfo file MAPINFOW.PRJ[6]. In this file are now two Netherlands coordinate systems:

"--- Netherlands Coordinate Systems ---"
"Netherlands National System\p28992", 20, 109, 7, 5.387638889, 52.156160556, 0.9999079, 155000, 463000
"Netherlands National System (mm accuracy)", 2020, 109, 7, 5.387638889, 52.156160556, 0.9999079, 155000, 463000, 0, 0, 300000, 650000

The second Dutch projection allowed us to import AutoCAD DXF directly without the distortions.

The final result was a dataset in MapInfo that enabled us to combine graphical information of the excavation plans, both as features and as structures, with the attribute information of the excavation and the analyses of the different find categories. This dataset proved to be of great help in the spatial analysis of the site.

notes

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2 I would like to thank NWO, the Netherlands Organisation for Scientific Research for providing us with the money for the equipment.

3 I would like to thank Marten Verbruggen and Jan-Albert Schenk for joining me in this experiment.

4 An example in the Netherlands of a commercial archaeological company that works completely digital is Becker & Van de Graaf from Nijmegen. Their claim is that during fieldwork everything is digitally recorded without the use of paper.

5 I am indebted to thank Bert Voorrips for this solution.

6 I would like to thank Milco Wansleeben for this solution.

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3 Geleen-Janskamperveld – landscape and soil conditions

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The site of Geleen-Janskamperveld is part of the well-known Graetheide cluster of Bandkeramik settlements, located at the northern edge of the South Limburg loess covered hills and forming the northernmost outlier of the LBK distribution. The specific conditions of the landscape have been described on several occasions (Bakels 1978; Modderman 1958-'59a, 1970, 1985) and are summarized here before focusing on the conditions at the site itself.

3.1 The South Limburg landscape

The South Limburg loess region stands out against the wider and more undulating loess plains of the Rhineland to the east and of Belgium to the west. It is a relatively narrow zone of the Middle European loess belt, where the loess covers the distinct terrace landscape of the river Meuse. There the river breaks out of the narrow gorge cut through the Ardennes, and enters the wide North European Plain to the north of it. The Cretaceous and Tertiary deposits in this region have been uplifted and tilted as a result of the gradual uplifting of the Ardennes Massif in the course of the Pleistocene. At the same time, the Meuse has alternately cut itself into these deposits, widened her valley or (in cold phases) deposited her coarse gravel deposits on the valley floors. Parts of the old valley floors were left as 'terraces' and were subsequently dissected by tributaries of the Meuse and her branches, like the Geleenbeek to her right side and the Jeker/Geer and the Heeswater to her left side. The formation of numerous small tributary valleys has been ascribed to cold phases with permafrost and solifluction. They are deeply cut into the very permeable Cretaceous subsoil and are nowadays without flowing water or have only a very modest stream. Dust was blown from the glacial tills of the northern plain and deposited as blankets of loess over this landscape in the same pleniglacial cold phases. In the intermediate temperate periods, these covers were eroded or preserved in the less exposed, flatter or protected parts of the terraces. The main preserved loess deposit is that of the last or Weichselian glacial stage.

The glacial-interglacial cycles of landscape genesis came to a stop for the time being by the formation of the Lower Terraces during the final incision of the Meuse. The small Late Glacial erosion valleys were fossilised in the early Holocene in the form of dry valleys. The final stage, dated to post-Bandkeramik times, is formed by the slope wash or colluviation, resulting in the infilling of the valleys and the raising by several metres of the valley floors of the main rivers.

These landscape formation processes have resulted in a more dissected and broken geomorphology of the Upper Terraces in the southeastern and central parts of South Limburg, where hardly any flat landscape forms occur, except for the valley floors. The northern fringe of this Upper Terrace landscape belongs mainly to the Pietersberg Terrace stages, correlated with the earlier stages of the Sterksel Formation, dated to the Middle Pleistocene. They rise to 55 m above the valley floor of the Geleenbeek, a difference of about 40 m compared to the Graetheide Plateau.

The wide and rather flat Middle Terraces contrast with this hilly landscape. They are found along the present-day Meuse valley floor and South Limburg's northern fringes, with the Graetheide Plateau as its most prominent feature. In geological terms, this plateau belongs to the Terrace of Caberg, correlated with the sands and gravels of the Veghel Formation, as distinguished in the sandy district farther north. This plateau still has the very level appearance of a valley floor, with slopes of less than 1°, except for some wide 'valley-like depressions' with slopes of up to 2°. Both the considerable difference in age and the extension of the plateau explain the contrast with the geomorphology farther south. Adding to this contrast, the Geleenbeek has cut its valley at the rear side of the terrace, so isolating the plateau from the hills farther south. It is this plateau that attracted the first Bandkeramik settlers and has remained a remarkable core region in the subsequent centuries.

The present-day occurrence (recovery) of LBK archaeological remains is very closely linked to this differentiation of the landscape. Hardly any remains have been recovered from the hilly Upper Terrace district. This may be partly explained by post-Bandkeramik erosion and a more limited prospection, but the main reason must be the primary site location choice made by the Bandkeramik peoples themselves. The same holds for the valley floor of the river Meuse, where not erosion but alluviation hampers the recovery of sites. In recent years sites have however been discovered at the fringes of the Upper Terrace landscape and on the valley

Fig. 3.1 Map of the Geleenbeek with LBK sites/AHN/Geology (after Van Wijk/Van de Velde 2007).

floor, both adjacent to the LBK settlement cluster. They are dated to the final stages of the LBK and demonstrate firstly that sites *are* preserved in these zones and, secondly that the occupied space was extended from the preferred territories on the Middle Terrace into these zones, which were only traversed and occasionally visited before.

The loess landscape with its hills and terraces is bordered to the west by the fluvial plain of the Meuse and the Pleistocene (cover)sand deposits of the Kempen, the same cover sands that are found on both sides of the Meuse north of the Greatheide Plateau.

3.2 The location of Janskamperveld in the landscape

The site of Janskamperveld is situated at a height of 64-64.5 m, at the eastern margin of the Graetheide Plateau. To the southeast the surface gently slopes down to the valley floor of the Geleenbeek at *c.* 51 m NAP, over a distance of about 800 m. A minor tributary, called 'Keutelbeek', flows into the Geleenbeek to the south of the site. The original relief in Bandkeramik times must have been slightly more pronounced in view of the post-Bandkeramik colluviation and alluviation processes mentioned above. In the other

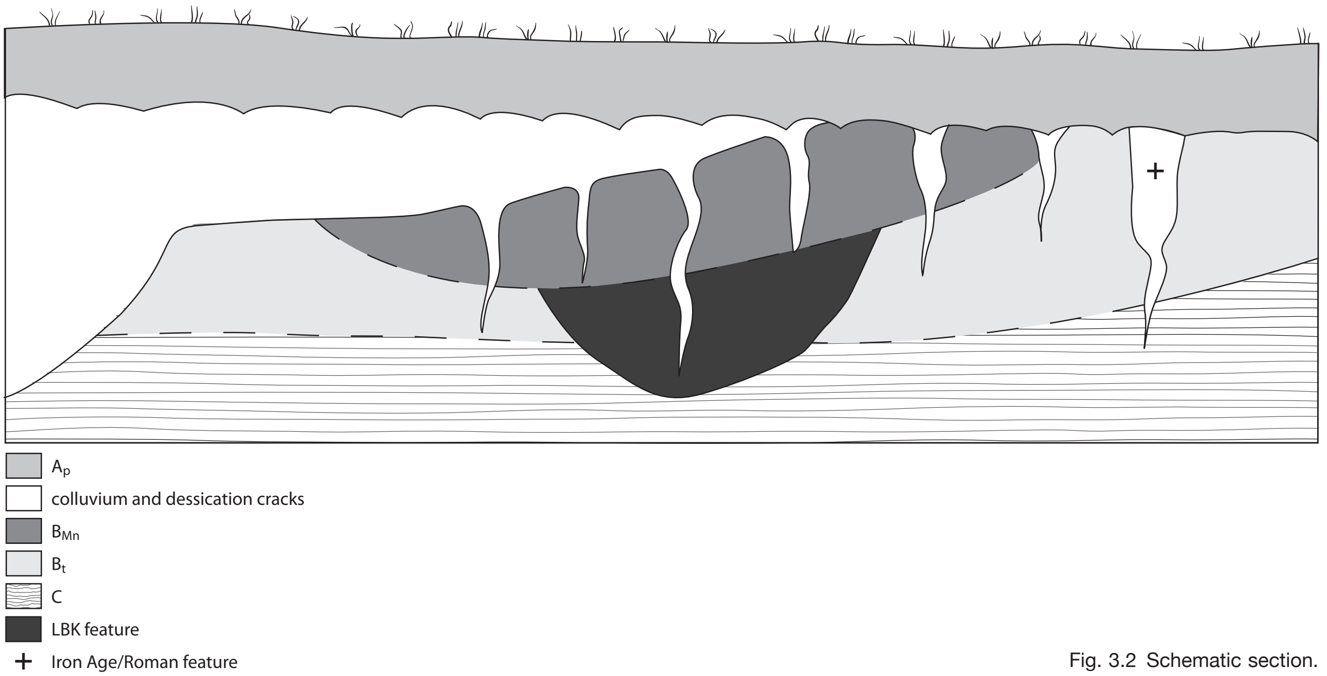

Fig. 3.2 Schematic section.

direction – to the north and northeast – the site is separated from the plateau itself by a wide and shallow depression, with a depth of a few metres below the site and the plateau farther to the north. The depression must have been several metres deeper in Bandkeramik times in view of similar alluvial deposition as assumed for the Geleenbeek valley. No research to establish the rate of these processes at this location has however been carried out. The location implies that the site was surrounded by gently sloping terrain at three sides and that an (almost) level surface, considered as optimal for crop farming, was restricted to the west over a distance of more than 1 km and covering roughly 50 ha. Water will not have been available from closer by than the Geleenbeek valley at *c.* 800 m and 15 m lower than the settlement. We assume, in contrast to Modderman (1970: 5), that the shallow valley to the north of the site, like most or all of the smaller Late Glacial valleys, will have been dry in Bandkeramik times, and not drained by an active brook. The subsoil is permeable and the valleys were filled by some metres of colluvium in the course of time. These small valleys will not have been a reliable source of water, especially not in periods of drought, without additional measures, like artificial water holes or wells.

From the site one has a view to the south across the Geleenbeek onto its southern valley slope, which rises relatively steep up to the Upper Terrace levels, intersected by a series of dry valleys. On one of the promontories, a few kilometres to the south, the la Hoguette site of Sweikhuizen is situated, within view of the early LBK settlements along the other valley slope. The contrast in site location combined with the absence of contact finds has been used as an argument for a difference in age, and is supported by the *ältesten* LBK contexts of similar la Hoguette material in the Frankfurt region.

The subsoil of the Upper Terraces consists of gravels deposited on Tertiairy sands, which outcrop in the upper parts of the valley slopes and may have been a nearby source of pebbles. At a distance of *c.* 13 km farther south, the subsoil changes into Cretaceous chalks with flint nodules, with Valkenburg and its eponymous flint in the southern valley slopes of the Geul as the nearest occurrence, but only incidently exploited by the Bandkeramik communities, who preferred the Rijckholt type, found at a distance of *c.* 20 km in the same, southerly direction.

3.3 Site location, cultural

Geleen-Janskamperveld is one of the many sites which together form the Graetheide cluster, and is part of the string of sites along the western slope of the Geleenbeek valley and its Keutelbeek tributary. The site lines up with well-known sites like Geleen-de Kluis (Waterbolk 1958-'59), Geleen-Haessselderveld (Vromen 1982) to the southwest, and Sittard (Modderman 1958-'59b; Van Wijk and Van de Velde 2007) to the northeast. The whole stretch of this valley slope – in

Fig. 3.3 Overview of the excavation from the west, from the roof of hotel Riche.

essence the southeastern edge of the Graetheide Plateau – is however dotted with finds and minor sites, giving the impression of an uninterrupted ribbon of occupation along the Geleenbeek and the small Keutelbeek. But we should be cautious in developing such a vision for the time when Janskamperveld was founded, in view of the differences in age of the individual sites. Truly synchronous with Janskamperveld are Geleen-De Kluis and Sittard in its first phases, which together make up a spatial arrangement of distinct settlements, separated by stretches of untouched woodland in this early stage, and continued to the west with the sites of Elsoo and Stein.

3.4 Local soil formation processes

The soil profiles in the sections of the excavated terrain reflect several stages of landscape evolution which can be dated in outline by the interconnections with dated archaeological features.

Similar soils have been the subject of intensive discussion on the occasion of earlier excavations of LBK sites. The arguments have been brought together and critically reassessed by Bakels (1978: 20-21).

At the base is the loess deposit, dating from the last glacial period. This loess is decalcified to a level deeper than the Bandkeramik features, which implies that all bone material has decayed. It must be assumed that the Bandkeramik farmers were confronted with this decalcified loess as well, since this decalcification will have started immediately after its deposition, at least five millennia earlier.

A gray brown podzolic soil, Dutch: *Bergbrikgrond*, German: *Parabraunerde*, (De Bakker and Edelman-Vlam 1976: 63) has been formed in its top as result of percolation and downward replacement of *lutum*.

This gave rise to a dense and tough B_t horizon, well known from all over southern Limburg and other LBK settlement sites in the region. There has been some discussion about the age of formation of this ‘argillic horizon’, summarized by Bakels (1978: 21). She is in favour of the arguments put forward by Scheys (1962) which are based on sections in nearby parts of Belgium, where he observed that LBK pits

Fig. 3.4 Field photo of a typical soil section, showing the arable, the colluvium and the B_t.

were dug through the A2-horizon into the clay illuviation horizon. Similar observations were made by Schalig (1973) in the adjacent German Rheinland. The earlier opinion of Van den Broek (1958-'59), that the illuviation continued through the filling of the LBK pits, should at least be adjusted. Bakels (1978: 121) concludes that "... the clay illuviation horizon in South Limburg was already present, at least to some extent, in the period in consideration" and that "... it is not inconceivable that the clay illuviation continued after this period".

It is obvious in Geleen-Janskamperveld as well that this soil is pre-Bandkeramik in origin, since all LBK features had been cut through it. The formation must have started when the glacial permafrost had disappeared and may have continued for some time after the Bandkeramik times. The present surface is almost perfectly horizontal and flat at a height of 64-64.5 m, but the local relief must originally have been slightly more undulating than it is now, as the upper horizons of this soil had disappeared at some places, bringing the B_t horizon to the surface, directly below the present arable layer. Modern plough furrows had cut into its top, affecting the depth and quality of the LBK features.

The B_t horizon had a soil structure of angular elements, into which it easily falls apart. The surfaces of these elements were covered with a dark film of *lutum*, which must reflect the last stage of eluviation. A second process of soil formation is the accumulation of (presumably) manganese and iron oxides in dark brown patches measuring from a few up to some ten metres in diameter and in places reaching deep below the lower limit of the B_t and as such obscuring the LBK features. Some of these patches were moreover clearly connected to large LBK pit fills, which because of their different texture and porosity may have been favourable for this process. Consequently, the process must be later than the LBK occupation. This 'browning' of the soil has in places seriously hampered the visibility of the traces left by the LBK occupation, which in general showed up as dark patches at 5-10 cm below the top of the B_t. The top itself was disturbed over some depth by recent burrowing of animals like moles which obviously had a preference for this level.

Fig. 3.5 Field photo of desiccation cracks.

The B-horizon *and* the LBK features were intersected by a polygonal pattern of linear features, to be interpreted as the leached fills of dessication cracks. These are in particular very pronounced in the sections of larger LBK pits. The cracks show a pale light gray, leached fill similar to those of the Iron Age and Roman period features, which at some locations seem to be part of this pattern. This would imply a stage of desiccation in or around that period (final prehistory), possibly related to the initial stages of the wide scale reclamation in that period. Similar observations have been made earlier by Modderman (1970: 6): " We have numerous times attested that the very characteristic *Trockenrisse* cut through the Bandkeramik features", and then very cautiously: "They originate also partly certainly from after 4000 B.C. (read: 4900 cal BC, LPLK)". The date could be more precise at Geleen-Janskamperveld thanks to the related features of later occupation phases. Modderman noticed that new cracks were formed in the excavation trenches at exactly the same locations, an observation which was not made, however, at Geleen-Janskamperveld forty years later.

The higher (A_1 and E) horizons were not preserved at Geleen-Janskamperveld in the (originally) lower parts of the terrain either, but transformed there into a pale yellowish and homogeneous deposit, relatively poor in lutum with a leached appearance and a depth of up to 30 cm, in places containing small particles of coal and brick. The youngest features covered by this deposit were the Roman burials, which showed up at the same level as the LBK features. Consequently, the deposit should be interpreted as a horizon of historical age, in which all original horizons (A_p and E) have been mixed up. Two processes may have played a role in its formation: colluviation and – in view of the very slight slope at most places – bio-homogenisation as well. A similar deposit was found as the fill of a large and deep feature in the centre of the excavated area, interpreted as a historical loess quarry, opening into the hollow road called 'Janskamper-veldweg', which intersects the area from the southwest to the northeast, and was found in some comparable minor disturbances. These quarries could not be dated through

Fig. 3.6 Section across a deep complex of LBK pits, feature 34065, showing the laminated loess below the B_t.

the lack of datable material, but they may be of considerable historical age in view of the possible age of the sunken road. This road may date back to Roman times in view of its relationship to the Roman cremation cemetery, which lines up along its northwestern side, while it separates this cemetery from a small group of burials with relatively rich grave gifts at the other side.

Van den Broek (1958-'59: 12) made similar observations at nearby Sittard and concluded that the "... soil material above the B-horizon mainly consisted of a colluvium, as far as could be attested, with a depth of 30-150 cm" He suggested a date between 1500 BC and medieval times based on circumstantial evidence. Modderman (1970: 5), however, assumes in Elsoo an undisturbed A-horizon in view of the absence of indications for colluviation at the very flat terrain, but our observations at Geleen give some reason for doubt.

The youngest phenomena at Geleen-Janskamperveld are infrequent pale features with a dark core and an orange or black outline. They have been interpreted as disturbances in historical times, mainly by natural phenomena like roots, but some features along a line point to man-made fences.

The top of the sections is formed by the modern arable horizon (A_p) with a depth of 20-35 cm.

The historical colluviation processes, the quarrying of loess, the incision by the sunken road 'Janskamperveld-weg', and the accumulation of manganese and iron in a distinct patchy soil horizon all add up to a critical attitude to the original idea that the Janskamperveld site would have been preserved in mint condition. These processes, together with the modern buildings at its southern fringe, will pose some restrictions on the analysis of its history.

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4 The neolithic houses

Pieter van de Velde

Remains of 69 houses have been partially or wholly excavated at the Janskamperveld village; they are analysed and described. Disregarding partially unobservable houses there are 30 three-part or type 1 constructions, 13 two-part or type 2, and 8 one-part or type 3 buildings (resp. Großbauten, Bauten *and* Kleinbauten*). The walls, another major characteristic of LBK houses, have been set up as boards all around (type a, 5 houses), boards around the rear part and wattle-and-daub elsewhere (type b, 13 houses), or as wattle-and-daub only (type c, 29 houses). The widths of the houses hardly differ from 5.1 metres, but lengths vary between 5.7 and 31.2 metres (with central parts generally between 5 and 10 metres), floor areas range from 25 to 190 m^2. In line with the early dating of the village, 42 houses have a corridor separating the central and rear parts, in addition 6 of them also present a corridor between their central and front parts. The interior space of the houses is subdivided by the three-post-rows ('DPR') into bays, in most of the constructions 2 or 3 per part, together some 2 to 7 bays per house.*

4.1 General remarks

In the appendix to this chapter, the tables and plans (figs. 4-6 ff.) list and show details of the 69 Bandkeramik house plans recognized in the excavated part of the Geleen-Janskamperveld settlement. The labels (H-numbers) are the same as those in Schute (1992) and Louwe Kooijmans *et al*. 2002. H 60 and H 61, in accordance with the Schute catalogue, as well as H 66 indicate constructions discovered previously during the housing estate development (Vromen 1985). HH 62-65 and 67-69 were recognized subsequently when the excavation plans were further analysed. The present discussion will not go into every single entry of the summary tables, not even every variable. Just a number of issues raised by Cladders/Stäuble (2003), Pavlů (2000), Coudart (1998), Von Brandt (1988), and Modderman (1970) will be followed up here. Of course, even a short glance at the tables will show that their conceptual background is largely predicated on texts by these authors.

Before entering into details, some remarks on the reliability of the observations are warranted. While analysing the plans, estimates of the quality of the conditions for the different observations were assembled and the weight determined that should be accorded to them, indexed on a five point ordinal scale, the observational quality index *w*. This index ranges from 0 for *'very bad conditions'/'no weight to be accorded'* to 4 for *'excellent conditions'/'reliable observation'* (table 4-1 provides summary definitions). Obviously, a certain amount of subjectivity cannot be avoided; yet an offset of more than one scale point seems unlikely, as earlier experiences have proved (cf. especially Van de Velde 2001). Table 4-2 groups together the observations' qualities of the LBK houses at the Janskamperveld settlement, divided over the structures' main features.

From table 4-2 it is apparent that only seven out of 69 houses are fully observable, while only guesses can be voiced for another eight houses (see column H); though a little skewed, the quality of the observations on the houses is more

w	conditions
4	excellent: reliable
3	good: fair estimate
2	reasonable: estimate
1	bad: poor estimate
0	very bad: mere guess

table 4-1 *w*, an index for the quality or reliability of observations

w	A	B	C	D	E	F	G	H
4	16	26	23	24	31	19	23	**7**
3	9	10	6	7	8	17	8	**15**
2	16	18	15	10	7	14	13	**14**
1	14	9	11	9	5	11	13	**25**
0	14	6	14	19	18	8	12	**8**
sums:	69	69	69	69	69	69	69	69

table 4-2 the quality of observations of structural features of the houses
col. A: overall length of the houses
col. B: partitioning of the plans
col. C: front or SE part
col. D: corridor between front and central parts
col. E: corridor between central and rear parts
col. F: central or middle part
col. G: rear or NW part
col. H: weighted average evaluation

or less normally distributed around bad to reasonable. Clearly the central features (the corridors, the middle part itself; as per columns D, E, and F) are better readable than the front and rear parts (columns C and G). These evaluations will have to be borne in mind in the subsequent paragraphs. Approximately 61% of the surface area of the settlement – as determined by the extension of surface finds in the field – has been investigated. The southern rim of the settlement and small areas to the north and east have only been partially excavated; consequently, a non-negligible number of houses in the settlement could not be analysed.

4.2 General, formal characteristics

It is customary to start a description of LBK houses with the length and width of the plans, as well as their orientation. Regarding the orientation of the houses on the Janskamperveld, fig. 4-1 enumerates the azimuths of their long axes, counted clockwise from north = 000°. House orientation is the point on the horizon to which the front gable and the entrance of the house are directed, roughly southeast in the Northwestern LBK. Given the rather wide spread of the orientations at the Janskamperveld settlement, it is quite unlikely that they refer to constant celestial phenomena such as midwinter sunrise, although this is also in a southeasterly direction[1]. Most astronomical phenomena occur always at the same bearings from a fixed geographical location such as a settlement, so one would expect a narrower distribution around an acutely observable target event than shown by the layout of these houses (only the moon's and planets' risings provide exceptions). It seems more likely that they point to Flombornia[2], from where the ancestors of the settlement's inhabitants came when they first settled in Dutch Limburg (see also, Bradley 2001), within living memory of the builders of the houses on the Janskamperveld. However, other authors have offered other suggestions to explain the phenomenon: e.g., directed toward the upper course of the Danube (Hauzeur 2006, 280-281, fig. 4-233), or the backs turned towards the nearest sea coast (Coudart 1998, 88-89, fig. 4-102).

House orientations are almost impervious to post-depositional disturbances as a single three-post-row ('DPR', from German *Dreipfosten Reihe*) or a few ridge poles suffice to establish them reliably. As can be seen from fig. 4-1, the most extreme orientations are 106° on the left or northern side, and 162° on the right or southern side; the average is 127°, not fully SE (which is 135°). With a standard deviation of 11.5° the distribution is quite flat (widely spread) as already noted. This is not exceptional in the Bandkeramik world, as for instance in nearby and partially contemporary Langweiler 8 (Von Brandt 1988, 218) the 82 houses are orientated between 108° and 161°, only one degree less wide on either side than on the Janskamperveld, their axes' standard deviation being also 11.5°, but averaging 136°.

The overall dimensions of the houses on the Janskamperveld are presented in graphical form in fig. 4-2. Evidently, their widths do not differ very much (range: 4.2 to 6.8 metres; average 5.1 with standard deviation 0.5 m), but the opposite is true for the lengths which range from 5.7 to 31.2 metres (mean 14.4 m, standard deviation 5.9 m). Length to width ratios range accordingly from 1.1 to 5.6, showing as much

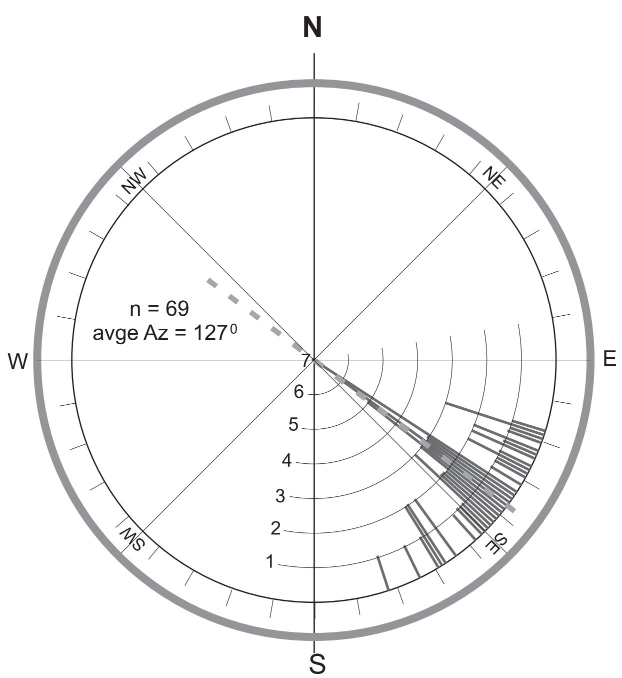


fig. 4-1 the orientation of the LBK-houses at Geleen-Janskamperveld

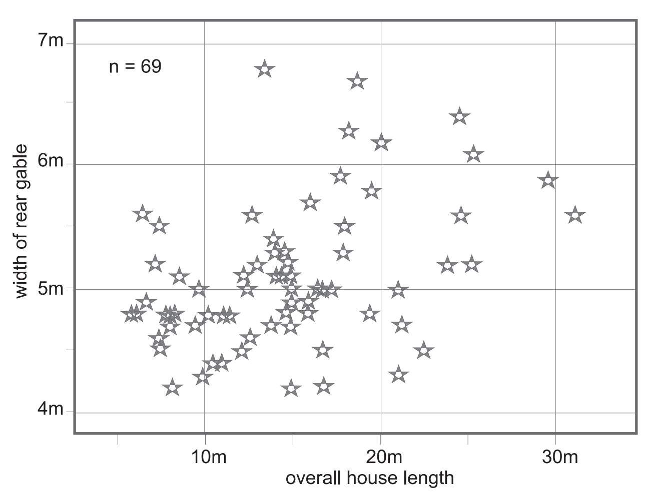


fig. 4-2 house length by width of rear gable (metres) variation as the house lengths. As mentioned earlier, these figures are not exceptional in the Northwestern Bandkeramik, whereas in Central Europe house sizes are even more differentiated. Thus, comparable figures for the 95 LBK houses at Bylany (Czech Republic) are 4.0 to 6.8 m wide (average 5.3 m), and 4.3 to 48.2 m long (average 15.4). There the distribution of lengths is three-modal, and suggests a division into long, medium, and short houses, with class boundaries at 13.5 and 26.0 m (Pavlů 2000, 190). At Geleen-Janskamperveld, however, the distribution of lengths is quite normal without subpeaks or gaps, with 23 houses within 3 metres (half a standard deviation) of the average length, and 14 houses in the lower tail and 16 in the upper tail, omitting lengths with observational qualification $w = 0$. Also, the correlation between length and width of the houses is only 0.40, from which it may be concluded that groupings or subdivisions of the houses according to either surface area or overall length are very much the same, being mainly dependent on length, at least in the present case.

More interesting though, especially from a methodological point of view, are the figures presented in table 4-3 where the relationship between the major houses dimensions and observational quality is detailed. Minimum house length and width are apparently fairly constant data, as the lowest values for the first and the averages of the second do not differ much in general. Yet at first sight the maximum lengths, and also their averages, seem to be correlated with the observational conditions. However, that correlation is only 0.28, or even 0.26 when the entries with a *w*-index value of zero are omitted; so almost negligible. The same holds necessarily for the (estimated) surface areas of the houses: the maxima as well as the averages show trends parallel to the reliability index values, but again this apparent correlation is almost spurious, with r = 0.25. It can even be inferred that less than 10% of the variation in house lengths or surface areas is attributable to bad observational conditions (as the r^2 are equal to 0.08 and 0.06, respectively).

If observational conditions can (almost) be ruled out, what are the causes of the variable lengths of the Bandkeramik houses at Geleen-Janskamperveld? The answer is, of course, the variable partitioning visible in the diversification of the house plans. There should be some relationship between the overall length and the partition, simply because all plans of the LBK houses show constructional coherence, whatever their complexity.

To substantiate that relationship, table 4-4 provides the number of one-, two- and three-part houses (resp., *Kleinbauten, Bauten,* and *Großbauten* in the terminology of Bandkeramik studies) recognized in the excavation plans per visibility category. As elsewhere in Bandkeramia, at Geleen-Janskamperveld houses consist minimally of a single central or middle part (in conventional typology these minimal constructions are labelled ‘type 3’, or *Kleinbau*), with an entrance in the southeastern wall, the front. This central room is often complemented by a second part or section at the rear, which is always to the northwest in the present Bandkeramik province (labelled ‘type 2’ or *Bau*, if the house plan is restricted to a combination of these parts). A single extension towards the front has as yet not been observed in this area. An extension with a third room to the front, in a southeasterly direction, yields the most complex house form (‘type 1’, or *Großbau*). It should be emphasized that the internal configurations of the three parts differ from each other, yet are more or less standard constructions (Modderman 1970, 100-120; Von Brandt 1988, 40-41; Coudart 1998, 27). Because of this early standardization, recognition is relatively easy, and for that reason the distribution of the observational qualities is quite different from that of the summary values in table 4-2 above. Starting with table 4-4[3], in the column for the best conditions ($w = 4$) the number of three-part houses is larger than that of single- and two-part houses combined (as observed long ago for settlements from the older phases of the LBK: Modderman 1970, 112): there are 11 houses of type 1 (three-part houses), as against 4 of type 2 (two-section buildings), and 5 of type 3 (single-part constructions). The column with the fair estimates ($w = 3$) has a similar distribution of counts: 8, 2 and 2 respectively. However, for the lower index values ($w \leq 2$), the distribution of the figures is different, with a preponderance of the smaller types instead.

w	length	range	width	area	range	n
4	17.5	6.4-31.2	5.1	93.6	32.4-189.6	17
3	13.3	7.4-23.9	5,0	69.4	36.0-126.7	9
2	15.4	5.7-25.3	5,1	81.6	26.6-143.0	14
1	13.4	5.9-19.5	5,1	69.8	45.0-95.0	16
0	12.5	6.1-24.5	5,1	65.4	29.5-151.8	13

table 4-3 observational quality and major dimensions of houses average lengths, ranges and average widths in metres; average surface areas and ranges in square metres. All measurements between the axes of the post(hole)s

P*w*	4	3	2	1	0	Σ
FCR	11	8	11	5	0	35
CR	4	2	7	5	1	19
C	5	2	1	3	4	15
	20	12	19	13	5	69

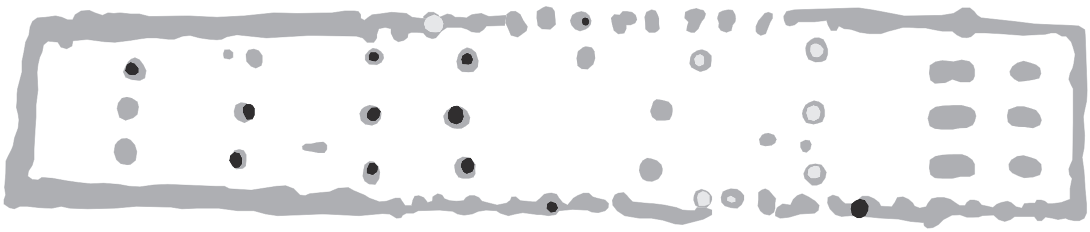
table 4-4 partitioning of the houses by observational quality
P: partitioning; w: quality of observation
House parts: F = front or SE part; C = central or middle part; R = rear or NW part

This poses the problem of total numbers of houses per type in this village: if trends change with the quality of observation, this latter variable may be the cause of that apparent dependency. However, a coincidence of trend shift and visibility problems is difficult to assume, and we could consider other hypotheses. For instance, one based upon the often stated principle that larger houses have deeper postholes than the smaller ones and thus would be longer visible when erosion gradually lowers the surface (e.g., Louwe Kooijmans *et al.* 2002). If this were the case, then roughly half of the 37 badly observable buildings should pertain to the lightest category, *viz.*, type 3, and of the remainder, again the larger part to type 2. This would result in approximately 25 houses of type 3 (7 with $w \geq 3$, plus ½×37 ≈ 18 for $w \leq 2$), 18 of type 2 (6 + 37/3 ≈ 12), and 26 of type 1 (19 + [37-18-12] ≈ 7). However from a constructional point of view, larger Bandkeramik houses do not necessarily have heavier foundations: the roof burden is absorbed by longitudinal poles resting on frames on top of the DPRs, and the load to be taken by the DPRs is directly related to the distances between them (cf. Von Brandt 1988, 244-247; Coudart 1998, 62-72). Assuming similar constructions of all houses, every DPR had to assimilate a similar load – as confirmed in the present settlement by the average depths of the DPR postholes: 3.0-3.5 dms, 4.0 dms, and 3.0 dms below the excavation plane for house types 1, 2, and 3 respectively, to which another 6-7 dms should be added towards the original surface. Given the fairly constant distances between the DPRs (see below) only the width of the houses is strongly consequential for the point weight of the roof, and should bear upon the size of the carrying posts – but then, there is not much variation in the width of the houses (fig. 4-2; the averages being 5.2 m, 5.1 m, and 4.8 m for types 1, 2, and 3 respectively), so there may be only a very small effect. In other words, house size/type and solidity of construction are not necessarily related, and cannot be taken to be expressed in differential archaeological preservation.

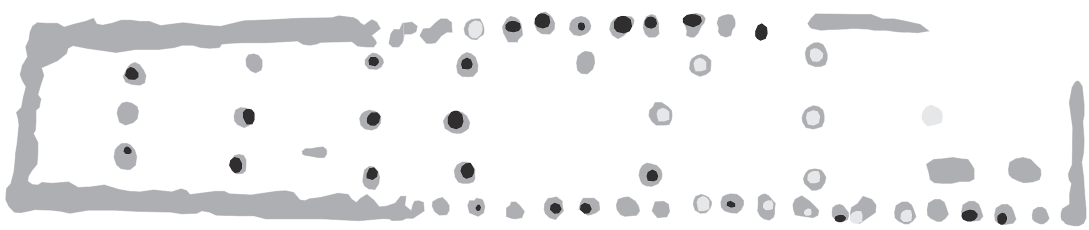
Ignoring the sturdiness argument, for different reasons house length may have an appreciable effect on our observations: larger houses have more posts than smaller ones, so with a proportional survival rate, the former are more likely to be visible than the latter. If this were the case, with average lengths of 18.5 m, 13.6 m, and 7.5 m (types 1, 2, and 3 respectively), the 69 houses in the excavation could be divided among the types with counts of 32, 24, and 13 respectively, which happens to be not far off from the total numbers in the table 4-above, and different from those estimates based on the previous argument. Again, the near coincidence of the result raises suspicions regarding its validity, for if it were applicable, the observed differences in visibility / recognizability of the houses would play no role. Probably, the assignment on the basis of length-associated probabilities should be restricted to the badly visible houses only: it is clear that there have been houses, but their signatures are unclear. These 37 houses should then be apportioned over the types, which adds 7 to type 3 (making a total of 14), 13 to type 2 (totalling 19), and 17 to type 1 (totalling 36).

There is, however, another argument bearing on the same problem. In fig. 4-3, the visibility of the remains of a Bandkeramik house have been reconstructed as a simple function of the depth of the excavation plane below the original, neolithic surface; the data on which this is based, derive from a nearby settlement excavated in the 1950s (Waterbolk 1959, 127). On average, the excavation plane at the Janskamperveld settlement site has been set at between 5 and 8 dms below the *present* surface, about 2-4 dms below the top soil. It is estimated that the neolithic surface was at about the same level as the present one (Schute 1992, 9; Louwe Kooijmans *et al.* 2002), so generally the situation as reconstructed in fig. 4-3c should obtain; indeed, substantial parts of the excavation plan are readily legible, with w-index values of 3 and 4. In reality however, compared with the neolithic situation the present field surface (and the excavation plane) undulates less due to many centuries of agriculture and its attendant erosion effects (decapitation of tops, filling up of dells; cf. Schalich 1988). Corroboration can be found in the fact that badly visible house plans tend to cluster in the excavation. Thus, the excavation plane is in some places less deep and in other places deeper than the average of 5-8 dms relative to the target situation, so w-indexes of 2 or even less are to be expected in places (fig. 4-3b, and -3e/f). Of course, when the situation in the field is as in fig. 4-3b, the plane will be set deeper, but in the reverse case there is no such way out. This post-occupational levelling of the surface, with its blurring effects, will have affected all of the settlement, not just one house type. For the higher index values, the number of houses per type should therefore reflect ("be representative of") the early situation as the excavation plane is at the right depth below neolithic datum; the unclear remains should be distributed proportionally to the former[4]. On this argument, originally probably some 41 three-section houses (19 derived from $w \geq 3$, and 22 reclassified for the lower index values), 13 two-part houses (6 plus 7), and 15 single room spaces (7 plus 8) were constructed in the excavated part of the Janskamperveld Bandkeramik settlement. In my opinion this argument is the strongest of all, although the relation of house length to probability of recognition may also have some merit, at any rate more than the other ones. If so, then 38-41 tripartite houses have stood within the confines of the excavation, 13-16 were of the two-section type, and about 15 were monopartite constructions. However, the large number of badly recognisable houses (37 out of 69) does lead to reservations about the outcome.

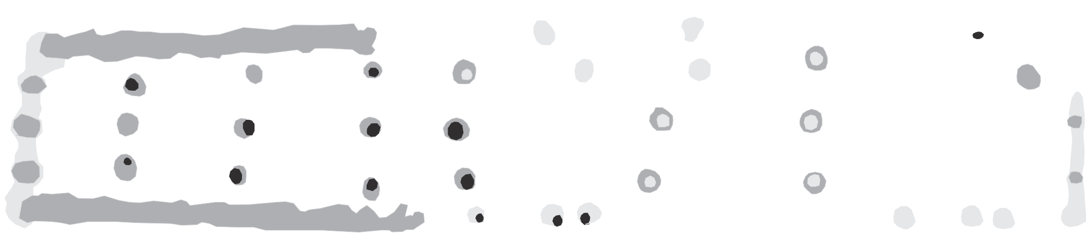
b) directly underneath the ploughsoil, at 40 cms depth



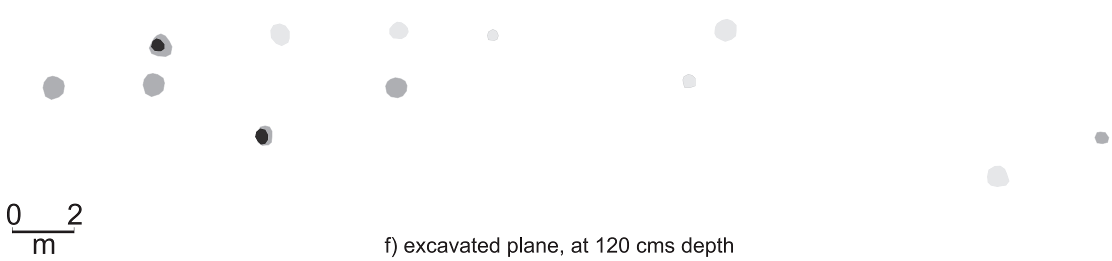
c) excavated plane, at 55-60 cms depth



d) excavated plane, at 80 cms depth



e) excavated plane, at 100 cms depth



f) excavated plane, at 120 cms depth

fig. 4-3 The visible remains of a large Bandkeramik house at various depths below the neolithic surface based on data for House W3 at Geleen-De Kluis; Waterbolk 1959

Turning now to more specific issues, the *always* present central parts of the houses (cf. above) show considerable variation in their lengths[5]. This length has a weakly bimodal distribution, with a separation at 7.5 metres: 33 houses have central parts which are not as long, and 33 houses have larger ones. Among one-part houses, 11 fall into the shorter and 3 into the larger category. For two-part houses, the numbers are 7 and 13, respectively; of three-part houses, 15 have central parts less than 7.5 m in length, and 17 have larger ones. Thus type 2 houses show a distribution similar to the larger type 1 buildings (fig. 4-4 is an illustration). At best a tendency towards larger central parts in the more complex constructions can be suggested, but no proof inferred. In comparison with the Janskamperveld settlement, the range of lengths of central house parts in Bylany shows appreciable differences: there, the shortest central part measures only 4.3 metres and the largest 28.9 metres (mean value 14.2 m) (Pavlů 2000, 190-191). There, the distribution of lengths of the central parts has two modes, too, with a separation of the subdistributions again close to the overall mean – in that case at 14.0 m, well beyond the largest central part on the Janskamperveld.

In the next section I shall divide the tripartite houses into three groups; types 1a through 1c (see that section for further details). Here, table 4-5 shows the differences in the main measurements of the component parts. Clearly, all parts of the type 1a houses are larger, as are their total lengths, in comparison with types 1b and 1c – a conclusion that also stands out clearly from fig. 4-4, where the five 1a types have been placed on the left, with the six 1b's, and the 21 1c houses to their right.

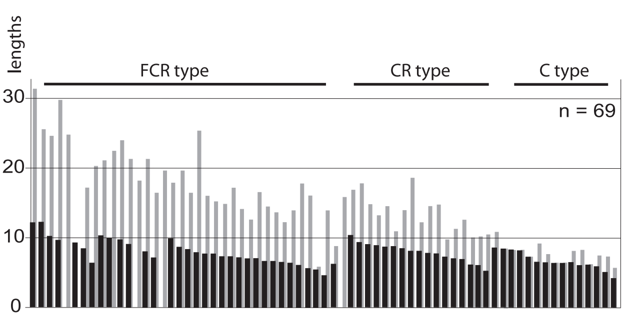


fig. 4-4 house complexity, house length and length of central parts

In the table, four houses have been classified "1x", as their class membership is unclear for various reasons; this applies to HH 18, 25, 39 and 60. Referring to their respective plans and the summary tables in the appendix to this chapter, a few additional remarks are relevant:

=H 18 shows side-wall trenches only, with neither front nor rear gable trenches; the corresponding house sections are also missing. From the sections of the lengths of the side-wall trenches, it can be established that the latter become gradually shallower towards the northwest, to disappear in the rearmost part of the central section of the house (from over 6 dms of depth in the SE to less than 1 dm in the NW). This would suggest a dislevelling of the excavation plane and neolithic surface, which – together with a five to ten centimetres deeper plane in the rear area – could account for the absence of this part. Towards the front of the house, a baulk had to be left standing because of estate development, yet in the ca. four metres between this baulk and the southeastern end of the side trenches no traces whatsoever could be ascertained of a foundation trench or of postholes. The side trenches suggest a type 1a house, and the length of the central part is considerable with 8.5 m (compare the average for the tripartite houses in this settlement which is 8.1 m). The evidence is not sufficient to substantiate that label though; on the other hand, to suppose an exceptional house construction also seems unwarranted, and for that very reason. I tend to consider this house as of type 1a yet maintaining $w = 2$ for its partitioning.

=H 25 seems a prime example of the situation depicted in fig. 4-3, somewhere between e and f, and so its overall evaluation is only $w = 1$. The symmetrical pits in the direction of the front part are suggestive of a fairly long central section of the house, leading to a type 1 proposition; however, neither

	house type	1a	1b	1c	1x	FCR
	n	5	6	21	3	35
front part	avge length	5.6	4.6	3.4	–	4.0
	range	4.5-6.9	2.4-6.7	1.8-6.6	–	1.8-6.9
central part	avge length	10.1	9.0	7.2	8.9	8.1
	range	6.4-12.2	7.1-10.2	4.7-10.0	8.5-9.3	4.7-12.2
rear part	avge length	6.7	5.7	4.0	4.0	4.8
	range	4.7-8.5	4.8-6.7	1.6-8.8	–	1.6-8.8
overall	avge length	26.2	21.0	15.8	20.8	18.5
	range	20.1-31.2	16.5-23.9	5.9-25.3	17.0-24.5	5.9-31.2

table 4-5 length of partitions by a sub-division of type 1 houses
1a, 1b, 1c: according to amended Modderman house typology;
1x: indeterminable

a front gable nor a rear part can be constructed from the very scanty remains. It seems impossible to decide on this house's type, though its possible length of several metres more than the observed 15 m is suggestive of a 1b classification.

=H 39 has many characteristics of a type 1a house on the excavation plan. Its size poses a problem, as with a length of 20.1 m it would be the smallest specimen of this type on the Janskamperveld, the next one in size (H 07) measuring 24.5 m. In a wider perspective, among the 19 houses of this type excavated so far on the Graetheide Plateau there is another small one (Stein-23, with a length of 17.0 m; Modderman 1970, T. 188); the average overall length of this house type in the entire *Siedlungskammer* being 27.5 m (standard deviation 4.9 m). Importantly, the present house has corridors both to the rear and to the front of the central part, a feature shared with all of the 1a type houses at Janskamperveld. Therefore, I am willing to accept this construction as a house of type 1a.

=H 60, finally, does not come with a clear plan mainly because of its location in a street trench, but the length of the observable right-hand side pit is suggestive of a fairly lengthy construction of at least 24.5 m, within the range of houses with three sections; the absence of wall trenches may (but need not) be due to the depth of the observational plane (again, cf. fig. 4-3). It is therefore impossible to decide between the variants of tripartite houses, and of necessity, $w = 1$ for this house.

Also problematic are houses HH 11 and 27, though they do not show up in table 4-5 as they are possibly of simpler construction:

=H 11 is situated on the eastern limit of the excavation, and its possible front part has not been excavated (hence $w = 1$); the house's substantial width, with 5.7 m over one standard deviation above the average of the entire settlement, is a weak lead to suppose a type 1b attribution, which may be countered by the small length of the rear part at only 1.8 m. Since not even the central part could be fully observed, this house will be treated as of type 2.

=H 27 is similarly located on the edge of the excavation; there is a clear rearward corridor visible on the plan, but due to the baulk behind it that could not be investigated, a possible rear part is obscured. No rear wall trench is visible, but then there are no holes for wall posts either, so there is no cue to decide upon this house's configuration, and the primary classification as type 3 is retained.

As holds for almost every combination of variables in the house plans, the correlation between overall house length and length of the central section is rather low at 0.33; which statistically "explains" only 11% of the variation in both variables. Other sources of variation are the conditions of archaeological visibility (less than 10%; see above), and – apparently much more important – those social factors that governed the partition of the houses. Given the low correlation of house width with house length, it is redundant to probe into the relationships between the overall and the several part surface areas: in every house both are dependent upon the same or very similar widths. Yet the lengths of the different parts do correlate one to another rather better than these meagre overall figures: the lengths of the central parts with those of the front yield a correlation of 0.60, rear and central parts 0.27, and rear and front parts 0.62 (zero values ever excluded). Even though these figures are appreciably higher than those presented earlier, they are rather weak statistically speaking: normally, only correlation coefficients with values of 0.7 and higher are considered worthy of attention. Any relationship of 'bigger this, so bigger that' can be ruled out, at least in the formal measurements, and this concurs nicely with one of Von Brandt's conclusions: "In summary, the ranges of the relative lengths of the several parts of the longhouses [in Langweiler 8] are much too wide to allow one to speak of dependent variables" (Von Brandt 1988, 205).

4.3 On typology, and some constructional details

Wall trenches and wall post settings define the perimeter of the Bandkeramik house. Basically, the walls of Bandkeramik houses consisted of upright posts with distances of one to two metres, with in between an infill made of either braided twigs and branches smeared with clay/loess, or of upright planks. The wattle-and-daub walls (as the first variety is called) as such do not register in the archaeological record, and only the postholes remain. Plank walls would have been set in trenches, and these may be preserved and visible in the excavated plan even when the planks themselves have disappeared, either through recycling or rot (table 4-6).

	trench	posts	indet.
front	5	44	20
sides	6	55	8
rear	19	29	21

table 4-6 distribution of wall types over façades
indet.: indeterminable

The two types of walls do not occur randomly; especially the rear part is often fitted out with trenches in which planks have stood. The central and front parts had wattle-and-daub infills predominantly. Table 4-7 lists the combinations on the Janskamperveld. One of the clearest implications of this table is that monopartite houses have been built from posts and wattle-and-daub walls exclusively, no trench at all there. Trenches occur in the larger buildings, either in the rear

walls\houses	C	CR	FCR	
trenches all around	–	–	5	5
tr's rear, posts else	–	6	7	13
posts all around	11	11	7	29
indeterminable	4	4	14	22

table 4-7 wall types by house types

section only, or all around the building in the case of a few tripartite buildings. This is the reason that Modderman has singled out these houses with all-around trenches as a special category, labelled 1a in his house typology; the remaining, more regular three-part houses with only a rear part wall trench, or with post settings all around were labelled 1b (Modderman 1970: 110-112). Recently, a further differentiation between houses with rear wall trenches and those with wall posts / wattle-and-daub all around has been proposed: types 1b and 1c, respectively (Cladders/Stäuble 2003). Being methodically better founded, and also suggestive of Bandkeramik idiosyncrasies (cf. the overall, and central part lengths in fig. 4-4 and table 4-5), I shall follow this specification (table 4-7). In the present settlement there are four (possibly six) 1a houses, and above their lengths have been compared to those of the other subcategories of tripartite houses, to the effect that on average the first group is larger than the second, and the second larger than the third (table 4-5, plus discussion).

The central part of the Bandkeramik houses – also the most frequent part, as it is common to all house types – has drawn special attention because of its diversified construction especially in the Northwestern LBK, and attempts have been made to relate the different configurations to chronology, suggesting an evolutionary trend especially in the Older Period (Modderman 1970, 112-120, 105-106; Von Brandt 1988, 189-191, 42-43). As illustrated in fig. 4-5, the central part of the oldest houses starts out with a configuration of four posts in the form of a regular Y (with the three-way point on the central axis of the building, and the stem pointing to the left perpendicular to the wall), hence christened "Y configuration" in the literature on the subject. This Y is located either halfway the length of the central part or slightly nearer to the front. The precise function of this peculiar construction (apart from the obvious one of roof beam support) has not been ascertained; one of the least exotic proposals is an extra buttress for the roof in snowstorms which usually come in from the NE quadrant in the Bandkeramik homeland which they left some generations previously. The top tips of the Y retain their places in the structure over time but with every new construction the 'stem' of the Y is set gradually further forward, until it arrives abreast of the Y's right (front) top; this configuration and the intermediate ones are called "degenerated Y's". The further forward the position of the stem, the more frequently a second post row is constructed to the rearside of the Y construction (here, dYi or Yi). Later the three-post-row to the rear of the former Y is affected by a constructional experiment as the post between the centre line and the left wall of the house is set further toward the back, to constitute a so-called "J configuration" in the excavated houses. Change does not stop there, for now the two DPRs of the central house part assume slanting lines on the plan, where before they had been either part of the "Y" or perpendicular to the long walls; this configuration is called "MS" (< German *Mittelquerreihe schräg*). Finally, the construction evolves towards three-post-rows perpendicular to the sides of the house, the "MR configuration" (< German *Mittelquerreihe rechtwinklig*). These configurational changes were not applied to standing structures but to new buildings only, suggestive of experiments to overcome perceived though not very important shortcomings of the roof construction.

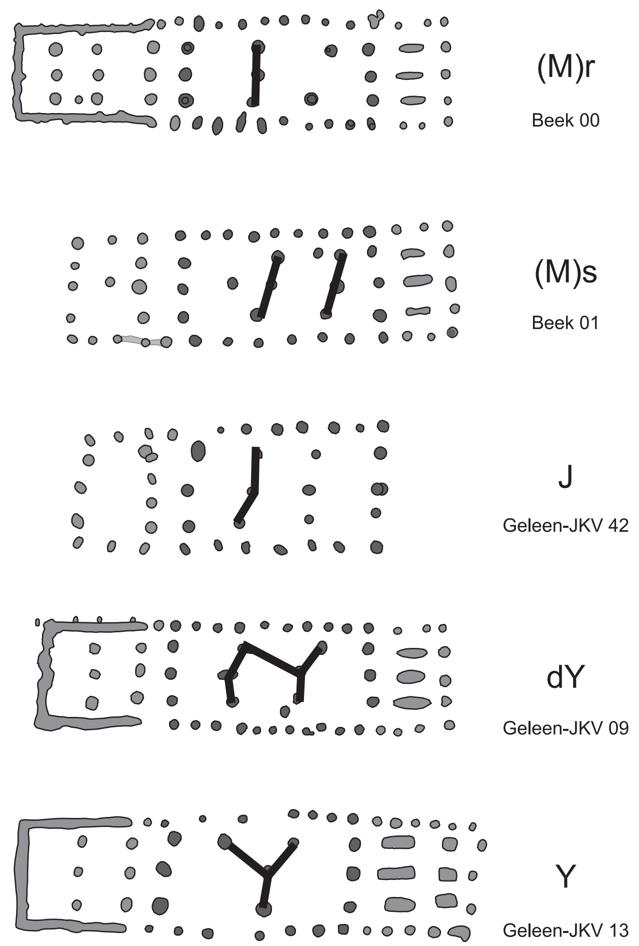


fig. 4-5 the evolution of the Y-configuration

"Pure Y configurations", also called "Geleen-Type"[6], are confined to the Flomborn period (LBK II-a in the German system; phase 1b in the Dutch chronology); "degenerated Y configurations" occur in the subsequent phase (LBK II-b, respectively 1c); "J configurations" and "MS configurations" complete the evolution at the end of the Older Period (LBK III, and 1d, respectively). Along with the "MS configurations", also the regular ("MR", or "Rx") configurations (the "Elsloo Type"[7]) start to appear which ends this development. As the Geleen-Janskamperveld settlement is dated to the Older Period, an interesting set of data on this topic is available here. In the present section I shall only discuss the constructional variations observed in the excavations, keeping the chronological implications for the appropriate chapter. Among the 40 *legible* central parts (listed in table 4-8) in this settlement, 10 show pure Y-configurations, as shown in their plans (with H 13 perhaps the most beautiful). The evolutionary next 'type' brings degeneration of the central Y ("dY"), and one of the peculiarities of the Janskamperveld settlement is the variability among these constructions. Thus, there are Y's that are "leaning" toward the front (e.g., H 57) counter to any regularity known from elsewhere; there are really exemplary degenerates (H 53 providing a fine and H 01 an extreme example). There are also degenerates with incipient additional three-post-rows, not only at the rear branch of the Y setting as it should be (such as H 09; "Y.i"), but also on the front (like H 35; "i.Y"). There is even one house where these supplementary rows[8] or foetal DPRs occur on both sides (H 45; "i.Y.i"). The J configuration – only discernable in complete plans – seems present in one house only (if so at all; the plan is not very clear, but see H 42). The Regular (slightly oblique to perpendicular) three-post-rows in the central parts of the houses are also fairly well represented on this site (the best examples are H 19, H56, and H 65).

config	house nos	n
Y	03,07,12,13,22,24,38,49,54,59	10
dY	01,05,28,53,57,58	6
dYi	09,17,31,48	4
iY, Yi	02,35	2
iYi	45	1
J	42	1
R*	04,06,08,10,11,14,15,18,19,25,26,27,40,41,62,65	16

table 4-8 listing of the houses with various central post configurations; n = 41
unrecognisable configurations omitted

4.4 On the structuration of house space

Then there is the issue of the manifest partition of Bandkeramik houses: their subdivision is quite pronounced in the plans, most of the time. Yet we have no idea how the houses were really subdivided internally: sometimes we get a glimpse of a wall that had once been erected somewhere *within* one of the archaeologically recognizable parts front, centre and rear (on the Janskamperveld the plans of houses 08 and 18 provide examples of cross walls made of boards), but wattle or wattle-and-daub walls evade us totally, as do separations constructed of hides or cloth. Coudart has dealt extensively with the internal organization of space in LBK houses, and her distinction of various types of separations is quite useful, if only to draw attention to possible different manifestations of a similar structure. Essentially, every DPR is considered a *separation* dividing the house's internal space . Their different characteristics give rise to several subclasses, most important those situated between the house's three parts. Even so, not all subclasses recognized by her can be substantiated in the Janskamperveld settlement. Among those that are present, so-called corridors are most prominent, and they are characteristic for the older phases of the Northwestern Bandkeramik. Decades ago Modderman defined them as follows: "In most central parts a relatively small part can be outlined on their north-western [rear] side" (Modderman 1970: 105). Coudart incorporates corridors in the definition of the class of separations between the different house parts. To her, corridors (French *couloirs*) are to be defined as "separations consisting of two close DPRs; the criterion of distance between the rows is clearly to be seen in relation to those between the other DPRs in the house". The other separations distinguished by Coudart are: separations coupled to the Y-configuration, emphasised separations (i.e., marked by strong posts), implied ones, and absent separations (Coudart 1998, 28-29). Corridors are most frequent between the central and the rear parts, though they occasionally also occur between the front and central parts. Yet there are houses where corridors do not appear at all, as in a small number of cases in the Janskamperveld settlement. Table 4-9 lists the frequencies with which the different divisionary features occur at this site. Although the number of separations to the front and the rear seem to be each other's opposite, this is only virtually so: for instance, five out of six houses with a corridor separation between front and centre parts also have corridors between the centre and the rear – the sixth

separation	front	rear
corridor	6(5)	42(35)
emphasised	40(23)	7(3)
none	2(1)	0(–)
indeterminate	21(1)	20(–)

table 4-9 quantified distribution of border features on both ends of central part
all houses ($w \geq 3$ only)

house could not be evaluated. Four out of seven emphasized separations (consisting of heavy posts, either separating central and front parts, or the central part from the outside world in the case of houses with one or two sections) between rear and middle are accompanied by similar constructions between central and front part. Even the unrecognizable separations front and rear are not often found in the same houses: there are only six houses that defy a reasonable guess at both these two major separations. Counting only those 38 houses where the separations can be observed under fair to good conditions ($w \geq 3$), four have corridors on both ends of their central parts (HH 4, 7, 24, 39), 23 have emphasized separations at the front of the middle parts and corridors at the rear (e.g., HH 3, 9; 12, 49; 27, 41), and only two have emphasized separations fore and aft (HH 26, 40). Probably only type 1a houses have corridors at both ends of their central parts, although the evidence for HH 35 and 36 is opaque (after all, $w = 2$ in both of the cases) being not fully legible in the excavation; H 04 (a 1b type) may be the exception (it would not be alone in the Dutch LBK: e.g., at Elsloo, HH 88 and 89, at Stein maybe H 33; Modderman 1970). However that may be, it is clear from this table that when entering a house in the Janskamperveld settlement the (for us visible) first separation encountered is generally less heavily executed with its single row of posts than is the second, double row border or threshold: there is a suggestion of privacy increasing with the depth of the house (as also observed by Coudart 1998, 105) with the apparent exception of those weird 1a types which have double rows at both ends of their central parts suggestive of even more privacy (or secrecy?).

One more general idea about the formal properties of Bandkeramik houses is the possible if not probable concordance of the number of bays (*travées*, Coudart 1998) into which the internal space is subdivided and the total length of the house, a measure of the structuration of the roofed space. As 'defined' by Coudart: "The DPRs divide the length of the house longitudinally in several intervals or bays. The distribution of these DPRs structures the space …" (Coudart 1998, 27). There are several reasons for preferring the count of bays over the number of three-post-rows or DPRs: people live in rooms, rather than between real or fictitious walls or partitions, bays are probably more representative of place than of space. Whether or not to count the corridor DPRs separately thus becomes a moot point as corridors are too narrow to afford true living space or place. Similarly, the bay idea evades the problems posed by the count of Y- and especially of "degenerate Y-configurations" of posts. And also the question of whether or not to count the frequently occurring double posts in the front part of the house as one or two DPR rows is easily bypassed as irrelevant.

bays	F part	C part	R part	full house
–	10	3	6	1
0	28	–	10	–
1	7	–	17	0
2	16	40	25	12
3	8	24	10	9
4		2	1	10
5				11
6	–	–	–	10
7				12
8				2

table 4-10 the number of bays per part and per house

As table 4-10 shows, in this settlement a general preference for two-bay spaces is apparent: for the front, the middle, as well as the rear parts of the houses, the twin bay arrangement is dominant, even for the central parts which are generally larger than the other parts (Von Brandt 1988, 180, 219). It is interesting to note that the central parts of the Janskamperveld houses always consist of two or more bays, never of one single *travée*. For the houses in their entirety, the double or four-bay (2 + 2) arrangements occur most frequently. However, 'predominance' does not imply 'exclusivity', and the frequency of smaller and larger sets per part is far from negligible, as are the larger combinations.

Bays being also extents of space, it seems logical to look for a relationship between the number of bays per house and the length of the houses (as noted above, surface area is very closely tied to the length of the houses on the Janskamperveld, as their widths do not differ much), a relationship easier to establish and also sharper or more discriminating than the simple mono-, bi- and tripartite classification. For those 28 houses with $w(length) \geq 3$, a regression equation of the number of bays on house length can be calculated as: $n(bays) = 0.28 \times Length + 0.55$ – which means that in a house of for instance a length of 20 metres, $0.28 \times 20 + 0.55 \approx 6$ bays may be expected. As it turns out, this equation "explains" (statistically that is) 67% of the variation in the relationship between these two variables. The standard deviation of the error in the outcome is 1.16 bays, which means that deviances of 1.2 bays or less from the calculated estimate may be expected in 68% of the cases (i.e., the normal assumption). Through the regression equation, the expected number of bays for every house in the excavation was computed[9], and compared with the number of bays based on field observations (or estimates, or guesses in the case of low quality observations). It turned out that HH 04, 31, 67 and 68 deviated by 2.4 bays from the expectation, and H 60 was even four bays short. As is clear from the plan of this latter house, the estimate of its length ($w(l) = 0$) is nothing but a guess, as is the estimate of the number of bays. Similar problems exist with H 04 ($w(l) = 1$). For the other houses, the measurements of their lengths have a better foundation ($w(l) \geq 3$), and therefore I prefer the calculated estimates of bays (H 31, 6 bays; H 67, 5 bays; H 68, 6 bays) to the loose guesses (8 bays, for all three houses in the main table.

The lengths of the bays are rather similar in the front and rear parts (2.1 and 2.4 metres on average, respectively), but considerably larger in the central part (3.2 metres) because of the presence of 23 Y-configurations (i.e., partially twinned cross rows; see above) in the houses of this settlement. Table 4-11 shows that the bays in the central parts of the houses with a more regular arrangement of posts (labelled 'Rx' in the table) with 3.1 metres on average are longer than those in the rear and front parts. Also, although averages and spreads are very much the same for the 28 houses where the central configuration could not be established in the excavation (row 'x') and those in the recognizable houses (row 'overall'), it turns out that almost all of them show deviations in the estimated number of bays of over one standard deviation from the calculated / expected number as derived from the regression equation above. As the deviations are in both directions (estimates either too large or too small) and their number is relatively large, the regression equations are virtually impervious to the exclusion or inclusion of the indeterminate cases.

4.5 Post holes and post ghosts

The relicts of the 69 houses in the excavation (63 were recognized in the field) are combinations of 1549 post holes and 134 wall trenches, of which 1210 have been cut and drawn to profile; 877 showed the ghosts of the former posts. All the ghosts had a cylindrical form, their bases were either flat or slightly rounded; none showed sharpening of the point or cleavage of the trunk. The recorded depths of the post holes have not been reduced to the original surface, although it may be assumed that 50-120 centimetres have to be added to these depths (see the discussion of fig. 4-3). Consequently, even for the single houses conclusions regarding relative depths are hazardous; see, e.g., the excavations at Bylany, where these measures were indeed established, and the slipping of the depths in relation to both the old surface and present datum graphically presented (Pavlů 2000, 199-214). Thus, although on the Janskamperveld *on average* the inner posts of the houses are founded deeper than the wall posts (2.8 dms over 619 posts *vs.* 1.7 dms for 591 wall posts) – which concurs with the general ideas about Older Period LBK houses – there are also cases where the reverse can be observed – as generally in Younger LBK houses. Also, the 1a type houses are founded deeper than the other tripartite and bipartite ones, and these again are dug in deeper than the monopartite houses. In the excavation, average depths were registered of 5.5 to 6.5 dms (type 1a), 3.0 to 4.0 dms (types 1b, 1c, 2), and 1.5 to 3.5 dms (type 3). Central part DPRs are founded deeper than the posts in the front and rear parts; averaging respectively 2.9, 2.6, and 2.5 dms, while especially the posts of the Y configurations show greater depths (averaging 3.4 dms below the plane). Front and rear façades are comparatively superficially set into the soil, with average depths of 1.8 and 1.9 dms (but note again that there is no correction for the depth of the excavation plane below the original surface), although in the case of the 1a houses especially the rear wall trench is much deeper (up to 4.0 to 13.0 dms). These latter houses also stand out because their wall trenches are deeper by several decimetres than the tips of the wall posts, whereas in the other houses with wall trenches (both tri- and bipartite) the post holes in the wall trenches are deeper than the ditches. According to Von Brandt, the DPRs in the front and the separation between rear and central part of the houses are the first to be raised during construction – as shown by the deeper and cylindrical and non-stepped (read: not corrected by the builders) profile of the post *holes* (Von Brandt 1988, 228, 224) – on the Janskamperveld the relative number of stepped holes (read: corrected) in these or any of the other DPRs is very similar to those in all of the constructions together (11.3 *vs.* 13%). In other words: no confirmation can be found for that hypothesis. Neither can Modderman's generalization be confirmed that the separation of rear and central parts is marked by the deepest founded DPR – here the average is 2.7 dms which ranks fifth among the depths of DPRs, behind all three-post-rows in the central part (Modderman 1970, 105).

config	length C part		no of bays	length bay		no of houses
	span	avge		span	avge	
Y	6.2-10.1	8.4	2.6	2.1-5.1	3.4	10
degen Y	6.3-12.2	8.3	2.6	2.3-6.1	3.3	13
J	7.1	7.1	4	1.8	1.8	1
Rx	4.0-9.3	6.6	2.3	1.3-4.7	3.1	17
x	5.4-12.1	7.8	2.2	2.1-6.1	3.8	28
overall		7.7	2.4		3.4	69

table 4-11 configuration of central cross rows *vs.* size and number of bays

Finally, during the excavation reddish burnt lumps of clay, supposedly deriving from wattle-and-daub walls or raised floor constructions, were frequently found in the post holes of the 1a type houses, suggestive of a fiery end to at least some of them. At the end of the excavation in 28 houses some or several reddish traces had been noted, derived from (hypothetical but probable) cooking hearths and/or (hypothetical but in this frequency not so likely) house fires. The problem is how to decide between the two (and possible alternatives), and on a suggestion by Rudolph Kuper[10] (Kuper *et al.* 1973, 44), the solution was sought in the division of the occurrences of baked clay lumps in post *holes* and in post *ghosts*. The fillings of the post holes will have been amassed during construction in the near vicinity of the hole, when and where controlled fires may have been lit for every conceivable household or construction purpose, so there is no need to assume something catastrophic behind the red lumps. The fillings of the ghosts, however, derive from the end of the house's life, when either the posts were torn out or rotted away and subsequently hearth leftovers may have tumbled into the holes, or the houses were consumed by fire and lumps of burnt daub and carbonized particles fell into the holes. To choose between these two possibilities seems impossible; yet 10 houses have red burnt clay lumps in their post ghosts, among which all five 1a houses; again, we'll have to bear in mind that the original surface lay more than 5 dms higher and the ghost holes were that much deeper than in the excavation. Also, the relative number of post ghosts with red traces is much larger in 1a type houses than in the other suspect houses: 17 to 70%, with an average of 50% or half of the ghosts; *versus* less than 10% elsewhere. An explanation can be sought in the all-wood construction of the former versus the substantial amount of clay in the latter buildings. If the burnt clay in the post holes were added, the picture remains the same: 1a type houses have far more of it than the other houses. It is not the first time that a fire has been suggested for the end of 1a houses: the only two type 1a houses in Sittard-Thien Bunder (H 03, and H 49) have also convincing fire damage (Modderman 1959, 48-49; Van Wijk 2001, 32, 81), H 05 in Langweiler 9 as well as H 21 in Langweiler 2 are of the same type, and also have fired clay in the post holes, while some houses of other types also show traces of fire (Kuper *et al.* 1977, Kuper *et al.* 1973, 44). The frequent association of type 1a houses with fire (as against more haphazard traces of burning of other houses) is remarkable at least. If the depth at which LBK house plans are observed in excavations is taken into account, the high incidence of fire in type 1a houses leads to the assumption that *all* type 1a houses were intentionally burnt down for one reason or another, for that depth may go a long way to explain the absence of such traces in cases such as (the 1a type) H 17 in Langweiler 9 (Kuper 1977). On the other hand the non-1a figures suggest one accidental house-fire per 200 or 250 house-years on the Janskamperveld, which translates to a destructive fire (with lightning, or hearth as causes) in this village once every 8 to 10 years – not an outrageous frequency, so it seems.

4.6 *Längsgruben* or side pits, and gutters

Side pits and gutters are discussed at fuller length in the chapter on features; here a few highlights will be presented. As regards side pits, most authors consider these integral to Bandkeramik houses (*"… ein Gebäude mit den angrenzenden Gruben als Einheit [zu] verstehen …"* Modderman 1970, 35). On the Janskamperveld 36 houses show oblong clay pits along both sides and another 14 may be added if one of the pits is hidden below the bank of the excavation while the opposite side of the house clearly exhibits this feature (table 4-12). Six houses seem to have one side pit only (HH 09, 22, 23, 30, 39, 40), while this cannot be unequivocally established for H 50. Furthermore, nine houses are not accompanied by side pits (HH 15, 20, 27, 46, 55, 63, 67, 68, 69) and three houses doubtfully so (HH 28, 54, 59). These twelve houses without apparent side pits all have *w*-indexes of 2 or less (except H 27, of which the possible left side pit may be hidden in an unexcavated street bank), and thus may be instances of the fig. 4-3e/f situation. Consequently, the absence of side pits is not conclusive. As regards H 28, its left side pit (viewed from the front) is obscured by close-by HH 26 and 27 (a right hand pit seems present); H 54 has complexes of pits on both sides into which its possible side pits may have merged; and H 59 shows a side pit on its left side in about the right place, but with an unusual plan (a right hand clay pit seems present). In the case of H 19 (*w* = 2) also some doubt remains: the suspected side pits seem to be situated on either side of where the front façade is supposed to have been, which is unusual; yet the almost perfect symmetry around this house's long axis is an argument for accepting them as (remnants of) side pits and rather questioning the position of the front.

A look at the distribution of the side trenches over the house types (table 4-12) shows nothing unexpected: all

	FCR	CR	R	
two side pits	18	11	7	36
possibly two pits	8	3	3	14
only one side pit	4	1	1	6
possibly one pit	–	–	1	1
no side pits	3	3	3	9
possibly no pits	2	1	0	3
	35	19	15	69

table 4-12: side trenches and the partition of houses

houses occur (many times) with and (sometimes) without side pits. Some comments seem apposite.

There are no serious doubts that the side pits (in German *Längsgruben*) started as quarries for the loam or daub that went into the walls and raised floors (e.g., Modderman 1988, 92), and so the *side* position of these trenches is understandable as far as the side walls have been daubed. Consider also those side walls where the rear part has been executed in boards, e.g., HH 03 and 13. However, why is it that neither front nor rear façades are ever accompanied by *cross* trenches? Also, the daub required for the inner walls (which can be found in quite unexpected places; e.g., HH 08, 18 show cross trenches for walls) must have been dug from aside the houses, as inside pits would be most uncomfortable in my opinion. Perhaps the front and rear gables were closed with hides, horizontal boards, or left open, or plastered with daub from the side trenches to leave the space in front of the entrance free of obstacles. Why the backyard was also kept level, escapes me as I know of no reconstruction with an entrance in the rear façade; nor do I understand why the type 1a houses with boards all around are always accompanied by considerable side pits – unless they were internally subdivided into numerous small cubicles or – as seems more likely – had a raised floor built of clay.

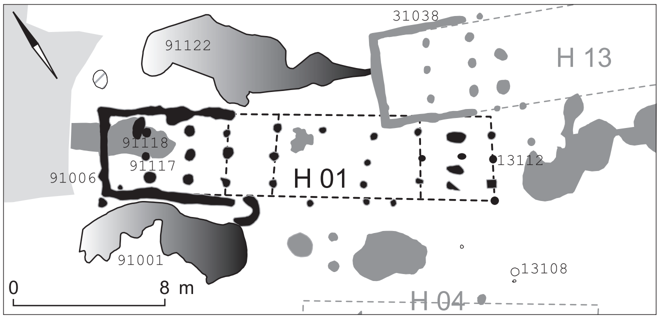
On closer inspection an interesting speciality becomes visible, as inside several houses also remnants of side trenches (German *Außengräben*) appear, situated between the wall posts and the side pits. They have been described as long narrow trenches, generally dug deeper than all other *'hausdefinierenden Befunde'* (house indicators); situated next to the front and central parts, never near the rear parts. Often, these so-called splash gutters are connected to the side pits, yet hardly ever contain finds, which would suggest different functions of the two features. The assumed function is summed by the name they went by previously: *Traufgräben* ('gutters'): it is assumed that they served to catch rain water gushing from the roof of the house and to prevent splashing against the daubed walls – in fact they occur only along wattle-and-daub walls (Lüning 1988). Houses with this peculiarity include: HH 02, 13, 16, 31, 35, and 57. According to the literature these *Außengräben* are restricted in time to the Earliest and First Flomborn phases (Cladders/Stäuble 2003). The houses with this feature in the Janskamperveld village all have Y- or degenerate Y configurations in their central parts, either confirming the chronologically restricted occurrence or underscoring the relatively early date of this village. A few houses in other Bandkeramik settlements in the Netherlands have also been recorded sharing this feature; these are from Elsloo (H 59; Modderman 1970), Geleen-De Kluis (H 1; Waterbolk 1959), and Sittard (H 1; Modderman 1959).

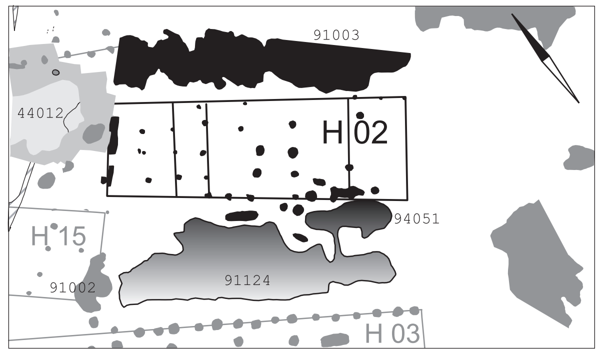
4.7 Summary

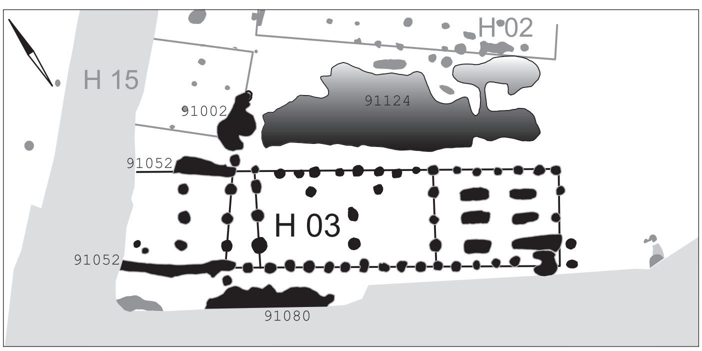
Approximately 61% of the surface area of the settlement – as defined by the extension of surface finds in the field – has been investigated. The southern rim, a small area in the north and the eastside have only partially been excavated. Only seven out of 69 houses are fully observable, another nine houses provide a glimpse of their previous existence only, and the other houses are somewhere in between regarding their completeness. Put another way, the quality of the observations on the houses is more or less normally distributed around bad to reasonable. Central features (the corridors, the middle part itself with the roof support posts) are better recognizable than are the front and rear parts. It is estimated that less than 10% of the variation in house lengths or surface areas is attributable to bad observational conditions (though other variables are much more affected), whereas 76% of this same variation can be attributed to the composition of the houses in terms of the number of bays they were divided into. By itself the number of bays or living places per house will have been governed by social considerations and imperatives.

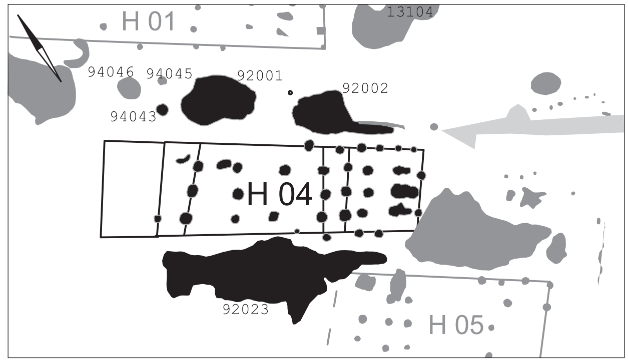
The Bandkeramik houses on the Janskamperveld are roughly orientated towards Flombornia, for the first settlers the area that they left behind, for later generations the Land of the Ancestors. As far as can be seen, house widths do not differ very much, the most variable dimension is house length with a range from 5.7 to 31.2 metres. Perhaps house wall material is another important aspect of these buildings: all types of houses have been constructed entirely from wattle-and-daub walls set between posts, whereas some of the larger houses had walls made of wooden boards in their rear parts, which were also their most private areas. And the five most special houses in the settlement (largest and most complex plans, heaviest founded, etc.) even have wooden boards on all sides. In addition, as if to further emphasize their specialty each of the specials seems to have been burnt down.

Many of the houses on the Janskamperveld are internally divided up by 'separations' between their frontal, central and rear parts; the separations consist either of twin post rows (so-called corridors), or single, rather emphasized DPRs. Houses of type 1a have corridors front and rear; the other houses show mainly corridors on the rear, as against 'fat' DPRs on the front side (types 1b, 1c, 2, and 3); only three (possibly four) houses do not have corridors in their rear, and this occurs only with the type 3 or single compartment houses. The classification of the partition of the individual houses into front, central, and rear parts has suffered from bad visibility conditions. Arithmetically correcting for this, the 69 houses excavated originally probably constituted 38-41 three-part houses (FCR), 13-16 two-part houses (CR), and about 15 single part spaces (C); the uncertainties arise

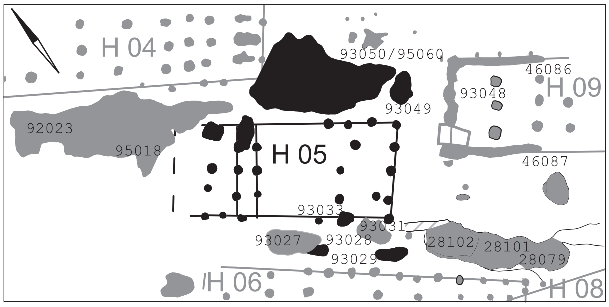


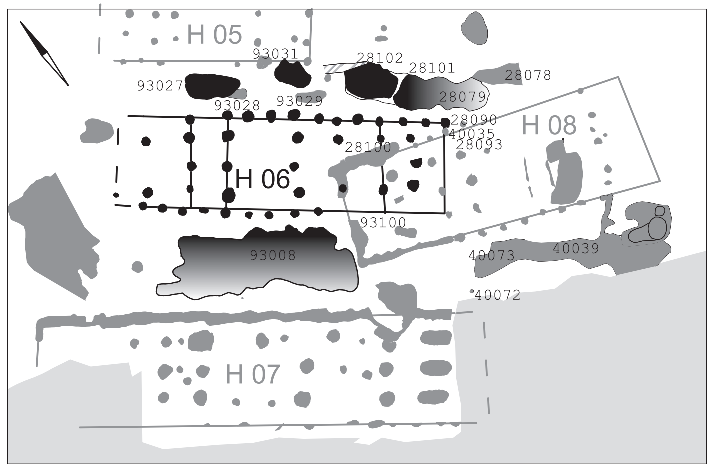


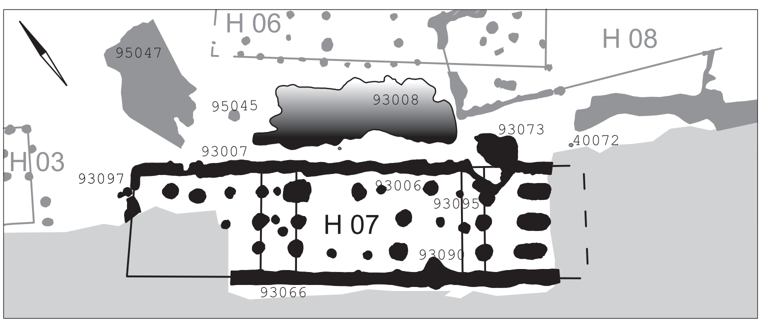


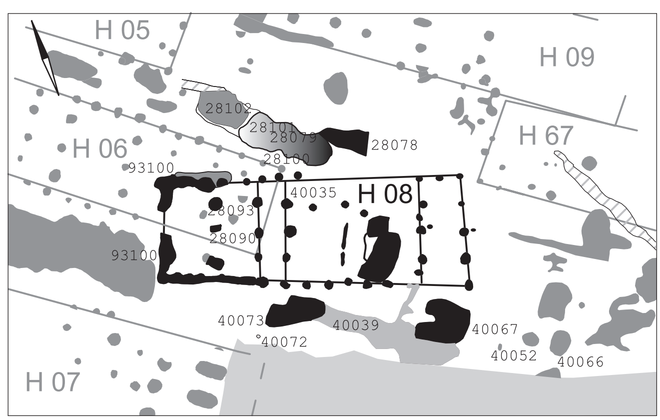


figs. 4-(6-9) plans of individual houses drawn to the same scale

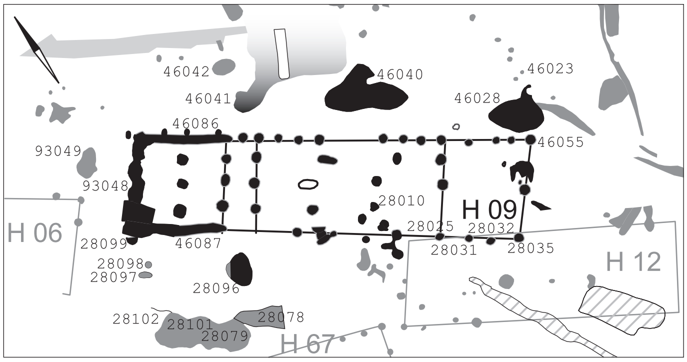


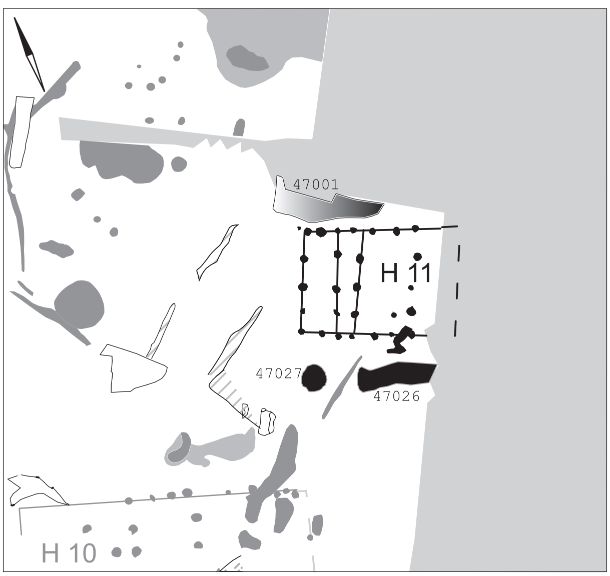


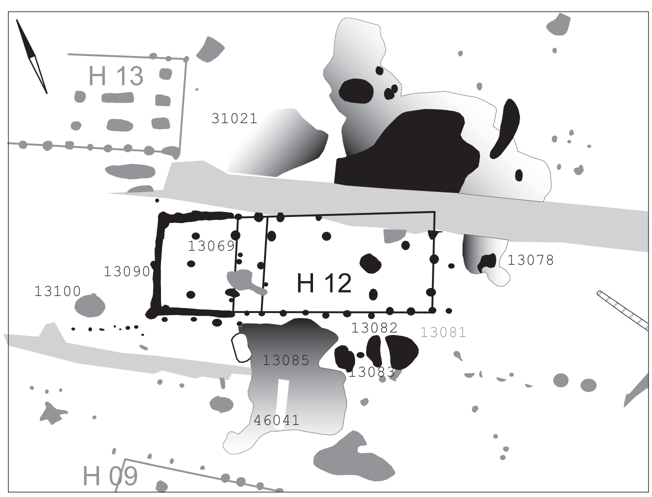




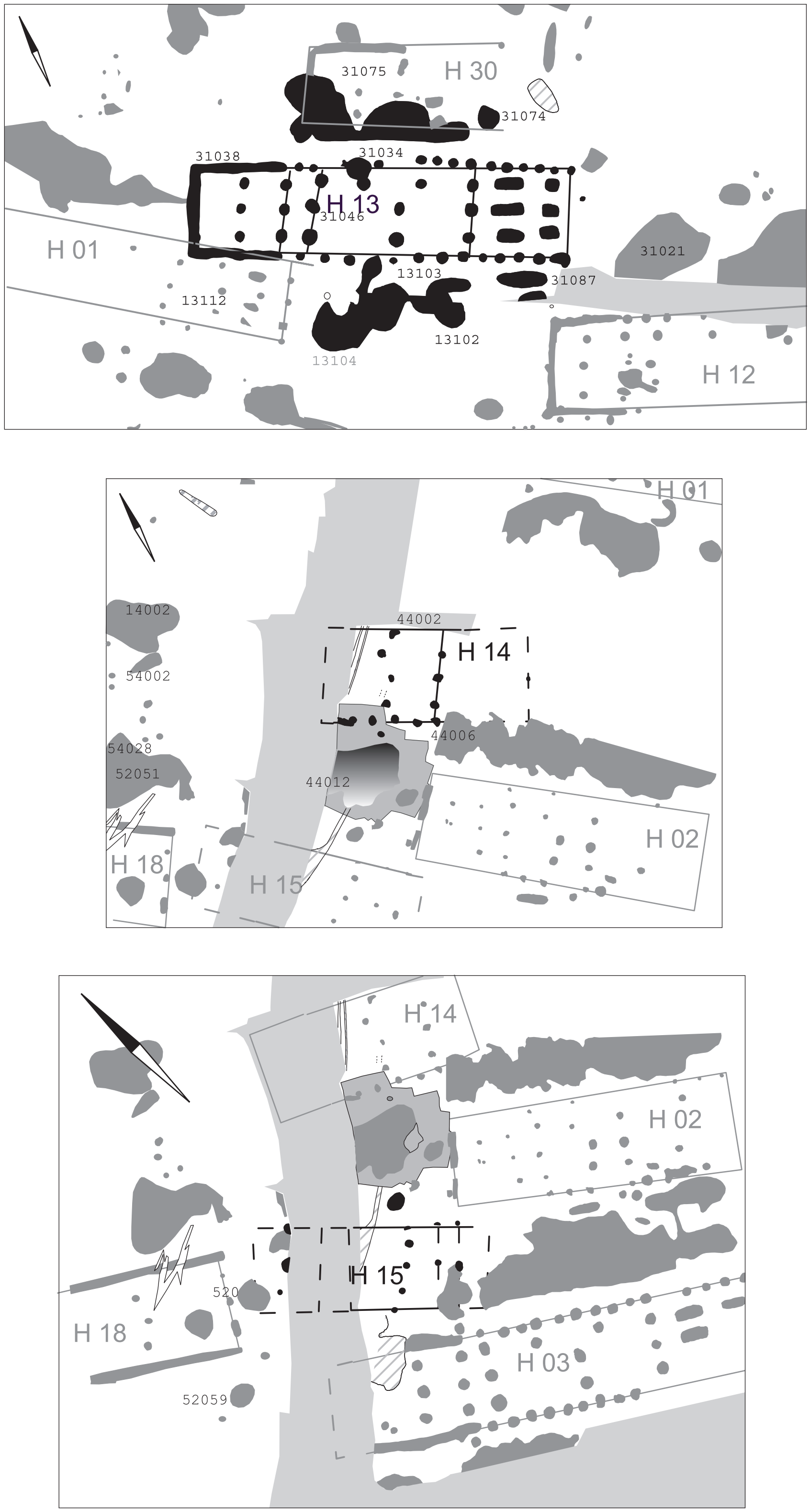
figs. 4-(10-13) plans of individual houses drawn to the same scale



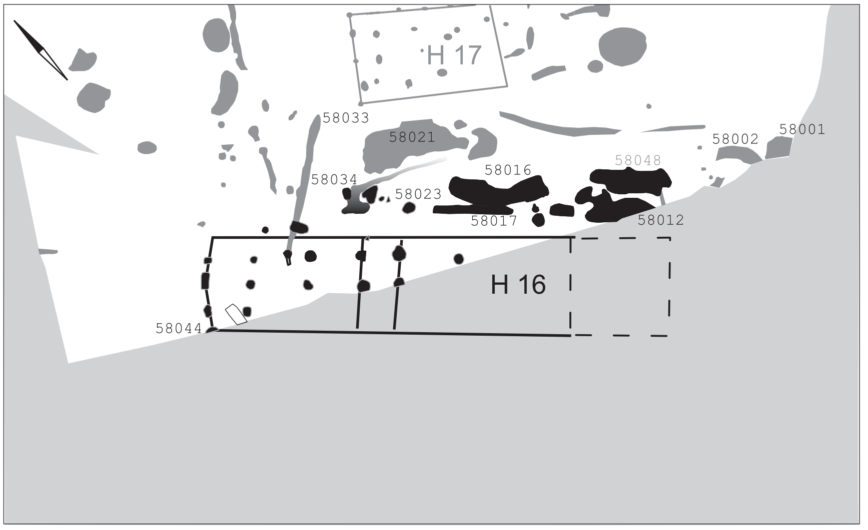


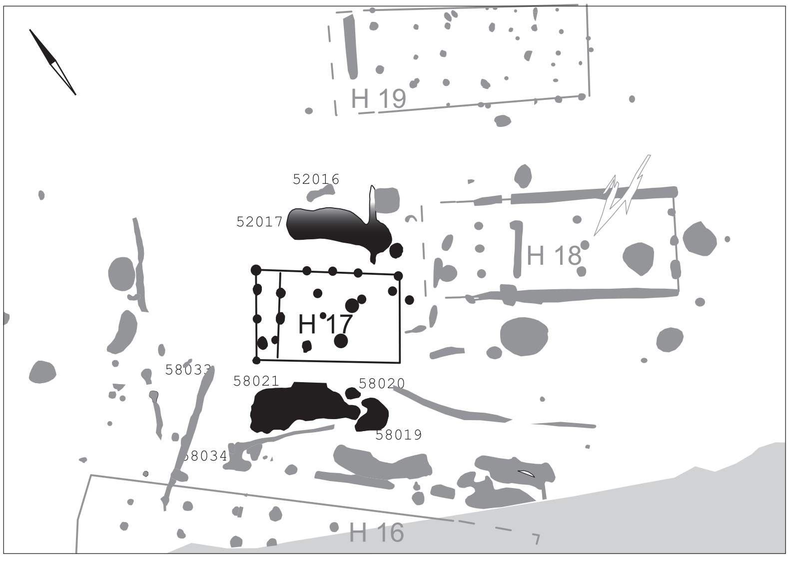


figs. 4-(14-17) plans of individual houses drawn to the same scale



figs. 4-(18-20) plans of individual houses drawn to the same scale





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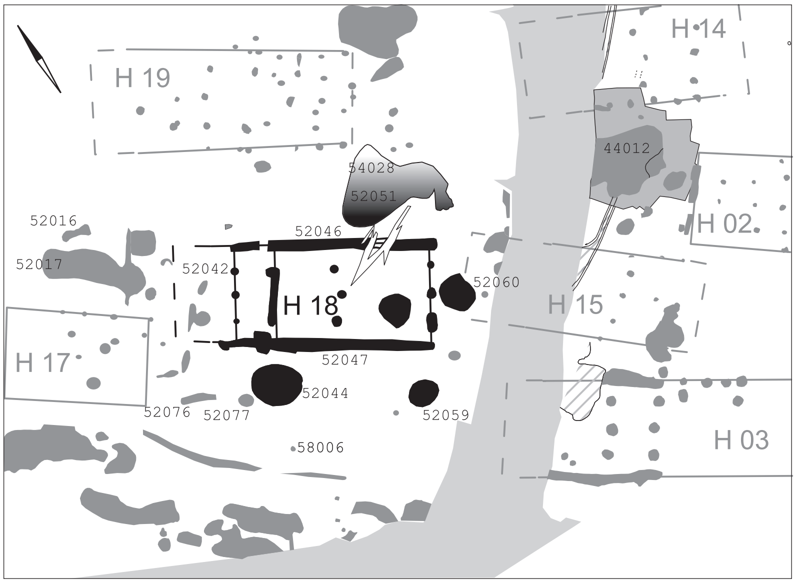

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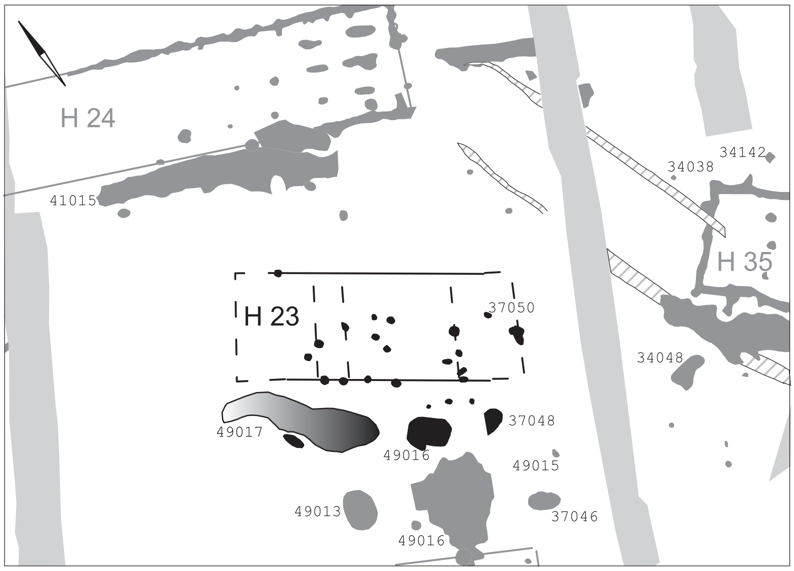
figs. 4-(25-27) plans of individual houses drawn to the same scale



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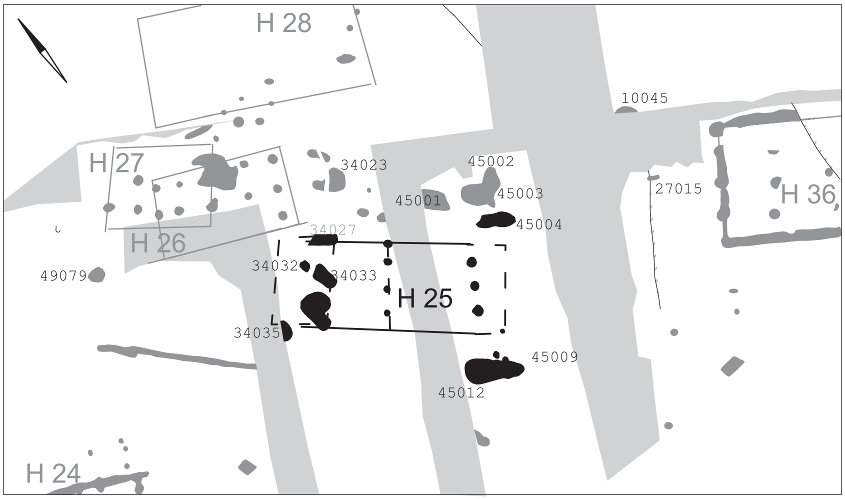

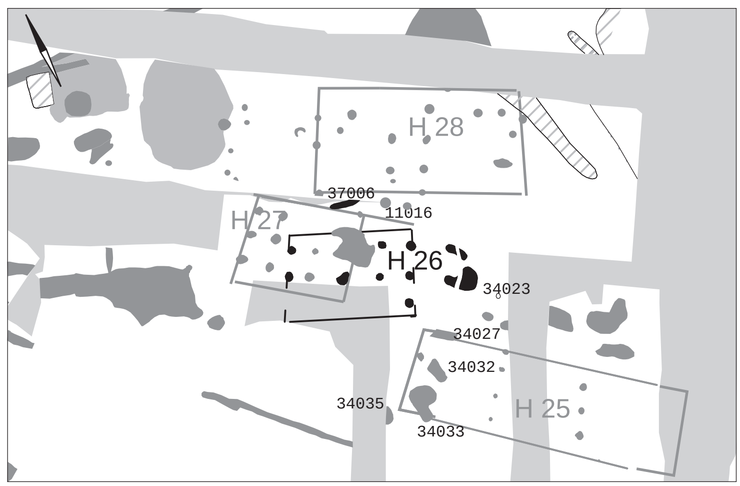

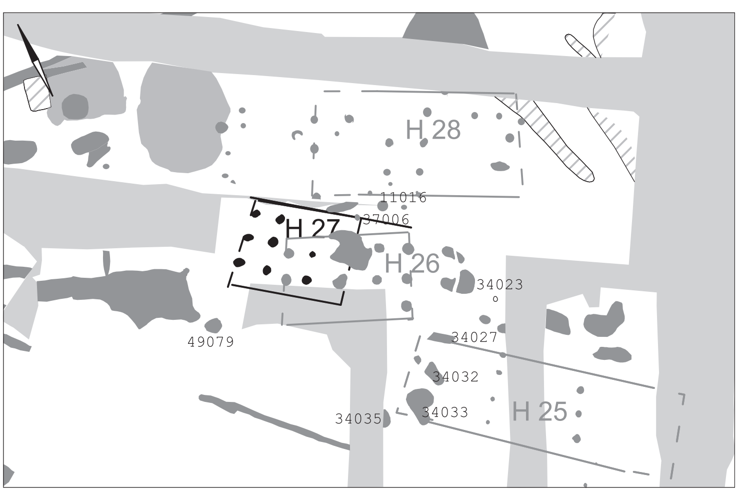

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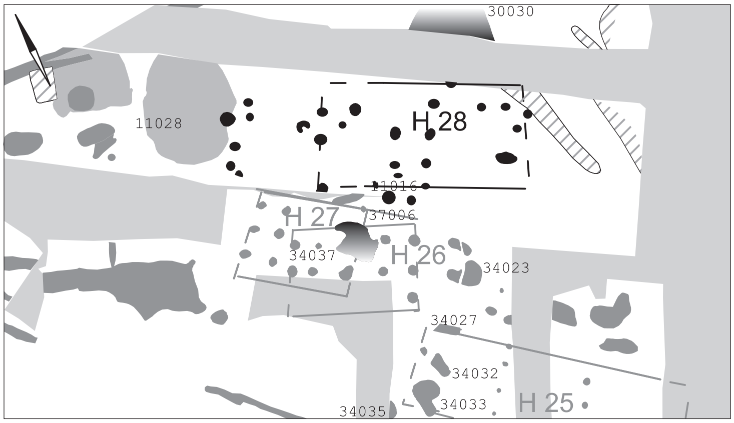

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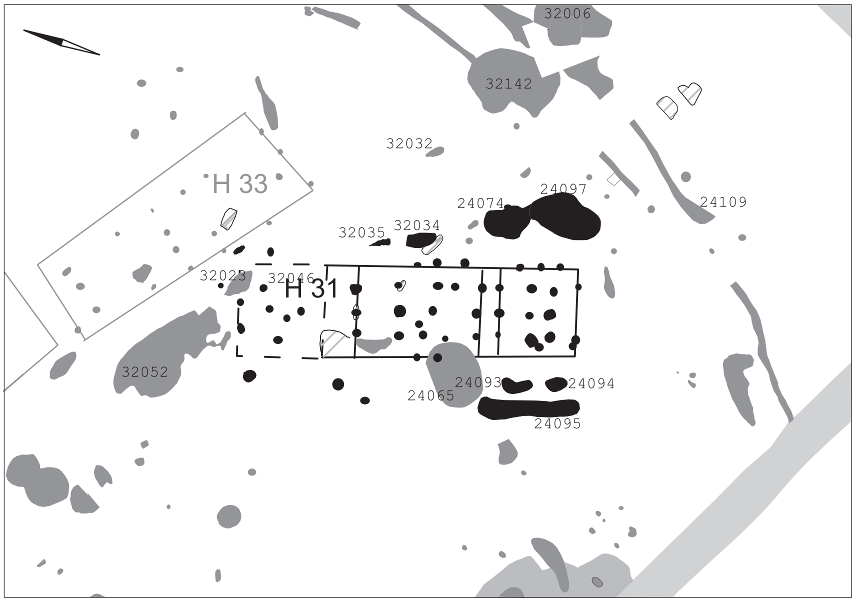

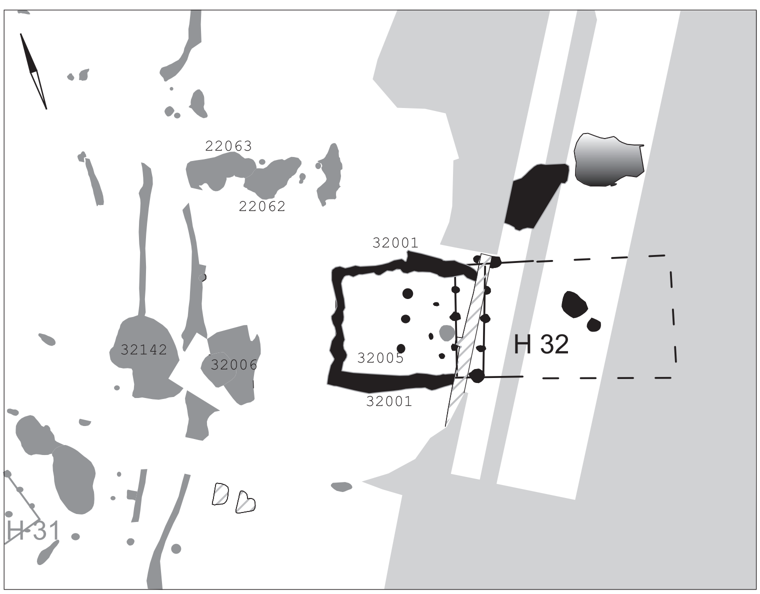

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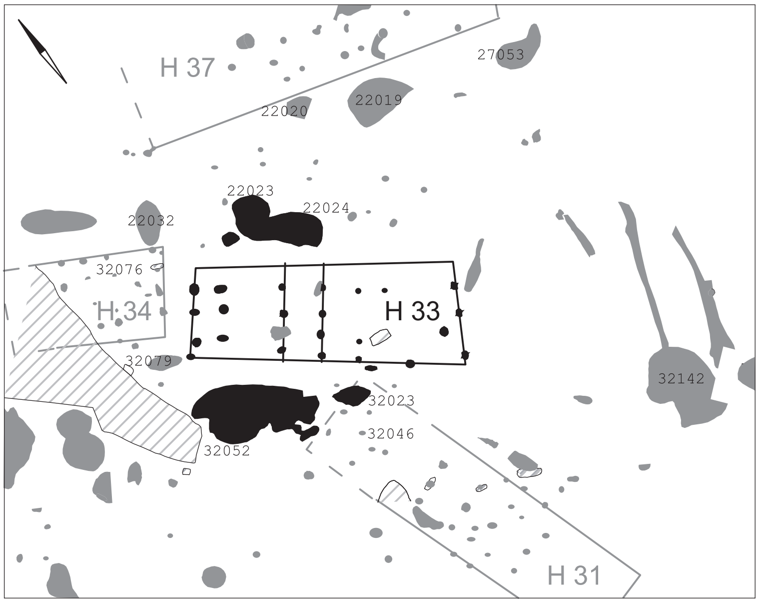

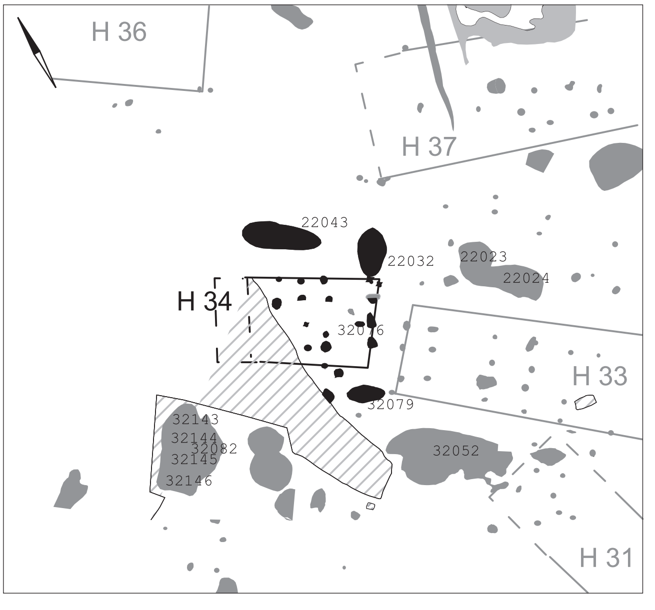

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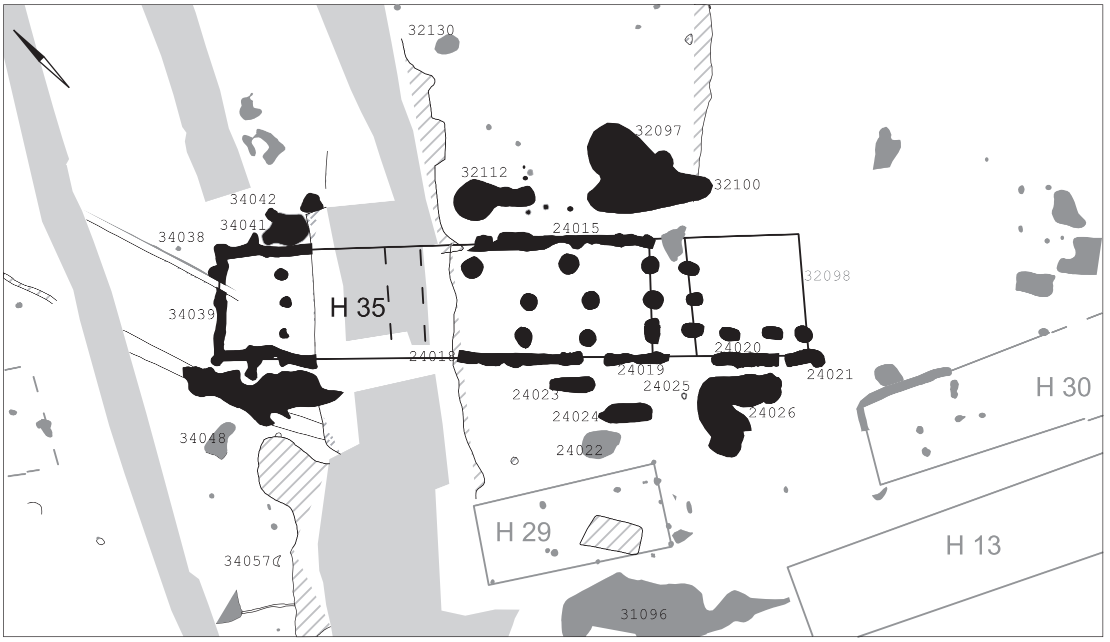

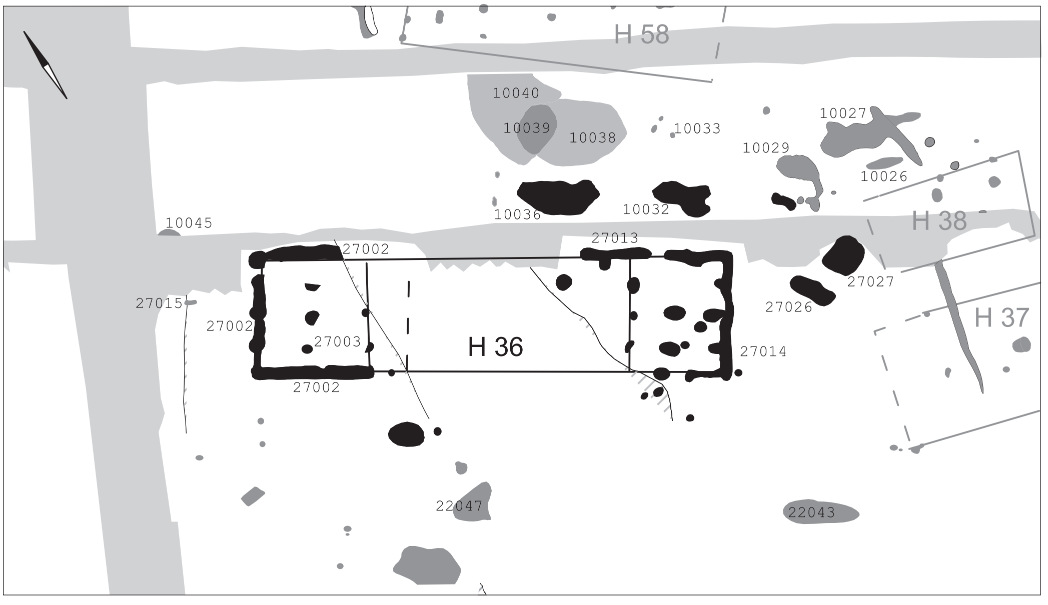

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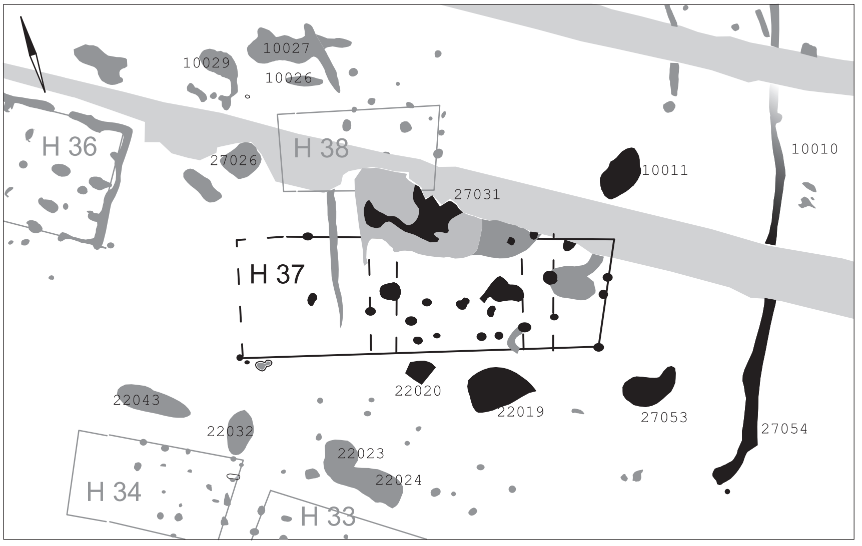
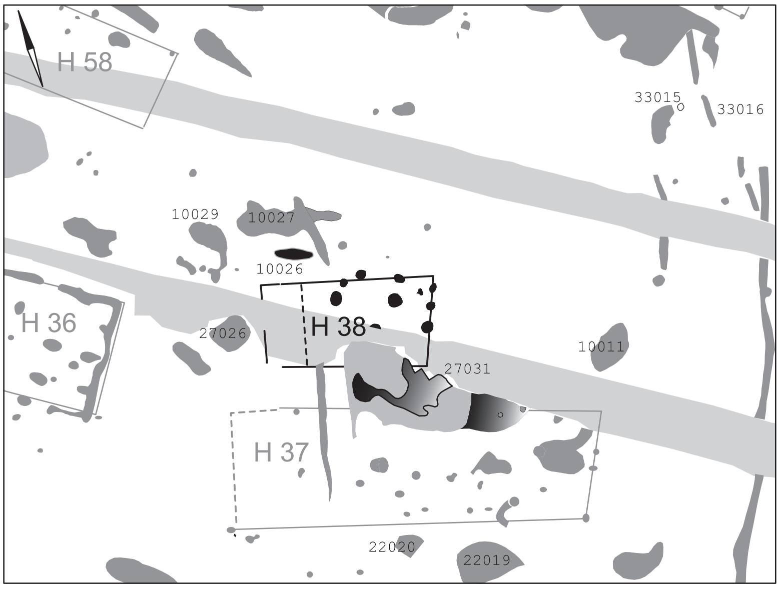
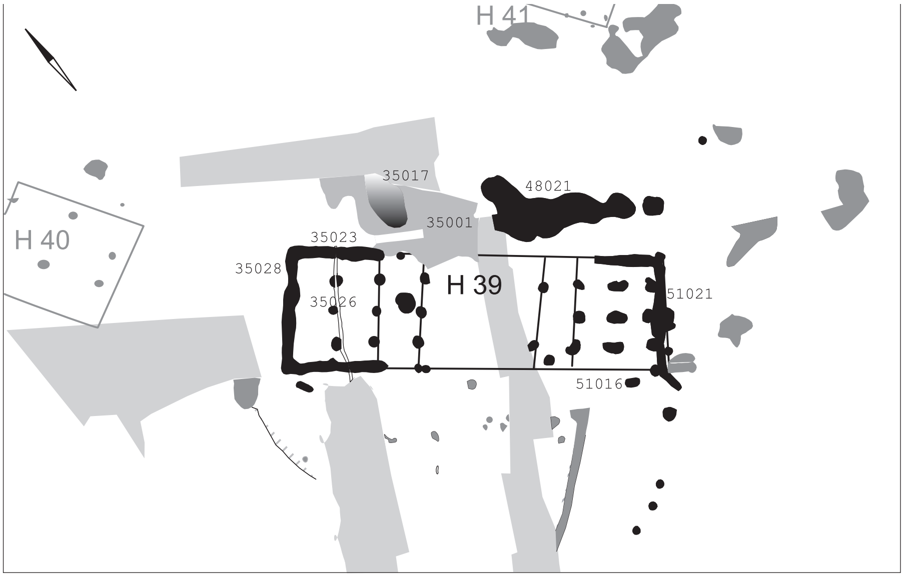
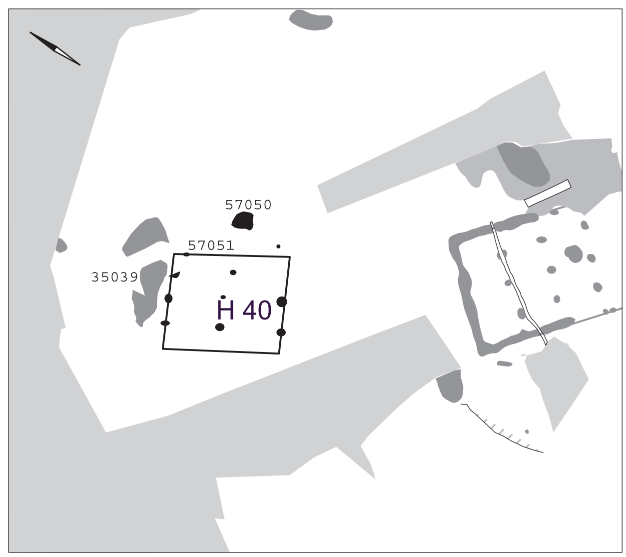




figs. 4-(42-43) plans of individual houses drawn to the same scale





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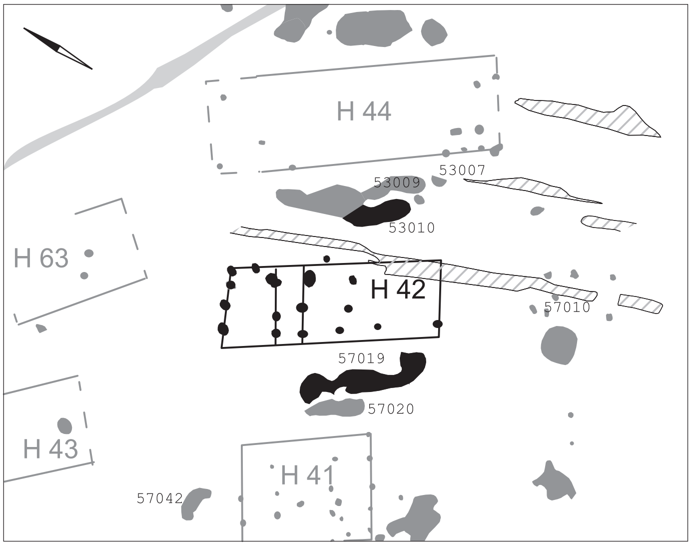
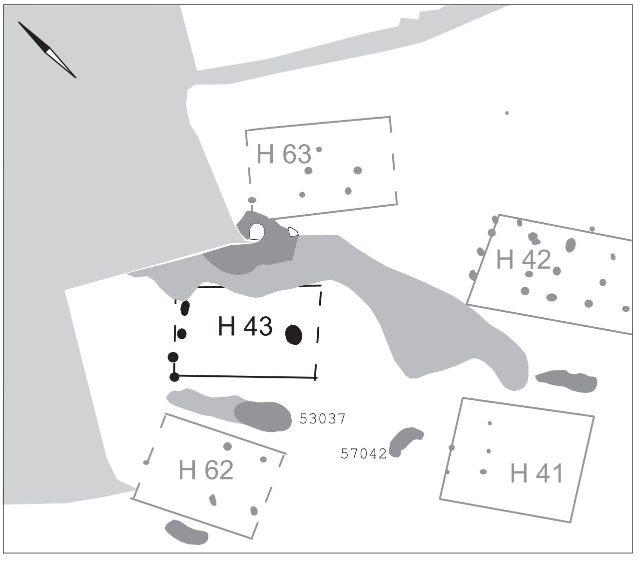
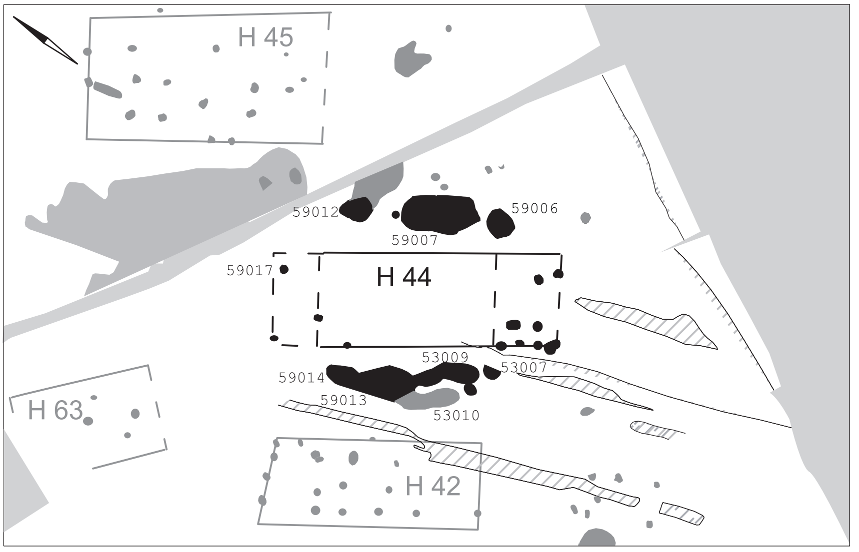
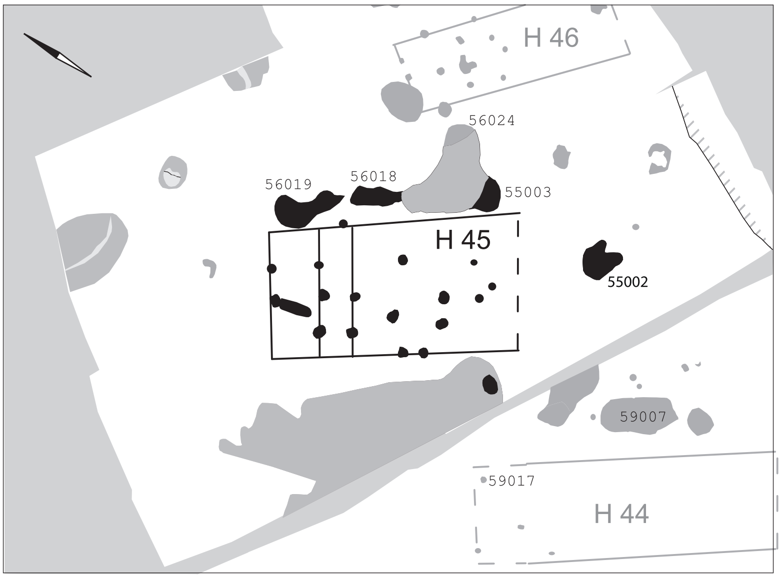


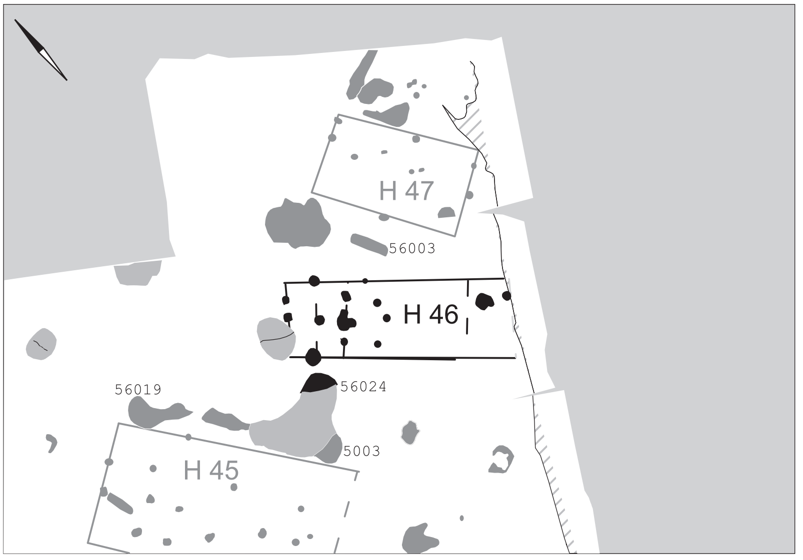


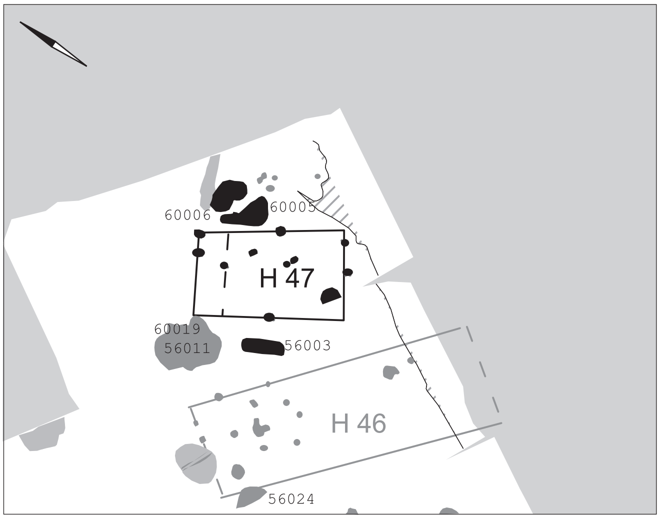
figs. 4-(47-48) plans of individual houses drawn to the same scale



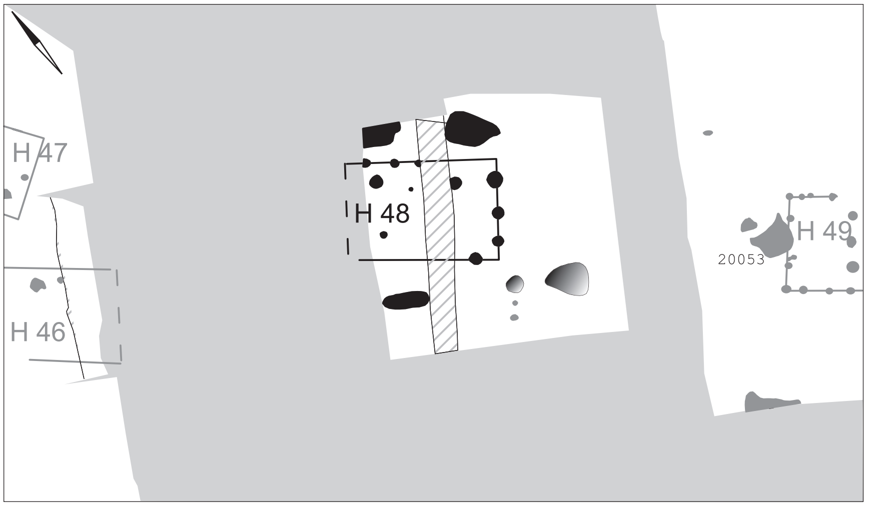


figs. 4-(49-50) plans of individual houses drawn to the same scale

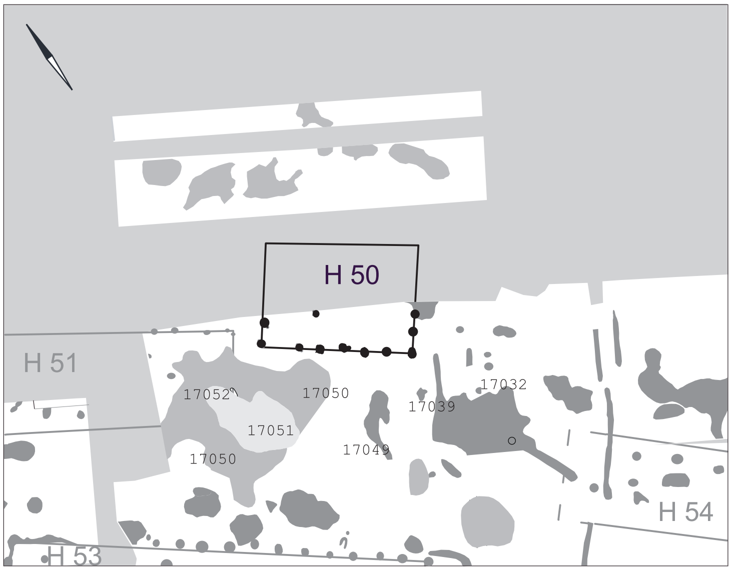


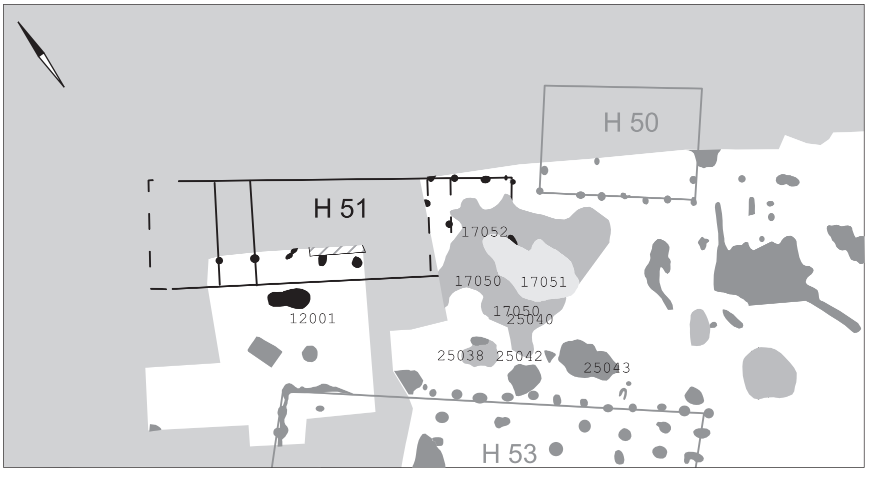


figs. 4-(51-52) plans of individual houses drawn to the same scale

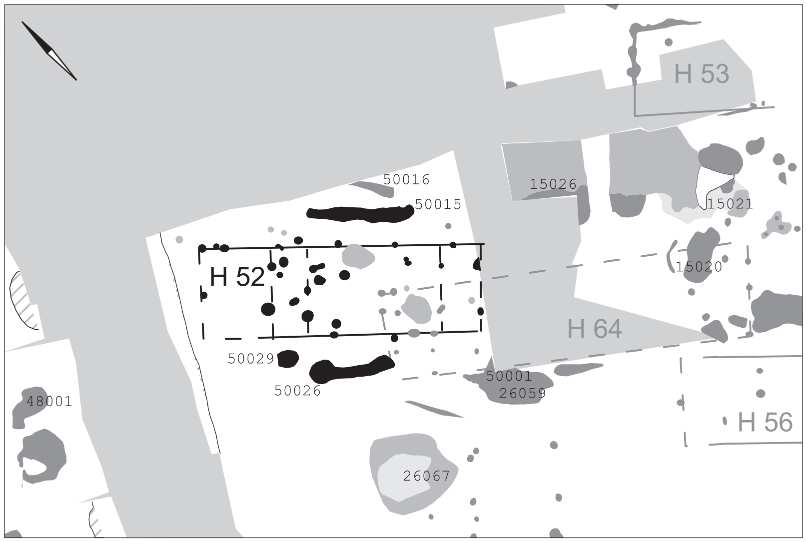


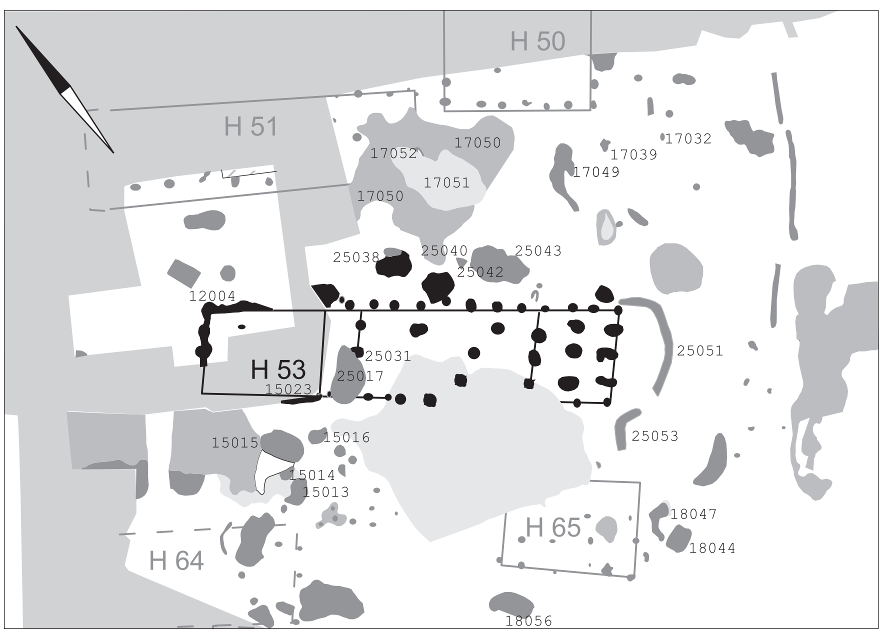
figs. 4-(53-54) plans of individual houses drawn to the same scale



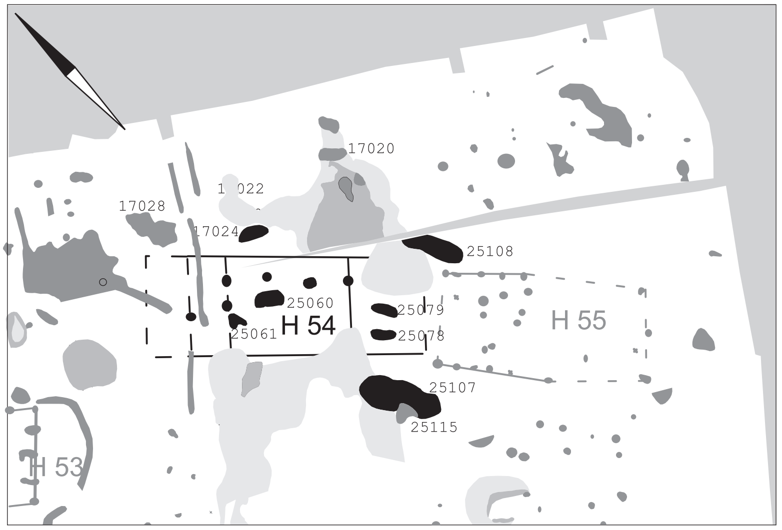


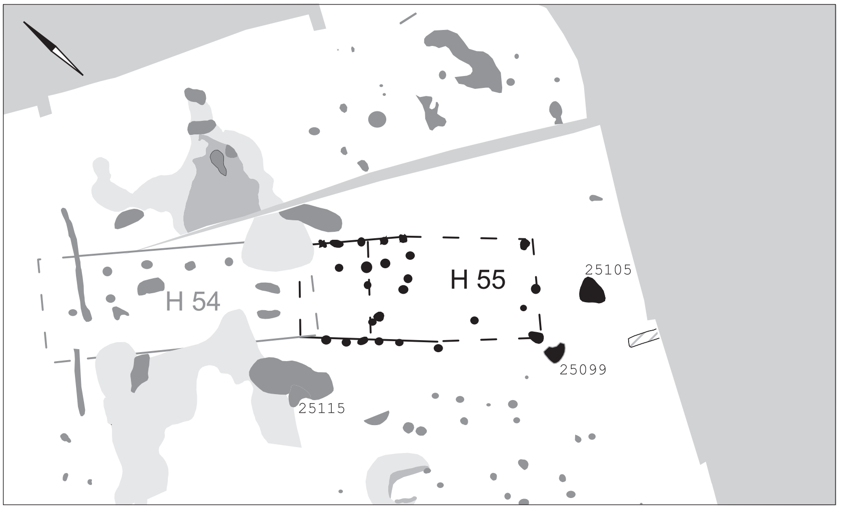
figs. 4-(55-56) plans of individual houses drawn to the same scale



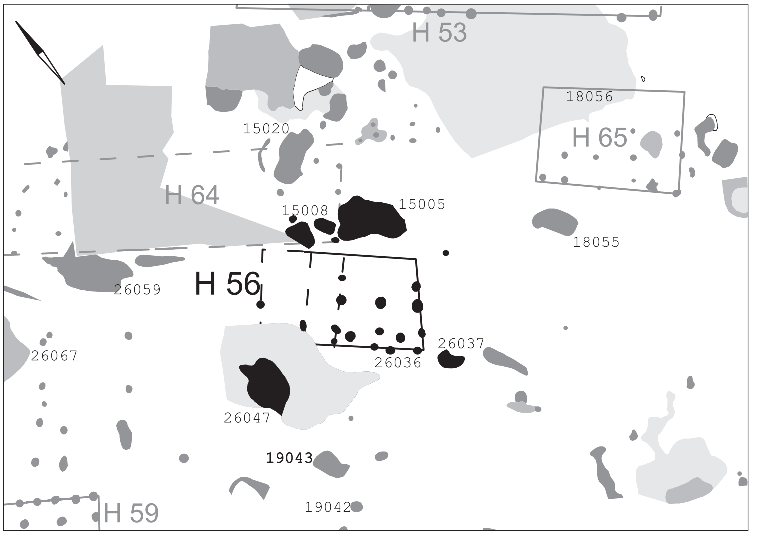


figs. 4-(57-58) plans of individual houses drawn to the same scale

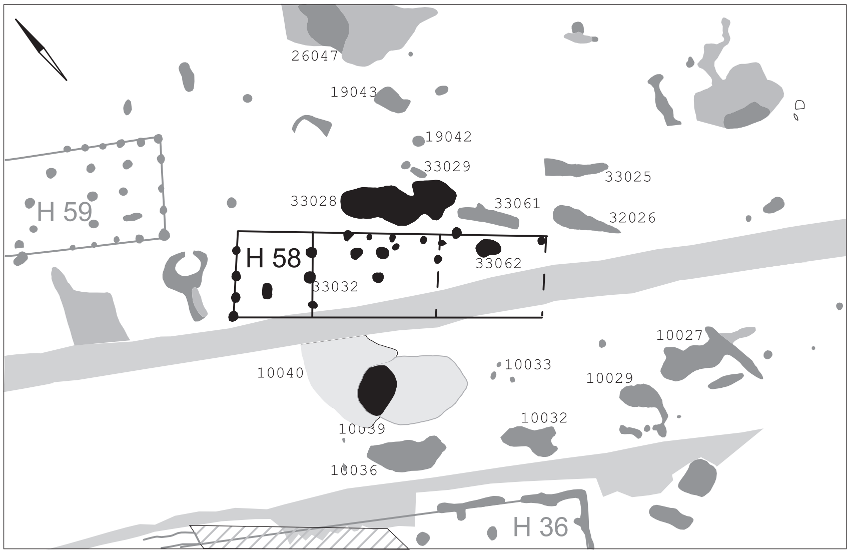


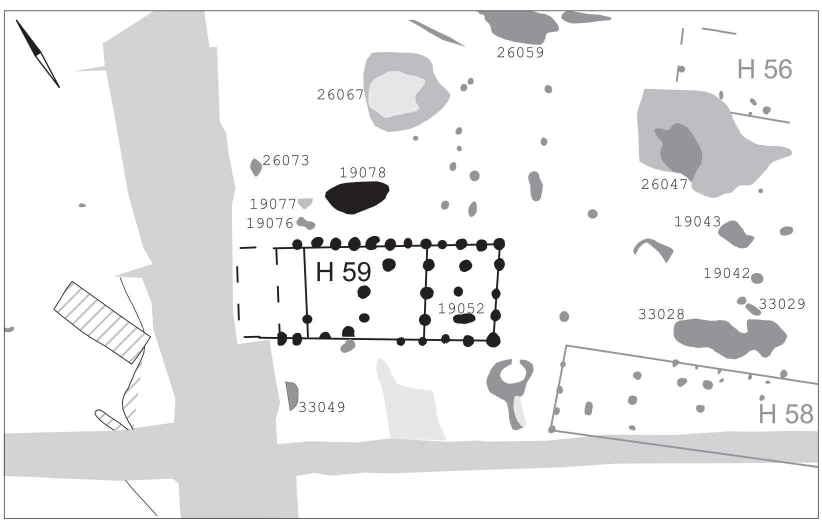


figs. 4-(59-60) plans of individual houses drawn to the same scale

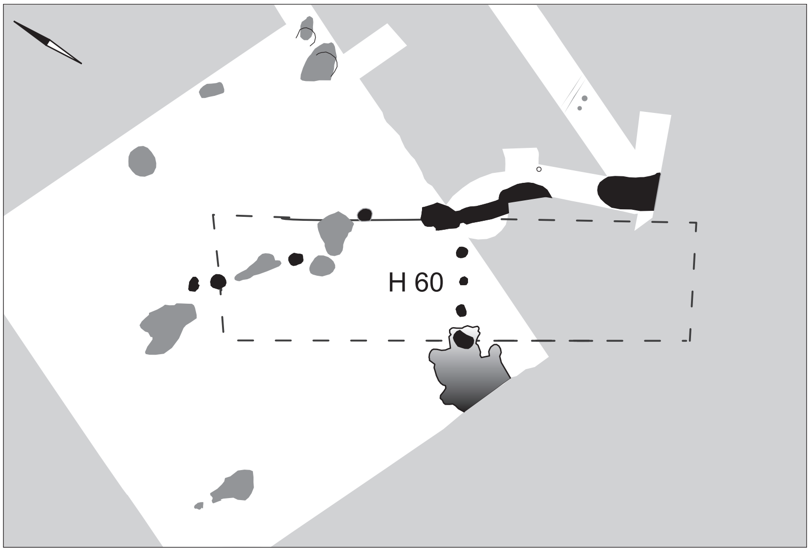


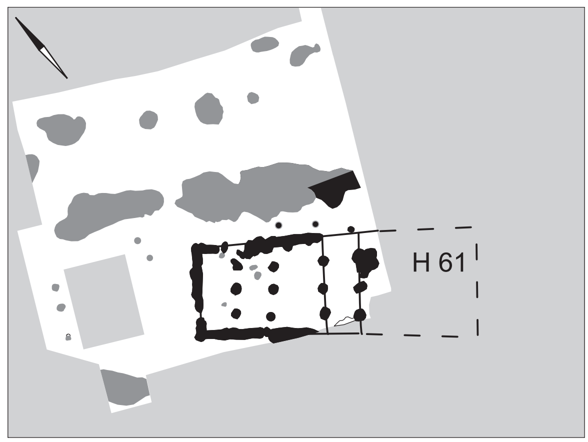
figs. 4-(61-62) plans of individual houses drawn to the same scale

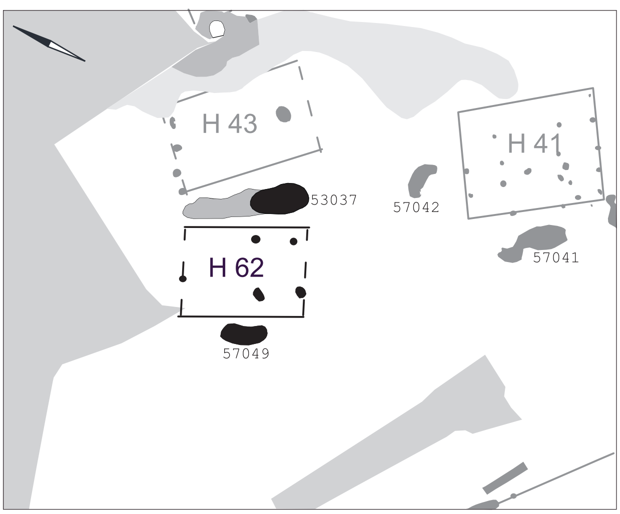




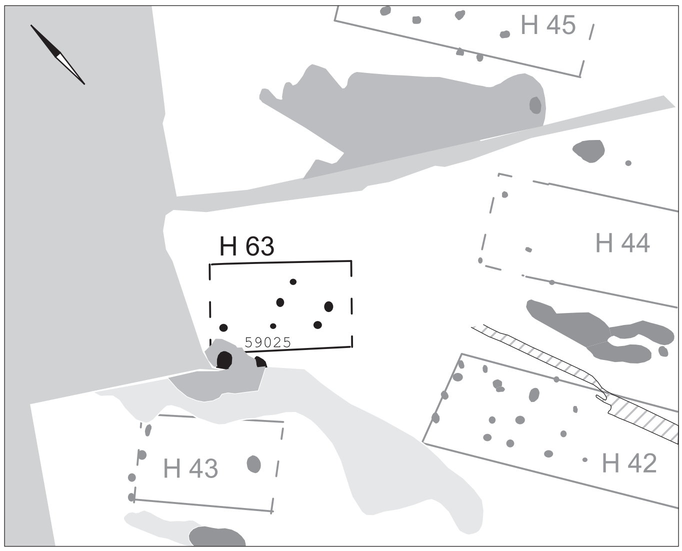
figs. 4-(63-64) plans of individual houses drawn to the same scale

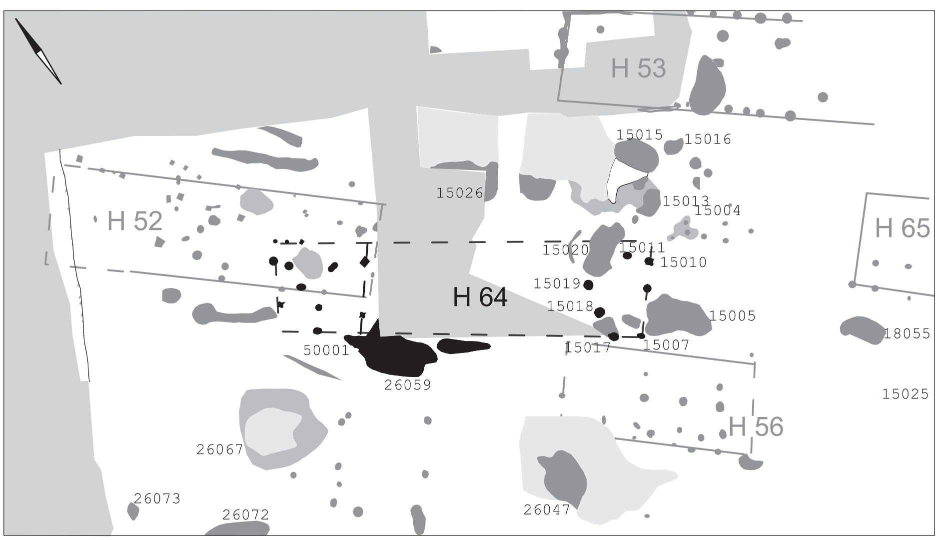




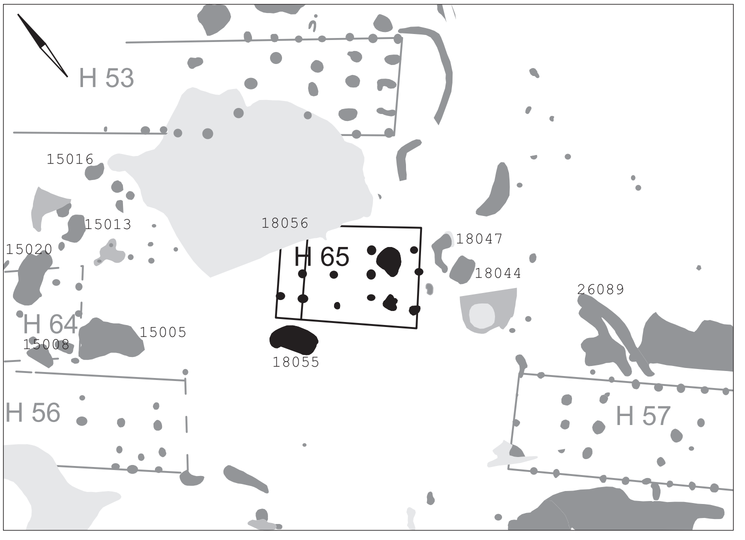


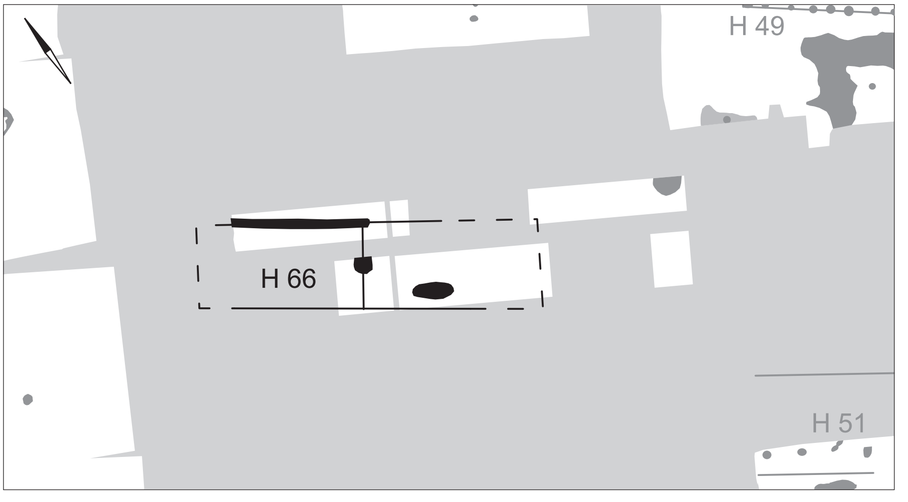
figs. 4-(65-67) plans of individual houses drawn to the same scale



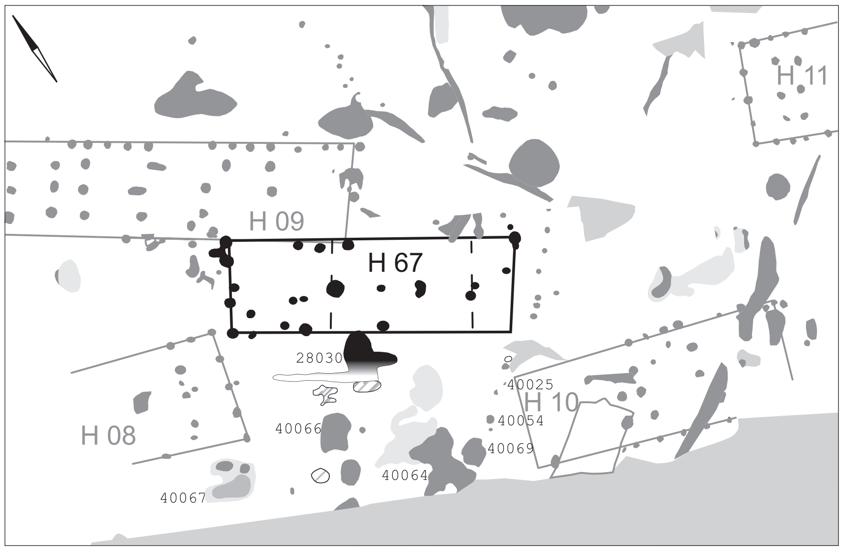


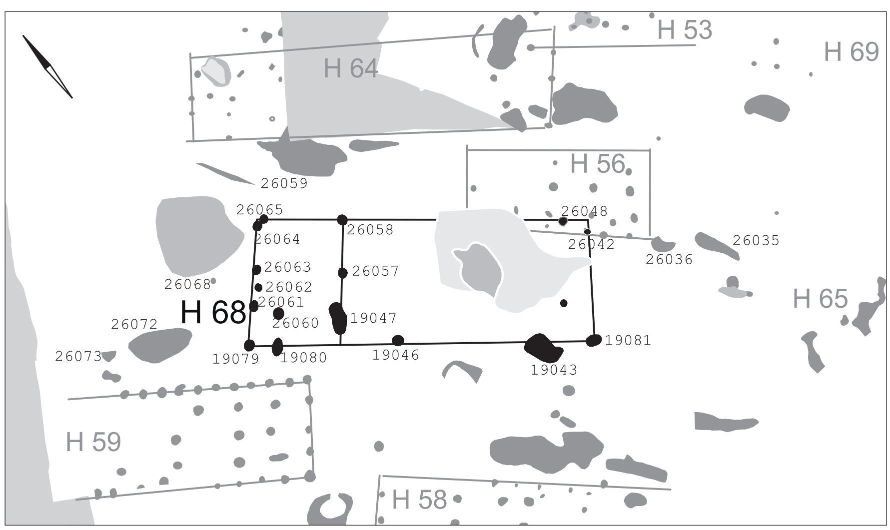
figs. 4-(68-69) plans of individual houses drawn to the same scale



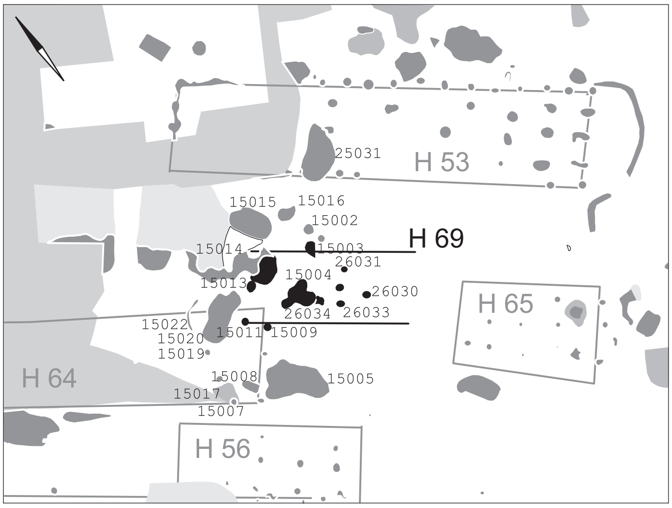


figs. 4-(70-71) plans of individual houses drawn to the same scale





figs. 4-(72-73) plans of individual houses drawn to the same scale



figs. 4-(74) plans of individual houses drawn to the same scale

from the large number (37) of badly legible house plans. Comparable to roughly every combination of variables in the house plans, the correlation between overall house length and length of the central section (all houses counted) is rather low at 0.33, which statistically 'explains' only 11% of the variation in these two variables.

The central parts of the houses in the Janskamperveld settlement offer an interesting view on the 'development' or 'evolution' of the central post configuration. There are 10 houses with a so-called Y-configuration, 14 houses show what is called 'degenerated Y's', and 16 have more or less recognizable regular (perpendicular) cross rows in the centre; a chronological evaluation of this presumed 'evolution' will be given in the chapter on Chronology.

Altogether, the houses in the excavated part of the Janskamperveld Bandkeramik settlement provide a picture of a quite regular Older Period LBK village, with few (if any) exclusive details.

Notes

1 The average direction of the house axes at Geleen-Janskamperveld is 126.5°; at nearby contemporaneosus Langweiler 8 the average alignment of the houses is 136.1°, precisely the direction of the midwinter sunrise at this latitude; the orientation of the Janskamperveld houses is almost 10° offset to the left of the midwinter sunrise.

2 I propose the name Flombornia for the country of the ancestors of the Northwestern Bandkeramians; it was located at the confluence of the Main and the Rhine, i.e., the Wetterau and its wider environment.

3 In this table, the visibility-score of the partitioning has been counted double, of the total length single, and of the other six values added up and averaged; then the sum of these figures was divided by (2+1+1).

4 In a few places in the excavation soil minerals have stained to illegibility patches with diameters of over 10 metres; in these spots the numerical correction below is also formally applicable, though for different material reasons.

5 The lengths of this part have been measured excluding the corridors on either or both ends.

6 Named after the first excavation where this configuration has been recognised: Geleen-De Kluis (Waterbolk/Modderman 1959: 163) situated about three kilometres SSW of the Geleen-Janskamperveld settlement.

7 After the extensive excavations in and publication of the houses at Elsloo-Koolweg (Modderman 1970), situated approximately 7.5 kms SW of the Geleen-Janskamperveld settlement.

8 Many authors consider these "secondary" rows indicative of repairs. However, in the reconstructions of bandkeramik houses which I have seen (e.g., Von Brandt 1988: 39; Coudart 1998: 69), the roof is always supported by longitudinal beams resting on the tops of the DPR poles. If one of these longitudinal beams shows bending or is in need of repair, then one single additional support suffices to deal with the problem, a set of poles is certainly not needed to support the other longitudinal beams.

9 When all houses are incorporated in the calculations, regardless of the *w*-indexes, the resulting regression formula is almost identical: E(bays) = 0.27xLength + 0.55. Consequently, the outcomes do not differ appreciably either.

10 "Especially telling is … that in almost all post holes [of House 21 at Langweiler 2] the post ghosts stand out, as partially their fillings fully consist of burnt loam and of carbonised wood. This finding suggests that the building has come down by fire" (Kuper *et al.* 1973: 44).

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APPENDIX: tables of major house dimensions and characteristics

LEGEND:

H: House identification number
01: Orientation of long axis of house
02: (estimated) length of house
03: *w*-index length estimate
04: width of front gable
05: width of rear gable
06: partitioning
(F = front, C = centre, R = rear)
07: *w*-index partitioning
08: house type according to Modderman/Schäuble typology
09: no of DPRs in front part
10: no of bays in front part
11: length of front part
12: *w*-index front section
13: separation front side
(C = corridor, W = wall)
14: *w*-index front separation
15: separation rear side
(as col. 12)
16: *w*-index rear separation
17: no of DPRs in central part
18: no of bays in central part
19: central post configuration
20: length of central part
21: *w*-index central part
22: no of DPRs in rear part
23: no of bays in rear part
24: length of rear part
25: *w*-index rear part
26: no of posts observed
27: estimated no of posts
28: estimated no of DPRs
29: *w*-index of estimate of DPRs
30: (estimated) surface area of house
31: surface area within excavation
32: *w*-index estimated surface area
33: type of front façade
(P = posts, T = wall trenches)
34: type of side walls (as col. 33)
35: type of rear walls (as col. 33)
36: overall average of *w*-indices

Lenghts and widths in metres; areas in square metres; ‘99’: indet.

H	01	02	03	04	05	06	07	08	09	10	11	12
01	124	21,0	4	4,5	4,3	FCR	4	1b	1d	2	3,8	4
02	127	15,9	2	5,4	4,9	FCR	4	1c	1	2	2,9	2
03	123	23,9	3	5,1	5,2	FCR	4	1b	2d	3	6,7	4
04	123	14,1	1	4,5	5,1	FCR	4	1c	1+1d	3	4,1	4
05	126	9,7	4	5,3	5,0	CR	4	2	0	0	0,0	4
06	127	16,3	2	5,0	5,0	FCR	4	1c	1	2	3,4	3
07	126	24,5	2	6,1	5,6	FCR	4	1a	1d	2	5,5	2
08	110	16,5	4	6,1	5,0	FCR	4	1b	0	1	2,4	4
09	124	21,1	4	5,4	5,0	FCR	4	1b	0	1	4,6	2
10	108	14,7	2	5,4	5,2	CR	2	2	0	0	0,0	2
11	112	8,8	1	–	5,5	CR	0	>2	99	–	–	0
12	112	15,0	4	5,4	5,0	CR	4	2	0	0	0,0	4
13	114	21,2	4	5,1	4,7	FCR	4	1b	2d	3	5,6	4
14	117	10,5	0	5,2	5,2	FCR	1	1c	0	–	5,0	2
15	135	13,7	1	4,7	4,7	FCR	1	1c?	0	1	1,8	1
16	132	25,3	2	–	5,2	FCR	2	1c?	99	–	6,6	1
17	125	7,7	3	4,6	4,8	C	4	3	0	0	0,0	4
18	123	17,0	1	5,4	5,0	FCR	2	1a?	99	–	–	0
19	123	17,5	2	5,0	5,4	FCR	4	1c	0	1	4,0	2
20	107	10,8	1	4,4	4,4	C	1	3	0	0	0,0	1
21	130	12,6	1	4,4	4,6	FCR	2	1c?	1d	2	2,3	1
22	119	19,4	2	5,8	5,8	FCR	2	1c	1	2	5,0	1
23	126	16,1	1	5,7	5,7	FCR	2	1c	1	2	3,6	2
24	113	29,7	4	6,1	5,9	FCR	4	1a	2d	3	6,9	4
25	128	>15,0	1	4,8	4,9	FCR	2	1x	99	2	–	1
26	116	6,6	2	4,9	4,9	C	4	3	0	0	0,0	4
27	126	5,7	2	4,8	4,8	C	2	3	0	0	0,0	4
28	117	12,7	1	5,6	5,6	CR	2	2	99	0	–	0
29	121	9,9	2	4,5	4,3	CR	2	2	0	0	0,0	4
30	114	16,8	1	5,4	4,2	CR	1	2	0	0	0,0	0
31	162	17,9	3	4,8	5,3	FCR	3	1c	2	3	4,1	4
32	109	17,7	0	6,2	5,9	CR	0	2	99	–	–	0
33	127	14,6	3	5,0	4,8	CR	2	2	0	0	0,0	2
34	118	9,4	0	4,9	4,7	C	0	3	0	0	0,0	1
35	134	31,2	4	6,5	5,6	FCR	4	1a	2d	3	5,8	4

H	01	02	03	04	05	06	07	08	09	10	11	12
36	123	25,4	4	6,3	6,1	FCR	4	1a	1d	2	5,3	3
37	108	19,8	2	5,8	6,7	FCR	1	1c	0	1	2,7	2
38	108	8,2	0	4,8	4,8	C	2	3	0	0	0,0	2
39	129	20,1	4	5,9	6,2	FCR	4	1a	1d	2	4,5	4
40	147	6,4	4	5,6	5,6	C	4	3	0	0	0,0	4
41	144	7,1	4	5,2	5,2	C	4	3	0	0	0,0	4
42	149	11,3	3	4,4	4,8	CR	3	2	0	0	0,0	2
43	136	7,9	0	4,8	4,8	C	0	3	99	0	0,0	0
44	144	15,4	2	5,1	5,1	FCR	3	1c	2	3	3,4	2
45	147	13,3	1	6,8	6,8	CR	1	2	99	0	0,0	0
46	131	12,1	2	4,5	4,5	FCR	2	1c	1d	2	2,3	1
47	148	8,0	3	4,7	4,7	C	3	3	0	0	0,0	3
48	129	8,5	0	5,1	5,1	C	0	3	0	0	0,0	3
49	128	14,0	4	5,3	5,1	CR	4	2	0	0	0,0	4
50	128	8,1	4	4,2	4,2	C	4	3	0	0	0,0	4
51	125	18,0	0	5,5	5,5	FCR	2	1c	99	1	3,5	2
52	133	14,9	2	4,7	4,7	FCR	4	1c?	1d	2	2,1	1
53	128	22,4	4	5,1	4,5	FCR	4	1b	1d	2	4,2	4
54	133	14,5	0	5,3	5,3	FCR	3	1c	1d	2	3,9	4
55	138	11,1	3	4,9	4,8	CR	1	2	0	0	0,0	2
56	128	10,2	1	4,8	4,8	CR	2	2	99	0	0,0	0
57	133	12,2	4	5,3	5,1	CR	4	2	0	0	0,0	4
58	130	16,7	2	4,5	4,5	FCR	3	1c	1d	2	5,7	1
59	123	14,0	0	5,3	5,3	FCR	4	1c	1d	2	3,9	4
60	148	24,5	0	6,4	6,4	FCR	2	1x	99	–	-	0
61	131	15,9	0	5,6	4,8	CR	2	>2	99	–	-	0
62	154	6,1	0	4,8	4,8	C	2	3	0	0	0,0	2
63	132	7,4	0	4,6	4,6	C	0	3	99	–	–	0
64	125	19,5	1	5,1	4,8	FCR	3	1c?	2	3	–	0
65	129	7,4	3	5,4	4,5	C	3	3	0	0	0,0	3
66	124	14,9	1	4,2	4,2	CR	1	>2	–	–	0,0	0
67	123	10,0	2	4,8	5,0	FCR	3	1c	–	1	2,2	3
68	126	18,2	3	6,6	6,3	CR	3	2	–	–	0,0	0
69	126	10,5	0	4,0	4,4	CR	1	>2	–	–	0,0	1

H	13	14	15	16	17	18	19	20	21	22	23	24	25
01	W	4	C	4	1	2	dY	8,0	3	2	3	6,7	4
02	W	2	C	4	2	3	Yi	7,8	4	1	2	3,5	4
03	W	4	C	4	1	2	Y	9,7	4	2	3	6,4	3
04	C	4	C	4	2	3	R2	7,1	4	0	1	2,6	1
05	W	4	C	4	1	2	dY	7,3	3	1	2	3,1	2
06	W	2	C	3	2	3	R2	8,5	4	1	2	4,0	2
07	C	4	C	4	1	2	Y	10,1	4	3	4	6,8	4
08	W	4	C	4	1	2	R1	7,1	3	1	2	5,1	4
09	W	4	C	4	2	3	Yi	10,2	4	1	2	4,8	4
10	W	2	C	4	2	3	R2	8,8	2	1	2	5,2	2
11	x	0	C	4	1	2	Rx	6,3	3	0	1	1,8	4
12	W	4	C	4	1	2	Y	9,1	4	1	2	4,3	4
13	W	4	C	4	1	2	Y	9,0	4	1	2	5,0	4
14	W	3	x	0	1	2	Rx	5,6	2	99	–	–	0
15	x	0	x	0	1	2	Rx	6,7	1	1	2	3,8	1
16	x	0	C	4	1	2	x	8,1	2	2	3	8,5	4
17	W	4	C	4	1	2	Yi	6,6	4	0	0	0,0	4
18	W	4	C	4	1	2	R1	8,5	4	99	1	–	1
19	W	3	C	4	1	2	R2	4,7	3	1	2	5,5	1
20	W	1	C	1	2	3	x	8,6	1	0	1	0,0	1
21	W	1	C	1	2	3,0	x	7,1	1,0	1	2	3	1
22	W	2	C	4	1	2	Y	8,7	3	0	2	4,8	2
23	W	3	C	2	1	2	x	5,8	2	0	2	5,1	1
24	C	4	C	4	1	2	Y	9,7	4	1	2	7,7	4
25	W	0	C	3	99	2	Rx	9,3	1	1	2	4,0	1
26	W	4	W	4	2	3	R2	6,6	2	0	0	0,0	4
27	W	4	C	4	1	2	R1	4,0	4	0	0	0,0	2
28	x	0	C	4	1	2	dY	6,9	3	1	2	3,9	2
29	W	2	x	0	99	2	x	6,2	2	0	1	2,4	1
30	µx	0	C	4	1	2	x	10,4	1	1	2	5,4	4
31	C	4	C	1	2	3	R2	6,3	3	2	3	4,4	3
32	x	0	C	4	1	2	x	9,6	1	1	2	6,5	4
33	W	1	C	3	99	4	x	7,7	2	2	3	4,9	2
34	W	3	x	0	99	2	x	6,6	0	0	0	0,0	0
35	C	4	x	0	2	3	iY	12,2	3	2	3	8,5	2

H	13	14	15	16	17	18	19	20	21	22	23	24	25
36	W	4	x	0	99	3	x	12,1	3	1	2	6,0	4
37	x	0	x	0	99	3	x	7.0	3	99	2	8,8	2
38	W	3	x	0	1	2	Y	6,2	2	99	–	–	0
39	C	2	C	4	1	2	x	6,4	4	1	2	4,7	4
40	W	4	W	4	1	2	R1	6,4	4	0	0	0,0	4
41	W	4	C	4	1	2	R1	5,1	3	0	0	0,0	4
42	W	2	C	3	2	3	J	7,1	2	0	1	2,7	4
43	x	0	W	0	99	2	x	7,9	0	99	0	0,0	0
44	x	0	x	0	99	3	x	9.4	2	99	1	2,4	1
45	x	0	C	3	3	4	iYi	8,9	3	0	1	2,6	3
46	x	0	C	3	2	3	x	6,5	1	0	1	1,6	1
47	W	2	C	2	1	2	x	6,4	2	0	0	0,0	3
48	W	3	x	0	1	2	Yi	8,5	1	99	–	–	0
49	W	4	C	4	1	2	Y	8,3	4	0	1	3,5	4
50	W	4	W	2	99	2	x	8,2	2	0	0	0,0	4
51	W	2	C	3	1	2	x	10,0	2	99	1	2,2	0
52	W	1	C	3	2	3	x	7,4	3	0	1	3,7	2
53	W	4	C	4	1	2	dY	9,9	4	2	3	6,0	3
54	W	2	C	2	1	2	Y	6,8	3	99	1	1,7	0
55	x	1	C	2	99	3	x	8,7	1	99	1	–	0
56	x	1	C	2	2	3	R2	6,1	3	99	1	2,3	0
57	W	4	C	4	1	2	Y	7,9	4	0	1	2,6	4
58	x	0	W	2	1	2	dY	7,0	1	99	2	2,7	1
59	W	4	x	0	1	2	Y	6,4	4	99	1	2,7	0
60	x	0	x	0	99	–	x	–	0	99	–	–	0
61	x	0	C	4	99	–	x	–	0	2	3	6,8	4
62	W	1	W	0	1	2	Rx	6,1	2	0	–	–	1
63	x	0	x	0	2	3	dY	7,4	1	99	–	–	0
64	W	0	x	0	99	–	x	–	0	1	2	4,4	2
65	W	3	C	4	2	3	R2	6,1	4	0	0	0,0	3
66	x	0	x	0	2	3	x	7,7	0	2	3	7,3	2
67	x	1	x	1	2	3	x	7,3	3	2	3	5,7	2
68	x	0	x	0	2	3	x	9,0	0	1	2	4,6	3
69	geen	1	C	1	2	3	x	5,4	0	1	2	5,1	3

H	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
01	33	70	10	4	91,0	91,0	4	P	P	T	**4**
02	30	60	8	4	83,8	83,8	3	P	P	P	**3**
03	69	69	12	3	126,7	117,6	3	P	P	T	**4**
04	37	70	11	3	79,6	79,6	2	P	P	x	**3**
05	30	45	6	3	55,6	55,6	3	P	P	P	**4**
06	43	65	9	3	94,4	94,4	3	P	P	P	**3**
07	32	75	12	3	143,0	119,3	3	T	T	T	**3**
08	46	57	7	3	90,7	90,7	4	P	P	T	**4**
09	43	73	9	4	109,0	109,0	4	P	P	T	**4**
10	31	58	7	3	78,6	78,6	3	P	P	T	**2**
11	27	36	-	0	51,3	36,1	1	x	P	P	**1**
12	37	47	6	4	77,5	72,9	4	P	P	T	**4**
13	56	62	11	4	105,5	105,5	4	P	P	T	**4**
14	12	46	>5	2	30,7	23,9	1	P	P	x	**2**
15	11	60	>6	2	65,1	34,8	1	x	P	x	**1**
16	16	79	>10	2	135,6	50,0	2	x	x	T	**2**
17	19	25	5	4	36,3	36,3	4	P	P	P	**4**
18	13	40	>5	2	64,1	64,1	1	P	T	x	**2**
19	36	54	8	2	73,9	73,9	2	P	P	x	**3**
20	12	40	>5	1	45,0	45,0	1	P	P	P	**1**
21	16	52	>10	1	57	51	1	P	P	x	**1**
22	15	55	>8	2	114,4	114,4	2	P	P	T	**2**
23	18	54	>8	1	93,6	93,6	1	P	P	x	**2**
24	57	70	12	4	173,8	167,3	4	T	T	T	**4**
25	11	60	>6	2	68,0	68,0	1	x	P	x	**1**
26	10	31	4	4	32,8	20,8	4	P	x	P	**3**
27	8	26	4	2	26,6	23,6	2	x	x	P	**3**
28	19	49	6	2	74,2	74,2	2	x	P	x	**2**
29	14	40	>6	2	43,2	43,2	2	P	P	x	**2**
30	8	50	>6	1	80,5	80,5	1	x	P	T	**1**
31	44	78	12	3	87,9	87,9	3	P	P	P	**3**
32	12	45	>6	1	111,7	53,0	1	x	P	T	**1**
33	23	61	9	1	74,5	74,5	4	P	P	P	**2**
34	21	35	4	2	42,2	23,9	1	P	P	x	**1**
35	28	89	>13	3	189,6	145,1	4	T	T	T	**4**

H	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
36	27	62	>9	3	157,5	88,9	4	T	T	T	**4**
37	23	57	>7	1	118,8	116,3	2	P	P	x	**2**
38	9	31	>3	2	37,5	18,0	2	P	P	P	**4**
39	31	66	10	3	121,4	110,2	4	T	T	T	**4**
40	10	21	3	4	32,4	32,4	4	P	P	P	**4**
41	16	28	4	4	36,1	36,1	3	P	P	P	**2**
42	17	38	6	2	50,9	50,9	2	x	P	P	**0**
43	5	21	>3	1	38,5	38,5	0	x	x	x	**2**
44	12	54	>8	1	73,5	73,5	2	P	P	P	**1**
45	17	44	7	1	90,2	90,2	1	x	P	P	**1**
46	15	56	8	2	50,6	50,6	1	P	P	P	**3**
47	9	32	4	3	36,0	36,0	3	P	P	P	**1**
48	11	24	>4	0	44,5	37,0	0	P	P	x	**4**
49	44	44	5	4	71,4	71,4	4	P	P	P	**3**
50	9	23	4	1	33,7	17,0	4	P	P	P	**1**
51	11	58	>9	2	93,5	33,5	0	x	P	x	**2**
52	30	61	>8	2	73,3	73,1	0	x	P	x	**4**
53	41	71	10	3	105,2	83,0	4	P	P	T	**1**
54	12	65	>8	0	77,6	77,6	0	P	P	x	**1**
55	25	37	>6	0	58,4	58,4	1	P	P	P	**1**
56	16	42	>6	1	52,0	52,0	0	x	P	x	**4**
57	35	38	5	4	62,0	62,0	4	P	P	P	**1**
58	22	58	>8	0	74,4	56,8	0	x	P	P	**2**
59	33	52	>7	0	70,2	70,2	0	P	P	x	**1**
60	6	52	>5	0	151,8	94,5	1	x	x	x	**1**
61	31	56	>7	2	76,6	47,4	2	x	P	T	**1**
62	5	21	>3	1	29,5	29,5	1	P	x	P	**0**
63	6	26	>4	1	32,7	32,7	0	x	x	x	**1**
64	17	75	>7	0	95,0	60,2	4	P	P	P	**3**
65	12	31	5	3	36,1	36,1	3	P	x	P	**1**
66	1	38	6	0	59,3	25,0	1	x	P	T	**3**
67	26	59	9	3	78,2	78,2	3	P	P	P	**2**
68	16	59	9	2	117,7	117,7	3	P	P	P	**0**
69	12	38	6	0	43,5	43,5	0	x	P	P	**0**

5 On the Bandkeramik features

Pieter van de Velde

In the excavation on the Janskamperveld 2429 singular and 119 complex features with LBK antecedents were recorded. They were classified according to their shape and context. Regular, standard shapes presuppose standard primary functions, "free" shapes rather relate to loam quarrying for potting, construction, and the like. By far the largest class of regular shapes is that of the post holes: 1369 located within houses, 373 elsewhere; from the house plans it can be estimated that a similar number of post holes is missing. Near the houses, 98 kettle pits and 79 side pits have been examined; the first, with a regular shape, probably have served as cellars with a volume of approximately 2.5 m^3 *each, the second irregularly formed group will have been used as loam quarries for the construction and upkeep of the houses. Away from the houses three sets of ditches are vestiges of (successive) palisades around the settlement during the first two house generations; the remaining three gates with screens/palisades in their centres are illustrated. Eight fence-like structures are likely to be later than the occupation of the village; they have been interpreted here as pertaining to the gardens of the nearby Haesselderveld LBK village.*

5.1 Introduction

In the excavation on the Janskamperveld, 2778 Bandkeramik "features" (*Befunde* in German) have been recorded. Visible as darker spots in the yellow-brownish loess, they have been measured, cut, their profiles drawn, sometimes completely sometimes only half dug up, and any artefacts in their fillings collected. "Features" are the present-day signatures of early pits. They come in several varieties, either defined according to their supposed early functions, their shape, or their position in the settlement, generally acknowledging an equation of form and function (Kok 1998, 21-33). There is also a basic distinction between composite and singular pits, and component pits that make up the first group, and numbering 119, 2429 and 230, respectively. In this chapter I shall mainly deal with the shape of the pits, their position in the settlement, and their mutual relationships. I shall also discuss their primary function (i.e., the reason why they were dug in the first place; Kok 1998, 66-69), as quite often implied by their context rather than their contents, which are characteristically secondary. Indeed, after an intensive study of the pits in the Langweiler 8 settlement on the Aldenhovener Platte, Boelicke claimed of Bandkeramik pits that neither shape nor position correlate to function (Boelicke 1988, 341-342). However that may be, in LBK archaeology several pit types are regularly distinguished on the basis of their shape and/or their position (e.g., Stäuble 1997). Based on the criterion of morphology, regular even standard geometrical shapes are supposed to relate to a primary function, whereas "free" forms all refer to the primary and secondary function as clay pit (Stäuble *contra* Boelicke). While a rigid application of morphological criteria does not work well, a rather more liberal definition of geometrical shapes allows the distinction of cylindrical kettle pits (cellar-like structures), smaller cylindrical post holes (foundations for house posts, but also for many other settlement furnishings such as fences, poles etc.), tan pits (*Schlitzgruben*, also known as *Gerbergruben*, presumed to have served in the tanning of hides), and also the ubiquitous trenches (foundations for house walls, palisades etc.). Free shapes come in three varieties, more or less distinguished on the basis of their ground plan and size: the *Längsgruben* (oblong side pits of the houses), pit complexes with Rorschach appearances on the excavation plan, and *sonstige Gruben* ("other pits").

Going beyond the characteristics of individual pits, in an often quoted study Boelicke has found a standard configuration of pits on the yards in relation to the houses in the Langweiler 8 settlement (Boelicke 1988). It is unclear, however, whether the same or a similar standardized configuration can also be found in other settlements (Stäuble 1997, 73; Hauzeur 2006, 161). At least in the present settlement the density of features (plus the paucity of finds in the pits other than *Längsgruben*) precludes attempts in this direction, nor has it been tried to my knowledge in any other LBK site apart from the Aldenhovener Platte, not even Pavlů's analysis of the Bylany site has a word on it (Pavlů 2000); probably for the same reason. Nevertheless, and based on the idea of relative position, in-house pits (like wall trenches and post holes), near-the-house pits (*Längsgruben*, and outer trenches — *Aussengräben*) and away-from-the-house pits (any pit not associable with a house plan) can be distinguished.

Assuming that *all* houses in the excavation have been identified, the dimensions of shape and relative position will be used to structure the account of the Janskamperveld features below, although it be borne in mind that 374 features (13.5%) could not be reliably classified.

5.2 In-house features: post holes and trenches constitutive of house plans

The first category of singular features, consisting of the in-house pits, comprises two classes, each a combination of the in-house position with one of two distinct geometrical forms and therefore presumably dedicated features. The most numerous class by far is that of the smaller cylindrical pits, the post holes that made up the construction. Some of the major characteristics of the "post holes" thus selected have been assembled in table 5-1. The metric properties of the different variables show statistically normal distributions (interquartile ranges of approximately 2 decimetres), except for the depth which is rather skewed, as is to be expected. The median depth is at only some 1.5 to 2.0 dm below datum[1], yet the maximum value is much larger at almost 10 dm (one metre), testimony to the misfit between the originally undulating surface and the present smooth excavation plane. Importantly, features which showed up as dark spots on the excavation plan but which proved 'empty' or 'invisible' when cut have been entered in this class as well. Occupying structural places in houses (numbering 432 post holes, or 23.7%), they are considered literally the terminal shadow of their previous existence — after all, a fairly reliable estimate of the number of posts in the houses is almost exactly twice the number of observed posts. It should be noted that such a rate is quite common in LBK excavations; e.g., Von Brandt reports the survival of only 42% of the in-house post holes in the Langweiler 8 settlement (Von Brandt 1988, 221).

Regarding the geometrical properties of the in-house post holes a few remarks may be appropriate. Table 5-2 features a summary of the relevant characteristics, with separations drawn at 2 dm depth for the sides: if the pit remnants are shallower, their direction can no longer be established reliably. A similar separation for the bottoms has been set at 1 dm, for, if shallower, not all of it may have been preserved. Though there are differences between indoor and outdoor post holes, these are not very large, as table 5-2 suggests. Stepped pit bottoms do occur more frequently inside houses (where the tops of the rows of poles had to be at an even level), and also vertical sides of the holes are better represented inside than outside, but that is all that is remarkable about this table.

Except for an occasional sherd or flint spall, little of interest has emerged from the post holes, be they located in the houses or in the field: not even building sacrifices have been observed, though the diggers were on the lookout for them. Another exception is provided by the occurrence of lumps of burnt loam and charcoal particles in house post holes; as detailed in the chapter on houses, in ten houses at least half of the post holes (as well as the wall trenches) show these traces of fire, probably testifying to a conflagration. The other vestiges of fire in houses (observed in 18 houses) are restricted to single post holes generally situated in the central part — in the vicinity of where the kitchen fire may have been kept. It should also be noted that in 13.6% of the post holes the ghosts of former posts have been observed. Their distribution is quite uneven, as in three houses (HH 24, 29, 35) more than half of the holes show this feature, whereas most other houses have few occurrences only.

Apart from the post holes in the house plans, 19 out of 69 houses also muster wall trenches, the second class of "geometrical" in-house features: five or six 'a'-type houses with trenches all around (all of them tripartite, and thus usually referred to as type 1a houses), and thirteen houses of the 'b'-type, with trenches restricted to their rear parts (6 three-partite or 1b and 7 two-partite or 2b type houses) (cf. the chapter on houses). The bottoms of the trenches are generally uneven, with deeper spots where wall posts have stood (sometimes still in evidence) and somewhat shallower stretches underneath the former boards. It is evident that they are foundation trenches as for the fourteen houses with

	count	median		
		length	width	depth
all post holes	1821	40	35	19
within houses	1369	44	35	20
outdoors	452	36	30	17
max values		170	140	95

table 5-1 Major characteristics of post holes in the Janskamperveld settlement
length and width in centimetres, depth in centimetres below the excavation plane

pit bottoms			pit sides		
	in-house	outdoors		in-house	outdoors
concave	5.4	5.2	conical	0.2	0.0
flat	17.9	14.1	vertical	63.4	52.2
convex	42.1	50.1	funnel	28.8	36.5
saucer	10.9	8.6	slope	7.6	11.3
stepped	17.4	9.1			
pointed	4.3	8.4			
complex	2.1	4.4			
ref. count	1023	383		975	362

table 5-2 Morphology of post holes, percentages

sufficient data eleven show vertical sides and trench heads, the remainder being rather more sloped in appearance on the section drawings generally because of their shallowness. The steep cuts render the measurement of the widths of the trenches sensible: their median is 5 dm (with a rather narrow interquartile range of 1.5 dm). The maximum depth recorded in this excavation was 9 dm, adding another estimated 4 dm towards the original surface, their approximate 1.3 metre depth roughly converts to about 2 to 2.5 metre wall height. The two instances of interior walls (in HH 08, 18) show vertical sides and heads (width 3 dm both), and also complex bottom profiles. Regarding finds, wall trenches are just as barren as post holes.

5.3 Near-to-houses features: *Längsgruben*/ side pits alongside the houses (including *Aussengräben*/outer trenches)

Very much present in any Bandkeramik excavation, the long pits alongside the houses (*Längsgruben* in German, *fosses de construction* in French) have no fixed shape; constant is only their position within a distance of about 4m from the side walls. Their origins/primary function can be found in the 'mining' of loam for the wattle-and-daub walls and probably sometimes also the filling of a raised floor inside the house; afterwards the pits became filled up firstly with their own useless top soil and secondly with natural and anthropogenic depositions, among which household debris of the adjoining house is thought to be most prominent (Coudart 1998, 73; Stäuble 1997, 23), hence their interest for the interpretation of the behaviour of the house's occupants. When repairs to the walls or floors were due, no doubt the same close to hand pits were used to obtain raw materials, one of the likely causes of the irregular contours and composite nature of these pits. In the chapter on houses their frequency and distribution in the settlement are discussed, and in the chapters on pottery and flint social and technical aspects of the artefacts in them are dealt with, here I shall deal with their volume and contents to seek an answer to the question of whether larger side pits contain more finds than smaller ones (the "artefact trap problem"). As a start, table 5-3 lists some of the major metric characteristics of these features. The number of pits ('count') register the numbers of features on the site excavation plan, where 56 houses show associated *Längsgruben*, of which 33 times single ones[2] and 23 times two; in most cases broken up into several separate pits. These latter, separate pits are considered distinct attributes by Coudart, but in my opinion they are simply a function of the depth of the excavation plan below the neolithic surface (Coudart 1998, 32, 44). Length, width, and depth relate to the excavation plane thought to be at the very least 4 dm below the neolithic level. As noted repeatedly the latter level was probably more undulating than the excavation plan shows, hence depth (or length or width, for that matter) cannot be easily converted to the original value. To estimate the original volumes, the average present depth (7.2 dm) has been augmented by 4 dm to suggest a minimum original depth — with a minimum depth set at 11 dm, the E(depth) in the table (for *estimated depth*). To provide reference values for the artefact trap problem (below) the rest volumes in the table have been calculated by simple multiplication from the excavation's figures, disregarding the depth below the original surface. It will be observed that the pits do not match box formats but should be corrected for by block coefficients in the order of perhaps 0.7 to 0.9. However, in the Janskamperveld excavation the pit forms have not been registered except on the drawings of the length and cross sections (cf. the reconstructed outlines of *Längsgruben* in Stäuble 1997), moreover the 'true' values of the rest volumes will be highly correlated with the values in the table as the deviations from the block shape are very similar in all cases anyhow. Table 5-4 provides an idea of the 'real' looks of the side pits, as derived from the excavation records. Funnel-like and steeply vertical sides are preponderant in the sections, from which it may be deduced that the deeper lying unweathered loess was required for Bandkeramik house building pursuits. Apart from that, there are some side pits which seem to have originated as (the ruins of) kettle pits, cf. the relevant section below.

	Length (dm)	Width (dm)	Depth (dm)	E(Depth) (dm)	restvol. (tons)	E(vol/p) (tons)	Vol/house (tons)
max	174	48	17	21	28.1	80.4	98.9
Q3	89	26	9	13	5.2	24.8	30.3
median	55	18	7	11	1.8	11.2	14.6
Q1	29	11	5	11	0.8	3.7	7.0
min	9	4	1	11	0.0	0.5	0.5
average	54	18	7	11	1.8	11.5	14.7
count	78	79	79	82	131	76	55

table 5-3 Side pits, major metrical characteristics

		cross section					
		vertical	funnel	sloping	irregular	indet.	
length section	vertical	4	7	4	1	1	17
	funnel	5	12	4	–	1	22
	sloping	1	–	4	–	–	5
	irregular	–	1	–	1	–	2
	indet.	–	–	–	–	1	1
		10	20	12	2	3	47

table 5-4 Morphology of side pits, counts

To return to the "artefact trap problem": it is generally assumed that larger pits carry more finds, and if so it would be difficult to base conclusions on quantified distributions — as is done in most chapters of the present publication, and indeed also in most Bandkeramik studies. In the Janskamperveld settlement 87 among 133 side pits (or pit fragments) have yielded pottery sherds, and with these numbers this "artefact trap hypothesis" can be tackled. As a test, the rest volumes of the side pits have been correlated with the sherd counts in them, with an outcome that cannot be misunderstood: $r = 0.43$ (and so $r^2 = 0.19$), signifying hardly any relationship between size and content. That is, side pits are no artefact traps. But then, side pits are supposed to have provided the loam to daub the wattle of the walls, and perhaps also to raise the inside house floor (Modderman 1988, 104), so there should be a relationship between the volume of the pits and the surface area of either the walls or the floor, or the two together. Just as an exercise and to get some idea of the quantities involved, with an average joint side pit volume of about 14.7 m^3 (table 5-3), and an average house size of 75 m^2 (cf. the chapter on houses), the loam would be sufficient to raise the house floor to a height of just over 15 cm; with a side wall height of 175 cm their total surface will also equate to about 75 m^2, and thus the wall thickness can be calculated to 15 cm, not counting the wattle; if both purposes obtained, height and thicknesses should be reduced accordingly. Pertinent coefficients for the relationship of the side pit volumes and the individual measurements of the houses are shown in table 5-5: the correlation of both variables, collectively for all houses, or separately for houses with boards only ("a-type"), with part boards and part wattle-and-daub walls ("b-type"), and with wattle-and-daub walls exclusively ("c-type"). The figures are truly disappointing to put it mildly; no relationship whatsoever can be confirmed on their basis. Even acknowledging the 'guesstimates' character of especially the pit volume estimates is no recourse. Therefore it is likely that the loam of the pits was put to other uses as well, for instance the upkeep and repair of walls and floors, and/or pottery production. On the basis of these figures, not one single exclusive function can be assigned, which is also the opinion of Stäuble after careful analyses of data from several settlements (Stäuble 2005, 180). Additionally, the post-depositional excavation effect of splitting up the original side pits into several smaller ones, jointly considerably shorter than their 'parent' is perhaps an additional explanation — and I refer to Coudart again, who does not go into this matter, though she did quantify almost every other aspect of Bandkeramik houses in her book (Coudart 1998, 73).

	all	a-type	b-type	c-type
wall surface	0.21	0.47	0.02	0.22
floor surface	0.29	0.38	0.15	0.38
jointly	0.24	0.47	0.06	0.25
references	55	6	14	35

table 5-5 Side pit volume correlated with house wall characteristics

In his analysis of the pit shapes *à propos* the excavations at the Oldest LBK settlement at Bruchenbrücken near Frankfurt, Stäuble remarks that the opposite side pits of the houses have systematically unequal depths, the difference being 5 to 6 dm there (Stäuble 1997, 125). In the Janskamperveld settlement there is also a tendency to unequal depths: for thirty houses with pits to both sides the differences are between 0 and 7 dm, with an average of 3 dm. In one house the left side pits are shallower than the right side pits; yet in the next house, it is the other way around: the median depths (computed for all pits, not just those that can be paired) are 7 dm on both sides. An average difference of 3 dm is not very impressive, in my opinion, and with Stäuble I should not be willing to draw wide ranging conclusions from it. It brings to mind, though, the report on the excavations at Cuiry-lès-Chaudardes on the Aisne River in France where kitchen refuse is found to be decently thrown into the side pits not on the side of the neighbours (Hachem 1997), suggesting differential use of these pits, if the Paris Basin Late Bandkeramik may be brought in as a model for the Flomborn cultural conduct on the Janskamperveld.

Closely linked to the side pits and even more so to the houses are a number of relatively narrow trenches, of which figs 1 and 2 provide examples. Though in most cases discontinuous on the excavation plan, they are considered singular in origin: dug in one go with unexplained purpose. They have all been dug to the same width (7 dm), with average depths of *c.* 4 dm below the excavation plane. These outer trenches are situated between the house walls and the side pits, they are characteristic of Oldest LBK houses and peter out in the Flomborn phase (Stäuble 2005, 186). Thought by some to be foundation trenches for low exterior walls (and then called *Außengräben* in German; Lüning 1988; Cladders/Stäuble 2003, Stäuble 2005), this is contested by others who see artificial rain trenches in these features (with the label *Traufrinnen* or *Traufgräben* in German; Lüning 1988, Coudart 1998, 73). Coudart notes that rarely if ever ghosts of posts have been seen in these trenches; she therefore considers the first interpretation less likely and prefers the gutter interpretation[3]. Stäuble, however, noting that their position is too far from the walls for vertical roof supports and adducing civil engineering arguments, explains these trenches as to provide horizontal or lateral strength to the soil. In Ältestbandkeramik houses the central part has no interior roof posts and so the roof rests entirely on the walls which therefore exert lateral pressure on the soil in the direction of the *Längsgruben*. The trenches held flat lying tree trunks which countered these stresses, according to him (Stäuble 2005, 177). The *horizontal* position of the beams would presumably also explain the often noted absence of post shadows since their weathering would provide similar colouring in the entire 'berth'. When in the central house parts roof supporting posts appeared (an innovation of the early Flomborn phase) taking over the roof load from the walls, the lateral stress exerted by the walls largely disappeared, and the need for outer trenches with it; as demonstrated by the other houses here on the Janskamperveld as well as in all younger LBK villages. At Geleen-Janskamperveld there are no houses without central roof posts, yet five or six houses are accompanied by (strictly spoken) superfluous outer trenches alluding to past situations. These houses (HH 05, 13, 16, 57, 58 and possibly 24 as well) are all fitted with central configurations of the Y or dY type and therefore built in the early Flomborn period. There is also a section of a pit (no. 49080) which has all the characteristics of an outer trench though not accompanied by a house, which may at least partially be situated outside the excavation and therefore not adequately registered on the plan. One of the houses accompanied by outer trenches has many post shadows in the post holes of its DPRs (HH 24, 35), so if there would have been posts in its outer trenches they would have been noted — no shadows were found though. Along other houses they are similarly absent. In Pavlů's Bylany report, an absence of post ghosts is also acknowledged; however to keep up the foundation trench hypothesis he suggests that boards used to stand in them instead (Pavlů 2000, 193). The photograph of the excavation of House 13 (fig. 5-1) shows its outer trenches clearly between the *Längsgruben* and the house walls. Fig. 5-2, a drawing of a section through one of the best examples of these trenches (feature 26090, to H57), shows the thin layering through gradual filling by natural agency, as required when either the rain gutter interpretation or the lateral stress alleviation hypotheses are correct; in the opposite case, the fillings would have to be more like post holes judging from Stäuble's theses on pit fillings (Stäuble 1997, 22-26). In the Graetheide *Siedlungskammer*, Geleen-De Kluis also yielded houses with outer trenches (Waterbolk 1959, Abb. 79, 80 – houses W1 and W2), as did Sittard (Modderman 1959, Abb. 23 – house 1), Elsloo and possibly also Stein (Modderman 1970, Taf. 26, 188 – houses Elsloo-59, Stein-26), all showing Y-configurations of their central posts.

fig. 5-1 House 13 during the excavation showing outer trenches on both sides

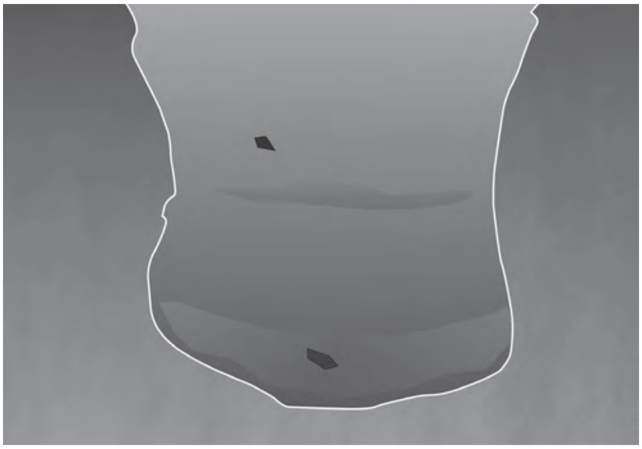

fig. 5-2 Cross section drawing of an outer trench of House 57 (feature no 26090)

5.4 Near-to-houses features: kettle pits

Lüning describes a great number of cylinder-shaped pits at Langweiler 9 on the Aldenhovener Platte, which he interpreted as silos. . similar pits in the Dutch loess region 40 km away, the Graetheide, are totally absent. ... This does not mean that the existence of underground silos in the LPC [Linear Pottery Culture, Bandkeramik] need in principle be rejected. ... If the silos prove to be a phenomenon that shows important differences in use on a local or regional scale, it becomes even more interesting to find an explanation. Modderman 1988, 104

Lüning's description of these drum like "kettle" pits (*Kesselgruben* in German) to which Modderman alludes is clear though quite extensive, so I shall summarize his text. A kettle pit, according to him, shows a box-like outline on section, the bottom and walls are straight; on the excavation plan it shows a round or slightly oval outline. In the Langweiler 9 settlement a large number of these pits has been found (121 are on record), which suggests a "regular need" for them — possibly the storage of stock in earth cellars. In an excavation, they feature a thin black layer at the bottom ("perhaps deriving from its primary use") on top of which a brownish layer of 20-35 cm has been deposited (possibly the earth with which the wooden boards over the pit were covered which on abandonment has fallen in). On this brownish layer irregular clumps of loess are found (torn loose from the cellar's walls once the cover was gone). Finally, these pits tend to be sealed by blackish and brownish naturally deposited layers mixed with human refuse like sherds, charcoal, burned loam, stones and flint spalls (Lüning 1977, 66-67).

Modderman lived to see the refutation of his statement above: in 2000 the present author was involved in the excavation of a Bandkeramik settlement at Beek-Geverikerveld, 7.5 km southwest of the present site, where associated with every house one or two silos have been found. In the report on the excavation we stated:

The Bandkeramik has been an orderly society as is proven time and again by the standard position of the various types of pits relative to the houses ... On the Geverikerveld silos are located to the South of the rear parts of the farm houses ...

Van de Velde/Bakels 2002, 45 (my transl., PvdV)

We also presented a section drawing of the largest silo there, measuring about 180 cm in diameter, and with a depth of an estimated 200 cm below the original surface (140 cm below the excavation plane; Van de Velde/Bakels 2002, afb. 14); Lüning's description fitted this specimen like a glove. The Beek-Geverikerveld settlement was dated to stages 2c and 2d of the Dutch sequence (LBK V in the German chronology). Ironically, in 2006 in a rescue excavation in the Elsloo-Koolweg village – the site of Modderman's extensive investigations in the 19-fifties and -sixties – several kettlepits were found, too.

Generally, silos are cylindrical pits with average diameters of between one and two metres, and depths of more than two metres. It is thought that they served as cellars and either had small entrances like a manhole covered by a lid sealed with loam, or that they were cylindrical to the surface and covered by wooden boards. In the wake of the excavations on the Aldenhovener Platte, Boelicke has conducted field experiments with this type of pits (Boelicke *et al*., 1976, 309-312). In the Janskamperveld site nearly one hundred features answering to Lüning's definition of kettle pits have been found and another 69 pits that show at least partially the main characteristics of vertical sides, flat bottom, round plan and characteristic fill pattern. Morphological characteristics have been assembled in table 5-6, their distribution in the settlement is indicated in the accompanying fig. 5-3. From the plan can be seen that few kettle pits in this settlement were found in separate spots, most are components of *Längsgruben* or of pit complexes; only 21 are individually visible on the excavation plan and therefore only these can be said to be singular; they have round or slightly oval plans. As with all other features, the depth of the kettle

walls:	kettle pits	look alikes
conical	14	–
vertical	63	52
funnel	11	7
indet.	7	4
sum	95	63

bottoms:	kettle pits	look alikes
concave	13	21
saucer	2	
flat	73	23
convex	4	–
indet.	0	16
sum	92	60

table 5-6 Morphology of kettle pits and "pseudo"-cellars

fig. 5-3 Kettle and kettle-like pits

pits can be approximated only because of the original undulating surface, although a minimum offset of 4 dm can safely be assumed. Table 5-7 shows the distribution of the depths of the kettle pits and the 'pseudo' kettles. It can be deduced that the original depth was at least 5 dm below the excavation surface. It is also clear that depths of over 13 dm below the present excavation (plus 4 dm to correct for post-occupational effects) should be considered exceptions; the regular depth seems to have been in the order of 11 to 14 dm (minus 4 dm in the excavation), which is obviously short of a man's height unless these ominous four dm are an underestimate. Similar sizes are reported for the kettle pits on the Aldenhovener Platte (Boelicke *et al.* 1976, 310).

Table 5-8 summarizes the diameters of these features; that is as far as these can be read from the section drawings. In many (though not specifiable) cases it is not clear whether the true diameter has been obtained: sections may have touched the pits, cut partially, or centrally, there is no way to separate this out from the available drawings. It is clear that when the section does not cut through the centre, the reported width is at best equal to the true width, so any computation based on the observed width provides a minimum estimate. Generally, the diameters seem to centre around 8 dm, and this obtains for both the 'true' kettles and the 'pseudo' cellars; again, values of 2 metres and more are rather exceptional just like the depths in that order. The computation of the original volumes provides approximate minimal values (table 5-9), firstly because of the estimation of the depths, and secondly because of the problems associated with the determination of the diameter. Given the averages of diameters and depths, the tendency toward volumes of 2000-2500 litres comes as no surprise. This volume equates to 1000 to 1250 kg of unthreshed grain (900-1100 kg after threshing) which would support 5 or 6 adults for a year, and includes seed-corn for the next harvest (cf. Van de Velde/Bakels 2002, 46-47).

All kettle pits in the settlement have collapsed; in several cases new cellars have been dug immediately next to, sometimes even within the perimeter of previous pits. The section drawings depict (almost standard) dark, generally conically shaped bottom layers, non-homogeneously structured and with coloured layers above these, and a much wider trough-like layered top-filling. The dark bottom layer possibly derives from remnants of the stored products (and several times many kernels of grain have been encountered); the inhomogeneous filling derives from the collapsed side walls, including part of the A-horizon; the layered top will be the natural after-fill of the depression which formed with the settling of the soil in the pit ruin (Boelicke *et al.* 1976, 309-310; Lüning 1977, 66-70).

Most kettle pits are situated close to houses, and it is likely that the inhabitants of these houses rather than other people used them. An undiscussed and unsolved problem is how they were kept dry: distances to the houses are larger than an overhanging roof would cover. Eventual post holes along their perimeter to support an awning have long disappeared — even if they would have been sufficiently deep to penetrate the excavation level, the collapsing pit sides would have obliterated their shadows. The number of

depth	kettle pits	look alikes
2	–	–
3	–	2
4	1	1
5	5	2
6	5	13
7	13	18
8	27	12
9	13	9
10	12	4
11	9	5
12	6	1
13	2	1
14	–	–
15	–	–
16	2	–
sum	96	68

table 5-7 Depths of kettle pits and "pseudo"-cellars below excavation planum, in decimetres

width	kettle pits	look alikes
<6	11	2
7-8	40	7
9-10	25	12
11-12	15	20
13-14	2	11
15-16	2	6
17-18	–	7
19-20	–	3
21-22	–	–
>22	–	1
sum	95	69

table 5-8 Diameters of kettlepits and "pseudo"-cellars, in decimetres

volume	kettle pits	look alikes
500	4	1
1000	1	5
1500	9	5
2000	11	10
2500	14	13
3000	9	10
3500	9	4
4000	5	1
4500	9	4
5000	8	4
6000	6	3
7000	3	2
8000	2	1
9000	2	4
10000	3	0
>10000	3	1
sum	98	68

table 5-9 Estimated original volumes of kettle pits and "pseudo"-cellars, in litres

per house	kettles	look alikes
0	17	–
1	18	13
2	13	12
3	2	5
4	3	8
5	–	3
6	1	1
10	1	1
∑	78 + 17	115

table 5-10 Numbers of kettle pits and "pseudo"-cellars per house

pits per house is quite variable (table 5-10), if we base ourselves on the (more than questionable) assumption[4] that all pits have been discovered during the dig and registered on the section drawings. The largest numbers have been observed along the type 1a houses H 35 (ten cellars) and H 17 (six kettles); type 1c house H 38 and type 2 houses H 25 and H 45 each had four kettle pits. From the Langweiler 2 and 9 settlements on the Aldenhovener Platte, kettle pits are reported to a maximum number of five per house (Boelicke *et al.* 1976, 309). On the Janskamperveld, probably several may have escaped detection (see footnote), but the larger house types seem to be accompanied by more cellar structures than the smaller ones; however, as two type 2 houses figure among those with the largest numbers this may be erroneous. Finally, one fifth of the kettle pits has no house in its immediate vicinity (as do 29 'pseudo'-cellars), and whether they served the community as a whole or any sub-group larger than the individual household, or are vestiges of the pioneering (pre-building) stage of the settlement will probably remain obscure: only very few finds which might establish a date derive from them.

One other problem with the kettle pits of the Janskamperveld should be signalled. The fact that 60 of them are part of 34 *Längsgruben* renders it at first glance difficult to accept them as 'cellars' or something similar. At the very least a simultaneous existence of side pit and kettle pit is very unlikely. Which leaves us with three not-exclusive options: either the kettle pits were in disuse before the side pits were opened, or the side pits are only apparently *Längsgruben* but rather the outcome of the collapse of earlier cellars; or the 'kettle pits' were not cellars at all, but just traces of the way in which the side pits were dug by some people. Given that 20 side pits hid one single cellar, the first option seems the best fit, which would perhaps imply the second option for the *Längsgruben* hiding several kettle pits; the third option seems less probable, given the findings from Beek and the Langweiler settlements — and thus Modderman's statement can be assigned to archaeology's history.

5.5 Features away-from-houses: trenches, fences and post holes

Among the features away from houses, several conspicuous ditches are visible, especially when houses and house-related features are removed from the site plan (fig. 5-4). This quite *irregular configuration* is clearly contemporaneous with the Bandkeramik occupation of the site: at several places the ditches lie plied around houses, as shown in fig. 5-5: H 24 in the western part, H 53 in the northeast. It is not certain whether the ditch constituted a continuous ring around the settlement, as no connecting traces have been found neither in the northern nor in the southern part of the site although they were intensively searched for during the excavation. On the profile drawings, the ditches get shallower towards their ends, suggesting that their bottoms are not fully parallel to the excavation plane and were originally considerably longer. Therefore I think that there was such a strong village perimeter or enclosure all around the settlement. Remarkably, hardly any post ghosts have been found in the trenches, although the irregular bottom profiles (in 24 out of 67 segments) would suggest their earlier existence, and at places their depth reached 60 cm, as if the posts were pulled out before abandonment of the installation. On cross sections the sides of half of the trenches are vertical and half are slanting. The remnants of the trenches are too narrow, however, to decide on the issue of their cross section, either Y- to V-shaped or with flat bottoms (so-called *Spitzgraben*, resp. *Sohlgraben*); their small width on the plan (most of them about 35 cm) is strongly at variance with the latter possibility (compare the Erkelenz-Kückhoven ditches where for the second ditch system with a depth below plane of only 40 cm a width of 1.2 m has been observed, and interpreted as a trench of the second type; Lehmann 2004, 228). No traces of a wall behind the trench have been found (although post-construction erosion would have obliterated any vestige of it), which is as would be expected, the palisade being founded in the trench itself, and not behind it.

As can be seen on the plan, not all ditches are part of one, singular trace; both in the northwest and the northeast smaller ditch segments run deviating courses. They may either be explained as internal subdivisions of the settlement or as earlier or later versions of the surrounding ditch. The ditch-palisade system seems to be more than just one single enclosure. At several places there are *three* ditches behind one another, in some places (e.g., the western part) situated rather close together, in other places (e.g. towards the northeastern part) with ample space between them. Although at several places cutting into each other (but nowhere could the sequence be established), the ditches nevertheless seem to follow roughly similar courses, and we may ask whether they were contemporaneous. On the one hand one wonders why there should be more distance between them here than

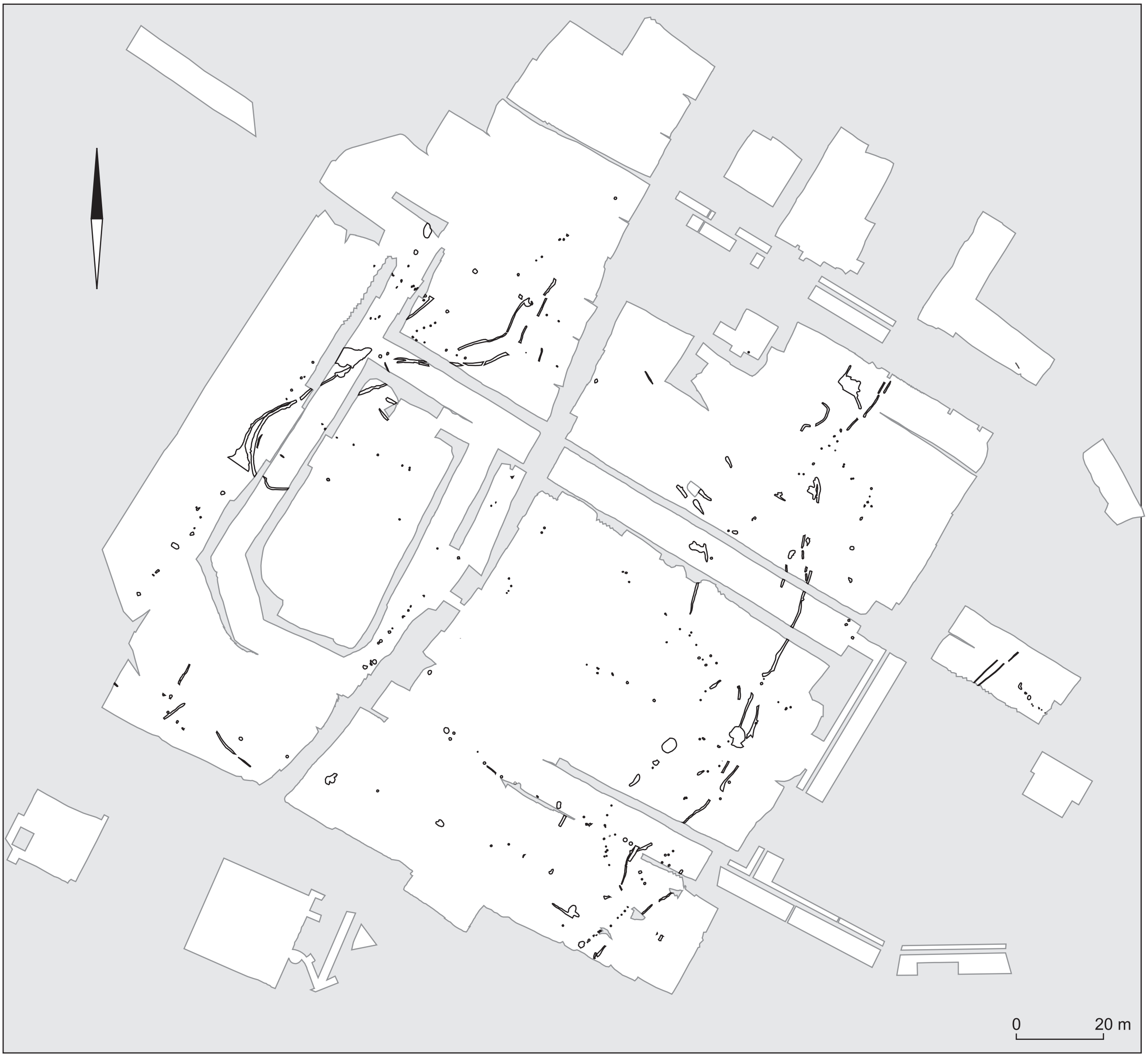

fig. 5-4 Site plan after removal of pit complexes, houses and near-to-house features

there, the narrow spaces between them do not at all look like fortified entrances (cf. Höckmann 1990, Abb. 20). And on the other hand, Bandkeramians seem to have had an inclination toward re-building rather than repairing, as witnessed by their house building practice. On the same topic, it is of interest that some of the section drawings or the accompanying field notes mention differences in colour, especially when the ditches are near to each other. Thus, in the northwestern quadrant, a light brownish grey filling is reported when the outermost ditch is discussed, in contrast to more inward ditches with darker colours. The colour differences may point to chronological differences — lighter colours referring to earlier situations (when the site was comparatively little soiled), darker to later points in time. If this were the case, the sets of treble ditches may really point to three different moments of construction. As none of the ditches can be followed all around the settlement, recourse has to be taken to guesswork: perhaps all or most of the outer segments of the sets constitute a single system, perhaps the inner ones form another circuit, and what is in between was an

fig. 5-5 Houses, palisade trenches and fences

intermediate palisade ditch. Following this through, and based on the colour differences, the assumption that the outer segments represent the oldest palisade ditch is confirmed by the dating of the houses lying along the visible parts of its supposed course, suggesting construction in the first house generation. By the same means, the inner ditch seems to come next, at the transition towards or even in the second house generation; and the intermediate ditch segments would have been dug in the second or towards the third house generation. Even if all three ditches were dug conspicuously around the rear of H 24[5], the course of the intermediate (youngest) palisade has more of a bend than of a bulge around that house, and so may have been laid out after the house's dismantlement yet approximately in line with the palisade's predecessors. The tentative dating of the three phases of the ditch system is of course irrespective of the precise connection of the individual ditch segments to one another. Originally the ditches may have followed crossing courses, fact is that a small number of segments can be associated with either contemporaneous or chronologically discordant houses and with it the originally associated enclosure; unsolved is the problem whether the enclosure was partially repaired several times or re-built (*i.e.*, newly erected) twice.

On the Graetheide Plateau, ditch complexes are known from Sittard and Elsloo (Modderman 1985) while yet another one at Stein is also mentioned in the literature. The latter has been reported in older investigations (Beckers/Beckers 1940) but with modern hindsight we would say that the very extensive twinned walls and ditches structure seems to be a medieval construction. In the autumn of 2005 a wider and deeper example, probably a *Sohlgraben*, has turned up in an evaluative heritage excavation at Beek-Kelmond, to the south of Geleen; its LBK origin is hardly questionable. Similarly a fairly large *Spitzgraben* construction was found on the valley bottom below the Beek-Hoolweg settlement in 2007 (Wijns/Van de Velde, in prep.). Also known from the literature is a double-ditch enclosure on the Caberg above the left bank of the Meuse River near Maastricht (Holwerda n.d.; Thanos 1994), which however is better attributed to the Michelsberg culture (Modderman 1959, 25).

The size of the enclosure can be estimated at 1.9 or 2.0 ha, which is in the order of the majority of the known neighbouring trench systems: the Langweiler 3 single ditches fence in about 0.55 ha (Eckert *et al.* 1971, Abb. 19), the Langweiler 8 trapezoid ring occupied 0.8 ha (Kuper *et al.* 1974, 429), Langweiler 9 measured about 0.6 ha within its inner circle, 0.8 ha within the outer circle (Lüning/Stehli 1977, 82); Inden-Altdorf 1.3 ha (Bollig *et al.* 2001); Erkelenz-Kückhoven 1.3 ha, 1.7 ha, and 4.1 ha (Lehmann 2004, 227); Darion-Colia "a little less than 2 ha" (Cahen 1986, Bosquet *et al.* 2004); Köln-Lindenthal 3.4, 4.4 and 3.4 ha (Bernhardt 1990); at Sittard-Monseigneur Claessenstraat only parts of two ditch systems have been excavated (Modderman 1959) but may be estimated at 0.4 and 1.2 ha; in Oleye-Al Zèpe and Waremme-Longchamps (Bosquet *et al.* 2004) the excavations were rather limited and surface areas can therefore not be established. Entrances, though restricted in number, have been perceived in all enclosures mentioned; on the Janskamperveld three are apparent on the excavation plan (figs. 5-5 and 5-6) — they suggest only a little elaboration by screens built longitudinally in the passages between the ditches/palisades (cf. Höckmann 1990 for the various LBK variations on this theme). With an estimated perimeter of about 600 metres, and approximately 200 metres of trenches left, the original number of entrances should be appreciably higher, but divided by three again to accommodate the separate trench phases.

There is much speculation regarding the function of ditch systems in the literature, by itself suggestive of a drive toward one homogeneous explanation for all these features. In my view, however, as diverse as the plans of the ditches are as diverse are their functions. Thus, in the present, Janskamperveld case, its rather irregular perimeter is quite ineffective as a defensive objective. With a depth of less than one metre below the original surface, if left open it would have been easy to jump across the ditches, when set with a palisade this would not have been higher than 1.5 perhaps 2 m above ground level and as such would only slightly have slowed down a human attack. Add to this the probably quite high number of entrances and it is clear that as a defensive bastion the system is virtually ineffective. Moreover, the LBK menu posed hardly a competitive threat to the hunters and gatherers in the forest — though their brethren within an hour's walk to the North, West and South may be another, more threatening option. Consequently rather than an enclosure, a marked separation of village area and forest, a within/without line, to keep regulars like children and pigs in, phantoms and wild creatures out, seems more plausible (in an attenuated sense of Hodder's *ager-domus* opposition; Hodder 1990, also cf. Höckmann 1990). In the same vein, the later, more regular plans (such as in Darion and its neighbours, Köln-Lindenthal if its rings were contemporaneous with the village) are likely to have more warring appeal, more likely also as intra-LBK tensions may have been building up towards the end of that culture. For these same tensions some other LBK groups may have sought ritual alleviation, as instantiated in the Langweiler-3 rings and elsewhere.

Let's now turn to post holes away-from-houses. In the section above on in-house post holes the outdoor orphans have already been introduced: those post holes not assignable to house plans. Post holes were defined there as geometrical, standardized more or less cylindrical features. It is difficult to separate post holes (which is a functional assignment) from other features that also show cylindrical features (a shape characteristic), many of them too large to serve as foundation for any reasonable post. Sometimes a palisade-like trail of pits may show up on the excavation plan, lending substance to the interpretation 'post hole'. More generally the problem lies, of course, with the single/singular round features with steep sides strewn over the site. A statistical approach to the problem (such as: all oval or round features with diameters of less than *xx* dm) comes up against the continuous, non-peaked distribution of pit sizes, which renders the selection of the value *xx* arbitrary. Fortunately, there are a considerable number of quite large unmistakable post holes in houses with ghosts clearly visible. Their maximum sizes are over one metre; and so *xx* was set to the largest of these post holes: 15 dm (within the class of geometrical or cylindrical features). Here, too, several features have been added which showed up only as dark spots in the excavation plan when configured in palisade rows (61, or 14.2%) and proved 'empty' when cut. As stated in the in-house post hole section, a fairly reliable estimate of the number of posts in the houses is almost exactly twice the number of observed posts including those with zero-depth, hence a positivist attitude rejecting such observations does not further the debate. As the depth of the outdoor post holes is generally less than those inside houses, their original number should probably be estimated at more than double the number in table 5-1.

Even so, the considerable number of 433 post holes has been *recorded* outside recognizable houses, still within the perimeters of the excavation. It could be objected that these holes may represent the bare survivals of otherwise completely vanished houses. As detailed in the chapter on houses the minimum count of post holes that was recognized as house remains was five holes, the legibility of their configuration probably sheer luck. Assuming (for the sake of argument only!) that some ten to twelve post holes normally suffice for the recognition of a house, the 433 ungrouped post holes would be evidence of another forty houses in the village — which strikes me as absurd.

The geometrical characteristics of the outdoor post holes are presented in table 5-2 in an attempt to compare them with the indoor post foundations. It appears that on the whole there were only small differences between the two sets. The smaller number of stepped pit bottoms in the outdoor class appeared most notable; also, there were twice as many pointed holes in the latter. Both, of course, readily understandable when it is assumed that there were no crossbeams on top of them.

This leaves us with the problem of the interpretation(s) of these features. As noted above, when post holes and trenches which make up the houses as well as features associated with them are removed from the excavation plan, what is left shows a distinct patterning, especially in combination with the remnants of the palisade ditches (figs 5-4 and 5-5). Two decades ago, at the end of his career, Modderman wrote regarding a less clear and marginally less complex yet comparable situation:

> *Single palisades, or with a second one parallel to them at a short distance, are now known from ... the Netherlands. They are usually not dug deeply, so that their presence must have been more common than present data would suggest. They have stayed unnoticed because either the settlement terrain was eroded or because rescue excavations on the site had to be made that went down too deeply into the surface.*
>
> Modderman 1988, 102

Though referring to the Sittard settlement, the quote seems applicable to the Geleen-Janskamperveld excavation too. In fig. 5-5 lines have been drawn connecting sets of the remaining post holes, suggesting a sub-division of the site by fences[6] — straight or slightly curved lines of at the very least five post holes with regular distances between them. Of the 433 orphaned post holes, 161 can provisionally be assigned to 14 palisades (table 5-11). Regular distances between the pales are sought for on the assumption that Bandkeramians, being the craftsmen their houses suggest,

fence no	n(pp)	pp-twins	netto(pp)	length	E(d)	E(pp)
F01	15	0	15	64.0	2.2	29
F02	14	3	11	66.6	4.4	15
F03	8	0	8	23.7	2.2	11
F04	5	1	4	10.5	2.2	5
F05	23	5	18	106.7	2.2	48
F06	14	2	12	31.2	2.2	14
F07	14	4	10	43.2	2.2	20
F08	9	2	7	40.8	1.5	27
F09	5	0	5	19.0	1.5	13
F10	18	3	15	52.1	2.2	24
F11	18	1	17	18.5	0.6	31
F12	6	1	5	16.3	2.2	7
F13	6	2	4	19.1	1.5	13
F14	6	2	4	28.2	3.0	9
	161	26	135	539.9		266

table 5-11 Major characteristics of fences
n: count; pp: posts; d: interval (metres);
E: estimate

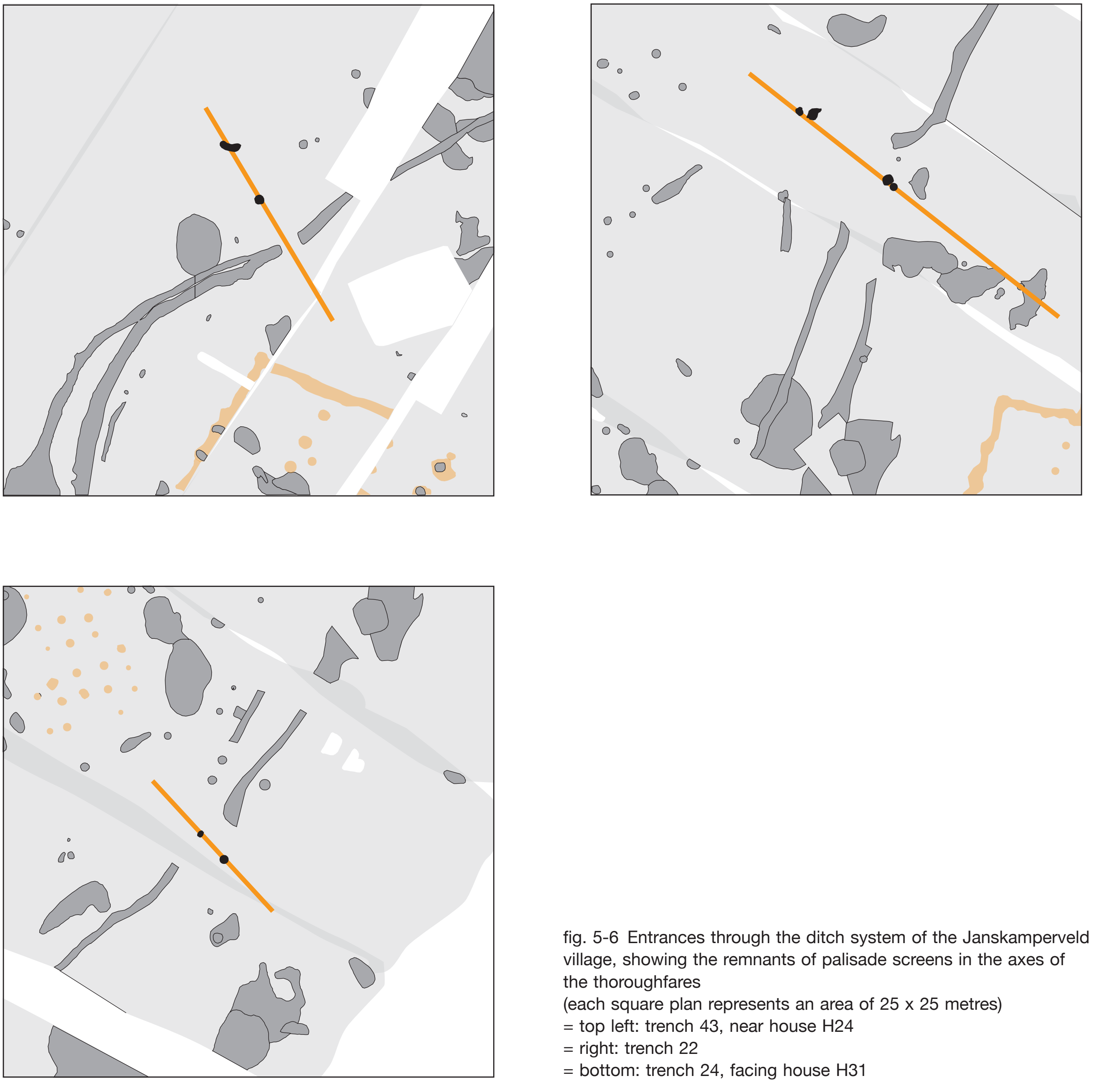

fig. 5-6 Entrances through the ditch system of the Janskamperveld village, showing the remnants of palisade screens in the axes of the thoroughfares
(each square plan represents an area of 25 x 25 metres)
= top left: trench 43, near house H24
= right: trench 22
= bottom: trench 24, facing house H31

also took care of regularity in their other constructions. However, regular intervals are not always evident: a number of post holes have not been observed where they should have been, if my previous assumption has any grounds. As noted time and again especially in the section on house-associated post holes, erosion and other post-depositional factors have wiped out many traces, so in the case of fencing lines something similar will have been the case. If so, then per palisade the observed intervals should be multiples of a common denominator; as the table 5-shows, that distance is in the order of two or two and a half metres for most rows. A comparison of the expected number of pales (*c.* 266) with the observed number of post holes (135, not counting doubles) suggests that approximately 49% of these holes have disappeared without trace (much like the house-associated post holes above).

If so, there are two distinct groups of palisades: a regular one, with lines running parallel and perpendicular to each other, and an irregular pattern constituted by ditch-palisade combinations, with curved sides and generally positioned obliquely to the first set of lines. The latter, *irregular configuration* of fences and ditches is clearly contemporaneous with the Bandkeramik occupation of the site as has been discussed above. The fences which belong to this group are F 01, F 07, F 09, F 11 and F 12 as labelled in table 5-11 and fig. 5-5; perhaps F 04 in the western part of the site is also a continuation of one of the ditches. It seems likely that where now 'fences' are positioned, there were originally ditches, since lost by erosion of the neolithic surface 5 to 10 dm up from the excavation plane; hence 'palisade' is a better name in this context. One remarkable coincidence should be mentioned: to the northwest on the outside of F 01 a little Bandkeramik neighbourhood was constructed seemingly or apparently respecting that fence, with the houses 39-44, 62 and 63 all dated to the last house generation, whereas the palisade was built in either the first or second house generation. The *regular system* of fences is approximately oriented like LBK houses in general and consists of the other fences in table 5-11. This system is not associated to ditches, hence 'fences' is perhaps a better word to describe them. Parallel to the houses, the long traces of F 02, F 05, F 08 and F 10 are relatively easy to pinpoint; there are perhaps also some shorter fence-like structures (F 03 in the northern part, F 14 towards the eastern part of the excavation). Then, perpendicular to them is F 04 situated in the western part but this may be an extension of a ditch, and the shorter F 06 in the centre (perhaps with F 13 parallel at 15 m to the east, which is rather questionable for being quite short; moreover this is the part of the site which has suffered most from erosion). On the assumption that they indeed belong to one, regular system the dating of these fences is an enigma. The *regular system* cuts through or is cut through by the *irregular system* to the rear of H 24, an indication for non-contemporaneity. F 05, a clear member of the regular configuration is situated slightly more than one metre to the right of this very same house, which unequivocally has directed the course of the irregular palisade ditch. The house has been assigned to the first house generation, yet a nearly self-evident association with F 05 would suggest contemporaneity of both (regular and irregular) fences. There are more problems as two houses, HH 25/37 (final occupation, resp. third house generation), are situated 'against' this F 05, and H 36 (final LBK occupation) close by. Then, F 06 is interrupted by the remnants of H 35 (dating to an early house generation), as does F 08 to H 31 (possibly early, too). F 10 passes very close by H 04 (house generation 3) and H 12 (possibly house generation 1).

Only one inference seems reasonable: the regular system is not contemporaneous with the Bandkeramik settlement. However, in the field notes it is several times stated of post holes grouped here with the "regular system" to have definite Bandkeramik characteristics in colour, soil fillings, and outlook. Therefore, if the assumption that the *regular system* is one single coherent feature is right, and the conclusion of non-contemporaneity of settlement and system is acceptable, the fences have stood either in the pioneering phase before the colonists constructed the houses, or after abandonment of this place in the fourth house generation they stood perhaps as delimiting gardens of the adjacent Haesselderveld village (an even later date, after the final LBK occupation = LBK 2d is unlikely, as subsequently the Bandkeramik vanished entirely from the Graetheide Plateau). Of course, this inference is no better than speculation.

Fences as defined here have turned up elsewhere too. In most sites on the Aldenhovener Platte, one to several such constructions have been reported (Kuper *et al.* 1973 and Kuper 1977; Boelicke/von Brandt 1988); also in Darion one fence has been observed (near house M 1, in a configuration very similar to F 05-H 24 in the Janskamperveld settlement; Cahen 1986). Even more comparable is Cuiry-lès-Chaudardes, where two parallel straight fences are partly obscured by one of the biggest houses; that same house has a fence around its left and rear sides (Howell 1983).

With 161 post holes attributed to fencing systems, there are still 272 post holes on the plans of this excavation which are presently unaccounted for.

5.6 Features away from houses: pit complexes and unclassifiable pits

In any Bandkeramik excavation, composite pits are conspicuous entities among the features. Among them, the *Längsgruben* along the houses are best known, yet they do not exhaust this category; 'pit complexes' are their complement. The origins of the latter may be several and complex by themselves. Thus all kettle pits have collapsed after falling into disuse, and in many cases successor cellars were dug nearby which also collapsed in due time; the result is labelled 'pit complex' (fig. 5-7). Also, clay quarrying was apparently not restricted to the side pits, and may be the most obvious additional alternative cause for pitted surfaces, with the collection of rain water maybe as a secondary purpose (or *vice versa*). Pit complexes are defined as features demonstrably consisting of two or more parts (Lüning 1977, 74-76). Clearly *Längsgruben* do comply with this definition too, only their position next to the houses' central and front parts single them out. On the Janskamperveld several pit complexes (especially when of the collapsed kettle type) are situated near houses, on one or both sides of the rear part of the houses (e.g., H 47 in fig. 5-7), or alternatively, near one or even both of the front corners of a house (e.g., HH 20, 34, 41). If they could be linked to the neighbouring houses, they would be part of the inventories of the house yards, in the

fig. 5-7 Recorded pit complexes

vein of Boelicke's standard set of pits accompanying the Aldenhoven/Langweiler houses. In the present case, there is no evidence for such a link whatsoever, and their presence near the houses may be entirely fortuitous. Also, these twenty pit complexes near houses may as well be considered part of the (regular) side pits, although evidence is similarly lacking — I have separated them out just by keeping strictly to the customary definition of the latter as being situated along the central and front parts of the houses. Composite pits elsewhere, even close to a house, then automatically pertain to the 'complex' variety.

Additionally there are at least 21 pit complexes away from the houses in the Janskamperveld settlement. Those on the plan (fig. 5-7) are demonstrably composite, but it is to be expected that among the other, 'singular' pits several more are hidden which have simply not been sectioned at the right spot to show their separate components. Of all pit complexes (as defined here) 20 register complex shapes of their bottoms, walls, and/or plan. Their sizes have been grouped in table 5-12 (to be compared with those of the side pits in table 5-3). Pit complexes are generally larger than side pits: their median width and length, even their depth is substantially larger than those of the latter pits. In my opinion these figures cannot be used to estimate the original pit volume as I did for the side pits: shapes are complex, and the lost forty-plus centimetres of top soil may have hidden side lobes and additional depressed features. Also, as noted by Lüning long ago, a detailed analysis of their contents is senseless due to their palimpsest nature and multiple origins (Lüning 1977, 75).

	length	width	depth
maximum	90	75	16
Q3	49	24	8
median	32	17	7
Q1	20	10	5
minimum	10	4	1
count	36	38	39

table 5-12 Major metrics of pit complexes, in decimetres

	length	width	depth
maximum	80	38	10
Q3	15	10	4
median	10	6	2
Q1	6	4	1
minimum	0	1	0
count	359	348	278

table 5-13 Major metrics of unclassifiable pits, in decimetres

Here perhaps better than elsewhere a few remarks may be made regarding the 347 features that escape classification except that they are non-geometrical and non-standard in outlook. Almost fifteen percent of all pits remain in this category; their major metric properties have been collected in table 5-13. Maximum sizes are close to those of the pit complexes but they are exceptions, as all other values are considerably smaller, especially their depth is fairly small. In that shallowness one, perhaps the main, explanation for their non-classification may be found: with similar depths as the post holes, their non-geometrical shapes on section are most of the time in the realm of simple funnels or craters, therefore quite indistinct.

5.7 Summary: the features of the Janskamperveld settlement

In the Janskamperveld Bandkeramik settlement 2778 features have been recorded in the excavation, 2429 singular ones, and 119 composite features formed by 230 component pits. In the analyses above they have been divided according to shape and context. Shapes are either standard geometrical or free forms; contexts refer to the position of the features in relation to the houses: in-the-house, near-the-house, and away-from-the-house. It is assumed that standard shapes relate to circumscribed primary functions: kettle pits served as cellars; post holes stabilized posts either in the house or outside, in fences; trenches founded fences or walls depending on context: in-the-houses walls, outside palisades. Free shape features are defined according to their context: near-the-house the side pits (*Längsgruben*), and away the pit complexes; they are supposed to have served primarily as loam 'quarries'. A residual category of 'other pits' grouped features that could not be otherwise accounted for.

In-the-house features are of two standard types: post holes and wall trenches numbering 1369 and 19, respectively. The former (which represent about half the original number, judging from the plans) show more or less cylindrical profiles, with 17% stepped and 42% convex bottoms; diameters average 4 decimetres, their average depth is about 2 dm below the excavation's level (originally probably 6 dm). Wall trenches, the second indoor feature, have a fairly standard width of 5 dm; there are five or six houses with a wall trench all around (type 1a), and another thirteen houses have trenches only around their rear parts (6 type 1b and 7 type 2b); the remaining houses are of the c-type, or too badly represented to tell us something about their walls. Two houses had traces of interior trenches with similar characteristics as the outward trenches (though less wide).

Next-to-the-house features appear in three types in this village: side pits, outer trenches, and kettle pits. Side pits are irregularly shaped and situated parallel to the side walls of the central and front parts of the houses. Their supposed function as loam pits for the raising of the house floor and the daubing of the walls could not be confirmed by comparing the volumes of the pits with those of the walls, so there should have been additional uses for the loam like potting, the building of ovens or other small structures, the upkeep of the houses, etc. Also, the “artefact trap hypothesis” was discussed, according to which larger pits would contain more finds; at least in this settlement no relationship appeared to exist between side pit volumes and sherd counts, and thus the hypothesis has to be rejected.

Outer trenches are regularly shaped straight gutter-like pits with distinctive U-sections, situated between the walls of the central and front parts of the house and the side pits along the houses; they occur along all Älteste LBK houses, and carry over into the Flomborn phase only to disappear soon after. In the literature they are explained as either rain gutters, foundation trenches for light secondary outer walls, or as the beds of tree trunks with the function to pick up the horizontal stress exerted on the soil by the house walls. As their distance to the house walls is too large to suppose connections with even a widely overhanging roof, the first two possibilities appear less probable. In the Janskamperveld village five, perhaps six, houses have outer trenches; these houses are all equipped with central Y post configurations indicative of an early construction.

Kettle pits are cylindrical, flat-bottomed features usually situated anywhere next to the houses, with diameters of about 8 to 10 dm and depths approximately 8 (+ 4) dm. Arguably kettle pits represent cellars, with estimated volumes of around 2500 litres, which, if filled with grain is sufficient to feed five or six people for a whole year, including next year’s seed. Ninety-eight of these pits have been recorded in the excavation; there were 20 kettle pits apparently not so near-the-houses (as their category suggests), and with 38 houses no such features have been observed. Yet there is a weak tendency toward two (probably non-simultaneous) cellars per house, to an observed maximum of ten kettle pits. Possibly, larger houses had more cellars, but this a very weak tendency at best.

First among the features away-from-the-houses are trenches, arranged in three irregularly configurated ditch systems. Much of the irregularity has to do with the position of apparently contemporaneous houses. No finds have emanated from the trenches, yet the dating of the associated houses suggests successive constructions in the first two house generations. Quite narrow in comparison with other Bandkeramik ditch systems, the section drawings suggest a function as foundation of palisades. The enclosed space is about two hectares, the perimeter about six hundred metres; three entrances are perceptible, with longitudinal screens in the passages. From the rather ephemeral impression made by these trench-palisades, a defensive function can probably be ruled out; instead, an enclosure to separate inhabitants from heathen creatures is suggested.

Second among the features away-from-the-houses range the lines of post holes, the latter again defined as cylindrical pits with diameters less than 15 dm, and numbering 373, to which have been added 79 small dark blots occurring on the excavation plan but faded when sectioned. Their shapes differ from in-the-house post holes in being less stepped and more pointed. When five or more such outdoor post holes were lying in a line and with regular intervals, they were grouped into ‘fences’, which grouped 161 features together into 14 palisades. On closer inspection two sets of fences could be suggested: a group of irregularly laid out palisades which are elongations of the ditch systems mentioned in the previous paragraph (and so dated to the first two house generations of the settlement), and a set of eight fences laid out parallel or perpendicular to the general direction of the houses. The latter set could not be associated with any of the other features of the settlement, although its constituents are clearly Bandkeramik.

Third among the features away-from-the-houses are the pit complexes, numbering 21, while another 20 complexes are found near houses next to the rear part or the front corners. Many pit complexes derive from sets of collapsed kettle pits, but other features in this class seem to be made up of ‘regular’, non-kettle components. Probably some more pit complexes are hidden in the category unclassifiable (which counted 374 features).

In the introduction to this chapter reference was made to Boelicke’s standard yard model derived from the excavations in the German Rhineland, which suggests a common set of pits in specific locations on all yards. In the present case, the density of features precludes such a grouping, although the side pits are located along the central and front parts of the houses, whereas kettle pits or cellars are sometimes found near the rear part, sometimes along the central part (after their collapse giving rise to side pits) or even immediately next to one of the front corners; yet evidence for a link of house and cellar(s) is lacking, apart from spatial adjacency. Also, dependent upon the acceptability of other arguments, the social organization in the Dutch settlements may have differed from that in the Rhineland — here, houses were grouped in yards in a lineage-like organization, there each house was on its own as if the households were more mutually independent (Van de Velde 1979 and 1990; Louwe Kooijmans *et al.* 2002; Hauzeur 2006, 161) — and hence the layout of the yards would necessarily be different too. However that may be, lacking convincing evidence to the contrary, presently no such Dutch Bandkeramik yard layout can be proposed.

Notes

1 Table 5-1 has been drawn up in centimetres suggesting a better accuracy than warranted as the post holes are sometimes quite conventionally rendered on the (digitized) plans. Therefore I prefer metrical summaries by decimetres, one factor down.

2 As several houses are near to or partially over the boundaries of the excavation, this number may be too high.

3 She also presents two beautiful photographs of *Baruya* houses in Papua New Guinea showing ethnographic examples of such rain gutters (Coudart 1998: 73). However, their depth seems to be some 10 or 15 cm to judge from these images, considerably shallower than the present trenches.

4 Many side pits (in which sometimes kettle cellars have been observed) were excavated only partially; among the other features, quite often only one quarter was excavated. Also, several pits were emptied with a dragline, due to time pressure, so that only one section could be drawn.

5 While the associations of H 24 and two of the three ditches, or of H 53 with part of the inner ditch seem beyond doubt, thus firmly establishing dates of construction, other associations and dissociations require some discussion. Thus H 57 sits astride the inner and intermediate ditches — in one interpretation suggesting it being part of those ditches (as in Louwe Kooijmans *et al.* 2002, apparently predicated on Modderman's inference regarding one of the palisades and a type 1b house at Sittard; Modderman 1959: 75). In my opinion, though, previous ditches were obliterated by the construction of the houses (why should they stop outside the *Längsgruben* and not continue between these and the house walls?), thus indicating *termini ante quem*.

6 The word *fence* is used in contrast to *palisade*, to distinguish larger from smaller intervals between the poles.

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6 Aspects of crops and crop processing in the Linearbandkeramik settlement of Geleen-Janskamperveld, The Netherlands

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The excavation of the Linearbandkeramik site of Geleen-Janskamperveld has revealed six crop plants: emmer wheat, einkorn wheat, pea, lentil, linseed and poppy. This is the normal set of plants for settlements founded in the northwestern part of the Linearbandkeramik world. The earliest crops contained fewer weeds than the relatively later ones. The increase in weediness can be explained by permanent use of the same plots. Special areas for disposing of agricultural waste have not been detected.

6.1 Introduction

Books and articles dealing with the crops of the early neolithic Linearbandkeramik culture (LBK) are numerous. The cultural habit of digging pits and filling them with waste, when their original role had been fulfilled, has left us with much debris, including carbonized seeds and fruits. Such remnants could not fail to attract scientific attention. For the northwestern sphere of this European culture, to which Geleen-Janskamperveld belongs, I refer to, for instance, Bakels 1979, Bakels/Rousselle 1985, Knörzer 1997, Kreuz 1990, and Lüning 2000.

Because so much has already been written about the crops and agricultural waste of the LBK, specific questions can be formulated which might, at least partly, be answered by new excavations. The excavation at Geleen-Janskamperveld offered such an opportunity. The following questions are put forward:

1. When did opium poppy (*Papaver somniferum* var. *setigerum*) arrive to form part of the crop assemblage?
2. Can changes be observed in the share of lentil (*Lens culinaris*) in the records?
3. Are there any changes in the course of time where the amount and type of field weeds are concerned?
4. Is there any difference in the waste associated with different types of houses?

5 Was the carbonized debris thrown away in special areas?
The background of these questions will be explained in the following text.

6.2 Materials and methods

To answer these questions, an intensive and systematic sampling programme was required in which every pit was sampled. The elongated pits alongside the walls of the houses were sampled in such a way that at least their centre and both ends were covered. When the fill of pits showed layering, each layer was sampled separately. The only features not sampled were postholes, as I know from experience that postholes of LBK houses are commonly void of seeds and fruits, though they can contain charcoal.

In general the sample size was 2 dm^3. The sediment was a sticky loessloam and had to be sieved by hand under gently running tapwater. The sieves used had meshes going down to 0.25 mm. The finest mesh was just fine enough to retain poppy seeds. Residues were slowly dried and then sorted with the aid of a Wild M5 microscope, after which the plant remains were identified and counted. As all sampled features were situated above groundwater level, only carbonized seeds had to be considered. Occasionally some uncarbonized seeds were found which were presumably introduced by soil fauna. Seeds of species which, when fresh, have a black or dark brown colour were cut in half to establish their carbonized state.

The complete procedure from the supervision of sampling to identification and counting was carried out by J. Goudzwaard. I did the necessary ‘second opinion’ identification of damaged specimens. All in all 444 samples were taken, processed and analysed.

The data set was processed by K. Fennema, who made tables and calculated the density of the finds.

6.3 Results

6.3.1 *General*

The list of cultivated plants shows the entire (short) set of species commonly found in the settlements situated in the northwestern part of the LBK world. These plants are emmer wheat (*Triticum dicoccum*), einkorn wheat (*Triticum monococcum*), pea (*Pisum sativum*), lentil (*Lens culinaris*), linseed (*Linum usitatissimum*) and poppy (*Papaver somniferum* var. *setigerum*). Emmer wheat is far more common than einkorn wheat. A notable absent species is barley (*Hordeum* sp.), confirming this characteristic feature of the northwestern LBK crop assemblage.

Remains of gathered nuts and fruits are present as well. Fragments of hazelnut shell (*Corylus avellana*) are regularly found, although concentrations of such remains are absent. Fruits are extremely rare. Two pits (24-026 and 44-012) contained fragments of apples (*Malus sylvestris*, parts of the fruit, cores and pips). One pit (59-007) revealed a sloe plum (*Prunus spinosa*, stone with adhering flesh). In another (32-025) a seed of elder (*Sambucus nigra*) was found.

A fruit of lime (*Tilia* sp.) was encountered in pit 17-050, but this is considered as not gathered for its own sake but as arrived together with the wood. Remains of other trees and shrubs, not considering charcoal, are absent. The other species are herbaceous and are interpreted as field weeds, except for bulrush (*Schoenoplectus* sp.) of which one seed was found. This rush may have been collected for basketry.

6.3.2 Opium poppy (Papaver somniferum var. setigerum)

The LBK opium poppy has drawn attention because the plant does not belong to the set of crop plants which came with the introduction of agriculture in central Europe. The other five crops mentioned in 6.3.1 are part of this set. Another characteristic is that until now finds are restricted to the, roughly, western half of the LBK world, a world which in its heyday reached from the river Dniestr in the east to far into the Paris Basin in the west (Bakels 1982, 1992). Occurrences of the wild ancestor of the opium poppy seem to be restricted to the western part of the mediterranean world, and the plant may have been brought into cultivation somewhere there and not in the Near East, which is the ultimate origin of the other five crops. The assumption that the wild opium poppy, which is growing today in the eastern mediterranean, is feral and not wild, is however not corroborated by genetic analysis. And recently poppy seeds have been reported from the Levant (Kislev/Hartmann/Galili 2004). Nevertheless, the LBK opium poppy is supposed to have been added to the list from southwestern, mediterranean sources, possibly the south of France. The plant arrived independently of the wheats, pulses and linseed.

The question is when did this plant arrive. The earliest LBK settlements did not reveal any traces of this crop (Kreuz 1990). So far, the finds date from the middle and late phases of the LBK, even in the area between the rivers Rhine and Meuse (contra Lüning 2000, p. 87). As a large part of the Geleen-Janskamperveld settlement has been dated to an earlier phase, the so-called Flomborn phase, the opportunity presented itself to look for earlier finds.

Seeds of opium poppy were found in seven pits: 23-005, 27-027, 28-079, 31-096, 35-039, 40-067C, and 59-007 (fig. 6.1). Four of these could be attributed to a definite phase of occupation. The oldest is 59-007, which belongs to local phase 3, followed by 28-079, placed in local phase 5. Numbers 31-096 and 40-067C belong to phase 6. Phases 1-5 are of Flomborn age (period Modderman 1b-1c), and phase 6 corresponds to Modderman end 2c/beginning 2d, which is late LBK. Two of the finds are therefore early. This implies that opium poppy was an early addition to the crops grown. As much earlier LBK settlements are hardly present in the region, poppy is supposed to have been grown from the earliest occupation onwards at least in this part of the LBK world. The finds provide new arguments that the plant was obtained from the elusive pottery-using societies, which were contemporaneous with the LBK in the west and had connections with France. But as long as no new information on early poppy is obtained in France and especially from early neolithic southeastern, mediterranean France, the route by which the LBK obtained poppy remains obscure.

Figure 6.1 Opium poppy (*Papaver somniferum* var. *setigerum*), 40 x, drawing W.J. Kuijper

6.3.3 Lentil (Lens culinaris)

The problem with lentil is that this pulse disappears from the records in the cultures following the LBK. This is at least the case in the area between the rivers Rhine and Meuse (Knörzer/Gerlach 1999, p. 80). Of the pulses grown by the LBK farmers, lentil is the most difficult to cultivate. The plant requires a climate with mediterranean traits, and, nothwithstanding the conditions of the climatological optimum prevailing during the Atlantic Period in which the LBK flourished, may have reached its northern limits in the Rhine-Meuse region.

Dendrological research, carried out in Cologne, has provided a tree-ring calendar valid for western Germany, which shows a serious climatological dip around 5050 cal BC. The climate became drier, which may not have affected lentil, but also colder (Schmidt/Gruhle 2005). It is therefore possible that the decline in lentil growing had set in already during the LBK, and that early LBK farmers grew more lentil than their successors living after 5050 cal BC.

The settlement at Geleen-Janskamperveld provided an opportunity to test this, because the terrain showed two periods of occupation, an early and a late one with a time gap in between. The early occupation is dated before 5100 cal BC, the late one after this date.

Seven pits have provided lentils (fig. 6.2). Four of them belong to the earliest phase of the early occupation: 32-100,

Figure 6.2 Lentils (*Lens culinaris*), 10 x, photo J. Pauptit

40-073, 57-020, and 57-041. Two belong to the late period of occupation, local occupational phase 6: 18-055 and 40-67C. And one, 34-041, could not be dated with certainty. Because pits belonging to the early period are more numerous than pits belonging to the late period, the ratio of two to four cannot be regarded as proof of a decline in lentil growing. It is quite possible that the dating of the last occupation is not precise enough for this kind of analysis. Another possibility is that the disappearance of lentil had no climatological background.

6.3.4 Crops and weeds

An earlier analysis of seeds and fruits retrieved from LBK settlements taught us that assemblages fall into six distinct categories: grain not yet dehusked either with many or almost without weed seeds mixed in, chaff with or almost without weeds, dehusked grain and *Chenopodium album* seeds (Bakels 1991). An assemblage is defined as a concentration of finds which cannot be explained by chance. The density of remains in the various samples (number of seeds, chaff and fruits per dm^3 of soil) commonly follows a Poisson distribution, which implies that the individual remains got together by chance. Densities which do not fit into this kind of distribution are not caused by just chance. The constituents of these lots were probably thrown away together and must be regarded as the result of one charring event. But of course such lots are not closed finds and can contain independent elements as a kind of noise.

In the Geleen-Janskamperveld set of data, densities equal or higher than 80 remains per dm^3 of pit filling do not really follow the Poisson distribution valid for this site. There are 27 of such assemblages. Concentrations of *Chenopodium album* are absent. Remains of crops other than wheat are so rare that they have to be considered as noise, when they turn up in the concentrations. This also applies to hazelnut shell fragments.

In not-yet-dehusked emmer the ratio grain / glumes is 1 to 1, and in einkorn 1 to 2. In the LBK finds the hulls are always found separately, even if they were originally attached to the grains. After charring, hulls are brittle and tend to separate from the grain, aided in this by taphonomic processes. The glumes, still held together by a part of the central axis of the ear, are found as ‘spikelet forks’, and if broken apart, as ‘lemma bases’. In lots of emmer and einkorn in the husk, the proportion should approach the ratio mentioned above. If the hull remains (chaff) far outnumber the grain, the assemblage is considered to be waste of dehusking. If the grain outnumbers the chaff, the grain was dehusked.

All three kinds of concentrations have been encountered in Geleen-Janskamperveld . But, as found in the analysis mentioned above, within these three a second characteristic turns up, namely the status with or without weeds. The explanation was sought in either crops cleaned or not cleaned before dehusking, or in crops from well-weeded versus badly-weeded fields, or fields without weeds versus weed-infested fields. The third hypothesis seemed to be supported by the fact that ‘clean’ assemblages belonged to earlier phases of occupation of a territory and those with weeds to later phases. Virgin forests do not have seeds of potential field weeds in their soils, at least not in serious quantities. Weeds are introduced with the sowing seed or see an opportunity when parts of the forest are kept open for a number of years. Newly laid-out fields will contain fewer weeds than old fields.

To check this hypothesis, the 27 concentrations present in Janskamperveld were checked once again for their weed content. Two clusters were observed. Ten concentrations held 10 percent or less herbs. All species could have been field weeds. They are found again and again in connection with LBK wheat (Knörzer 1971; Bakels/Rousselle 1985). Nine concentrations contained 55 percent or more weeds. The remaining eight are dispersed in between. When the samples in the clusters are dated, it is striking that all concentrations with a low weed content belong to the early phases of occupation of the terrain. Even when taking into account that four assemblages come from the same pit (although from different places and layers), the fact remains that the late phase 6 is absent. The late phase turns up in the cluster with high amounts of weeds (table 6.1). With this result, the Geleen-Janskamperveld site provides new indications that the age of the fields is linked to a weedy or non-weedy condition. It is presumed that LBK fields were permanent (Bakels 1978, p. 49).

Another approach to the weediness of fields is to see whether the number of weed species increases between the early phases and the much later local phase 6. To this end, the frequency in which the weed species occur in the samples was compared (table 6.2). The frequency is here the percentage of samples in which the plant was found. The table gives no reason to conclude that the composition of the weed flora developed from a simple flora during the early, Flomborn, LBK into a much richer flora in the late LBK (local phase 6).

weeds %	*⩽ 10*	*>10 < 50*	*⩾ 50*
	local phase		
Grain in the husk			
13.100.01.03	*.*	*1*	*.*
15.005.02.02	*.*	*1*	*.*
17.020.04.03	*.*	*.*	*5*
20.027.19.01	*1*	*.*	*.*
32.100.05.03	*1*	*.*	*.*
32.100.06.01	*1*	*.*	*.*
32.100.10.01	*.*	*1*	*.*
32.100.12.01	*1*	*.*	*.*
24.065.02.02	*.*	*.*	*1*
40.067B.02.01	*.*	*.*	*6*
40.076C.02.04	*.*	*.*	*6*
48.021.08.02	*.*	*.*	*6*
Chaff			
32.100.08.03	*1*	*.*	*.*
32.100.16.03		*1*	*.*
32.142.05.02	*4*	*.*	*.*
35.039.03.03	*1?*	*.*	*.*
44.012.02.02	*1*	*.*	*.*
52.017.04.03	*2*	*.*	*.*
52.017.04.02	*.*	*.*	*2*
Grain dehusked			
52.051.04.02	*1*	*.*	*.*
28.079.4.2.01	*.*	*.*	*5*
59.006.02.00	*.*	*.*	*2*

Table 6.1 The weed content of cereal concentrations. Only those with

It may be argued that the forest had returned in the time between the first and second period of occupation. In that case the starting point of the second, late LBK set of fields may have been almost identical to the first. But this is probably not true. Although occupation ended after local phase 5 on the Geleen-Janskamperveld terrain to return only much later, occupation has been proved for the time interval on terrains nearby. It is highly probable that the forest was given no opportunity at all to return. The conclusion must be that the increased weediness of fields cannot be attributed to an increase in weed species but must be sought in a more abundant growth of species already present.

6.3.5 *House types and crops*

LBK farmhouses come in three types. They are composed of three modules, which, according to their place in the always NW-SE oriented buildings, are called the NW, the central and the SE part. Large houses of type 1 consist of all three modules. Medium houses, type 2, are composed of the NW and central module. Houses of type 3 have only a central part.

In the LBK settlements on the Aldenhovener Platte (Germany), some 30 km east of Geleen-Janskamperveld, it

	early	*late*
local phase	*1-5*	*6*
N samples	*229*	*65*
Chenopodium album	*72*	*83*
Bromus secalinus	*56*	*78*
Fallopia convolvulus	*37*	*57*
Atriplex patula/prostrata	*7*	*6*
Lapsana communis	*6*	*9*
Persicaria lapathifolia/maculosa	*6*	*8*
Vicia hirsuta/tetrasperma	*4*	*5*
Bromus sterilis/tectorum	*3*	*3*
Chenopodium polyspermum	*3*	*2*
Phleum sp.	*2*	*8*
Poa pratensis/trivialis	*2*	*3*
Galium aparine/spurium	*2*	*9*
Veronica hederifolia	*2*	*0*
Rumex sp.	*0*	*5*
Setaria verticillata/viridis	*1*	*3*
Echinochloa crus-galli	*1*	*3*
Cruciata laevipes	*1*	*0*
Vicia cracca	*1*	*2*
Solanum nigrum	*0*	*2*
Trifolium sp.	*0*	*2*

Table 6.2 The frequency of weed taxa in the waste.

was found that the waste of people living in all three house types contained dehusked grain, but that chaff was mainly to be found in pits associated with houses of type 1 (Lüning 1988, p. 81). Type 1 is characterized by having the SE module, which is the part with the heaviest foundations. It is interpreted as the part where heavy and bulky products were stored, for instance cereals. The fact that chaff was found mainly near this kind of building gave rise to the idea that the grain was dehusked there and perhaps distributed from there.

The Geleen-Janskamperveld excavation provided an opportunity to look into this hypothesis again. Table 6.3 shows the concentrations of the three kinds of cereal products mentioned in 6.3.4 in connection with the house types. Concentrations of chaff are present near houses of type 1 (1a and 1b are subdivisions of this type) and type 3. Dehusked grain is present near houses of type 1. Not-yet-dehusked grain is encountered near all three types. In the case of Geleen-Janskamperveld it is therefore not possible to conclude that dehusking took place exclusively in or near type 1 houses. It is more probable that dehusking took place in every household, probably on a day-to-day basis as is customary in many societies which grow emmer and einkorn wheat (see for instance Hillman 1984).

	house nr	*type*	*situation*
Grain in the husk			
13.100.01.03	*12*	*2*	*N*
15.005.02.02	*56*	*2*	*L-E*
17.020.04.03	*–*	*–*	*–*
20.027.19.01	*49*	*2*	*L-W*
22.020.00.04	*37*	*1b*	*L-W*
24.065.02.02	*–*	*–*	*–*
27.027.01.01	*–*	*–*	*–*
28.102.02.02	*6?*	*1b*	*L-E*
32.100.05.03	*35*	*1a*	*L-E*
32.100.10.01	*35*	*1a*	*L-E*
32.100.06.01	*35*	*1a*	*L-E*
32.100.12.01	*35*	*1a*	*L-E*
35.029.05.02	*40*	*3*	*N?*
40.064A.01.03	*–*	*–*	*–*
40.067B.02.01	*8*	*1b*	*L-W ?*
40.076C.02.04	*8*	*1b*	*L-W ?*
48.021.08.02	*39*	*1a*	*L-E*
Chaff			
32.100.08.03	*35*	*1a*	*L-E*
32.100.16.03	*35*	*1a*	*L-E*
32.142.05.02	*–*	*–*	*–*
35.039.03.03	*40*	*3*	*N?*
44.012.02.02	*14*	*1b*	*L-W*
52.017.04.03	*17*	*3*	*L-E*
52.017.04.02	*17*	*3*	*L-E*
Grain dehusked			
28.079.4.2.01	*8*	*1b*	*L-E*
52.051.04.02	*18*	*1a?*	*L-E*
59.006.02.00	*44*	*1b*	*L-E*

Table 6.3 Concentrations of cereal remains, house types and position of the finds. N = north, L-E = along the eastern wall, L-W = along the western wall.

6.3.6 The disposal of cereal waste, especially chaff

The farmhouses of the LBK were surrrounded by yards, which were not so much defined by boundary structures as by a certain clustering of pits around the buildings. There are oblong pits parallel to the long walls and a number of other pits in a more scattered position. Pits are absent from the area in front of the southeastern end of the house. The pits must have served different purposes but most of them ended up as rubbish pits. The composition of the waste can vary however. A. Kreuz (1990) found that most of the chaff was to be found in the scattered pits. K.-H. Knörzer (1988) discovered that even the fill of the scattered pits was not uniform, but that the largest amounts of burnt chaff turned up in pits situated to the north and west of the houses.

Since then I have looked for such trends in more settlements than the Langweiler 8 settlement analysed by Knörzer and found them in the settlements of Schwanfeld and Meindling, both in Germany (Bakels 1995). Schwanfeld was reported to have burnt chaff in pits east of the houses, but a recent study has changed the attribution of those pits to yards, and the same pits are now pits west of houses (Lüning pers. comm. 2006). The inhabitants of the second site, Meindling, had thrown their chaff in western pits as well, though not in scattered pits but in the oblong pits near the wall. A third site, Cuiry-lès-Chaudardes in France, proved not to be suitable because local taphonomic conditions are adverse to the preservation of brittle carbonized matter.

Geleen-Janskamperveld offered another opportunity. The analysis of the site has failed to reconstruct yards. Most pits are of the wall-accompanying type. Scattered pits are present but not as numerous and more difficult to ascribe to individual buildings. Table 6.3 presents the pits in which concentrations of chaff have been found. Four out of seven turned up along the eastern side of the house wall, one along the western side, one was a pit of the 'scattered' type north of a house, and the last was a solitary pit which could not be attributed to a definite household. The conclusion is that Geleen-Janskamperveld does not reveal the western position of disposal of chaff as earlier predicted by the situation in the three sites mentioned above.

The same table shows the position of the other two kinds of cereal waste. Dehusked grain lies near eastern walls and not-yet-dehusked grain alongside both eastern and western walls. An analysis of the position of the different kinds of waste in connection with the exact place along the walls did not result in the detection of preferred places. If these had been found, they could perhaps have marked the location of a door or window. As it is, the inhabitants of Geleen-Janskamperveld showed a tendency to discard their waste east of their houses, but it is just a tendency.

6.4 Conclusions

According to the fruits and seeds, Geleen-Janskamperveld corresponds to the average Linearbandkeramik settlement as found in the region between the rivers Rhine and Meuse. The six usual crop plants, emmer wheat, einkorn wheat, pea, lentil, linseed and poppy are all present. The fact that emmer wheat is far more important than einkorn wheat gives the site perhaps a minor distinction. As usual, remains of gathered products are scarce.

The five questions, put forward in the introduction, have got their answers.

Opium poppy was part of the crop assemblage from the beginning. The finds indicate that the plant has been cultivated from at least the Flomborn phase of the Linearbandkeramik culture onwards.

Lentil does not disappear from late Linearbandkeramik contexts, at least not in Geleen-Janskamperveld.

New fields in an area not cultivated before may have given fewer problems with weed growth than fields which had already been tilled for several generations.

There is no difference between the different types of houses as far as cereal waste is concerned. Houses of type 1 do not stand out because of disproportionate amounts of chaff, nor of other kinds of cereal waste.

The west side of buildings was not the preferred place to burn chaff or to dump burnt chaff. If there is a preference at all, it is the east side.

Acknowledgments

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7 On the neolithic pottery from the site

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In the present chapter the analysis of 13,707 ceramic sherds deriving from 3609 neolithic 'sherd families' (roughly equivalent to pots) is recounted. Four categories are recognized: decorated fine ware, undecorated coarse ware, undecorated fine ware, and decorated coarse ware, of which the first two constitute nearly 98% of the inventory. Mainly on the basis of the tempering of the clay bodies, 1649 pots are supposed to have functioned as service or table ware, 1299 pots for cooking, and 609 vessels for storage purposes. When distributed over space and time every household possessed resp. 3, 4, and 3 pots in these categories at any moment. The decoration on the service ware betrayed affiliation to matrilinear moieties. Additionally, mixed with the regular (local) LBK pottery, there is a highly differentiated set of 57 sherd families of non-local origins, partially attributable to the Limburg Group; a likely mechanism of its entry into the LBK settlement is discussed.

7.1 Introduction

From the beginning of Bandkeramik studies, neolithic pottery has been separated into two distinct classes, decorated and coarse ware — a heuristic rather than methodical distinction. The decoration class has profited from most attention, albeit only to the decoration itself and not to its container aspect (of which I have been guilty too: Van de Velde 1979). Klopfleisch, the first to define Bandkeramik as a separate archaeological entity, true to his art historic education only referred to the main decorative motifs on the fine ware: Bandkeramik is pottery with strip decoration in wave or spiral forms (and associated finds) (Klopfleisch 1883, 92). More than half a century later and notwithstanding the clear differences between the two wares, Buttler included the coarse pottery accompanying the decorated sherds in his definition of this pottery; he is however vague about their relationship apart from their regular empirical association (Buttler/Haberey 1936, 109). Most pages of that important study were devoted to descriptions of the decoration and their choro- and chronological implications. More recent literature has generally followed Buttler's pragmatics, perhaps best put into words in Ingo Gabriel's reworked doctoral thesis:

> *The first thing is the differentiation of fine and coarse ware. As long as no exact definition can be given, experience is used regarding structure, tempering, surface treatment, size of the vessel, thickness of the walls and when appropriate the way of decorating. — Apart from that it can be stated that normally the fine ware has been compactly kneaded with layered looks on fracture, whereas the coarse ware often is characterised by its porous substance. — The raw material of the fine ware has usually been well refined. Coarse impurities hardly occur. Whenever temper has been added the size of the particles is less than 0.3 mm. In coarse ware typically more additives are included, even particles larger than 0.5 mm. — The surface of the fine ware is generally well smoothed or burnished. Macroscopic determination of inclusions is therefore only possible on the fractures or on heavily weathered surfaces. Coarse ware on the contrary has been slightly smoothed at best. In most cases its surface finishing through wiping with straw or similar material, or rubbing with the hand has resulted in a more or less even roughness or striations. [...] As regards size, the coarse vessels are generally considerably larger than the fine pots...* Gabriel 1979, 14-15 (my transl., PvdV)

Whenever attention is paid to the 'coarse ware' it is by morphological analysis of the geometric properties of the vessels' outlines, generally including those of the 'decorated' ware (*e.g.* Pavlů 2000, 101-148; Stehli/Zimmermann 1980), followed by a rapid turn of attention to the decoration (again, Pavlů 2000, 149-186; his' is perhaps the most balanced treatment of the subject to date).

Admittedly, the decoration is much easier to 'read' than the other characteristics of the pottery, especially if we are interested in its chronological possibilities. In the present chapter, however, the emphasis will be on functional distinctions within the artefact group of pottery considered as a whole, similar to the analysis of the flints in their different chapters. Accordingly, the next section will deal with macro characteristics of pottery like tempering and thickness of the walls, resulting in a definition of three classes (service ware, kitchen ware, and storage for short), followed by a section on two as yet unnamed but logically implied classes (undecorated fine ware and decorated coarse ware). A separate section will deal with another, probably non-LBK type of pottery, the rare but ubiquitous Limburg ware found in small quantities in most Northwestern Bandkeramik settlement sites as well as on the Janskamperveld. Finally

I shall venture into some more social implications that can be squeezed from the decorated pottery.

7.2 Bandkeramik pottery: description of basics

The excavation at the Janskamperveld has yielded 13,707 Early Neolithic sherds from 334 features. They have been grouped to at least 3609, perhaps even 3629 'sherd families' (more or less equivalent to pots; Orton *et al.* 1993). No attempt has been made to compare and group like sherds from different features; from other LBK excavations it is known that less than 2% of the sherds of the same pot landed in more than one feature (Drew 1988, 544; Kloos 1997, 155, 163). The number of sherds per feature range from 1 to 178 (mean 26.8), of the pots from 1 to 43[1] (mean 7.4). The thickness of the sherds ranges from 4.1 to 10.6 mm (maximum 20.4 mm), with a median value of 6.9 mm (interquartile range 5.4 - 8.5 mm); the mean thickness is 7.0 mm (standard deviation 2.2 mm); these values correspond to the thickest belly sherd of every pot. Thicknesses of the sherds are graphically represented in fig. 7-1, where the clearly bi-modal distribution is broken down into the two regularly acknowledged ware types: fine and coarse with averages of 5.5 and 8.3 mm, respectively. For a small number of pots represented by over twenty sherds, all sherds have been measured. In this latter sample (n = 7) the median thickness of the sherds ranges from 5.8 to 14.0 mm per vessel, with interquartile spans of 1.1 to 2.7 mm, suggesting that the general parameters are within one millimetre of the original values. Coarse pots have left 5.0 sherds on average, more than twice as many as fine ware pots did (2.4 sherds/pot), an advantage of size and thickness: fine ware is more prone to fracture from thermal stress and handling than are vessels made from coarse heterogeneous pastes (Sinopoli 1991, 14).

The materials from which the pots have been made may very well have come from pits near the houses, where especially the deeper levels contained excellent clays. Neither coarse ware pots nor decorated vessels have left sherds with clear indications of the construction technique of the vessels except that they have not been wheel-thrown. Alternatives such as building the pots either through coiling or from slabs (Shepard 1954, 54-60) would perhaps show up through regular breaking on the joints, with Z- or S-shaped sherd sides and more or less similar widths; hardly any have been observed though, suggesting either careful finishing through smoothing the joints and/or another method of building. Modelling from a single lump of clay by pounding (also known as 'thumb pots') would presumably result in irregularly shaped and sized sherds — a fitting description of the present corpus. Also, the use of paddle and anvil to make the walls of the pots thinner often used in conjunction with coiling as well as with modelling, obviates scraping of the vessel's walls to the required thickness and evenness; evidence of internal scraping has been found on about one tenth of the coarse-walled pots only. It therefore seems that the Janskamperveld potters built their pottery from lumps of clay in the modelling technique, perhaps using a paddle and anvil. It is interesting to note here that Pavlů reports slab formation as well as coiling at LBK Bylany (Pavlů 2000, 105), though in earlier descriptions of that site's pottery the production technique was described as unobservable (Franklin 1998, 8).

As extensively spelled out by Gabriel, contrary to the fine ware sherds with their well-sieved pastes, in the bodies of the coarse ware tempering is almost ubiquitous: nearly all thick-walled pots from the Janskamperveld settlement have one or more generally ill-sorted additions to the matrix paste, visible with a simple magnifying glass (table 7-1 provides a summary). Among the thick-walled ware, only 9.7% (192 pots) show hardly or no apparent tempering; 39.5% (784 vessels) were tempered sparsely, 12.0% moderately (238), and 38.8% heavily (771 pots). Over half of the coarse ware (63.1%, or 1252) were treated with one kind of temper only, the remainder with different additions. Tempering materials differ appreciably, though over three quarters of the coarse ware pots (78.5%, 1557 pieces) have clay pellets

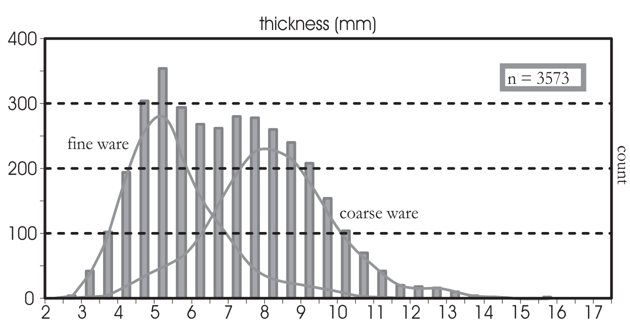

fig. 7-1 the distribution of wall thicknesses of Bandkeramik pottery at the Janskamperveld settlement

i\ii	none	pellets	sand	chalk	bone	vegetal	sum
none	34	–	–	–	–	–	34
pellets	664	237	359	8	1	20	1289
sand	283	254	77	–	2	6	622
chalk	9	5	5	1	–	–	20
bone	1	1	2	–	1	–	5
vegetal	3	8	3	–	–	–	14
sum	994	505	446	9	4	26	1984

table 7-1 tempering of coarse ware pots
rows: major or primary temper; columns: secondary additions

as additives and half of them (49.9%, or in 991 vessels) have silt, sand, or quartz. Regarding the often reported grog (*i.e.*, crushed pottery) in Bandkeramik coarse ware, neither its presence nor its absence in the Janskamperveld material could be established, as the pottery pastes contain many grains of siltstone (often reddish from its iron oxide-constituents) and/or clumps of silt, which are 'rather difficult to differentiate' from grains of grog[2] (also *cf.* Franklin 1998). Much less frequent are organic additions (vegetal 2.0% of the coarse ware, or 40 pots, animal 0.4%, or 8 pieces) and fine chalk (1.4%, representing 28 vessels).

It should be noted, though, that many if not all of these tempers may have been accidental, *i.e.* were already present in the clay when this was dug up. For instance, sand and quartz occur naturally in the lower layers of the loess on this site, as does chalk, and may have been consciously sought for to be incorporated in the paste because of the properties these additives would have on the finished pots. Vegetal matter may simply have been lying around when the pots were built, only animal bone will have been consciously added (bone temper was regularly incorporated into contemporaneous non-Bandkeramik pottery; *cf.* that section, below). The 'clay pellets' may derive from the preparation process of the clay itself: once the clay has been dug up and subsequently dried, it will have to be crushed through pounding to detect and remove unwanted impurities; to render the clay workable, water is added afterwards. However, it seems to be very difficult to achieve a homogeneously fine clay body by pounding and milling on a stone, and without sieving the result will consist of 'ill-sorted' particles in every size between micrometres and millimetres — which will carry over into the paste of the pots (Franklin 1998, 5). Only when working with wet clay which has not been dried but was mined shortly earlier is a more homogeneous paste attainable, and this may be the origin of the fine-walled pottery which has hardly or no additives to its paste. The quantities of both fine and coarse paste pots testify to a conscious choice between the two modes of clay preparation, probably led by the intended function of the pots.

Accordingly, little or no systematization of the recipes for the clay mixes is apparent, and consequently the fabrics seem not very standardized. This suggests a small-scale production, if not individual preparation of materials. However, there is a different aspect to it in that clay pellets, grog and organic matter are reported to bolster the resistance of the vessels to thermal stress, while sand and silt probably weaken the clay body yet prolong the life expectancy outside the kitchen fire (Orton *et al.* 1993, 221; Shepard 1954, 27; Sinopoli 1991, 15). It may be tentatively inferred that the Bandkeramians prepared the pastes of their pots with an eye to the intended functions (and here is the ground for my merging the two wares traditionally separated): service vessels with little or no tempering (the 1649 pieces of fine ware plus 34 coarse pots are 1683 pots, or approximately 46% of the ceramic inventory), cooking pots tempered primarily with clay pellets, organic matter and/or grog (part of the coarse ware, numbering 1328 vessels, 37% of all pots), and storage containers strengthened with sand or quartz kernels (the remaining 624 pots of the coarse ware, 17% of all pots). Of coarse, intended function — as possibly manifest in the clay temper — does not always square with actual function, so the numbers reported should be taken as indication only.

One tenth of the coarse ware vessels —to stick with the traditional division into classes— show traces of thinning on their insides; the remainder has been smoothed or even polished, though another tenth of the pots are quite rough because of the sandy or quartz temper protruding from the surface. As for the (subjectively scored) colours of the sherd surfaces of the coarse ware, the majority (55%) shows a reddish to buff outer surface, the remainder is greyish or blackish. Of the inner surfaces, a large majority (75%) had a greyish or blackish look instead (approximately 1953 individual pots counted; *cf.* table 7-2). Reportedly, iron oxides, the carriers of reddish colours in pottery, are gradually dissolved in ground water; therefore a larger part of the vessels than indicated here had originally a lighter appearance (Franklin 1998, 5). Even so, the presently

	outer surface	%	on break	%	inner surface	%	on break	%
reddish	22	1.1	17	0.9	4	0.2	5	0.3
orange	54	2.7	49	2.6	9	0.5	11	0.6
buff	576	29.0	369	19.8	190	9.8	139	7.5
brownish	449	22.7	412	22.2	279	14.3	381	20.5
greyish	731	36.8	795	42.8	1190	60.9	982	53.1
blackish	152	7.7	216	11.6	281	14.4	335	18.1
	1984		1858		1953		1853	

table 7-2 surface and interior colours of wall sherds of coarse ware
colours 'on break' refer to the outer and innermost layers, respectively

observable colours suggest that in all likelihood the pots were fired upside down, so that on the inside a more or less reductive atmosphere existed while on their outside rather more oxygen was available. Approximately 45% (864 vessels among 1960 counted coarse pots) have a homogeneous appearance on the breaks, 25% (482) show two zones and 30% (614) three colour zones, indicative of changing or uneven conditions during the firing process. In experiments at the Department of Pottery Technology, it was established that on average the firing temperature of the pottery was at slightly over 600^0 centigrade; in some cases the ceramic conversion had not even been fully achieved. From this may be derived that the pots were 'cooked' in open fires, or at best in pits (of which no evidence has been found in this settlement).

There is one complicating factor here, as a substantial number of coarse ware pots will have been used domestically over a kitchen fire, changing the original colours of especially the outer surfaces. Temperatures in the (open) kitchen fires will have been in the same range as those in the (open) 'kiln' fires. Indeed, colour differences between the outer surfaces of the pots and the colours on the break are not negligible: as can be read from tables 2 and 3, against 55.5% of the outer surfaces, only 22.2% of the homogeneously fired pots have a bright colour on their breaks. For the layered or discontinuously fired pots the figures are not very different with 64.3% bright outer layers for the two-colour fabrics and 59.6% for the three-layer sherds. We can also read from that table that the three-quarters darker inner surfaces of the pots are symptomatic of dark layers inside: 77.8% for the simple breaks, 73.6% for the double-layered, and 60.7% for the treble-layered breaks. Not unexpectedly, the influence of the kitchen fires on the inside of the pots has been tempered by the broth. While at first sight this might suggest lack of control of the firing process, it may be observed that the fine ware is generally homogeneously coloured on the breaks, so Bandkeramians apparently knew how to control the fire when finishing their pots and they also knew the properties of the pastes. With more than half the coarse ware showing evidence of discontinuities in the firing process, we could ask whether they had special objectives in mind, or simply didn't care. The rather better finishing of the service ware which contrasts with the rougher look of the kitchen pots and of the storage vessels suggests a dining practice more open to the lookers-on, and a kitchen conduct more hidden (cp. the few instances where a hearth has been ascertained in Bandkeramik houses: in the centre of the central part of the house) —public mealing, private cooking — which will have fed back into pot production.

Although nearly two thousand coarse ware pots could be identified, only 614 (30.9%) had rim fragments among the sherds; from the more than sixteen hundred fine ware pots, only 544 (34.4%) rims survived. The rim diameters of the latter were not registered as not even a handful was of sufficient size; diameters of the coarse ware pots varied considerably, as far as could be estimated (63.7% of these sherds are too small for this purpose): from a minimum orifice of 6 cm for a small cup up to a bowl-like opening of 35 cm (fig. 7-2). Not all sizes however were equally well represented, as can be derived from that multi-modal graph, where only a very weak tendency towards diameters of about 15 cms is apparent. Therefore, an average diameter computed at 17.3 centimetres has no meaning at all, especially since no differentiation to pot shape has been nor could be made because of the small size of the sherds.

Among the coarse ware inventories, flat bases have been observed on 51 pots (of course, round bottom sherds (*Wackelböden* in German, 'wobbly bases') go completely

	single	double		treble		
reddish	0.4	1.7	0.2	1.0	0.5	0.2
orange	0.7	5.0	0.2	3.2	0.3	0.8
buff	3.0	28.5	5.6	33.7	0.6	14.5
brownish	18.1	29.1	20.4	21.7	18.2	23.8
greyish	54.6	30.8	47.8	37.8	57.5	55.0
blackish	23.2	5.0	25.8	2.6	22.9	5.7
reference:	758	484		617		

table 7-3 distribution of coloured layers on sherd breaks, percentages
'single': homogeneously coloured; 'doulble': two layers/colours visible; 'treble': three layers visible
outer layer to the left, etc.

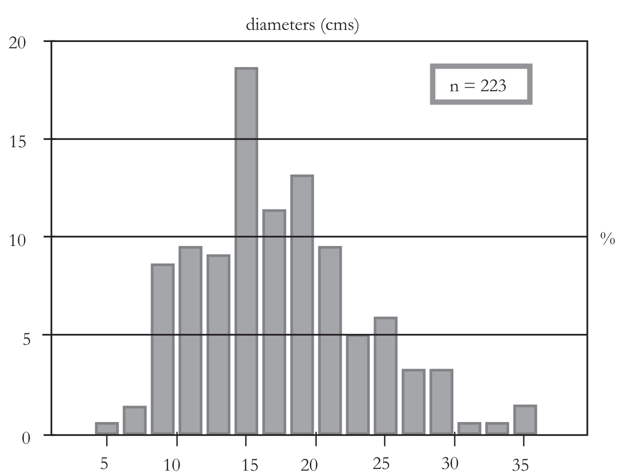

fig. 7-2 rim diameters of coarse ware from the Janskamperveld LBK settlement
classes of two centimetres wide

unnoticed as they cannot be distinguished from sherds of the sides of the pots). That number is certainly not in any proportion to the original number of flat-based pots ever present on the Janskamperveld. Rather, the figure is much too small, for bottoms make up only a small proportion of the pot's surface (perhaps in the order of one to ten) and thus only a minority of the pots with such a flat feature will be recognized in the archaeological record. This kind of bases does not occur in the Bandkeramik repertoire after the Flomborn period, and so they constitute yet another confirmation of the relatively early date of this settlement. Their later disappearance may be related to the smaller resistance to thermal stress of flat bases compared to round-bottomed pots (Orton *et al.* 1993, 220; Sinopoli 1991, 84).

On 34.7% (689) of the coarse ware pots and on 2.3% (37) of the fine ware pots knobs, lugs, handles or ears were present (fig. 7-3): 146 + 5 pots, respectively, carried strip ears made of rolls of clay leaving an opening to ply rope through (type A); 179 + 3 pots had flat slabs (type B) in the horizontal direction; the remainder had smaller or larger round or nipple-like knobs (182 + 18 type C, and 51 + 2 type D) to ease handling, while 8 + 2 pots had protuberances on their rims (type E, in fig. 7-3); there were also 12 + 7 pots with pierced ears. Two exceptional A-type lugs are illustrated in fig. 7-4. Combinations on the (putatively) same pots did occur, albeit rarely: round knobs and horizontal slabs (seven cases), strip ears and round knobs (four) or with slabs (thrice). As indicated by these figures both wares do show lugs, although considerably fewer such features were applied to the fine ware than to the coarse ware: correcting for the total number of vessels and also for the smaller set of sherds per pot, one would expect about 249 fine ware pots with archaeologically visible handles, which is more than six times the observed frequency — if the thin-walled vessels would be equipped similarly to the coarse pots. If the knobs have any functional meaning (and who would doubt this?), these figures testify to substantial differences between the two wares, and it seems likely that the majority of the fine pots had no handles at all.

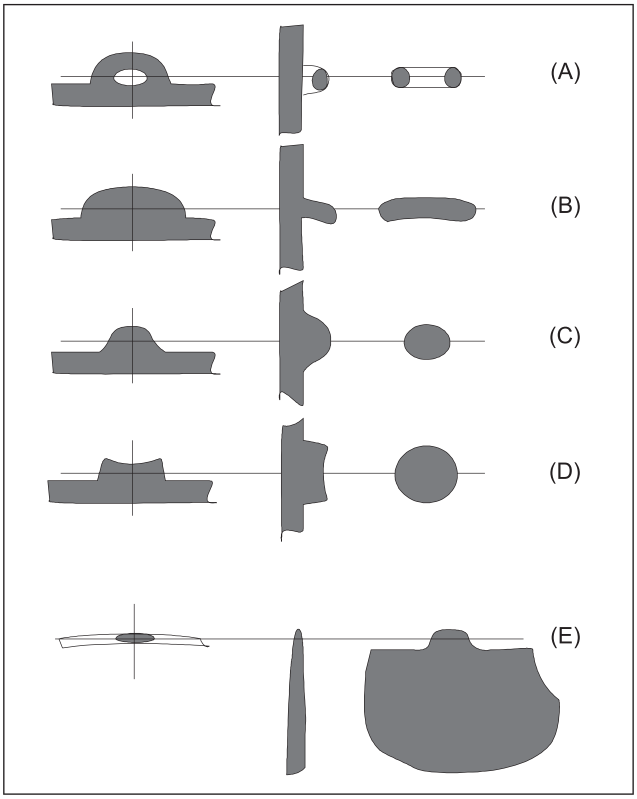

fig. 7-3 types of pot handles mentioned in text: top, side and front views
(A) band ear; (B) slab ear; (C) knob; (D) nipple knob; (E) rim ear

Among the rarer features of the pottery recorded, the remains of seven fine ware pots and ten coarse pots with applied bands should be mentioned; several of these will be discussed in the section on decorated pottery. Among the coarse-walled vessels, eight pots had ear-like protuberances on their rims, one had a thickened, and four had wavy brims — considering the survival percentage of rims in relation to the number of pots, these numbers should be trebled to obtain a more realistic estimate for this site. Four coarse pots and one fine pot had been repaired prior to their final rejection, as indicated by small drilled holes, again a number to be multiplied by at least ten or so to obtain a better estimate of the original frequency of repair.

While most pots were too fragmented to reconstruct their form, it could be established that the outer surfaces of the coarse ware pots have been smoothed or burnished in more than 70% of the cases, as shown by table 7-4. Sandy surfaces (from sandy or gritty additions to the paste) and roughened exteriors almost equally make up the remainder. Interestingly, also on the inside more than three-quarters of the pots have been smoothed or burnished; again the remainder is almost equally divided between roughened and sandy looks and feels. Smoothing and burnishing is done to seal the surface and thus to prevent percolation of liquids and increase heating efficiency, from which may be concluded that one of the main functions of the pots is in the realm of cooking. For water storage, a rather porous surface ('roughened', 'sandy') is generally considered more appropriate, as the leakage results in a cooling of the liquid when it evaporates. Amazingly, only 3.5% of the pots had visible signs of food processing; three-quarters of these with organic residues clinging to their insides, one quarter also or only to their outsides.

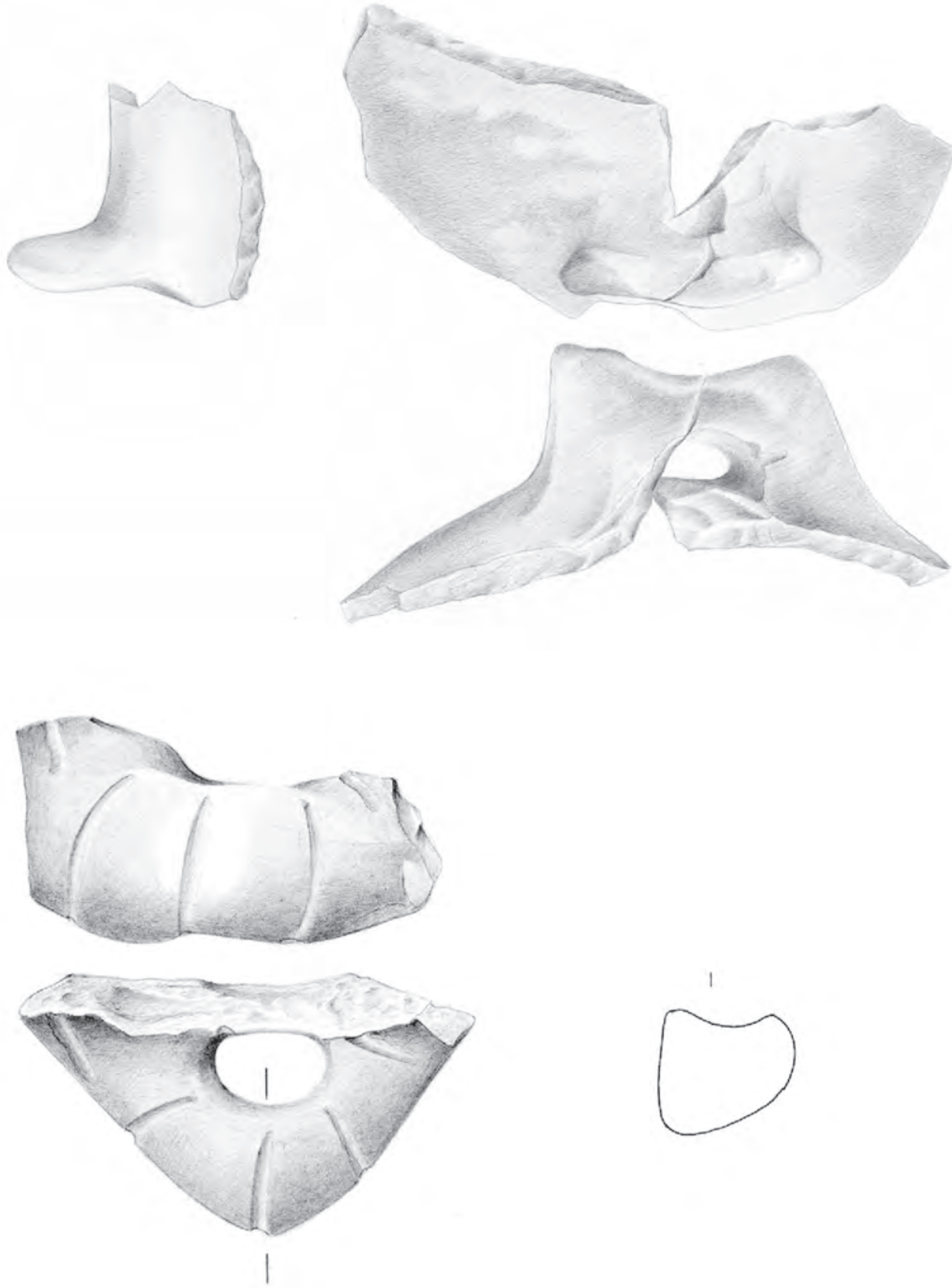

fig. 7-4 two exceptional lugs (scale 1:1)
Drawn by Erik van Driel

	outside	inside	same treatment
polished	15.1%	25.9%	15.1%
smoothed	56.9%	55.1%	67.3%
roughened	13.8%	9.6%	6.6%
sandy/gritty	14.2%	9.4%	11.1%
100% equals	1840	1800	1036

table 7-4 surface treatment of coarse ware vessels

7.3 Bandkeramik pottery: different yet similar

In the opening section of this chapter I alluded to ceramic vessels that do not fit neatly into the customary categories of *decorated* ware and *coarse* ware. With the notable exception of the amateur archaeologists' report by Beckers/Beckers (1940, 38), in earlier writings these awkwardly exceptional pots have simply been neglected, as far as I could ascertain. Logically however, 'decorated' implies the existence of an 'undecorated' or 'plain' category, just as 'coarse' implicitly assumes a 'fine' category. Not unexpectedly, therefore, *undecorated fine ware* as well as *decorated coarse ware* have turned up in the present excavation (table 7-5), though the small numbers of both groups (together only 2.6% of all pots) may indicate that the early Bandkeramians had as many problems with these extraordinary pots as modern archaeologists. The problem is whether or not these few pots represented different categories for the Neolithic people, the answer suggested here can be no more than a reasoned guess, though.

The statistical properties of both small groups can be compared to those of the larger classes to weigh mutual differences and similarities — not a definitive answer to the problem of the previous paragraph, of course, but rather one of the possible approaches open to us. It turns out that the plain fine ware is distinct from the decorated fine ware only in its lack of decoration: thicknesses and colours of the sherds are the same or very similar, as is the average number of sherds per pot in the excavation (2.35 decorated fine sherds/pot, 3.0 undecorated fine ware). The decorated coarse ware has metrical parameters which are a little larger than those of the plain coarse ware, at least regarding the average number of sherds per pot (6.6 for the decorated coarse vessels, 5.02 for the undecorated coarse ware). However, the number of decorated coarse pots (25) is statistically too low to allow firm conclusions; moreover, partial decoration results in under-representation in a sherded sample.

If these figures have any meaning outside contemporary archaeological discourse it must be that undecorated fine ware is nothing but fine ware, though undecorated, and that decorated coarse ware is just coarse ware, albeit slightly embellished. After all, the decoration of the latter is decidedly different from that on fine ware: finger impressions in small fields, nail pinches and coarse spatula strokes in single strips, all vaguely reminiscent of pre-Flomborn practice (Pavúk 2004), and none of which occur on the 'true' decorated, i.e., fine, ware. Thus, for the time being the undecorated fine ware should be seen as a sub-category of the fine ware, and the decorated coarse ware as a sub-category of the coarse ware; not all decoration on the pots is distinctive, apparently — just as has been done implicitly by Buttler and his heirs (Buttler/Haberey 1936, 109).

Another approach to the specialness or commonness of this ware may perhaps be found in its distribution and associations in the settlement. The plain fine ware has a very distinctive presence as of the 67 pots, ten occur in pairs, two three-folds are on record, one four-fold, one five-fold, and even one group of nine pots occurs in features of this excavation, all associated with other types of vessels; the remainder, 33 undecorated fine ware pots occur singly per pit, of which 29 are associated with other pots as well. From the thin-walled and undecorated pots, 50 can be assigned to houses; of these, fifteen occur singly, seven pairs are found each associated with a different house, another house is associated with three such vessels and one with four such pots, and two other houses even had nine undecorated fine ware pots each.

The other exceptional category, decorated yet thick-walled ware is represented by 25 pots distributed over 14 features. This pottery is not evenly spread either: 23 of these pots occur with regular coarse ware, and 17 (in 6 features) together with undecorated fine ware (as well as with coarse ware vessels). Only two decorated thick-walled pots occur singly (as far as their own category is concerned), and there are features with one, two, four and eight of these pots each. Nine sets of decorated coarse pots are associated with one house each (six of which also go with undecorated fine ware). Statistics are dangerous, and most of its results difficult to explain, especially when small numbers are involved as in this case. Additionally, it should be noted that the number of decorated coarse ware pots is probably several times larger than reported here, the decoration being generally sparse and very partial: the larger part of the pot's surface is devoid of embellishments and therefore the number of sherds with decoration is small. On the other hand undecorated fine ware is probably hardly under-represented, for on fine ware pots if decorated this decoration usually covers almost the whole surface, hence undecorated sherds would hardly result from their breakage. The two deviant types occur together in six

	coarse ware		fine ware		totals	
	vessels	sherds	vessels	sherds	vessels	sherds
decorated	25	164	1582	3723	1607	3887
undecorated	1878	9431	67	198	1945	9629
totals	1903	9595	1649	3921	3552	13516

table 7-5 numbers of Bandkeramik sherds and vessels at Janskamperveld pits, which is close to the expected number of 5.0 given random dispersal[3] and therefore suggestive of independent deposition. As has been noted, given the small number of undecorated coarse ware pots, no weight should be given to this latter conclusion.

Regarding their chronological position, the exceptional wares are just as unexceptional: they are quite evenly spread over the generations, as far as can be established on the basis of the associated regular decorated fine ware.

7.4 Non-Bandkeramik (or so) pottery: unity in diversity, or diversity in unity?

Another exceptional item in the excavation's pottery record is a distinct, non-LBK pottery, presently known as "Limburg Ware", popping up a number of times among regular LBK finds.[4] Probably representative of relationships with groups outside the Bandkeramik world, the how, what and why are elusive (*e.g.*, Brounen 1999; Jeunesse 2001; Verhart 2000). With its orange, reddish or brownish looks among the generally grey or black LBK ware, with its herringbone or dragon's teeth decoration entirely outside the Bandkeramik decoration canon, it must have been as visible to them as it is to us. As already recognized by Buttler, Limburg ware occurs in every major Northwestern Bandkeramik settlement (Buttler/Haberey 1936, 106), as we now know starting in the Flomborn period and vanishing with the demise of the LBK-proper (Constantin 1985; Lüning *et al.* 1989). In other words, its presence in the Janskamperveld settlement is nothing special; but these finds do have to be shown and described.

To start with the discipline's context of this ware, it was first recognized as a coherent, stylistically different group by Buttler, and as such described in an early short report on the Köln-Lindenthal excavations (Buttler 1932). Later, in the final publication of that excavation this pottery was labelled *Import Gruppe 1* (Buttler/Haberey 1936, 106-107), defined as being made from 'badly mixed and fired black clay', often covered with a reddish or yellowish slip; in the Lindenthal sample about a quarter of the rims of this ware had been made thicker. The pots show different patterns of decoration, although triangles are almost always present, either filled in with hatching or with impressed small dots; the decoration on the outside is generally organized in vertical metopes around the pot. More often than not, the clay has been tempered with small kernels of ground potsherds or grog, and an estimated 50% has a tempering of crushed and burned bone which sometimes show up as tiny white particles, sometimes as black specks in the paste. Also, a minority of perhaps 10% of the pots has sand added to its paste. Buttler's description of "badly mixed... clay" is suggestive of a substantial proportion of clay pellets in the pot's paste, as described above for the majority of the Janskamperveld Bandkeramik coarse ware pots. Its name in Buttler's account, *Import Group*, derived from a mineralogical analysis which indicated non-local origins of the Lindenthal Limburg ware — which has been contested by Constantin, even for the very Lindenthal sherds (Constantin 1985(I), 139). Yet, a chemical analysis of this type of sherds from an early excavation at Elsloo-Koolweg similarly revealed non-local origins (Beckers/Beckers 1940, 135-137). Later, Modderman was to rename this ware *Limburger Keramik*, after the Dutch province where the first sherds had been excavated outside a Bandkeramik context in 1964 (Modderman 1965; 1970, 141-143; and 1974). In the meantime some more of such independent sites have been found in the Rhineland, Belgium and France (Cahen *et al.* 1981, 159).

Already Buttler (Buttler 1932; Buttler/Haberey 1936) pointed to the diversity of the decoration on this ware; in 1932 he illustrated part of the same spectrum for Lindenthal as has now been excavated on the Janskamperveld. Thus, dragon's teeth, herringbone and ladder motifs mainly in rectilinear structures, are found together on the same vessels but also on different sherds; this could be labelled *classical Limburg decoration* or *Limburg ware sensu stricto* (Modderman 1974). Apart from that, there are other types of decoration (with *Furchenstich-ähnliche* or stab-and-drag-like lines, in curvilinear or even chaotic arrangements) which are very dissimilar to the previous group, though they do figure on pots made to a similar fabric recipe. Also in both the Lindenthal and Janskamperveld settlements (and doubtless in many others as well; *e.g.* Claßen 2006, 250-251), Limburg decoration has been found on pots of otherwise Bandkeramik complexion, although the reverse has not been described as yet. Now the paste of the Limburg pottery is generally certainly distinct from the Bandkeramik ware, whether coarse or fine pottery are considered: "badly mixed and fired" (Buttler) or "little compacted" (Constantin) cannot be said of the latter, and the red to bright yellow surfaces are just as distinctive for the former. But then again, there is Limburg-like decoration on "Bandkeramik" pots, according to Buttler a *Mischgruppe* (Buttler/Haberey 1936, 107), and Limburg-like tempering, too (Constantin 1985(I), 108) to which I shall come back later.

I would now like to turn to the subject of this ware in the excavation. Sticking to the old Klopfleisch definition of the Bandkeramik of wave and spiral motifs on the fine ware, and associating these with a fairly distinct coarse ware, on the Janskamperveld site 175 sherds (deriving from probably 57 pots) have been recognized as deviating from this standard in at least one important attribute, and are therefore strictly speaking of 'non-Bandkeramik' antecedent: it concerns 36 decorated pots, and at the very minimum 21 undecorated ones. By applying different criteria, different counts of "Limburg ware" result:

based on the *decoration*, 28 vessels qualify, apart from the 21 undecorated pots;

based on their *shapes*, only fourteen vessels can be properly grouped with this ware for their thickened rims (11) or ridges (3); in addition there are ten pots with thin rims, which may have a Bandkeramik look but also occur among “Limburg” pots; there is one vessel with an applied strip which seems a clear Bandkeramik characteristic; and 32 otherwise exceptional vessels are indistinctive or not recognizable on this score;

when the way of *firing* is taken as a guide twenty-two decorated and twenty undecorated pots show the distinctive three-layer pattern with a pitch-dark interior on the fractures;

and based on the *tempering* perhaps only nine pots (among which four undecorated) should be labelled “Limburg” for their white particles of crushed bones or chalk (if that is a valid criterion); however, grog, sand and clay pellets also occur as tempers in otherwise “Limburg” ware, according to the literature; in Janskamperveld 6, 12, and 9 pots, respectively, with one or more non-LBK characteristics have been collected.

Apparently the different categories are very much overlapping in this set of finds. All pots incorporated above are deviating from ‘true’ Bandkeramik characteristics in at least one respect. On the other hand, none of the definitional Limburg characteristics is exhaustive according to the literature, for pots not tempered with bone, and/or with non-thickened rims regularly occur together with Limburg-decoration and are nevertheless also considered elements of this ceramic group, too (*e.g.*, Cahen *et al.* 1981). In the accompanying drawings, the sherds have been grouped according to their decoration: herringbones (figs. 7-5-d, e), triangles (figs. 7-6-b, d, e, 7), dragon’s teeth (figs. 7-6-a, f) and ladders (fig. 7-8) constituting the classical variety, and coarse stab-and-drag with oblique fringes (fig. 7-9) a deviant one. The find numbers and major characteristics of these sherds (temper, shape, firing, decoration) have been collected in the table in the Appendix to this chapter.

The decorative diversity is obvious: some pots have been carefully ornamented, whereas some others have very awkwardly executed tracery, arguing for different artisans. Not unexpectedly, several pieces cannot meet the standards of the definitions above. Although temperings with bone do occur in the Janskamperveld material, their frequency (2 decorated and 2 undecorated pots) is well below the 35% indicated by Constantin for this region (Constantin 1985(I), 88); note however that bone tempering is also extremely rare[5] in the Graetheide LBK. Among the sherds, there are several much like those reported from the Omalien site of

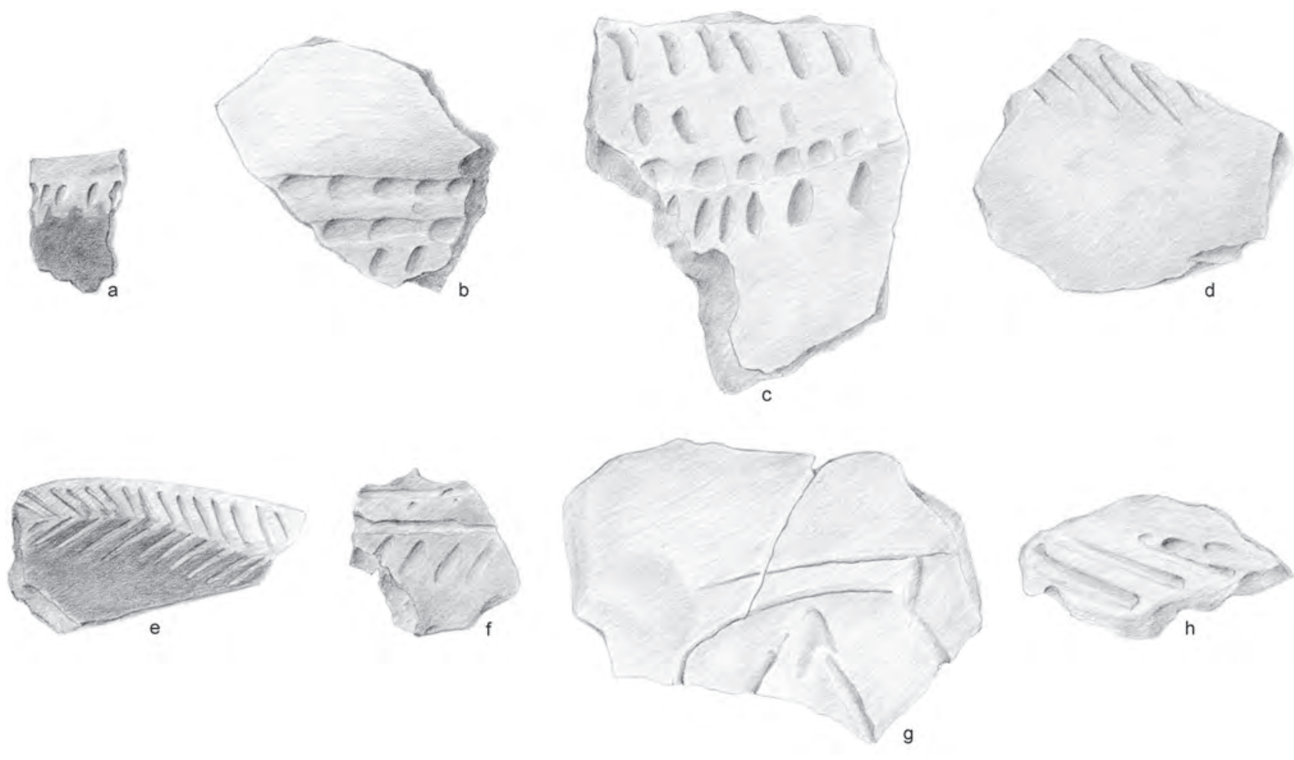

fig. 7-5 non-local LBK sherds from features (a) 94052; (b) 26090; (c) 19087; (d) 91124; (e) 31075; (f) 31075; (g) 33025; (h) 22019 (scale 1:1) drawn by Erik van Driel

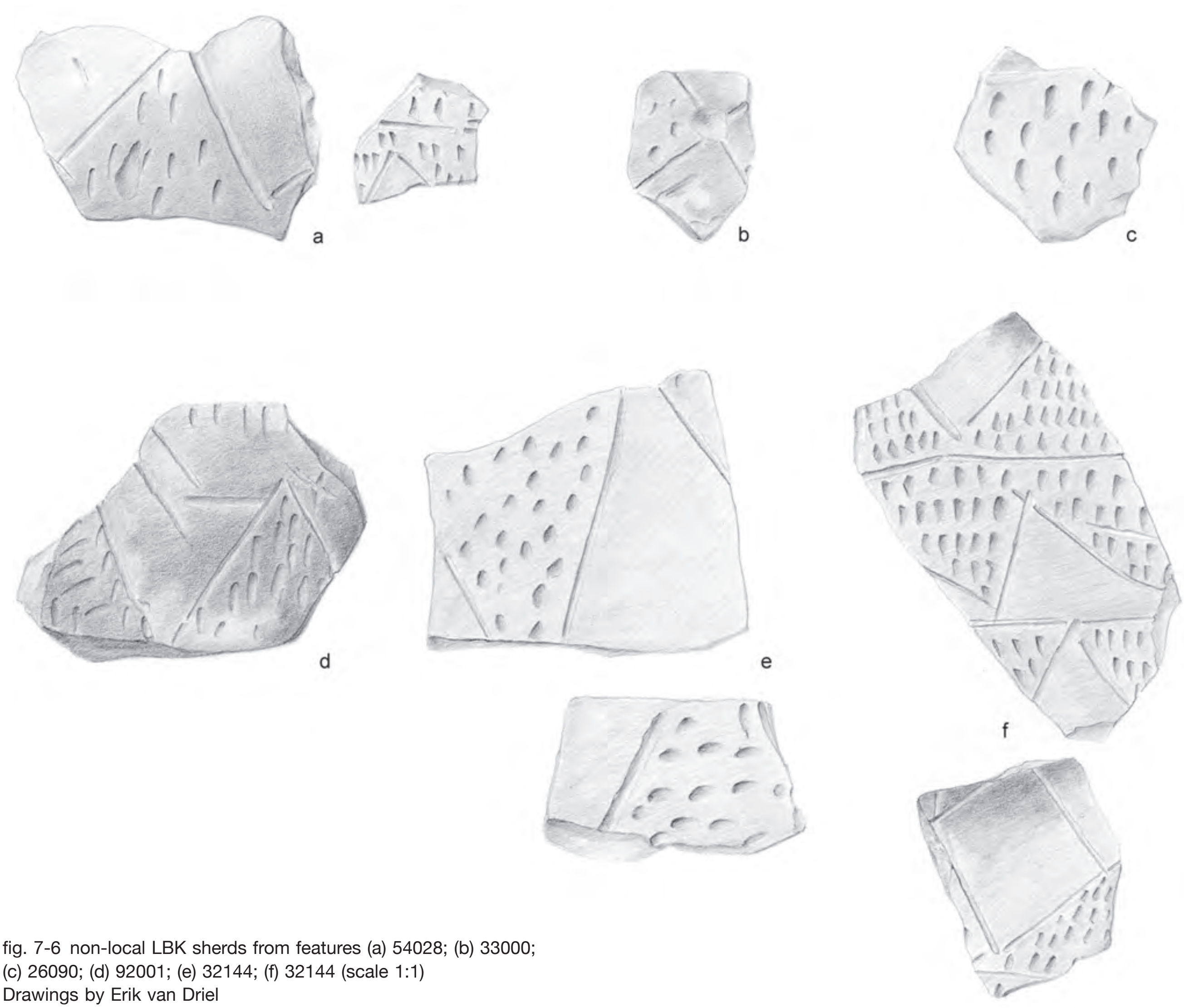

fig. 7-6 non-local LBK sherds from features (a) 54028; (b) 33000; (c) 26090; (d) 92001; (e) 32144; (f) 32144 (scale 1:1)
Drawings by Erik van Driel

Rosmeer in Belgium (in the Hesbaye, on the other side of the Meuse River, 24 km southwest of the Janskamperveld village) (figs. 7-5-c / e, 9-a / f; cf. Cahen *et al.* 1981 figs. 8-10), whereas others are similar to pieces found elsewhere in Dutch Limburg (figs. 7-8-b; cf. Cahen *et al.* 1981, figs. 1-3, or Van de Velde/Bakels 2002, afb. 16). The stab-and-drag-like decoration on 4 pots executed with a single-dented spatula is even reminiscent of the La Hoguette group (compare figs. 7-9-g with Lüning *et al.* 1989, esp. figs. 9 no. 7, 15 no. 8, or Van Berg 1990, 10A "*réattribution à la Céramique de La Hoguette*"), although I shall not insist on this similarity. Nor shall I spell out the different cultural attributions of the same or very similar decoration by different authors, such as for instance the sherds in fig. 7-9-f: according to Cahen *et al.* (1981, fig. 9-10) to be grouped with Limburg ware and "reattributed" to Blicquy by Van Berg (1990, fig. 7-3).

Among these fifty-seven purported "Limburg" or rather "non-LBK" pots from the Janskamperveld site, 38 pots from fifteen finds have dependable chronological status, while 19 pots from seventeen features have to make do with informed guesses. The chronological attributions span the whole occupation of the village, testifying to regular visits from the makers of these vessels (table 7-6).

The explanation of the presence of Limburg ware in LBK settlements is generally sought in the sphere of allochthonous

fig. 7-7 non-local LBK sherds from features (a) 26090; (b) 44012; (c) 91124; (d) 31075 (scale 1:1)
Drawings by Erik van Driel

H Generation	I-1	I-2	I-3	I-4	II
no of features	3/11	2/-	4/3	5/-	1/3

table 7-6 the number of features with Limburg/non-LBK ware per house generation
w ≥ 3 / all finds with Limburg ware in this phase

contacts, although a functional differentiation *within* the LBK has also been proposed (Constantin 1985; Verhart 2000, 229), especially since nothing else with an apparent non-LBK signature has been found in the local archaeological record. Because of the considerable differences between the two wares, other scholars support the idea that Limburg ware is made by a (hypothetical) group of herders or hunters in the area to the west of the Northwestern Bandkeramik territory (Van Berg 1990, 163; Jeunesse 2001; Lüning in Lüning *et al.* 1989, 357; Modderman in Cahen *et al.* 1981, 140), and therefore occasional exchanges of meat or grain would be the mechanism of acquisition. While this may be an option, there will have been more to it than food exchange alone. In my opinion at least two issues are not addressed here: the substantial variability of "Limburg" decoration, and the occurrence of "Limburg"/"non-LBK" decoration on "Bandkeramik " pots. The first problem may be solved by the introduction of yet another hypothetical herders' or hunters' group, similarly of the "non-digging" class (Modderman in Cahen *et al.* 1981, 159; Modderman 1985, 118), which is, given the mosaic of Late Mesolithic and Early Neolithic cultures of those days, not really a daring proposal (*cf.* Brounen 1999; Jeunesse 1994). The second problem of Limburg-like characteristics on otherwise Bandkeramik pots and *vice versa* are neither addressed nor explained in the literature but probably tacitly included under the label "LBK" (*e.g.*, Gabriel 1979).

As noted above, most archaeologists seem to be pretty certain of what it is that makes a pot "Limburg" or "Bandkeramik " thus negating any problem here[6] — sometimes just as tacitly justified through the notion of "*polythetic distribution of characteristics*" (*cf.* Clarke 1968, 37-38). Though a choice between shape, temper, and firing as *the ultimate razor* cannot reasonably be made, only decoration if any defines LBK pottery (by definition; also *cf.* next section). Therefore, a grey zone where one scholar will say "LBK" and another "LB" (or "Blicquy", or "La Hoguette", as the case may be), both with justifiable confidence, will necessarily continue to exist. On the assumption that these non-LBK pots were made by people not versed in the LBK canon — I am very much aware of the dangers of the pots-and-people-problem — this extracanonical ware can be explained as a product of

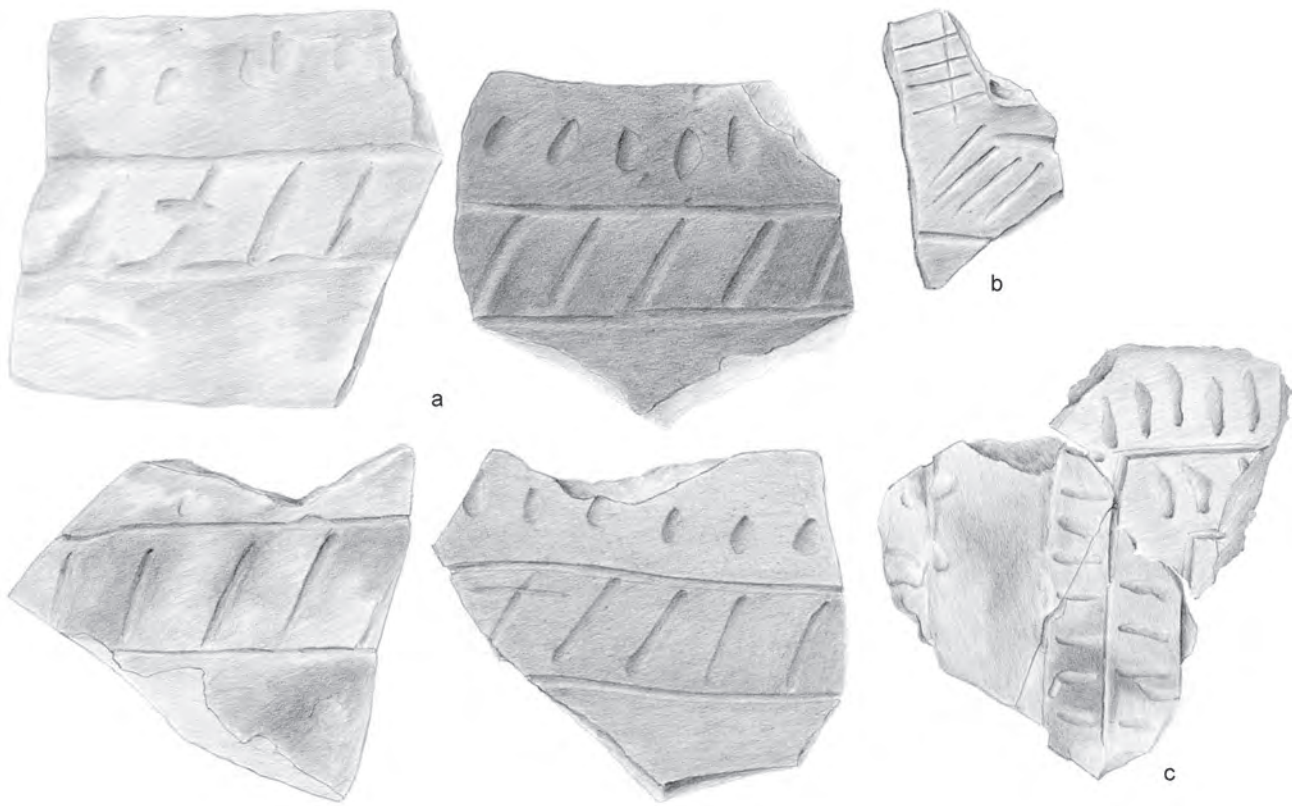

fig. 7-8 non-local LBK sherds from features (a) 46004; (b) 44028; (c) 31075 (scale 1:1)
Drawings Erik van Driel

acculturation. Acculturation that is, or (re-)socialization of non-Bandkeramian or non-local LBK immigrants in the Bandkeramik world: occasionally a female from beyond the Frontier will have entered a Bandkeramik village, as marriage partner, an element of the symbiotic relationships across that border (Brounen 1999; Verhart 2000, 18, 40). At first she will have continued to use the foreign pot(s) she brought with her as part of her identity, only to replace them after breakage with decreasingly non-conformist ware, gradually losing her native, extra-territorial "practical knowledge" (Giddens 1984, 49-50), first as regards clay preparation and firing, second in the area of pottery decoration. Probably, the making and firing of the paste is the first thing to do when joining the Joneses, since finding, mining, selecting and preparing the clay will have been done jointly with the neighbours, resulting in Bandkeramik-like ware, or fabric of the pots. Decorating, though probably done in company as well, has more of an individual pursuit, regulated rather by private and innate custom or habitus than by conscious persuasion — to be lost only with the passing of the years but until then resulting in Bandkeramik ware pots with some lingering non-local characteristics. It should be borne in mind that the other members of the potters' circle also understood pottery decoration as part of their own family identity (*cf.* section on social implications, below). And certainly, where several of these non-LBK pots occur together near a house, different stages of "Bandkeramization" are represented.

Moreover, some confirmation of this mechanism can be found in the diminutive amount of such non-LBK ware in the archaeological record of the Janskamperveld settlement: 99 sherds deriving from 36 pots (or 175 sherds for 57 pots, when the undecorated pots are also incorporated) in a corpus of over 1500 decorated pots, and more than 3600 pots when the coarse ware is included. This is not even two percent of the total, and therefore testimony to something special, in the order of only a few allogenic immigrants in a full one hundred years. Even when considered per house, this type of ware is not very common: fifteen houses (among a total of 69 houses excavated) can be associated with altogether 45 non-LBK vessels, eight houses being accompanied by only one single pot (table 7-7).

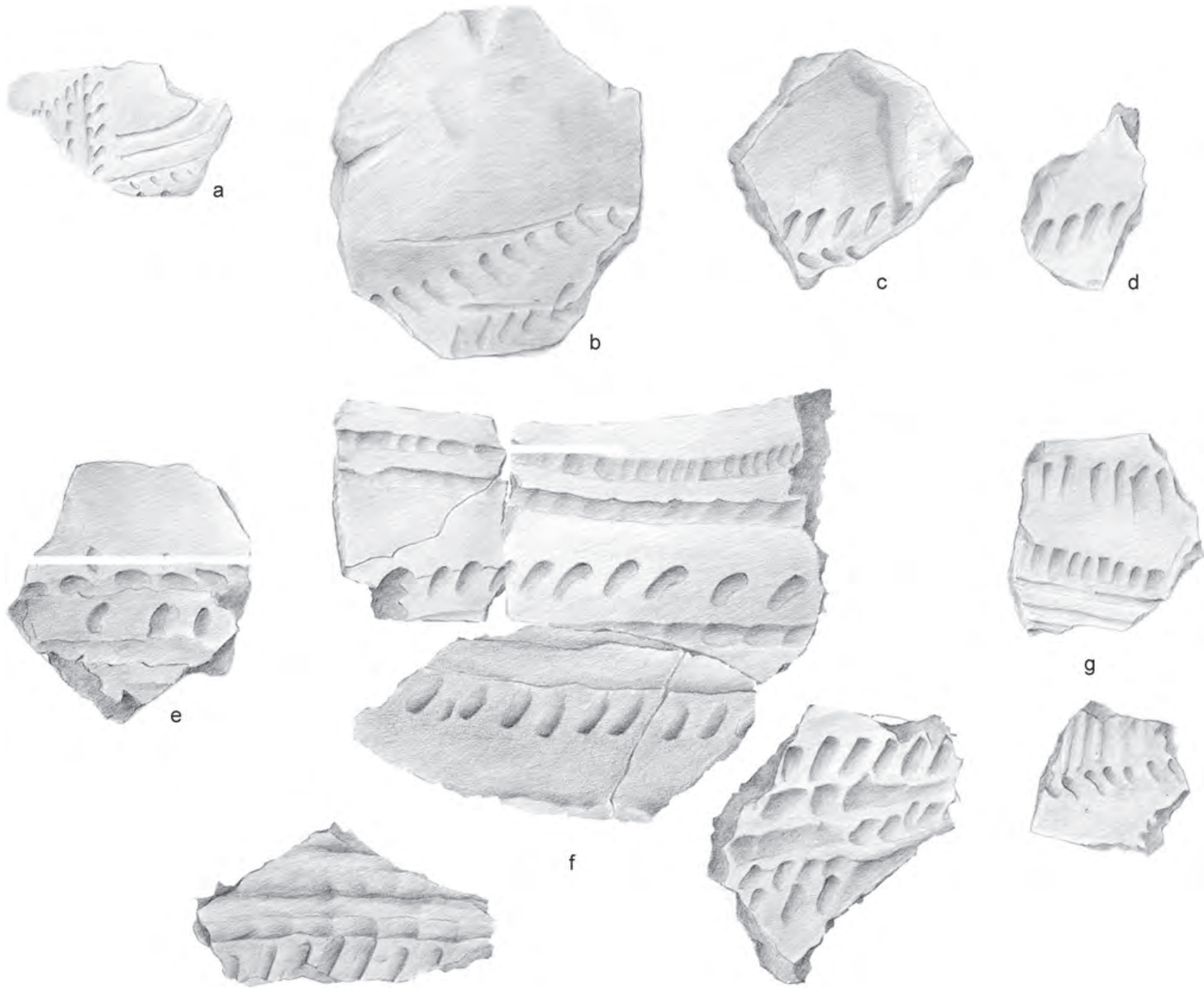

fig. 7-9 non-local LBK sherds from features (a) 57020; (b) 91124; (c) 91124; (d) 91124; (e) 19087; (f) 26090; (g) 91002 (scale 1:1)
Drawings Erik van Driel

7.5 Pottery decoration, some examples from the village, and general observations

From 193 find numbers or features, 3723 decorated Bandkeramik sherds have been collected, probably deriving from 1582 pots. Thicknesses ranged from 2.7 to 13.3 millimetres (fig. 7-1). The average thickness is 5.6 mm with a standard deviation of 1.4 mm, and a median value of 5.4 mm with an interquartile range of 4.7-6.4 mm. Comparable measures from other areas are: in German Hessen (right bank of the Middle Rhine) the average thickness of the fine ware is 4.9 mm, and in Bylany 5.9 mm (respectively Kneipp 1998, 60; and Pavlů 2000, 139). Although I have no quantified data on the other settlements on the Dutch Graetheide, the run of the decorated pots from the Janskamperveld settlement does not distinguish itself from that in the other Dutch sites, given comparable age: made from finely ground clay in which tempering of the paste is rarely if at all visible; grey to dark grey on fractures; with well-polished surfaces; more often than not with dark grey to black outer surfaces. Also, the decoration is not exceptional for a Bandkeramik repertoire; only the non-LBK, Limburg and Limburg-like pottery stands out in these respects, as discussed in the previous section. On average, per pot only 2.4 sherds have survived; since an average decorated pot seems to fall apart into about 10 to

House no	H Gen	no of pots	feature nos
02	3	1	91002
03	1	3	91124
04	3	1	92001
05	(1)	1	95050
13	4	4	31075
14	4	3	44012
19	3	3	54028,54029
23	4	3	49015,49016
35	(II)	1	*32100*
36	(3)	1	10032
37	1	1	22019
41	4	1	57020
53	1-3	17	19087,19088,26090
58	2,4	4	*10038,10040*
68	(1)	1	*19043*

table 7-7 houses associated with Limburg/non-LBK ware
italicised: association uncertain

20 sherds in this excavation (as can be inferred from the distribution of sherd numbers), the survival rate of these sherds is in the order of one in four to one in eight. There is a tight correlation of the number of pots with the number of sherds (r = 0.95) which is indicative of the weight to be accorded to this survival figure.

Notwithstanding the regular and unobtrusive similarity of the pottery from this site with that from nearby settlements, I shall illustrate those few decorated pots of which the decoration can be partially or wholly reconstructed; again, most of the time not because of any specialty, but only to give an impression. In addition, in the chapter on relative chronology, examples of assemblages from each of the ceramic phases are presented. The first pot to be shown is easily the most conspicuous piece of earthenware from this settlement (find no. 19078; fig. 7-10). Unfortunately its lower part is missing entirely so nothing can be said of the bottom; the remaining height is 22 cms. The profile, though, suggests a steeply-walled beaker, which by its rim diameter of 25 cms is among the largest known (J. Lüning, pers. comm.).
The wall sherds have thicknesses of around 8.4 mm, while the applied strip adds almost a centimetre to the outside. The decoration is incised with approximately one millimetre wide grooves with a U-profile, administered when the smoothed surface was still wet as shown by the sharp edges of the grooves. The organization of the decoration is different from regular Bandkeramik practice though its details remain within the canon: wave-like motifs occur in the zone above

fig. 7-10 beaker from feature 19078 (scale 1:2)
Drwan by Erik van Driel

the band of this pot, whereas normally they are restricted to the belly zone exclusively; also, the vertical stripes below the band are hardly ever seen on this culture's fine ware (coarse ware, though, occasionally shows vertical striping). On the one hand, the unique, anomalous decoration may qualify this vessel as non-Bandkeramik, while the technique with which it has been executed seems to allude to early Flomborn practice. On the other hand, the colour of the surface is dark grey, internally and externally; on fractures a lighter yellowish grey is shown; temper is not perceptible (and certainly not organic temper): regular LBK fine ware therefore. The context in which this pot was found is an all-out Bandkeramik pit, datable to an early ceramic phase 2 of the settlement. Feature 19078 was positioned along a type 1c house (H 59) with a Y-configuration of its central posts, and another pit also associated with this house was even dated to the first phase (house generation) indirectly confirming this early occurrence.

Clay strips around pots are comparatively rare in North-western Bandkeramik inventories, although not entirely unknown, especially with coarse ware (*e.g.*, in feature nos 10032, 32142, 49080, 52051, 58016, 91002, 91003, 91124 and 92023 from the present settlement excavation; also on fine ware, some appliqué bands have been ascertained in find nos 32144 and 57020; both a coarse and a fine ware pot derive from feature nos 19078 and 28079). Steeply-walled beakers figure in several publications, and here only a small and uneven selection will be referred. Initially Stehli included these vessels as *"Exceptional form 2: steeply-walled beaker with flat bottom"* (Stehli 1973, 63-64) but their rarity has led to their exclusion from his' and others' relative chronological schemes. From the Graetheide I know of one other example, excavated by Modderman in Sittard next to a type 2 house dated to phase LBK-1d/2a of the Dutch chronology (find no. Sd 208; Modderman 1959, Abb. 69). Ironically, this latter one has a missing *upper* part, while the Janskamperveld specimen lacks a *lower* part. From the Königshoven *Siedlungskammer* with its 14 or 15 small settlements, two such beakers are reported (Claßen 2006, 252), and on the other side of the Rhine river, in the Soester Borde, a few more of these vessels have been excavated: from Soest (Nicolai Kapelle), Werl (Salinenring) and Nideruff; complete as well as fragmented pieces are illustrated by Gabriel (1979, TT. 28/102, 29/102, 33/105, 40/478). None of these Soester beakers shows an appliqué band, chronologically they are divided up over the LBK II-V phases (German LBK-chronology).

The next pot (fig. 7-11) comes from the richest feature in the excavation where 543 decorated sherds, representing at least 207 vessels, have been secured; additionally there were nine sherds (3 pots) with non-LBK type decoration (find no 91124). This assemblage is securely dated to the first phase/house generation of this settlement (LBK 1b in the Dutch chronology), House 03 (type 1b) is directly associated. The bowl in the figure has a rim diameter of 15 cm, the thickness of its wall is 4.6 to 6.2 mm. The surface colours

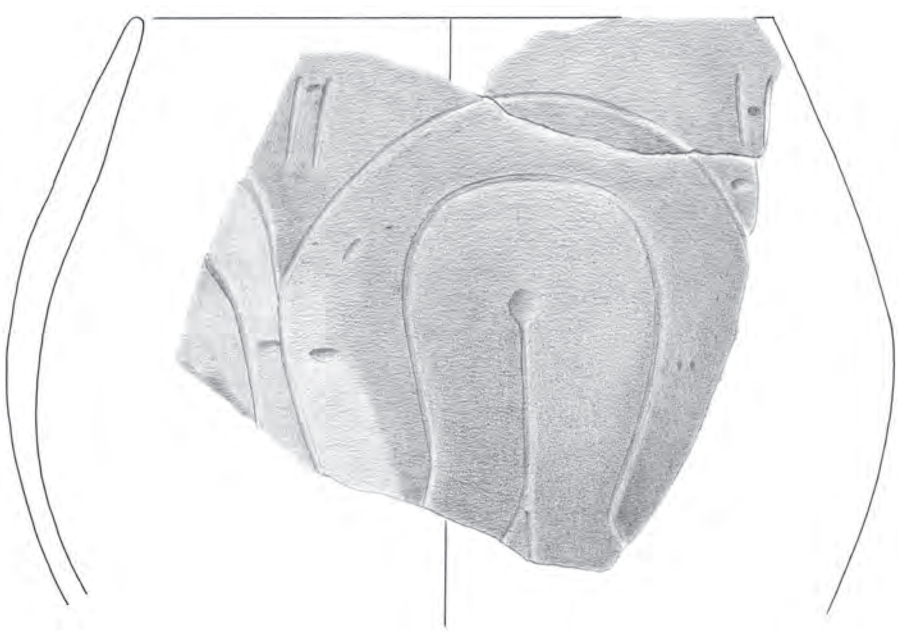

fig. 7-11 bowl from feature 91124 (scale 1:1)
drawing Erik van Driel

are dark grey to greyish black on the outside, and dark grey on the inside; on fractures a homogeneous dark grey colour is shown. The paste of fine-grained clay has either been tempered with silt or did contain already some slightly larger particles which produce a tinkling glitter in the sunlight. The outer surface has been rubbed to lustre, whereas the inside is just smooth. The competently incised motif is not complete, and its original outline cannot be specified.

The small bowl in the next drawing (fig. 7-12) was found in a pit which held a.o. another 12 decorated sherds from seven vessels (feature no. 55003) — this pit belongs to the large type 1b House 03 (as also feature no. 91124 previously mentioned), and is dated to the second house generation. The pot's rim diameter is 11 cm, the walls have thicknesses of 4.5 mm. The surface colours are brown to dark brown on the outside, and a greyish brown on the inside, on fractures homogeneous yellow grey. The clay has been tempered with some silt, if this was not already present in the parent mineral. The outer surface has been burnished, the inside simply smoothed. The spiral motifs of the decoration suggestive of rolling waves were applied with a fairly broad utensil when the clay was almost leather dry (which is contrary to normal LBK practice): the traces of this utensil are quite superficial, and one gets the impression that the embellishment was hastily executed, perhaps only as an afterthought.

Also decorated by a spiral motif (though here possibly in a reflected composition) is the bowl depicted in fig. 7-13. Deriving from one of the *Längsgruben* (feature no. 59007) associated with the barely recognizable House 44 (possibly, type 3), it is dated to the third house generation. The rim diameter of this bowl is 16 cm, the walls measure 5.9 to 6.6 mm. The surface colours are yellowish brown to grey on the outside, and grey on the inside of the vessel; on fractures dark grey. As with the previously described vessels, this one has also been tempered with silt. Outer and inner surfaces have been carefully smoothed such that the outside shows a thin yellow brown layer like a skin. The rim decoration of this bowl is quite bizarre with its (pseudo-) music notes[7] on an incised line parallel to the rim, with a second music line positioned below it between the vertical lines which subdivide the belly zone into equal panels.

The sherds of the small bowl illustrated in fig. 7-14 have been found together with a.o. 47 decorated sherds (22 vessels incl.; feature no. 52017). The pit from which these finds have been collected is the northeastern *Längsgrube* of House 17, a house of type 3 with a degenerated Y configuration in its central part. The decoration on the sherds from this pit indicates a positing in the third house generation, final LBK 1b or early 1c in the Dutch chronology. The decoration on the bowl is quite unusual, or atypical, although it cannot be fully specified. It seems that four oblique incisions constitute an X, the four outside sectors of which are alternatively filled with short, irregularly placed incisions (top and bottom), and with disparate impressions of a spatula (left and right). The bowl has a rim diameter of only 8 cm, and its walls measure 5.0 mm. Colours are grey to yellowish grey on the outside, yellowish grey on the inside, and brownish grey on fractures. The paste has been tempered with tiny brown clay pellets, as well as with silt; both surfaces have been smoothed.

Seven sherds remain of a nicely formed and ably decorated bowl (fig. 7-15; feature no. 40073), the only decorated pot in this small assemblage. They came from the southwesterly *Längsgrube* of House 08, of 1b type and with a regular central post configuration; this house is one of the few on this site that cuts through an earlier building, H 06 in this case. The rim is approximately 22 cm wide, sherd thickness ranges from 3.5 to 5.7 mm. Both outer and inner surfaces show a brownish colour, on fractures a homogeneous dark grey. The tempering of the paste consists of silt and some tiny black clay pellets. The decoration of the belly zone consists of a wide zigzag strip, bordered with neatly drawn

fig. 7-12 bowl from feature 55003 (scale 1:1)
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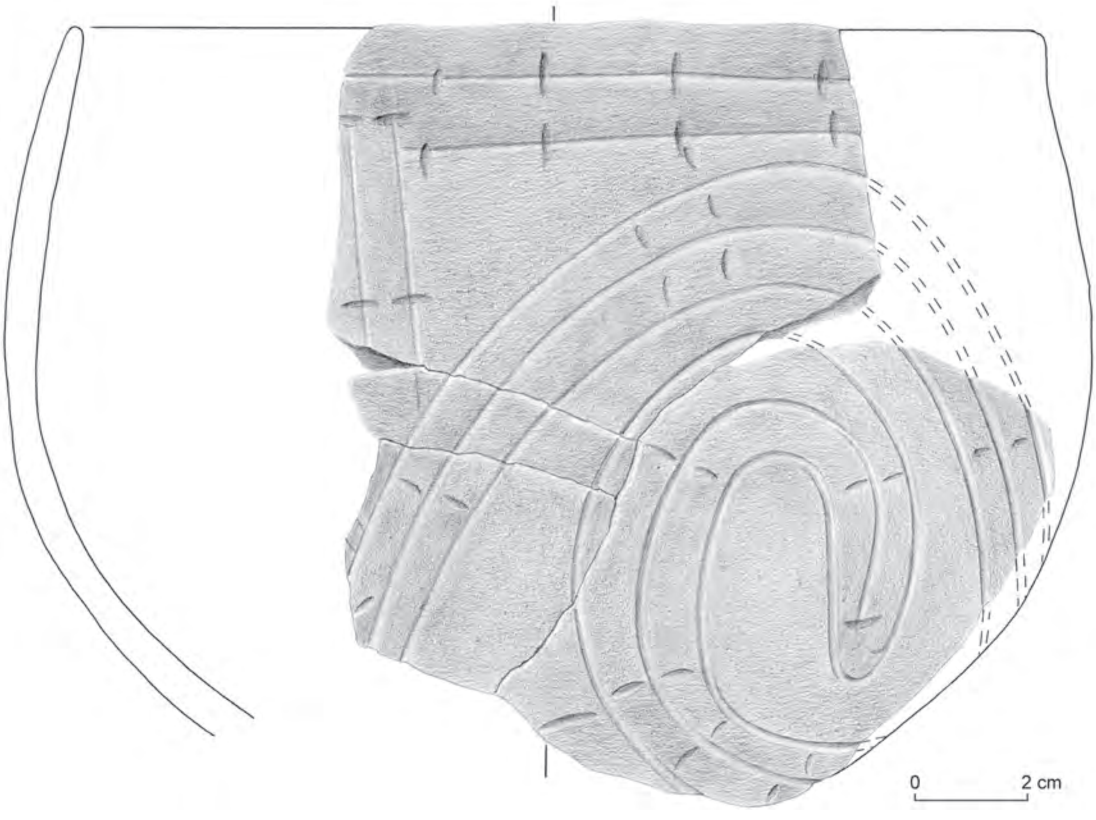


fig. 7-13 bowl from feature 59007 (scale 1:1)
Drawing Erik van Driel

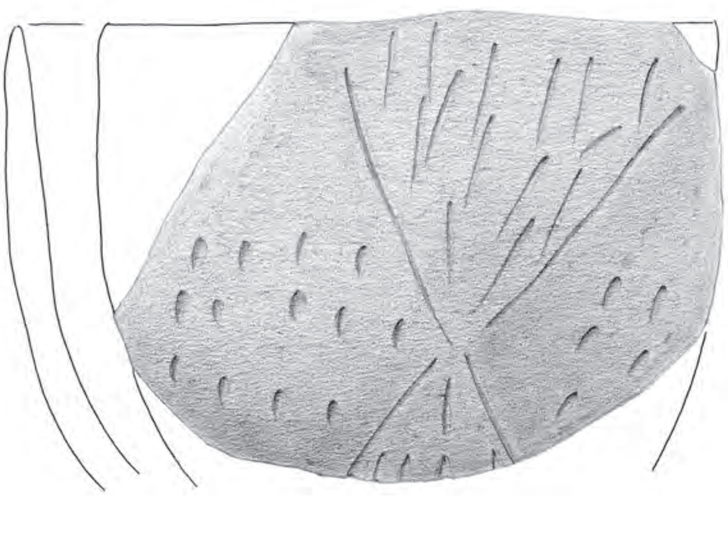


fig. 7-14 small bowl from feature 52017 (scale 1:1)
Drawing Erik van Driel

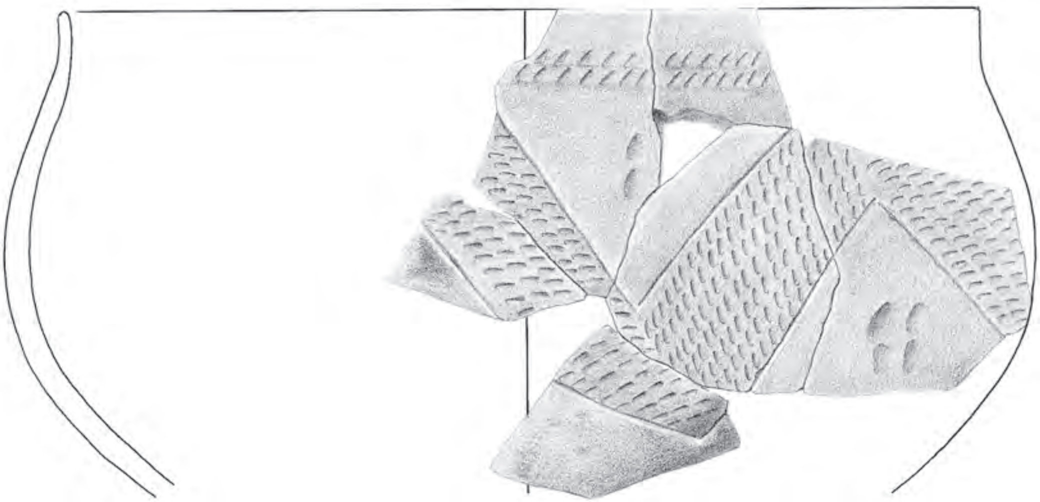


fig. 7-15 small bowl from feature 40073 (scale 1:1)
Drawing Erik van Direl

incisions and filled with rows of very regularly placed impressions of a spatula, obliquely to the axis. The top zone has been decorated with equally regular, obliquely placed spatula impressions, in two rows parallel to the rim. The outer surface had been burnished before the decoration was applied; the inner surface has been simply smoothed. Judging by its decoration the vessel should have been made during the second Bandkeramik habitation of the site (LBK-2c); however, as nothing datable was found along with it, this attribution is hardly better than a guess, although both the stratigraphic position and the central construction of the house to which this pot probably belongs are definitely not contradictive.

The remaining well over three thousand decorated Bandkeramik sherds from the Janskamperveld excavation are generally too small to reconstruct their motifs reliably, and therefore they are not illustrated here. In table 14-1 of the chapter on chronology counts of decoration features are presented relative to the number of pits; substituting this latter number by the number of pots (approximately 1582) the fragmented nature of the decoration becomes clear. For instance, only 544 pots (not even one third of the total on record) allow recognition of a subdivision of the surface into a neck zone and a belly zone. The small average number of 2.4 sherds per pot, already alluded to above, should underscore this once more.

I shall now turn to a discussion of the various classificatory schemes that have been devised to describe Bandkeramik decorated pottery, partially reiterating, partially elaborating on points made in the chapter on chronology. There, I have written about the 'Rhineland Model' of pottery decoration classification, which has as its main objective a seriation of the finds over time. A 'type variety method of typology', that Model has as its major characteristic "an emphasis on creating a regional framework for ceramic description" by way of a listing of all observed decorative details on the pots in a region (quote from Sinopoli 1991, 53). Therefore, transportability of the scheme is very low: to everyone familiar with Bandkeramik decorated pottery it is clear that regions differ in their repertoire — there are even differences between the neighbouring Belgian Omalien decorative practice and those from the Dutch Graetheide. Such differences should be incorporated in the Rhineland Model if it is to be used on a trans-regional scale; however, apart from one attempt in this direction by Stehli (1994) I have not seen any others as yet (*e.g.*, Constantin 1985; Kneipp 1998). While this problem is of a methodological nature, a serious practical problem with the Model is its immense extent: originally starting out with some thirty "types" (Stehli 1973, 60), it has grown into a bewildering mass of characteristics (as in, *e.g.*, Kneipp 1998, where 792 attributes of decoration are defined; in Claßen's study, however, the chronology is based "only" on those 67 bandtypes common to the Aldenhovener Platte and the Königshoven areas; Claßen 2006, 145). One will neither know whether all possibilities in the data at hand have been exhausted nor that all observables have indeed been coded. Taken to its logical extremes, there should be as many characteristics as there are pots in the study for they have all been handmade, and therefore each and every pot is different. Moreover, as recognized by Stehli in his early work, in settlement debris only a few characteristics are observable on a regular and repetitive basis (Stehli 1973, 60;

also, *cf.* the previous paragraphs). Notwithstanding these practical and methodological drawbacks, the Model has been very successfully applied to the relative chronology of the Aldenhoven *Siedlungskammer,* as with it the individual house generations could (almost) be recognised (Stehli 1988).

Much simpler to use is the Buttler-Modderman scheme (Modderman 1970, 121-140, 192-201), which is purely a differentiation of 18 types of strip fillings, based on Buttler's work in Köln-Lindenthal and amended for the excavations on the Dutch Graetheide. This typology, though initially intended as merely an aid to description of the pottery, became popular (that is, among archaeologists working on the Early Neolithic of NW Europe) as a chronological index, differentiating two periods with seven phases in the Northwestern Bandkeramik. There are some problems with this scheme too (Van de Velde 1979, 8), primarily because its classes were also drawn up inductively based on research experience in the Northwestern Bandkeramik area, and thus do not incorporate ways of decoration current in other Bandkeramik areas, such as the Aisne Valley or Central Europe. On the other hand, its simplicity has much to recommend it, and this has led to wide acceptance of this classification by those working in the Northwestern Bandkeramik.

In my Ph.D. thesis, in which I had to work on material from two markedly different style regions, German Bavaria and the Dutch Graetheide, the deficiencies of the models just mentioned soon became apparent. As a remedy, I developed a classification based on simple analytical categories which allowed the description of *all* Bandkeramik decoration, wherever found (Van de Velde 1976). These categories were designed with an eye to quantification and statistical analysis — included were techniques of decoration, the bare components that made up the decoration, the structures of the motifs such as zoning of the pots and recti- and curvilinearity, and the basic and developed motifs (waves and spirals, algebraically developed through reflection, gliding, and rotation), plus some auxiliary variables (see below). Here, I shall not enter into a full discussion of this scheme; the reader is referred to earlier publications (Van de Velde 1976, 1979, 1987), as well as to the chapter on chronology in the present publication. Also in the chronology chapter a hybrid classificatory scheme by Pavlů is alluded to, a system which combines a few characteristics of the Rhineland Model with a number of features more reminiscent of my own model. It is interesting to note that Pavlů's work is aimed at the social structure of the Bandkeramik Bylany settlement (Pavlů 2000, 1-3).

Whatever the merits and demerits of the respective classificatory schemes, they were designed as means to an end: the Buttler-Modderman scheme and the Rhineland Model mainly or even exclusively as an aid to chronological differentiation[8], the Pavlů and author's classifications to allow social inferences (including relative chronology, of course a derivative of changing social habits). Obviously, pottery decoration is not the only possibility of social analysis — houses and settlement plans are at least as instructive — but it should not be neglected as a source of understanding. It is to this dimension that I shall now turn.

7.6 Decorated pottery, and social implications for the Janskamperveld village

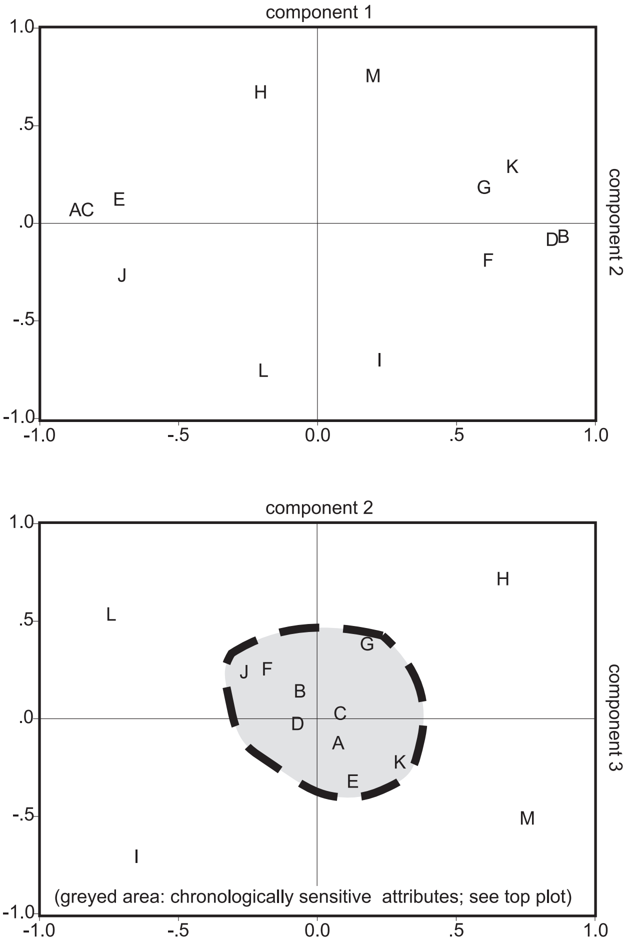
A major research concern is the social relationships between the groups that occupy the houses of the settlement. In the ethnographic literature there is often mention of house (or lineage, or clan) emblems, either in house decoration, on shields, or clothing — sometimes on a purely individual level, but more often involving larger groups like our own family names. Within local groups, identities are played out; related to other identities, they constitute the social structure of the group. To participants, the emblems are visible signs of belonging or not belonging, observable for everybody. When these signs consist of relatively non-perishable material, they may even be visible to archaeologists.

Therefore, if the designs on LBK pottery have any meaning, they will be related to group identities, however small or large those groups are defined in the local society. Trivially, Bandkeramik decorative motifs differ conspicuously from those on Limburg pottery, marking out the locals from the foreigners. Obviously, differences within the local group should be readily perceptible, at least to the initiated, although perhaps on a more subtle scale than those between the larger traditions. Just as a starting hypothesis, I suggest that the choice and execution of the main motifs on the decorated pottery has social sign value (*cf.* Sinopoli 1991, 124-125; Krahn 2003, 516). Frirdich notes that some strip types (the 'main motifs' in the Rhineland Model) are restricted to individual yards (*Wohnplätze*; Frirdich 1994, 254). Pavlů writes about rectilinear and curvilinear designs being markers of the two local groups ("lineages") at Bylany (Pavlů 2000, 167), and in my dealings with the Elsloo cemetery the same distinction could be interpreted as a token of matrilineal kinship (Van de Velde 1979, 112-113). Also, the remarkably uniform mix of this variable over the houses of the LBK village of Elsloo could be explained by virilocal marriage arrangements. In that same text I had to admit though, that the patterning of the distribution of the main motifs (wave, spiral) remained obscure to me.

There were 193 features with LBK decorated pottery sherds from the excavation in the Janskamperveld village, remains of almost sixteen hundred sherd families. A general principal components analysis to analyse the associations and oppositions among the variables and attributes showed, apart from the chronologically relevant variables (further elaborated in the chapter on chronology), three sets of opposed attributes. The first set consisted of the presence and absence of fillings of the strips; it was strongly aligned with the chronological component (in that analysis, 41.9% of the variance); my reason for not incorporating this set into the computations of the temporal sequence was its low frequency in the data. A second set consisted of recti- and curvilinear motifs, mainly associated with the second component (accounting for 18.4% of the variance in the data), almost perpendicularly positioned relative to the time axis in the component plot; this is neatly illustrated by the lower plot in fig. 7-16 which is perpendicular to the top one (by definition: principal components are mutually independent, *i.e.*, geometrically at right angles). The third set, associated more or less with the third component (accounting for 15.0% of the variance), opposed presence and absence of auxiliary lines.

To begin with the third set of attributes, auxiliary lines, these are probably best considered as indicators of the skill with which the decoration has been applied to the pot surface. In order to draw three or four motifs on a pot belly or any other surface, an initial subdivision of that surface is required for these motifs to come out evenly. People with a feeling for decorative arts are aware of this, and they will begin with setting out some markers (in my terminology: 'auxiliary lines'; cf. fig. 7-17), where the intended motifs have to go, later adding finer subdivisions. In a way, this component is quite personal or individual: because of it, the better drawn motifs can be selected among the finds, and hence those potters from among whom the 'Geleen-painter' would eventually emerge — to be entered in an art historical anthology.

Not being an art historian, I shall leave the third component, and turn to the second one which opposes rectilinear and curvilinear motifs. In earlier publications these structural variants of the motifs have been related to a division of Dutch Bandkeramik society into matrilineal moieties, female burials always being associated with either one but never both, and male graves generally with the two together (especially Van de Velde 1979, 112, and Van de Velde 1995). Apparently, the males became associated with both societal halves, one through their mother by birth, and the other one through their wife, by marrying out[9], an ethnographically well-known arrangement. The ratio of the two alternatives was shown to be approximately equal in all houses in the settlement of Elsloo (a few kilometres to the west of Janskamperveld, and in its initial phase contemporaneous), a result to be expected from such a grouping. For, if the selection of rectilinear or curvilinear decoration would have been according to individual whims, then not an *equal* but instead a *random* selection should be observed, resulting in a more or less even distribution of all ratios instead of a peaked one. I inferred that curvi- and rectilinearity served as badges for the two (matri-)moieties, which through virilocal house recruitment had been spread all over the place — only recently confirmed by isotope analysis of bones from LBK graveyards (Price *et al.* 2001). It is not farfetched to expect a similar division of society in the Janskamperveld settlement. In fig. 7-16 it is shown that this component is 'bipolar', with the attributes (*L*, and *M*) diametrically and maximally opposed. There are no other contributors to this dimension in this set of variables, and therefore the scores of



A: simple spatula
B: multidented spatula
C: no neck decoration
D: with neck decoration
E: lines
F: pointlets
G: hatchings
H: no auxiliary lines
I: with auxiliary lines
J: strips not filled
K: filled strips
L: curvilinear motifs
M: rectilinear motifs

fig. 7-16 plots of first three principal components of pottery decoration at Geleen-Janskamperveld
greyed area: chronologically sensitive atrributes (see top plot)

the finds can be directly read from the proportions with which rectilinearity and curvilinearity are represented.

Fig. 7-18 and table 7-8 show the proportions of the curvilinear structures in the finds from the Janskamperveld. It is clear that the distributions of curvilinearity for the individual features as well as for the amalgamated finds per house are centred around a value of 0.65 (at Elsloo the frequencies were reversed). Probably at least part of the deviation from the expected 50/50 ratio is due to a bias of observation on small sherds, although it should be noted that among the large sherds shown in the previous section, curvilinearity is also slightly dominant. It is clear that extreme values do occur — mainly but not exclusively for the smaller finds, with less than six structures observed. Indeed, among the 54 finds with at least six structures counted, only one has an 'extreme' value (over 90%, and less than 10% for the opposite attribute), while some ten or eleven might be expected when no selective preferences were involved. In other words, the earlier observations at Elsloo are duplicated at this settlement, pointing to a non-random distribution of the structures dimension too. Meanwhile this phenomenon has been observed elsewhere, too: in the generally much smaller Königshoven settlements the ratio varied between 0.2 and 0.6, averaging 0.5 for the whole group (Claßen 2006, 243). That is, when the earlier interpretation of matrilineal kin associations of this variable is correct, then that very phenomenon is found at Janskamperveld as well as at other Northwestern Bandkeramik sites. Note that matri*linearity* not matri*locality* is suggested: in the latter case part of the settlement would have shown curvilinearity only, and the other part rectilinearity by relative exclusion.

Among the houses of the settlement accompanied by sufficient decorated pottery, the distribution of the structures shows the same tendency: the ratios of curvilinearity to all structures range from 0.5 to 0.8 with two exceptions provided by H 16 and H 56 (9, and 11 decorative structures observed, respectively). In the chapter on the history of the Bandkeramik settlement I shall come back to the structures of the pottery decoration in relation to social life.

Meanwhile a few words should be said on the (different) topic of the main motifs on the pots. Three generations ago, Buttler wrote:

Spirals and waves, the most original and fundamental decorative motifs of the Bandkeramik surely have had a special meaning to the Danubian people, perhaps even a religious one.

Buttler 1938, 25 (my transl., PvdV)

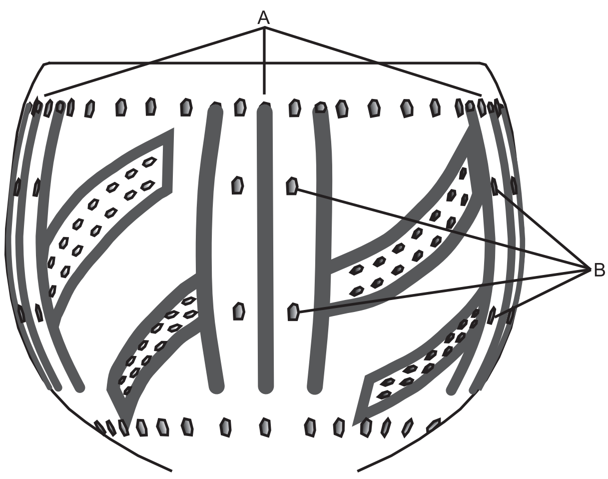


fig. 7-17 an example of auxiliary lines (pot from feature no 31021) A: vertical incision lines to subdivide circumference into four equal panels B: spatula marks subdividing height to position the arms of the motifs

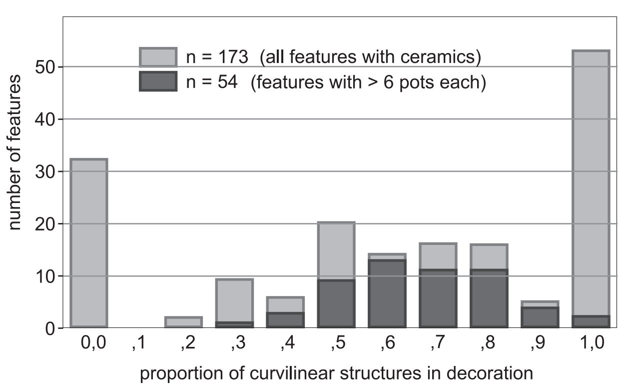


fig. 7-18 the proportions per feature of curvi- and rectilinear decorative structures

ratio	pits	houses
0.0	–	–
0.1	–	–
0.2	–	–
0.3	1	–
0.4	3	–
0.5	9	6
0.6	13	6
0.7	11	6
0.8	11	5
0.9	4	1
1.0	2	1
total	54	25

table 7-8 the proportion of curvilinear structures in complexes with more than 6 structures

Knowing that also the recti- and curvilinear structuring of the motifs is indicative of a basic distinction in this Bandkeramik society, one cannot but concur with him. However, in settlement debris spirals and waves can only seldomly be discerned, and even in the cemetery of Elsloo with its mostly complete pots I was not able to infer the reason behind the totally disjunctive distribution of the two basic motifs in the decoration (Van de Velde 1979, 115). Simply the fact that the two are never found together (in a grave, that is) is already strong evidence of one or another important principle governing their assignment[10]. The Janskamperveld settlement pots are too fragmented for the distribution of the main motifs to be studied there.

7.7 One step up: pottery and the Bandkeramik households

Pots do not exist for the sole benefit of archaeologists, but rather to assist in keeping the ancient households going by their contribution to in the preparation and storage of food. Two related questions can be formulated: is there anything recoverable from the different functions of the vessels, and how many pots were needed for the running of a Janskamperveld Bandkeramik household. To begin with the last question as to the number of pots per house. Altogether in the excavation there were 334 pits/features which held fine and/or coarse ceramics; 170 of these pits could not be associated with any of the houses, yet they contained the remains of 551 coarse and 364 fine ware "sherd families" (Orton *et al.* 1993, 56, 172), and also 11 pieces of non-LBK ware, together 5.5 pots on average. Those 164 pits that could plausibly be assigned to houses yielded 2680 pots (1349 coarse fabrics and 1285 fine ware, 46 non-LBK), with a mean of 16.3 vessels per pit. The number of pits per house varied between zero and six, the number of pots per house between zero and 320. Although there is a basic relationship between pits and pots — after all, no pits, no pots: in Bandkeramik excavations nearly all mobile finds are from pits — there is no relationship beyond that qualitative one. At first sight it might be supposed that when the larger houses are accompanied by more pits, they would therefore end up with more ceramics. However, although the number of pits is indeed tied with the size of the houses, the number of pots (equally coupled to house size) shows apparently no relationship to the pattern of the pits. Strikingly, thick-walled sherds were dumped everywhere, in contrast to the fine ware: 160 pits among the 164 associated with houses, and 156 features among 170 elsewhere contained coarse ware pots; the corresponding figures for the fine ware are 140 and 96 pits, respectively. Perhaps this 'preferential' distribution of the decorated pots can be interpreted as a confirmation of the identity aspect of the fine ware as spelled out in the previous section. Yet the ratios of fine ware to coarse pots do not differ very much, either near or away from houses, although their counts differ by a factor of about three in the two contexts. Thus, near the houses averages are 8.6 coarse and 7.5 fine ware pots per feature, away from the houses 3.3 and 2.0, respectively.

With this a beginning of an answer to the question of the number of pots per household in this settlement can be formulated. Roughly, the equivalent of *c.* 60 (complete) houses have been excavated, and the number of pots should be referred to this figure. Thus, 1945 coarse and 1607 fine pots (not counting the non-LBK ones) amount to 32, respectively 27 pots per house — assuming equal distribution over the different types (more on this in the Settlement chapter) — figures which are better manageable than the overall ones. However none of the pots will have been in use as long as the house in which it served would have existed. In this context specialist texts on archaeological pottery generally make a threefold distinction according to function: cooking pots, service vessels and storage containers (*e.g.*, Sinopoli 1991, 84). As these three categories go through different *chaînes opératoires*, they tend to have different life expectancies, with considerable variation caused by the general availability of the pottery. Thus when vessels are relatively easy to obtain, such as when there are workshop industries (sometimes household industries too; Van der Leeuw 1984, 748-757), average use life for all three categories tends to be 0.8-1.5 years, whereas with true household production (*i.e.*, every household produces its own pots, when need arises) more economical and caring handling results in considerably more durability: for cooking pots 3-5 years, service ware 2 years, and containers 5 or more years (Sinopoli 1991, 88). Notwithstanding rumours of specialist potters — "household industry", in Van der Leeuw's terminology — in LBK society (recently, Jadin *et al.* 2003, 290), household production is the most likely general way of potting there, in my opinion, every woman building and firing pots whenever the number of vessels available to her drops below the threshold of functionality. Thus, to estimate the vessel spectrum per house, a guess as to the different functions will have to be made, the first question for this section.

The fine ware, almost always decorated, is considered service or table ware (although I have not come across a suggestion of the existence of tables in Bandkeramik society). This attribution is quite plausible, for two reasons. Firstly, the fabric is very fine and homogeneous and therefore has little resistance to thermal stress which would cause cracks to start as the vessel is put on a fire for cooking purposes; and the conduction of heat across the wall is relatively slow/inefficient (Sinopoli 1991, 14). This leaves the functions of storage and service. Secondly, the decoration serves as an emblem of the user/owner/house for all to see when the pot is handled — aimed at the others expressly, as there is never decoration on the inside of the containers. This makes a storage function less likely: pots in a dark corner have little advertising appeal. This leaves the service function for this ware.

The coarse ware comes in many varieties, as described in a previous section. There are varieties of surface finishing, varieties of fabrics. Clay tempered with coarse granules has generally a fair resistance to thermal stress, as developing cracks are stopped by these particles. However, this is only the case when the expansion coefficients of the clay body and the particles are similar; considerable dissimilarity (as with sand or quartz tempers) increases the likelihood of cracking (Sinopoli 1991, 14-15). Smoothed inner surfaces are a slightly less porous and so the liquid contents percolate out at a slower rate than with rough and more porous finishes (also, Franklin 1998, 5). Roughened outer surfaces may be more efficient over a fire than smoothed or burnished surfaces.

Weak though these functional associations may appear (and probably they are no better than tendencies in any real life situation), they may serve to differentiate the coarse ware vessels into cooking and storage functions on an approximate basis. Earlier in this chapter, table 7-1 provided a summary of the tempers encountered in the sherds as visible through a simple magnifying glass, and divided into major and minor components. *E.g.*, on a total of 1921 vessels that have been scored on this property, 13 vessels did not show any tempering of the clay body. Following the reasoning for fine ware, these pots may have served a similar purpose. 609 pots had predominant sandy or quartz tempering, and therefore these were (at least in principle) less likely to have functioned as cooking ware. The remaining 1299 pots may then be considered cooking vessels; especially so as with rare exceptions these pots were tempered with 'pellets' — clay kernels and grog or pounded sherds — which have very similar if not identical properties to the clay matrix in which they are embedded. Being quite hypothetical, or rather very approximate attributions, the functional attributions should not be given too much weight. Yet, as an indication to approximately estimate the number of pots per household it may hold some water.

Thus, and now I am getting very speculative, the vessel counts of table 7-1 added to the 1649 fine ware pots assembled in table 7-5 can be divided into service vessels (1649 fine ware, plus 13 coarse pots), cooking pots (1299) and storage vessels (609). These pots refer to about 60 households (the 69 partially incomplete house plans in the excavation are equivalent to approximately 60 complete house plans), and thus the number of pots per function should be divided by that figure to obtain an average household inventory. Then, multiplying these counts by 2 years for the service, 3 for the cooking, and 5 for the storage vessels, in accordance with the life expectancies in years for the pots as derived from the literature on the subject, the pot-years per average household are obtained. These figures should have some relation to the number of pots available to the inhabitants of the houses summed over the years that the houses stood. If this latter period is set to between 20 and 15 years, then it would result in an average household in the Janskamperveld settlement having about three service vessels, four cooking pots and three storage containers available at any moment.

Though highly speculative, these figures present some food for thought. It is truly remarkable that (contrary to archaeologists' first impressions) so few ceramic pots were in use at any one moment: only three service vessels, four cooking pots and a similar number for storage purposes. Comparing these numbers with those obtained for other places, the Janskamperveld households were considerably less endowed with ceramic ware than elsewhere: in the Dutch village approximately 3600 sherd families/pots have to be shared by 60 full house equivalents; with households lasting about 20 years, the average renewal rate can be computed at three pots per house per year. Reckoning along the same lines, in the Langweiler 9 village about 6.5 pots had to be fired per house per year, and in Bruchenbrücken an estimated 7.8 vessels (Stehli 1977, 122; Kloos 1988, 174-176). No doubt, containers made of perishable material were also in use — the bark bucket and the wooden bowl from the well at Kückhoven are only mentioned as a reminder (Weiner 1993). Similarly skins and/or bladders, and wicker-work baskets will have been used as containerss making up for additionally required functionality, perhaps more in this village than in the other, though these all have disappeared from the archaeological record of course. The problem is that in order to improve on these dismally low figures, a huge loss percentage is to be assumed: putting the minimum set of fine ware at four pieces per household (which seems a bold *under*estimate) half the number of vessels should have disappeared without leaving any archaeological trace — yet, from a simulation study it appears that after a loss of approximately 90% of the initial sherds, an astonishing 88 (± 3%) of the original pots are still represented in the debris (cf. the chapter on this simulation). Therefore, the assumption of substantially more vessels per household does not seem very realistic.

However that may be, conceptionally expanding the Janskamperveld vessel inventories does not alter the numerical relationships suggested above, as the size of the sample we do have in hand is sufficiently large to warrant reliable inferences in this respect. Not everybody will become a good potter, but with some trial and error most people will achieve at least sufficient competence in building and firing pots to replenish the set after breakage.

7.8 Some afterthoughts, by way of conclusion

One of the topics that has not been discussed in this chapter is that the sherds of the decorated fine ware may have been used secondarily as lids or covers after the breaking of the pot until they too fell apart, while coarse ware sherds are assumed to have been dumped immediately after the collapse of the pot. Perhaps so, for initially the larger decorated sherds had still recognizable tags, and thus may have retained some value as service ware. Also, Neolithic society may have been less inclined to dispose of things than our culture (but that would also pertain to the undecorated, thick sherds). Yet from the dissimilar distributions of the two wares over the settlement area — decorated sherds relatively concentrated around the houses, coarse sherds evenly spread — dissimilar valuations apparently did prevail.

I also skipped over possible links of pits through sherd joins. The reason is that with this quantity of sherds any attempt at checking for sherd joins is a very time-consuming (and frustrating) business. What has been done in this direction is that for the larger pits (especially the *Längsgruben*) which all have been excavated in sections, the sherds from the different sections have been mutually compared, and allocated to 'sherd families' (*i.e.*, equated with pots) on the basis of their fabric and/or decoration. As to the easier to memorize decoration on the fine ware, I have not come across any possible links between different pits, except for a few Limburg sherds which have been reported in the appropriate section of this chapter. This is not to deny the existence of links (and thus smaller totals of pots), only to signal the problem and minimize its importance.

Several houses have been excavated that could not be associated with sherd-holding features; they have been incorporated into the computations of the averages on the assumption that all Bandkeramik houses were occupied by more or less independent households. Also, being more or less independent, no household can do without cooking, storage and service ware. Hopefully the majority of their broken pottery was also tossed into pits next to the houses which in this case have subsequently disappeared due to post-depositional processes like erosion, levelling and excavation.

When referring to storage containers in this chaper, I would like to point out that the arguments pertain to ceramic vessels only. From a sociological perspective, the underground silos dug by the Bandkeramians in their villages are certainly just as interesting if not more so. Also missing are the containers of perishable material that undoubtedly have played their roles: why should we assume comparability of life expectancies for 'ethnographic' pots and 'archaeological' pots and not accept non-ceramic containers ethnographically current but archeologically invisible. I mention these caveats to put into perspective the weight of the above discussions and inferences: an archaeologically important category like ceramics need not have been equally important from a prehistoric point of view, and the non-ceramic 'ware' may very well have made up fully for the differences noted and elaborated here.

One of the sections of this chapter was about the Neolithic fine ware excavated in the Janskamperveld settlement, 3921 sherds representing 1649 pots. The decorations on these pots were positioned as common in the Flomborn and Middle phases of the Northwestern Bandkeramik ; those few pots that could be reconstructed have been described and illustrated, with a steeply-walled beaker as its most notable item. Regarding the pottery decoration, another section went into the classificatory schemes in use for its analysis: first the Rhineland Model, non-transportable and very unwieldy, and then the Buttler-Modderman scheme, temptingly simple but only regionally applicable, followed by my own classificatory scheme, less simple but generally applicable in all of Bandkeramia. And finally some words on the classification employed by Pavlů on the Bylany pottery, a hybrid of Rhineland and my definitions. The aims of the classifications have been said to differ: Stehli's Rhineland Model, and Buttler-Modderman were either developed as an aid to or exclusively used for (chronological) seriation; the other two schemes were aiming at social structural dimensions, fundamentally noting that change as a measure of time is nothing but social change. Application resulted in the recognition of the effects on the pottery decoration of a matrilineal moiety system: curvilinearity and rectilinearity of the designs serving as badges of the two societal halves.

Several sections dealt with the coarse ware from this excavation: 9595 sherds from 1903 vessels. They were analysed regarding their tempers: less than 2% of these pots had no temper, sand was added to 30% of the bodies, and nearly 80% had pellets or grog in their fabrics; organic tempering of any kind was extremely rare. Of some three-quarters of the pots the surfaces had been smoothed or polished; the remaining pots had sandy or roughened surfaces.

A very different topic was analysed in the discussion on customary terms for Bandkeramik ceramics. On the one hand, decoration is generally taken as defining for a class of their pottery, on the other hand coarseness or thickness of the sherds. Logically the first dimension presupposes also a class of undecorated pots, the second dimension implicitly assumes a fine ware. Crossed, the two dimensions yield four classes: undecorated fine, decorated fine, undecorated coarse, and decorated coarse ware — indeed these were all found in the archaeological record of the Janskamperveld (and presumably elsewhere, too, although they have not been discussed, to my knowledge). Together, members of the deviant or undiscussed classes (undecorated fine, decorated coarse) constitute only a meagre 2% of the ceramic total.

Their patterns of distribution conform to those of the fine/coarse distinction. Another under-theorized class of pottery is generally referred to as Limburg Group ware although certainly in the present context 'non-local' would be a better label. It is common to all larger Bandkeramik sites in limited quantities. It was shown in discussion and illustration that (at least here on the Janskamperveld) along with the regular, clearly non-Bandkeramik Limburg ware (distinct in fabric, firing, form and decoration), are also found pots with LBK-fabric and Limburg-like decoration and *vice versa*, as well as undecorated pots with fabrics analogue to Limburg ware. The occurrence of the non-Limburg yet non-Bandkeramik potsherds was tentatively linked to marrying-in and acculturating Limburg (and other non-local or aboriginal) women.

The final section considered the distribution of pottery over the households; by converting average pot counts per house to pot years and then to the number of pots available, it was found that households possessed relatively few ceramic containers at any one time, with a mean of ten vessels per house — three for service, four for cooking, and three for storage.

Notes

1 These figures represent the 95-percentile values: outliers have not been included.

2 As observed by L. Jacobs, potter at the Department of Pottery Technology at Leiden University, in a report on a controlling experiment. His findings have been incorporated in the present paragraph.

3 There are N = 334 relevant features in the excavation; and 67 plain fine ware pots, and 25 decorated coarse ware pots. Co-occurrence of the two types of pots is to be expected in $[p(F).p(C)].N = [(67/334).(25/334)].334 = 5.0$ features.

4 I gratefully acknowledge the ample discussions on the present topic with Luc Amkreutz, Fred Brounen, Leendert Louwe Kooijmans and Leo Verhart; they may not agree with every statement but then the text is mine. Substantially similar is Van de Velde 2007, set into the context of a symposium on all kinds of Early Neolithic pottery in the wider region.

5 This will *not* be due to the soil characteristics in this area: although all untreated animal and human bones have dissolved completely, burnt bones have survived comparatively well, as instanced by the 40+ cremations from the Elsloo cemetery.

6 "We have deliberately grouped these vessels with the Bandkeramik pottery because of their shapes" (Constantin 1985: 108, *à propos* undecorated ware tempered with calcinated bone.)

7 True music notes are found on Bandkeramik pottery from Poland; an occasional pot with such decoration has made it to the Northwestern Bandkeramik area, but the dates are always fairly late in the sequence, surely later than the abandonment of the Janskamperveld village.

8 Recently, analyses by means of secondary motifs (*Zwickelmotive*) of pottery decoration —defined according to the Rhineland fashion— have been aimed at social relationships within and between settlements; with partial success: Krahn 2003, Claßen 2006: 352-359, etc.

9 To avoid incest, they *had to* marry into the other moiety —just like we do not marry into our family of birth.

10 Perhaps yet stronger evidence is that as soon as the prehistoric potters started to use other motifs than precisely these two, we talk about Hinkelstein, Grossgartach, Rössen, VSG etc. cultures, noting that in these successors many things (not only pot decoration) had changed considerably with respect to the Bandkeramik.

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feature no	temper	shape	firing	decoration	House	H Gen'n	fig. 7-no	parallels
10032	2	3	5	none	36	3?	–	
10038	2	4	1	none	58?	2	–	
10038	2	4	4	none	58?		–	
10040	3	x	5	none	58?			
10040	2	x	4	none	58?	4	–	
11025	3	1	6	none	–	II	–	
12001	5	1	4	none	–	1?	–	
19043	3	x	4	none	68?	1?		
19087	1	1	4	stab-and-drag, fringe	57		10-b	A-fig.7-3 B-fig. 9-10 E-Abb. 9-7
19087	5	x	5	ladder	57		14-e-	A-fig.10-2
19087	5	x	5	oblique hatches	57		–	A-fig. 15-1; D
19087	5	x	1	curvilin. incision	57		–	
19087	3	4	5	none	57		–	
19087	x	4	4	none	57	1		
19087	5	x	5	none	57			
19087	5	x	5	none	57			
19087	5	x	4	none	57		–	
19087	5	x	4	none	57		–	
19087	5	x	4	none	57		–	
19088	5	x	4	none	57	1	–	
19088	5	4	4	none	57		–	
19088	3	x	4	none	57		–	
22019	4	x	4	fishbone	37	1	10-h	A-fig. 12-10
26090	1	1	4	stab-and-drag, fringe	57	3	14-f	A-fig. 7-3 B-fig. 9-10
26090	3	1	5	stab-and-drag, fringe	57		10-b	A-fig. 7-3 B-fig. 9-2
26090	0	x	2	triangle, pointlets	57		11-c, 12-a	A-fig. 17-1(?)
31075	4	x	4	double ladder; incrustrated	13		13-c	?
31075	5	x	4	stab-and-drag, fringe	13		10-f	A-fig. 7-3 B-fig. 9-10
31075	0	1	4	fishbone	13	4	10-e	A-fig. 12-1 B-fig. 9-5
31075	0	4	4	triangles, pointlets	13		12-d	A-fig. 15-4, 5
32100	5	2	4	2 deep incisions parallel to ridge	35?	II?	–	
32144	3	1	1	triangle, pointlets	–	II	11-e	A-fig. 17-1
33000	3	x	4	triangle, pointlets	–	II?	11-b	A-fig. 15-4, 5
33025	4	1	4	curvilin.wave	–	1?	10-g	
44012	5	1	2	traingle, fringe; pointlets parallel to rim	14		–	
44012	4	x	6	triangles; oblique hatched strip	14	4	12-b	
44012	5	2	6	none	14		–	
44028	x	x	4	oblique hatched strip (2-t. spatula?)	–	1?	13-b	A-fig. 10-2
46004	5	4	1	oblique ladder; row pointlets	–	1?	13-a	
49015	5	x	1	small triangles	23	4	–	

feature no	temper	shape	firing	decoration	House	H Gen'n	fig. 7-no	parallels
49015	5	4	1	triangle, pointlets	23		–	A-fig. 17-1
49016	1	x	1	parallel incisions	23	3?	–	
49050	5	2	4	curved fishbone	–	1?	–	A-fig. 14-3
49080	5	x	2	triangle, pointlets	–	3?	–	A-fig. 17-1
49104	4	x	5	fishbone-like	–	1?	–	A-fig. 12-10, 13-1
49105	1	x	4	parallel lines?	–	1?	–	
54028	5	x	1	dragon's teeth	19	3	11-a	
54028	5	x	1	dragon's teeth	19		11-a	
54029	5	x	1	dragon's teeth	19	1?	11-f	
57020	0	1	4	stab-and-drag, fringe	41	4	14-a	A-fig. 7-3 B-fig. 9-10
91002	0	x	5	cross-hatched strip, fringe	02	3	14-g	A-fig. 10-1
91124	2	x	6	pseudo-fishbone	03	1	14-b/d	
91124	2	x	6	fishbone	03		–	B-fig. 9-5
91124	0	4	1	double triangles	03		12-c	A-fig. 15-4, 5
92001	4	4	1	triangle, pointlets	04	3	11-d	A-fig. 17-1 C-t. 33-101
94052	3	1	6	2 rows pointlets	–	2	10-a	
95050	0	x	6	parallel lines, fringe	05	1?	–	B-fig. 8-4, 10-1

table 7-9 overview of the Limburg and non-LBK pottery
legend:
find no: find number in excavation
composition: temper in clay body (0: none apparent; 1: organic; 2: bone fragments; 3: clay pellets; 4: crushed pottery; 5: sand/silt; x: not determined)
shape: shape of pot (1: thickened rims; 2: ridge; 3: applied band; 4: straight rims; x: not visible)
firing: as per sherd fracture (1: light heart; 2: id. & fair skins; 3: id. & grey surfaces; 4: dark heart; 5: id. & fair skin; 6: id. & dark surfaces; x: indeterminate)
H Gen'n: House Generation
parallels: A: vanBerg 1990; B: Cahen *et al*. 1981; C: Constantin 1985; D: Jeunesse 1994; E: Lüning & Kloos 1989

8 Sherds and pots

a simulation for the Janskamperveld

Pieter van de Velde

In any excavation, the problem is what part of the original inventory is still present. Most earlier attempts at answering this question start from a reconstruction of the pots and then derive the sherd loss, without accounting for those pots that have vanished completely. Here, simulated populations of 2500 pots were subjected to random deletion of sherds to specified percentages. Comparing the results of the simulation to the actual values from the excavation, a sherd loss of 86-87% was indicated, yet leaving remains of 86% of the fine ware pots and 94% of the coarse ware still represented in the sherds. Extending the results to those households that were not included in the sample and comparing the figures to estimates constructed differently, it appears that for the excavated area losses of 26-30% of the fine ware pots and 12-17% of the coarse ware pots have to be assumed.

8.1 A research problem

In the previous chapter the sherds of the Janskamperveld LBK-settlement have been analysed as to decoration and type of ware; thin-walled and thick-walled ware were treated separately as the first category is virtually identical with decorated ware, and the second with undecorated ceramics. The distribution of these categories over the site proved different: decorated sherds were found mainly near the houses, the thick-walled sherds were more or less evenly spread. As in the chapter on pottery, the sherds have been grouped into "sherd families" (Orton 1980), there equated with a pot each. A summary can be found in table 8-1. As pointed out in that chapter, the equation of sherd families with pots is probably a little too easy as no account was taken of sherds of the same pot being distributed over different features, which leads to an overestimate of the number of pots. Because of this the counts are off in the order of 2 - 5% in LBK settlements (Drew 1988; Kloos 1997); to indicate this difference, 'SF' is used for 'sherd family'.

	thick-walled	thin-walled
sherds	9595	3921
SF	1903	1649
pits (features)	302	194
sherds/SF	5.0	2.4
SF/pit	4.6	6.0
max no of SF	110	207
P95 SF	22	29
max sherds/SF	62	10

table 8-1 central values JKV-pottery
SF: sherd families

Some initial comments to table 8-1:

= 'Max[imum] no. of SFs' refers to all pits with ceramics; 'P95 SFs' gives the maximum number of SFs in the lower 95% of the features: there is considerable difference between this and the maximum counts;

= the averages (sherds per SF, SFs per feature) have been calculated over these 95% accordingly;

= the averages are pseudo-averages: features without sherds, and completely vanished pots cannot be taken into account, null-values are missing.

It may be asked then what is the proportion of the neolithic inventory still represented in this excavated set of sherds.

I am not the first (LBK-) investigator of this problem, of course; however, many archaeologists seem to be content with the tacit assumption of at least a reasonable representativity of their finds. Peter Ihm wrote a short theoretical treatise (Ihm 1978); in an extended analysis Ulrich Kloos made an inductive estimate (Kloos 1997) but did not go into, even denied the problem of features without ceramics. I will first discuss some previous estimates including Kloos' attempt, and then deal with Ihm's, to end with a simulation and further extension of my own.

8.2 Previous estimates

An early estimate of the rate of loss is recorded by Modderman: "... especially in the LBK much, even very much has been lost" (Modderman 1959, 77; my transl.). He held the conviction (in common with the other investigators discussed here) that all refuse, including sherded pottery had been dumped near the houses, so several factors must have intervened to arrive at the present low densities: for instance, re-use as temper after grinding of the sherds, but also and most importantly erosion after abandonment of the site, including the excavation process in which the marginal costs of recovery of the last 10% of sherds are too high in view of the results which would not differ anyhow. He then notes that of the twenty reconstructed pots in the Sittard excavation, only one third or one quarter of every pot was original; besides there were some 1000 'loose' decorated sherds. Thus, all in all about 90% of the decorated sherds have disappeared. Again, "quantitatively, in our opinion a loss rate of 75 to 90% has to be assumed" (Modderman 1959, 77; my transl., PvdV).

In the fourth of the "Theses on Bylany", Pavlů informs us that the average number of sherds per pot is 1.9 at that site, inferring "so ... one sole potsherd from most vessels was preserved" and "we presume the mean ratio of preservation to be on the order of one per cent of the volume [= the mass? PvdV] of the vessels" (Pavlů *et al.* 1986, 313-314).

A related problem is attacked by Drew in his investigations of the distribution of sherds of the same pot over different features and time. Pertinent to the present discussion is his observation / guesstimate that approximately 2% of the pots of which at least 2 sherds remain are dispersed over several features – which implies that the sherds of 98-99% of the pots have become embedded in the same feature (Drew 1988, 544). Drew does not attempt the quantification of the loss of sherds between their emanation from the pot body and present-day scientific enquiry, although he attributes secondary use of large sherds and erosion of the settlement area to much of that loss.

Kloos (1997) has analysed the ceramics from Bruchenbrücken specifically with an eye on the detailed reconstruction of the original LBK inventory. After differentiating between several basic pot types and allotting the sherds as far as reasonable to them, he inquires into the weight and surface area of pots of each of the types. Then, as far as sherds can be attributed to any of the types (about one third of the total), their joint weight and surface area are compared to the estimated total weight and surface area of the pots represented, resulting in a survival rate of 4.7%. This then allows an estimate of the average number of sherds per pot on breaking: with a mean of 2.5 sherds remaining, equalling 4.7% of the original pot, an average breakage of 58 sherds per pot can be calculated (the text provides parameters for each of the types; Kloos 1997, 171). If the 4.3% number is set equal to the survival rate (which is not correct, as Kloos rightly notes; the figure is similar to the 'pseudo average' in table 8-1, I would add), then the surviving frequencies can be calculated following a negative binomial rule (specified a.o. by Ihm 1978, 78-81). In a follow-up of Drew's he also goes into the number of pots distributed over more than one feature (approximately 5% in this case).

According to various (German) archaeologist authors, Ihm has written several texts touching upon the present subject; I have access only to his *Statistik* book (Ihm 1978). In it, he describes several statistical distributions, among which is the negative binomial distribution (pp. 78-81) that can be used to mathematically model archaeological distributions like (his example) the number of scrapers from the features on a site – though not identical, quite similar to the reconstruction of the number of pots. Importantly, features that did not contain any scraper, are included in all computations, beginning with the calculation of the mean from which several of the parameters are to be derived, a point explicitly dismissed by Kloos (esp. Kloos 1997, 176).

To conclude this short discussion, Orton skims the problem: his text aims at completely excavated sites with all pottery present:

> *We suppose that all pots used at the site are, sooner or later, broken and deposited there. It is a curious fact that even in such cases it is rare to find all the sherds from one vessel. ... Whatever the reason, one just has to live with the problem.* Orton 1980, 162

I don't think we should be content to live with the problematic reconstruction of prehistoric inventories but rather face the issue.

8.3 Discussion, specifications

On the assumption that the present collection of sherds represents a random selection from the originally set present, the reconstruction of the original pottery inventory of the settlement should be along probabilistic lines.

From the outset it should be emphasized that any and all of the processes involved are undeterministic. The number of sherds from a pot, the 6th millennium decision to dump some of them here or there and keep those other sherds for other purposes than container, the degree of trampling or fragmentation, the global and local environmental influences then, now and in between (including excavation, cleaning, working up and analytical processes) – these are some of the processes involved. They can be indicated only, and they all have resulted in loss of part of the previously available material. As the number of external influences is large and independent of one another, their cumulative effect can be modelled probabilistically.

When setting up such a model, an initial estimate has to be made of the number of sherds resulting from the shattering of a pot. The maximum number of sherds per pot in table 8-1 can be taken as an approximation of that parameter: thin-walled pots are substantially smaller than thick-walled pots, the heights of the first being in the order of one quarter to one half of the second; hence the difference between the two table values. However, at JKV the estimate of 10 sherds to a thin-walled pot would seem an *under*-estimate and 62 sherds to a thick-walled vessel probably an *over*-estimate. Below I shall use 15 ± 8 sherds per thin-walled pot and 40 ± 15 sherds per thick-walled pot as averages, the plus-minus factor being probabilistically interpreted; in a later section I will discuss the effects of larger variations and different averages.

Comparing these parameters (15, resp. 40 sherds per pot) with the (pseudo-) average number of sherds per pot in the excavation (2.4 and 5.0) and trying to account for the missing zero-values in these pseudo-averages as well, a degradation of perhaps some 90% seems indicated by these figures. The exact percentage is not important here, it is only to estimate the order of magnitude which should result from the simulation.

8.4 Implementation

In order to be a reasonable representation, the model should not be smaller than the modelled reality; in the present case the initial population consisted of 2500 (virtual) pots for each of the two categories. By transforming the results to percentages, comparison with non-standardized and/or empirical sets is possible. Calculations are performed[1] on a matrix S(100, 25) with elements $s_{ij} = x \pm p_{ij}.y$. In this equation *p* is a random number between 0 and 1; *x* is the assumed average number of sherds per pot on breaking (15, or 40 depending on the type of ware), and y the assumed range, the variation in the number of sherds (8, resp. 15, see above). The equation describes the event “a pot is shattered to a (variable) number of sherds”. It is on these (virtual) sherds in matrix S_0 that the decaying process is operating, gradually obliterating one after another, algebraically $S_t = S_0.2q_{ij}.v_t$. Here, S_t is the matrix with the remaining sherds, q_{ij} a random number as before, and v_t the target percentage of remaining sherds referred to the parent set (or 100 – loss percentage). Every element in the matrix S is representative of one individual pot; that is, every matrix element can be thought of as a pot equivalent. This means that the number of matrix elements with 1 or more sherds left, represents the number of still recognizable pots, given the loss percentage. All other central values can be calculated from the matrix.

First the thin-walled pottery will be examined, in the excavation represented by 3921 sherds derived from 1649 SFs (table 8-1). The central values of a probabilistically generated initial set of sherded pots are assembled in table 8-2, column ‘initiallly’; comparable values after simulated losses as in the table’s header in the other columns. Note that in the simulation ‘pots’ are considered, while the empirical data such as in table 8-1 refer to ‘sherd families’ or SFs. In a series of simulations especially the average number of sherds per pot proves stationary, and it is therefore that figure that should be used for comparative purposes. If the pseudo-average number of thin-walled sherds at JKV is 2.4 (table 8-1), that number should be compared with the figures for ‘sherd/pot (1)’ in table 8-2. It appears that about 86% of the sherds have disappeared, but with the remainder 86% of the pots can still be recognized; which puts the original number of thin-walled SFs at JKV at (100/86).1649 = 1917 units as generative for the present sherds. The difference between the totals (1917 – 1649 = 248 SFs, 14%) has been obliterated by the depositional and post-depositional processes. The results of the simulation are valid only if the original average number of sherds per pot has been similar to the parameters set up for this exercise (cf. next section), and if the decay process has been modelled mathematically correctly.

A similar exercise for the thick-walled pottery (shattering to 40 ± 15 sherds per pot) provides results as in table 8-3. Along similar lines as for the thin-walled pottery, from the remaining average of 5.0 sherds the loss of sherds is computed as *c.* 87% of the original stock, while still 94% of the pots are represented by members of their respective sherd families. This latter value converts to (100/94).1903 = 2024 thick-walled pots originally present, yielding a numerical loss of 121 thick-walled SFs (2024 – 1903 = 121); as a percentage (121 / 2024) * 100 = 6%; validity as before. Fig. 8-1 summarizes tables 8-2 and 8-3 in a graph.

8.5 Discussion: how many sherds per pot?

Within the framework of this simulation there are only two variables affecting the outcome: the average initial number of sherds per pot (*x*, in the formula), and the range of variation in *x* (*y*, in the formula) – apart from the stipulated percentage of loss. The effects on the results of variation in these variables should still be looked into. In fig. 8-2 an attempt is made to render the effects. The continuous lines represent the relationship between the original number of sherds into which a pot has shattered (on the abscissa) and the average number of sherds that remain (the ordinate to the left). The grey lines stand for a small variation in the number of sherds (± 5 above and below the figures on the horizontal scale), the coloured lines for a larger range (± 15 above and below the figures on the horizontal scale). It is fairly evident that the lines almost coincide; the variation in breaking into sherds is apparently of little consequence. The same conclusion can be read from the fairly flat slope of the lines which show that with more initial sherds, in the end “a few more” sherds remain.

The dotted lines in figure 8-2 represent the relationships between the average number of initial sherds (abscissa) and the number of still recognizable pots in the later archaeological record (ordinate, right-hand scale) as a function of the loss percentages. Here, too, the grey lines are representative of small variations (± 5 sherds), and the coloured lines of a relatively larger range (± 15 sherds). It can be seen that especially with lower initial sherd counts – because of small-sized pots or strong pottery – the small differences have considerable effect on the estimate of surviving/recognizable pots.

percentage loss:	initially	-25%	-50%	-60%	-70%	-80%	-85%	-90%	-95%	-98%
total sherd count	37110	28291	18448	15189	11414	7663	5535	3675	1837	461
number of pots	2448	2437	2408	2403	2342	2302	2170	2029	1585	461
sherds/pot (1)	15,16	11,61	7,66	6,32	4,87	3,33	2,55	1,81	1,16	1,00
σ (sherds/pot)	10,16	7,65	5,10	4,07	3,10	2,06	1,58	1,07	0,63	0,39
sherds/pot (2)	14,84	11,32	7,38	6,08	4,57	3,07	2,21	1,47	0,73	0,18
max-sherds/pot	45	33	23	18	14	9	7	5	2	1
% pots	98	97	96	96	94	92	87	81	63	18

table 8-2 simulated compositions of the remains of an original set of 2500 thin-walled pots, after stipulated percentages of loss
sherds/pot (1): averaged with omission of zero values; sherds/pot (2): averaged including zero values

percentage loss:	initially	-25%	-50%	-60%	-70%	-80%	-85%	-90%	-95%	-98%
total sherd count	100360	75911	51640	40222	30016	19281	14938	9887	5085	1918
number of pots	2484	2474	2477	2471	2458	2395	2399	2331	2183	1655
sherds/pot (1)	40,40	30,68	20,85	16,28	12,21	8,05	6,23	4,24	2,33	1,16
σ (sherds/pot)	25,23	19,05	12,56	10,05	7,56	4,90	3,77	2,53	1,32	0,62
sherds/pot (2)	40,14	30,36	20,66	16,09	12,01	7,71	5,98	3,95	2,03	0,77
max-sherds/pot	109	81	55	43	32	22	16	11	5	2
% pots	99	99	99	99	98	96	96	93	87	66

table 8-3 simulated compositions of the remains of an original set of 2500 thick-walled pots, after stipulated percentages of loss
sherds/pot (1): averaged with omission of zero values; sherds/pot (2): averaged including zero values

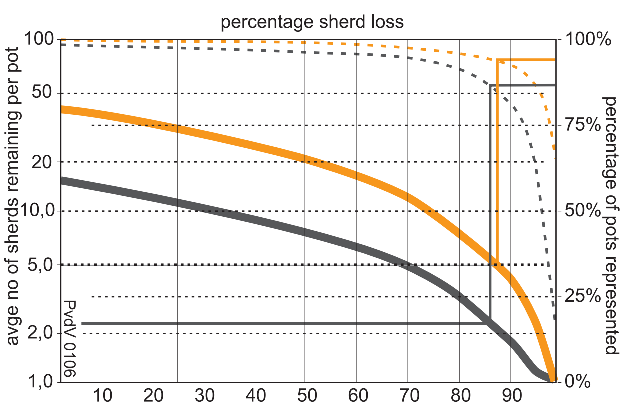

fig. 8-1 average number of sherds remaining per pot, the percentage of sherds lost, and the number of still recognizable pots
continuous lines: remaining sherds; dotted lines: recognizable pots
coloured lines: larger pots; grey lines: smaller pots

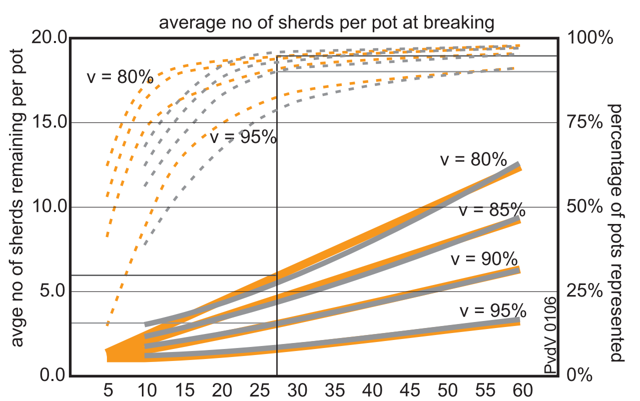

fig. 8-2 number of initial sherds of a pot and remaining sherds (left scale), and percentage of the initial stock of pots recognizable (right-hand scale) for sherd losses *v* of 80, 85, 90, and 95%
coloured lines: at ± 15 sherds on breaking; grey lines: ± 5 sherds on breaking

8.6 A partial validation, marginal notes, and some inferences

While on the one hand the number of sherds into which an average pot breaks has important consequences for the result of the simulation, on the other the amount of variation in that number has few consequences (as implied by figs 8-1 & 8-2). Therefore, any validation of the simulation procedure should be welcome. Even without a simulation it will be clear that with increasing loss, the maximum number of sherds per pot will decline, and with it the spectrum of frequencies of sherds per pot will contract. In other words, that spectrum has different characteristics for different situations. Thus, the observational spectrum of sherd counts per SF from the excavation may be compared to those generated by simulation, so that at least an indication can be found whether the model behind the latter agrees in its outcome with empirical reality, as represented by the sherd counts from the excavation. For the thin-walled ware no counts are available: it has been entered into the database and scored per feature instead of by SF. For the thick-walled ware, though, the necessary data have been collected, and it is these that are compared to a simulated loss of 92,5% for the larger variety (40 ± 15 sherds per broken vessel) in fig. 8-3. The counts have been converted to percentages of the total, in order to allow direct compatibility, 1988 real sherd families from the Janskamperveld village, 2248 virtual pots from the model. Though the model specifies somewhat larger values for the smaller sherd families and somewhat smaller values for the larger sets – the simulated spectrum is slightly steeper than the empirical data –, the fit between the two distributions is quite good, especially when the guesswork nature of the model's central values is considered. Presumably, a higher initial average number of sherds per pot, and/or a larger spread/variation in the fracturing count would allow a better approximation.

Then it was stated that over a series of simulations with the same loss percentage, the average number of sherds per pot remains quite stationary, and therefore this number should be used for comparative purposes. Starting from the average numbers of sherds per SF at JKV, approximately equal percentages of loss can be inferred for both the thin- and the thick-walled pottery varieties, in the order of 87%. Working not with a rate like average number of sherds per pot but rather directly with the counts, there appear to be differences between the two wares: thin-walled ware then has 88% of sherd loss derived from the sherds and 91% sherd loss going by the number of SFs; for thick-walled SFs these

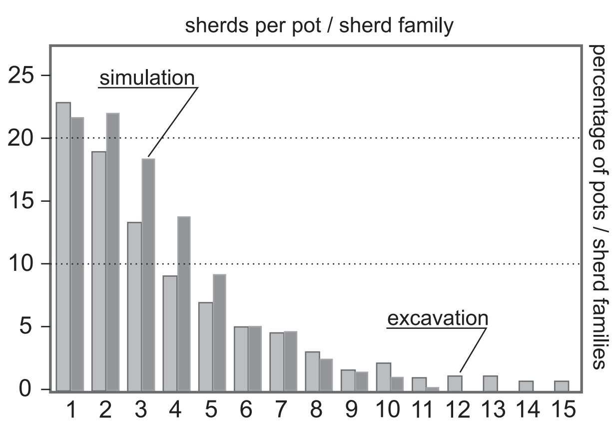

fig. 8-3 a comparison of the outcome of a simulated loss of 92,5% of the sherds with the counts of the excavated thick-walled pottery (in percents of total numbers of sherds)

figures are 88% and 95%, respectively. This should be caused by differences between the real and the simulated breaking patterns.

The differences in survival rate of the two wares may (partially?) be referred to their different distribution patterns: the fine ware has been dumped and recovered mainly near the houses; the coarse sherds were spread more evenly over the entire site. Perhaps more importantly, though, another contribution to the losses can be found in the differential erosion of the excavated area of 3 ha which has 'beheaded' the site in places by 40 cms, in other places by over 100 cms.

8.7 From sherd population to village inventory

The research problem was not phrased in terms of the number of neolithic sherds that have ever been present on the site, but rather in terms of the percentage of pots remaining in the archaeological record. According to the simulation *c.* 86% of the thin-walled, or fine ware, and *c.* 94% of the thick-walled, or coarse ware are still recognizable in the finds. This still does not take into account the number of ceramically empty and the erosionally vanished pits, as the simulation refers to a sample defined by the *presence* of sherds. For, though the reconstruction introduced completely vanished pots on mathematical inference, they nevertheless are restricted to, or belong to the houses and features where pottery has been found in the excavation. To solve the problem of the ceramically empty and completely vanished pits, a comparison of the number of houses which happen to be accompanied by pottery with the total number of such structures should at least be indicative. That is, in the excavation there were 49 houses with thin-walled ware and 56 houses with thick-walled pottery, figures that should be used to convert the pottery's totals to the full count of 60 'house equivalents' (60 equivalents, instead of 69 houses, to compensate for the parts of the house plans hidden outside the excavation's limits; cf. the chapter on houses). This results in (60/49).1649 = 2019 thin-walled vessels and (60/56).1903 = 2039 thick-walled vessels serving these 60 houses.

Starting from a different point, a confirmation of these theoretical and simulated estimates can be sought. Thus, the upper half of the houses with associated pottery contain on average (sherds of) 32 thin-walled and 36 thick-walled SFs (cf. the counts at Bylany: respectively 29 and 17 pots in the smaller houses, 60 and 44 in the larger houses; Pavlů 2000, Table 4.2.5; at Bruchenbrücken Kloos registered 207.7 pots per house; Kloos 1997, 176). By means of the results of the simulation, the JKV data can be reconstructed as (100/86).32 = 37 thin-walled SFs, and (100/94).36 = 38 thick-walled SFs per house. The 60 house equivalents would comprise sixty of these sets, or 2220 thin-walled and 2280 thick-walled sherd families in all. The results of the estimate above and the

sherds/SF	JKV	simul'n	sherds/SF	JKV	simul'n
1	23,1%	21,9%	6	5,2%	6,0%
2	19,1%	22,3%	7	4,8%	4,5%
3	13,5%	17,7%	8	3,3%	2,7%
4	9,3%	13,5%	9	1,8%	1,9%
5	7,2%	8,6%	10	2,3%	0,8%
			(more:)	(10,4%)	(0,2%)

table 8-4 spectrum of numbers of sherds per pot in percentages of totals
JKV: thick-walled pottery from excavation; simul'n: simulated values for thick-walled ware at 92,5% loss

present one differ by no more than 5%, and therefore can be read as a confirmation of the exercise. However, apart from the likely though never proven assumption that all houses were accompanied by pottery, the average number of SFs of the quantitatively upper half of the houses is of course purely arbitrary: a few houses more or fewer in the counts would lower, respectively boost that number and therewith reduce the comparison's expressiveness.

If, then, these calculations have any sense, the total losses of pottery at the Janskamperveld can be computed as 26-30% of the thin-walled pots that were originally present (2220 pots having left only 1649 SFs), and 12-17% of the thick-walled variety (2280 pots becoming 1903 SFs). The causes of these losses should be sought in the well-known, though unquantifiable, cultural selection for recycling of the sherds and the subsequent erosion of the archaeological record at the settlement site.

Note

1 In this description I am skipping a few mathematical subtleties.

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9 A ceramic anthropomorphic figurine

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Two sherds remain of a ceramic figurine, smashed in prehistoric times by the inhabitants of house H 20 and dumped into the house's left-hand side pit. A discussion of current and recent views on LBK figurines —commonly called idols— renders religious connotations doubtful. Instead the label „statuette" is suggested for these objects possibly linked to an ancestor cult. Finally, a full reconstruction of the original figurine is presented.

9.1 Introduction

An entry in the excavation diary reporting on the proceedings in trench 14 requires attention:

> *Feature 14002 ... turned out to be quite rich ... From feature 14002 two botanical samples have been taken and a charcoal sample; also some bone fragments were collected ... Feature 14002 is possibly part of the southwestern side pit [left-hand* Längsgrube *of House 20]. This feature presents a homogeneous humous filling rich in finds. In its first half a decorated sherd was found, the shape of which cannot as yet be placed.* (my translation, PvdV)

After that, the curiously formed sherd disappeared without notice. In July 2005, however, it was returned (together with quite a number of other decorated sherds from fifteen different features in a crate) by an anonymous sender, who presumably had guarded it in the meantime. Among the other sherds, a second fragment of the same object was found. The sheer quantity of the forwarded sherds made it necessary to re-compute almost all tables and adapt my text in a number of places: needless to say that I am very obliged to Mr/Mrs Anon.

More important than that lament are the two oddly shaped pottery sherds from the crate, begging a special discussion. I shall start with a short description accompanying the drawings, then set them in their wider Bandkeramik scholarly context, and finally venture a reconstruction.

9.2 Description

The two sherds to which the diary refers derive from the same object: they neatly fit together (fig. 9-1). The larger fragment measures 75 × 44 × 27 mm; the walls vary in thickness between 6 and 8 mm. This sherd consists of two hollow shapes, the larger one slightly conical (almost a tube) with an inner diameter ranging from about 40 mm to 27 mm; its axis is taken as defining the vertical with the largest diameter on the lower end. If a tube may be assumed for its original shape, the cone has been halved lengthwise and also broken in its lower part so that no trace of a lower end has remained. On one of the cone's vertical sides a kind of small platform or shoulder (16 × 23 mm) is visible; this platform looks as if a protuberance (like an arm) originally had been fastened there, since lost. Underneath this platform the second sherd fits over an area of *c*. 11 × 7 mm (vertical × horizontal). The second hollow shape on the first sherd is like a partial rim, and has been fixed on top of the cone, as can be seen on the fracture and by the smearing on the inside of the object. At the junction the sherd attains its largest thickness (8 mm) around the full perimeter. The rim probably represents the top of the original object; its shape suggests a collar. The outsides of both collar and cone have been decorated: the first one with a small set of point impressions. The cone shows a combination of a spiral line and auxiliary points twinned in a refracted (mirrored) pattern set in a frame; on either side are two slanted lines also refracted to V-structures, again with auxiliary points.

The smaller sherd measures 51 × 30 × 11 mm with a thickness from 7 to 9 mm, its thickest part is towards the lower end. This sherd is slightly convex width-wise, quite reminiscent of the tube-part of the larger sherd; indeed the inner surfaces of both sherds smoothly define an oval line at their junction (as shown in the cross-section in fig. 9-4). Unlike the other sherd, the smaller sherd is slightly hollow to a depth of about 2 or 3 mm along its longitudinal axis. Though original corners or edges are missing, the sherd's orientation is fixed by its fit to the other sherd. The upper half of the outer surface is eroded away; a few incised lines only remain at right angles, similar to the first sherd. Importantly, a diminutive almost horizontal ridge in the centre of the sherd suggests the original presence of an appliqué, now broken off. The elements of the decoration on both sherds are fully in line with those on the other sherds from the same *Längsgrube*, putting them firmly in the third House Generation of the settlement.

Both sherds have been made from finely sieved clay without apparent inorganic temper; small holes on the surface of the inside and black specks on the fractures of the two

fig. 9-1 Geleen-Janskamperveld, feature no 14002; two sherds from ceramic figurine

suggest organic additives, which burnt up when the object was fired. Organic additives to the temper are very rare in the ceramic inventory of the Janskamperveld LBK village (less than 2% of the pots); this type of temper is reminiscent of pre-Flomborn, or Älteste Bandkeramik practice. The surface has been smoothed on the outside as well as (but less so) on the inside. The colour of the non-eroded surface of the larger sherd is dark greyish brown, of the smaller one brownish grey with preserved parts of dark greyish brown; both their cores are light greyish yellow. The light colours of the sherds' interiors with smaller parts of dark greyish brown are perhaps indicative of a hollow (tubular) original shape, as this would allow sufficient oxygen to enter during the firing of the object; had it been closed on either or both ends much darker colours would have prevailed.

The object, of which the two sherds are the remains, belongs to a class of objects labelled "idols" (more on the terminology and classification in the next section). Such objects occur in a limited number of forms, and their more or less standardized attributes in the Bandkeramik culture allow a guess at the reconstruction of the Janskamperveld specimen as described in the final section of this chapter.

9.3 Discussion

Both Dutch (Beckers and Beckers; Modderman) and German (Becker, Grönwald; Höckmann, Kaufmann, Schade-Lindig, Stäuble, etc) texts on similar unique, non-pottery ceramic objects, label them *idolen* (in Dutch), *Idole* (in German) which may be translated into English as 'idols'. In the three languages that concept may be defined as 'Image of deity used as object of worship' (as the *Concise Oxford Dictionary* has it[1]). However, with the exception of Lüning (2005) nowhere in the archaeological literature is presented a justification for the religious attribution of these objects, the cult character merely being assumed, probably based on the rarity and the invariably (sometimes even clearly on purpose) broken nature of these diversely formed and decorated baked clay things from outside the regular bandkeramik ceramic programme. 'Cult' and 'religion' refer to institutionalized conduct, that is repetitive behaviour with a regular attendance and participation of several people, mostly at specific places and set times[2]. Thus, Lüning writes about "priests" and "priestesses" in LBK society (Lüning 2005, 275). As Kaufmann quite some time ago rightly observed, LBK society was not that complex to expect much institutionalisation — yet he persisted in using the *Idol*-label in his overview (Kaufmann 1976, 63). Although agreeing with Kaufmann's reasoning, I rather prefer 'figurine' or 'statuette' (German *Figur, Figurine, Statuette, Plastik* or *Kleinplastik*) to 'idol' as signifiers, being void of cultic or religious connotations.

Never complete, figurines occur exclusively in the regular household debris, they are never encountered in graves. Yet another common denominator of these Bandkeramik figurines[3] is their rarity. Kaufmann writes that "they may be expected in almost every Bandkeramik settlement" but has to admit, a few lines later, that they have been found in only 4% of well over 1400 East-German LBK sites (Kaufmann 1976, 63) – in the present light, LBK figurines are restricted geographically to Central European regions (with a few outliers) and chronologically to the Älteste Bandkeramik period (LBK-I in the German system), also with a few off-shoots into the Flomborn period (LBK-II). On the Dutch Graetheide, far from the Central European main distribution, and post-dating the Älteste LBK, three such objects have now been secured from some seventy or eighty known sites, one from Stein (Beckers/Beckers 1940, 53, 122), one from Sittard (Modderman 1959, 100, 97), and the present one from the Geleen-Janskamperveld excavation (fig. 9-1). For comparative purposes I have presented the other Graetheide figurines in figs 9-2 and 9-3; the Stein 'idol'/object has only superficial similarities (if any) with the one from the Janskamperveld, the Sittard 'idol' is less different.

The excavation of figurines is generally announced in short reports (e.g. Lehmann 2004, 64, the 'Venus of Kückhoven' almost hidden between hundreds of pages of finds and features; or Stäuble/Steguweit 2003, with their 'Adonis von Zschernitz' inconspicuously tucked away between noisy advertisements of Roman archaeology books; an exception is Schade-Lindig 2002). Systematic general treatments have been few and far between until the last turn of the century: Höckmann (1972), Kaufmann (1976) in the last century; then one shortly after another beginning with Pavlů (1998, mainly about Central European finds), followed by Grönwald (2004; with an extended bibliography, all titles pre-1980, and most even pre-1950), Hofmann (2005; also with an extensive bibliography), Lüning (2005), Becker (2006a, b), and Hansen (2007).

When comparing the various studies, it is striking that the circumscription of this class of objects becomes narrower with time. In the 1970s Kaufmann and Höckmann include all kinds of outlandish shapes as well as the anthropomorphic/tortoise (*Krötendarstellungen*) pottery appliqués and incised decorations on pottery vessels; both authors present extensive typologies based on the systematization and grouping of their data. Grönwald, in the present century still elaborating on Höckmann's earlier studies, emphasizes the rarity of the

fig. 9-2 "Arm of an Idol, Hut 2, Stein" —after Beckers & Beckers 1940, Afb. 9

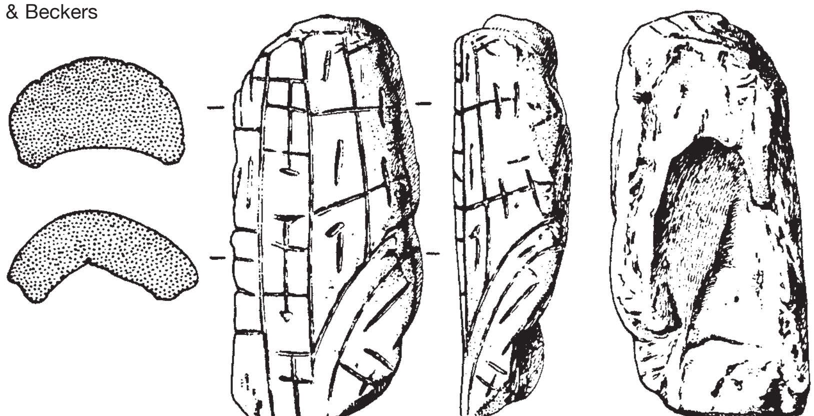

fig. 9-3 The Sittard Idol —after Modderman 1959, Abb. 71

statuettes, their exclusive settlement location and fragmentation; as his predecessor, he distinguishes anthropomorphic and cylindrical 'idols', but also a vase-like enthroned type with many sub-types (he bases the cultic implication on the probably intentional fracture of these objects). Other recent studies have generally been more restrictive in the definition of types. Thus, in her two overviews of Balkan and Central European figurines, Becker defines two main types of 'idols': one limbless type without feet or legs, and rounded or oval on section; the other type is quite articulated with a face, a long neck and upper part of the body, has accentuated buttocks and well-formed legs and feet — each of these two classes again comprises a fairly large number of sub-types. Quite different in approach is Pavlů's reticent and straightforward study of Central European face vessels as regional cultural markers. Lüning similarily observes that only a restricted gamut of shapes, gestures and postures is behind the many differences; they come in four types, female, male, zoomorphic and human-zoomorphic. In a clearly postmodern reaction to these generalizations, Hofmann writes about the individuality of each of these objects and proposes a continuum from purely anthropomorphic shapes by intermediate stages to zoomorphic images.

If the present Janskamperveld sherd indeed presents half of a cylindrical figure, it may be grouped with the anthropomorphic class recognised by all authors quoted.

Noting that these figurines are ubiquitous in preceding (Starcevo-Körös), simultaneous (Vinča and others), and subsequent (Zeliezovce) Balkan neolithic cultures, most authors implicitly or explicitly seek explanations for the occurrence of this class of objects in the diffusion of neolithic Balkan ideas (especially fertility cults) into Central Europe (e.g., Schade-Lindig 2002, 57, 62, 63; Hansen in Gallay/Hansen 2006, 254-255; Grönwald 2004). A small sample of quotes is illustrative: "Similar far-reaching ties right to the Starcevo-ring can be demonstrated" (p. 57); a few lines down: "Often a possibly cultic destruction of the idols has been pointed out … A connection with the Vinča culture seems thus proven" (p. 57); also interesting is "From the make-up and shape of the idols, connections with easterly regions are less clear, although their basic shapes and 'ideology' derive from there" (p. 62) (all from Schade-Lindig 2002; my transl., PvdV). Such remarks make one wonder why geographical space is favoured over diachronic time, as already in the Palaeolithic quite similar figurines were made in the same area as was later occupied by the LBK (Verpoorte 2000). That technology, size and the properties of the clay do severely limit the possible variability and thus force a basic "comparability" on miniature clay objects (once given an anthropomorphic turn) over vast spaces and deep time, is not taken into account by these authors. Like Pavlů wrote: "… the occurrence of similar objects in distant, non-contiguous cultures and areas shows that we are dealing here with the universal representation of the human body under certain, locally conditioned circumstances" (Pavlů 1998, 124, my transl.).

As regards the *meaning* of these objects, Schade-Lindig proposed a special link between "regional centres" and (the production of) figurines. Writing about the excavations in Nieder-Mörlen, by some considered a "regional centre" of the LBK settlement (*sensu* Zimmermann 1995), she imagines several specializations within the village, among which the tabooed production of 'idols'. According to her, "regional centres" are generally better equipped with statuettes; however, Elsloo, reputably a regional centre, has as yet not yielded any figurine[4]. Quantitative differences may be apparent rather than real, though: at Nieder-Mörlen the layer with finds had an exceptional thickness of one and a half metre; small wonder that there are many more figurine(-like object)s there than in other settlements, central or peripheral. A different tack has recently been taken by Hofmann (2005). She writes about these figurines from an ethnographically informed perspective[5], rightly rejecting diffusionist Balkan unitary connotations and parallels for reasons of ignored geographical and chronological distance, instead of accounting for local uses and meanings in local contexts. To her, "each piece is very individualistic" and quite abstract. This latter quality of enigma will have been a problem to common understandings in LBK societies, and their smashing served to dissipate the resulting tensions "in [a] small-scale domestic ritual involving … perhaps only one person". In other words, the figurines were occasionally made to answer individual psychological problems. Lüning's short twin-essay estimates the total number of excavated figurines at about 150: fifty recognizably female statuettes, fifty possibly[6] male, and fifty animal figurines (Lüning 2005). There are likenesses between figurines from different settlements, as well as similar decoration in the three classes, likenesses and similarity that may be attributed to a cult of common ancestors of lineage segments (p. 212, clearly referring to Pavlů 1998 who first considered kin relationships as background in this respect). Based on the richer settlements of the Älteste Bandkeramik, where there are equal numbers of houses and figurines[7], an original location of these statuettes in "a small separate Holy of Holies" in the rear part of the LBK houses is proposed (like the Roman *lararia*), where they served as ancestor images to be destroyed at the giving up of the house, every generation so (Lüning 2005, 273, 209).

Thus one major argument seems to revolve around the numbers of figurines present in the settlements compared to the numbers of houses. However, the declining production of figurines already within the Flomborn period of the LBK impedes any attempt at 'testing'. Leaving this aside, from a simulation, similar to the one described for the regular pottery in another chapter[8], it can be derived that their present rarity (on the Graetheide, and more specifically in the Janskamperveld village) is probably a reflection of earlier rarity, as with 90% sherd loss (as inferred for the pottery at Janskamperveld) about 40-60% of the original units would still be represented in the record; with higher loss rates, that percentage rapidly declines (at 95% only approximately 10-30% remaining). In round numbers: there may originally have been 2 or 3 *ceramic* figurines, or if the last condition obtains, anywhere between 3 and 10; certainly wooden or textile figurines may compensate for the difference, but just as likely Central European customs may have differed from those in the northwestern Bandkeramik as well, including the area of ancestor veneration.

9.4 An attempt at reconstruction[9]

In fig. 9-4 is presented an attempt at a graphical reconstruction of the Janskamperveld figurine. The starting point for the reconstruction is the junction of the two sherds which defines an oval with axes of 45 × 52 mm (inside 29 × 40 mm). Perpendicular to this junction plane, the long axis of the figurine to be reconstructed neatly groups both sherds to a joint height of 96 mm. The top of the statuette is still partially present, feet or bottom are no longer in evidence, but the thick lower part of the second sherd suggests a nearby position of the bottom rim or the bottom of the hollow figure. The part of the oval occupied by the larger sherd suggests a similar piece as complement to complete the shape on the other side. This allows a symmetrical positioning of another platform to which a second protuberance may have been fixed; it also allows a mirroring of the ornament, resulting in a symmetrical filling in of the space between the platforms.

A problem is posed by the upper rim, which starts to look like a collar, if the previous paragraph is a correct inference. Collars were unknown among Bandkeramik figurines: whenever an upper part is present, a head with eyes and nose (with often also a hat on top) is evident (cp. the figures accompanying Lüning 2005). Leafing through the literature, though, two Hungarian statuettes from the Zeliezovce culture (Late Music Note, slightly younger than LBK-V) site of Törökbálint-Dulácska were found which without any doubt show collars similar to the one reconstructed in fig. 9-4 (Becker 2006a, T. 56, and 474-475; also in Hansen 2007, T. 509-1.2). With that image still in mind, a rimsherd (diameter 12 cm) from Bad-Nauheim-Nieder-Mörlen, a (early Flomborn) Bandkeramik object, also has to be interpreted as showing a collar (Kneipp 1998 T. 53, 3; Becker 2006a, T. 78-3). Thinking this through the collar defines the back of the figurine, and a face can be reconstructed on the front. This then leaves the two small platforms facing frontward, and two arms can be reconstructed over the 'diminutive ridge' in the centre of the lower sherd, like in the Hungarian examples but also visible on several LBK statuettes. The 'eroded' upper half of the lower sherd suggests the presence of an appliqué larger than the two arms, and therefore a small bowl has been drawn there in the reconstruction; breasts, indicative of a female image, can probably be ruled out: those that are found on other Bandkeramik figurines are small, and not sufficient to fill up the eroded space. This leaves only the lower rim of the object questionable;

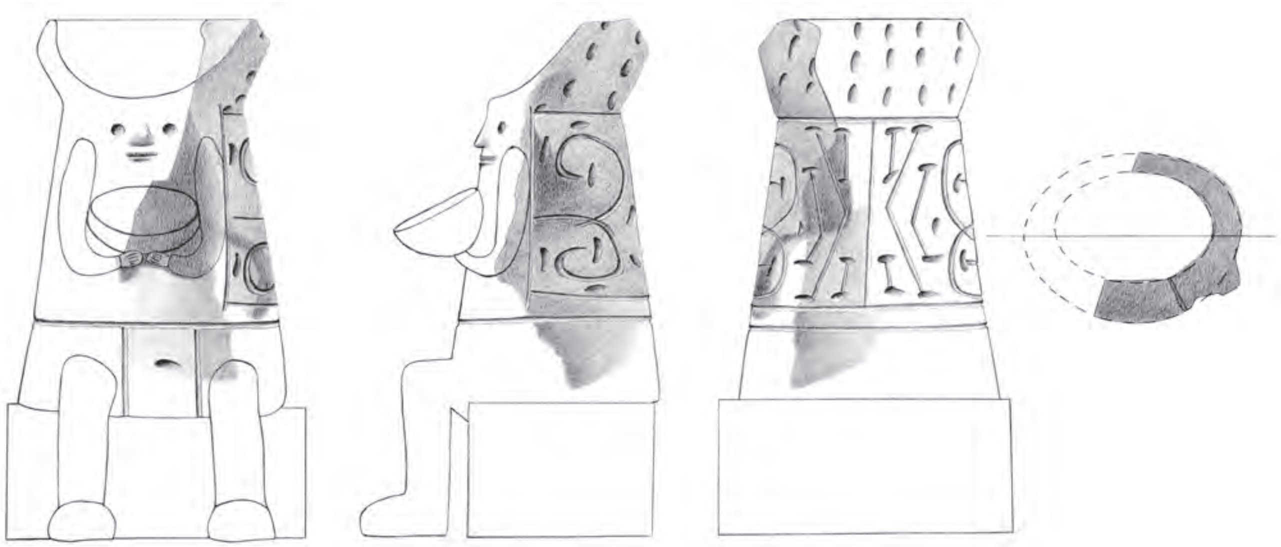

fig. 9-4 Reconstruction of the figurine; drawing by Erik van Driel

the solution in fig. 9-4 is one of a number of possibilities. One weak indicator of a sitting posture may be the slightly conical shape of the larger sherd; judging from the illustrations, sitting ("enthroned") figurines show such outlines, whereas standing statuettes have either straight or crooked cylindrical body shapes (cf. Gallay 2006, Abb. 5 in Gallay/Hansen 2006). If the reconstruction of this figure is accepted, then the height of the statuette is 140 mm, which is neatly within the range of sizes of these objects.

A note on the number of sherds into which the original statuette may have been broken, this *à propos* the simulation referred to: in the upper part three sherds make up the circumference, the height is divided over more than two sherds; this would amount to the figurine having been fractured into 6 to 9 sherds, perhaps even one or two more.

The biggest problem with the reconstruction is, of course, the head. The top of the larger sherd clearly had no such feature but a collar instead, whereas all those LBK "idols" that have preserved their upper parts show head-like protuberances, however awkwardly executed. The Nieder-Mörlen sherd mentioned above is not very helpful in this respect either. Yet one enthroned female figurine (from Erfurt) which lacks a head and shows a rim instead has often been depicted, although from the drawings it is not clear whether the rim has actually been observed or is merely an imaginative reconstruction (Kaufmann 1976, Abb. 3a; Grönwald 2004, Abb. 20).

To sum up: with the sherds at hand it is impossible to decide whether it is a female or a pan-human/male image (although the latter option is more likely), nor whether it had a stool / throne to sit on or stood upright (although the former option is more likely). The reconstruction in fig. 9-4 presents just one possibility, being one (not unlikely) permutation of LBK standards.

Notes

1 The German equivalent of the *COD, Wahrig Deutsches Wörterbuch, renders 'Idol: Götzenbild; Abgott, Gegenstand der Verehrung'*, also clearly implying religious comport; Dutch dictionaries present similar definitions.

2 Another (similarly dishomogeneous) class of LBK obejcts, where cult practices have been assumed, is the earth works, an interpretation which has also been contested.

3 In this discussion the quotes are mainly from secondary sources; references can be found there.

4 This need not be conclusive as not even half of that settlement has been excavated.

5 In line with recent Anglophone theorizing, Melanesian and Indonesian ethnography is projected on prehistory.

6 "Possibly male": most objects in this group are unmarked as to gender characteristics, and may convey a meaning similar to the English word 'man', either *human being* or *adult male*.

7 If one calculates the loss of ceramics and statuettes at about 90-95%.

8 Average number of sherds on fracture: 5; variation ±3, and 8±5.

9 I gratefully acknowledge extended and intensive discussions of the present figurine, its reconstruction and its implications with Jens Lüning, Köln.

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10 Flint: procurement and distribution strategies; technological aspects

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10.1 Introduction, research aims and procedures

The main objective of this study was to investigate the way flint working was organized at the JKV site, thus getting an insight in the procurement strategies and the technological choices made at this early stage of Bandkeramik habitation west of the river Rhine.

A quick scan at the beginning of this study revealed that the JKV flint assemblage showed the same technological characteristics as those from other well-studied Bandkeramik settlements in the Rhine-Meuse region, e.g. Beek-Kerkeveld (De Grooth 1987), Langweiler 8 (Zimmermann 1988) and Liège-Place Saint-Lambert (Cahen 1984). Given the limited amount of time available for study at that time (2001), it was decided not to perform a time-consuming technological study of individual artefacts (*Merkmalanalyse*, cf. Zimmermann 1988), but to concentrate on a spatial and diachronic analysis of the assemblage, whilst A.E. van Gijn and her collaborators carried out use-wear analyses on a large sample of tools and blades. Hence, in keeping with work done previously on the Elsloo flints (De Grooth 1987), features (pits) were used as the unit of analysis, grouping the artefacts recovered in every pit into broad typomorphological categories that were counted and weighed. In addition, for every artefact class, the number of specimens with cortex and the number of burned pieces were registered. Next, the dimensions (length, width and thickness) of complete tools, blades and cores were measured. Finally, for a sample of blades and blade tools, attributes thought to be relevant to determine the knapping technique applied were recorded; for a second sample, parameters deemed relevant for establishing the provenance of the flints were registered as well.

At the time of the initial analysis, the flint material from six excavation trenches in the northwestern part of the settlement could not be examined (De Grooth 2003b). In later years, most of these missing artefacts, as well as some additional material from the southern part of the settlement, gradually became available for study, filling in some annoying gaps on the distribution map and allowing a more detailed spatial analysis to be performed. Ultimately (up till August 2006), 7941 flint artefacts, with a total weight of *c.* 58 kg, were analysed. 5883 of these were recovered from 54 pits containing at least 15 flints and dated by their ceramic content (Table 10.1). The composition of these sub-assemblages is remarkably stable, indicating that the assemblage is homogeneous to a large extent.

10.2 Raw material procurement

The flints used at JKV originated almost exclusively from the limestone area south of the river Geul, at a distance of 20-30 km from the settlement (Fig. 10.1). This region is considered to be the major procurement area for Bandkeramik settlements in the Graetheide cluster (Bakels 1978; De Grooth 1987), as well as the Rhineland (e.g. Zimmermann 1995; Zimmermann *et al.* 2004). It has been recognized for a long time that the flints used in Bandkeramik times are very similar to those exploited in the well-known Middle Neolithic flint mines located between Rijckholt (mun. Eijsden NL) and St.-Geertruid (mun. Margraten NL) (cf. Bakels 1978).These flints are now known to originate in the western facies of the Lanaye member of the Gulpen Formation (Felder and Felder 1998; Felder *et al.* 1998; Felder and Bosch 2000).

The initial investigation of the JKV flints, in 2001, showed almost all of the material to be of the Lanaye type. Therefore, it was decided not to invest time in a registration of specific raw material attributes for individual artefacts. In retrospect, as it became clear that Lanaye flints from different geological positions could be distinguished macroscopically (De Grooth forthcoming a) and taking into account new evidence for possible Early Neolithic activities at the Banholt and Rijckholt extraction sites presented by Brounen and Peeters (2000/2001), this was found to be an unwise decision. In 2006 a set of variables now known to be diagnostic were recorded for a sample of material from well-dated pits belonging to all settlement phases. Thus a more precise assessment of the actual extraction sites used by JKV's inhabitants could be made.

The western part of the Lanaye member contains 23 different seams of flint (numbered from bottom to top). Of these, layer 10 comprises the largest amount of usable flint. This was the seam mainly exploited in open-cast workings and deep pits at Rijckholt/St. Geertruid.

In places, for instance in the slopes of the 'Schone Grub' dry valley, small quantities of flints from the other seams may have been extracted as well (Felder *et al.* 1998: 11-12).

	All			≥ 3 artefacts 179 pits			≥ 15 artefacts 77 pits			≥ 15 artefacts dated 54 pits		
TYPE		N	%		N	%		N	%		N	%
CORES		26	0.3		23	0.3		18	0.3		15	0.3
HAMMERSTONES		59	0.7		52	0.7		44	0.7		40	0.7
FLAKES		5744	72.3		5418	74.6	72.8	4815	73.5		4391	73.6
primary cortex *	219			206			191			161		
secondary cortex*	1327			1211			1099			969		
no cortex	2784			2641			2422			2158		
rejuvenation flakes	195			174			155			131		
chips (< 15 mm)	1026			1007			948			843		
hammerstone fragments	193			179			154			129		
BLADES		1083	13.6		1007	13.6		891	13.2		789	13.2
entire no cortex	69			67			59			50		
proximal fragm. no cortex	362			334			293			261		
medial fragm. no cortex	226			215			194			169		
distal fragm. no cortex	147			139			124			112		
entire cortex	38			36			34			31		
proximal fragm. cortex	95			84			71			64		
medial fragm. cortex	44			41			37			30		
distal fragm. cortex	46			40			39			36		
crested blades	56			51			40			36		
ARTIFICIAL BLOCKS		148	1.9		142	1.9		134	2.0		122	2.0
TOOLS (cf. Table 10.5)**		890	11.2		785	10.6		701	10.4		611	10.2
SUM		7950	100.0		7427	100.0		6757	100.0		5968	100.0

* Primary cortex flakes: at least 85% of dorsal surface covered by cortex or natural fractures;
Secondary cortex flakes: less than 85% of dorsal surface covered by cortex/natural fractures.
** the fragment of a polished flint axe found in the upper fill of pit 18056 is not included.

Table 10-1 Composition of the flint assemblage

The flints from layer 10 are nodular in shape and in general have a length, width and thickness of at least 30 cm. The cortex is thin, rough and whitish. Natural fracture planes often are covered with iron incrustations. The internal colour varies from very dark to very light grey, both sometimes with a hint of blue. The surface of artificial fractures is smooth but dull, the texture is mainly fine grained. Both colour and texture may vary within individual nodules; the lighter grey parts often contain zonated areas, with gradual transitions. Sometimes the zone directly under the cortex is the darkest, with a smoother, more vitreous texture. The main types of inclusions are (De Grooth 1998; Felder *et al.* 1998):

– concentrations of light (white or light grey) round specks (<1 mm); isolated small (1-3 mm) and medium-sized

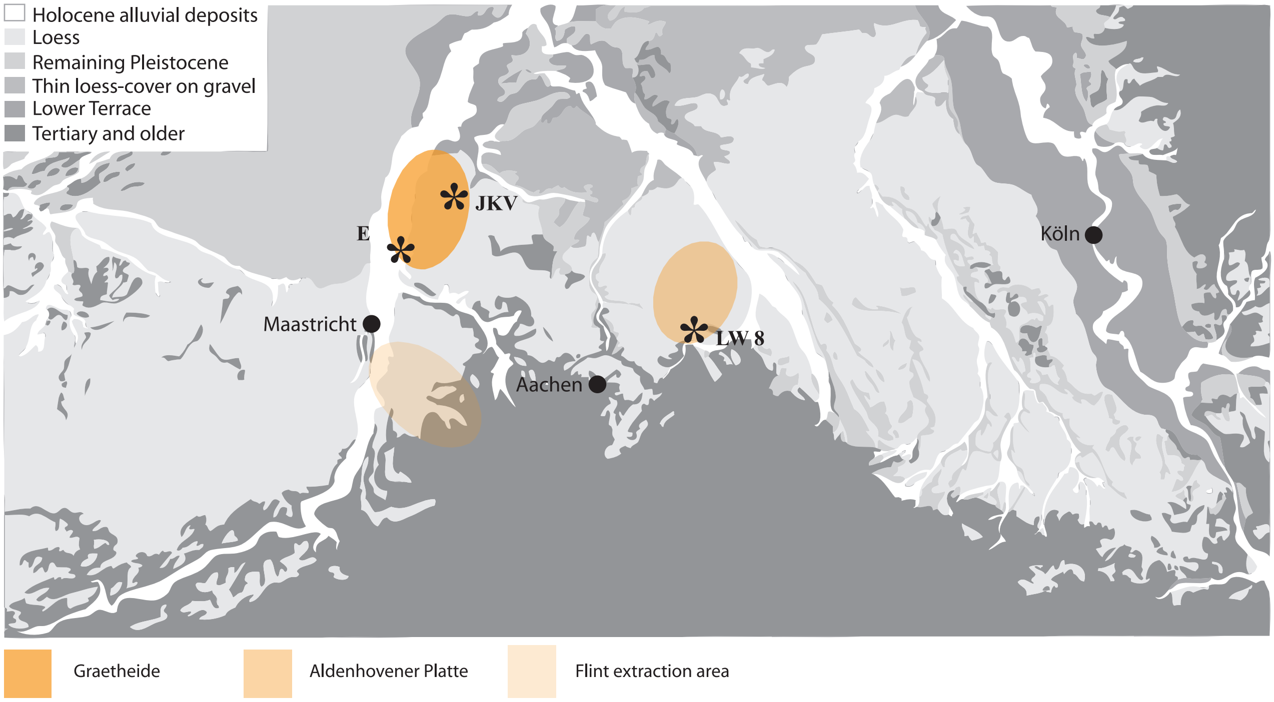

Fig. 10-1 JKV's position in relation to the flint-bearing limestone area and to other sites mentioned in the text. Map based on Modderman 1970 and Zimmermann 2002.

(3-10 mm) round or ovoid spots, light grey or white, with the same texture as the matrix;

- small (1-3 mm), medium-sized (3-10 mm) and large (>10 mm) ringed spots, round or irregular in shape, with a smooth whitish outer ring and a smooth or rough darker centre;
- large (>10 mm) spots, round or irregular, abrupt border, light grey or whitish, with a rougher texture than the matrix;
- large, vague lighter grey flecks;
- concentrations of black round specks (<1 mm); small and medium-sized (between 1 and 10 mm) black or very dark grey round, ovoid or sickle-shaped spots; dark wisps or tendrils;
- small angular cavities.

Flints from the other seams within the Western Lanaye member for the most part have the same characteristics, notably as regards colour, texture and the presence of both dark and light spots and specks. A detailed study of four of these showed the following divergences: dense concentrations of small white spots are present in layer 01; the flints from layer 2A often contain seemingly overlapping inclusions, and fossils that are not completely silicified; abrupt transitions in colour occur in the zonated areas in layer 12A. Also, the cortex may be thick (e.g. layer 02A, 12A) or irregular, with hollows and protuberances (layer 01).

The combined presence of several kinds of dark inclusions is the major characteristic distinguishing Lanaye flints from other flint types in the region. They occur as specks (<1 mm), small and medium-sized spots (1-10 mm), that may be round, ovoid or sickle-shaped, or long wisps. These attributes are shared with some of the flint varieties found in the Hesbaye – such as the so-called silex grenu (coarse-grained flint) used in small quantities at Verlaine-Petit Paradis (Allard 2005), the material from the mines at Jandrain-Jandrenouille (comm. Jodoigne, B) and the flints from the Craie de Spiennes, in the Mons area of southwestern Belgium. De Grooth (forthcoming a) discusses the possibilities of distinguishing between these.

Lanaye flint nodules could have been extracted from four different depositional contexts:

Firstly from their primary position, in the chalk bedrock. Secondly, from slope, talus or scree deposits, that came into being when the valleys which had developed during the Pleistocene cut into the chalk beds, thus exposing and eroding them. Thirdly, from residual loams (also known as eluvial deposits) that are the result of disintegration of the chalks during the Tertiary. Finally, from gravels deposited by the river Meuse during the Pleistocene and the Holocene.

The conditions prevailing in these secondary deposits sometimes led to visible alterations in the aspect of the flints. Flints from slope deposits differ from the material in primary context only as regards a slight weathering of the cortex and other natural surfaces. Material collected in river gravels may be identified as such only when parts of the cortex or other natural surfaces are still present, as the river transport led to heavy abrasion of cortex, to a decrease in size of the flints, and to an increase in the frequency of non-cortical natural surfaces. These often have a battered aspect and carry a glossy patina (pebble patina, Verhart 2000). The most extensive alterations, however, are present on flints embedded in residual loams, especially when these are mixed with iron-rich Oligocene sands.

Prehistoric extraction points that probably were in use during the Early Neolithic are known for three of the four depositional contexts (Fig. 10.2, Table 10.2). With the exception of Rodebos, artefacts probably dating to the Early Neolithic have been found at, or in the immediate vicinity of, all sites under consideration.

1. Lanaye nodules from both a primary context and from slope deposits may have been extracted in the mining area situated between Rijckholt (mun. Eijsden, NL) and Sint-Geertruid (mun. Margraten, NL). The well-known

Fig. 10-2 Possible Early Neolithic extraction sites. Map: Zuid-Limburg, 1:50.000 (topografische dienst Nederland 1980).

	Rijckholt Mines	Rijckholt slopes; de Kaap	Mheer	Banholt	Rullen	Rodebos
Primary context	X					
Slope deposits		X				
Residual loams			X	X	X	X
Oligocene sands				X	X	X
Oligocene cobbles					X	X

Table 10-2 Geological characteristics of known extraction points

underground mining activities there are contemporary with the Michelsberg culture (Felder *et al.* 1998). Earlier mining of primary material, by means of shallow pits, cannot be excluded *a priori*. In the immediate vicinity, flints were extracted from slope deposits as well, as has been shown by the excavations in the Schone Grub, a dry valley in the northwest of the prehistoric mining area (Rademakers 1998; Felder *et al.* 1998).

2. The steep slopes between the Upper Terrace and the Middle Terrace surrounding the plateau known as De Kaap, located some 500 m further to the south may also have been exploited (Felder 1998). At present these activities cannot be dated but some Bandkeramik adzes have been found on the Rijckholt plateau (Brounen and Peeters 2000/2001).

Early Neolithic exploitation of residual flint deposits may have taken place at the following sites. All deposits are composed mainly of Western Lanaye flints, with an admixture of material from the underlying Lixhe member (cf. Felder 1998):

3. Hoogbos, between Mheer (mun. Margraten, NL) and 's Gravenvoeren (mun. Voeren, B). Discovered in 1908, preliminary investigation by Hamal-Nandrin and Louis (Louis 1936). Exploitation is thought to have taken place in the steep valley slope where the material crops out. Nothing is known about age and character of the mining activities, but Louis reported that some of the cores and rejuvenation tablets collected here resemble those found at Omalien (i.e. Bandkeramik) sites in the vicinity of Liège.

4. Banholtergrub, close to Banholt (mun. Margraten, NL), situated on the northern slope of a narrow dry valley. The eluvial deposits lie on the remaining chalks and are covered by Quaternary gravels. Some Oligocene sands are mixed with the loams (W.M. Felder, oral communication 29/06/2006). Recently, Brounen and Peeters (2000/2001) presented plausible evidence for (open-cast) mining and knapping activities at this site during Early Neolithic, more specifically Bandkeramik times.

5. A cluster of extraction sites at Rullen and Sint Pieters-voeren (Vrouwenbos according to Felder 1998; also known as Bois Communal and Bois des Sapins, De Warrimont and Groenendijk 1993) in the municipality of Voeren (B). The material extracted here is commonly known as Rullen flint. At these sites, the residual loams are mixed with important amounts of Oligocene sands, rich in iron oxides, displaying intense red and yellow colours. The flints derived directly from the Lanaye and Lixhe members are mixed with some cobbles from a Tertiary pebble floor, i.e. a littoral deposit on the shore of the upper Oligocene sea (Felder 1998: 174). These had their origin in the Lanaye chalks as well. Since the discovery of the sites at the end of the nineteenth century, huge amounts of knapping waste, blades and blade cores, as well as (rough outs for) axes have been collected and excavated. In 1998, during a rescue excavation prior to the construction of a liquid gas pipeline, traces of a funnel-shaped extraction pit, with a preserved depth of *c.* 3 m and a reconstructed diameter of 7.20 m, were found at Rullen (Vermeersch *et al.* 2005). The available Radiocarbon dates correspond to the end of the Neolithic or even later. The presence of blanks and tools in earlier Neolithic settlements, however, points to extensive extraction activities in this period: Rullen flints are encountered sporadically during the LBK, but are an important to predominant raw material in settlements of the Grossgartach, Planig-Friedberg and Rössen cultures (Gehlen and Schön in press).

6. Rodebos, close to Remersdaal (mun. Voeren, B). Discovered in 1919; preliminary investigation by Hamal-Nandrin and Servais (Hamal-Nandrin and Servais 1921). The site is undated and the character of the mining activities unknown. The geological situation is identical to that at Rullen, i.e. residual loams mixed with Oligocene sands.

No specific extraction points for gravel flints are known, but the material was widely used during the Neolithic, especially in areas where it formed the nearest source of raw material (Weiner 1997; Mischka 2004).

A number of researchers have sought to develop sets of variables with which the flints from the relevant extraction sites can be reliably described at a macroscopic level; moreover several petrographical and geochemical analyses were undertaken, as an independent method of characteris-ing raw material and studying within- and between-source variation (cf. Felder *et al.* 1998: 13-16). Initial geochemical research was performed by a.o. Bakels *et al.* (1975; Bakels 1978) looking for differences in trace element content by means of neutron activation analysis. Fifty artefacts from pit 334 of the Bandkeramik settlement at Elsloo were analysed. They indeed were very similar to the material mined in the Rijckholt flint mines, but it proved to be impossible to distinguish the material of the Rijckholt flint mines from that found at the exploitation sites of Banholt, Mheer and Rullen. Subsequent research by Kars et al. (1990) and McDonnell *et al.* (1997) found differences between material from these different extraction points, using both macroscopic and petrographical and geochemical methods. Kars *et al.* (1990) recorded that a noteworthy character of the Western Lanaye Chalk flints is the sometimes high amount (varying between 5 to 50%) of carbonate. This carbonate is partly present as dispersed micrite (finely crystalline marine calcium carbonate), and as angular to rounded or elongated bioclasts (fossil debris). Later on, McDonnell *et al.* (1991) reported that a combination of petrographical and geochemical analyses made it possible to distinguish between flints originating from Rijckholt and from the Rullen area, with Banholt and Mheer having an intermediate position. Finally, in 1993 De Warrimont and Groenendijk offered an important contribution to the characterization and distinction of the flints under consideration, in a study that combined a macroscopic assessment with Munsell colour measurements using a spectrophotometer. They reached the conclusion that the sites can be subdivided into two groups. The first comprises Rijckholt (chalk bedrock and slope deposits), Hoogbos and Banholt; the second consists of Rullen, St. Pietersvoeren (Bois Communal and Bois des Sapins) and Rodebos. In both cases, a subdivision was suggested: Banholt was separated from Rijckholt/ Hoogbos and Rodebos from Rullen/St. Pietersvoeren.

De Warrimont and Groenendijk considered five attributes to be diagnostic in distinguishing the flints from these sites:

– the dominant colours, expressed according to the Munsell System, the scores for hue and value being of special importance;

– a thick (>1 mm) white zone under the cortex;

– a clear reddish brown zone under the cortex;

– concentrations of white specks (<1 mm) and small white spots (indicating the presence of flints from Lanaye layer 01 and/or the Lixhe member).

To these may be added (De Grooth forthcoming a):

– differences in colour and texture of the cortex;

– the presence of yellowish or brown streaks penetrating deeply into the nodules;

– natural and artificial fracture planes with a ‘dusty’ aspect, due to the presence of dense concentrations of minuscule, vermiculate, spots;

– differences in the degree of translucency. Using a method devised by Ahler (1983), unweathered freshly knapped flakes were studied in a darkened room with a light source (provided by a 12 V/20 W halogen desk lamp) diagonally behind them. The boundary between the opaque and translucent parts of the pieces was then marked in pencil, and the thickness measured with a pair of sliding callipers. The measurements then were grouped into 5 classes: T1: translucency ≤ 2.4 mm (opaque); T2: translucency between 2.5 and 4.9 mm (low); T3: translucency between 5.0 and 7.4 mm (medium); T4: translucency between 7.5 and 9.9 mm (high); T5: translucency greater than 10.0 mm (very high). Into this last class falls very translucent material such as obsidian, and most of the north-European “Baltic” flint. Translucency is not directly correlated to grain size: some coarse-grained flints show high translucency (for instance the so-called Valkenburg flint from the Emael Member), whilst others, such as the flints from the Lixhe member, combine a low translucency with a smooth, shiny surface.

Using these attributes, the flints found at the extraction sites under consideration may be characterized in the following way.

Rijckholt plateau and De Kaap:
The artefacts studied here are thought to result partly from the deep-mining activities and partly from nodules collected in slope deposits (cf. De Warrimont and Groenendijk 1993).

	JKV	Rijckholt	Hoogbos	Banholt	Rullen c.s.	Rodebos
White zone	14%	No	No	Common	Common	Common
Red zone	23%	No	Rare	Common	Frequent	Frequent
Brown wisps	4.5%	No	Rare	Common	Frequent	Rare
Dusty surface	No	No	No	No	Frequent	Rare

Table 10-3 Comparison of raw material characteristics of JKV and extraction points

The material is identical to that extracted in the deep shaft mines and to the geological samples of Lanaye 10 flints. The translucency is low to medium.

Mheer-Hoogbos:
In colour, texture and inclusions this material is identical to the flints encountered at Rijckholt; the cortex, however, is rough, thin and brownish. Yellowish streaks are infrequently present, as are concentrations of small light spots. Opaque reddish brown zones are very rare. The translucency is low to medium.

Banholt:
Again, the material is similar to the Rijckholt sample. The cortex, however, is rough, thin, brown or grey. Frequently a thin reddish brown, glass-like zone below the cortex is present, and a thick white layer may occur; brown or yellowish streaks are common, as are concentrations of light specks (<1 mm); the fracture surface lacks the dusty appearance typical of Rullen (see below). The translucency is medium to high.

Rullen/Sint Pietersvoeren:
At the Rullen/Sint Pietersvoeren sites, material originally deriving from all the levels within the Lanaye member were exploited. This follows from the observation that concentrations of light specks (<1 mm) the size of a pinhead and concentrations of small light spots are common, whilst abrupt transitions in colour and sharply defined stripes parallel to the cortex occur as well. The cortex is brown, sometimes rough, sometimes smooth; mostly thin, but sometimes thick. A thick, white layer is often present, especially in material from the Sint Pietersvoeren (Bois Communal and Bois des Sapins) sites. As befits their origin in the Western Lanaye deposits, the basic colour of the flints found at the different Rullen/ Sint Pietersvoeren extraction sites was grey. Three phenomena, however, caused alterations that make it possible to distinguish these flints from the Lanaye material from primary chalk deposits. Firstly, their long stay in an eluvial matrix gave them a 'bleached' aspect, possibly caused by the dissolution of the carbonates that are present in large amounts in primary Lanaye material (cf. MacDonnell *et al.* 1997; Giot *et al.* 1986 describe the same loss of carbonates for flints from Le Grand-Pressigny). This bleaching sometimes affected the dark inclusions as well. And possibly because of the same loss of carbonate content, Rullen flints have a high translucency (predominantly class 4-5). Thirdly, infiltration of the iron compounds present in the matrix led to a yellowish-brown discoloration. At its most intense, this results in the 'honey' or 'egg-yolk' coloured nodules often seen as typical Rullen flint (esp. Löhr *et al.* 1977). In many artefacts found at the Rullen and Sint Pietersvoeren sites, however, solid reddish or yellowish brown colours are limited to the outer part of the nodules, whilst the rest of the piece is grey, with just some brown, yellow or orange streaks. The fracture planes are dull and mostly have a 'dusty' aspect, probably because the bleaching has made the presence of dense concentrations of minuscule, vermiculate, spots visible.

Rodebos:
Besides the basic Lanaye attributes, this material is characterized by the frequent presence of a reddish brown glassy zone under the cortex. Sometimes a thick white zone occurs as well. Specks, yellowish streaks and fracture planes with a dusty aspect are rare. The fracture surfaces are more reflective than those at Rijckholt and Rullen, and the translucency is extremely high, almost 60% of the sample belongs to classes 4 and 5.

By comparing the raw material characteristics of the different extraction points with those of the JKV flints, the latter's probable origin could be established. As their slightly weathered cortex shows, the JKV flint material was not acquired from a primary chalk deposit. Nor did river gravels play an important role as raw material source: only two of the cores display the heavily abraded natural surfaces characteristic of material transported in river gravels. This leaves the residual loams and the slope deposits as possible sources.

In a sample of 358 well-dated JKV artefacts, 82 pieces (23%) showed a glass-like reddish-brown zone underneath the cortex; 50 times (14%) a thick white zone was present under the cortex, and 16 artefacts (4.5%) had yellowish brown streaks. The concentrations of small light round spots and the dusty fracture surfaces characteristic of Rullen flint, however, were all but absent. Thus, the JKV material shows characteristics not encountered in the Rijckholt samples, but resembles best the raw material collected at Banholtergrub and Rodebos (Table 10.3).

Subsequently, the translucency of 271 unweathered JKV artefacts was measured. Of these 3% were opaque, 46% slightly translucent, 35% showed a medium translucency and 16% were highly translucent. Moreover, 181 of the artefacts (67%) were completely translucent (Fig 10.3). This phenomenon reflects partly the relatively low thickness of the JKV artefacts, but it also points to an overall high translucency of the raw material utilized. In order to make a comparison possible with the data from the extraction sites, the measured translucency was presented in three ways: 1. raw data; 2. increase with one mm for all entirely translucent artefacts; 3. increase with 2.5 mm. This, of course leads to an increase of pieces in the higher translucency classes. Again, the JKV sample does not resemble the

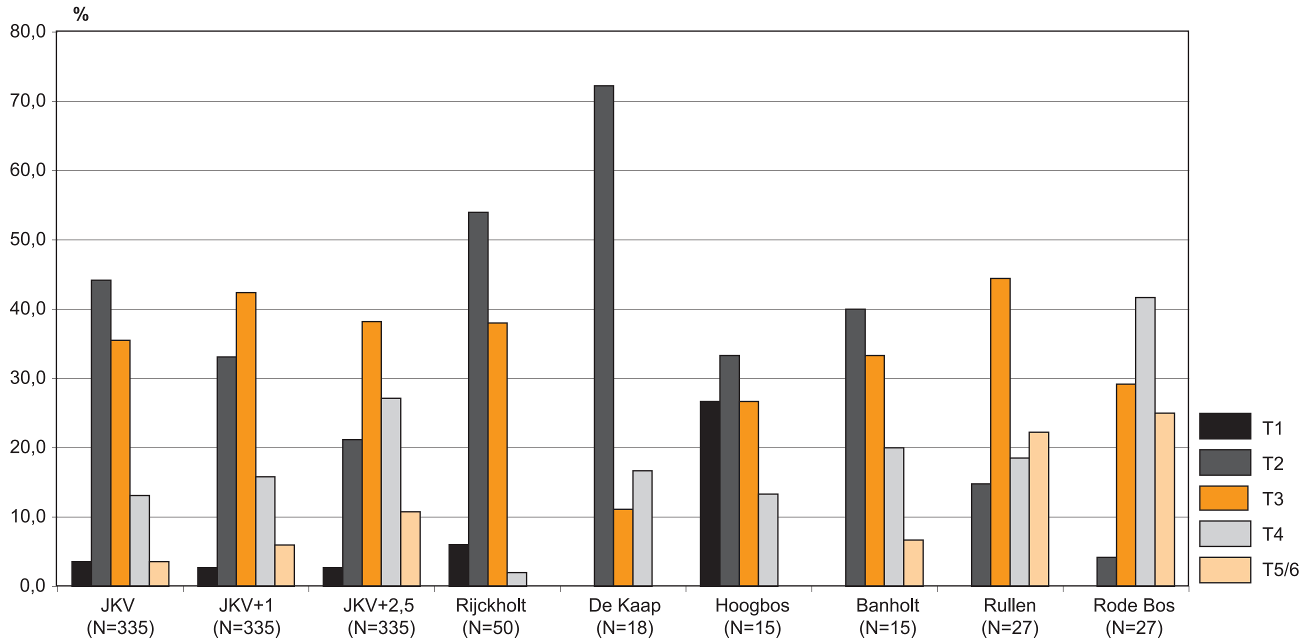

Fig. 10-3 Comparison of translucency of JKV and extraction points

	Hesbaye	Emael	Gravels	Rullen	Zeven Wegen
Cores	2		3		
Flakes	5	17	12	1	1
Blades	11	9	2	1	
Tools	15	1		3	3
N	33	27	17	5	4

Table 10-4 Occurrence of rare flint types

Rijckholt material, even when only the 'raw' data are considered. The correspondence with the data from Rullen, Banholt and Mheer is much better, and increases when regarding the enhanced data; Rodebos, on the other hand, seems a less likely source, because there flints with a low or medium translucency are scarce (Fig. 10.3).

Thus, it seems highly probable that the majority of the JKV raw material was collected at the Banholtergrub (or at one or more as yet unknown extraction sites where the flints were embedded in similar conditions), with Mheer-Hoogbos and Remersdaal-Rodebos as possibilities of secondary importance.

The flints of the Bandkeramik sites at Elsloo and Beek-Kerkeveld display the same characteristics (observation by the present author). Given the mention of transparent reddish-brown zones as typical of the so-called 'Rijckholt' flint encountered elsewhere in the Bandkeramik world (e.g. Deutmann 1997; Löhr *et al.* 1977; Zimmermann 1988: 606), it seems plausible that all this material mainly originated from Banholt as well. Therefore, it seems advisable for archaeologists to comply with the recommendation made by geological experts (cf. P.J. Felder 1998: 159; Felder *et al.* 1998) and use 'Western Lanaye' (or, for the more cautious) 'Western Lanaye-Lixhe' instead of 'Rijckholt' as denomination for this type of raw material. The Banholt variety of Lanaye flint even reached as far east as Friedberg-Bruchenbrücken in Hesse, where at least two artefacts were identified among the Oldest Bandkeramik material by A.L. Fischer and the present author, using the author's reference collection (Fischer 2005; De Grooth forthcoming a).

Apart from the ubiquitous Western Lanaye flints of the Banholt variety, a small number of artefacts made of other raw material types was recovered at JKV (Table 10.4). The majority of 'other' flints belong to the so-called 'light-grey Belgian' flints, that have their origin in the Hesbaye region near Liège in Belgium (cf. Löhr *et al.* 1977; Cahen *et al.* 1986; Caspar 1984; Allard 2005). Fifteen of these are blade tools (45%). Not all this material reached the settlement 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. Seventeen artefacts – including three cores but no retouched tools – originate from river gravels, three of these could be classed as Oligocene beach pebbles ("Maasei"), on the basis of their heavily rolled, thick yellow or red cortex. Flints from the Emael member – known to archaeologists as Valkenburg flint (e.g. Brounen and Ploegaert 1992) – are mainly represented in the waste material, one retouched flake and one hammerstone fragment being the exceptions.

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 and Felder 1998). For a detailed description of these flint types please refer to De Grooth (forthcoming a)[1].

10.3 The process of flint working

The chaîne opératoire (Pelegrin *et al.* 1988) chosen by JKV's inhabitants to transform their raw material into manufactured products greatly resembles the one practised at other regional Bandkeramik sites, such as Beek-Kerkeveld (De Grooth 1987), Liège-Place St. Lambert (Cahen 1984), or Verlaine-Petit Paradis (Allard 2005). It can be summarized as follows:

Striking platforms were made by the removal of one or several large decortication flakes. Although preparation of the core face often consisted only of the removal of bulges and decortication, sometimes a rough crest was prepared to guide the first blade (witness the presence of crested blades in the assemblage). This preparatory work was performed in the hard hammer mode.

The flaking angle of the core was regularly improved by centripetal removal of flakes from the striking platform (witness the faceted aspect of striking platforms on the cores and the presence of many dihedral butts on blanks). If that did not suffice, the whole striking platform could be rejuvenated by hard hammer removal of a core tablet. The same core face remained in use, but the blades produced were 1-2 cm shorter. The removal of tablets also took care of damages on the upper part of the core face when, owing to a wrong flaking angle or irregularities in the flint, hinge fracturing had occurred. Axial or lateral flanks (Cahen 1984), meant to correct damage at the bottom part of the core face, are but rarely encountered at JKV.

Only three blade cores and one flake core have more than one striking platform and/or core face. All blade cores had faceted platforms, as did 10 of the hammerstones still recognizable as former blade cores. Four of the flake cores turned hammerstone had a faceted striking platform as well, suggesting that they too may have been used to produce blades in an earlier stage of reduction. Nine of the blade cores were worked along the whole periphery, seven over three quarters of the periphery. Most blade cores are cylindrical in shape, only three could be described as pyramidal; with two exceptions, they had only a single striking platform. Three of the flake cores belong to the 'flaked flake' category; one was made on a naturally fractured block.

The reduction was aimed at the production of blades, with more or less parallel edges, this notwithstanding the fact that also flakes were produced rather often.

For a sample of 83 well-dated blades and blade tools, attributes visible on the proximal part and thought to reflect the knapping techniques applied, were recorded. The butts of these blades are mostly oval in shape (63%), with a surface that may be flat (52%) or dihedral (46%). They are comparatively large (platform width mean 10.6 mm, sd. 3.1; platform thickness mean 4.3 mm, sd. 1.4). Although a slight lip is often present on the edge between butt and ventral surface (66%), and the bulbs of percussion mostly are diffuse (75%), lance scars and pronounced eraillures (bulbar flakes) also occur quite often (59%). A slight, rather irregular form of dorsal reduction is common (60%), whilst primary faceted butts are completely absent. The flaking angles (between the butt and the ventral surface of the blanks) approximate 90°. The mean L:W index of complete blades is 2.6; the mean index for L:W:Th is 0.6; for the complete blade tools these figures are 1.9 and 0.3 respectively. Thus, JKV's blades show a combination of attributes described by Mateicucová (2003, 2004) as characteristic of direct soft hammer percussion and indirect percussion (punching). In a technological sense, the JKV blades neither resemble the long, narrow regular blades characteristic of Earliest LBK assemblages, with their preponderance of primary faceted butts – thought to be of southern Central European Late Mesolithic origin (Tillmann 1993; Gronenborn 1997), nor the blades with small, smooth, almost point-like butts that were present in small numbers at Friedberg-Bruchenbrücken, whose origin is sought in the Late Mesolithic of the North European plain, northwest continental and western Europe (Gronenborn 1999).

As the newest Radiocarbon-based Bandkeramik chronology indicates that the Flomborn LBK may have co-existed for about 150 years with the later phase of the Earliest LBK found at e.g. Friedberg-Bruchenbrücken (Lüning 2005), a new assessment of the origins and technological affinities of Early Bandkeramik flint technology clearly is called for (De Grooth forthcoming b). This study should evaluate the complete chaîne opératoire, with special focus on raw material sources and on the technology of blade production, rather than on comparisons of single tool types, such as arrowheads (see below).

The toolkit used by JKV's inhabitants is extremely conventional, both in composition and in morphology (Table 10.5). Arrowheads, borers (or rather: inserts for drilling machines), truncated blades, blades with lateral retouches, end-scrapers and side-scrapers are the main standardized tool types. Following common practice (e.g. Allard 2005; Bohmers and Bruijn 1958/59; Cahen *et al.* 1986; Gronenborn 1997; De Grooth 1987; Zimmermann 1988), to these are added the blades with intensive gloss, interpreted as sickle inserts, even though they often are not modified by intentional retouch. Only one 'quartier d'orange' in the strict, typo-morphological sense of the word (Cahen *et al.* 1986) was found at JKV, an isolated find from an undated pit. Tools of aleatory morphology (Hauzeur 2006) comprise retouched flakes, notches, denticulates, burins, and splintered pieces.

Standardized tools were almost exclusively made on blades – with the exception of end- and side-scrapers. Also arrowheads at JKV were mainly made on blades, although their small size often makes it difficult to determine the type of blank. Most retouched tools show a direct steep retouch, only arrowheads sometimes displaying bifacial or inverse flat retouch.

Among the standardized tools, the arrowheads alone merit special attention because of the role assigned to them in recent discussions on Mesolithic-Neolithic interactions and the relationships between the LBK and the La Hoguette and Limburg Groups (Löhr 1994; Gronenborn 1997, 1999; Jeunesse 2002; Gehlen 2006; Heinen 2006; cf. De Grooth forthcoming b).

	All material		Pits ≥3 artefacts		Pits ≥15 artefacts	
Types	N	%	N	%	N	%
Arrowheads	74	8.3	65	8.2	56	8.0
Borers	47	5.3	39	5.0	36	5.1
End-scrapers	264	29.7	229	29.2	197	28.1
Side-scrapers	23	2.6	20	2.6	18	2.6
Truncated blades	62	7.0	58	7.4	55	7.8
Retouched blades	179	20.1	157	20.0	146	20.8
Sickle blades	131	14.7	121	15.4	106	15.1
Retouched flakes	44	4.9	38	4.8	35	5.0
Splintered pieces	37	4.2	32	4.1	27	3.9
(micro) Burins	5	0.6	4	0.5	4	0.6
Notches	11	1.2	10	1.3	10	1.4
Denticulates	4	0.5	4	0.5	4	0.6
Microliths	3	0.3	3	0.4	3	0.4
Quartiers d'orange	1	0.1	1	0.1	0	
Non-sickle gloss	5	0.6	4	0.5	4	0.6
	890	100.1	785	100.0	701	100.0

Table 10-5 The main tool types

For a long time, asymmetric triangular points (especially those on which the base and the least-retouched side meet in an obtuse angle) were considered to be the typical, classic Bandkeramik type of arrowhead and accordingly dubbed Bandkeramik or Danubian point (e.g. Ankel 1964; Bohmers and Bruijn 1958/1959). Recently, however, this type is seen to epitomize LBK interactions with indigenous groups, and their origin is sought in (south)western European Mesolithic traditions (Löhr 1994; Jeunesse 2002; Gronenborn 1999).

This view is based on two typomorphological observations. The first of these considers regional traditions in the laterali-sation of trapezes and asymmetric triangular points. According to Löhr and Jeunesse right-winged arrowheads are predominant in the LBK of Dutch Limburg, Belgium and northwestern France. Left-winged arrowheads prevail in the Alsace, along the Neckar and the Moselle river area. 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 second observation has to do with the occurrence of an invasive retouch on the ventral surface (retouche inverse plate or RIP, Löhr 1994; retouche plate inverse or RPI, Jeunesse 2002) on the base of both symmetric and asymmetric arrow-heads. This trait too is encountered on many Late Mesolithic trapezes, and its origins are sought in central and southwestern 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 combination of these two phenomena on many arrowheads found in the flint industry of western Band-keramik groups and their successors such as the RRBP 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 and Jeunesse 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 has. Finally, the use of the micro-burin technique is also seen as evidence of Mesolithic influence. JKV is located in an area where both La Hoguette and Limburg pottery has been recovered, not only from Bandkeramik rubbish pits but

	All	angle > 90°	RIP
Symmetric	18		7
L-winged triangle	10	5	5
R-winged triangle	11	5	4
R quadrilateral	3		1
irregular	6		3
All	48		20 (42%)

Table 10-6 Characteristics of arrowheads

also on independent sites – e.g. Sweikhuizen (Modderman 1987) and Haelen (Bats *et al.* 2002) for La Hoguette pottery and its Begleitkeramik and Kesseleik (Modderman 1974) and Roermond-Musschenberg (Tol 2000) for Limburg pottery. Therefore, and especially given its Early LBK date, a study of its arrowheads may provide a valuable contribution to this ongoing discussion (De Grooth forthcoming b).

Of the 48 arrowheads that could be described in typo-morphological terms, 21 were asymmetric triangles, and three asymmetric quadrilaterals, thus fifty percent may be described as asymmetric. Pronounced asymmetry, with an obtuse angle between the base and one of the long sides, however, is found on only ten specimen, equally divided among the right- and the left-winged specimens (Table 10.6). In only one case a diagnostic scar visible at the tip demonstrates that the so-called micro-burin technique was used to obtain a blank with the required length. Four times the tips was positioned at the proximal end of the blank, once the remains of the butt were preserved at the base. Only four arrowheads were recovered from pits ceramically dated to the second, LBKII habitation phase (2 symmetric, 1 right-winged and one irregular), consequently there was no need to consider them separately.

In terms of the interpretation advocated by Löhr and Jeunesse, the high percentage of asymmetric arrowheads would indicate that the indigenous (and partly southwestern) influence on arrowhead morphology was already clearly present in the Graetheide region during the Early LBK. Additionally, the presence of almost equal amounts of left- and right-winged points would refute Jeunesse's claim that the Dutch LBK belonged exclusively to his right-winged region, inhabited by people making Limburg Pottery, but would be in accordance with JKV's location in a region where La Hoguette and Limburg pottery are both found (even though La Hoguette pottery is absent at the site itself).

Three microlithic points were found at the site, all in pit 91.124, dating to ceramic phase 1. Two of these are so-called B-points: they show a steep direct retouch running from the tip part way down the left side of the blank. One (25-12-3 mm) has a truncated base, the other (22-11-3 mm), made on a flake fragment, has a fracture at its base. The third is a fragment that could not be classified. As B-points mainly occur during the Early Mesolithic, they must be regarded as remnants from an earlier occupation of or visit to the site. Characteristic Late Mesolithic artefacts, such as broad trapezes or mistletoe leaf points, are absent.

At the other side of the time-scale, the fragment of a polished axe with oval cross-section clearly postdates the Bandkeramik occupation, as – probably – does a high, double end-scraper made of flint of the Zeven Wegen type.

In Chapter 11 A.E. van Gijn discusses the results of an extensive use-wear analysis, showing among other things that tools may have been used for several different activities, regardless of their morphology. Actual retooling, i.e. turning one tool type into another through retouching, was not a common practice, the most striking examples being three arrowheads and one borer made out of former sickle inserts.

10.4 Dimensions of cores, blanks and tools

The cores and hammerstones recovered at JKV are quite small. With a mean length of 55.2 mm the discarded blade cores are considerably shorter than those of the younger LBK site Beek-Kerkeveld (mean length 71.6 mm) and at the Banholt extraction site (87.4 mm). This even holds true for the cores of the second habitation period that are coeval with the Beek material.

Given the low numbers of dated cores in most of the phases, it was decided to group cores from the four first settlement phases together (Table 10.7). There are no differences in

Phase	mean (mm) / median / stdev / range	L	W	Th
Early (Habitation Phase 1-4) N= 44	mean (mm)	53.7	44.9	34.0
	median	54	47	34
	stdev	11.6	9.6	8.1
	range	31-80	24-67	13-53
Late N=8	mean (mm)	56.1	46.5	38.1
	median	54	43.5	38.5
	stdev	13.3	10.1	11.0
	range	42-87	37-69	24-57
X N=29	mean (mm)	57.2	48.8	38.3
	median	57	48	38
	stdev	15.3	15.8	15.3
	range	31-111	24-109	12-100
All N=81	mean (mm)	55.2	46.4	36.0
	median	55	47	36
	stdev	13.1	12.2	11.5
	range	31-111	24-109	12-100

Table 10-7 Dimensions of cores

average size between cores subsequently used as hammerstones and the unmodified cores (Table 10.8), or between blade cores and flake cores (Table 10.9).

The core rejuvenation tablets present at the site show, however, that the blade cores initially were considerably larger: on average at least 18 mm in length (corresponding to the mean thickness of the rejuvenation tablets), at least 15 mm in width and at least 10 mm in thickness (Table 10.10).

The blades are rather stocky, three quarters (76.5%) of them have a length:width ratio between 1:2 and 1:3. (48.1% between 1:2 and 1:2.5). (Fig. 10.4). With a mean length of 40 mm, they fit nicely with the size of the cores. The blades from the LBK II habitation seems to be slightly shorter than average, a surprising observation as in general the Younger LBK blades in the region are longer than the early ones (cf. Newell 1970; Bohmers and Bruijn 1958/1959; De Grooth 1987).

	Cores				Hammerstones			
		Length	Width	Thickness		Length	Width	Thickness
Early (phase 1-4)	mean	52.7	41.2	26.2		54.1	46.3	37.1
	median	51	41.5	26.5		55.5	48	36
	sd	14.2	11.2	5.1		10.6	8.7	7.0
	range	31-75	24-67	13-33		32-80	28-64	25-53
	N=12				N=32			
All	mean	55.2	44.9	30.4		55.2	47.2	38.5
	median	55	43	30		54.5	47.5	38
	sd	14.1	12.6	9.5		12.8	12.1	11.5
	range	31-87	24-69	12-57		32-111	25-109	24-100
	N=25				N=56			

Table 10-8 Comparison of unmodified cores and hammerstones

	Blade Cores/Hammerstones				Flake Cores/Hammerstones			
		L	W	Th		L	W	Th
Early	mean	48.4	43.2	35.8	mean	55.3	45.4	33.5
	median	49	42.5	35.5	median	56	47	32
	sd	7.3	7.7	6.2	sd	12.2	10.1	8.6
	range	36-70	33-62	25-50	range	31-80	24-67	13-53
	N=10				N=34			
All	mean	55.0	47.3	39.3	mean	55.3	46.1	34.5
	median	54.4	47.5	40	median	55	47	33
	sd	11.6	9.7	8.2	sd	13.8	13.2	12.4
	range	35-87	35-69	25-57	range	31-111	24-109	12-100
	N=22				N=51			

Table 10-9 Comparison of blade cores and flakes cores

	Tablets					Cores			
		L	W	Th	Surface		Platf L	Platf W	Surface
Early	mean	60.8	47.7	17.5	2520		42.5	36.5	1580
	median	60	44	17	2795		42.5	35.5	1438
	sd	12.1	12.3	5.7			7.1	7.6	
	range	37-82	30-77	9-30			33-54	25-52	
	N= 31					N=10			
All	mean	62.1	48.7	18.2	3003		47.6	39.7	1946
	median	61	47	17	3039		46	40	1955
	sd	12.0	10.9	5.9			10.0	8.6	
	range	37-93	30-77	9-35			33-69	25-57	
	N=52					N=24			

Table 10-10 Dimensions of core rejuvenation tablets compared to blade cores

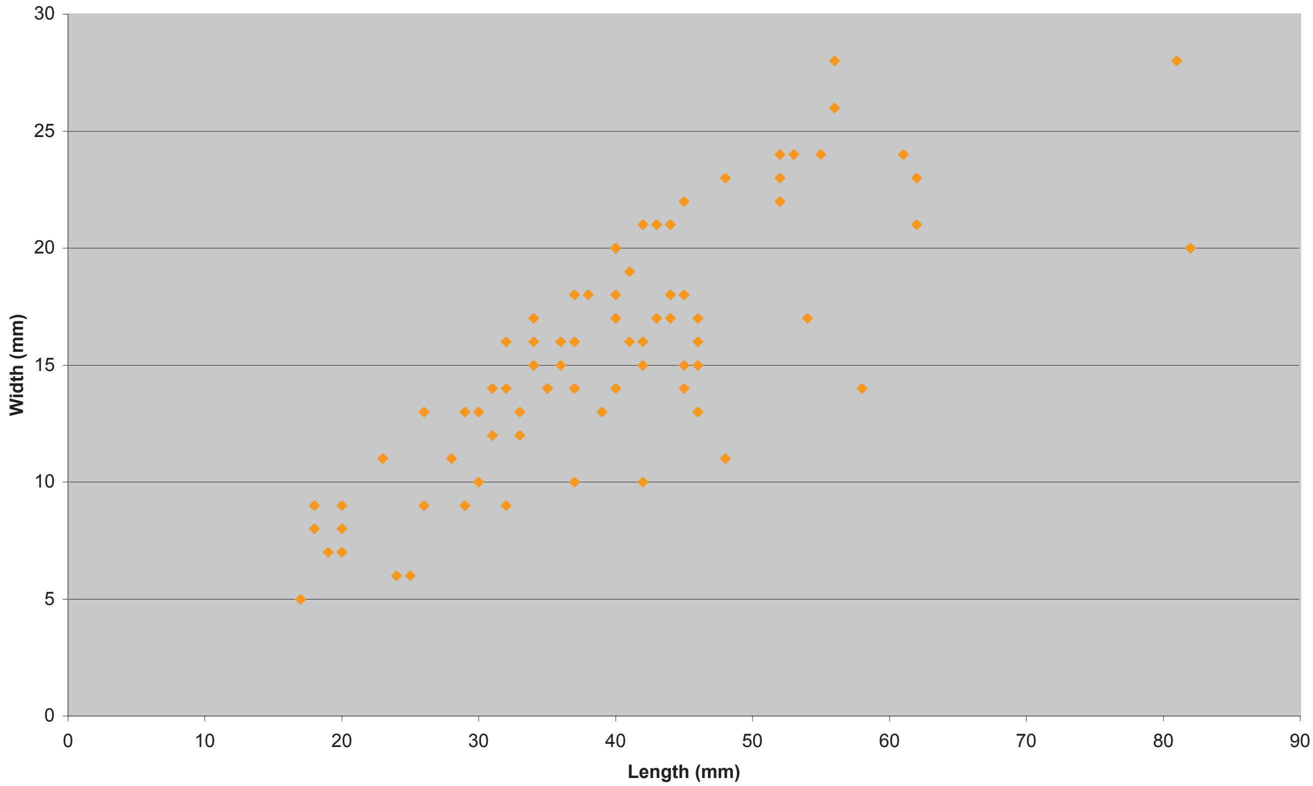

Fig. 10-4 Dimensions of complete blades

At first sight, the dimensions of the blade tools (sickle inserts, truncated blades, borers, and end-scrapers made on blades) are similar to those of the unmodified blades (Tables 10.11, 10.12). These figures are, however, negatively influenced by the end-scrapers. The other blade tools categories are considerably longer and wider than the unmodified blades (Fig 10.5). This indicates that many of the complete unmodified blades were discarded as wasters, unsuitable for making tools (but see Van Gijn, Ch. 11, on their use). End-scrapers differ from the other blade tools in having the working edge perpendicular to the long axis of the blank, and thus get shortened during use. It remains puzzling however that the borers are not affected in a similar way.

10.5 Spatial observations

By students of Bandkeramik settlements it is generally assumed that most of the material found in the pits of a farmstead was secondary rubbish, discarded close to the places of origin during the time the farm was in use. Apart from this direct discard, the pits would have contained in the

Phase mean median stdev range	L	W	Th
Early (Habitation phases 1-4)	40.3	16.0	5.5
N=53	40	15.5	5
	12.3	5.5	3.7
	17-81	5-28	2-21
Late	26.0	10.0	3.7
	27.5	9	3
N=6	5.9	2.5	1.8
	18-33	7-13	2-7
X	43.0	16.6	5.5
	44	17	5
N=23	12.6	4.6	2.3
	18-82	8-24	3-12
Total	40.0	15.7	5.3
	40	15.5	5
N=82	12.6	5.3	3.2
	17-82	5-28	2-21

Table 10-11 Dimensions of entire unmodified blades

Phase mean median stdev range	L	W	Th
1 N=25	39.3 36 13.2 23-81	21.2 21 5.2 11-33	6.5 6 2.3 4-14
2 N=20	44.9 44.5 15.3 22-86	21.6 20 4.8 15-30	7.5 7 2.8 4-15
3 N=31	38.5 39 11.1 16-65	22.4 22 5.9 13-39	7.1 7 2.1 4-13
4 N=26	37.9 36 10.6 24-76	22.7 22 4.7 15-31	7.0 7 1.5 5-9
Early N=102	39.8 38 12.5 16-86	22.0 22 5.2 11-39	7.0 7 2.2 4-15
Late N=27	37.7 36 9.0 24-60	22.7 23 4.6 12-31	7.7 8 2.0 4-12
X N=45	39.3 38 11.1 21-74	20.4 21 5.7 8-30	7.3 8 2.5 4-13
All N=174	39.3 37 11.6 16-86	21.7 22 5.3 8-39	7.2 7 2.2 4-15

Table 10-12 Dimensions of complete blade tools (arrowheads excluded)

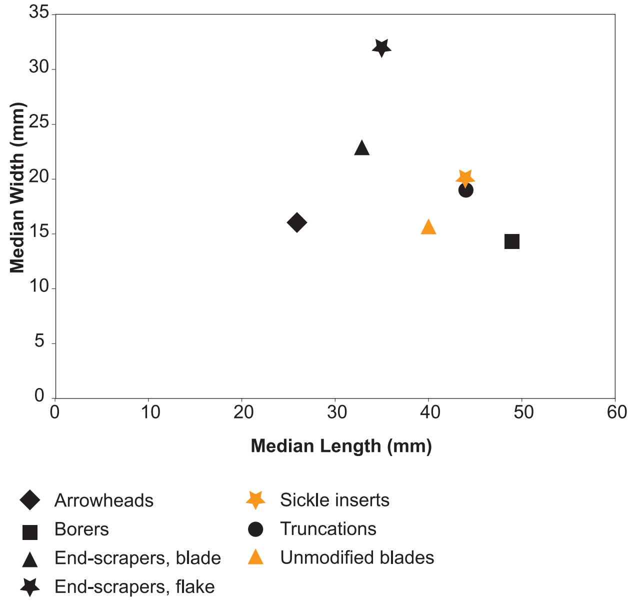

Fig. 10-5 Dimensions of complete tools and blades

	mean	Npits
Associated with houses	54.0	123
Not associated	14.1	56

Table 10-13 Average number of flints in pits (containing at least three artefacts)

lower layers some accidentally washed-in surface material from all stages prior to the digging and, in the top of the fill, a mixture of contemporary, earlier and later primary and de facto refuse, which was discarded on the surrounding surface and had slipped down during the filling-in process (Schiffer 1976; Van de Velde 1979; De Grooth 1987).

At JKV, the majority of flints were recovered from the lateral construction pits (*Längsgruben*) situated alongside the houses (Table 10.13). In the Early habitation phase there are, however, some well-dated pits containing considerable numbers of flint artefacts that could not be assigned to a specific house. Pits connected with all house types contained on average a considerable amount of flints. This picture is however somewhat distorted because of the huge amount (N = 593) of flints recovered from pit 48021, alongside the type1a house 39 of the Late habitation phase. In the early habitation phase, pits along the type 1b and 1c houses contained the highest amounts of flints (Table 10.14).

Despite the good state of preservation, no pits filled with huge masses of flint debris (*amas de débitage* cf. Allard 2005), as found at Beek-Kerkeveld (De Grooth 1987) and many Belgian Bandkeramik sites, e.g. Liège-Place St. Lambert (Cahen 1984), Verlaine-Petit Paradis (Allard 2005), were excavated at JKV. Apparently at those sites a different method of refuse disposal was used.

In an earlier analysis (Louwe Kooijmans *et al.* 2003), different spatial groupings were suggested for the JKV house plans. Where Louwe Kooijmans postulated the existence of four ‘yards’ and three ‘activity areas’, Van de Velde saw two wards, in the northeastern and southwestern part of the settlement respectively. As it is the simplest, here the latter division is used as the basis for an analysis of the spatial aspects of JKV flint working.

House type	All			Early		
	Mean	N pits	N houses	Mean	N pits	N houses
1a	48.2	20	6	22.3	16	5
1b,1c,1x	60.1	69	27	73.8	53	21
2b,2c,2x	36.9	19	10	38.3	17	7
3c,3x	41.0	14	8	42.5	11	5

Table 10-14 Average number of flint artefacts in pits associated with different house types; pits containing at least 3 flint artefacts

In both wards the highest amounts of flints were retrieved from the lateral extraction pits. The NE and SW wards comprise an equal number of houses (each c. 30), and a similar number of pits contained at least 3 flint artefacts (82 in the northeastern and 97 in the southwestern ward). There are, however, striking differences in the amounts of flint found at these spatial entities (Table 10.15). Only 34% of all flint artefacts are associated with the NE ward, and 66% with the SW ward[2].

As the SW pits with the highest amounts of flakes were mainly investigated during the 1990 campaign, at first this pattern was thought not to be the result of past human behaviour, but to derive from differences in excavation strategies, with more careful retrieval of material during the trial excavation. A comparison of the upper quartile of flint-rich pits, however, falsified this assumption: the 1990 SW pits did not differ from the 1991 ones (both SW and NE) in the average weight of unmodified flakes or in the percentage of chips, and the pits were evenly distributed over the three entities (Table 10.16). Moreover, Van de Velde noted one important disparity regarding the pottery associated with houses from both wards. The average numbers of pots per house are 54.8 in the SW ward, *vs.* 38.5 in the north-eastern one, and the numbers of thin-walled pots are 22.6 and 14.1 respectively. According to Van de Velde (Chapter 15), these differences are in part the result of real differences in household size, and in part the effect of erosion, as more erosion took place in the northeastern part of the settlement. Therefore, the SW-NE dichotomy in the amount of flints should also be explained in terms of past human behaviour.

The figures are not stable but change with time (Table 10.17). Of the 42 pits dated to the Early LBK and containing at least 15 flint artefacts, 24 are located in the SW ward (= 57%), and 18 (43%) in the NE ward. 76% of the dated ‘Early’ flints, however, derived from SW pits, and only 23% from NW ones. Consequently, the SW pits contain higher amounts of flints (mean 154.6) than those in the NW (mean 63.8, both for pits containing at least 15 artefacts[3]). In the Late (LBKII) occupation this is the other way round: whilst 8 dated pits (67%) lie in the SW ward and 4 pits (33%) in the NE ward, 70% of all dated flint artefacts are associated with the NE ward, and only 30% with the SW ward. In this phase, the average amount of flint in NE pits is much higher than that of the SW ones (193 vs. 42). Moreover, the two wards do not only differ in the absolute amounts of flint recovered, but also in proportions of main artefact categories.

Type N column % row %	NE	SW	All
Cores/hammerstones	30 1.2 40.0	45 0.9 60.0	75 100.0
Flakes	1798 71.3 33.2	3620 73.8 66.8	5418 100.0
Blades	346 13.7 34.5	661 13.5 65.5	1007 100.0
Tools	294 11.7 37.5	491 10.0 62.5	785 100.0
Others	54 2.1 38.0	88 1.8 62.0	142 100.0
N	2522 100.0 34.0	4905 100.0 66.0	7427 100.0

Table 10-15 Comparison of the amounts of flints in the two wards (pits with at least 3 flints)

	SW90	SW91	NE91
Chips (%)	15.2	15.3	17.2
Mean weight flakes (gr)	5.5	7.6	6.0
Mean weight All	5.5	6.3	5.3
N pits	6	7	6

Table 10-16 Comparison of upper quartile of pits (according to total amount of flints), between South-western ward (excavation 1990 and 1991) and North-eastern ward (excavation 1991)

	Early			Late			X		
Types N Column % Row %	NE	SW	All	NE	SW	All	NE	SW	All
Cores/ Hammerst.	16 1.4 34.0	31 0.8 66.0	47 100.0	3 0.4 37.5	5 1.5 62.5	8 100.0	3 1.1 42.9	4 0.8 57.1	7 100.0%
Cort. flakes	235 20.4 24.3	733 19.7 75.7	968 100.0%	102 13.2 63.0	60 18.0 37.0	162 100.0	49 17.3 30.6	111 22.1 69.4	160 100.0
Noncort. Flakes	369 32.0 21.3	1363 36.7 78.7	1732 100.0%	323 41.9 75.8	103 31.0 24.2	426 100.0	108 37.8 40.9	156 31.0 59.1	264 100.0%
Chips	97 8.4 15.6	526 14.2 84.4	623 100.0%	183 23.7 83.2	37 11.1 16.8	220 100.0	24 8.4 22.9	81 16.1 77.1	105 100.0%
Blades	183 15.9 27.3	487 13.1 72.7	670 100.0%	68 8.8 57.1	51 15.4 42.9	119 100.0%	33 11.5 32.4	69 13.7 67.6	102 100.0%
Tools	152 13.2 29.9	356 9.6 70.1	508 100.0%	57 7.4 55.3	46 13.9 44.7	103 100.0%	45 15.7 50.0	45 9.0 50.0	90 100.0%
Others	101 8.8 31.9	216 5.8 68.1	317 100.0%	35 4.5 53.8	30 9.0 46.2	65 100.0	24 8.4 39.3	37 7.3 60.7	61 100.0%
N	1153 100.0% 23.7	3712 100.0% 76.3	4865 100.0%	771 100.0% 69.9%	332 100.0% 30.1	1103 100.0%	286 100.0% 36.2	503 100.0% 63.8	789 100.0%
N pits	18 43%	24 57%	42 100%	4 33%	8 67%	12 100%	11 48%	12 52%	23 100%

Table 10-17 Differences in important artefact categories between the wards in Early, Late and undated pits (for pits containing at least 15 flint artefacts)

It is not easy to assess these figures looking only at percentages, firstly because of their interdependence and secondly because of the enormous difference in frequency between e.g. unmodified flakes and cores. Therefore, the mutual proportions of the categories are given as well (Table 10.18).

	Early		Late	
	NE	SW	NE	SW
Flakes : Blades+Tools	2.3:1	3.3:1	5.1:1	2.3:1
Flakes : Cores	48.2:1	89.3:1	210.3:1	44.4:1
Blades+Tools : Cores	21.0:1	27.2:1	41.7:1	19.4:1

Table 10-18 Proportions of main artefact categories in the two wards in Early and Late habitation

Although during the Early LBK all artefact categories are underrepresented in the pits of the NE ward, this is especially the case for the unmodified flakes and the chips. The distribution of cores/hammerstones, rejuvenation pieces and tools (and to a lesser extent unmodified blades) is considerably less biased. A more detailed analysis, at the level of house generations, is hazardous because of the very low number of datable pits per ward in most of the phases (Table 10.19). The main SW flint working activities however seem to be concentrated continuously in the same area until phase 4, when the distribution becomes more balanced. In the Late habitation, pit 48021 (belonging to type 1 house 39) contained debris resulting from similar intensive flint working.

There is however no evidence for specialist activity in the use of tools at either the ward or the household level. During

	E1		E2		E3		E4	
	NE	SW	NE	SW	NE	SW	NE	SW
Cores	8	5	7	4	0	18	1	4
Flakes	173	498	413	615	44	1320	141	334
Blades	47	111	76	97	11	214	49	65
Tools	27	75	68	61	6	176	52	44
N	265	712	583	780	61	1760	245	460
Npits	7	3	6	2	2	14	3	5
Mean	37.9	237.3	97.2	390.0	30.5	125.7	81.7	92.0

Table 10-19 Main artefact categories in the two wards, during the four Early LBK habitation phases

all phases the main tool categories were discarded (after use and/or maintenance) in both NE and SW wards by several coeval households (Table 10.20). Nor is there any evidence for differences in the rate of recycling and/or retooling, or in the use of rare raw materials between the two wards (Table 10.21). The lower amounts of tools (and blades) discarded in the northeastern ward may be seen as another indication for the difference in household sizes postulated by Van de Velde on the basis of the amounts of pottery (cf. Chapter 15).

10.6 The organisation of flint working

To get a better insight into the mechanisms underlying the spatial variation observed in the previous section, and thus in the way flint working was organised at JKV, a Principal Component Analysis was performed, as this statistical technique had proven a useful aid in distinguishing underlying patterns of co-variation in the comparable data-set of Elsloo (De Grooth 1987).

Principal component analysis is a method of transforming a given set of variables into a new set of composite variables

	NE Ward	SW Ward	Total
Hesbaye	12	21	33
Emael	9	18	27
Gravels	8	9	17
Rullen	2	3	5
Zeven Wegen	1	3	4
N	32	54	86
	37.2%	62.8%	100.0%

Table 10-21 Distribution of rare raw materials in the two wards

or principal components that are orthogonal (uncorrelated) to each other. It determines what would be the best linear combination of variables, the best in the sense that the particular combination of variables would account for more of the variation in the data as a whole than any other linear combination of variables. The first principal component, therefore, may be viewed as the single best summary of linear relationships exhibited in the data. The second component may be defined as the linear combination of variables that accounts for most of the residual variance after the effect of the first component is removed from the data etc (Doran and Hodson 1975; Nie et al. 1975).

The eigenvalues associated with each component represent the amount of total variance accounted for by the factor. Therefore, the importance of a component may be evaluated by examining the proportion of the total variance accounted for. By selecting only PCs with an eigenvalue greater than (or equal to) 1, one ensures that only components accounting for at least the amount of total variance of a variable will be treated as significant.

The analyses were performed by P. van de Velde with the SPSS statistical package.

Because of the often wide scatter of ceramic dates for pits associated with many houses (cf. Ch. 14), it was decided to

Ward	Phase	arrowheads	borers	end-scrapers	sickle inserts	truncations
NE	E1 (7)	4 (4)	2 (2)	12 (3)	4 (2)	1 (1)
	E2 (6)	4 (3)	5 (4)	15 (4)	10 (5)	10 (5)
	E3 (3)	2 (1)	1(1)	2 (1)	5 (3)	2 (2)
	E4 (3)	2 (1)	1 (1)	22 (3)	5 (3)	4 (2)
	L (5)	3 (2)		20 (5)	6 (4)	3 (2)
	X (58)	9 (8)	4 (4)	27 (20)	12 (7)	4 (4)
SW	E1 (3)	3 (1)	4 (1)	23 (2)	13 (2)	5 (3)
	E2 (2)	8 (1)	6 (1)	8 (2)	16 (2)	4 (2)
	E3 (15)	18 (7)	6 (4)	49 (12)	26 (11)	16 (8)
	E4 (6)	2 (2)	5 (3)	15 (4)	8 (3)	1 (1)
	L (10)	4 (3)	2 (2)	9 (4)	6 (3)	2 (2)
	X (61)	6 (6)	3 (2)	27 (18)	15 (9)	4 (4)

Table 10-20 Distribution of main tools types in the two wards through time (Npits)

CORES
HAMMERSTONES
HAMMERSTONE FRAGMENTS
PRIMARY CORTEX FLAKES
SECONDARY CORTEX FLAKES
CRESTED BLADES
REJUVENATION FLAKES
FLAKES WITHOUT CORTEX
CHIPS
COMPLETE BLADES
PROXIMAL BLADE FRAGMENTS
MEDIAL BLADE FRAGMENTS
DISTAL BLADE FRAGMENTS
ARTIFICIAL BLOCKS
ARROWHEADS
BORERS
END-SCRAPERS
SICKLE INSERTS
TRUNCATED BLADES
SIDE-RETOUCHED BLADES
OTHER TOOLS

Table 10-22 Variables used in initial Principal Component Analysis

	PC1 Eigenvalue 2.2 Variance 28.1%	PC2 Eigenvalue 1.5 Variance 18.8%	PC3 Eigenvalue 1.4 Variance 17.2%
CORTPRIM	-0,10	-0,51	0,61
CORTSEC	0,36	-0,01	0,75
REJU	0,49	0,60	-0,11
NOCORTFL	-0,79	0,01	-0,07
CHIPS	-0,61	0,06	-0,35
COREHAM	0,11	0,82	0,25
BLADEPM	0,67	-0,20	-0,39
TOOLS	0,64	-0,40	-0,30

Table 10-23 Result of final Principal Component Analysis

use the pits rather than the houses as the unit of analysis, with the exception of five cases where the pits associated with a house were reliably dated to the same ceramic phase. To decrease the influence of missing values, only pits containing at least 15 flint artefacts were used as cases. Initially, 21 main artefact categories served as variables (Table 10.22). Their raw counts were converted to percentages to ensure that the smaller finds counted as heavily as the large ones.

The initial results indicated that several typomorphologically related variables behaved in a similar way. They were lumped together, again in an effort to reduce noise. This concerned all tools, cores and hammerstones, proximal and medial blade fragments. Finally, variables that did not load significantly (i.e. at least +/- 0.4) on one of the first three PCs were discarded. Thus, the final analysis comprised 49 well-dated pits/houses as the cases, and eight artefact categories as the variables: primary cortex flakes; secondary cortex flakes; flakes without cortex; chips; rejuvenation flakes; cores/hammerstones; proximal/medial blade fragments and tools.

The SPSS mineigen criterion (eigenvalue higher than 1) selected three PCs, accounting for 64% of total variance (Table 10.23). The first two PCs are bipolar, with both high positive and high negative loadings for some variables, the third is specific, with only high positive scores (Table 10.24). On the first PC, high positive loadings for tools and proximal/medial blade fragments oppose high negative loads for non-cortical flakes and chips. Thus, this PC seems to reflect an opposition between pits filled with production waste and pits where tools were discarded after use. The high positive loadings for unmodified proximal and medial blade fragments on this first PC indicates that they may have served to a large extent as tools too (cf. Chapter 11 on use wear analysis).

The second PC has to do with different stages in the core reduction, as decortication flakes are opposed to rejuvenation and discard of exhausted cores. It indicates that (some of the) cores circulated within the settlement after initial preparation, and subsequently were reduced and rejuvenated elsewhere.

The third, specific, PC again should have something to do with the first stage (decortication) of the reduction sequence.

	PC1	PC2	PC3
High positive	tools proximal/medial blade fragments	cores/hammerstone rejuvenation flakes	primary and secondary cortex flakes
High negative	non-cortical flakes chips	primary cortex flakes	

Table 10-24 Highest loadings in final Principal Component Analysis

FEATURE	Ward	HOUSE	type	PHASE	PC1	PC2	PC3	PC1loading	PC2loading	PC3loading
41019	N	24	t1a	E3	-2,20	-0,11	-1,75	H –		
48021	N	39	t1b	L	-1,57	-0,18	-0,84	H –		
94052	S	.		E2	-1,25	-0,21	-1,02	H –		
44012	S	14	t3	E4	-1,23	-0,11	-0,88	H –		
58016	S	16	tx	L	-1,16	-0,36	-1,08	H –		
H02	S	02	t2	E3	-1,12	-0,05	0,60	H –		H +
10036	N	36	t1a	L	-1,02	-1,78	0,44	H –	H –	
19087	N	57	t2	E1	-1,02	-0,86	0,54	H –	H –	H +
24026	S	?35	t1a	L	-0,99	0,92	0,17	H –	H +	
91123	S	.		E4	-0,89	-1,77	2,66	H –	H –	H +
91117	S	?01	t1b	E3	-0,78	1,18	-0,59	H –	H +	
92023	S	04	t1b	E2	-0,77	-0,27	-0,33	H –		
20027	N	49	t2	E2	-0,70	-0,29	0,34	H –		
31021	S	?12	t2	L	-0,63	0,44	1,56	H –		H +
49104	N	24	t1a	E1	-0,61	1,17	0,18	H –	H +	
53037	N	62	tx	L	-0,53	0,14	-0,59	H –		
31075	S	13	t1b	E3	-0,51	-0,22	0,20	H –		
10040	N	?58	t2	L	-0,43	0,84	-0,47		H +	
H09	S	09	t1b	E4	-0,35	-0,34	0,70			H +
92001	S	04	t1b	E3	-0,26	-0,56	-0,95		H –	
32145	S	.		E1	-0,25	-0,73	0,24		H –	
22019	N	37	t3	E1	-0,20	2,85	0,61		H +	H +
91124	S	03	t1b	E1	-0,10	-0,46	0,48			
26090	N	57	t2	E2	-0,09	-0,02	2,62			H +
H17	S	17	t3	E3	-0,09	-0,34	-1,99			
54001	S	?19	t3	E3	-0,03	0,36	-1,91			
10027	N	.		E2	-0,01	-0,16	0,50			H +
H08	S	08	tx	L	0,03	-1,16	0,71		H –	H +
32142	S	.		E3	0,04	0,42	0,54			H +
33065	N	.		E4	0,17	0,15	-1,43			
12002	N	.		E1	0,18	2,98	-0,30		H +	
32144	S	?34	t3	L	0,28	0,75	0,05		H +	
32052	S	33	t3	E3	0,40	-0,17	1,24			H +
45004	N	25	t3	E3	0,45	-0,56	-0,20		H –	
28061	S	10	t2b	L	0,50	0,98	-0,42	H +	H +	
19078	N	59	t1b	E1	0,51	-0,16	0,64	H +		H +
32143	S	?34	t3	E3	0,51	0,86	0,12	H +	H +	
57020	N	41	t3	E4	0,61	-1,51	-0,47	H +	H –	
53010	N	42	t3	E2	0,75	-0,49	-0,55	H +		
H23	S	23	t2	E3	0,75	-0,34	-0,33	H +		
55003	N	45	t3	E4	0,95	-1,59	-0,79	H +	H –	
10038	N	?58	t2	E2	0,97	0,45	-0,27	H +		
54028	S	19	t3	E4	1,20	-0,75	-0,20	H +	H –	
46004	S	.		E1	1,40	0,36	-0,17	H +		
15005	N	56	t3	E1	1,42	2,41	1,80	H +	H +	H +
59007	N	44	t3	E2	1,62	-0,56	0,23	H +	H –	
31125	S	.		L	1,95	-0,26	-1,99	H +		
49098	N	?23	t2	E1	1,99	-0,97	1,22	H +	H –	H +
14002	S	19	t3	E3	2,60	-0,39	-1,15	H +		

Table 10-25 Distribution of factor scores in final PCA (units sorted according to scores on PC1). Col. 'ward': N=NE, S=SW.

In a subsequent step, the cases that show many of the characteristics compounded by these PCs were identified through computing their so-called 'factor scores' (Table 10.25).

For all three PCs houses/pits with high positive and high negative factor scores occur in all habitation phases, indicating that none of the PCs should be interpreted in chronological terms. This is not really surprising, given the limited time depth of habitation at JKV (and the substantial hiatus between the Early and Late habitation phases).

A cluster of pits, whose factor scores indicate that they were important in the early stages of the reduction process, is located in the central part of the southwestern ward, whereas pits with high positive scores on PC1 (connected with tool use) have a more marginal position in the southwestern ward, and in the northeastern part of the settlement (Fig. 10.6).

The pattern, however, is much less clear cut than one would have liked: although the PCs are by definition (mathematically) independent of one another, about half of the pits/houses marked as 'consumers of tools and blades' by their scores on PC 1, also have high scores for one or both of the other PCs, and thus would have contributed to the production as well.

Nevertheless, it seems plausible to conclude that different production strategies were employed by JKV's inhabitants. Although in every habitation phase flint was worked in most of the households (witness the ubiquitous presence of unmodified flakes and rejuvenation pieces), during the Early LBK habitation households in the central part of the south-western ward were slightly more intensively involved in the early stages of core reduction than others. Some of the prepared cores were subsequently transferred to the NE ward, where the further reduction and tool production took place (but see section 8 for an alternative interpretation).

A similar overlapping of different modes of production (Van de Velde 1979) has been described for Elsloo (De Grooth 1987). There too evidence for the presence of

Fig. 10-6 Location of features with high loadings for tool use on PC1

'ad hoc' specialists was found. During every micro-phase one of the households worked more flint, in a more efficient way, and transferred part of the blanks and tools manufactured to be used and discarded by the other households in the settlement. It should be stressed, however, that both at Elsloo and at JKV, this 'loose mode of production' was of minor importance in comparison to the domestic one.

10.7 Diachronic observations

Apart from the spatial differences outlined in sections 5 and 6, the JKV assemblage also displays important diachronic variation (Table 10.26). In all habitation phases, the percentage of unmodified flakes at JKV is very high (between 67.4% and 77.3%), as is the percentage of unmodified flakes with cortex (between 34 and 39%). Again, not only the percentages but also the mutual proportions of main artefact categories are helpful in an assessment (Table 10.27).

In the first habitation phase (E1) the proportion of flakes to cores is considerably lower than in the other phases, as is the proportion of flakes to blades plus tools. Two main interpretations are feasible for this phenomenon. In the first, the phase E1 assemblages have too few flakes for every core, and the situation in the other phases is regarded as standard. If, alternatively, the phase E1 situation is regarded as standard, the other phases would have too many flakes, i.e. too few cores.

Phase	JKVE1		JKVE2		JKVE3		JKVE4		JKVL	
	N	%	N	%	N	%	N	%	N	%
Type										
Cores/hammerst.	13	1.3	11	0.8	18	1.0	5	0.7	8	0.8
Hammerstone fragm.	27	2.8	28	2.1	43	2.4	11	1.6	20	1.8
Crested blades	10	1.0	7	0.5	11	0.6	4	0.6	2	0.2
Rejuvenation flakes	22	2.3	29	2.1	46	2.5	9	1.3	25	2.3
Flakes with cortex	213	21.8	261	19.2	356	19.6	138	19.6	162	14.7
Flakes without cortex	354	36.2	466	34.2	693	38.1	219	31.1	426	38.6
Blades with cortex	34	3.5	41	3.0	46	2.5	19	2.7	18	1.6
Blades without cortex	114	11.7	125	9.2	166	9.1	91	12.9	99	9.0
Tools blades/flakes	102	10.4	129	9.5	182	10.0	96	13.6	103	9.3
Chips (<15 mm)	55	5.6	244	17.9	226	12.4	98	13.9	220	19.9
Artificial blocks	33	3.4	22	1.6	32	1.8	15	2.1	20	1.8
Total	977	100.0	1363	100.0	1819	100.0	705	100.0	1103	100.0

Table 10-26 Amounts and percentages of artefacts through time

	JKVE1	JKVE2	JKVE3	JKVE4	JKVL
Flakes: Blades+Tools	2.6	3.4	3.4	2.3	3.8
Flakes: Cores	51.6	93.5	75.8	95.0	106.6
Blades+Tools: Cores	20.0	27.5	22.5	42.0	27.8
Blades: Tools	1.6	1.3	1.2	1.2	1.2
N	977	1363	1819	705	1103

Table 10-27 Proportions of main artefact categories through time

In the first case, during phase E1 flakes would have been underrepresented at JKV because the preparation of (some of the) cores had taken place elsewhere, e.g. at the extraction sites, whilst during the other phases unprepared cores were brought into the settlement. As this practice would not influence the intensity of blade and tool production at the site, one would expect the proportions of blades and tools to cores to be similar for all phases. This clearly not being the case, the alternative interpretation seems to fit better. As it is known that flints of the Western Lanaye type circulated widely throughout the Bandkeramik world, the most plausible scenario would be based on the assumption that production and use of cores was a local affair during phase E1, but that in the other phases part of the cores prepared at the settlement were not discarded there but exported. Moreover, the fluctuations in the ratio of cores to blades plus tools, and of flakes to blades plus tools indicate that this export may have occurred at different stages in the reduction process as well. It is not easy to interpret these figures in more detail, partly because they may be the result of several different strategies, partly because of the many parameters involved. A tentative interpretation would be:

E1: local production; no cores, but some (un)modified blades were exported (hence the relatively low proportion of blades and tools in relation to both flakes and cores).

E2: local production, but part of the cores were exported (hence the higher ratio of flakes : cores), possibly some of them after preparation, some after initial blade production (resulting in a higher ration of blades plus tools to cores).

E3: part of the cores were exported after preparation (given the low ratio of blades plus tools to cores); the amount of exported cores may have been somewhat lower than in the preceding phase.

E4: the amount of exported cores increased again, but export mainly took place after initial blade production (hence the high ratio of blades plus tools to cores).

A corroboration of this interpretation is provided by a comparison of the size of blade cores and rejuvenation tablets discarded at JKV. The differences in surface of the striking platforms and of the complete rejuvenation tablets, allow for an estimate of the amount of blades to be made (Fig. 10.7). The median platform surface of cores is

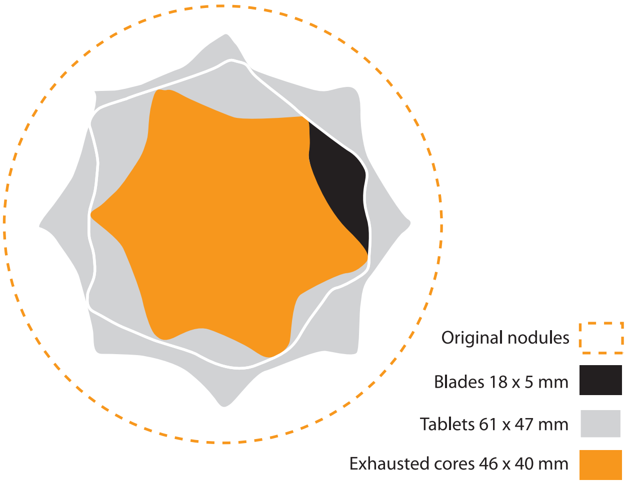

Fig. 10-7 Relationships between surface of blades, blade cores and tablets

1955 mm², the complete tablets have a median surface of 3039 mm² . Thus, a median surface of 1084 mm² was removed during one stage of blade production. Given a median surface (i.e. width × thickness) of 90 mm² per blade, c. 12 blades would have resulted (Table 10.28). Presuming that the same number of blades was produced before core rejuvenation, every core might have yielded some 25 blades. If most cores discarded at JKV originally produced blades, the proportions of cores to blades plus tools for the phases E2 and E3 would correspond quite nicely to this estimate, supporting the idea that some nodules were prepared as cores at JKV, but exported before blades were struck from them. In E1 the number of blades/tools is somewhat lower, and in E4 much higher than would be expected. Thus, during phase E1 some (un)modified blades may have been exported, whereas in E4 cores were used for initial blade production at JKV before leaving the settlement.

10.8 Inter-site comparisons

To assess the value of this interpretation, one would like to compare the JKV data with those from the settlements that could have received its flints, especially sites further to the east that used important quantities of Western Lanaye flints, as well as from contemporary settlements in the Graetheide region, located at approximately the same distance from the extraction sites (De Grooth in press).

Unfortunately, at the moment it is impossible to synchronize the JKV chronology with the four micro habitation phases that comprise the Early LBK period at Elsloo (cf. Van de Velde 1979). On the other hand, I am fairly confident that, despite the differences in the analytic techniques applied, one may equal the JKV habitation phases as defined by Van de Velde (Ch. 15) with the House Generations (HG) of the Rhineland, as they are based on the analysis of quite similar decorated pottery. Both phase JKV-E1 and House Generation I belong to the beginning of Modderman's (1970) phase Ib, JKV's generation E4 is situated somewhere during Modderman Ic, as are House Generations IV and V, with HG VI and VII representing Modderman Id, when JKV had been abandoned (cf. D. Mischka 2004, Abb. 9).

The overall number of flint artefacts at LW 8 is considerable: 9532 (Zimmermann 1988, Abb. 576), of which 7554 are assignable to dated features (D. Mischka 2004, Abb. 15). The amount of flint recovered at Langweiler 8 and the other settlements on the Aldenhovener Platte during the Early LBK (comprising the first seven House Generations), however, is so small as to preclude a meaningful comparison at the level of House Generations (Table 10.29). At best one may observe

Blades/blade tools	median width (mm)	median thickness (mm)	median surface (mm²)
	18	5	90
Blade cores/hammerstones	median platform length (mm)	median platform width (mm)	median surface (mm²)
	46	40	1955
Rejuvenation tablets	median length (mm)	median width (mm)	median surface (mm²)
	61	47	3039

Table 10-28 Estimates of the average amounts of blades produced

JKV	E1	E2	E3	E4			
N	977	1360	1819	705			
% unmodified flakes	68.7	75.6	75.0	67.4			
LW8	I	II	III	IV	V	VI	VII
N	49	230	209	553	774	188	262
% unmodified flakes	59.1	61.7	67.5	62.0	64.2	64.9	64.5

Table 10-29 Comparison of the number of flint artefacts and of unmodified flakes at JKV and at LW8 (LW8 according to D. Mischka 2004)

that the percentage of unmodified flakes at JKV is consistently higher than that at Langweiler 8. Given the high percentage of unmodified flakes and of pieces with cortex, as well as a lower amount of unretouched blades and tools than is found at its neighbours, Langweiler 8 is often interpreted as having played a central role in the production and distribution of flint cores and blanks (Kegler-Graiewski and Zimmermann 2003; Zimmermann 1995, 2002). In this early period, however, the differences with the presumed consumer settlements of the Middle Merzbach valley are not really clear-cut. Obviously, it took time for Langweiler 8 to establish itself as a regional flint redistribution centre. Weisweiler 17 is also described as a flint producing central place (Kegler-Graiewksi and Zimmermann 2003; Zimmermann 2006). As this site provided only 214 datable flint artefacts (of which 126 belong to the Early LBK), it is difficult to assess this claim.

Therefore, the comparison had to be performed at a more general level, concentrating on JKV, Langweiler 8 and Elsloo, and looking at the Flomborn period as a whole. Of course, the data may not be used directly to infer differences in the ways flints were worked, without taking differences into account in excavation and sampling methods and in post-depositional processes. The three sites share two handicaps: firstly, the topsoil was removed mechanically, causing the loss of a considerable amount of mainly tools and blades, as witnessed by the excavation at Sittard. There the manually removed topsoil contained 55% of the tools, 56% of the cores and hammerstones, but only 37% of the waste flakes and blades (Modderman 1958/59: 113). Secondly, the pits' contents were not systematically sieved, resulting in the possible underrepresentation of smaller artefacts (Gronenborn 1997). Elsloo and Langweiler 8 were investigated during rescue excavations, often under extreme time stress (Zimmermann 1987: 636), whilst JKV, as a student training project, could be investigated in a (somewhat) more leisurely way. Moreover, the preservation at JKV is considered to be better than at the other sites (Louwe Kooijmans et al. 2003). Both at Elsloo (observation by the present author) and at Langweiler 8 (Zimmermann 1988: 635) only *c.* 3% of the unmodified flakes have a length under 15 mm, against 18% at JKV. The mean weight of unmodified flakes also differs: 5.8 g. (or 7.0 g when the chips are excluded) for JKV *vs.* 9.7 g. for Langweiler 8 (no data on weight are available for Elsloo). These differences, however, could also partly have to do with the intensity of flint working *per se*: where more preparation takes place, more chips and smallish flakes are produced. To neutralize the possible bias caused by JKV being more carefully excavated, its data will be presented with and without chips. Moreover, in view of the observations from the previous sections, data for both wards will be given as well (Table 10.30). From this data a number of observations may be derived:

– The percentage of unmodified flakes at both JKV and Elsloo is considerably higher than that at LW8. At JKV this holds true especially for the southwestern ward.
– The percentage of cores is lowest at JKV, and highest at Elsloo, with LW8 in an intermediate position.
– The ratio of flakes to cores at JKV is very much higher than at both LW8 and Elsloo, not only in the southwestern, but also in the northeastern ward.
– At JKV there are 14 blades and 11 tools for every core; at LW8 7.7 blades and 6.6 tools, and at Elsloo only 3.9 blades and 2.4 tools.
– At JKV seven (or six) flakes are present for every tool; at LW8 four and at Elsloo 10.5.
– At JKV there are 5.4 (or 4.4) flakes for every blade, at LW8 3.6 and at Elsloo 6.4.

	JKVE NE	JKVE SW	JKV Early	JKVEarly (no chips)	LW8 Early	Elsloo Early
% flakes	66.8	74.5	72.7	68.7	63.2	76.0
% cores/hammerst.	1.4	0.8	1.0	1.1	2.3	2.9
% blades/tools	29.2	22.7	24.2	27.8	32.8	18.9
N	1154	3712	4866	4241	1351	3515
Flakes: Cores	48.2	89.3	75.3	62.0	27.5	26.4
Blades: Cores	11.4	15.7	14.2	14.2	7.7	3.9
Tools: Cores	9.6	11.5	10.8	10.8	6.6	2.4
Flakes: Tools	5.0	7.8	7.0	5.7	4.2	10.5
Flakes: Blades	4.2	5.7	5.3	4.4	3.6	6.4

Table 10-30 Comparison of the intensity of flint working at JKV, Langweiler 8 and Elsloo during the Flomborn period. (Elsloo: De Grooth 1987; Langweiler 8: Zimmermann 1988, Abb. 596)

These observations may be interpreted in the following way:

– The three sites under consideration all have very high percentages of unmodified flakes, and thus would qualify as sites where flint has been worked locally. In terms of the models developed by Zimmerman (1995) to study exchange mechanisms on the Aldenhovener Platte, the difference in the percentage of unmodified flakes between JKV and Elsloo on the one hand and Langweiler 8 on the other hand, would indicate that the earlier stages of core reduction were better represented at the former settlements. In other words: some of the cores arriving at Langweiler 8 had been prepared elsewhere.
– As JKV and Elsloo both have a very high percentage of flakes, the low index of flakes to cores at Elsloo cannot be explained by assuming that core preparation was not performed locally. Therefore, I think that the Elsloo cores remained in the settlement, whilst part of the JKV cores were exported. Instead, Elsloo was an exporter of blades, witness its low ratio of blades plus tools to cores. This is corroborated by the high index of flakes to blades plus tools.
– If Langweiler 8 was a receiver of JKV cores, one would expect the flake:core index at this site to have been lower than that of Elsloo. The relatively high index can be understood however when taking into account that Langweiler 8 in its turn was an exporter of further reduced (and rejuvenated) cores (cf. Kegler-Graiewski and Zimmermann 2003). Moreover, if the blades missing at Elsloo were in part transferred to LW8, they help to account for the low ratio of flakes to blades and tools, and the high ratio of blades plus tools to cores.
– A nice corroboration of the idea that JKV exported part of its cores to Langweiler 8 is provided by the size of the core rejuvenation tablets (Table 10.31). Whereas the exhausted cores of JKV and Langweiler 8 have similar sizes, the tablets discarded at Langweiler 8 are considerably smaller, they have served to rejuvenate cores in a later stage of the reduction sequence. The data for the Aldenhovener Platte as a whole and for Hambach 8 (some 10 km to the north-east) confirm the trend, especially as they comprise material from both the Older and the Younger LBK (when cores tend to be larger).
– Both wards at JKV seem to have participated in the export of cores.

The debris recovered at the Banholt extraction site makes the pattern even more complicated, as it yielded not only exhausted blade cores but also quite a number of rejuvenation tablets (collected by the present author). Although the extraction activities here are undated, apart from large polyhedral blades cores such as published by Brounen and Peeters (2009/2001), that bring to mind the cores worked at Beek-Kerkeveld and other Younger LBK sites, smaller cores, closely resembling the JKV material are present as well. Therefore it seems plausible that during some of the time, some of the material was brought into some of the settlements under consideration in the shape of blades produced at the extraction site, as was the case in e.g. the Gäuboden area of southeastern Bavaria (De Grooth 2003a). Thus, although the three settlements were located at approximately the same distance from the extraction sites, they used different procurement strategies, and Langweiler 8 was in part dependent on cores and blades from the Graetheide settlements (Fig. 10.8).

At first sight, this variability in procurement and exchange strategies is surprising, as Bandkeramik long-distance exchange networks generally are thought to be based on long-standing, stable kinship ties that were carefully maintained from one generation to the next (e.g. Krahn-Schigiol 2005; Lech 2003). A general overview of Flomborn-period population dynamics may provide an explanation.

Radiocarbon and ceramic dates alike indicate that JKV was a 'first generation' settlement, as were Geleen-Kluis,

		JKV Early	LW 8 Early (I-VII)	Ald. Platte, general	Hambach 8
Tablets	N	31	8	163	48
	Mean L (mm)	60.8	54.3	56.2	52.0
	Mean W (mm)	47.7	38.5	41.9	37.8
Cores	N	44	18	628	28
	Mean L (mm)	53.7	51.8	56.8	50.6
	Mean W (mm)	44.9	41.2	43.7	34.9
	Mean Th	34.0	28.3	32.1	22.7

Table 10-31 Comparison of the size of rejuvenation tablets and exhausted cores (Ald. Platte & Hambach 8: Hohmeyer Taf. 54, 59; 71, 72. LW 8 Early: data made available by A. Zimmermann, Cologne)

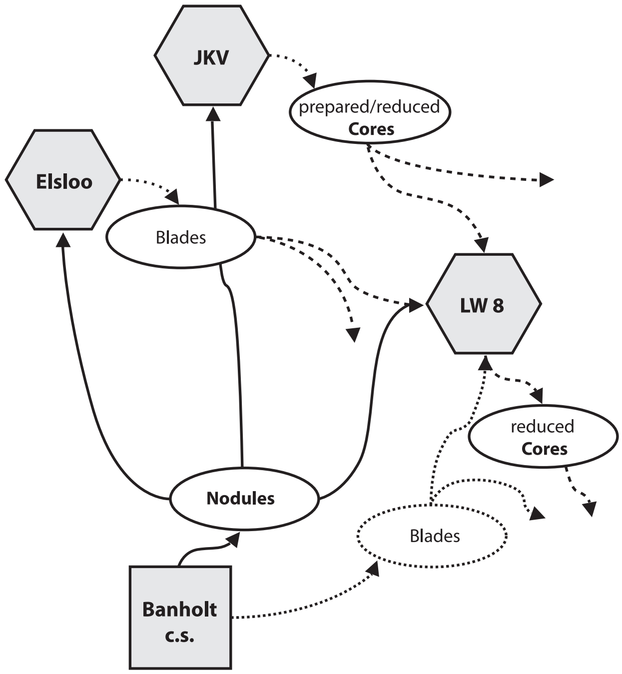

Fig. 10-8 Possible procurement and exchange strategies practised during the Early LBK in the Rhine-Meuse area.
Thick continuous line: direct procurement of nodules. Thick dotted line: transport in the framework of down-the-line exchange.
Thin dotted line: transport after direct procurement and production of blanks at extraction sites.

House generation	N settlements	N Houses
I	1	4
II	7	14
III	8	20
IV	9	23
V	8	24
VI	9	26
VII	9	29

Table 10-32 Summary of Early LBK settlement dynamics along the middle Merzbachvalley and its surroundings during the Flomborn period (after Münch 2005)

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 during the next generations. Several sites in this Hinterland were settled in the same early stage as well, the best-studied being Langweiler 8 on the Aldenhovener Platte. Münch's (1999, 2005; cf. Mischka 2004; Zimmermann 2002) recent re-analysis of this area's decorated ceramics enabled her to give an exemplary insight into the dynamics of settling in the seven house generations of the Flomborn period for this settlement and its neighbourhood, comprising an area of some 25 square kilometres. Inhabitation began at Langweiler 8, with four contemporary houses. In the next generation, not only did the number of houses there increase to 7, but at least six new settlements started, mostly inhabited by a single household. In the next house generations, some of these too grew in size, others remained single farmsteads, or were abandoned. In the last Flomborn generation, almost 30 houses are known to have been inhabited (Table 10.32). Similar dynamics are documented for other parts of the Rhineland (Zimmermann et al. 2004; Claßen 2006), even Erkelenz-Kückhoven, located some 23 km to the north on the northern fringe of the Rhenish loess area, was first settled in House Generation III (Lehmann 2004). At all of these sites, Lanaye flints, in part definitely of the Banholt variety, played an important role.

Given the fact that all settlements under consideration were located within one day's walking distance from the extraction sites, and could acquire alternative raw material of reasonable quality in local river gravels (Weiner 1997), there was no intrinsic need for the establishment of the exchange routines that were shown to exist between JKV (and other early Graetheide settlements) and the Rhenish settlements. On the contrary, 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.

On the one hand, the pioneer situation outlined above would induce people to cherish and maintain kinship ties. On the other hand, this was a time of immense change in settlement and habitation, where one could not depend on traditional, fixed exchange networks alone, but had to be flexible and opportunistic. Yesteryear's trusted exchange partner and his family today may have moved on, or may be bound by obligations to other relations. In such an unstable situation, differentiated procurement and exchange strategies were called for, even on a micro-regional scale. Therefore, the fluctuations in the export of flint found at JKV, in my view are perfectly compatible with the alternation of expansion and consolidation and the multiple networks visible in the Rhineland.

Notes

1 Although this study demonstrated that it is possible to attribute artefacts encountered in a settlement context to specific extraction sites, especially at the assemblage level, a cautionary note should be added: Given the often ephemeral character of the differences described, it seems highly advisable not to rely solely on the descriptions offered in this study, or even on photographs, but to consult the well-documented reference collections established at the archaeological centres in Leiden, Maastricht, Leuven and Cologne.

2 These figures differ from De Grooth 2003b, where it was stated that equal amounts of flints were retrieved at both wards. This discrepancy is caused by the fact that several flint-rich southern pits from the1990 excavation could not be considered at the time of the initial analysis as the relationship between find numbers and features was insufficiently clear.

3 Again, this observation differs from De Grooth 2003b because after Van de Velde's new ceramic analysis presented in this volume, the flint-rich northern pit 48021, belonging to house 39 is now dated to the Younger LBK.

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11 Use-wear analyses of the flint tools from Geleen-Janskamperveld

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A selection of the flint implements from Geleen Janskamperveld was subjected to a functional analysis. The most frequently encountered contact material was hide, similar to what has been demonstrated in other LBK contexts. Quite a large number of cereal harvesting implements were seen as well. Several tools displayed 'polish 23' and 'polish 10', two common but as yet unexplained types of wear traces. Flint was also used for craft activities like wood working and working mineral materials. Traces from contact with bone and antler were virtually absent. Flint tools were therefore employed in both subsistence and craft activities.

11.1 Introduction

The flint of Geleen Janskamperveld was studied extensively from a technological point of view (De Grooth, this volume Ch. 10). However, because the site was excavated for two thirds and was believed to be one of the earliest in the Graetheide cluster, it was decided to also perform a use-wear analysis of a sample of the material. LBK flint is generally in mint condition and forms ideal training material for students to learn the ins and outs of use-wear analysis. A number of student projects were therefore carried out throughout the years. The material for these projects was selected from specific sections within the excavated area. As parts of the flint assemblage got lost shortly after the excavation, only to be found again years later, the sample for use-wear analysis is unevenly distributed across the excavated area. It is therefore impossible to perform a spatial analysis of the different activities inferred.

Use-wear analysis provides information on the activities carried out by means of flint tools at Geleen JKV. Obtaining an idea of the range of tasks carried out at the site was therefore the prime objective of this study. Specific questions relate to whether or not bone and antler objects were manufactured by means of flint tools. So far, the number of bone and antler tools from LBK contexts is very limited, due to preservation circumstances. We therefore have very little knowledge on the significance of bone and antler tools. Strangely enough traces from contact with bone and antler are largely absent on LBK flint implements, something that is in marked contrast with sites from the wetlands. Another focus in the analysis is placed upon the harvesting and the processing of cereals. A final question pertains to a possible specialisation between different households. Unfortunately the sample taken for use-wear analysis does not allow this latter question to be examined.

11.2 Methods and selection

A total of 170 artefacts were selected for the functional study. In this selection all tool types were selected in a proportionate number. Additionally some unmodified flakes, blades and blocks were included as well (table 11.1). Apart from the material analysed in the context of student projects, an additional sample was taken by De Grooth. As the surface of the flint objects was generally in mint condition, the degree of preservation was not a factor of importance in the selection. All tools were cleaned with 96% alcohol to remove grease and dirt; no chemical cleaning was necessary. The edges and ridges of the tools were studied with both a Wild stereographic microscope (magnifications 10-64×) and different Nikon metallurgic microscopes, fitted with Nomarski Interferential Contrast (magnifications 50-560×). A digital camera was used to take photographs of the wear traces (Van Gijn 1990).

tool type	*traces*	*no traces*	*not interpretable*	*total*
unretouched flake	*30*	*10*	–	*40*
unretouched blade	*52*	*4*	*2*	*58*
retouched flake	*6*	*1*	–	*7*
retouched blade	*5*	–	–	*5*
borer	*4*	*2*	–	*6*
point	*5*	–	–	*5*
quartier d'orange	*1*	–	–	*1*
long end scraper	*10*	*1*	–	*11*
round scraper	*1*	–	–	*1*
short end scraper	*27*	–	–	*27*
scraper indetermined	*6*	–	–	*6*
block	*2*	*1*	–	*3*
total	*149*	*19*	*2*	*170*

Table 11-1 The use-wear selection and the presence of traces on the various tool types.

11.3 Activities inferred

The use-wear analysis showed that quite a broad range of activities had been carried out by means of the flint tools (table 11.2). Of the 170 artefacts studied 149 artefacts show traces of use. These 149 tools with use-wear traces displayed 227 actually used zones because some tools had multiple used areas, some up to four (table 11.3). Two artefacts were not interpretable due to post-depositional surface modifications and 19 artefacts did not show any traces of wear (table 11.1). It should be stressed however that absence of wear traces does not imply that an artefact was not used. Artefacts used for a very short interval or on a soft material do not necessarily develop polish when used experimentally (Van den Dries/Van Gijn 1998, 499-502).

	longitudinal	*transversal*	*diagonal*	*boring*	*shooting*	*hafting*	*unsure*	*total*
plant	*1*	–	–	–	–	–	*3*	*4*
cereals	*28*	*1*	*1*	–	–	–	–	*30*
wood	*3*	*4*	–	*1*	–	*4*	–	*12*
hide	*20*	*46*	–	*6*	–	–	*8*	*80*
soft animal	*1*	–	–	–	*4*	–	*1*	*6*
bone antler	–	*1*	–	–	–	–	–	*1*
clay pottery	*1*	–	–	–	–	–	–	*1*
soft stone	–	*1*	–	–	–	–	–	*1*
mineral other	–	–	*1*	–	–	–	*1*	*2*
polish 10	–	*1*	–	–	–	–	*2*	*3*
polish 23	–	*3*	–	–	–	–	*5*	*8*
hard material	–	*2*	–	–	–	–	–	*2*
soft material	*1*	*2*	–	–	–	–	*3*	*6*
unsure	*6*	*8*	–	*3*	–	*1*	*29*	*47*
hafting	–	–	–	–	–	*24*	–	*24*
total	*61*	*69*	*2*	*10*	*4*	*29*	*52*	*227*

Table 11-2 Activities inferred: contact material versus motion

Nr. of Used zones	*Nr. of tools*
0	*14*
1	*74*
2	*100*
3	*27*
4	*12*
totals	*227*

Table 11-3 Frequencies of the number of used zones per tool

11.3.1 Working hide

The predominant contact material is hide: 35% of the used zones (N=80) show traces from the working of hide (table 11.2). This high percentage is due to the fact that scrapers are predominant in our sample and because there is a strong correlation between scrapers and working hide (see below). However, traces of working hide are also seen on flakes, blades and borers (fig 11.1). Hide is for the most part worked in a transverse, scraping motion (N=46), indicating that the hides were thinned and smoothened. Hides were subsequently transformed into various objects like clothing and so forth because we also find hide cutting tools (N=20) and occasionally hide piercing implements (N=6).

On the basis of the variability within the hide working traces, we can conclude that different stages of hide processing were performed within the settlement: the cleaning of fresh hide by removing remnants of flesh and grease and the further treating of hides, including the tanning, thinning, smoothening and loosening of the skins. Fresh hide scraping leaves a greasy band of polish and a slightly rounded edge, while dry hide leaves a dull, rough polish and a highly abraded edge (fig 11.2). There can be a substantial variability in the exact techniques and processes of hide treatment (after the initial cleaning), involving different tanning agents, and consequently there is also quite a bit of variability in the resulting traces of wear. These

contact material

HI	hide
CE	cereals
UN	unknown
UNS	unsure
"23"	polish "23"
HM	hard material
SoMin	soft mineral
WO	wood

degree of use

● heavily developed traces
• medium developed traces
· lightly developed traces

motion

drilling/boring
transverse/scraping
hafting
drilling/boring

technical information

▲ bulb of percussion precent
△ bulb of percussion absent but direction of percussion clear

Legend of codes in figures of this chapter

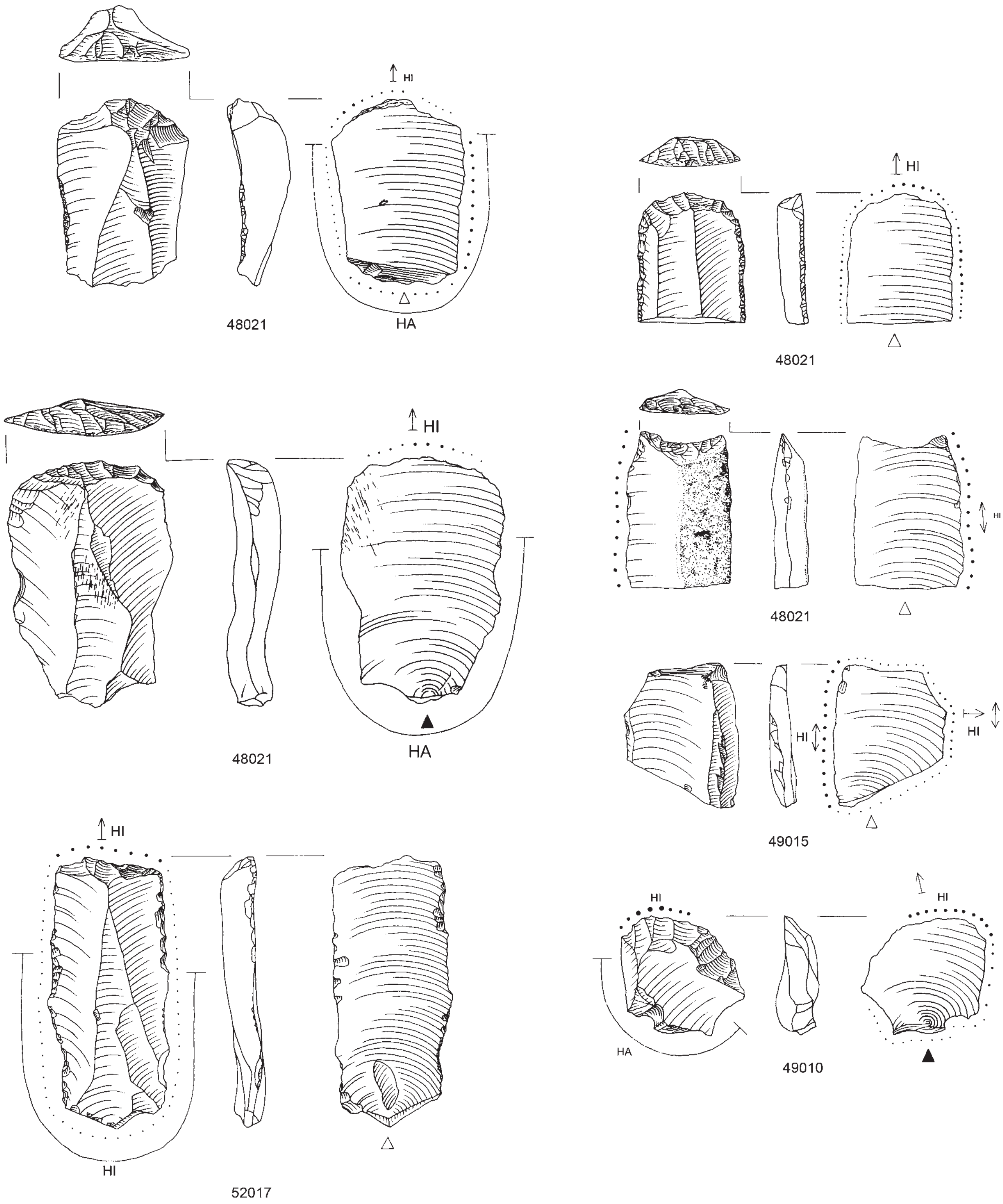
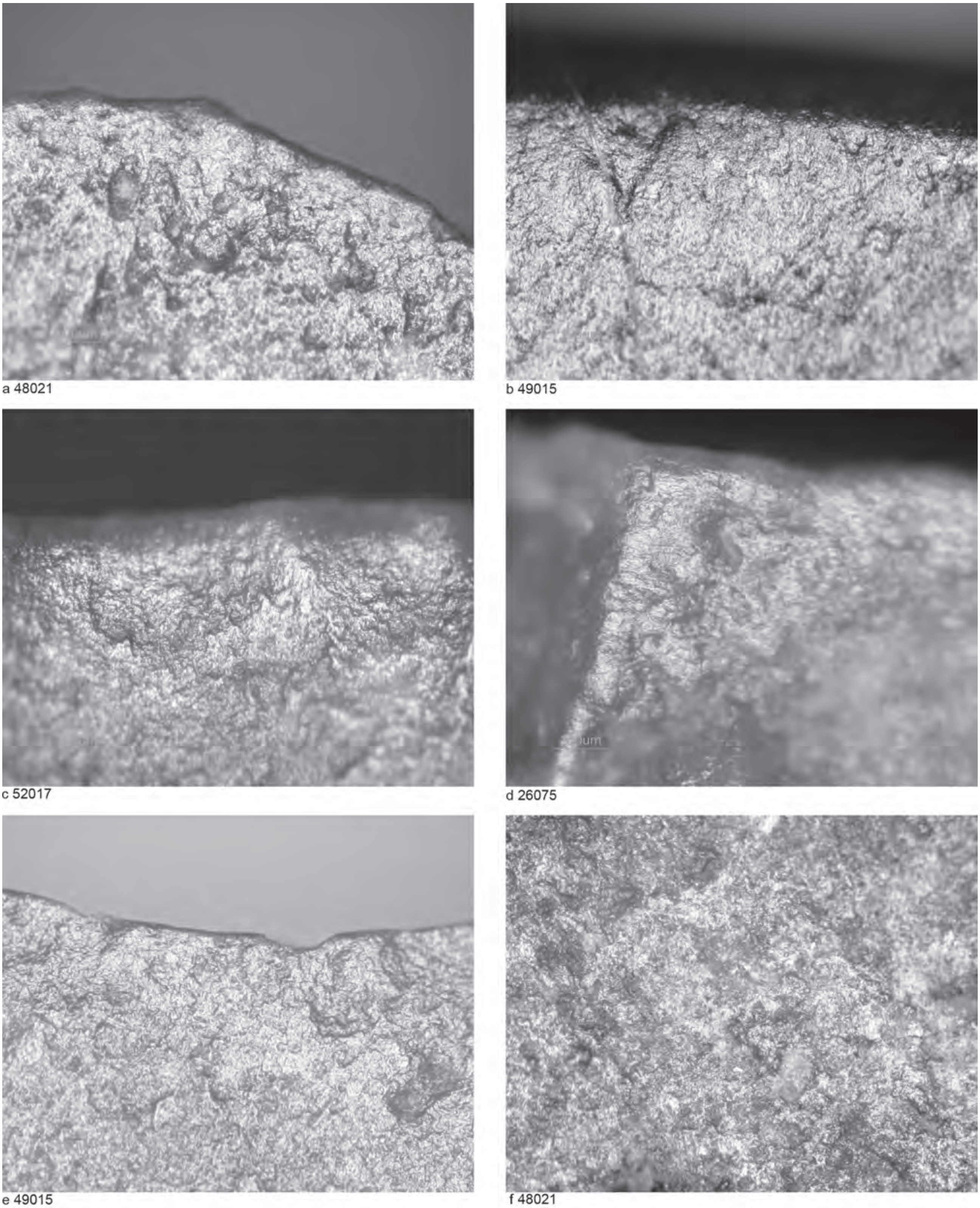


Figure 11-1 Artefacts with traces of working hide (scale 1:1)


a 48021
b 49015
c 52017
d 26075
e 49015
f 48021

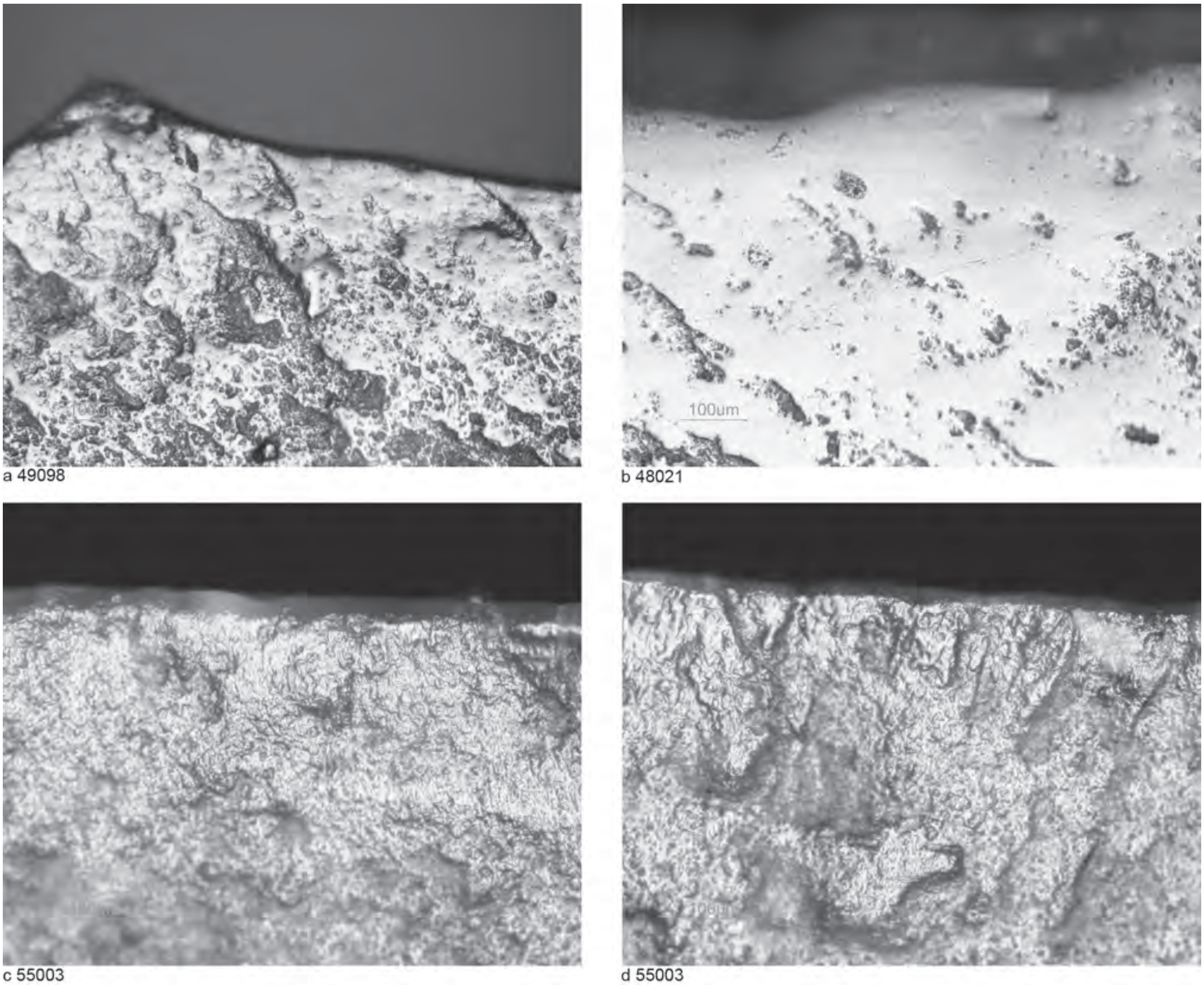


Figure 11-3 Traces of cereals and ‘polish 23’ (original magnification 100 ×)
a: traces of cutting cereals
b: traces of cutting cereals
c: traces of the rough aspect of ‘polish 23’
d: traces of smooth aspect of ‘polish 23’.

Figure 11-2 The variation in the hide working traces (original magnification 100 ×)
a: traces of scraping hide
b: traces of scraping hide
c: traces of scraping dry hide
d: traces of cutting dry hide
e: traces of cutting hide
f: traces of hafting in hide

traces cannot always be distinguished and will be referred to as 'hide working traces', without making an attempt to further differentiate them. Four used zones displayed clear traces of dry hide working. All other zones displayed traces of hide working that could not further be specified.

The different activities carried out on hide indicate an extensive amount of hide processing in and around the settlement, not only cleaning hides (transverse motions), but also further processing hides into for example clothes or other household items (longitudinal motions and piercing). The large amount of hide working corresponds to what has been observed in other LBK sites where use-wear analysis was performed: hide was generally the predominant contact material (a.o. Van Gijn 1990, 77).

Skin is also used to haft implements. Three scrapers, two long and one short end-scraper, had been wrapped in raw hide before being put in a haft. Upon drying the hide firmly fixes the tool in the haft. Binding with such a strip of hide also facilitates retooling (Keeley 1982) of a composite implement because the hide loosens again when soaked in water so that the exhausted flint scraper can be replaced by a fresh one (Caspar 1985, 69; Van Gijn 1990, 86).

11.3.2 Harvesting cereals

Traces of working cereals were seen on a total of 30 used zones. Cereal harvesting causes a very bright, flat polish with a high degree of linkage and a distribution that extends far into the surface of the tool. The polished surface displays many thin, often filled-in striations. The striations may be due to the presence of large amounts of weeds in the fields. It can often be seen with the naked eye (the so called sickle gloss) (fig 11.3). The distribution of the polished areas, covering a triangular section of the edge of the implements, indicates that the blades were hafted obliquely and in sequence in a lunar-shaped haft, with each segment protruding from the haft at a slight angle. This way of hafting sickle inserts has been noted at other LBK sites as well.

At Geleen JKV cereals were mainly cut in a longitudinal way, although one tool was employed in a diagonal motion and another one even displayed a transverse directionality. These variations in the directionality of the polish may be due to different positions of the flint inserts within the composite tool. The sickle inserts were mostly made on retouched and unretouched blades and flakes. In some cases we observed a secondary use of another tool type, reworked into a sickle insert. One example is a scraper whose longitudinal side was used for harvesting cereals (fig 11.4). Only five of the tools used on cereals showed traces of hafting, with no further information on the type of material the tools had been hafted in. Considering the general absence of hafting traces on the sickle inserts, they were probably hafted with an adhesive, firmly securing the tool in such a way that no friction gloss could occur.

Geleen JKV is remarkable in the relatively large number of sickle blades encountered. In nearby Beek Molensteeg, for example, only nine zones used for reaping cereals have been retrieved (Van Gijn 1990, 81). However, the considerable number of sickle inserts found at Geleen JKV corresponds with the large amount of querns from this site (Verbaas & van Gijn, Ch. 13 this volume).

11.3.3 Wood working and soft plant processing

Wood was also worked by means of flint: polish from this material was encountered on twelve of the used areas (table 11.2). In four of these cases it concerned tools that were hafted in wood. Both transverse and longitudinal motions are seen, showing that the flint implements were employed in different ways for fine wood working activities. One borer was used for drilling soft wood. The flint tools however were not involved in more heavy wood working tasks like chopping, chiselling or splitting. These coarser woodworking tasks were probably carried out with the adzes (Bakels, Ch. 12 this volume). Flint thus served to manufacture smaller objects and household materials. Woodworking is also seen in other LBK assemblages (Van Gijn 1990, 79), but in most sites a larger percentage of the tools are used for woodworking than is the case at Geleen Janskamperveld.

Several implements displayed traces from contact with non-silicious soft plant materials that could not further be distinguished. Experiments with cutting and scraping a large variety of plant species have shown that the resulting variability is limited and that it is difficult to distinguish between the wear traces caused by different plant species. In the present selection a total of four areas have been used on non-silicious plants: one tool was used in a longitudinal motion, the others in an unsure motion. It is likely that activities like processing plant fibres or making domestic utensils such as baskets or nets are responsible for the development of these wear traces.

11.3.4 Bone and antler

Only one implement displayed vague traces from working bone or antler (fig 11.5). Evidence of working bone and antler is minimal in other Dutch LBK assemblages as well (Van Gijn 1990, 79; pers. observ.). Considering the fact that quite a large number of LBK flint tools from different sites within the Graetheide cluster have by now been examined for the presence of traces of use, it is unlikely that the low representation of bone and antler working traces is a result of sampling procedures. This is even less likely because especially contact with bone results very quickly in distinctive traces of wear (Van den Dries/Van Gijn 1998). Elsewhere bone objects have occasionally been found (De Grooth/Van

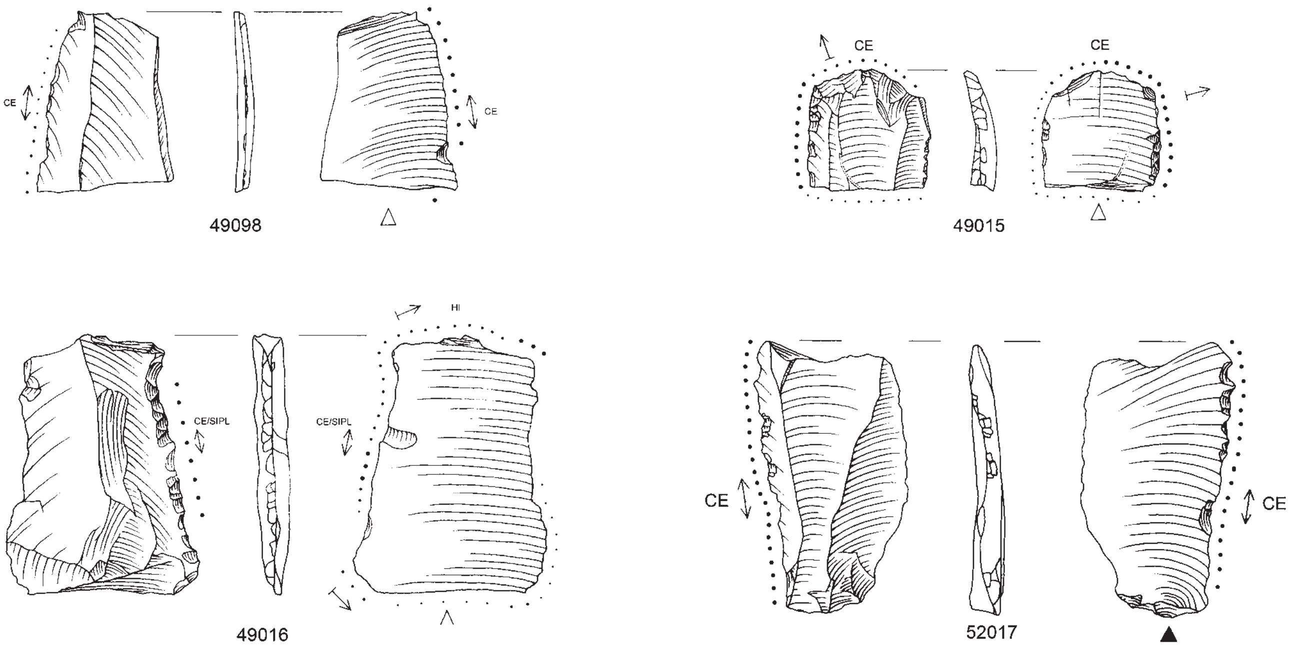


Figure 11-4 Different artefacts with traces of working cereals (scale 1:1)

de Velde 2005, 221). In our region however, flint and also hard stone do not seem to have served in their manufacture (Verbaas/Van Gijn, Ch. 13 this volume). The virtual absence of these traces forms, however, no proof that bone and antler were not used for the production of tools and objects.

11.3.5 Soft animal material

Soft animal material is a category in which traces from contact with meat and sometimes soft fresh hide are subsumed. The polish is greasy but generally quite indistinctive, the rounding of the edge minimal and edge removals are largely lacking. It should be noted that meat as a contact material is notoriously under-represented because traces of meat only develop after extensive use of the tool (Van den Dries/Van Gijn 1998, 501). Most traces from contact with soft animal material are seen on projectile points and must probably relate to the shooting of animals (N=4). One tool was used in a longitudinal motion, whereas in one case the motion could not be further specified.

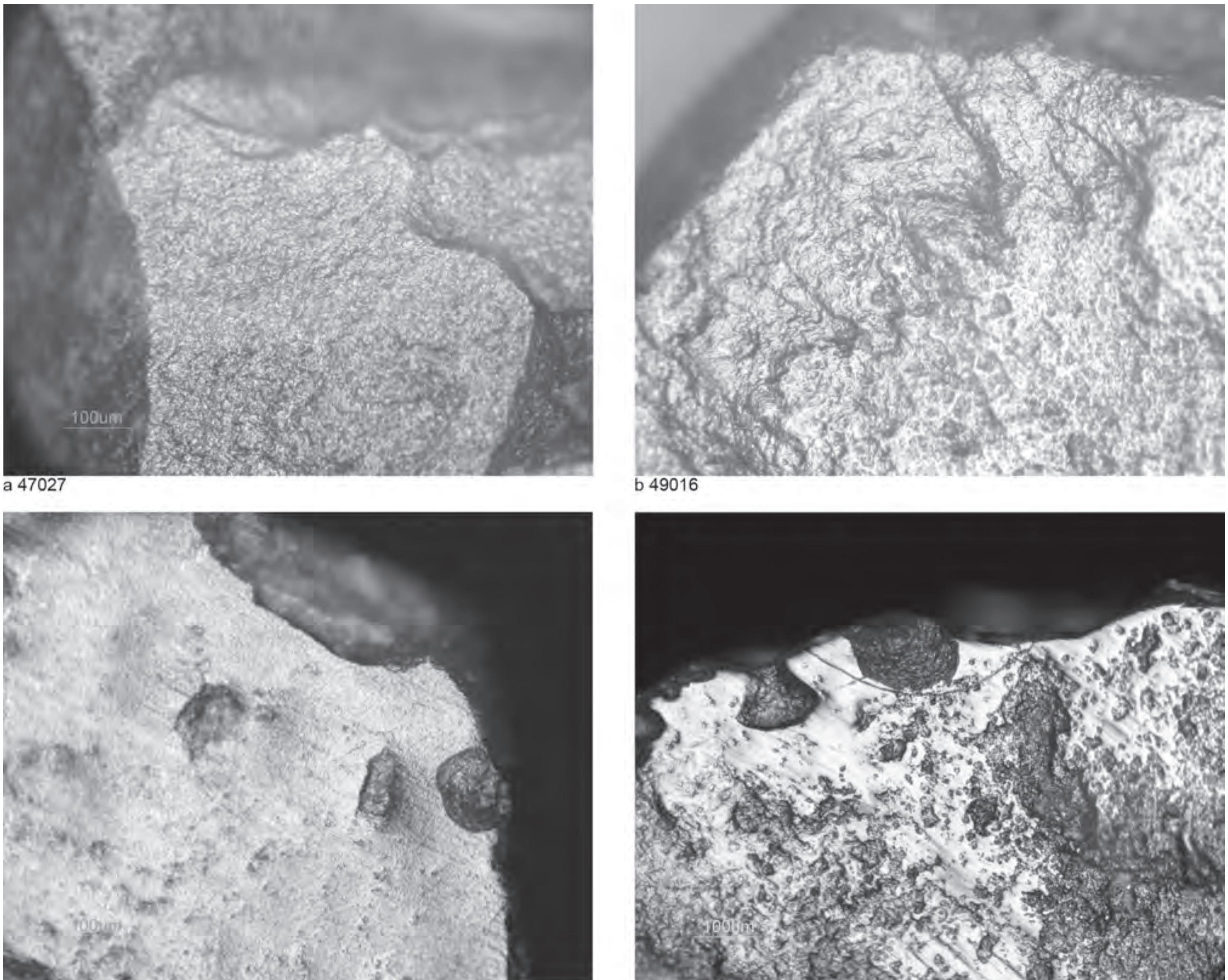
11.3.6 Mineral materials

Evidence for contact with mineral materials was seen on four tools. One blade and one flake were used on a mineral material that could not be further specified. In one case pottery was cut with a flake. It concerned pottery in medium hard state, probably leather hard clay. A pointed end of the tool was used to incise decorations in the clay. Last, a block was used to scrape a soft stone, perhaps jet (fig 11.5).

11.3.7 'Polish 10' and 'polish 23'

'Polish 10' and 'polish 23' are two unresolved mysteries in use-wear analysis. In LBK context 'polish 23' is generally observed on *quartiers d'orange*, but in Geleen JKV it was also seen on blades and flakes with obtuse, unretouched angles (fig 11.6). This type of wear was seen on a total of eight used zones. 'Polish 23' consists of two aspects: one side displays a smooth and highly reflective polish, the other a rough and matt polish with abundant striations (fig 11.3). Both aspects are correlated and caused by one single activity (Van Gijn 1990, 85). Experiments with working different materials such as the processing of fibres from flax, nettles, brambles and different kinds of bark have been carried out, but no clear matches with the archaeologically observed polishes have been found yet. The wear traces do seem to be the result of working plant fibres and experiments are still continuing.

'Polish 10' is seen on two blades and a short end-scraper (table 11.3). It concerns a relatively bright, cratered rough polish with a lot of striations, distributed in a band along the edge. The polish has characteristics that are also seen on



a 47027
b 49016
c 17000
d 19082

Figure 11-5 Traces of diverse materials (original magnification 100 ×)
a: traces of bone/antler
b: traces of graving a mineral material
c: traces of pottery/clay
d: traces of working hard stone, possibly jet

tools used on mineral, siliceous plant materials and hide, but resembles neither fully. This unknown contact material can be worked in longitudinal and transverse motions. In Geleen JKV one tool was used in a transverse motion, the other two zones did not display a clear directionality. Even though ‘polish 10’ is mainly found in Michelsberg assemblages (but not exclusively so), it does not seem to be linked to the Middle Neolithic or to a certain landscape type (Schreurs 1992, 147-148). The gloss is probably the result of harvesting or processing plants for the manufacture of fibres but, again, it has not yet been replicated experimentally.

11.3.8 Hafting

A total of 29 of the analysed tools displayed traces of hafting. These traces were found on flakes, blades, scrapers and one point. Distinguishing hafting traces is notoriously hard but possible (Rots 2002). Traces of hafting include tiny specks of friction gloss on the flint surface or spots of black

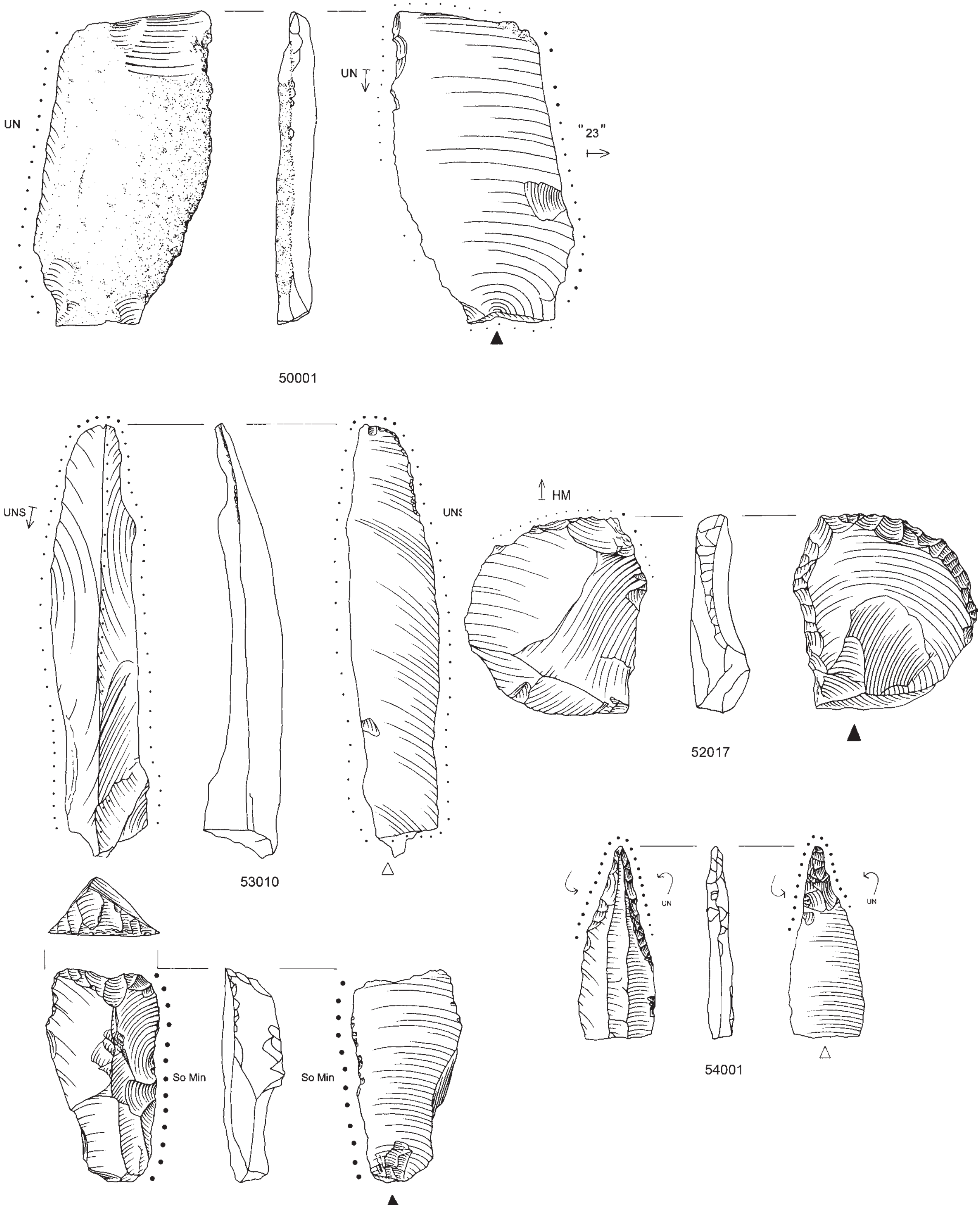


Figure 11-6a Artefacts with traces of different materials. (scale 1:1)

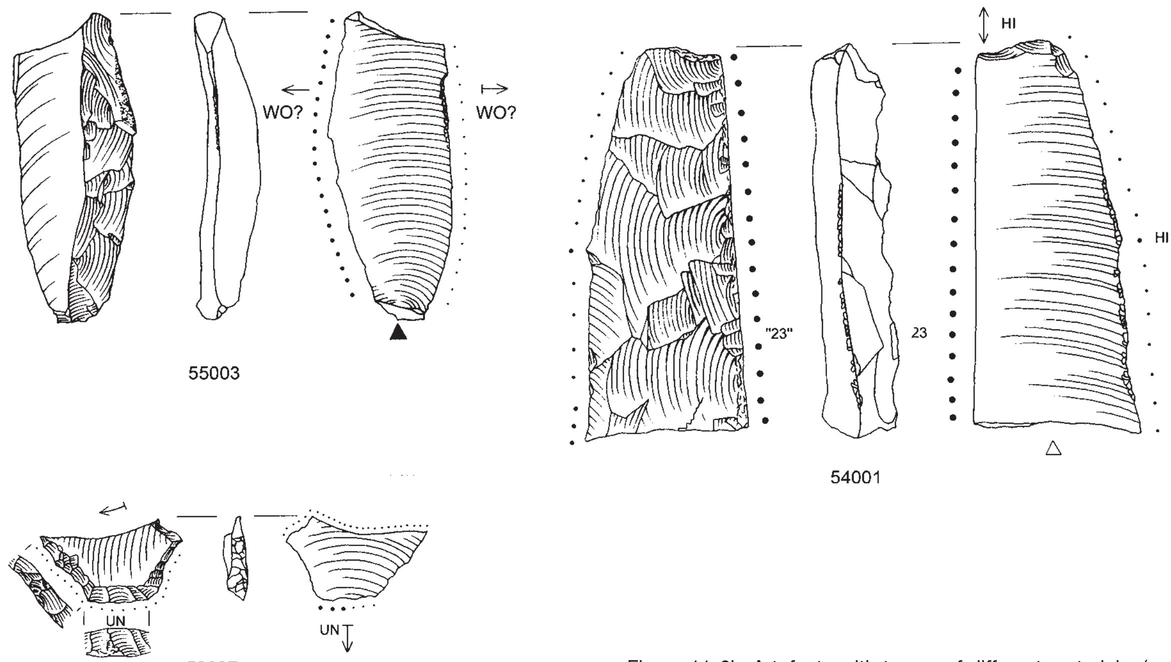


Figure 11-6b Artefacts with traces of different materials. (scale 1:1)

residue. Tar was used for fixing tools into their hafts and residue from this material was found on eleven artefacts, including unmodified blades and flakes. Friction gloss was observed on 22 implements, in one case along with traces from a wooden haft. A total of six artefacts (scrapers and blades) were hafted in hide (fig 11.2). In these cases a strip of raw leather is placed between the tool and the haft. In the other cases of hafting the hafting material could not be specified.

11.4 Relationship between tool type and function

Flint artefacts are commonly divided in tool types on the basis of modern analogies. One of the main questions asked through use-wear analysis is whether our assumptions about tool use correspond to the choices made by prehistoric man and whether there is a correlation between tool type and activity.

Flakes and blades form multifunctional tool types: they are used in longitudinal, transverse and diagonal motions and occasionally also for drilling or boring (table 11.4). The same pertains to the retouched blades and flakes. Borers have, as expected, been used predominantly for boring or drilling (five out of eight used zones), but are occasionally used for scraping and cutting too. One borer was used for scraping, cutting and boring hide, one borer for boring and scraping hide. These two tools were thus multifunctional implements, employed in the manufacturing of clothing and containers from hide. Points are used as shooting devices (N=4) but one point was used for drilling, with no traces from a use as arrowhead. Scrapers are mainly used in a transverse motion, but one scraper was used to bore skin. Scrapers were sometimes reworked to cereal harvesting tools: it concerned a short and a long end-scraper.

When we look at the relationship between tool type and contact material flakes and blades also turn out to be multifunctional implements (table 11.5). They are used on a wide range of materials including ‘polish 23’. The latter contact material was also seen on the one *quartier d’orange* present in our sample. The retouched blades are however mainly used on cereals. Borers are associated with hide working (N=7), with the exception of one borer that was used on soft wood. Points showed traces of soft animal material, as a result of penetration of the animals when shot. Long end-scrapers, round scrapers and general scrapers are mainly used on hides (77% of used zones), whereas short end-scrapers are used on a wide range of materials including wood, cereals, plant materials and ‘polish 10’. The short end-scrapers have been exclusively used on hide, in 53% of the cases. The short end-scrapers are therefore used for a wider range of tasks than the long end-scrapers.

	longitudinal	*transversal*	*diagonal*	*boring*	*shooting*	*hafting*	*unsure*	*total*
unretouched flake	*24*	*13*	–	*1*	–	*4*	*14*	*56*
unretouched blade	*25*	*16*	*2*	–	–	*12*	*15*	*70*
retouched flake	*1*	*3*	–	–	–	–	*2*	*6*
retouched blade	*8*	–	–	*1*	–	*2*	*1*	*12*
borer	*1*	*2*	–	*5*	–	–	–	*8*
point	–	–	–	*1*	*4*	*3*	–	*8*
quartier d'orange	–	–	–	–	–	–	*1*	*1*
long end scraper	*1*	*6*	–	–	–	*4*	*3*	*14*
round scraper	–	*2*	–	–	–	–	*2*	*4*
short end scraper	*1*	*21*	–	–	–	*4*	*10*	*36*
scraper indetermined	–	*3*	–	*2*	–	–	*3*	*8*
core preperation flake	–	*1*	–	–	–	–	–	*1*
core preperation blade	–	–	–	–	–	–	*1*	*1*
block	–	*2*	–	–	–	–	–	*2*
total	*61*	*69*	*2*	*10*	*4*	*29*	*52*	*227*

Table 11-4 The relationship between tool type and executed motion

While the majority of the tools are used for the activities they seem to be designed for, the activities carried out with the tools are not restricted to the tool design. Borers are sometimes (also) used for cutting and scraping, a point is used for boring and the scrapers are used for longitudinal activities and drilling. No strict correlation is therefore found between tool type and tool use, although most tools seem to be mainly used for the tasks they were presumably designed for.

11.5 Conclusion

A large proportion of the 170 analysed artefacts showed use wear traces (88%). Except for one retouched flake, two borers and one long end-scraper, all formal tools turned out to have distinguishable traces of use. A wide range of activities was carried out at Geleen JKV, which is to be expected of a settlement site. Hide is the most frequently encountered contact material (35% of the used areas), a figure that is consistent with what has been found in other Dutch LBK assemblages. The number of cereal harvesting tools seems to be somewhat higher than commonly seen, an observation that is mirrored in the large number of quern fragments retrieved at the site (Verbaas/Van Gijn, Ch. 13 this volume). Traces from working wood are encountered but are limited to those caused by fine wood working tasks like shaping and smoothing small household utensils. Bone and

	plant	*cereals*	*wood*	*hide*	*soft animal*	*bone antler*	*clay pottery*	*soft stone*	*mineral other*	*polish 10*	*polish 23*	*hard material*	*soft material*	*unsure*	*hafting*	*total*
unretouched flake	*2*	*9*	*1*	*17*	*1*	–	*1*	–	*1*	–	*2*	–	–	*18*	*4*	*56*
unretouched blade	*2*	*13*	*8*	*16*	–	*1*	–	–	*1*	*2*	*4*	–	*3*	*11*	*9*	*70*
retouched flake	–	–	–	*2*	–	–	–	–	–	–	–	–	–	*4*	–	*6*
retouched blade	–	*7*	–	*1*	–	–	–	–	–	–	–	–	–	*2*	*2*	*12*
borer	–	–	*1*	*7*	–	–	–	–	–	–	–	–	–	–	–	*8*
point	–	–	*1*	–	*4*	–	–	–	–	–	–	–	–	*2*	*1*	*8*
quartier d'orange	–	–	–	–	–	–	–	–	–	–	*1*	–	–	–	–	*1*
long end scraper	–	–	–	*10*	–	–	–	–	–	–	–	–	–	–	*4*	*14*
round scraper	–	–	–	*3*	–	–	–	–	–	–	–	–	–	*1*	–	*4*
short end scraper	–	*1*	*1*	*18*	*1*	–	–	–	–	*1*	–	*1*	*3*	*6*	*4*	*36*
scraper indetermined	–	–	–	*5*	–	–	–	–	–	–	–	*1*	–	*2*	–	*8*
core preperation flake	–	–	–	–	–	–	–	–	–	–	*1*	–	–	–	–	*1*
core preperation blade	–	–	–	–	–	–	–	–	–	–	–	–	–	*1*	–	*1*
block	–	–	–	*1*	–	–	–	*1*	–	–	–	–	–	–	–	*2*
total	*4*	*30*	*12*	*80*	*6*	*1*	*1*	*1*	*2*	*3*	*8*	*2*	*6*	*47*	*24*	*227*

Table 11-5 The relationship between tool type and contact material

antler are rarely worked by means of flint tools. Flint tools were thus important in several subsistence tasks, like cereal harvesting and hunting, as well as in craft activities like hide processing and wood working.

Acknowledgements

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12 The Linearbandkeramik settlement at Geleen-Janskamperveld: the adzes

Corrie C. Bakels

The excavation of the Linearbandkeramik site of Geleen-Janskamperveld has revealed 51 adzes or fragments of adzes. Most of these were made of amphibolite or basalt, types of rock which do not occur in the surroundings of the settlement. This observation is in agreement with the early date of the site. The only specimens made of local, siliciclastic materials belong to a second, late phase of occupation. The implements were almost used up before they were discarded, suggesting that the settlement was situated near the end of a down-the-line exchange of adze blades.

12.1 Introduction

The adze was a common tool in Linearbandkeramik (LBK) society. It is a cutting tool with a blade at right angles to the handle. Its blades are found in almost all regions where this neolithic culture flourished. With the axe absent from the LBK toolkit, the adze is interpreted as the wood-cutting and wood-working tool of the time. But an interpretation of the blades as parts of hoes has its adherents as well. Experimental archaeology has proved that the larger blades can be used to fell trees, while the narrow, small ones are handy for finer carpentry (for instance Pleyer 1991). Hoeing gardens with the tool is also possible, though the kind of wear seen on the cutting edge hints not quite at regular contact with soil. However, an intensive study of the wear and tear of LBK adzes has still not been carried out. One of the problems is the weathered surface.

The Geleen-Janskamperveld (Geleen-JKV) excavation revealed 51 specimens of the implements in question. Only two or three of these were complete. Most of the others are represented by fragments, two of which fit together. Four are considered to represent rough-outs or waste from tool-making.

12.2 The raw material

LBK adzes are not made of flint or chert but of a narrow range of crystalline rock types. In the case of Geleen-JKV only three kinds have been used (table 12.1). The most common rock is amphibolite (A), a term used here in its broadest sense. Second come dense basalts (B): fine-grained porphyritic rocks. Only two objects were made of a fine-grained siliciclastic rock (S): a dark-coloured quartzitic rock.

The rocks are of the same types as those described for other settlements in the cluster of LBK sites to which Geleen-JKV belongs (Bakels 1987). This cluster is situated between the rivers Meuse and Geleen in the southeastern part of the Netherlands and is known as the Graetheide cluster. The exact description of the rocks and their provenance is discussed in the publication in question. It should suffice here to repeat that the most likely sources of amphibolite are to be found in central-eastern Europe and that the basalts come from volcanoes in the Siebengebirge and eastern Eifel near Bonn in Germany. The two pieces of siliciclastic rock have most likely been obtained from the gravel in the river Meuse.

There is no trace of the working of amphibolite at the site. All fragments were clearly once part of an implement. This is in agreement with the observations made in the other settlements belonging to the cluster. In a neighbouring cluster, the cluster around the Merzbach on the Aldenhovener Platte in Germany some 30 km to the east, the situation was the same: no working of amphibolite. Adzes of this type of rock obviously arrived in the region as finished blades. But when such blades broke, they were, if possible, reshaped into new, serviceable blades. In Geleen-JKV two instances of attempts to make a new blade out of a fragment are present. The attempts were obviously not successful, because the results were thrown away. The pieces were retrieved from the same pit. The evidence is flimsy, but the pit may have been situated in the working area of somebody adept at reshaping broken adzes.

The local working of basalt is attested by three pieces of the same rock with feature-number 52017. One looks like a rough-out intended for a so-called thick adze, which is a blade with a thickness exceeding its width. Problems with shaping the cutting edge caused the piece to be discarded. The other fragments are just waste. The same number (same feature) includes a butt end of a broken adze made of a different type of basalt. One may wonder whether this butt end was intended to be provided with a new cutting edge. Only it was too short. This pit too may have been lying in the activity area of an adze mender. Signs of basalt working are rare in the region. A comparable rough-out has been excavated in the Belgian site of Rosmeer, a site belonging to

feature	raw material	remains	cer. phase	house generation	Modderman phase
91124	A	fragment	1	1	1b
54029	A	fragment	1	1	1b
54051	A	fragment	1	1	1b
92023	A	butt	2	2	1b
94052	A	complete	2	2	1b
10027	A	fragment	2	2	1b
10038	A	fragment	2	2	1b
10038	A	cutting edge	2	2	1b
58021	A	cutting edge	3	3	1b
14002	A	fragment	4	3	1b
32142	A	complete, secondary	4	3	1b
32142	A	cutting edge, reworked	4	3	1b
49015	A	fragment	4	3	1b
49015	A	cutting edge	4	3	1b
49015	A	cutting edge	4	3	1b
49016	A	fragment	4	3	1b
55003	A	cutting edge	5	4	1c
57020	A	fragment	5	4	1c
91002	A	fragment	–	–	–
91045	A	fragment	–	–	–
92023	A	fragment	–	–	–
41019	A	fragment	–	–	–
15002	A	fragment	–	–	–
22020	A	cutting edge	–	–	–
51615	A	cutting edge	–	–	–
90019	A	complete	–	–	–
92023	A	butt	–	–	–
58017	A	fragment	–	–	–
19078	B	fragment	1	1	1b
31131	B	fragment	1	1	1b
46004	B	cutting edge	1	1	1b
26090	B	fragment	2	2	1b
92001	B	cutting edge	3	3	1b
52017	B	rough-out	3	3	1b
52017	B	rock fragment	3	3	1b
52017	B	rock fragment	3	3	1b
52017	B	butt	3	3	1b
14002	B	fragment	4	3	1b
45004	B	fragment	4	3	1b
49015	B	2 fitting fragments	4	3	1b
33065	B	butt	5	4	1c
44012	B	butt	5	4	1c
46040	B	cutting edge	5	4	1c
58048	B	cutting edge	5	4	1c
40073	B	fragment	6	13/14	2c

feature	*raw material*	*remains*	*cer. phase*	*house generation*	*Modderman phase*
91002	*B*	*cutting edge*	–	–	–
22020	*B*	*complete ?*	–	–	–
24025	*B*	*butt*	–	–	–
28061	*S*	*cutting edge*	*6*	*13/14*	*2c*
94051	*S*	*rough-out*	*6*	*13/14*	*2c*

Table 12-1 The adzes with the numbers of features in which they were found, their raw material and their relative date as regards the ceramic phase, house generation and the LBK phase according to Modderman. A = amphibolite, B = basalt, S = siliciclast.

a cluster southwest of the Graetheide cluster. Another rough-out has been retrieved at Langweiler 2, a site belonging to the Merzbach cluster on the Aldenhovener Platte (Bakels 1987).

The two quartzitic pieces concern one broken-off cutting edge and one rough-out. The latter is made on the basis of a flat pebble.

One of the results of the 1987 study was that the ‘choice’ of rock type changed with time. Amphibolite was predominant in the first phase (Modderman phase 1) of the occupation of the region. Basalt increased in importance during the first half of Modderman phase 2. Other types of rock became only common in the last phase of the LBK, phase 2d. The ultimate source of rock shifted from far away, to a source at closer distance, followed by a local source. This reflects a shrinking of the social network. The material cannot have been fetched by the inhabitants of the sites in the Graetheide and Merzbach clusters, at least not the amphibolite and probably neither the basalt, but must have been obtained through a system of exchange. It is not a case of people discovering better materials nearby in the course of time. Amphibolite is the best rock to made adze blades from, because it is the toughest of the three rock types. Quartzitic material is the worst because, relatively, it is the most brittle.

The pattern is also seen in Geleen-JKV. It is striking that the two siliciclastic implements are both dated to Modderman phase 2c, when the location was re-occupied after a time gap. The principal remains belong to phase 1b and 1c. The population of this early settlement used exclusively amphibolite and basalt. Geleen-JKV differs from the other settlements in the Graetheide cluster in that the proportion of basalt is much higher than expected. In its proportions of 56% amphibolite and 44% basalt, the site resembles the Merzbach cluster. In most of the Graetheide settlements amphibolite is absolutely predominant during phase 1 (fig. 12.1). Nevertheless, when the occupation at Geleen-JKV is divided into its four house generations, a tendency towards an increase in the use of basalt through time can be observed (table 12.2).

Geleen-JKV phase 1				
house generation	*A*	*A%*	*B*	*B%*
1	*3*	*50*	*3*	*50*
2	*5*	*83*	*1*	*17*
3	*8*	*57*	*6*	*43*
4	*2*	*33*	*4*	*67*
total phase 1	*18*	*56*	*14*	*44*

Table 12-2 The raw materials present in the four house generations belonging to Modderman’s phase 1.

12.3 The tools

Only two blades are complete (fig. 12.2). Both are made of amphibolite. One, no. 90019, has a length of 64 mm, a width of 36 mm and a thickness of 12 mm. It is a flat type of adze blade. The other, no. 94052, has a length of 68 mm, a width of 39 mm and a thickness of 22 mm. The greatest thickness is reached at the beginning of the part bearing the cutting edge, suggesting that this blade may originally have been thicker and longer. The blade must have been resharpened several times, decreasing in length in the process. It is a blade of the type ‘thick adze’ as defined in Bakels 1987.

A third blade, no. 32142, is made out of a fragment of another blade. Its length is 58 mm, its width 31 mm and its thickness 11 mm. Its contour is rather irregular, but it will have served as a flat adze (fig. 12.2d). A fourth blade, no. 22020, may have served in the state in it was found but may also have been discarded after breakage. The butt end looks as if it has broken at the spot where the blade was inserted into the haft. The implement is made of basalt and measures 33 by 14 by 6 mm. It was a slender, small blade.

The remainder of the finds is too damaged to be regarded as serviceable tools. They represent broken-off cutting edges, splintered blades and short butt ends. Most of the small splinters are of amphibolite. Block-like fragments mainly belong to basaltic implements. The manner of breakage reflects the raw material. Amphibolite is apt to splinter, basalt to fragment into pieces.

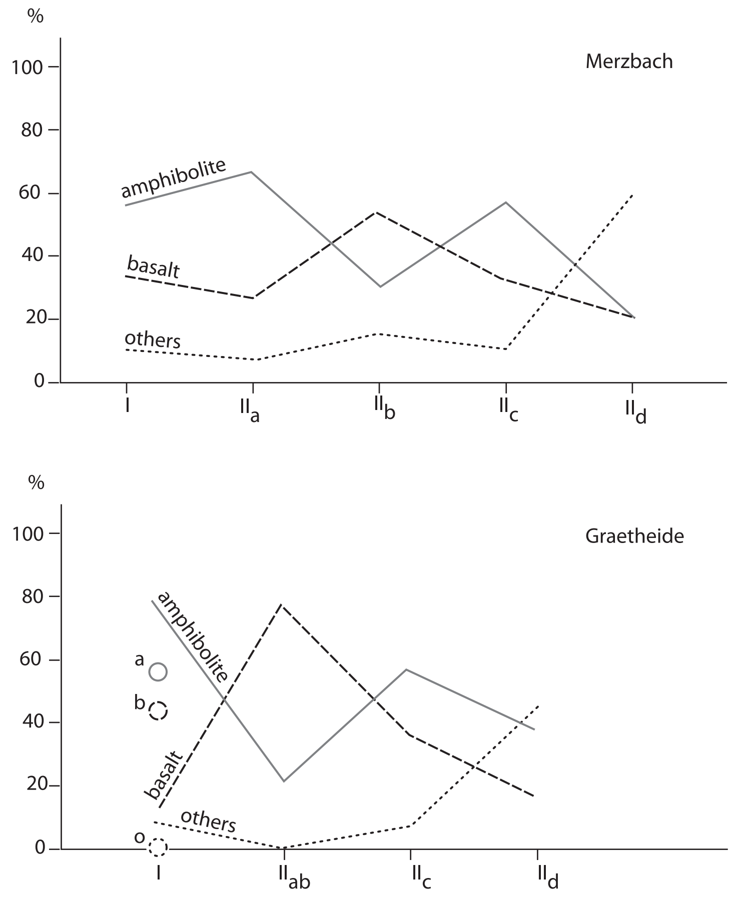

Figure 12-1 The relation between rock-type and phase in the Merzbach and Graetheide clusters after Bakels 1987. Data from Geleen-JKV added; a = amphibolite, b = basalt, o = others.

Fragments with traces of perforation are absent.

One piece deserves special attention. It is a long, central part of a thick adze made of amphibolite, no. 10038. Its length is 96 mm, its width 26 mm and its thickness 38 mm (fig. 12.2c). This blade fragment evoques the kind of adzes found in depots, such as the depot of Berg-aan-de Maas, a site belonging to the Graetheide cluster (Bakels/Hendrix 1999). Such depots have been found elsewhere in Europe as well. (Schwarz-Mackensen/Schneider 1983, Vencl 1975) The Berg-aan-de Maas depot is the most western instance of such finds. The exact nature of such depots, religious or connected with trade, is open to debate, but the adzes in them may very well represent the adzes as they arrived, brand-new, from the original source. The large fragment in the Geleen-JKV settlement is the first of its kind in the Graetheide cluster and the Merzbach cluster.

12.4 Adzes and the settlement

The adze remains were present everywhere in the settlement. They formed part of the normal household waste. Even the complete blades have been found among the common rubbish. This is a normal kind of situation and recurring in every settlement excavated sofar. The only aspect that varies is the number of adze fragments. Some settlements are richer than others. The ‘wealth’ can be expressed in the number of adze remains per house (household). Table 12.3 presents the values for Geleen-JKV and compares them with other relevant sites (data from Bakels 1987). It must be noted that Geleen-JKV has been split up into two settlements, one for the period phases 1b-1c, and one for phase 2c, because of the time gap in occupation.

The original 1987 table showed that settlements are richer when they are smaller. This at least is seen in the case of the Merzbach cluster on the Aldenhovener Platte. The largest settlement had, relatively, the lowest number of adze remains. This site, Langweiler 8, was a distribution site for imported flint (Zimmermann 1982). It may also have been the pivot in the distribution of imported adze blades. The explanation offered for the ‘wealth’ increasing with the decrease in settlement size, was that the inhabitants of smaller

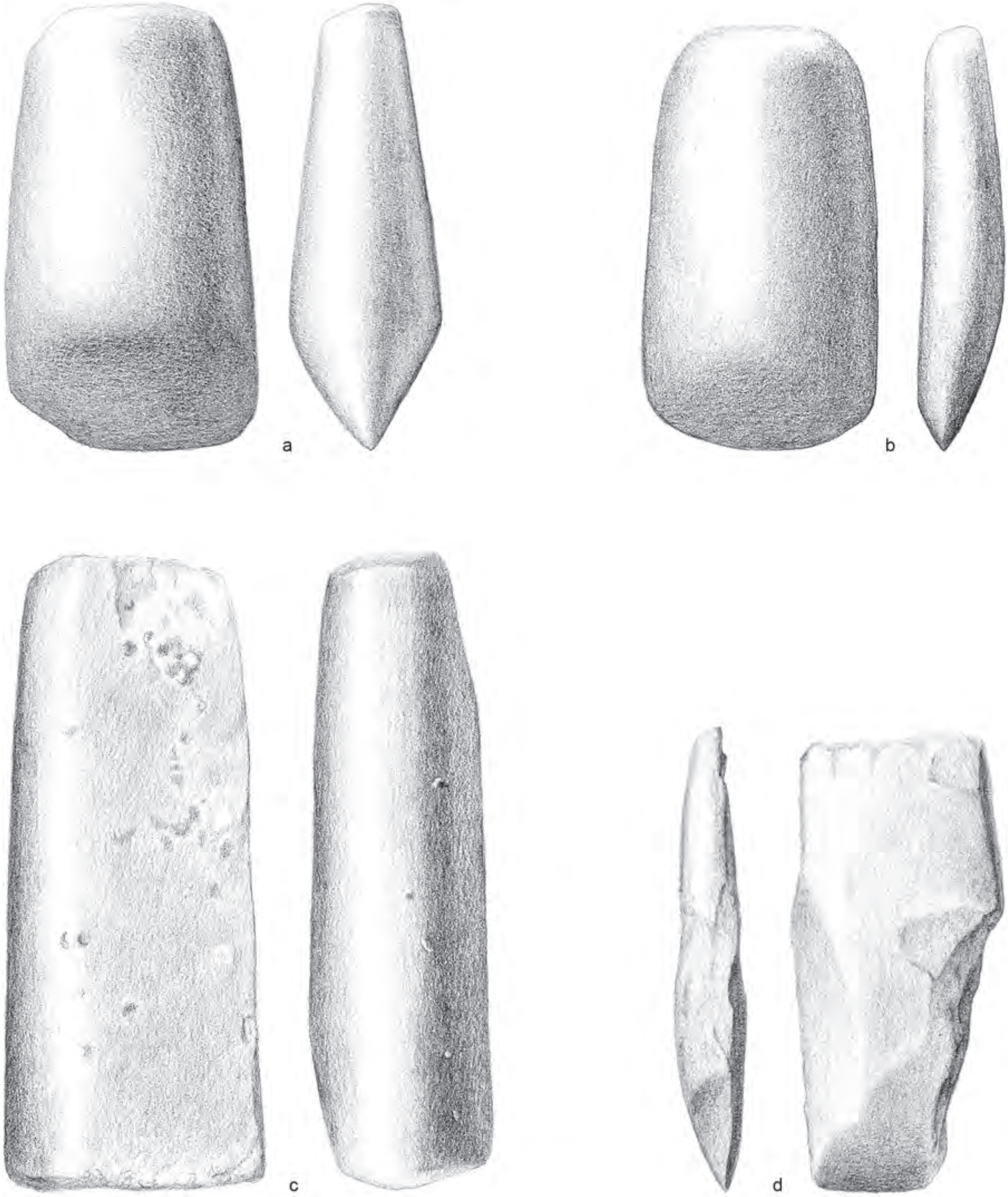

Figure 12-2 Three blades and a blade fragment, scale 1:1. The complete blades (a and b) were drawn after sketches, because the blades were not available anymore at the time of publication. In contrast to the blades of the upper row, those of the lower row are depicted with their side view left of their dorsal view.

	N houses	*adzes/house*
Merzbach cluster		
Langweiler 8	*98*	*0,6*
Langweiler 2	*20*	*1,1*
Langweiler 9	*17*	*1,8*
Laurenzberg 7	*9*	*2,5*
Langweiler16	*3*	*3.0*
Graetheide cluster		
Elsloo	*95*	*0,4*
Geleen-JKV phase 1	*52*	*0,7*
Stein	*49*	*0,4*
Sittard	*48*	*0,5*
Geleen-JKV phase 2	*6*	*0,5*

Table 12-3 The number of adzes per house in the settlements belonging to the Merzbach and Graetheide clusters. Phases are those according to Modderman.

settlements were at the end of the distribution line and had, therefore, more to mend, to reshape and, finally, to throw away.

The settlements in the Graetheide cluster show the same kind of values as Langweiler 8. According to the number of houses they are large. A flaw in the analysis may be that almost all settlements are multi-phase sites. Splitting-up the data according to the different occupational phases has shown, however, that the results do not alter. This is also seen in Geleen-JKV. The wealth of the second occupation is not so very different from that of the first. Nevertheless, with a value of 0.7, the first is the ‘richest’ of the Graetheide cluster. This may imply that this first phase of occupation was rather dependent on an influx of adze blades coming from a more dominant site. The underlying cause may be the dependence on distribution sites east of Geleen in Germany, presumably in the Neuwiederbecken, where LBK sites have been found which may represent the ancestors of the Geleen site. But this is mere speculation at the moment. The flow of ready-made adze blades deserves a more detailed study.

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12.5 Conclusion

The adzes and adze fragments retrieved during the Geleen-JKV excavation support the general picture that the blades in this part of the LBK world were made of rock with a foreign origin. They were presumably obtained through exchange. Geleen-JKV may have been dependent on an intermediary group based in Germany. The settlement may have been situated at the end of a down-the-line exchange of amphibolites and basalts.

Only in the second, late phase of occupation local material has been considered as material to work into adze blades.

Adzes were almost used up before discarding. When possible, broken specimens were reshaped into a serviceable implement.

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13 Querns and other hard stone tools from Geleen-Janskamperveld

Annemieke Verbaas and Annelou van Gijn

All hard stone tools from Geleen Janskamperveld, with the exception of the stone adzes, were studied for the presence of traces of production and wear. The predominant tools were quern fragments, along with some polishing stones and hammer stones. Most of the querns were used for processing cereals. The querns displayed a special biography because after use they were broken and sometimes rubbed with ochre. This, probably ritual, treatment indicates their special significance in LBK society.

13.1 Introduction

Stone tools are commonly found in excavations and represent an important part of material culture, but they are often neglected or forgotten. This lack of attention is due to their mostly uninspiring looks and lack of traces of manufacture and use. However, this attitude is changing over the last few years and stone tool analysis is no longer only directed at typology, but also focuses on raw material selection, production sequences and actual use. This information can not only contribute to our knowledge on subsistence strategies and the daily (craft) activities of prehistoric people, but occasionally sheds light on long distance social networks and, sometimes, ideological aspects as well.

The first aim of this study was to study the production, morphology and use of the stone tools found at Geleen-Janskamperveld, with the exception of the chisels. These are described elsewhere in this volume (by Bakels, in Ch. 12). By examining the stone tools from different perspectives, it was hoped to obtain information on the life history of the objects and about the various activities they were involved in. Another aim was to understand the role of stone tools in the technological system: which tasks were carried out by hard stone tools and how did this relate to associated tasks carried out by flint implements? In this way it was hoped to be able to reconstruct toolkits, sets of tools made of different materials and used for a complex activity, like woodworking or plant processing (Van Gijn 2008). A specific research question focussed on the role of cereals in the community as this is reflected in the use and treatment of querns. We also hoped to obtain information on possible bone and antler tool manufacturing in a Bandkeramik context. Even though occasionally we find bone objects in LBK contexts (De Grooth/Van de Velde 2005), use-wear traces from contact with bone and antler are largely lacking on Bandkeramik flint assemblages (Van Gijn 1990). We were interested to see whether such traces would be visible on the hard stone assemblage. Last, a specific research question was whether stone tools were used for chisel maintenance.

13.2 Methods of study and selection

13.2.1 Technology and typology

The excavation of Geleen JKV produced 781 stone artefacts, all of which were included in this study. As loess does not naturally contain stones, all stones must have been brought to the site intentionally and hence have to be considered as artefacts. A total of 436 implements show traces of manufacture and/or use on a macroscopic level and are therefore classified as tools (table 13.1). All stones found were measured and weighed, and the following variables were described[1]: primary classification, typology, raw material, modification, degree of burning, fragmentation, grain size, patination and the extent and character of the cortex. The artefacts were examined for the presence of traces of manufacture using a stereomicroscope (magnifications 10-64×). This type of microscope was also used to determine the raw material.

Stone tools are often shaped by use rather than manufacture. These traces of use are clearly visible with the naked eye and classify a piece of stone as a tool. There are many uses however that did not require any prior shaping and that might not have caused any visible use-wear traces such as for example net sinkers. Such unmodified tools are almost impossible to recognize. Although use-wear analysis may reveal such hidden tools, it is a time and money consuming method and it is often not possible to subject a large body of unmodified artefacts to use-wear analysis.

Tool types distinguished include hammer stones, whetstones, querns and flakes (table 13.1). This conforms to what is commonly found in LBK assemblages (Gaffrey 1994). No retouchoirs were found. Stones with grooves were present, some of which could be described as arrow shaft polishers, but no complete 'sets' were found.

type	*subtype*	*total type*	*%*	*total subtype*	*%*
quern		*200*	*25,6*		
	complete quern			*2*	*0,2*
	quern mano			*2*	*0,3*
	bread-shaped, fragment			*24*	*3,1*
	large and flat, fragment			*37*	*4,7*
	quern indet, fragment			*124*	*15,9*
	quern flake with quern surface			*11*	*1,4*
polishing stone		*64*	*8,2*		
	whetstone indet			*17*	*2,2*
	block shaped			*7*	*0,9*
	elongated			*1*	*0,1*
	grinding stone			*5*	*0,6*
	with regular u-shaped groove			*21*	*2,7*
	with irregular u-shaped groove			*10*	*1,3*
	polishing stone			*3*	*0,4*
hammerstone		*9*	*1,2*		
	hammerstone one sided			*1*	*0,1*
	hammerstone bipolair			*1*	*0,1*
	pounder			*7*	*0,9*
rubbing stone		*2*	*0,3*		
ornamented		*1*	*0,1*		
unknown		*1*	*0,1*		
block		*2*	*0,3*		
flake		*157*	*20,1*		
unmodified		*345*	*44,2*		
total		*781*	*100*	*273*	*35*

Table 13-1 Frequencies of the different types of artefacts distinguished

13.2.2 Use-wear analysis

Use-wear analysis has been performed on a selection of 40 tools, encompassing a representative sample of the different tool types present in the assemblage. A total of 31 stone implements exhibited traces of wear on a macroscopic level. As some tools display more than one used surface a total of 70 used zones were observed. It should be emphasized that the tools without traces of wear may have been used; absence of wear traces does not necessarily imply that these have not been used. The wear traces may have been removed by post depositional processes. Alternatively, the tools were used either very briefly or on very soft contact materials.

Use-wear analysis on stone tools is a relatively new development, in contrast to use-wear analysis on flint implements. Until recently it was limited to the so-called low power analysis, using a stereomicroscope (Dubreuil 2002; Hamon 2006; Van Gijn *et al.* 2001; Van Gijn/Houkes 2001). In the analysis of flint this low power approach is often combined with a high power approach with the use of a metallographic microscope (van Gijn 1990). Experiments have shown that the high power approach is effective on hard stone tools too (Verbaas 2005; Van Gijn/Houkes 2006; Knippenberg 2007). One of the main problems with high power analysis of stone tools is the size of the objects compared with the limited working space offered by a metallographic microscope. The solution to this problem was a microscope with a free arm, which gives the possibility to look at stones of virtually any size. This study made use of a stereomicroscope with both incident and oblique lightning and a metallographic microscope with incident light. Micrographs were made with a digital camera. Some tools were cleaned with alcohol to remove dirt and grease or were immersed in distilled water in an ultrasonic tank.

All stone artefacts from Geleen JKV have a relatively fresh appearance, displaying almost no weathering or patination. The use-wear traces are generally well preserved. Their visibility varies somewhat between different stones, depending on the hardness and grain sizes of the stone type. Traces of wear on soft stones are slow to build up and often wear away as the stone continues to be used. The traces of wear are therefore never very extensive on such stones and conclusions about the duration are precarious at best. On coarse-grained tools traces develop only slowly and concentrate on the higher points of the surface. Therefore the traces of wear are fragmented and the distribution of traces is not as clear as they are on finer grained stone tools. This variability in wear traces depending on the grain size and other physical attributes of the different stone types is a problem that is much less pertinent in the use-wear analysis of flint surfaces.

Since the reference collection of experimental use-wear traces on stone tools present in the Laboratory for Artefact Studies was relatively limited and focused on tasks relating to the Late Mesolithic, an additional seventeen experiments were carried out for the purpose of this study, focussed on possible Bandkeramik uses of stone tools (Verbaas 2005). All experimental artefacts were of the same raw material as the tools used in LBK: a quartzitic sandstone that could be collected along the Meuse River. The materials worked were, among others, cereals, linseed, bone, antler, wood, ochre and different types of stones used for the production of chisels in the LBK. The motions included crushing, grinding and polishing. All experiments were carried out for at least three hours since it was shown that traces on stone tools develop relatively slow. The results of the experiments were promising. All of the contact materials produced distinctive traces of wear although traces from contact with organic materials developed much slower than from inorganic materials.

13.3 Raw materials represented

The range of raw materials found is quite large. Different types of sedimentary, metamorphic and igneous stones were found (table 13.2). Most artefacts are made of sandstone, ranging from fine and coarse-grained sandstones to quartzitic and micaceous sandstones. All sandstone has a greyish brown colour, which is the original colour, so no patination or secondary colouring took place. The material can be found relatively near to the settlement areas, along the banks of the river Meuse. These banks consist of fluviatile gravel deposits, originating in the Quaternary, which are covered with sediment and which were eroded away by the Meuse (Berendsen 1998, 272). On these same banks the vein quartz and quartzite can be collected. In addition, a small number of metamorphic and igneous rocks were found along the Meuse. These probably originate from the Ardennes and possibly

type	*subtype*	*sedimentary*	*general*	*quartsitic sandstone*	*micaceaous sandstone*	*conglomerate*	*vein quartz*	*mehtamorphic*	*general*	*quartsite*	*shale*	*slate*	*schist*	*gneiss*	*igneous*	*general*	*basalt*	*indet*	*total*
quern																			
	complete quern		*1*	*1*	–	–	–		–	–	–	–	–	–		–	–	–	*2*
	quern mano		*2*	–	–	–	–		–	–	–	–	–	–		–	–	–	*2*
	bread-shaped, fragment		*20*	*4*	–	–	–		–	–	–	–	–	–		–	–	–	*24*
	large and flat, fragment		*32*	*4*	*1*	–	–		–	–	–	–	–	–		–	–	–	*37*
	quern indet, fragment		*102*	*19*	*3*	–	–		–	–	–	–	–	–		–	–	–	*124*
	quern flake with quern surface		*8*	*3*	–	–	–		–	–	–	–	–	–		–	–	–	*11*
polishing stone																			
	whetstone indet		*11*	–	*6*	–	–		–	–	–	–	–	–		–	–	–	*17*
	block shaped		*5*	*1*	*1*	–	–		–	–	–	–	–	–		–	–	–	*7*
	elongated		–	*1*	–	–	–		–	–	–	–	–	–		–	–	–	*1*
	grinding stone		*3*	*2*	–	–	–		–	–	–	–	–	–		–	–	–	*5*
	with regular u-shaped groove		*15*	*5*	*1*	–	–		–	–	–	–	–	–		–	–	–	*21*
	with irregular u-shaped groove		*8*	–	*2*	–	–		–	–	–	–	–	–		–	–	–	*10*
	polishing stone		*2*	–	*1*	–	–		–	–	–	–	–	–		–	–	–	*3*
hammerstone																			
	hammerstone one sided		*1*	–	–	–	–		–	–	–	–	–	–		–	–	–	*1*
	hammerstone bipolair		*1*	–	–	–	–		–	–	–	–	–	–		–	–	–	*1*
	pounder		*5*	*2*	–	–	–		–	–	–	–	–	–		–	–	–	*7*
rubbing stone			*2*	–	–	–	–		–	–	–	–	–	–		–	–	–	*2*
ornamented			*1*	–	–	–	–		–	–	–	–	–	–		–	–	–	*1*
unknown			–	*1*	–	–	–		–	–	–	–	–	–		–	–	–	*1*
block			*1*	*1*	–	–	–		–	–	–	–	–	–		–	–	–	*2*
flake			*78*	*73*	*1*	–	*1*		–	*2*	–	–	*1*	*1*		–	–	–	*157*
unmodified			*171*	*77*	*12*	*1*	*41*		*1*	*20*	*4*	*9*	*1*	–		*2*	*1*	*5*	*345*
total			*469*	*194*	*28*	*1*	*42*		*1*	*22*	*4*	*9*	*2*	*1*		*2*	*1*	*5*	*781*

Table 13-2 The different raw materials represented per tool type

even from the Vosges, because the Moselle used to be a tributary of the Meuse river (Bosch 1982). One piece of basalt was encountered, this artefact may be related to the production of chisels, but displayed no traces of modification or use. Also a lot of iron concretions (N=22) were found that often resemble polishing stones with grooves (N=6). These iron concretions can very well have been used as polishing stones, but since the grooves found in the stones are mainly irregular it seems that we are dealing with locally found and unmodified concretions of natural origin.

13.4 The querns

13.4.1 General features

The querns are easily recognizable by their regularized shape and flat and smooth grinding surface. The surface lacks the characteristic linear traces of grinding stones. The main raw material used for querns is sandstone of an average grain size, but some quartzitic sandstone and occasionally micaceous sandstone was also used (table 13.2). Traces of manufacture are often encountered. The sides of the querns were flaked into shape and the top surface was picked to create a roughened surface to facilitate the grinding. The grinding surface of the querns may initially have been flaked too, but the subsequent picking, long use life and rejuvenation of the quern top may have removed traces thereof. Different types of querns can be distinguished (Zimmerman 1988) and often traces of colorants as for example ochre are found on the tools (De Beaune 1988). Querns consist of an active, dynamic component (the *mano*) and a stationary one (the *metate*). The term quern often refers to the stationary component, the *metate,* a practice also used in this article. During grinding only the central part of the surface of quern is actually used, gradually causing the development of one or two raised borders (Hamon 2006). This process is accelerated by the recurrent roughening of the grinding surface for rejuvenation purposes.

13.4.2 Typology and technology

Querns and quern fragments form 25% (N=200) of the total assemblage and 46% of the number of modified tools. Only two complete querns were encountered (table 13.1). These two complete querns show no resemblance to the quern fragments found and seem to be of another type altogether. The quern fragments can be subdivided in two types: large and flat (N=37) and bread shaped (N=24) (fig 13.1). The remaining 124 fragments are fragmented to such an extent that they can no longer be assigned to one of these categories. Only two *manos* were recognized, but more can possibly be found among the fragments, albeit not recognizable as such. Also eleven flakes with remnants of a quern surface on the platform were found (fig 13.1). These flakes originate from the rejuvenation of the quern surface; in order to keep the grinding possible, the top surface of a quern needs to be rejuvenated on a regular basis by pounding the surface (Gaffrey 1994). The flakes with quern surface remnants seem to have accidentally come off during rejuvenation or by intentional breakage after discard.

The querns show obvious traces of manufacture: not only is the top surface picked to create a roughened surface which is regularly rejuvenated, the quern sides also display traces of flaking in order to create a standardized quern shape. A total of 157 flakes without any further traces of modification were found, many (N=152) of these of the same raw material as the querns. It is thus very likely that the production of the querns took place on the site. The bottom sides of the querns do not show any traces of modification other than rounding due to the long use life of a quern. We have no clues as to the original size of the querns. The two complete querns show no typological resemblance to the fragments and thus cannot be used as evidence for the original quern size. We can however extrapolate the original quern size from the size of the quern fragments: upon discard the querns seem to haven been roughly 25-30 centimetres in length and around 12 centimetres in width.

13.4.3 Use

Of the 200 querns and quern fragments found 20 were selected for use-wear analysis. All of these showed traces of use on a microscopic level, with a total of 44 used zones (table 13.3). Most of the traces could be attributed to the milling of cereals. This high incidence of use is not surprising since querns already display extensive wear traces on a macroscopic level (in fact these traces form the basis for their typological designation as querns). All querns but one had only one active zone of use, with their bottom sides displaying wear traces from lying on a surface with ground flour and seeds. One fragment classified as a polishing stone turned out to be a quern fragment, deriving from the concave part of an implement (fig 13.1). On three querns traces were present, but it was not possible to determine the use, because the traces were not developed well enough to determine the contact material involved. Two querns displayed traces of a combination of cereals and stone. The traces from contact with stone did not resemble any of the traces obtained experimentally by polishing materials used for chisels, so chisel production or maintenance can be ruled out. Rather, the traces seem to be result of stone on stone contact between *mano* and *metate*.

Milling cereals result in a granular, domed polish that is spread over the surface in small linked spots. The gloss is matt and is mainly formed on the higher parts of the stone. Often short striations can be observed with a clear directionality parallel to the longer axis of the quern. Under a stereomicroscope fresh and sharp fractures are visible. Although

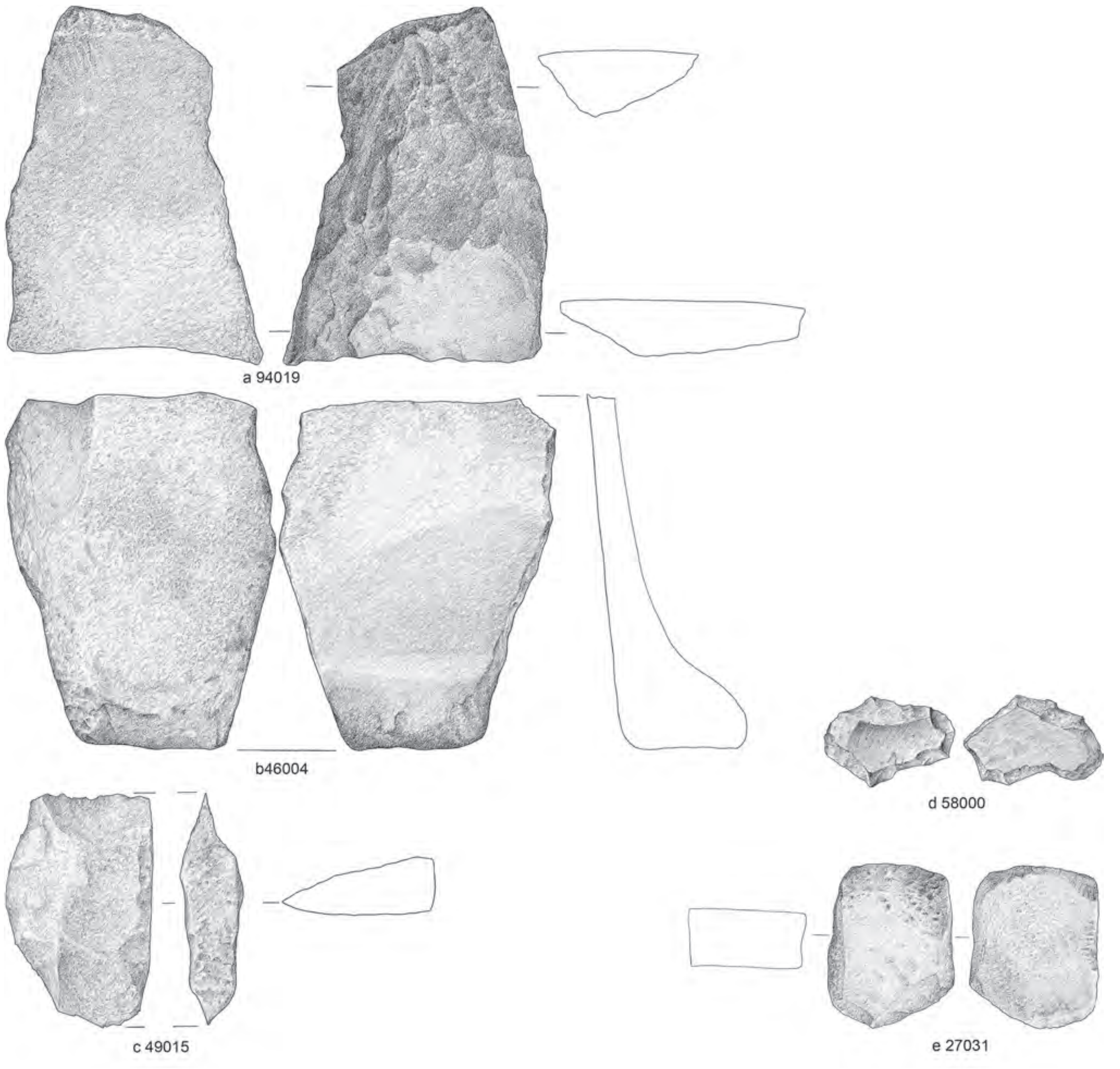

Fig. 13-1 (scale 1:3)
a: fragment of a bread-shaped quern
b: fragment of a large and flat quern
c: quern flake with quern surface
d: quern fragment re-used as a polish stone
e: quern fragment re-used as a *metate*.

	non - silicious plant	cereals	cereals / stone	'quern bottom' polish	wood	stone	holding	hard organic material	not specified / well defined	unknown	total
quern	–	–	–	–	–	–	–	–	–	–	–
complete quern	–	2	–	–	–	–	–	–	–	–	2
breadshaped fragment	–	6	1	3	–	–	–	–	1	–	11
large and flat fragment	–	15	1	9	–	–	–	–	–	–	25
fragment	–	2		1	–	–	–	–	2	1	6
polishing stone	–	–	–	–	–	–	–	–	–	–	–
general	4	2	–	–	–	–	–	–	5	1	12
with U shaped groove	3	1	–	–	1	1	–	–	1	–	7
with irregular U shaped groove	–	–	–	–	–	–	–	3	–	–	3
hammerstone	–	–	–	–	–	–	1		2	1	4
total	7	28	2	13	1	1	1	3	11	3	70

Table 13-3 The relationship between tool type and contact material

the traces from milling cereals are very distinctive, they are not spread evenly over the quern surface. The polish is more developed at the original edges of the quern where rejuvenation was probably less intense than on the central part of the stone. On querns with a raised border the polish is most pronounced on the concave part of the stone (fig 13.2). Due to rejuvenation of the grinding surface use-wear traces are removed during the use life of a quern so no extensive gloss can build up. This rejuvenation can be accomplished by pounding the sandstone quern surface with a hammer stone. Considerable force is needed to do so. The flint blade cores frequently encountered in LBK context often display pounding marks (Van Gijn 1990). Experiments with replicas of these cores show these exhausted cores to be eminently suitable for this purpose. Because of their pointed butt ends and the fact that flint is much harder than sandstone, it is possible to roughen a smooth sandstone quern surface (Verbaas 2005).

The querns are predominantly used for milling, executed in a longitudinal direction, parallel to the long axis of the implement (table 13.4). On two querns traces of pounding were found, indicating a secondary use of the quern as hammer stone. The bottom sides of the querns also show traces of wear. These traces resemble those resulting from contact with cereals, but have a slightly different character, sometimes almost resembling polish from hide (fig 13.2). The gloss visible on the bottom side of the querns seems to be caused by friction with the seeds and flour that get underneath the quern while grinding and from the surface the quern is placed on to catch the cereals and flour that fall off the quern, most likely a hide. The bottoms of the querns are highly worn and rounded. Since this side of the querns is not rejuvenated during use, they give a good indication of the long use life of the querns.

13.4.4 Discard

Almost all the querns found were fragmented. This is a common practice not only in the LBK (Gaffrey 1994), but also in other periods and regions (Bakker 1979; Chapman 2000). Fragmentation is often referred to as accidental, but ground stone tools are not easy to break. They are very tough and substantial force has to be applied to fracture them.
It can of course be proposed that these tools were broken during rejuvenation of the work surface. However this would result in the snapping in half of the original quern at the centre of the tool where it was rejuvenated most intensively and was therefore the thinnest. Such breaks do occur but in addition we see fragmentation of much thicker parts of the original quern, where breaking could not have been accidental. In order to quantify the degree of fragmentation,

	longitudinal	*transverse*	*pounding*	*grinding*	*polishing*	*crushing*	*holding*	*unknown*	*total*
quern	–	–	–	–	–	–	–	–	–
complete quern	–	–	–	*2*	–	–	–	–	*2*
breadshaped fragment	*1*	–		*5*	–	–	–	*5*	*11*
large and flat fragment	*1*	–		*16*	–	–	–	*8*	*25*
fragment	–	–	*2*	*2*	–	–	–	*2*	*6*
polishing stone	–	–	–	-	–	–	–	–	–
general	*3*	–	*1*	*1*	–	*2*	–	*5*	*12*
with U shaped groove	*3*	*1*	–	–	*1*	–	–	*2*	*7*
with irregular U shaped groove	–	–	–	–	–	–	–	*3*	*3*
hammerstone	–	–	*3*	–	–	–	*1*	–	*4*
total	*8*	*1*	*6*	*26*	*1*	*2*	*1*	*25*	*70*

Table 13-4 The relationship between tool type and executed motion

the number of fractured surfaces was counted for a selection of 102 quern fragments. A total of 63 quern fragments display more than one fractured surface, with a maximum of four. If this high degree of fragmentation is not accidental, there has to be another explanation. Querns could be fragmented in order to reuse the fragments for other purposes. However, only three quern fragments were reused, two as *manos* and one as a polishing stone. Fragmentation in order to obtain stone fragments for the production of other types of tools can thus be ruled out as well.

We propose that the fragmentation is due to the intentional destruction of the querns after their use life is finished. This intentional fragmentation is a feature that we frequently see in so-called ritual context (see for examples Chapman 2000). Agriculture, the practice querns are of course intimately associated with, is of old surrounded with taboos and magical practices to ensure the fertility of the land and the abundance of the crops. Offerings are made to the gods and the ancestors to ask for favourable conditions. We propose that the fragmentation of the querns can be seen from this perspective: the querns had to be destroyed, had to die so to speak.

This proposition is supported by another striking feature seen on the quern fragments: they frequently display remnants of ochre. Again, this is a common feature in other LBK sites (Zimmerman 1988) and has also occasionally been noted for other agricultural tools (De Beaune 1987; Van Gijn *et al.* 2006; Van Gijn *et al.* in prep). Most researchers assume that the ochre traces on the LBK querns are due to the use of these querns for grinding ochre. However, the ochre on the quern fragments of Geleen JKV is not only present on the top of the querns (their actual grinding surface), but also on the bottom, the sides and, most noteworthy, on the fractured surfaces. There are no signs of use-wear polish and striations on the stone surfaces that can be linked to the grinding and crushing of ochre, so the ochre must have been intentionally applied after the fracturing of the stone. Ochre is frequently seen as a symbol of blood and thus life and used in ritual context. In LBK society it is occasionally applied in graves (Modderman 1970; De Grooth 2005) where ochre is given as a grave gift in the form of nodules or powdered ochre is spread under or over the body of the dead. The combination of intentional fracturing of the quern and the application of ochre thus seems to have a symbolic and ritual significance, marking the final death of this agricultural implement and the last step in its biography.

13.4.5 Quern biography

The querns therefore have a distinct life cycle. The sandstone cobbles from which they were produced were obtained in the gravel deposits of the river Meuse and transported to the settlement. The presence of production flakes of sandstone indicates that the querns were manufactured locally. The querns were shaped by percussion, probably with a hard hammer. We find manufacturing flakes throughout the settlement. The querns were subsequently used for grinding cereals. The quern was most likely placed on a piece of hide or leather. The tool was regularly rejuvenated during its use life. At some point, its use life ended. Because several querns

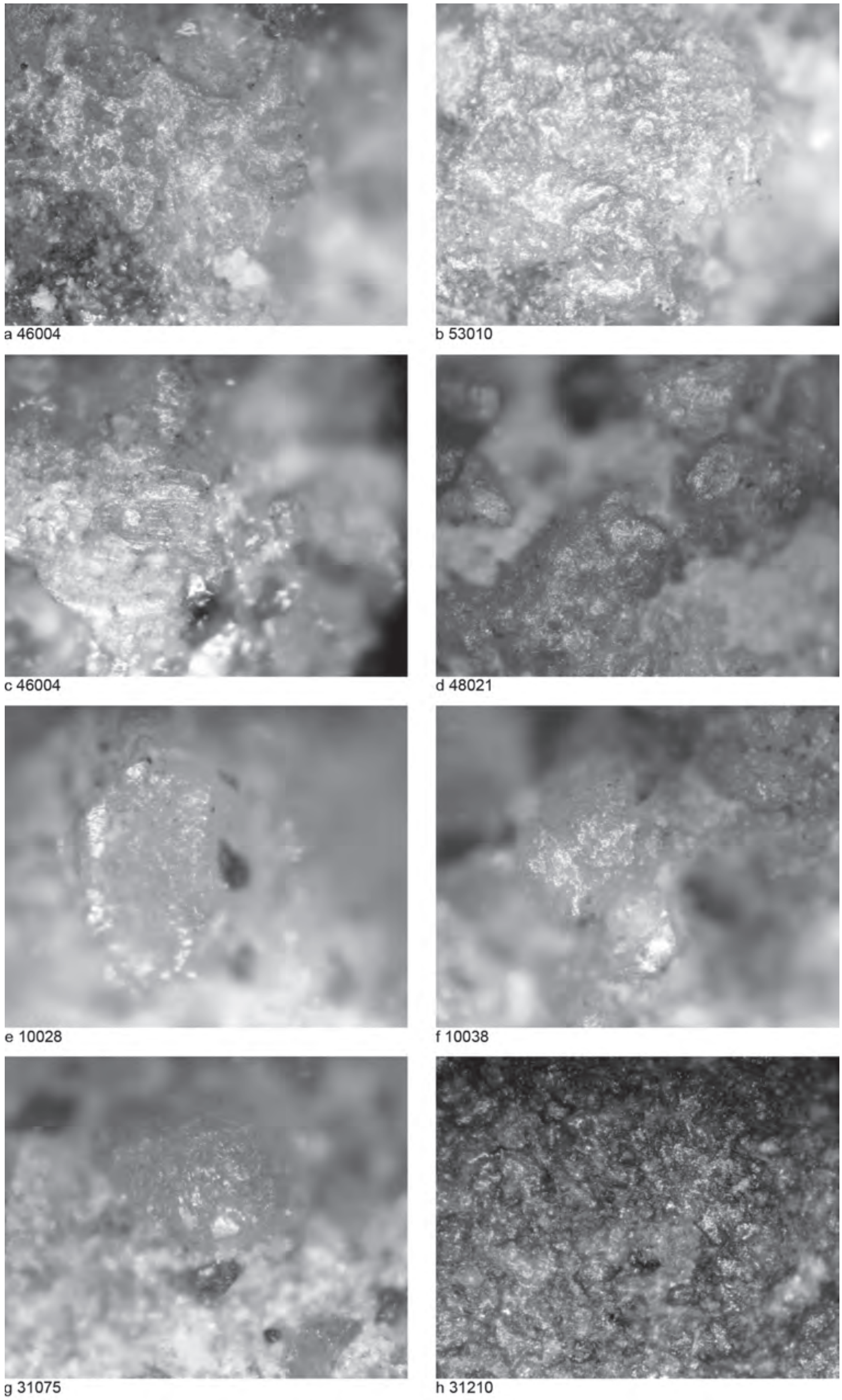

Fig. 13-2 (original magnification 100 ×)
a: traces from grinding cereals
b: traces from grinding cereals
c: traces seen on the bottom of quern
d: traces seen on the bottom of quern
e: traces from contact with both cereals and stone
f: traces from contact with non-silicious plant
g: traces from contact with wood
h: handling traces on pounder

were not exhausted when they were discarded, it is not clear why their use life was ended. All fragments differ substantially in terms of their thickness, indicating that exhaustion cannot have been the sole reason to end the use life of the querns. It is more likely that we will have to seek the explanation in the cultural sphere. We suggest that this fragmentation was intentional and had to do with the ending the life of the quern. At the end of its use-life the quern is thus fragmented and the fractures and other surfaces rubbed with ochre. After this the fragments are discarded. The fact that these querns were not just discarded after their use life but made unusable by breaking them and were covered in ochre indicates their special significance in society. Although the majority of the quern fragments was found in the features, there is no evidence that querns were deposited in pits as special depositions such as has been observed in LBK and Blicquy context in Belgium (Jadin *et al.* 2003, 457) and in the Paris basin (Hamon 2006, 148).

13.5 Other stone tools

13.5.1 Polishing stones

Polishing stones form a total of 8.2% of the assemblage (N=64) and can be further subdivided into stones with and without grooves (table 13.1). The raw material used for polishing stones varies from very fine- to very coarse-grained sandstones (table 13.2). Occasionally quartzitic or micaceous sandstone was used for the production of the polishing stones. Especially the micaceous sandstone is very fine-grained and eminently suitable for polishing, whereas the stones with grooves are mainly made of coarser-grained stones.

Polishing stones without grooves (N=33) display polished or otherwise ground surfaces. They vary from two to fourteen centimetres in length and range from 1.6 to 393 grams in weight with an average of 69 grams. They are mainly made of sandstone and micaceous sandstone but in one case a quartzitic sandstone was used. The appearance of these tools is mainly shaped by the natural surface of the raw material used. Since stones of many different shapes and sizes were employed, polishing stones display different characteristics; also they often have more than one polished facet (fig 13.3).

Stones with grooves (N=31) are commonly referred to as arrow shaft polishers. However, since this term is directly indicating an assumed use and because no corresponding 'sets' were found, the term will not be used here. Stones with grooves are found with U-shaped grooves (N=21) and with irregular grooves (N=10). These irregular grooves are either not straight or they have an irregular bottom, suggesting these grooves may not have been due to use but rather have a natural origin. In fact we have several such naturally grooved stones in our possession, found in southern Limburg, that further support their dismissal as human artefacts. Stones with regular grooves often also display flat polished surfaces (fig 13.3). They vary from 2.6 to 8.3 centimetres in length and have an average weight of 39.8 grams

The variability in polishing stones is probably larger than the two categories differentiated here as they display numerous different shapes and sizes and often have multiple used areas (fig 13.3). Even the strict distinction between polishing stones with and without grooves is not as strict as presented here. Polishing stones with groove often also display flat polishing surfaces. In this study however, grooves were seen as the distinctive attribute, so they were described as stones with grooves.

An alternative subdivision of the polishing stones can be made on the basis of grain size of the parent material. Such a distinction is related to the presumed use of the polishing stones: the finer-grained tools would be used for polishing, whereas the coarse-grained tools would be more suitable for the rougher, grinding work. When tools are subdivided this way we distinguish fine-grained (N=19), medium coarse-grained (N=17) and coarse-grained (N=28 of which 8 with irregular grooves) polishing and grinding stones.

A total of 18 polishing stones were selected for use-wear analysis, half with and half without grooves. Nine polishing stones show traces of wear, producing a total of 22 used zones (table 13.3). The main contact material is plant (fig 13.2), but the kind of plants and/or the part of the plant that was processed, could not be further specified. Detailed phytolith analysis would have to be performed to establish this (e.g. Van Gijn/Houkes 2006). Also traces from milling cereals were found on one of the polishing stones, an inference that seems to contradict with the tool type. This implement, however, was originally a quern fragment, that was subsequently re-used as a polishing stone (fig 13.1). On one polishing tool traces of working stone were found. This is significant since chisels were commonly used at Geleen JKV and these chisels had to be maintained and re-sharpened. One polishing stone for this purpose seems very little but it may well be that the polishing and maintenance of the stone chisels was done near a stream outside the actual settlement area. Such locations are the most appropriate areas for this task: water and sand are at hand (Pétrequin/Pétrequin 1993; Hampton 1999).

No traces of bone or antler have been found, this is consistent with the use-wear analysis of the flint tools (Verbaas/Van Gijn this volume, Ch. 11). Bone and antler tools are not found in Geleen JKV due to conservation circumstances. It is therefore impossible to determine whether these raw materials were used for tool production. It seems relatively certain however that flint and other stones did not play a role in their production.

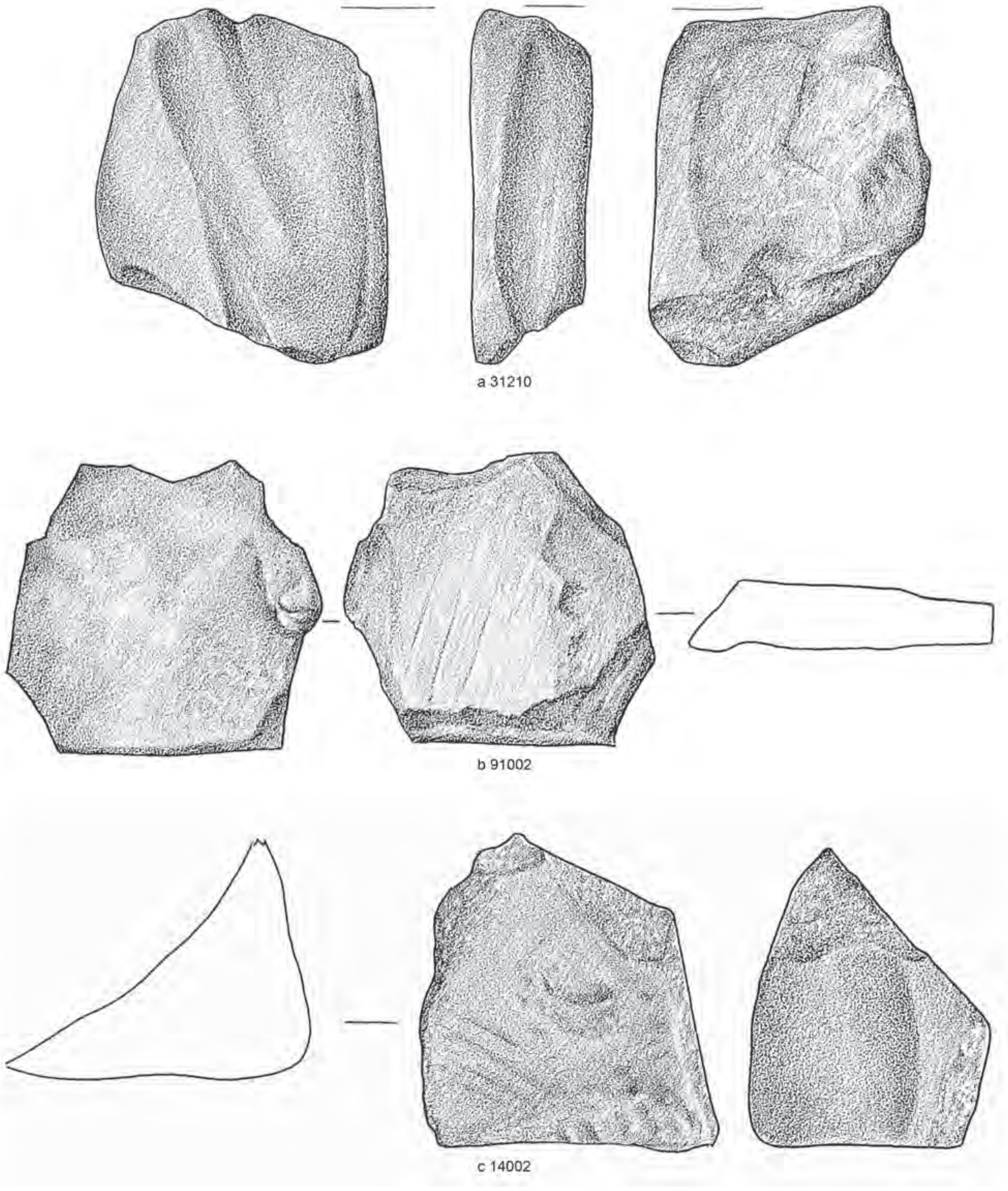

Fig. 13-3 (scale 1:1)
a: polishing stone with multiple grooves
b: polishing stone with two polished facets
c: polish stone with multiple facets

In some cases wear traces were observed on the polishing stones, but no further indication for the worked material could be given because distinctive features of wear were lacking. These wear traces were described as hard organic material, not specified/well defined and unknown materials.

13.5.2 Hammer stones

Only nine pounding- or hammer stones were found in Geleen JKV (2.1% of the tools found). In LBK context however, exhausted flint cores were reused as pounding stone (Van Gijn 1990; De Grooth, Ch. 10 this volume) making hammer stones of other raw materials largely superfluous. The hammer stones are made of sandstone (N=7) and quartzitic sandstone (N=2) (table 13.2). Two of the hammer stones found were round pebbles with impact traces on a protrusion. One was used one sided, the other two sided (table 13.1). The other hammer stones can be described as pounders, oblong in shape with pounding marks on one or both ends. One pounder showed traces of pounding a red residue on both ends (fig 13.4). It was probably used to crush and finely grind hematite nodules into powder.

Two pounding stones were selected for functional analysis (table 13.3). Both showed traces of pounding but the contact material involved could not be determined. One of the pounders showed traces of sustained holding. Holding traces are characterized by the presence of a greasy, domed and highly linked polish, located on both the lower and higher parts of the surface. These traces are also found on experimental tools that are used for a long time. The pounding traces on the tool were not very extensive; probably either a very soft material was pounded with the tool or it was used very gently.

13.6 Spatial and diachronic patterns

Both on the basis of the pottery (Van de Velde, Ch. 7 this volume) and flint (De Grooth, Ch. 10 this volume) two wards could be distinguished within the settlement, a northern and a southern one. In order to see whether this distinction would also be visible in the distribution of the hard stone tools, all artefacts found in features were plotted, both the modified and unmodified ones. Distribution plots were also made of the different subtypes (bread-shaped versus large and flat querns and polishing stones with and without grooves). Last, the distribution of the querns with ochre was examined.

It can be seen that the majority of the hard stone finds is found in the southern part of the settlement (fig 13.5). This was also observed for pottery and flint. No technological or typological differences could be seen between the northern

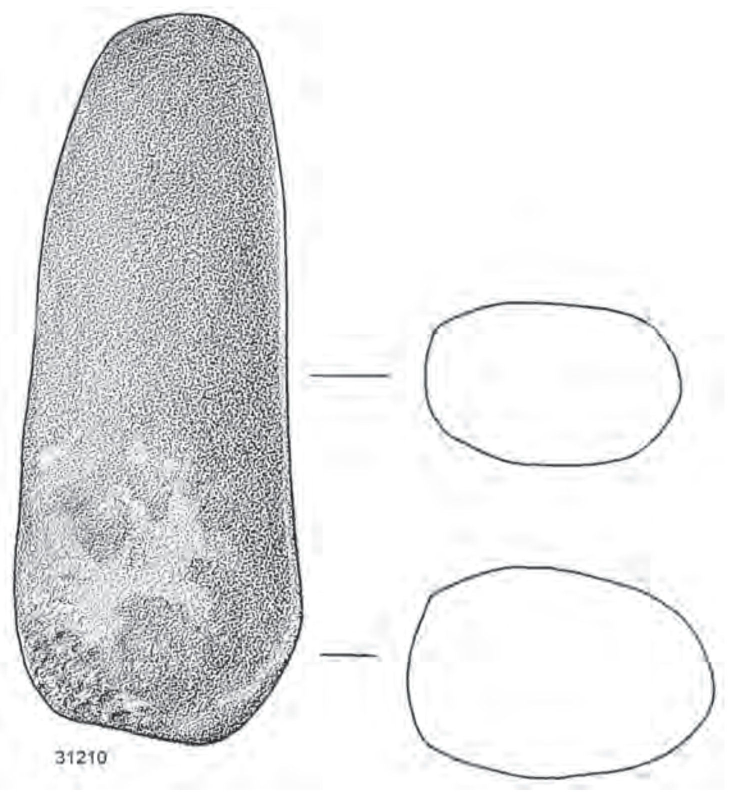

Fig. 13-4 Pounding stone used on both ends and with traces of ochre (scale 1:1)

Fig. 13-5 Distribution map of all stone tools found at Geleen JKV.

and southern ward of the settlement. The flakes with quern surfaces are all located in the southern part of the settlement. For the other tool types and the querns with ochre no spatial patterns can be observed. Diachronic patterns could not be distinguished as there was no difference in number of quern fragments between the different house generations that were distinguished. This pertained both to the fragments with ochre, as to those without.

13.7 Conclusion

The predominant hard stone implement is the quern. A considerable number of quern fragments were found, indicating the importance of cereal processing for the LBK people. Considering the large number of finds and the probably extensive period these tools were used, we cannot but conclude that the milling of cereals constituted an important subsistence activity. Other plant materials were processed as well, usually on flat surfaces of polishing stones. It is not clear what kind of plants were involved but it most likely concerns a subsistence activity as well.

As far as craft activities are concerned, the hard stone tools have not produced much evidence. Bone and antler working traces are absent. This is in support of the findings from the use-wear analysis of the flint implements that also indicate that bone and antler tool manufacturing may not have been a predominant task for the LBK people and certainly did not seem to involve tools of flint and other stones. Polishing stones are somewhat of an enigmatic tool category. They include grooved stones and stones with polished surfaces. Some of the grooved stones were dismissed because they were products of nature, not of man. The stones with polished surface incidentally displayed interpretable traces of wear. One such tool was found with traces from polishing hard stone, a tool that we may associate with the maintenance of chisels. However, it is likely that chisel repair and maintenance mainly took place outside the settlement proper near a stream with running water where sand was also available. Stone hammers were involved in the crushing of ochre, considering the presence of this material on one hammer stone. The hammer stones must probably be seen as multi-purpose tools. However, this is difficult if not impossible to demonstrate as the continuous pounding removes particles of the tool, and thereby developing traces of polish.

The number of tasks the stone tools were involved in is relatively limited. It is therefore difficult to reconstruct the part of hard stone tools in relation to tools made of flint. The picture is also far from complete because no chisels were examined for traces of wear. This tool type is believed to have played a role in wood working (Dohrn-Ihmig 1979/1980). It is also postulated that chisels were used for clearing the land. Hopefully the chisels can be examined for traces of wear in the future, but the experimental programme that must lie at the basis of functional inferences, will require quite an investment of time and money. Apart from the chisels other multifunctional tools were the hammer stones and possibly the polishing stones. The latter display use-wear traces from different kinds of contact materials. The amount of information is too limited to obtain a good idea of the role of flint and hard stone tools in the technological system.

	longitudinal	*transverse*	*pounding*	*grinding*	*polishing*	*crushing*	*holding*	*unknown*	*total*
non - silicious plant	*4*	–	–	–	*1*	–	–	*2*	*7*
cereal	*1*	*1*	–	*24*	–	–	–	*2*	*28*
cereal / stone	–	–	–	*2*	–	–	–	–	*2*
‘quern bottom’ polish	*2*	–	–	–	–	–	–	*11*	*13*
wood	*1*	–	–	–	–	–	–	–	*1*
stone	*1*	–	–	–	–	–	–	–	*1*
holding	–	–	–	–	–	–	*1*	–	*1*
hard organic material	–	–	–	–	–	–	–	*3*	*3*
not specified / well defined	–	–	*5*	–	–	*2*	–	*4*	*11*
unknown	–	–	*1*	–	–	–	–	*2*	*3*
total	*9*	*1*	*6*	*26*	*1*	*2*	*1*	*24*	*70*

Table 13-5 Activities inferred: contact material versus motion

As said above the quern fragments constitute the most important category of hard stone tools in Geleen JKV. The study of their life cycle has provided essential information on the significance of this type of tool. They not only formed an essential implement in the agricultural *chaîne opératoire*, processing the seeds of various cultivated cereals, but also were attributed a special significance. They seemed to have undergone a special ritual after their actual use life came to an end. This can be inferred from the intentional destruction of the querns at the end of their use life, sometimes before they were actually exhausted, and the subsequent rubbing of the fractures and other surfaces with ochre. Obviously, we will never know what their exact significance was to these past people. However, this unusual treatment of an agricultural tool *par excellence* indicates that cropping practices were surrounded by rituals, suggesting that agriculture played an important part in the ancient belief systems.

Stone tools are frequently not studied extensively, because they are often simple and not intentionally modified. In this paper we hope to have shown that stone tools merit a more thorough study. It is especially the study of the life cycle of stone tools, from the initial selection of the raw material, through manufacture and use, to the actual discard and the treatment the tool undergoes upon deposition that promises to provide not only essential but foremost exciting information on the significance of stone objects for past societies.

Notes

1 Typology and raw material were described according to the specifications of Archis, the digital national reference collection set up by the Archaeological State Service, Amersfoort, The Netherlands.

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14 On chronology: pot sherds, house ghosts, and carbonized seeds

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Current practice of the seriation of LBK pottery is analysed in order to overcome the difficulties obtaining with the (seeming) stasis during the Flomborn period, generally resolved by recourse to stages in the development of the houses' construction. A finer resolution of the analytical categories of the pottery decoration allows further chronological differentiation, and that way house construction and pottery decoration become separate and mutually independent categories again. An important result is that the evolution of the central post configuration of the houses is not step-wise but gradual/battleship-like, like any other category of material culture. Also, a series of 8 AMS dates is presented, four of which can be pooled to provide a date of 6204±22 bp; on archaeological grounds the JKV village was established less than a generation earlier, so that 5220 BCE is suggested as the year of the LBK immigration into the Graetheide area and adjacent Siedlungskammer.

14.1 Introduction

The aim of the present chapter is to establish an internal settlement chronology and to relate this to the general, external chronological frame. As in other Bandkeramik villages, stratigraphic analysis is only marginally applicable here as houses and associated features almost consciously seem to avoid overlaps. Instead I will attempt an analysis of changes in the decoration of the fine ware to seriate the associated houses. Previous efforts to sequence Bandkeramik pottery decoration have met with partial success only because of the apparent stasis in the repertoire during the Flomborn or Older LBK period. Recourse has usually been sought in the evolution of the construction of the houses. In a way, apples (decorated pots) are compared with pears (house plans) — a methodologically suspect procedure. By chance, the present settlement was inhabited mainly in that early period so that this apple and pear problem will have to be tackled head on. A closer look at the current practice of pottery decoration analysis will reveal that it is not so much a stasis in the decoration's evolution that is at fault, but rather the coarse and un(der)theorized categories in the analyses.
A sharper definition and analysis of the pottery decoration will allow the sequential ordering of the houses, even within the Flomborn period. Apart from this, the establishment of the absolute chronological position is (at least initially) quite straightforward from an archaeological point of view: a selection of carbon samples is sent to the laboratory, and out come the physical dates, if all goes well. However, even the methods of 'science' have their problems —in the present case the conversion of radiocarbon readings 'bp' to calendar dates is complicated by the presence of 'wiggles' in the relevant parts of the calibration.

First earlier classificatory schemes for decorated LBK ware will be dealt with as a basis for the study of pottery decoration, and then an analysis of the Janskamperveld decorated pottery and a relative chronology based on it will be presented. Next I shall discuss relative chronologies based on the changing configuration of the posts in the central parts of the houses; again followed by a similar attempt for the present settlement. Finally the outcomes of a set of radiocarbon determinations will be presented, with the aim of positioning the Janskamperveld settlement in the wider prehistoric and Bandkeramik contexts.

14.2 The analyses of LBK pot decoration: a short review

Analysis of Bandkeramik pottery decoration usually aims at establishing a relative chronology along with a regional differentiation: decorative preferences have evolved over time, regionally in slightly different directions. Similarities indicate synchronicity; recognition of regional styles allows perception of contacts between regions (after Montelius and Childe). These generalities were applied relatively early in Bandkeramik studies, and a vast body of texts on the subject has appeared since. Here ignoring the earliest attempts (e.g., Jenny 1928; Butschkow 1935) and also selectively shopping among recent authors, in Buttler/Haberey's report on the Lindenthal excavations a fair number of pages was devoted to the definition of types of pottery decoration (mainly based on the different fillings of the strips which make up the ornamentation on the pots, yet not neglecting rim decoration), which through careful examination of their mutual association in that long-inhabited site's pits could be assigned chronological significance. Regional origins were considered through archaeological and mineralogical comparison, too (Buttler/Haberey 1936, 92-121). Buttler deduced that with time the empty decorative strips on early LBK pottery gradually became filled up with an extra line, small points and/or hatchings, and also that the motifs became more convoluted. He signalled some more elements of change and regional differentiation; the 14 authentic LBK strip types distinguished by him became standard tools for generations of scholars (e.g., Meier-Arendt 1966). When Modderman and Waterbolk published their excavations of Dutch LBK sites in the 1950s, they applied Buttler's typology to the finds from Geleen, Sittard and Elsloo, slightly amending two types only (Modderman/Waterbolk 1959). Important from a methodological point was their explicit recognition (all translations are mine, PvdV):

> *For the assessment of the decorated pottery we have employed the classification made for the finds from Köln-Lindenthal by Buttler. The classification is based upon the type of the decoration, which is most appropriate for the very fragmentary ceramic material from Bandkeramik settlements. The decoration's motifs are not useful as a starting-point, as they are rarely complete.*
> Modderman/Waterbolk 1959, 173

For his later, still more extensive excavations, Modderman developed this classificatory scheme into the one that was to become most influential in Bandkeramik studies, and which was purely a differentiation of 18 types of strip fillings (Modderman 1970, 121-140, especially the chart on p. 122); as in Buttler's accounts, in the accompanying text rim decoration and secondary motifs were not neglected. This typology was explicitly not intended as a chronological index[1]:

> *We have very consciously sought not to build a typological chronology…* Modderman 1970, 121

but presumably as an aid to description only (my inference, as this is nowhere stated). Yet, in the chapter on relative and absolute dating in that same book (ibid., 192-201) a scheme was presented which had only one possible implication: a relative chronology based on a combination of characteristics of ceramic decoration and house plans — represented by 32 and 7 elements, respectively (ibid., 199).

On the other side of the border, several investigators aimed at refinement of Buttler's periodization of the northwestern LBK (Gabriel 1979; Dohrn-Ihmig 1974). They worked with punch cards on material from earlier excavations but it proved impossible to achieve their aims by hand. At about the same time Stehli was working on an analysis of the first finds to emerge from the Aldenhovener Platte Project (Stehli 1973, 86 n. 42). He left no doubt about his quantitative and statistical inclinations — after all, vast amounts of data were to be expected from that Project. He opened quite programmatically with:

> *The pottery will be analysed on its characteristics, for which the classification and count of the finds already articulate with storage in a planned database.* Stehli 1973, 57

(Remember, this was just before computers became available to universities). And some lines later he added:

> *In this investigation, the pottery shall serve the purpose of ordering the pits and the houses [at Langweiler 2] chronologically as precisely as possible.* ibid. 57

He intended to work with all commonly recognized properties of individual pots (ware, shape, and decoration), yet had to admit that most of the elements were either too laborious to observe on all sherds, or too large to be visible on settlement debris, as had been noted by Modderman and Waterbolk before. Hence, only a small part of the original scope was retained, the "elements of the motifs" (Stehli 1973, 60; I shall refer to this classificatory scheme and its derivatives as the 'Rhineland Model' below). He manually sequenced the pit counts from that settlement to a chronological series. In later publications, accounting for neighbouring settlements, the list of elements (or band types, *Bandtypen*) was slightly amended though not fundamentally so (e.g., Stehli 1988), and the results of the meanwhile computer-assisted analyses of pottery decoration combined with changing architectural characteristics finally allowed the recognition of fifteen house generations along the Merzbach, an impressive achievement. But again, the earlier *ceramic* phases (with their Flomborn/Older LBK attribution) showed so little stylistic variation that the changes in the post configuration of the central part of the houses had to be brought in to differentiate these phases (Stehli 1988, 458; Boelicke *et al.* 1988, 915) — an unacknowledged return to the Modderman scheme of 1970.

Whereas Stehli's work with the Rhineland Model was aimed at establishing a relative chronological sequence only (Stehli 1988, 453), other students have tried to extend the idea of stylistic variation to inter-settlement analyses (again, in a return to Buttler's studies):

> *Normally, in a seriation of the strip types the stylistic evolution (chronological sequence) is represented by the first Eigenvector [in a Correspondence Analysis]. … In a continuous development the distances between the units are small, whereas a discontinuous evolution is indicated by substantially larger distances on that vector. This rule of thumb is void when apart from stylistic development other factors like, e.g., social structure, have a strong influence on the composition of the units.* Kneipp 1998, 93

In the last sentence of this quote, Kneipp hits the nail on the head, though from a wrong angle: social influences are all there is to 'stylistic variation'; there is nothing else — even chronology is but an effect of social change. Thus, there is no *a priori* reason why the time factor should account for the largest part of the variation in the data as hinted at in his first sentence: that depends on the composition of the data, as correctly noted in the last sentence of the quote. Unless time is reified as a causal factor, every Eigenvector in the outcome of any multivariate analysis should be examined as to its constituents before positing its interpretation. Although Kneipp seems to hint at intra-settlement variation (my reading of his term *social structure*), in the remainder of the book he is concerned with the definition of stylistic groups with chronological content, and the determination of regional styles in the area between Rhine, Weser and Main. In Germany, several more analyses of the mixes of pottery characteristics in Bandkeramik settlements have been made, all with the same aim of defining stylistic groups and chronology; most notable is Frirdich (1994), who based on the same data came to very similar conclusions as Stehli, so providing a confirmation of that work. Also, Krahn (2003) and Claßen (2006) should be mentioned here; apart from the regular chronological concern with band types, they shifted attention to the secondary motifs to investigate communication and marriage patterns within and between the Rhineland LBK settlements.

One other development in this field should be noted here. In Czechoslovakia in 1956 Soudský started the investigations at Bylany, later directed by Pavlů, which with few interruptions continue up to the present. The first results were made public in 1960, and comprised a quantitative analysis of the decorated pottery for the purpose of a site chronology (see Pavlů 2000, 1-3 for the history of that project, and the references). Research interests gradually shifted towards wider pursuits, and in the most recent publication the chronology is hardly discussed, figuring merely as a backdrop for social and ideological inferences, more often than not grounded in distribution patterns in time and/or space of decorative characteristics. One example should suffice:

> *It would be more acceptable to explain the line shape and its symbolic value as an index of kin groups, as has been proposed for the central motifs … the order of these motifs is less chronological than sociological, and comprises a genealogy of the Bylany site's two lineages.* Pavlů 2000, 167

The text describing Bylany's pottery is replete with this kind of inferences, often quite specific, sometimes more general, providing well-founded explorations of what more can be read from pottery decoration than chronology alone.

14.3 The analyses of LBK pot decoration: on methods

The above discussion shows that several archaeologists have considered Bandkeramik pottery decoration as a venue into relative chronology and prehistoric social structure, although they differ in the scope of their aims. Most have been content with the definition of regional groups of pottery decoration presumably mirroring tribal affiliations or something of that sort, some have inquired into local structures, explicitly assuming group/socially conditioned preferences in the field of pottery decoration. From the substantial effort necessary to establish regional traditions (e.g., Dohrn-Ihmig 1974, Stehli 1994, or Kneipp 1998) it can be inferred that to arrive at the even more detailed intra-site level, intricate and probably quite extensive analyses are required.

Almost thirty years ago I proposed yet another, though conceptually quite different classificatory scheme for Bandkeramik pottery (Van de Velde 1976; slightly amended in Van de Velde 1979, 1-25). It started as a reaction to the obvious shortcomings of previous classificatory schemes, including that of Modderman discussed above. To me, an important flaw of those classifications is their 'open' (inductive) character (Claßen 2006, 189), which means that no conclusions are drawn from the logical relationships governing the design or structure of the decoration. Rather, the schemes are based on the local variation, adding 'classes' as new material is excavated which does not fit — as a consequence, one never knows whether all variation in the data has been incorporated (one recent application of the Rhineland Model defined eight hundred (!) characteristics, with coding instructions requiring a full 54 pages; Kneipp 1998, 215-269). Another major flaw has been the general avoidance of the question of the relationship between research interest and classification — most clearly illustrated by Modderman's explicit denial of chronological intentions while developing his scheme, and the subsequent, just as explicit, use of it for chronological ordering without acknowledging this methodological shift[2]. And although Stehli was quite programmatic about his chronological intentions, he has nowhere discussed (at least as far as I am aware) the reasons behind the incorporation of at first some thirty-plus traits, and later adding 150 traits — I mean: why specifically this set of elements, and why not another one? Even if it were true that it is impossible to know beforehand what is chronologically relevant (or relevant for the delimitation of style groups, or the relationships between social groups, or whatever), a pilot study would presumably clear the field substantially. To put it simply, previous studies could be used as pilots — e.g., the Lindenthal publication by Buttler is full of chronological conclusions (Buttler/Haberey 1936).

It is my considered opinion that the decoration on the pottery of a group has a logic that can be fleshed out and understood. Being a relatively bounded cultural field, a well-worn tradition like LBK pottery decoration is unlikely to be deficient in this respect. Still, I suspect that the Stehli classificatory scheme/Rhineland Model was designed fully aware of this problem without openly coming to grips with it:

… possible interdependencies of rim and strip motifs interfere with the gravity point calculation since two characteristics would be counted separately which in reality rest upon a common factor. When such stylistic or even functional dependencies can be excluded, nothing can be held against a joint ordering in a single matrix of different kinds of characteristics. The point is to catch temporal change through the changing combinations of characteristics which vary independently of one another.

Stehli 1973, 85

As a consequence, the Rhineland Model was fitted with as many different 'types' as intuited on the pottery at hand, although no definition of the concept 'type' was given. As can be demonstrated easily, this early Model and all its later derivatives (including Kneipp's scheme), are quite deficient as many more 'types' will turn up in further excavations. As an example, and restricting myself to Stehli's 1973 chart with types of rim decoration: that decoration is made up of either lines, small points, stab-and-drag small points, finger impressions or small hatchings (five alternatives); they come singly or paired (theoretically providing two alternatives); they occur in one, two, or three-or-more rows (three alternatives); their direction is undetermined, horizontal, oblique, or vertical (four alternatives); and they are either continuous around the rim, or metope-like partitioned (two alternatives). Together they make 5 × 2 × 3 × 4 × 2 = 240 possible combinations, of which his 39 types (also including the undecorated rim) are but a partial sample (cf. Stehli 1973, 69). Four or five simple and mnemonic variables each with a small number of attributes instead of 240 separate 'types' would have described *all* possible alternatives.

Returning to my conviction that there is a logic behind LBK pottery decoration, I proposed a simple reduction of the decorative motifs on Bandkeramik pots to wave and spiral basic forms, developed according to reflection, rotation, translation and glide, together constituting an algebraic group (an *algebraic group* implies that *all* possibilities of variation are exhausted in it) (Shepard 1954, 266-276; Washburn/Crowe 1988, 44-51). So far, I have not found any LBK design outside this group[3]. For instance, in Pavlů's analytical scheme especially this dimension and its format have been adopted for the elucidation of social relationships (Pavlů 2000, 151/D, K). Similarly and as a further example, a motif is executed either in a rectilinear or curvilinear format — rectilinearity of course being restricted by the round form of the pot belly — no other possibility is conceivable.

The other major flaw in existing schemes is the relationship of the research question to the aspects or dimensions entered into the classification. If every imaginable dimension of pottery is to be incorporated in order to answer all possible questions, the required set of characteristics would be infinite: there is some real reason for selection here. In the present analysis I have two research questions: the relative chronology of the site, and the definition of and relationships between social groups in the Janskamperveld settlement. As for the first problem, already in Modderman 1970 a set of traits is indicated which are sensitive to chronology (or, rather, which are indexing change over time). Obviously, more or less change over time will be visible in all aspects of pottery decoration, stagnation is nowhere to be expected; yet some aspects vary directionally, while others behave haphazardly. Based mainly on Modderman's observations, obvious candidates in the Graetheide LBK for directional change are the dimensions of techniques of decoration, and complexity and contents of design.

Regarding the techniques of the decoration, I sought to define them exhaustively as there are only five logical possible ways to decorate a pot's surface (Shepard 1954, 69; Sinopoli 1991, 25-26) of which incision is by far the most frequent in Bandkeramik ceramics. Also, the incisive tools with which the surface has been modified had either one single or a multiple (comb-like) point, the latter being an addition rather late in the LBK era. Thus, the members of this class are sticks, simple and multidented spatula, plastic moulding with either finger imprints or an appliqué. The quantitative composition of the tool set shows variation over time, as does the complexity of the decoration. Still according to Modderman, the zonation of the decoration shows marked changes: early in the Dutch sequence only the belly zone of the pots is decorated, while towards the end of the older phase also rim zones gradually become decorated; at the end of the LBK these two zones are filled in on all decorated pots (Modderman 1970, 193). Another aspect of the complexity of design is the contents or density of the decoration; the (perhaps too simple) idea being that the strips change from simple lines to bands to filled-in strips. Rather it seems to be the case that in this northwestern LBK-region, different components go through different popularity cycles. Thus, excepting the very youngest pottery, lines are nearly always present in the decoration, almost exclusively so in the earliest sub-phase, dominant somewhere in between, and from present to virtually absent in the end. Apart from the lines, the relative number of small point impressions increases at first, and later falls off due to the introduction of hatching to fill in the strips (this same phenomenon of popularity cycles is called "stylistic phases" in German analyses, although combinations with other aspects of the designs are then also involved). Especially these "components" (as I called them in my 1979 publication) are easy to observe on even minute sherds, and also the tools with which they were applied, so together they constitute a dependable basis for inferences regarding relative chronology.

Several more variables/dimensions in the pottery decoration were defined in my text. In the accompanying table 14-1 their visibility in the present site is listed, i.e., the proportion

variables	valid	invalid	% valid	count
total reference	194	0	100	1597 pots
		GENERAL		
techniques	194	0	100	1934 motifs
numericity		n.a.		
zoning	130	64	67	544 pots
		BELLY ZONE		
structures	179	15	92	1405 motifs
basic motifs	34	160	18	87 motifs
developed motifs		n.a.		–
auxiliary lines	129	65	66	728 motifs
fillings	166	28	86	1065 motifs
angle of fillings	128	66	66	535 motifs
ends of strips	83	111	43	275 motifs
secondary motifs	91	103	47	309 motifs
components	194	0	100	12731 comps
		NECK ZONE		
neck decn. fillings	70	124	36	147 motifs
neck decn. components	78	116	41	1155 comps

table 14-1 visibility of attributes of pottery decoration in the Janskamperveld settlement debris
valid: the number of features; n.a.: no summary data available

of the finds or motifs that allowed observation of the individual variables. Whereas the original classification had been designed with an eye to the analysis of the generally complete pots from cemeteries, in settlement debris like that from the Janskamperveld, the recognition of most variables is difficult as shown by the table. For, although the column "% valid" suggests a reasonable quality of the data, these figures refer only to the features (units) which yielded *some* observations. A more appropriate index for the quality is provided by the final column, which shows the numbers of motifs (pots, sherds, components) that could be scored for the respective variables. For instance, 34 features (17% of all units) yielded data on the basic motifs; however, the number of identified basic motifs is only 87 out of a total of 1405 motifs registered: a little more than 6% (table 14-1). From the table it is shown that *techniques* of decoration, *structures* (recti- and curvilinearity of the designs), and *fillings* of the strips and the *components* of the decoration provide the best data. *Zonation* of the design and the occurrence of *auxiliary lines* are less visible, with the other variables faring even worse in this respect. The dimensions just mentioned have been used to establish a relative chronology, and as indexes of social structure.

14.4 The chronological analyses of LBK pot decoration: on statistical techniques

In LBK settlement analyses, most attention is generally paid to the finds from the long pits (German *Längsgruben*) adjacent to the houses, presumably directly connected with the habits of the inhabitants. It is supposed that these pits originated as loam quarries for the adjacent house when it was being built, and were subsequently used as refuse dumps by the household inhabiting it[4]. On empirical grounds the estimates of the use life of the pits and of the life span of the (wooden posts of the) houses are always equated with at least one human generation (e.g., Stehli 1973, fig. 14-55, p. 99). Most investigators turn to the contents of the long pits as units of analysis without much discussion of post-depositional processes (e.g., Modderman 1970, 121). It should be noted that mainly 'secondary' refuse has been assembled in these pits (i.e., waste produced not on the very spot but elsewhere and then deposited in the long pits). Moreover, nothing but waste is found in them, and no useful objects, suggesting 'curate behaviour' by the Bandkeramians (LaMotta/Schiffer 1999). Certainly the suggested relationship between the house's inhabitants and the contents of the long pits along the houses is less than one-to-one, and waste from elsewhere will also have been thrown into them. Finally, as long as the village site had not been abandoned, through the actions of LBK children, swine, mice, and moles post-habitation objects may have entered the long pits, even if these had been filled up already (Stäuble 1997). Which means on the one hand that the archaeological material from these pits cannot be fully representative of the household utensils, and on the other that noise can be expected obscuring whatever structure there is in the data. It appears though that on the Janskamperveld the pits associated with houses tend to contain about 30% more decorated sherds than the other pits (cf. the chapter on pottery) — which may at least be interpreted as a confirmation of a link between the household and that type of pits; noise and structure will be dealt with shortly.

Earlier investigations like those of Buttler and Haberey's or Modderman's have established relationships between chronology and pottery decoration: some strip types occur in a restricted number of sub-phases only, whereas others have wider references. Since most settlement analyses, including the present one, aim at an overview of the history of the site, perhaps the best way to achieve this is by arranging the contents of the different features on the site through what in German is called the *Schwerpunktverfahren* (sequencing the points of gravity). The central idea is that characteristics ('types', 'classes', and the like) are continuously distributed over time while in use; they start to be replaced gradually by alternatives somewhere during their life time. In Stehli's somewhat obscure words:

In the period in which a pit is filled, i.e. when the pit is open, there are popular and less popular strip types. Leaving aside non-chronological factors [SIC] then the rare types represent either trailings of earlier current types or the beginnings of types that will flourish in the future. The common strips get into the pits with a higher probability than the not so common ones, and therefore are more determinant for the position of the gravity point in the matrix. Common strips also get deposited more often, therefore the largest quantities should be found in the vicinity of the gravity point. The gravity point thus falls certainly in the time range that the pit's fillings were assembled. Stehli 1973, 89

Therefore, if the assemblages from an excavation could be arranged in the correct chronological order, the incidences of the characteristics should be concentrated in time (hence the English name of the technique: sequence dating). Originally the idea was developed at the end of the 19th century by Sir Flinders Petrie in his analysis of an Egyptian predynastic cemetery. While this was performed entirely by hand, in the 1960s a more formal, matrix-algebraic approach was elaborated by Goldmann and Kendall and appropriately coined "Petrie concentration principle" (Graham 1973 provides references). An early implementation in Bandkeramik studies has been given by Stehli and Graham for the analysis of the decorated pottery from the Langweiler 2 site (Stehli 1973, 87-88; Graham 1973). In both Graham's and Stehli's analyses the concentration points are calculated across all available characteristics / 'types', and thus depend critically on the non-theorized and undiscussed investigator's selection of them. As ever, the outcome is fully dependent upon the input, and addition or omission of characteristics in the analyses of the find complexes has consequences for the results: the algorithm duly produces an ordering of the finds, although it is not clear what is represented by the ordering (cp. Schwerdtner 2007 *s.v.* "Deutungen"). Simply stating that the ranking is a relative chronology (as in Stehli's and Graham's accounts) is not sufficient:

… successful diagonalisation of a contingency table is in itself no warranty for a chronological ordering… Ihm 1983, 8

Clearly, time is not an autonomous variable in the data; change/difference (the usual measure of time, but also of spatial separation) is predicated upon social and ideological factors[5]. Status differences, personal preferences, economic differentiation may each and all have been more important for the composition of the assemblages than change in either of them.

Certainly, social relationships are changing with time, *though not in a causal way*; but the 'looks' of things change with time, again not in a causal way: present houses differ from those built a few decades ago, as do houses built in poorer and wealthier districts, but they are houses all the same and the differences have nothing to do with time. Changing relationships, changing habits all cause differences, and only some of the differences are primarily indicators of chronologically consistent trends in social relationships while other differences are primarily indicators of spatially consistent trends in social relationships. Therefore, analyses which assume that all typological differences are interpretable as chronological differences (as in the *sequence dating* procedures described above) cannot fail to produce invalid results, yet even Baxter (2003) has no discussion on this topic. What is needed, therefore, is an analytical technique which allows an interpretable differentiation of the variation in the data on whatever dimension with sufficient observations, in this case in the pottery decoration.

Since early in the 20th century, statisticians have been working on the theory of multivariate analyses of data matrices; the Petrie concentration principle was but one of the first instances. As long as electronic computers were not available applications remained largely restricted to small data sets, only to explode after these contrivances became available (Harman 1967, 3-5). The basic idea of multivariate analysis is that in every more or less coherent set of empirical data co-varying patterns can be disclosed through matrix operations. These patterns, called 'factors' or 'axes' are nothing but mathematical / statistical constructs; their aim is to describe observed data as succinctly as possible (technically: 'data reduction'):

This aim should not be construed to mean that [multivariate] factor analysis necessarily attempts to discover the "fundamental" or "basic" categories in a given field of investigation … rather it represents a simple, straightforward problem of description in several dimensions of a definite group functioning in definite manners, and he who assumes to read more remote verities into the vectorial outcome is certainly doomed to disappointment. Harman 1967, 5-6

That is, a data set comprising 'many' variables is reduced to a much smaller set of 'underlying' factors; routinely computer output of any of the available techniques presents the correlations of the original variables with ('loadings on') the different newly derived factors. It is these loadings which are invoked to arrive at an interpretation of the several factors. Thus, in a Principal Components Analysis (one of the many multivariate techniques) of LBK pottery decoration, a factor may turn up with high loadings for variables we have learned to consider as related to chronology, such as presence/absence of rim decoration, simple or multidented spatula, and various basic components of decorative elements, etc. The other variables will show minimal affinities to this factor, while loading on other axes instead, begging other interpretations. It may thus be possible to propose sociologically relevant factors 'behind' the pottery decoration.

If the only interest is a relative chronological ordering of the data, it is important to enter chronologically relevant variables into the calculations while leaving out non-relevant ones as these obscure rather than clarify patterns. Most multivariate analyses allow such a heuristic use in that patterns in the data ('data structure') are revealed in the grouping of the variables (each group a 'factor'); they also provide the relative weight of the several factors, a measure of the part of the variation in the original data covered ('explained') by the individual factors (see also discussions in Pavlů 2000, 14-15, 22-23, 90-91, etc.). So, in one data set the time factor may account for over half of the variation, whereas in another its contribution may be small or negligible (such as when there are no chronologically relevant variables in the data set, or when status or gender differences are so important as to swamp all other variation). Once a sought for combination of variables has been identified (i.e., those contributing jointly and importantly to one factor), the analysis is repeated with only these variables, thus eliminating most of the contamination ('noise') by non-relevant variables. The resultant ordering of the units (according to their *scores* on that factor) should be a better approximation of the desired result than is the summed effects of all variables.

14.5 An analysis of the Janskamperveld LBK pot decoration: chronological implications

In the excavated part of the Janskamperveld settlement decorated pottery occurred in 192 features. The decoration was described by means of the above classificatory scheme with the pit as analytical unit, and entered into a database. Figure 1 shows the distribution of the numbers of motifs per pit, the basis of the analysis below. From the outset the informative content of small finds is uncertain, as 'noise' (by sherds lying about on the site and accidentally having been tossed into the pits) and 'signal' (purposively dumped household debris) cannot reliably be separated. In the case of larger finds the effects of the first are effectively dampened by a substantially larger amount of the latter. Pits with few motifs will be omitted from the analyses; as an illustration, in the figure the threshold value has been set to the median count of four motifs per unit.

The first problem to be dealt with is the determination of the attributes relevant to chronological ordering. Finds with less than the median value of four motifs were omitted for being possibly too noisy (in the sense discussed in the previous paragraph), and the remaining 96 units with 1747 motifs were subjected to a general principal components analysis. The main objective was heuristic (Baxter 2003, 17), i.e., to confirm the above ideas about the chronologically relevant attributes in this body of data. The computations suggested four principal components as underlying descriptors of the data, together accounting for 85.1% of the variation in this body, individually 52.5%, 14.5%, 11.7% and 6.5%, respectively. Figure 2 shows the relationships of 16 attributes to the first two components as derived from the calculations. On closer inspection, there is indeed an association of precisely those attributes already considered as

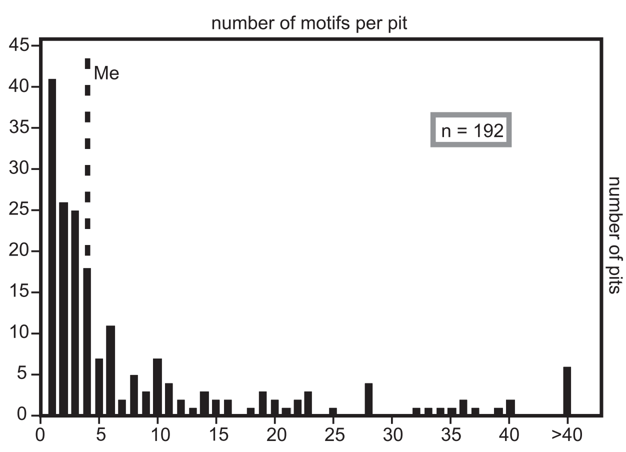


fig. 14-1 the number of motifs per feature
Me: median

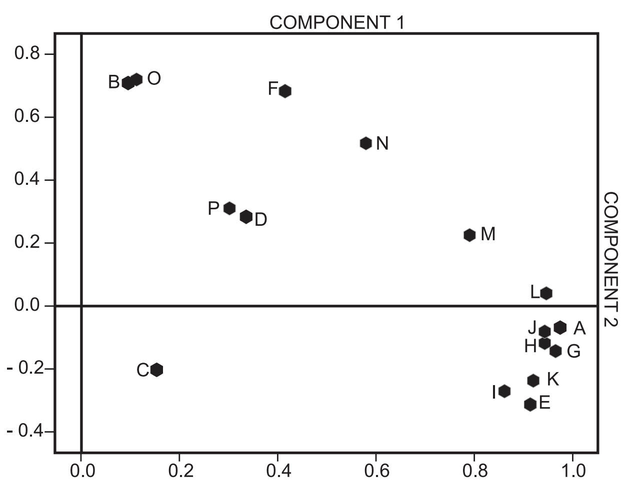


fig. 14-2 Component plot of general Principal Components Analysis Component 1 accounts for 52.5% of the variance, Component 2 for 14.5%

A: simple spatula
B: multidented spatula
C: grooves
D: finger impressions
E: no neck decoration
F: with neck decoration
G: curvilinear motifs
H: rectilinear motifs
I: no auxiliary lines
J: with auxiliary lines
K: strips not filled
L: filled strips
M: log (no. of lines)
N: log (no. of pointlets)
O: log (no. of hatchings)
P: log (no. of finger imprints)

chronological candidates with multidented spatula (B), presence of neck decoration (F), and hatchings (O) situated close together, as are their logical counterparts simple spatula (A), absence of neck decoration (E), and the number of lines in the decoration (M), with the number of small points (N) neatly in between these two groups of attributes. The attributes just mentioned are roughly positioned on a line running obliquely from top left to bottom right, and thus indicative of association with *both* components in the graph[6]. The distribution of the other pairs of variables is rather clumped per set, and their interpretation should accordingly be different. It may therefore be concluded that in the Janskamperveld repertoire of pottery decoration no more (nor fewer) attributes are chronologically relevant than known from other sites in the Graetheide region.

Having established the chronologically relevant variables in this data set, I hoped that notwithstanding the Flomborn appearances of the larger part of the Janskamperveld pottery a quantitative statistical treatment would be more discriminating than a qualitative one like Modderman's scheme and that a relative chronology would result which is based *exclusively* on pottery decoration. A rereading of an early text of Lüning´s was my inspiration:

For the description of time slices combinations of characteristics and types should serve, [as] singly they cannot be ascribed to the finest subdivisions of … a chronological scheme. The sharpest subdivision is attained when not only presence or absence, but also the quantitative relation of attributes and types are analysed and changes in these relations can be interpreted as chronological after the elimination of other possibilities. Lüning 1972, 213

The scores of the 96 features on the first component, the chronological axis, then shows a dense cluster of closely packed units with a small number of outliers probably because of the remnant 'noise', but also because the second component played a (small) role in the chronological variation.

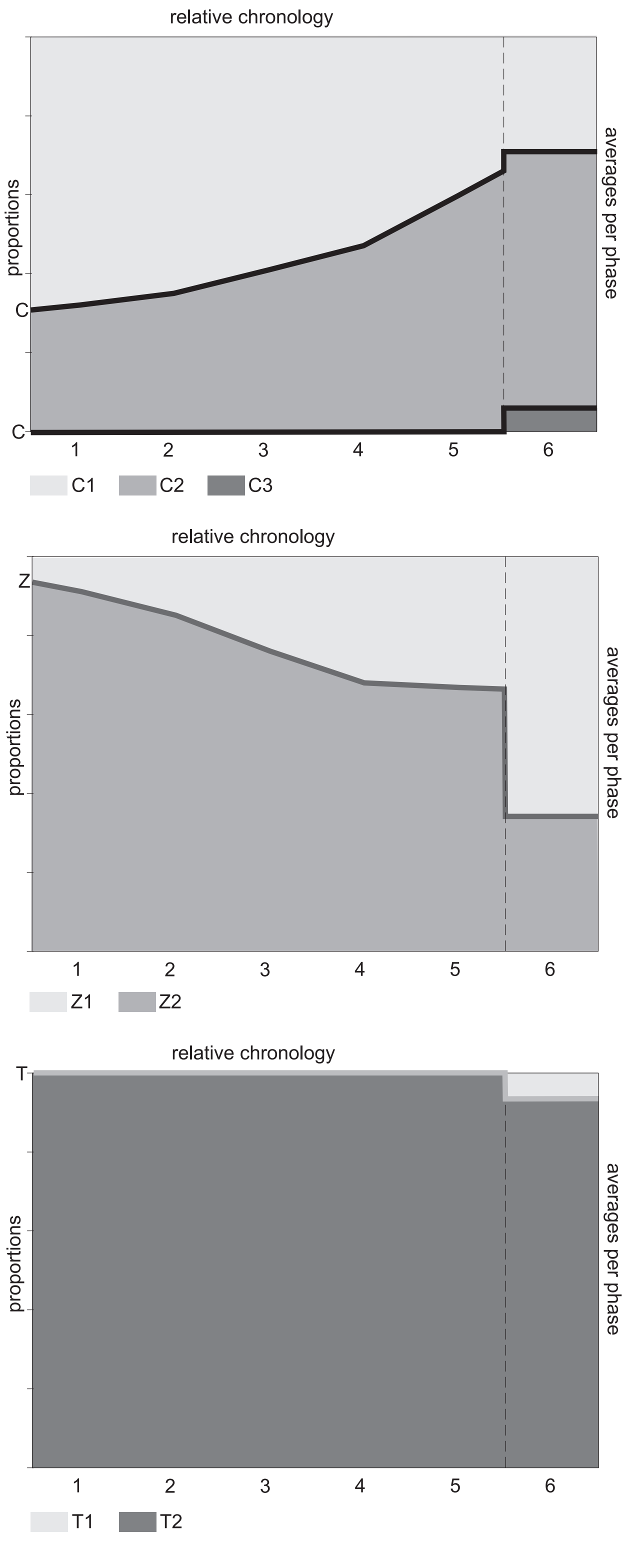
On closer inspection it appeared that the larger finds were rather evenly spread, and this suggested an analysis of only their chronological possibilities[7]. If a convincing ordering could be established for these larger units, then the smaller finds could hopefully be related to this grand picture afterward. Also, the raw counts were recoded to proportions per variable (thus: 2 pots without, and 4 pots with rim decoration in the same unit, were translated to 2/(2+4) = 0.3 and 4/(2+4) = 0.7 respectively) — which much enhances comparability. For statistical reasons, an absolute minimum was set of at least six observable *rims*; even then uncertainties about the proportions ranging from 0.1 to 0.35 have to be allowed at a 95% level of confidence. A higher threshold was impractical in this set of data as too few finds would be left to base generalisations on. Similarly, minimal counts of more than ten were set for the dimensions of *techniques* and *components*, which in practice proved redundant, as with six or more rims in a feature the other counts attained much better values than these thresholds. The sample of units thus defined contained 28 features (the very best in the lot, together numbering 2309 sherds from 947 pots), and this was the basis for a principal components analysis from which the chart of fig. 14-3, table 14-2, and the generalisations and specifications below have been derived. In this analysis, the time vector accounted for 58.3% of the variance in the relevant variables (the next two principal components took 18.4% and 12.5%, with no apparent relation with the chronological attributes).

From this component the passage over time of the different attributes of the decoration has been calculated, keeping to the ordering provided by the time factor, and grouping the finds to approximate equal numbers of pots per phase into six 'ceramic phases' (respectively numbering 1, 5, 6, 6, 5, and 5 units, in an attempt to equalize the numbers of pots between them).

The results of this computation initially suggest a *continuous* development, simply because it is a best ordering of the coded data. However, in the final, sixth, phase two innovations occur simultaneously (multidented spatula, and hatched decoration), while also the share of decorated rims nearly doubles; changes in the other variables are less impressive. Already during the excavation a discontinuity in the use of the site seemed likely, with many of the houses and finds pertaining to the Older Period, and there are also a few from the Younger Period, with nothing in between. Discontinuous development of pottery decoration

ceramic phase	techniques		rim decoration		components		
	singledent	multident	absent	present	lines	pointlets	hatchings
1	1.00	.00	.9	.1	.68	.32	.00
2	1.00	.00	.8	.2	.64	.36	.00
3	1.00	.00	.7	.3	.57	.43	.00
4	1.00	.00	.7	.3	.52	.48	.00
5	1.00	.00	.6	.4	.42	.58	.00
6	.95	.05	.3	.7	.29	.63	.08

table 14-2 changes in the proportions of chronologically sensitive elements of pottery decoration at the Janskamperveld settlement (cp. fig. 14-3)



(a necessary correlate of discontinuous habitation) should show up in larger and smaller *coincident jumps* in the values of the several variables (Van de Velde 1979, 42-45; Kneipp 1998, 93). Clearly, the calculated values can be depicted so as to show simultaneous jumps of most variables from the fifth to the sixth phase, especially marked by the appearance of multidented spatula and hatched components in the decoration and a doubling of the share of decorated rims, while the other variables show smaller changes (fig. 14-3).

Prior to that gap, the Older LBK decoration shows *gradual* changes: the preponderance of line components over small points shifts slowly to its reverse towards the fifth phase and although no innovations are introduced the percentage of decorated rims increases appreciably; while as a contrast the single-dented spatula remains a constant in the execution of the decoration. In these five phases, the evolution of the three chronological variables is almost model-like as if decorated pottery was deposited at this site without serious interruption. The data behind the plot in the figure are presented in table 14-2.

The main trends in pottery decoration in the Janskamperveld settlement are clear, as is demonstrated by the numbers in table 14-2. On the variable *techniques* the multidented spatula is a rare phenomenon in this data set, being introduced only late in the sequence, and even then a by far larger part of the decoration is executed by means of the simple single-dented spatula. The *components* of the decoration show some slight evolution in the early phases: in the beginning of the sequence up to two thirds consists of lines with only a few small points added; the latter component increases to well over half[8] over time; then hatchings appear on the site's pots, simultaneous with the introduction of the multidented spatula. Perhaps the most dramatic change in this repertoire is to be seen in the frequency of undecorated *rims*: from (almost) exclusivity in the earlier phase, dwindling to approximately two thirds in the fifth phase, and to jump to a third of the pots recorded here at the end of the scale. The attributes of the *techniques* variable contribute to a chronological differentiation only in the youngest phase, yet their observability and their numbers are sufficient to warrant specification in the table of up to two decimal figures, which is lamentably not the case for the variable with the steepest evolution, *zonation*. There, low numbers hamper attribution because of wide confidence limits; yet here, as ever the best guess is of course the observed value.

fig. 14-3 trends of pot decoration in the Janskamperveld LBK
(top diagram) C: components (1: lines; 2: pointlets; 3: hatchings)
(centre diagram) Z: zonation (1: with rim decoration; 2: no rim decoration)
(bottom diagram) T: techniques (1: simple spatula; 2: multidented spatula)

The figures listed in table 14-2 are based on the larger finds, and were meant to allow chronological attribution of the 166 other, smaller finds. The main problem then is that small samples have large confidence ranges, and mechanical attribution is therefore likely to be no better than simple guesswork (which was also the reason to omit small finds from the previous computations). Yet, the sheer quantity of these second-rate data is an invitation not to leave it at that as there may be some little or sometimes even considerable information hidden in it. As a matter of fact the attributes of the *components* variable exhibit considerable and directed change; moreover, these attributes always show the largest totals per find and they are always visible — if not, there is no decoration on the pot. That they come up with the largest totals implies that the confidence range is comparatively small around the observed value on this variable, so when the number of rims in a find is too low, the components may still point to a conclusion.

E.g., when a total of 15 lines and 5 small points has been counted in a unit, the proportion of small points in the sample is 5/(5+15) = 0.25. The 95% confidence limit can then be computed as ±0.18, which means that the sample has been drawn from a 'population' in which the proportion of small points is anywhere between (0.25 - 0.18) and (0.25 + 0.18), or 0.07 and 0.43; in 95 out of a hundred cases. Re ferring these proportions to table 14-2, it can be seen that the exemplary find belongs to any of the first three phases, with the first phase (being closest to the observed value of the sample) as best guess.

To apply the tendencies shown in the table to the smaller finds, scores on all three variables should be considered, weighted according to their respective total numbers. The total numbers should be referred to sampling theory, in order to estimate the confidence limits, which will provide an idea about the value of the determination; here I put my ambition rather high with a 95% level (a similar procedure was followed for hooking the finds from the Königshoven group of settlements, to the NW of Cologne, to the larger Rhineland sequence; Claßen 2006). For the Janskamperveld finds, a rating of the qualities similar to the one used in the chapter on houses was used; thus, whenever confidence limits soared to ±0.3 or more, the find was accorded a *w*-index of 1 or even 0; between ±0.2 and ±0.3, w = 2; from ±0.15 to ±0.2, w = 3; and better ranges were given an evaluation of 4. When one of the variables had not been scored (no rims in the find, for instance), rates were lowered one point on this scale. On the other hand, given that sample values are always the best available estimate of the population, small counts coinciding with a phase spectrum have been rated higher. A summary is presented in table 14-3.

As could be expected, most (smaller) units have been assigned to the two extreme phases; these are the finds with entries for either line or small points decoration only. As noted earlier the components of decoration are generally best preserved and visible in the archaeological record, and since thin-walled pottery tends to break on incised lines, their over-representation (leading to an attribution to the first phase) is an annoying artefact of this procedure. Conceivably, these (50 or 60) lowly classed units should be re-distributed over all phases as small finds occurred throughout the sequence — since it cannot be specified which of these units should go where in the sequence, it serves to put into perspective the low-valued chronologically extreme attributions by means of the decorated pottery.

	w-index					
phase	0	1	2	3	4	totals
1	56	14	2	8	1	81
2	3	2	0	6	4	15
3	1	4	1	3	6	15
4	8	3	1	4	6	22
5	3	3	0	6	5	17
6	12	6	14	9	3	44
totals	83	32	18	36	25	194

table 14-3 summary of the quality of the chronological attribution of all features with decorated pottery

It is here that I have to add another cautionary remark. The finds from this excavation were collected without regard to the stratigraphy — which in most cases was difficult to perceive, if at all. In a number of instances, however, secondary (and later) fillings have been noted on the section drawings, and sometimes problems with the ceramic dates (as when apparently old type houses are seemingly associated with younger phase finds) can thus be explained. For instance, decorated sherds from kettle pit 13100 yield a sixth ceramic phase indication. This pit probably belongs to house 12 which shows a clear Y-configuration and should therefore have a much earlier attribution (as also indicated by several other pits around this house). An AMS measurement on grain from the second layer in the pit similarly yielded a quite early date. In this case the complications can be spelled out, in most others not.

14.6 Addendum: from five ceramic phases to four house generations

In the chapter analysing the settlement, a sequence of four house generations ('HG') is derived for the first habitation period, coincident with the first five ceramic phases from the previous section. Ceramic phases 1 and 2 in the Janskamper-veld settlement equate approximately with HG I and HG II, respectively, while ceramic phases 3 and 4 pertain jointly to the third house generation, or HG III; and ceramic phase 5 is equivalent to HG IV. A quick comparison showed that the decorated pottery from the earliest phase at Elsloo-Koolweg (Van de Velde 1979) is chronologically almost identical with that from the Janskamperveld; moreover, as far as can be judged from its publication by quantifying the depicted decoration[9] Geleen-De Kluis (Waterbolk 1959) is just as old. Similarly the oldest decorated pottery from Langweiler-8 on the Aldenhovener Platte (Stehli 1994) has the same characteristics. Together these data suggest simultaneous migration of several LBK groups towards these regions. That way at least the first house generations in both areas may be synchronous. The second LBK occupation of the Janskamperveld site (above, 'ceramic phase 6') should have been more or less contemporaneous with HG XIII in the Rhineland. In this chapter I shall continue to use ceramic phases unless otherwise stated. However, as recent practice in LBK studies tends to substitute HG-reckoning for the older schemes (LBK I-V, LBK 1b-2d, etc.), in the other chapters of the present publication HG is employed, rather than ceramic phases or similar other rankings.

14.7 House plans and house chronologies

One of the major points of interest in the results of the excavation at Geleen Janskamperveld has been the occurrence of quite a number of Flomborn period houses, those of the so-called Geleen type. As described in the appropriate chapter, with time the configuration of the large posts in the central part of the houses changed notably, gradually evolving from the Geleen type into the Elsloo type. This evolution has been an argument in the chronological interpretation of the plan of excavated settlements (e.g. Louwe Kooijmans *et al.* 2002). Although this trend is clear and unquestioned[10], it does not mean that the Bandkeramik carpenters reconstructed the interiors of standing houses, for which there is no archaeological indication whatsoever neither here nor in any other northwestern LBK excavation. Apparently the pros and cons were not considered that important, yet newly erected houses showed small differences with the earlier ones — perhaps a subtle example of *distinction* (Bourdieu). That is, in a living Bandkeramik settlement, houses of slightly different constructions have stood side by side, depending upon their foundation date, just as pottery decorated in the older style was still used while a newer fashion was tried on newly built vessels. This simultaneous occupation of differently constructed houses — perhaps even simultaneous building according to different constructions — necessarily results in rather wide confidence intervals for their foundation. Therefore, both Modderman's and Stehli's turns toward the evolving central post configurations of the houses to define sub-phases within the Flomborn period, are methodologically weak. Even more so as in most settlements the number of different constructions is quite small. The Janskamperveld settlement, while relatively well provided with early houses, will nevertheless not fare much better in this respect: here, too, the sample of 40 houses with legible central structures is statistically quite small (cf. the chapter on houses), especially as 16 of them belong to the regular R-type. Moreover, not all houses are clearly associated with decorated pottery, as can be inferred from table 14-4.

	probable	possible	none	total
Y	1.1.1.1.2.4	1.1	9.9	10
dY	2.2.4	1.1.6	–	6
J	2	–	–	1
iY,Yi	3.3.5.5	1.1	9	7
R	3.3.4.5.5.5.6.6.6	1.2.5.6	9.9.9	16
count:	n = 23	n = 11	n = 6	40

table 14-4 central post configurations of houses *vs.* ceramic phases
'probable': clear association and good quality finds ($w \geq 3$)
'possible': possible association or bad quality finds ($w \leq 2$)
'none': no decorated ceramic finds associated

In that table the distribution of the houses over the ceramic phases is listed according to their central configurations. For example, among the ten houses with identifiable Y-configuration, the associated finds suggest that four of them belong to the first ceramic phase, one to phase 2 and 1 to phase 4 (second column, 'probable'); there are two houses of this type with either a shaky association or with small finds (third column, 'possible': both houses in phase 1), and two other houses with this pattern have no associated decorated pottery and therefore cannot be placed chronologically (fourth column, 'none').

Another way to look at these very data is presented in table 14-5, where the spectrum of the construction types is crossed with the ceramic phases. Thus, in ceramic phase 2 (at least[11]) one house with central Y-structure stood (H 49) together with three houses (at least) with a degenerate central Y-configuration (H 42, 57, 58). The distribution over time of the finds with decorated ceramics has been added for comparison. These numbers are minima for this settlement: six houses with recognizable central configurations could not be assigned to a ceramic phase for lack of associated decorated sherds, and another 29 houses had eroded too much to allow identification of their central configurations. Given the discussion on the ceramic phases in a previous section, the discontinuous sixth phase should perhaps be disregarded, leaving only 46 houses (of which 30 recognizable) in this analysis. Yet the table's patterns are so fully in accord with the probable evolution of the central post configuration of the houses as described by Modderman (see

ceramic phases	houses				features	
	Y	dY, J	iY, Yi	Rn	*w*≥3	(*w*≤2)
1	03,07,24,59,(12,22)	(01,05)-	(31,35)	(40)	9	(72)
2	49	42,57,58	–	(18)	10	(5)
3	–	–	02,17	04,06	9	(6)
4	13	28	–	25	10	(12)
5	–	(53)	09,45	14,19,41,(65)	11	(6)
6	–	–	–	08,10,62,(11)	12	(32)
x	38,54	–	48	15,26,27		

table 14-5 ceramic phases *versus* central post configurations of houses (catalogue numbers) and counts of features with decorated pottery (numbers in parentheses) uncertain ceramic phase

the chapter on houses), that a random background can safely be rejected — thus providing a confirmation of the relative ceramic chronology established in the earlier sections of this chapter. The table also shows that facile attributions (like R-type = late; or Y-configuration, so earliest) are grossly misleading: here too, change is gradual, not in jumps. It is also clear that the Elsloo type house (with its regular DPR configuration) made its appearance well before the onset of the Younger LBK (i.e., before phase IIa, Dutch chronology; or HG IX), contrary to present understandings. For a methodologically sound view of the development of the village plans, a similar approach to the central post configurations should be attempted as has been done for the pottery decoration.

A few short remarks on the out-of-range entries are appropriate here, being more or less at odds with the expected distributions over time. Firstly, the iY-construction of the 1a-type house 35 has been tentatively attributed to phase 1 because of a pit next to the rear part of this building (34046, w = 0). A possible remnant of its Längsgrube (32112, w = 0) is similarly dated to the first phase. The very low w values render this 'date' questionable. Then one pit from the sixth phase cuts into another part of the Längsgrube (pit 24026, w = 2), which provides a not very impressive terminus ante quem for the present house. The pit complex to the right of the front part of this house (32100, dated to phase 6, w = 2) may or may not be related to this building at all.
Secondly, the rather eerie Yi-setup of the central section of house 31 is post-dated by a pit with some decorated pottery (24097, phase 1, w = 1) which cuts into the right-hand Längsgrube of this house. As in the previous case, with such a small find there seems to be no reason to trust this date, though there are no clear grounds to reject it either.
And finally, according to the present dataset the earliest occurrence of the R-construction is the outlying house 40 in the NW part of the settlement; the association with pit 57052 (phase 1, w = 0) is questionable and its value practically nil. More to the point seems the in many respects extraordinary house 18: its right-hand Längsgrube (52051) held a few decorated sherds suggesting a dating to the 2nd ceramic phase (although w = 1 only). There are no other pits with decorated pottery which might be associated with this house.
To sum up: the exceptions or outliers in table 14-5 are either due to uncertain associations or to very small samples of pottery decoration. I suggest, therefore, that the outlying entries be disregarded, and only the continuous ranges be accepted.

The data in tables 14-4 and -5, crossing ceramic relative datings with the evolution of house constructions, accord fully with what might be expected: with the ceramic 'dates' predicated upon battleship-like frequency distributions of several variables of decoration over time, the resulting developments of the house constructions similarly prove to be battleship-like. An important implication is that pottery decoration can indeed be used for relative chronological purposes even WITHIN the Flomborn period, given sufficient attention to logical consistency and detail of the classificatory scheme. The analysis of the Elsloo data that I presented in 1979 (Van de Velde 1979) implied the same, although much less emphatically. Yet practice elsewhere has persisted in combining the Rhineland Model for the Younger LBK with house typology for the Older LBK. Only recently a successful attempt has been made at the Cologne Institute to break down some of the early 'types' of pottery decoration into elements rather similar to those employed here, and through them define ceramic evolution within the Flomborn period (Münch 2005).

If tables 14-4 and -5 represent the distribution over time of the varieties in the central post setup, then the houses which have to do without sufficient decorated ceramics for the relative chronology should be distributed over the phases in a similar way. This as a preliminary to the study of the development of the settlement as a conglomerate of houses (dealt with in a separate chapter), but also in order to prepare the way for a check of the few overlapping house plans in the excavation. Their number is very small; indeed, notwithstanding its 69 houses, the Janskamperveld settlement would qualify as “not dense” on Coudart’s scale. The relevant houses are: H 08 cutting into the H 06 plan, H 13 into H 01, H 26 into H 27, H 56 and H 68, H 64 together with H 52 and H 69. The first pair of houses, H 06 and H 08 have decorated sherds associated, assigning them to phases 3 and 6 respectively; central constructions are of the R-kind in both houses, not discretionary therefore. Also H 01 and H 13 are associated with decorated ware which puts them into phases 1 and 2 respectively; their central configurations are a degenerated Y and a regular (perhaps slightly degenerate) Y, providing a retro-reaction against the general trend of table 14-5. Houses 26 and 27 cannot be connected to decorated pottery; their central alignment consists of R-type DPRs in both cases, so again there are no conclusions to be drawn here. Of the H 56 - H 68 pair only the first is associated with a few decorated sherds, resulting in an assignment to the first ceramic phase; in both plans the central post arrangement is no longer recognizable; hence no conclusion following. H 64 can be relatively dated by ceramic means and belongs to the very first phase of the settlement; the two adjacent or overlying houses have no pottery to help out; all three houses no longer give clues as to their inner configurations. Nothing here that was not implied already in table 14-5 therefore.

14.8 The ^{14}C (AMS-) datings

A few years ago a justifiable reproach to the excavators of this site was printed which read:

> *Referring to the radiocarbon datings regarding the Bandkeramik in southern Limburg, nothing has changed since the Lanting & Mook (1977) article. In spite of new excavations such as at Geleen-Janskamperveld (Louwe Kooijmans et al., 2002)… no new determinations have been carried out. This is especially lamentable in the case of Geleen-Janskamperveld. That settlement was mainly inhabited in phases 1b and 1c…*
>
> Lanting/Van der Plicht 2002, 45

In the meantime, this complaint has been acted upon; table 14-6 presents the results of eight determinations on features from this site. Readings (five by the Groningen laboratory, three by Oxford) have been taken on samples with negligible own age: peas and grain pellets. The results should therefore reflect the true ages. The carbonized wood samples used previously are prone to an average off-age effect of some one hundred years *too early* (as extensively discussed in Lanting/Van der Plicht 2002). Dates in print for the oldest Dutch Bandkeramik were all taken on such carbonized wood from post holes: 6370 ± 60 bp (Geleen-De Kluis), 6320 ± 90 (Elsloo), and 6270 ± 85 (Elsloo) are all older than the oldest determination of 6260 ± 50 bp in table 14-6 (references and details in Lanting/Van der Plicht 2002). Obviously series on wood and series on grain pellets cannot profitably be compared as the range of uncertainties caused by the age of the wood samples is undetermined; consequently, little attention is presently paid to them (e.g. Jadin *et al.* 2003, Lanting and Van der Plicht 2002, Lüning 2005, Whittle 1996). Given the early character of the site, the main aim of this series of AMS datings was to establish the chronological brackets of its settlement. At the same time the lower readings should shed more direct light on the first arrival of the Bandkeramians in this region, which has been estimated as 5230 BCE (through extrapolation and wiggle-matching from German dates; Lanting/Van der Plicht 2002).

sample no	feature no	house	bp years	1 sigma BCE	lab no
1	20027	49	6260±50	5308-5207	GrA 27838
2	13100	12?	6240±70	5303-5202 5165-5113 5103-5076	GrA 27836
3	31021	12	6204±35	5215-5201 5167-5110 5107-5074	OxA 15542
4	31075	13	6208±38	5217-5199 5169-5072	OxA 15600
5	31075	13	6180±50	5210-5189 5177-5062	GrA 27842
6	15005	56	6170±45	5206-5187 5178-5143 5139-5061	GrA 27837
7	32100	35	6120±38	5201-5167 5109-5108 5074-4988	OxA 15601
8	32100	35	6110±45	5197-5172 5069-4954	GrA 27839

table 14-6 AMS-readings from the Janskamperveld excavation

Preliminary to further discussion[12], it should be noted that the INTCAL 04 calibration curve is characterized by two plateaux in the Bandkeramik age (fig. 14-4); an older one between 6300 and 6250 bp (which translates to 5300-5220 BCE approximately), and a younger plateau from 6200 to 6140 (5210-5060 BCE). Determinations within these ranges cannot ‘simply’ be converted but rather equate with a range of BCE equivalents. Taking this into account, the samples listed in the table have been calibrated; they derive from and are part of:

1. Feature no. 20027; from the bottom, first fill of the left-hand *Längsgrube* associated with house 49. Conversion yields a range of 5310-5205 BCE, which equates with the older plateau in the calibration curve; the house has a central Y-post construction, and an associated ceramic date in the second ceramic phase.

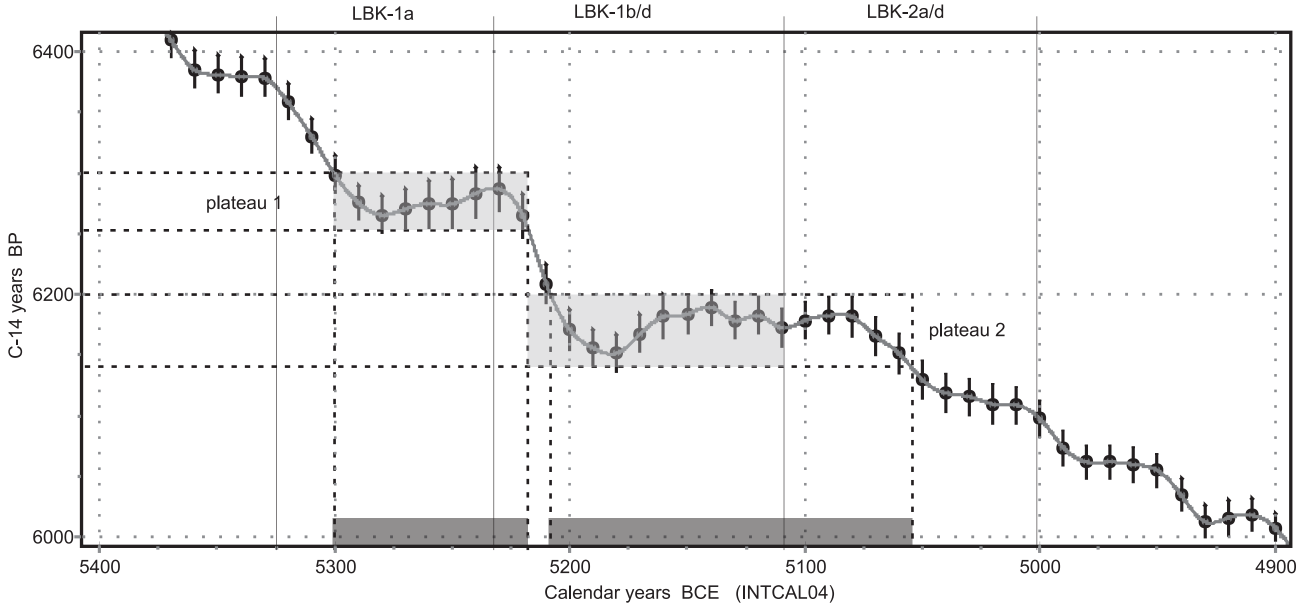


fig. 14-4 The INTCAL04 calibration curve for the LBK age
LBK-ranges (top) according to Lanting & Van der Plicht 2002

2. Feature no. 13100; second filling of a kettle pit behind house 12; association with that house is uncertain though not unlikely. The measurement equates with a calendar date of 5215 BCE (neatly in between the two plateaux), yet it converts to a range of just as likely dates between 5305 and 5205 BCE.
3. Feature no. 31021; from the right-hand *Längsgrube* of house 12. If an association of kettle pit 13100 (previous paragraph) with this house is assumed, the two datings are mutually supportive, and confirm the early dating of house 12, which is fitted out with a central Y-post construction, and has a ceramic phase 1 attribution.
4. Feature no. 31075; from the upper layer of the fillings of the right-hand *Längsgrube* or pit complex next to house 13, with many chunks of burnt loam immediately below. Therefore this sample is younger than the founding of the house by perhaps 15 years, one generation or more. Probable conversions of the reading: 5210-5190, and 5175-5060 BCE. Given the central Y-post configuration and attribution to ceramic phase 2, the earliest range or slightly before it, seems the best fit.
5. Feature no. 31075, as previous entry, being a sample from the same find.
6. Feature no. 15005; second filling of the right-hand *Längsgrube* along house 56. Best conversion: 5180-5060 BCE, coincident with the second calibration plateau. House 56 associated by its *Längsgrube* with this feature shows an R-type (regular) configuration of its central *Dreipfostenreihen*, in accordance with the expectations; the associated ceramics are poor.
7. Feature no. 32100; from the lowest fills of a silo bin or pit complex to the right of house 35, sealed by a massive layer of chunks of burnt loam, charcoal and carbonized grain pellets on top. Best conversion estimates 5195-5170 and 5070-4955 BCE. With a central iY-post configuration and very small samples of decorated ceramics associated, the younger range is much less probable than the older one.
8. Feature no. 32100, as previous entry, being a sample from the same find.

Because they relate to the same or very similar archaeological events, six of the readings in table 14-6 can be paired: nos. 2 and 3, nos. 4 and 5, and nos. 7 and 8. Of every pair one sample has been taken to Groningen, the other to Oxford; as was to be expected, pair wise differences are small, and therefore the readings can be pooled in order to tighten the uncertainty ranges (all weighted to their variances):

= House 12 (nos. 2 and 3) obtains an average date of 6211 ± 31 bp, which converts to 5217-5202 BCE (in between the two calibration plateaux), and 5166-5113 or 5104-5075 on the younger plateau.

= House 13 (nos. 4 and 5) then has a date of 6198 ± 30 bp, suggestive of 5212-5202 BCE (again, in between the two plateaux), and 5166-5113 or 5104-5075 on the younger shoulder of the curve. As noted above, being from the top layer of the *Längsgrube* this dating is somewhat later (at least fifteen years?) than the founding of the house.

= House 35 (nos. 7 and 8) is calculated to 6116 ± 29 bp, or 5187-5179 BCE on the younger plateau or 5061-4993 BCE after it. This provides the youngest date for this settlement: the sample was sealed off by a thick destruction layer which may be testimony of the end of the house when not of the second occupation. It is, on ceramic grounds, a few generations earlier than the definitive demise of the LBK from the Graetheide region. Lanting and Van der Plicht (2002) propose a closing date for the Dutch LBK of *c.* 5005 BCE which would tally best with the second, youngest range.

A statistical test does not reveal important dissimilarities between the readings on the four samples on which the datings of the HH 12 and 13 have been established, and therefore the four can be pooled to obtain an even better estimate for the earliest events on the site. Their weighted average is 6204 ± 22 bp which translates to 5214-5203 BCE (between the two obnoxious plateaux), and 5163-5131, 5127-5116, and 5099-5078 in the range of the younger calibration plateau (adding the first reading, the average becomes 6213 ± 20 bp, or 5216-5204 BCE; other ranges: 5161-5133, 5124-5118, 5096-5079). Reading no. 2 being a few years younger than the opening of the pit it is taken from, and samples nos. 4 and 5 perhaps fifteen or more years later than the associated house, this average could be some ten to fifteen years younger than the beginnings of the two houses. If it is accepted that they belong to the first generation, then the coming of the Bandkeramians to the Graetheide is fixed to the decennium around 5220 BCE. Then, on the other side of the local occupation, on ceramic grounds the second habitation on the Janskaperveld was set to LBK-2c, which equates with HG XIII in the Rhineland; the pooled date for House 35 of between 5060 and 5000 BCE (above) compares well with the dendrochronologically obtained 5057 ± 5 for the second well at Kückhoven, constructed in that very House Generation (Weiner 1998: 106).

These dates pose problems for current Neolithic chronologies, since it is generally assumed that the Flomborn phase starts *c.* 5300 BCE. It should be noted, though, that in final analysis that date is based upon the second well at Kückhoven constructed in HG XIII of the Aldenhovener Platte; that phase of the well has yielded a dendrochronological date of 5057 ± 5 BCE (Weiner 1998: 106). Then extrapolating, it is assumed that House Generations last on average about 20 years, so that 12½ × 20 ≈ 250 years should be added to arrive at the beginnings of HG I, which defines that of the Flomborn phase, *i.e.*, 5057 + 250 ≈ 5300 BCE (Whittle 1996, Jadin *et al.* 2003, Lüning 2005). However, as noted above already in 2002 Lanting and Van der Plicht proposed 5230 for that event on the basis of the well's date and wiggle-matching of substantially the same determinations for the *älteste* LBK used elsewhere to estimate the length of the oldest LBK period (though, as they complained in the quote above, *without* direct evidence). That estimate accords very well with the Janskamperveld AMS date of 5220 BCE, but if this latter date were to be accepted —based as it is on direct evidence— then one of the consequences is that the average length of a LBK house generation is to be reduced from *c.* 20 years to (5220 - 5055) / 12½ = 165 / 12½ ≈ 13.3 y/HG if no overlapping is to be assumed. Also, the long contemporaneity of the Bruchenbrücken phase (or *älteste LBK-II*) with Flomborn should then be halved from 5300-5150 (Lüning 2005: 71) to 5220-5150, its 70 years still representing five house generations (as proposed here) instead of the original six (proposed by Lüning).

14.9 Some conclusions

Analysis of the decorated pottery to obtain a relative chronology for the Janskamperveld settlement proceeded along several steps beginning with a discussion of its basis: the classification of the motifs. A few alternative classifications were first compared on their versatility and logical consistency, and found to be lacking in either or both aspects; instead (and possibly not surprisingly) the classification that I had developed earlier (most extensively in Van de Velde 1976, 1979) was preferred as being both easily and widely applicable and methodologically well founded. As a computational method to derive the chronological ordering of the ceramic complexes, principal components analysis was selected which allows the efficient separation of relevant and irrelevant variables, a procedure with one exception (Pavlů 2000) not explicated elsewhere in applied Bandkeramik archaeology.

With this classification, the twenty-eight largest assemblages of decorated sherds were analysed, yielding a coherent and clear picture of the changes over time, even within this Flomborn period assemblage. These were arbitrarily divided up into six ceramic phases with strong indications of a discontinuity from the 5th to the 6th phase (table 14-2 and fig. 14-3 above). Then the 166 finds with less decorated pottery were fitted to this master frame assigning a quality value each on a scale from 0 ('bad') to 4 ('excellent') based on their size (table 14-3). The resultant distribution is weighted towards the extremes, where the smallest finds tend to of necessity. In the chapter on the settlement's development, it is found that there are four house generations in the first occupation —with the ceramic phases 3 and 4 jointly making up the third generation, and the other ceramic phases approximately equal to one generation each. The first house generation here equates with HG I of the Aldenhovener Platte, and also with the first LBK activities at Elsloo-Koolweg and Geleen-De Kluis.

Next, attention was turned towards differences in the house plans, more specifically to the evolution of the configuration of the roof posts in the central section of the houses going from a single, simple Y-plan in the beginning, via degenerate derivations towards two or more regular DPRs per house in the end. Different types do not define separate house generations, though; replacement occurs rather gradually, with newer constructions alongside older types. As with pottery decoration, at any moment in time there was a *spectrum* of central configurations. Therefore a definition of house phases based on this central configuration as companion to ceramic phases is methodologically nonsense. Instead, the distribution of house types over the ceramic phases (table 14-5) was found to confirm the latter, as the post configurations were neatly arranged according to their (supposed) evolution.

Finally, eight AMS-radiocarbon dates from this excavation were presented, all read from samples with negligible age; yet the two plateaux in the calibration curve for this era have the effect of 'smudging' the results. Four dates suggest a founding of this village in the second half of the 53rd century BCE, right at the beginning of the LBK presence in the Netherlands, thus establishing a pioneer status for the settlement's earliest inhabitants. Two other dates confirmed the late re-occupation of the village area, also deduced from the decorated pottery ('ceramic phase 6'), close to the end of the LBK in this region in the first decade of the 5th millennium.

Thus, the beginning of the village can be estimated at about 5220 BCE, the end of its first occupation in ceramic phase 5 / HG IV (fifty or sixty years later, probably), while the village area was re-occupied by Bandkeramians in the next-to-youngest LBK (2c, Dutch chronology; HG XIII, Rhineland chronology), with a suggested date of around 5050 BCE obtained from well beneath a destruction layer. Apparently, the site has been witness to the Bandkeramians' arrival on the Graetheide; but probably not to their departure.

Notes

1 For which purpose the evolution of the central posts' configuration of the houses was recommended; cf. in the present publication the chapter on houses.

2 Recently, attitudes are changing: Krahn 2003 is very explicit on this topic, as is Claßen 2006; but cp. Schwerdtner 2007.

3 For instance., the individual pots illustrated in Jadin *et al.* 2003, the generalized motifs in Hauzeur 2006: figs. 93-97, 163-164, 199-200, or the analytical schema in Pavlů 2000: fig. 14-5.03; respectively illustrating the Belgian Omalien, the Gallo-Luxemburgian Moselle group, and the Czech LBK.

4 This is contested by Stäuble 1997: 19 who holds that the long pits were filled right after the end of their quarrying function.

5 One simulation study suggested that only one in ten runs of a seriation produces a reliable, or rather, stable outcome (Graham et al. 1976). However the problem appears to have been not so much with the seriation *per se*, as with the auxiliary programmes intended to "polish" the input data (Djindjian 1985).

6 *Rotation* did not improve matters.

7 Note that in seriations well-filled units tend to the centre of the distribution, and therefore are preferably left out.

8 The proportions for the Components variable have been computed from natural counts (regular numbers), which takes no account of the visual differences of, e.g., a line and a pointlet.

9 The sherds have disappeared since.

10 But cf. Coudart 1998: 39 and 57, note 14, who rightly observes that in some cases circular reasoning may be involved.

11 "At least" is added as a reminder that non-pottery or illegible houses (including those that could not be excavated) should be considered, too.

12 I am much obliged to Professor Van der Plicht who kindly discussed with me some of the pitfalls of 14C-calender date conversions.

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15 The Bandkeramik settlement

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*The Janskamperveld LBK excavation has uncovered 2.7 of the 4.5 ha of the LBK village. Although considerable quantitative differences exist between the pottery inventories of the houses, on this score no evidence could be found of substantial prehistoric differences beyond household size; differential erosion being just as likely. The village is divided into two wards by a central space; the NE ward has been excavated in its entirety, the SW ward not so. The NE ward was made up of either a type 1a or 1b house, with another 6 houses of the lesser types in every House Generation; the SW ward probably held two such groups or "lineages" (*houses*, in recent anthropology). Thus, the village consisted of about 20-25 houses at any moment during its occupation. The type 1a houses were found to switch from generation to generation between the two wards; an explanation is sought in virilocal residence rules crossed with matrilinear heritage of titles (of which major aspects of the pottery decoration are evidence). Comparison of the earliest pottery from several sites reveals that Elsloo, Geleen-De Kluis and JKV have been founded at about the same date in history, together with, e.g., the first House Generation at Langweiler-8 on the Aldenhovener Platte. The chapter ends with a critique of Modderman's subdivision of the LBK period in the Netherlands.*

15.1 Introduction: from archaeological site to neolithic village

This section repeats some general statistics from earlier chapters on the excavations on the Janskamperveld in 1990 and 1991 as a step towards a social and historical reconstruction of the village in later sections.

Approximately 61% of the surface area of the Janskamperveld LBK settlement (2.7 ha out of 4.5 ha) has been investigated. The southwestern rim has been excavated only partially. And right in the centre of the present excavated area, clay pits and a hollow road both of medieval provenance have disturbed the neolithic archaeological record.

From the number of 69 houses that appeared partially or wholly in the excavation trenches, the total in the settlement can be provisionally estimated as 98 houses. This estimate is probably off the mark as it is foremost dependent upon the assumption that the unexcavated part of the settlement has similar characteristics as the uncovered area. For instance, apart from the post holes that can be associated with and thus define recognized houses, there are many other post holes on the plans. When in lines and at regular distances they have been interpreted as 'fences'. Even so, about 375 post holes in the excavation plans are unaccounted for – based on their soil colour they should pertain to the Bandkeramik, their function(s) is (are) unclear, but some might as well derive from unrecognized houses. If so, the settlement would have been larger, of course.

The (numbers of the different) house types – which will play a role further on in this chapter – are based on the different constituent parts which are more or less standard constructions as far as seen in the excavated remains (Modderman 1970, 100-120; Von Brandt 1988, 40-41; Coudart 1998, 27). Because of this early standardization, determination of the number of partitions in the houses is relatively easy (the first criterium of the typology). This is less easy for the wall types (the second root), as these have been dug less deep, and are therefore more liable to vanish and with it the specification of the house types. Counting only those houses that can be relatively securely recognized (with overall *w*-index values of 3 or 4, to a count of 38), the number of three-part houses is larger than that of single- and two-part houses combined (as has been observed long ago for settlements from the older phases of the LBK: Modderman 1970, 112): there are 23 houses of type 1 (the three-part houses), against eight of type 2 (or two-part buildings) and seven of type 3 (the single-part constructions). However, turning to the lower index values ($w \leq 2$), the distribution of the figures is radically different, with a marked preponderance for the smaller types instead. Whether this difference is real or apparent only has been a point of extended discussion in the chapter on the houses. The unexcavated 29 houses from the previous paragraph (98 – 69 = 29) would probably be inversely distributed over the types, but even so, the tripartite buildings would still account for half the number of houses. A similar outcome is obtained in one of the sections below, but then based upon the distribution over the settlement of each of the various types and their combinations.

15.2 The settlement over time: house generations and house groups

In 2003, the excavators Louwe Kooijmans and Kamermans, and the present author published a text on the Janskamperveld excavation with a first analysis of the LBK village (Louwe Kooijmans *et al.* 2003). Unavoidably major differences have come up between then and now, for two obvious reasons: (1) the further elaboration of the old Modderman scheme of 1a, 1b, 2, and 3-types of houses toward a classification based on the number of partitions crossed with the nature of the walls, in {1,2,3} × {a,b,c} types; and (2) revision and re-interpretation of the excavation plan and section drawings. Differences are summarized in table 15-1. Re-classification is quite apparent from that table, and a relatively important number of houses has been up- or downgraded with 21 promotions and 4 demotions. More precisely, five *Kleinbauten* (type 3 houses) were promoted to the *Bauten* class (type 2; HH 29, 42, 45, 55, 56) and ten to *Großbauten* (types 1b, 1c, 1x; HH 14, 15, 19, 21, 25, 33, 37, 44, 46, 52); also five *Bauten* were reclassified as *Großbauten* (HH 02, 06, 22, 23, 58); even one *Großbau 1b* was now entered as a type 1a house (H 39), although doubts linger. Downgraded were one *Großbau* to type 2b (H 30) and three *Bauten* to type 3 (HH 26, 38, 48). The present classification (summarized in fig. 15-1) results in a more gradual or less discontinuous distribution of the sizes of the houses as demonstrated by fig. 4-4 (in the chapter on houses), with type 1c being quantitatively most prominent, and type 1a least so.

There are no important differences between the identifications of the central post configurations of the houses in the two texts concerned (fig. 15-2). Hence the diachronological implications of the evolution of this construction remain as they were. We posited a duration of the settlement of four or five house generations of approximately 25 years each, and this was then translated to the Dutch phases LBK-1b, -1c, and the beginning of -1d on the basis of Modderman's equations of type of configuration with chronological phase – cf. the section on periodization below, now scaled down to four house generations, covering at best one hundred years, three generations in LBK-1b and the fourth in LBK-1c. There is also a later, less intensive LBK occupation of the same site to be dated to LBK-2c and -2d; this second period was neglected in the 2003 text.

Before I turn to the development of the settlement over time, a methodological point should be discussed bearing on the assignment of especially the houses to a chronological phase (the same implications can be attached to any other type of find complex). For even working with decorated ceramics alone, different (putatively diachrononical) sequences are found, depending on the units employed in the computations. Although in itself this does not lead to questioning the basic method, it does pose the problem of choosing the 'right' series (cf. Claßen 2006, 151-154). In the chapter on Chronology, I used a sequence based on the weighted average of the phase attributions of the different finds (as described in the chapter on Pottery) associated with each house. In the Chronology chapter I compared the central post configurations of the houses with the same figures (esp. tables 4 and 5 of that Chapter); for the present Chapter the associated finds in one series have all been summed, and in another series the earliest of the different finds along each house have been used – all series with different (though not contradictory) outcomes. It has been known for some time now that the pottery contents of pits from which fitting sherds were excavated may differ by as much as two or more house generations (e.g., Kloos 1997, 166-167). The data sets are representative of probably different situations, and a choice between these sequences should be based upon the research context. The average of the individual finds is thought to be related to the terminal use of the pots in or near the house and so with habitation; the finds summed over each house have a similar interpretation, though the larger quantities per unit should offer more reliable results than the former approach; and the (smaller number of) earliest finds in each house may be relatively near the first use of

type	*2003*	*2007*	*late*
1a	*4*	*5*	.
1b, 1c, 1x	*12*	*26*	*4*
2b, 2c, 2x	*13*	*11*	*7*
3c, 3x	*26*	*14*	*1*
exceptional	*2*	*1*	.
sum	*57*	*57*	*12*

table 15-1 different attributions of houses to types in 2003 and present texts
'late': houses not entered in 2003 analyses

	1	*2*	*3*	*4*
1	–			
2	*0,58*	–		
3	*0,51*	*0,58*	–	
4	*0,78*	*0,93*	*0,61*	–

table 15-2 correlations between chronology of the houses computed from
1: central post configuration
2: weighted average of separate finds associated with each house
3: all associated finds summed
4: for each house the earliest of the associated finds

fig. 15-1 all houses per type

the house, its founding date. As a check the evolution of the central post configuration was used, which is very much tied to the foundation date of the house. However, different central post configurations occurred together at any one moment, as did different combinations of ceramic decoration attributes, each combination yielding a different and not necessarily adjacent position on the time scale. Table 15-2 lists the correlations between the different series. Clearly, the earliest finds align considerably better with the central post configurations than the other variables. My present objective being to define House Generations, the oldest associated find is indeed the best approximation and below I shall therefore use that sequence. From this table also a justification can perhaps be read for the common practice to first group finds from features around a house on the basis of their correlation and then join them (e.g., Claßen 2005, 114; Lüning 2005, 55). However, a computation of the relative position of a house *vis à vis* the other houses in a settlement should not be done without a consideration of the problem laid out here. As Stehli noted:

> *Also the association of pits with houses should be checked with a new, [settlement-] internal chronology, as the presently available one is unsatisfactory because of the wide scatter of the datable pits of a house.* Stehli 1994, 127 (my transl.)

The ceramic phases derived in the chapter on chronology cannot be translated directly into calendar years or house generations as no *a priori* conversion parameters exist. For example, ceramic phase 3, with only four houses attributed to it, seems too narrowly defined when the total number of houses on the site is considered and a steady building programme assumed, while ceramic phase 1 with seven houses in the excavation seems better in line with expectations. In other words, the ceramic phases are only obliquely relevant to the establishment of house generations. A rather more direct attempt departs from the probability that only one type 1a house was standing in the settlement at any one moment (Van de Velde 1979, 141, 152; Van de Velde 1990; Modderman 1985, 82). If so, their ceramic dates (if available) should provide a series ranking them relatively between early and late. There are five such constructions[1] (HH 07, 24, 35, 36, and 39). H 39 is ceramically assigned to phase 6, i.e., the second occupation (moreover, its 1a status is doubtful), H 36 poses a problem as its factor score on which the sequence depends is just on the limit between phases five and six so it is either the latest of the first habitation, or the earliest in the re-occupation of the site; post-depositional factors have erased its central post configuration, hence no clue. This leaves three or four such houses of this type for the first settlement on the Janskamperveld, presumably to be equated with three or four house generations[2].

Another approach to an estimate of the number of house generations starts from the assumption that the people who have built and inhabited the houses had a more or less constant group structure (recently, Louwe Kooijmans *et al.* 2003, 380). In other words., every generation inhabited about the same number of houses and set of house types. The counts of each of the various house types should then show a least common denominator equal to the number of house generations. The counts of houses per type (plus those 24 that could not be classified re-distributed over the various categories) in the excavation[3] are presented in table 15-3 – all restricted to the first inhabitation period, equivalent to ceramic phases 1 to 5.

However, if this Least Common Denominator principle is to be applied, the distribution of the numbers of the various types for the entire village should be taken into account, not just those in the excavation. One observation running against an easy extrapolation from excavation to village is the differential distribution of the various house types over the excavated area. As has been described elsewhere, the NW, NE and SE limits of the excavation almost or fully coincide with the limits of the settlement, whereas towards the SW a not-negligible slice of the site has not been investigated, although 'prehistoric traces' have been reported there by constructors. Importantly, the 1a and 1b types seem to cluster in the south-western half of the excavation; 1c type houses are rather evenly spread over the excavation; type 2 and even more so type 3 houses occur predominantly in eccentric positions (fig. 15-1). Assuming a more or less symmetrical layout of the village, this would suggest that the majority of the houses of 1a and 1b types have been uncovered by the excavation; that the number of type 1c houses should have been somewhat larger than within the excavated area; and that types 2 and 3 houses should have been present in quite larger numbers than a simple blow-up would suggest. With these considerations in mind the column 'village' in the table has been drawn up.

While in that table in the 'count' column the common denominator appears to be three, the 'corrected' column wavers between three and four, and the 'village' column

type	*count*	*corrected*	*village*
1a	*3 or 4*	*3 or 4*	*4*
1b	*6*	*7*	*8*
1c,1	*14*	*23*	*24-30*
2b,2c,2	*8*	*15*	*18-24*
3c,3	*5*	*13*	*15-24*
sum	*36-37*	*61-62*	*69-90*

table 15-3 counts of the houses per type for the first habitation period
'count': houses that could be recognised as to their type
'corrected': unrecognisable houses added
'village': estimate for the entire village area of 4.5 ha (see text)

even tends to four as common factor. It is provisionally deduced that either of the two should equate with the number of house generations in the first habitation period, if the assumption of a constant format of the settlement over a restricted period of time is about correct; the number of 1a-houses points in the same direction.

An additional problem of the estimate of the number of house generations may lie in a possibly different use-life of the several house types: it has been suggested that the *Großbauten* stood for about 30-40 years, and the *Kleinbauten* for perhaps 20-30 years (Louwe Kooijmans *et al.* 2003, 381). The argument is strictly a functionalist one as it is ultimately based on the possibly different liability to dilapidation of the house constructions. Taking the depths of the post holes as an index of construction solidity, these have been computed as 11 dms on average for type 1a houses, ca. 8.5 dms for other *Großbauten* and type 2 houses, and 7.5 dms for type 3 *Kleinbauten* (reduced to approximate neolithic floor level) which in this respect render differences between *Großbauten* and *Kleinbauten* less impressive. Moreover, given the experiences with the reconstructed LBK houses in open air museums (a.o., Cuiry-les-Chaudardes, Asparn an der Zaya), insect attack and rotting of the posts are much less than abandonment of the structure might justify (Bakels 1978, 86, Coudart 1998, Ch. 3). In other words, if the concept House Generation has any ground, it is a *social* not a *functional* one causing new constructions to be erected every 20 to 25 years[4] (also, Lüning 2005, 70). Of course, this is not the definitive answer to the question of the *use* life of the different house types, although the set of undatable type 2 and 3 houses rebuilt in virtually the same spot (e.g., HH 26, 27, 28) is not incongruent with a four generations scenario including elimination of the houses, while much else points to a similar conclusion.

If the estimate of the number of house generations is set at four[5], the next problem is which houses belonged to which generation. Only a meagre 34 houses have been *ceramically* dated to the first habitation, plus five to the second (early finds series); 30 houses are without sufficient decorated pottery to allow a reasonable relative chronological ranking. Fortunately, among the non-pottery houses, several provide an additional index for chronology through their central post configuration. As table 15-4 shows, among the houses with decorated ceramics most houses with a Y-centre belong to the first ceramic phases (and I now tend to incorporate the iY- and iYi-houses with the Y-central constructions); those with degenerate post configurations (i.e., dY, Yi, and J) occur from the second ceramic phase through to the fifth; and the houses with regular central DPRs appear for the first time in ceramic phase 3, and continue to the end of the occupation.

An initial four-generation division of the houses of the first habitation can be made by keeping the first and second ceramic phases as first and second generations, merging the third and fourth phases to a new third generation, and relabel the fifth phase as fourth generation; the second period of habitation equals the original sixth ceramic phase. This way the number of datable houses per phase / generation runs a normal course, counting 7, 11, 10, and 7 respectively in the first habitation period, and 5 houses in the second. To these sets several of the non-dated houses can be added as in the previous paragraph: both Y-type centrally configured houses (HH 22, 38) can be assigned to the first generation of the first habitation (fig. 15-2), as they do not turn up in the other phases. The central configuration of the undated iY house (H 35) is restricted to the first habitation; it has been entered on the plan of the settlement's first phase or generation (fig. 15-2). Based on table 15-3, five houses with so-called degenerated Y central configurations (HH 28, 31, 48, 53, 54) should not occur in either the first phase of the first habitation, or in the second habitation; accordingly, they have been entered as grey images on the plans for the second, third, and fourth generations of the settlement (respectively figs. 15-3, -4, -5). R-type central configurations have as yet not been observed in the first two generations; those four that are without phase indicator (HH 15, 26, 27, 40) have been drawn in on the other plans with a grey signature: they either pertain to the second habitation (fig. 15-6), or to the later generations of the first period of the settlement. The remaining 17 houses with no clues as to date or type, clog up the plans of every generation; like jokers, they can be thrown in in every interpretation of any site plan. The plans of the various phases have been re-oriented to the average direction of the houses, with their fronts towards the lower edge as well as toward the Geleenbeek; this is probably the way the inhabitants experienced their hamlet.

Continuing with the reconstruction of the format of the early settlement, the 2003 text proposed two different interpretations: one had 4 *clusters* (consisting of types 1 and 2 houses), plus two special areas (comprising the type 3 structures); the other postulated two wards (each grouping all types). In both views a central open space was included

phase	**Y**	**iY, iYi**	**dY, Yi, J**	**R**	x	*row sums*
1	5	.	.	.	2	*7*
2	3	1	2	1	4	*11*
3	.	1	2	1	.	*4*
4	.	.	.	3	3	*6*
5	.	1	1	2	2	*6*
6	.	.	.	4	1	*5*
x	2	1	5	5	17	*30*
totals:	*10*	*4*	*10*	*16*	*29*	*69*

table 15-4 central configuration types *vs* ceramic phases

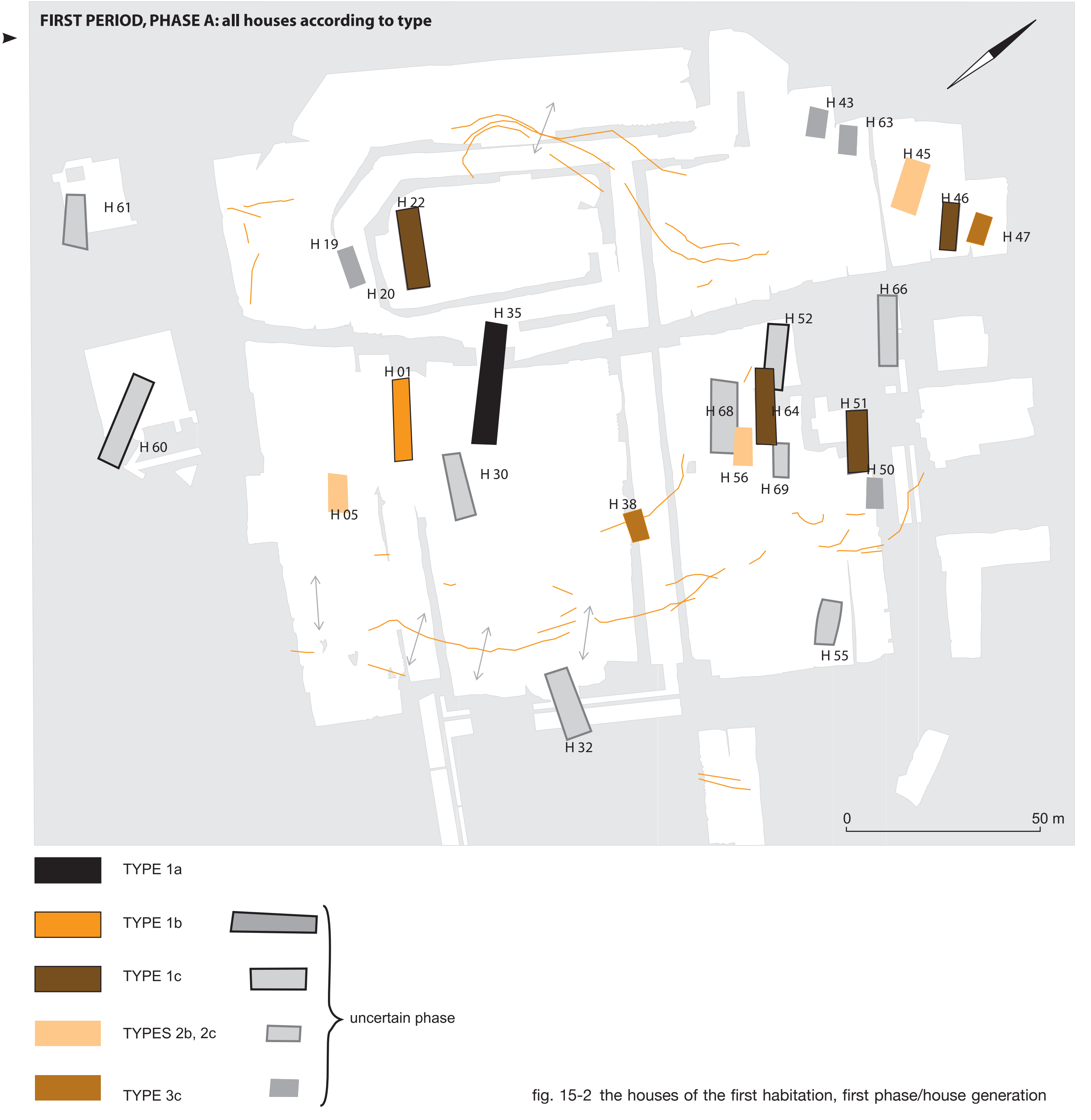

fig. 15-2 the houses of the first habitation, first phase/house generation

fig. 15-3 the houses of the first habitation, second phase/house generation

fig. 15-4 the houses of the first habitation, third phase/house generation

fig. 15-5 the houses of the first habitation, fourth and last phase/house generation

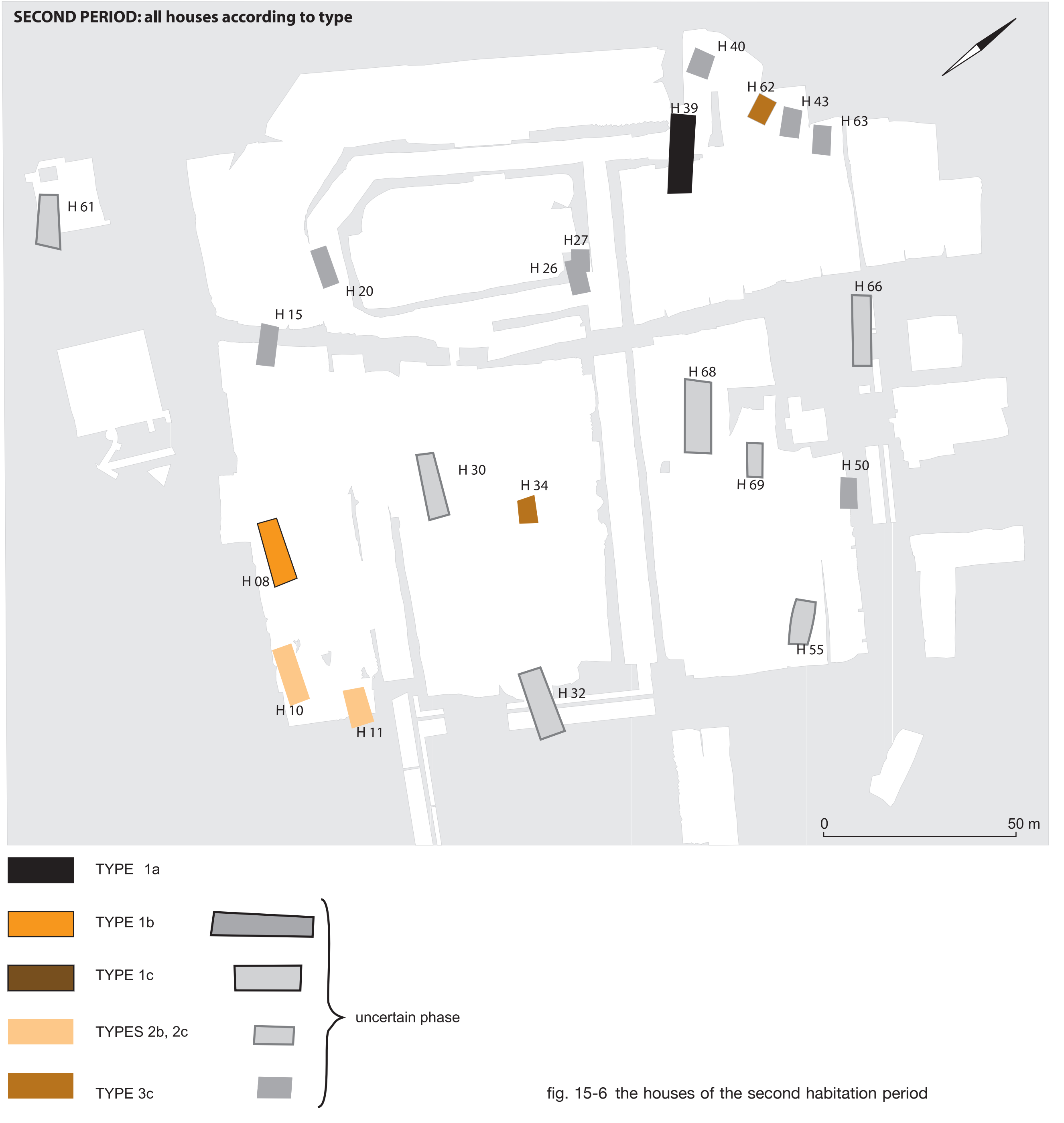

fig. 15-6 the houses of the second habitation period

(Louwe Kooijmans *et al.* 2003). The central, though in the excavation off-centre, open space and the consequent division of the settlement site into two sub-areas or wards still seems reasonable. However, one may wonder whether this separation is to the North or to the South, to the right or to the left of H 37/38 in phase 1; the subsequent phase discloses a layout which answers the question with 'left'. But in that same second phase the same question arises as regards H 24, and again the answer is provided by the third phase: 'left', simultaneously repeating the question, now with reference to H 25, and again the next phase shows the answer to be 'to the left'. If the succeeding phase/generation had not been there in each case, the situation would have been ambiguous, which it is not now. At the same time, the constant and rather stable separation argues for an intended prehistoric division of the hamlet; the two neighbourhoods have been labelled 'wards' in the 2003 text, and I shall stay with that word below.

Turning to the format of the wards, the right hand one (in the NE) should be nearly complete on the plans: the limits of the excavation coincide approximately with the bounds of the settlement debris in this area. Averaging the house counts per type, it is partly possible to bypass the problem posed by the undated houses: on the assumption of 4 house generations, the NE ward consisted of a 1a or a 1b house, two houses of each of the types 1c, 2 and 3. When comparing these figures with the plans, a number of differences appear, an important one being the absence of either a 1a- or a 1b-type house in the first generation. On the other hand, the 1b-type H 53 with no date attached, right in the densest part of this ward, would fit nicely in the third generation. The other undated houses, however, are not so easily assigned to a phase: there are simply too many of them.

In the southwestern ward, the situation is even less clear-cut because of the unexcavated area of the settlement to the SW. Yet, a count of the houses per type results in two houses of type 1a, six of type 1b, fourteen of type 1c (assuming that two *undated* 1c-type houses belong to the first habitation period, because none of the *dated* houses of that type occurred in the second period of the settlement), only five of type 2 and two houses of type 3. Both largest house types (1a and 1b) summed yields eight, or twice the number of generations which is the basis of the present discussion. Similarly, the fourteen houses of type 1c also point to a much larger ward than that across the empty space to the NE – if two such houses could be found outside the excavation, this figure would also double the number postulated for the NE ward. Obviously, even more type 2 and type 3 houses will have to be supposed there to bring their numbers to double of those in the NE ward; which, although speculative, is not really unlikely. Very cautiously, I tend to see the SW ward as composed of two house groups each of a similar format as the northeastern ward. That is, the NE ward consisted of one house group, the SW ward of two such groups.

Returning attention to the SW ward, the succession of the houses on the plans is not as smooth as it 'should' be. The major inconsistency is posed by the six houses of type 1c in the third generation (fig. 15-4); they all have been directly and securely 'dated' by associated decorated pottery so there is no responsible way to dispose of at least one, if not two of these houses. One possible exception: H 06 is set in ceramic phase 4 (i.e., the third generation) through its *likely* association with find no. 93008 (which has a *w*-index score of 4, indicative of sufficient data); *likely*, because this pit may also wholly or partially belong to H 07, although this latter association is *unlikely* given the very pronounced Y central post configuration of that house. The *Längsgrube* to the right of H 06 no. 28101 held very few pottery, and was dated to the fifth ceramic phase (fourth house generation) with a *w*-index of only 1. Add to this that the oldest associated find is thought to be closest to the founding date of the house and it is clear that H 06 is set in the proper time slice. A second problem lies in the small distance of hardly more than four metres between houses 07 and 03 (types 1a and 1b, respectively) with the rear gable of H 07 right in front of the façade of H 03, a rather improbable configuration. However, H 03 seems quite firmly dated to the first ceramic phase by its right-hand side pit 91124 (with the largest set of finds in the excavation); H 07 comes with four very small finds, all with a *w*-index of 0, all from possibly (rather: 'guessed') the first phase; moreover, both houses feature very similar central post configurations (pure Y's) from which no differentiating argument can be drawn therefore. Because of their joint configuration, the 1b-type H 03 is likely to have been earlier, and abandoned when the 1a-type H 07 was built.

With this, the size of the settlement in the first habitation period can be calculated as some 20 to 25 houses per house generation, made up of one house of type 1a, two of type 1b, six of type 1c, about six of type 2, and also six of type 3; which roughly translates to seventy five inhabitants (if buildings of type 3 served other purposes than habitation quarters). Of course, the first house generation was smaller than subsequent generations, as reasoned above; consequently the other generations will have been a little larger than this figure.

I would have much preferred to present a neater picture of successive house generations, if possible something like that available for the Aldenhovener Platte settlements. Yet figs 15-3 to -6 do show a weak coherence only. More than a division into two parts does not emerge, not even individual yards can be teased out. In some plans several houses do seem to cluster, with the other houses dispersed around them, but neither in the previous nor in the following house generation is that format predicted or retained. Even the two house groups in the southwesterly ward cannot be circumscribed but for their central, i.e., largest, house. Apparently the Janskamperveld LBK-village consisted of three *bunches* of houses in two wards, the groups not lined up internally but rather strewn haphazardly (*"habitat en grappe"*, instead of *"aire d'habitat"* or *"Hofplätze"*, Hauzeur 2006, 161). As a comparison, the considerably smaller Langweiler 8 settlement had its eight neat yards grouped into two wards as well (Schwerdtner 2007).

The second LBK occupation of the site (ceramic phase 6; LBK-2c in general terms) can be estimated to around 10 houses: five (out of 39, or one eighth) have been positively dated to that phase. In addition, 16 houses with regular DPRs (among 40 with identifiable central structure) will not all belong to this re-settlement. Indeed, seven have earlier ceramic associations, as against four with the final phase which suggests that 6-7 houses with a still identifiable R central configuration plus a few from the unidentified buildings belong to this second occupation. However, the major part of the settlement in that period should be sought nearby, namely to the southeast in the Haesselderveld site; unexcavated, built over, and presently lost to all archaeological purposes. It is remarkable that notwithstanding the in all likelihood marginal position of these late houses as regards the Haesselderveld village, a type 1a house (H39) has been excavated and dated to this phase by the associated finds (fig. 15-6). However, this house is also interpreted as of type 1b, as the trench on its front side is possibly later, and therefore does not belong to the building.

15.3 À *PROPOS* THE POTTERY, THE BANDKERAMIK HOUSEHOLDS

The chapter on the pottery from this settlement should have made clear that there are considerable differences between the finds, essentially quantitative. Differences in details over time (listed in the chapter on chronology) resulted in a relative chronology of six ceramic phases, the last of which was disjunctive from the earlier five by an interval of probably one hundred-plus years. Much less has been written about the spatial relations between the finds, the subject of the present section. To this end the first thing is to group the finds according to their association with the houses of the settlement: it is assumed that the contents of the pits near the houses in one way or another reflect practices in the houses when inhabited. To recall, 335 pits or features had remnants of 3607 pots; of these, 185 features with remains of 2910 vessels may possibly be associated with 58 houses, and 161 pits with sherds of 2278 pots are reasonably securely associated with 56 houses – that is, 13 houses are possibly without pottery, and 11 definitely do. Differences in the LBK evaluation of the pottery can be inferred from the distribution of the two major classes of pottery – table 15-5 summarizes the pertinent data. There, features (finds) associated with houses are separated off from the features that are located elsewhere, away from the houses; the two groups are almost equal in size (column 'sum'). Features with course ware are proportionally represented along the houses and elsewhere; but fine ware is found far more often than commensurate along the houses than away from them. Apparently, the latter was deployed preferentially in or near the houses, a corroboration of its function as an identity index (as described in relation to the spatial distribution of characteristics of the structure of the pottery decoration in the chapter on pottery).

		pits with		
		course ware	*fine ware*	*sum*
pits	*assoc.*	*160*	*140*	*164*
	not assoc.	*156*	*96*	*170*
sum		*316*	*236*	

table 15-5 the association of pits with fine and/or coarse ware with houses

A search for more detailed patterns shows that decorated ware is vastly under-represented near the smaller houses (types 2 and 3) than with the *Großbauten*: only eight houses of type 3 (among 15) have decorated pottery; similarly, eleven type 2 houses (numbering 18 in the excavation) are accompanied by this pottery variety. As regards undecorated or coarse ware, the contrast is less dramatic, as respectively ten and thirteen houses of said types go with pottery. Almost all bigger houses feature both types of pottery, in an invitation to suspect early social inequalities. Table 15-6 presents some more details on this matter.

Although this pattern is sufficiently clear, it must be asked whether the differences are indicators of past LBK situations or merely the result of differential preservation due to erosion and other post-depositional factors – after all, the majority of the houses with no or little pottery only occur in the northeastern part of the site where most erosion has taken place[6]. The question can only be answered through an internal check: comparison with other, even similar, settlements is methodologically unwarranted as the post-depositional factors for the different sites cannot be detailed, let alone quantified. Therefore, I divided the finds associated with the houses (henceforth 'houses' for short) in three sets: seven houses with more than 100 pots each, 29 with between 10 and 100 pots, and 23 with less than ten pots per house. While all counts are subject to accidental variations these will have relatively more effect on small numbers, and so the small number group will be left out. The rich set should provide a standard against which the modal group can be checked, as the random fluctuations will have had least weight for the former. Table 15-7 lists a set of figures relevant to this comparison. Not unexpectedly large differences appear between the two samples when the average counts are compared; for instance, there are 73 undecorated pots per house in the wealthy group, against only 19 such pots in the modal houses, similarly so with the decorated ware with 60 *versus* 15 vessels. The quantitative differences, however, are entirely qualified by the qualitative similarities between the two sets: the ratio of undecorated to decorated ware, the relative presence of the several functional groups of pottery, the curvilinearity index, and the degree of fragmentation are virtually identical for both samples, although the spreads (as indicated by the standard deviations) are substantially larger in the regular sample than among the 'fat' houses. The implication is that post-depositional factors have affected both groups in the same way; but still the question remains whether or not they were affected to a different degree, so that *quantitative* differences between house types do not reflect original LBK differences but rather different degrees of preservation.

If the relative values do not differ when rich and moderate complexes are compared as in table 15-7, they still may hide qualitative differences between the house types; table 15-8 was compiled to check that possibility. There it appears that there are differences between the house types (at least where the ceramics are concerned), especially when the counts and the averages based on them are compared, yet the mutual relationships, such as percentage of decorated vessels, proportion of kitchen ware, the number of sherds remaining per vessel, and the "matrilinearity index" differ only marginally, as before. Again, the message seems to be that there are no important qualitative differences between the inventories of the house types (and neither therefore, between the individual houses). Whatever differences there are

house type	*all pots*	*undec'd*	*dec'd*	*Limburg*	*n(H) (all)*	*all/H*	*undec/H*	*dec'd/H*	*LB/H*	*house type*
1a	*80*	*47*	*32*	*1*	*3 (5)*	*26.7*	*15.7*	*10.7*	*0.3*	*1a*
1b	*224*	*114*	*106*	*4*	*6 (8)*	*37.3*	*19.0*	*17.7*	*0.7*	*1b*
1c	*1161*	*665*	*485*	*11*	*19 (23)*	*61.1*	*35.0*	*25.5*	*0.6*	*1c*
2	*338*	*182*	*148*	*8*	*11 (18)*	*30.7*	*16.5*	*13.5*	*0.7*	*2*
3	*160*	*81*	*78*	*1*	*8 (15)*	*20.0*	*10.1*	*9.8*	*0.1*	*3*
sums	*1998*	*1109*	*864*	*25*	*47 (69)*	*42.5*	*23.6*	*18.4*	*0.5*	*general*

table 15-6 numbers of (house associated) pots *versus* house types

	undec'd	*dec'd*	*ratio ud/d*	*%(T)*	*%(K)*	*%(O)*	*%(x)*	*c/(c+r)*	*fragmentation*
n = 7	*73*	*60*	*1.2±0.71*	*47*	*32*	*11*	*10*	*0.61±0.10*	*4.01±0.49*
n = 29	*19*	*15*	*1.3±2.24*	*46*	*26*	*13*	*15*	*0.67±0.11*	*4.04±1.26*

table 15-7 numerical comparison of central values of ceramic inventories of houses with more than 100 pots, and with 10 to 100 pots
undec'd, ud: undecorated ware; dec'd, d: decorated ware
T: table ware; K: kitchen ware; O: storage pots; x: function unknown
c, r: curvilinear, rectilinear decoration
fragmentation: average number of sherds per pot

	n(pp)	*n(H)*	*pp/H*	*%dec'd*	*%(T)*	*%(K)*	*%(O)*	*c/(c+r)*	*fragm.*
1a	*144*	*5*	*28*	*43*	*50*	*38*	*12*	*57*	*3.23*
1b	*322*	*8*	*40*	*50*	*65*	*24*	*11*	*69*	*3.29*
1c	*1196*	*20*	*60*	*42*	*49*	*38*	*13*	*60*	*4.37*
2	*371*	*13*	*29*	*44*	*58*	*23*	*19*	*69*	*3.82*
3	*248*	*10*	*25*	*49*	*61*	*25*	*14*	*72*	*4.21*
all	*2278*	*56*	*41*	*45*	*54*	*33*	*14*	*64*	*4.04*

table 15-8 numerical comparison of central values of ceramic inventories of houses per house type
pp: ceramic vessels; H: houses
dec'd: decorated; T: table ware; K: kitchen ware; O: storage ware
c, r: curvi-, rectilinear decoration; fragm: average number of sherds per pot

between the ceramic associations of the house types, they are of a quantitative character only.

It seems difficult, perhaps impossible, to decide between the two alternatives of post-depositional, quantitative and non-selective erosion of the original ceramic inventories on the one hand, and quantitative differences between the households in LBK times on the other. Yet, usually analyses proceed as if present proportions and distributions reflect prehistoric ones, and I will do so too, at least as far as the houses with pottery are concerned. To this an additional argument can be contributed, namely the results of the simulations reported in a separate chapter. There, it is shown that there are two important parameters, the average number of sherds per pot (which is independent of the number of pots involved, and is calculated from the excavated data), and the distribution of the numbers of sherds per pot (also an empirical datum). From the first figure the rate of decay of the finds is read, from which the original number of pots can be inferred – here, 4.03 sherds per pot, 88% decay of the sherd population, still 90% of the pots represented; this is confirmed by comparing the simulated distribution of the sherds per pot counts with the observed distribution which is almost identical[7]. That is, the simulation approves of the common archaeological practice (with an allowance of about ten percent), observed distributions and proportions *generally* reflect prehistoric distributions and proportions, at least on the Janskamperveld. However, the simulation does pronounce *only on the houses accompanied by sherds*; it is strictly bound to the relations between sherd counts and original pots, and says nothing about the distribution of pots over the houses in the settlement. Thus, especially the houses presently without ceramics have lost their possible inventories beyond repair because of post-depositional processes: as ever, absence of evidence is not evidence of absence; see the chapter 'Sherds and Pots'.

Before embarking on an interpretation of table 15-8, it should be noted that it presents averages, calculated across the houses of each type: considerable variations are dampened this way. For instance, on the one hand there are three type 1c houses without any sherds, and five type 2 and five type 3 houses with the same defect. On the other hand, of the seven houses that compose the set with more than 100 pots each in table 15-7, five pertain to the 1c type and one to types 2 and 3 each. In fact, the distributions within each of these types are different: the type 1c houses (n = 23) all have a fair number of pots except for seven houses with less than ten pots or none at all; three type 1b houses (n = 8) have more than 70 vessels associated, the other five have less than 20 pots; for the type 1a houses (n = 5) there is an even spread of the number of pots around the average; one house of type2 (n = 18) has more than 100 pots, and all the other houses have less than 50; and finally, among the type 3 houses (n = 15) two are accompanied by over 60 pots, the other houses by less than 20. As table 15-9 shows there is only a marginal relation between the visibility of the houses and the quantity of associated pottery; in other words, the table seems to demonstrate that the quantitative differences between the houses are indeed reflective of past differences. When ceramics are evidence of inhabitation of the houses then the least one can say about it is that they have had very different histories, all of them: on the assumption of a constant number of pots per individual, some seem to have been occupied by larger households and/or for a longer time than most others. Roughly 20 pots in the excavation associated with a house (representing 21 or 22 vessels originally) equate with a use life of about 20 years, assuming 2 service vessels, 3 cooking pots and 2 storage jars (being the average inventory of a LBK house in this village) in use[8] at any time; and visible to us as ten sets of fine ware sherds plus another ten or twelve groups of coarse ware sherds. Larger inventories, larger families, up to five times as large in houses H 13, H 57, and H 17; and still larger, up to even nine times in HH 02, 04, and 23. And similarly, smaller ceramic inventories, fewer occupants of the associated houses – or, perhaps, more ephemeral use? At any rate, this set of data does not allow the conclusion that houses of type 3 (or even type 2) have not served as dwellings, several show traces of intensive and/or full-time occupation, whereas others (about half the type 2 houses, about three quarters of the type 3 houses) seem to have been inhabited less than full-time and used for other miscellaneous purposes, if a similar lifetime for these constructions can be assumed as for the larger ones.

Going down from the general level of house types to the level of the wards, the next factor to be investigated is whether there are important differences in ceramic contents between the two local groups, the wards of the previous section. If so, this might point to cultural, social, or material differences between the two groups which are reflected in the pottery. The numbers of houses in the two groups are quite similar: 25 in the northeastern ward, 22 in the southwestern group (here, I included all houses with ceramics not explicitly from the 6th ceramic phase). There is a slight difference in

w \ pots	*°›100*	*15-100*	*1-14*	*0*
4	2	11	3	1
3	34	-	6	2
2	21	9	4	2
1	-	9	5	7
0	-	-	2	1
n(H)	*7*	*29*	*20*	*13*

table 15-9 *w*-index of houses *vs* pottery counts per house the fragmentation of the pottery between the two wards: all in all 4.23 sherds remain on average per pot in the northeastern ward, while 4.00 in the southwestern zone, yet the difference is not even half the standard deviation of that figure (table 15-7) and thus of no consequence. Similarly so with the presumed functions of the vessels: the presence of the numerically most important group (table ware, accounting for 46% of all pottery) differs by 5% only between the two wards, the other functions 3% each. Also, the matrilinearity or curvilinearity index is nearly identical for the two groups (0.63, and 0.66 respectively, well within the bounds of the variation). Finally, there is one important disparity, as the average number of pots per house is 54.8 in the southwestern *vs.* 38.5 in the northeastern companion. As averages per house they seem to convey a message which probably reads: fewer inhabitants per house in the northeastern ward than in the southwestern group, probably compounded by more post-depositional decay. To differentiate between the two alternatives, a comparison can be made of the pot type spectra of the groups: household size will perhaps be reflected in the (relative) numbers of fine ware (service ware, also serving as identity badges). Indeed, the numbers of thin-walled pots are 22.6 and 14.1 per house respectively, or 46% and 41% of the ceramic contents of the two wards, suggesting that "household size" is mainly responsible for the difference.

15.4 A SOCIAL INFERENCE OF THE MAJOR PATTERNS

Another subject to look into is the nature of the early settlement, the initial occupation. From the analysis of the botanical remains, it appears that the first harvests were reaped from newly laid-out fields in the virgin forest (Bakels, this volume). Given what is ethnographically and historically known about primary colonization (e.g., Graves/Addison 1995; Melo Bento 1994; also cf. Frirdich 2005), these harvests will have been preceded by an intensive reconnoitring of the Graetheide area first, probably by a few able-bodied people only, who after ringing forest trees at choice locations returned to their homeland. The next or the second year a larger group brought seed, cut trees, and sowed the first fields in the new world, to return to kith and kin in the southeast again, perhaps leaving some guardians, well-hidden in the forest. Then just before harvest time, the pioneers will have gone with their families and cattle the two or three weeks walk to settle definitively, first in the guardians' shacks while building sturdier houses[9] – needless to say that their group was of sufficient size to ward off attacks by outraged autochthonous hunters. With plenty of spare time left after agricultural work, a first house generation will not have taken many years to complete, labour is not a scarce resource in tribal society (on average, only 2 hours a day are sufficient for agricultural production; Sahlins 1972, Ch. 2 —such an average means that there are major idle periods per year).

The exact number of earliest houses will remain a matter of speculation, although clearly there should have been several from the onset. If the total number of houses is proportional to the ratio of site area to excavation, then those ten that have been ceramically relegated to the first phase, have to be converted to $100/61 \times 10 \approx 16$ in the complete set; also, 10 central post configurations are recognizably of the "pure" Y-type, which yields a similar number of early houses. Both estimates may be too high: above I have argued that houses are *not* evenly distributed in the excavation, and also half the number of Y-configured houses has the second generation attached to the associated finds. Thus I arrive at about six to twelve houses (all types included) for the first generation, a number which would have sheltered about 15 to 25 able-bodied men plus a similar number of women, almost certainly a task force sufficient for any building endeavour and for countering inimical raids. As is said of the easterly neighbours on the Aldenhovener Platte:

> *Pioneer settlements like Langweiler 8 opened up the landscape for a few kilometres along smaller or larger streamlets. They rapidly expanded to a size of seven to ten houses.* Claßen 2005, 120

Previously I have deduced a matrilineal moiety system (emphatically *moieties*, not *clans*; Eisenhauer 2003; see Van de Velde 1979, 108, 133, 148) in the Elsloo village's social structure which was the cause of carefully mixed characteristics of the pottery decoration; the chapter on pottery in the present study confirmed that inference for the Janskamperveld LBK settlement (now also established elsewhere in Bandkeramia as well: in the Königshoven group in the Rhineland, on the Aldenhovener Platte, and in Württemberg; resp. Claßen 2006, Krahn 2003, Strien 2000). One of the more relevant facts also bearing on this issue is the shift of the 1a-type houses from one ward to the other and back: when a matri*lineal* definition of some important function is applied to a non-matri*local* practice, its location will of necessity shift through the village as the titular heiress has to marry someone in a house different from that of her birth and her mother's (this is simply a consequence of exogamy and incest avoidance, a universal marriage arrangement). In earlier analyses I deduced patri- or rather virilocal marriage rules, which together with matriliny would do the trick very well; in the meantime, Eisenhauer established virilocality through molecular analysis of the skeletal remains from Talheim (Eisenhauer 2003), as had been done shortly before for the cemeteries of Flomborn and Schwetzingen in the Rhine-Main area (Price *et al.* 2001). As inferred in a previous section, the spatial division between the two wards is crossed in every house generation by the 1a type houses; such a house exists first in the southwesterly ward (H 35), then in the northeasterly ward (H 24), after which the central open space is merely crossed to the southwesterly ward (H 07), to return again to the northeasterly part of the village (H 36) in the fourth house generation. This house type is outstanding based on probably important characteristics like size and construction of the walls; in this latter aspect it is the only Bandkeramik house type with wooden boards all around and therefore a different function than of the other houses is indicated – not necessarily by exclusion but rather by addition on the basis of the associated pottery which is not really different from that with the other house types. The different function of this house type is accentuated by their having been burnt down, all of them, in contrast to the other LBK houses on the site which only rarely show traces of a fiery ending and thus generally seem to have met a less violent fate.

A social interpretation of the *wards* as moieties begs the question of the status of the three house groups or *yards* that emerged from the analysis of the site plans. 'Ward': the word is used here to indicate a small (part of a) hamlet, a tiny neighbourhood, a *barrio*, a group of houses which are nearer to each other than to the nearest similar group; its social equivalent being a (localized) moiety. 'Yard' indicates a house's premises, being groupings of a house plus its appurtenances like the houses of dependents, hay stacks, stables, manure heaps, dumping areas and storage pits, and its grounds[10]. Thus, in the Janskamperveld case the northeastern ward is coincident with a yard, while the other ward comprises two yards. These spatial sub-divisions of LBK-villages have also been noted elsewhere; they have been accorded a lineage status (Van de Velde 1979, 141-149); the two halves of Langweiler 8 also come to mind (Schwerdtner 2007). More generally, Coudart writes "When looking at LBK sites with not too high a density of buildings, groupings or alignments of houses are apparent, which recall the spatial lineage or clan divisions (*"division spatiale lignagère"*) existing in very many tribal societies" (Coudart 1998, 107; my transl.). Given the repetitive composition of the yards (as especially visible in LBK settlements which last longer than this village), they each probably represent the accommodation of a House (or lineage) *sensu Lévi-Strauss*[11]. In the loose description of Stone:

> *…. persons are grouped into corporate estates, or 'houses' that perpetuate themselves through the transmission of their names, titles, privileges, and wealth through real or imagined lines of descent . . . Actual membership in houses can follow simultaneously any number of different paths — descent (matrilineal or patrilineal), marriage (endogamous or exogamous), through fictive kinship, adoption, or other means of incorporating assorted persons.*
> (Stone 2004, 247)

Certainly, the name "house" is confusing, as in LBK contexts every single excavated house plan is customarily designated "house", while the Lévi-Straussian concept "house" embodies an estate grouping a number of persons which may or may not inhabit several distinct buildings. The word *yard* has been introduced precisely to refer to the archaeological deposit of the group that once made up such a sociological House. The main house of a yard (in LBK contexts, either the 1a or the 1b type) has already been labelled ***lineage house*** to indicate its importance to the whole group beyond simple dwelling place.

15.5 Second thoughts on the chronological situation

Probably, house generations on the Graetheide will not have differed much in length from those on the Aldenhovener Platte, especially in the Older or Flomborn LBK phases when the common cultural background was not yet completely swamped by diverging histories (Stehli 1989, 58; Lüning/Stehli 1989; Lüning 2005). The equation of Dutch LBK-Ib with house generations ('HG') I-III on the Aldenhovener Platte, of Ic with HG IV-VI, and of Id with HG VII-VIII (ibid.) does not solve the problem of positioning the HGs on the Janskamperveld relative to those in the east. Closerby, a comparison of the earliest Janskamperveld pottery decoration with that from other early sites on the Graetheide produces no differences between the sets. Thus, if the illustrations represent all finds from Geleen-De Kluis, then only four out of 67 rim sherds (6%) there show independent rim decoration (Waterbolk 1959, 143-155). At Elsloo I counted six decorated rims on 62 fine ware pots (10%; phases 0 and 1 summed), similar to the Janskamperveld village with ten among 102 pots (10%; first house generation). If pottery decoration can be trusted with respect to chronological positioning, the only conclusion can be that the colonization of these Graetheide villages has been simultaneous. Mainly because of the quite early, mutually reinforcing ^{14}C-datings obtained for the earliest phase of the Janskamperveld settlement, my *impression* is that the first house generation there was approximately contemporaneous with the first one on the Aldenhovener Platte (indeed Stehli equated Geleen-De Kluis with the Aldenhovener HG I-VI; Stehli 1994, 125). Since the characteristics of the pottery decoration do not go beyond phase LBK-1c[12], this would imply four, at most five house generations based on the pottery alone. If this all be true, then the first occupation on the Janskamperveld would altogether account for no more than 60 or 80 ± 10 years, setting one HG equal to 15 years. Note that the number of house generations deduced from the distribution of the houses in a previous section was also four.

There are some minor problems with this quite low estimate, the most important of which is the chronological placement of the first Janskamperveld habitation period. Because, on the Aldenhovener Platte, the nearest LBK *Siedlungskammer*, the first three house generations have been equated with the Dutch LBK-1b phase, whereas here on the

Janskamperveld the ceramics from the fifth ceramic phase (*i.e.*, the end of the first habitation period, and equated with the fourth house generation) show LBK-1c characteristics like filled strips and decorated rims, while several of the associated houses also appear to have regular DPR central configurations – allegedly a post-Flomborn element. On the other hand, the early ^{14}C-datings from the *Längsgruben* do suggest an early colonization, probably before 5200BCE, quite early in the Flomborn sequence, in line with the Lanting and Van der Plicht estimate from wiggle matching and dendrochronology of Aldenhovener Platte datings (Lanting and Van der Plicht 2002, 45). This may suggest either a shorter Flomborn period with a rapid evolution towards post-Flomborn characteristics of pottery decoration and house construction (at least on the Graetheide), or a beginning in the Rhineland of the Flomborn phase later than the commonly assumed beginnings of the 53rd century (e.g., Lüning 2005, 71).

15.6 On the periodization of the Dutch Bandkeramik, a critique

The periodization of the Dutch Early Neolithic was originally defined by Modderman in the wake of his excavations in Elsloo and Stein (and, more implicitly, his earlier ones in Sittard, too; Modderman 1970, 195-198). Although the backbone of that scheme is uncontested, the finds from Geleen-Janskamperveld pose serious problems for the definition of the Older period, comprising LBK phases Ib, Ic, and Id. As an introduction to these problems an extensive quote of the relevant Modderman text may serve:

No plausible arguments can be put forward against the assumption of an oldest phase of the LBK which is characterized by the use of organic temper in the pottery. … So far, this oldest pottery has definitely not been found in Dutch Limburg. We therefore wanted to keep a place for this pottery in our chronological scheme, for which we have reserved a Phase Ia. The . . . oldest LBK finds from the Netherlands clearly do not fit into this first phase. We relegate these to Phase Ib . . . Furthermore, phase Ib is distinguished by buildings with a Y-construction of the Pure Geleen Type, the lack of rim decoration on the pots and the presence of the strip types BI, DI and BII alongside AI. Apparently our phase Ib corresponds with Meier-Arendt's Phase II (Meier-Arendt 1966, 23).
Characteristic of the next phase of the Older LBK (Ic) is a different arrangement of the roof supporting posts in the central part of the buildings. The Degenerated Geleen Type replaces the Pure Geleen Type. Indeed two variants of this type exist, of which it is not clear whether they were contemporaneous or one after the other. Apart from this change in the plans [of the houses] we now find simple decoration on the rims of the pottery. The characteristics of Phase Ib can also still be found in this phase.
Just like the third phase of the Older LBK, the youngest one (Id) was also recognized in Sittard. This phase has to be seen as … really transitional to the Younger LBK. Apart from the transitional form of the Geleen type in the buildings the rare occurrence of strip type DII in the pottery decoration as well as the first application of rim decoration consisting of two rows of pointlets … are characteristic of this last phase of the Older LBK. … Our distinction of phases Ic and Id is first and foremost based on the changes in the plans of the buildings. The simultaneous changes in the pottery decoration are much less outspoken. The latter is the reason why investigations dealing exclusively with ceramics have not established further subdivisions, according to us.
The first phase of the Younger LBK (IIa) is as much of a transitional nature as is the preceding one. Many characteristics of the Older LBK have disappeared altogether, as has the Y construction. … Lack of rim decoration is a rare exception.
(Modderman 1970, 195-198; my transl,)

In the above text, primarily house construction and characteristics of pot decoration define the phases. Thus, phase Ib is defined by buildings of the Pure Geleen Type (= houses with a Y-configuration of posts in their central part) and the complete absence of rim decoration on the pots; phase Ic by the Degenerated Geleen Type (in the present text, houses with a dY-configuration of central posts) and some simple rim decoration on the pots; phase Id by houses of a Transitional Geleen Type (similar to the iY and J-types described for the Janskamperveld settlement) and on the pots by a rim decoration made up of two rows; and finally, phase II by the Elsloo Type of Houses (i.e., with regular central DPRs, here the R-type). In the accompanying table 15-10, the contrasting findings from the Janskamperveld excavation are summarized.

Clearly, in this settlement Y-configured central parts do not occur solely with pots without rim decoration; in fact, there is only one such house where exclusively pots without rim decoration have been found – but a total of three rims seems hardly convincing. This means that at least for this settlement the Modderman definition of Dutch LBK-1b cannot be

central config.	*no of houses with pottery*	*A*	*B*	*C*	*D*	*E*	*F*
Y	*10*	*61*	*79*	*11*	*64*	*131*	*49*
dY	*4*	*23*	*61*	*9*	*87*	*47*	*57*
Yi, J	*7*	*127*	*84*	*15*	*87*	*228*	*46*
Rn	*14*	*131*	*60*	*48*	*85*	*252*	*53*
x	*19*	*87*	*64*	*29*	*62*	*177*	*49*
	54	*429*	*71*	*112*	*78*	*835*	*50*

table 15-10 Geleen-Janskamperveld: types of central configurations ***vs.*** some characteristics of pot decoration
A: number of associated pot rims; B: percentage of rims with no decoration;
C: number of pots with rim decoration; D: percentage of of rims with simple decoration;
E: strips in belly decoration of pots; F: percentage of strips with fillings

upheld. Similar implications can be drawn regarding the definition of phase Ic through the first occurrence of simple rim decoration and the Degenerated Geleen Type (or dY, in the table), as well as for that of the Id phase by Transitional central post configurations (iY, J) and the filling of the strips in the belly decoration of the pots (approximately equivalent to Modderman's type DII strips). Then, if the Younger LBK is characterized by the paucity of undecorated pot rims together with exclusive occurrence of Regular DPRs in the central parts of the buildings, the 60% of pot rims that go undecorated in association with R-type houses seem to also put this stipulation into perspective.

When anomalous evolution of the Janskamperveld houses' constructive details and/or the pottery decoration is ruled out as explanation, a search for rather more rational factors behind the discrepancies is called for. In table 15-10 as in Modderman's definitions, the central configuration of the house posts is set up as an independent variable, against which the other developments (in this case the pottery decoration) are checked. Of course, this procedure can be turned around and the evolution of the pottery decoration taken as the independent variable. A major advantage of the latter procedure is that in itself the pottery decoration is a composite of potentially independent variables which may all run their own historical trajectory, and thus together provide a more secure framework for diachronological comparisons – after all, with this same concept Modderman gave different combinations of strip types as being characteristic for each phase. In the chapter on chronology, six ceramic phases have been defined on the basis of changing frequencies of chronologically sensitive variables. In table 15-4 (above) these are presented as the independent variable for ordering the houses' central post configurations on the assumption that the finds in the *Längsgruben* along the houses are contemporary with their use and therefore only one, at most two decades later than the building of the house[13]. Restricting the discussion to the first period of the settlement, and therefore leaving the sixth ceramic phase aside, it should be emphasized that the relationship between ceramic phases and the Dutch chronological system (or with the absolute chronology, for that matter) is by no means a straightforward one. Still, both sequences are running in the same direction: 'earlier' and 'later' in the one will translate to 'earlier' and 'later' in the other, etc. Furthermore, the number of ceramic phases has been determined by the amount of change on the defining characteristics jointly, an essentially arbitrary criterion.

With these provisos, table 15-4 paints a quite different picture than table 15-10, in that types of central configuration occur in different (generally contiguous) phases. Not unexpectedly, the Y-type is earliest in the scheme, whereas the Degenerative and Transitional types (dY, and iY, respectively), and of course also the Regular DPR constructions are successively later. More importantly, there are chronological overlaps between the different configurations, corroboration and extension of Modderman's observation that there are two alternative "degenerative" sub-types of which it is not possible to say whether they were contemporaneous or sequential (quoted above). Apparently, they are both and they are not restricted to the Degenerated types. Perhaps the most remarkable entry in table 15-4 is the relatively early occurrence of the Regular or Elsloo Type central post configuration, doubly remarkable for the fact that they all occur in type 1c houses (the smallest of the ***Großbauten***); for this early appearance I have as yet no parallels.

Above I have contrasted Modderman's chronological scheme with a developmental picture. In his scheme, a classification with distinct classes (of central configurations, of pottery decoration) was presented which through the necessarily disjunctive nature of the classes suggested sudden changes. Here however, development was taken to be graded, and therefore differences were only gradual, both in pottery decoration and in house construction. The different methodologies aside, there are important differences between the outcomes: Y-configured houses were seen to be accompanied by pots with rim decoration (almost a quarter of all associated pots), and Regular DPRs in the central parts turned out to be much earlier than supposed by Modderman.

15.7 Some further thoughts

As extensively discussed in the chapter on chronology, neither the original Modderman scheme, nor Stehli's decoration analyses could do without the configuration of the central posts of the houses to get anywhere near the specification of the earliest Flomborn developments in the settlements. Already in earlier publications (Van de Velde 1976, 1979), I have levelled critiques at the heterogeneity of these approaches, which conflate methodologically and historically distinct data streams, with therefore coarse and uncontrollable results. With the classification system of pottery decoration proposed instead, an attempt was voiced that could effectively get at the development of that decoration over time (and space, but that is not the issue here), even in the Flomborn phase until then assumed to be immune to analysis. The results of an application of that system to data from the Elsloo settlement have never been contested to my knowledge, not even those concerning the oldest phases there (Flomborn period); that village spanned the entire LBK period in the Southern Netherlands. In the meantime, in her doctoral thesis at Cologne, Ulla Münch has redone Stehli's analyses, differentiating into variants two of the strip types considered early, with the result that now the earliest house generations of the Aldenhovener Platte can be directly (relatively) dated through the pottery decoration, without recourse to considerations of spatial distribution etc. (Münch 1999). The Münch thesis has not been published, although in texts by other researchers several references to it exist; as far as I know the only public statement from her hand is a poster in the jacket at the end of the Brauweiler book (Münch 2005). As from that poster, the nine variants are still combinations of elements at different levels of analysis, involving mainly (in my terms) the components pointlets and lines and continuous or discontinuous strip fillings; they have been presented here as chronologically relevant in the appropriate chapter, too. The nicely coherent succession of houses following from her study provides a validation of Münch's analysis. Using my own classificatory system in the present study (especially the chapters on pottery, on chronology, and on the settlement) the Flomborn phase at the Janskamperveld LBK village has been divided into five ceramic phases, which could (also successfully) be checked against the independent variable of the development of the central post configuration of the houses. It should be emphasized that the five plus one ceramic phases reported here are relevant to the Janskamperveld LBK village only; it is to be expected that even in neighbouring Sittard or Geleen-De Kluis different subdivisions will emerge when the finds there are subjected to analysis of pottery decoration. The major pattern of the evolution of the pottery decoration, however, will be quite similar throughout the Graetheide region, going from simple to complex but all the while restricted to only two main motifs, executed either in a recti- or curvilinear fashion.

Another question is, why did they give up this location after less than one hundred years? The answer is that they did not really give up the site: on the one hand in the southward adjoining Haesselderveld lower on the valley slope a settlement was established at about that time (Vromen, pers. comm.); on the other hand, the site itself was converted into a garden area, if my inferences about the fences in the chapter on features hold water. A translation to a more downslope area a little nearer to the Geleenbeek brought an easier and shorter access to running water; perhaps also the threat of attacks by hunters had proven less imminent than expected when the first location was chosen. At any rate, their knowledge of potentials of the human, geographical, and biological environment was certainly much better than on their first arrival. Other villages shifted over the landscape as well: the yards in Elsloo moved over a considerable area (e.g., Van de Velde 1979), the house plots in Schwanfeld (e.g., Lüning 2005), in Langweiler 8 on the Aldenhovener Platte, and elsewhere in the Rhineland moved to and fro (e.g., Claßen 2005). That is, the LBK habitus of constructing new houses every twenty years or so, allowed every new generation to go for (momentarily more) convenient locations, convenience being a mix of a thousand considerations. In the same vein the second occupation of the site, much later in the LBK sequence, can be "explained".

15.8 Comparable excavated sites in Dutch territory

As far as our present knowledge goes, there are three, perhaps four early LBK settlements in the Graetheide *Siedlungskammer*. They may have been founded simultaneously (together with Maastricht-Klinkers and -Christoffelplein in the Heeserwater area[14] to the southwest, and Langweiler 8 in the Aldenhovener Platte *Kammer* to the east; resp. Theunissen 1990, Dijkman 2000, and Stehli 1989) in one single colonization enterprise emanating from the Middle Rhineland. Apart from Geleen-Janskamperveld, these settlements are: Elsloo-Koolweg, Geleen-De Kluis, and probably Sittard-Thien Bunder as well. A short summary is offered as comparison.

After the Janskamperveld settlement, the most extensive excavations have been at Elsloo Koolweg, approximately 6 km southwest of the former site; large-scale investigations by Modderman in 1957-1959, 1963, and 1966, with small but important additional excavations by Van Wijk and Van Hoof in 2006 and 2008. Based on surface finds the extent of the site is *c.* 12 ha of which 3½ ha or 25% has been excavated. Contrary to the Janskamperveld's short occupation, Elsloo-Koolweg is dated to the entire LBK sequence in this region (LBK II-V, in Meier-Arendt's German LBK periodization). Altogether, an estimated 200-plus houses have stood there (101 in excavations, of which at least 15 can be assigned to the LBK Ib phase). Also the village graveyard of approximately 120 internments was found (113 in excavation, dated to LBK 2c/d). Apart from several specialist texts, main publications are: Modderman 1970; Bakels 1978; Van de Velde 1979; Van Wijk and Van Hoof in prep..

Another 1.5 km south of the Janskamperveld establishment, a small part of the settlement at Geleen De Kluis was excavated by Waterbolk in 1955-1956. The extent of the site is unknown because of its being situated in a built-up area, but might amount to 6-10 ha; the excavation uncovered 1.3 ha or 15%. Similarily to Elsloo-Koolweg, surface finds date this settlement to the full LBK sequence, but in the excavated part mainly LBK 1b material has been uncovered; in fact, Geleen-De Kluis has long been considered the oldest LBK settlement in the Netherlands. Eight house plans were found but no estimate of the total number of houses is available. The main publication is Waterbolk 1959.

Roughly in the same period Sittard Thien Bunder (2 km north of the Janskamperveld settlement) has been excavated by Modderman (1953-1954, 1956), with several small additions by Van Wijk in 2000. The extent of the settlement is unknown, but is probably (much?) larger than 10 ha; the excavated area measured *c.* 3 ha; the occupation is dated to the full LBK sequence in this region. No estimates of the house count have been made, though 56 house plans, among which a few probably from the older LBK (or 1b) phase, were recorded in the excavation. The main publications are Modderman 1959; Van Wijk 2001.

Thus, if at the beginning of the 53rd century the large region between Tongres and Cologne was virtually empty but for an odd band of hunters, at the end of that century a constellation of farming villages had been established by people with a very similar cultural background, seedlings of what was to become in the next few centuries a relatively densely populated area differentiated into three recognizably different societies. The Janskamperveld settlement, one of the pioneers, had long been abandoned by then.

Notes

1 Here, H18 has been classified as type 1b, which should be read as "tripartite house, different from 1a-types."

2 Strictly speaking, 'house generation' refers to one single house: when '(farm-)yard' designates the grounds around a house, including the pits, manure heaps etc. pertaining to that house, then a 'house generation' is the temporal extension of a yard (Claßen 2005). The meaning of the term as used here is the average time between the construction of two successive houses or farms (summed over time and space). It does definitely not imply the immediate abandonment of the earlier house nor simultaneous construction of new houses all over the village.

3 Again, H18 has been entered as type 1b.

4 In the lakeside villages of the Late Neolithic of SW Germany and Switzerland the houses were scrapped and rebuilt at intervals of 20-25 years, as could be established by dendro-analyses (e.g. Billamboz 1990: 193; Capitani *et al*. 2002: 20). Moreover, nearer to the present situation, as described in the chapter on the hard stones from this village (Ch. 13, by Verbaas & Van Gijn), querns were sometimes also destroyed without apparently being at the end of their use life; there, too, cultural idiosyncrasies have decisively interfered with functional considerations.

5 I have also worked through a three-house-generations solution, but that led to more inconsistencies.

6 Neither the number of individual pits nor the number of *Längsgruben* has much relation with the number of pots recovered; correlations are less than .45, which means that less than 20% of the variation in the data is related to these variables.

7 For Schwanfeld a decay rate of 95.7% has been computed from the weight of the excavated sherds in relation to the estimated weight of the original pots (Kloos 1997: 171); no allowance has been made for completely vanished pots, however.

8 As described and referenced in the chapter on pottery: a use life of 2 years for a service vessel, 3 years for a cooking pot, and (over) 5 years for a storage vessel.

9 In my opinion, cattle is required to move the trunks from the forest to the houses under construction.

10 Note that in the German literature a yard ('*Hofplatz*') is conceived of as the area around every single building / house, usually extending 15 metres to the front and the back, and 20 metres to either side (Boelicke 1982; Claßen 2006: 148). In other regions, different arrangements may have obtained (e.g., Hauzeur 2006; the present text).

11 The original French text runs: [La maison est] une seule et même institution: personne morale détentrice d'un domaine composé à la fois de biens matériels et immatériels, qui se perpétue par la transmission de son nom, de sa fortune et de ses titres en ligne réelle ou fictive, tenue pour légitime à la seule condition que cette continuité puisse s'exprimer dans le langage de la parenté ou de l'alliance, et, le plus souvent, des deux ensemble. (Lévi-Strauss 1979: 151-152)

12 Here, I am leaving aside the final ceramic phase (6), as being irrelevant to the present argument.

13 When among the finds from a house's side pits different ceramic 'dates' were derived, I have accepted the oldest reliable one as being closest to the house's foundation. In other chapters, the averages of the assignments have been used.

14 The Heeserwater area comprises a set of settlements along the middle reaches of the Jeker and the Hees brooks flowing into the Meuse in Maastricht. The few easternmost LBK settlements are on Dutch territory, the majority of the settlements in this group is situated in Belgium; cf. map in Dijkman 2000.

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16 The Iron Age habitation[1]

Leon G.L. van Hoof

During the excavations at Geleen-Janskamperveld, not only features from the early Neolithic were found. Later activities date to the Iron Age, the Roman and the post-medieval periods. In this chapter the Iron Age features will be dealt with and the Roman features will be referred to briefly. The Iron Age features consist of a loose spread of a main building and some granaries, belonging to a wandering farmyard typical of the Iron Age settlements from the Dutch and Belgian sandy soils. It is becoming increasingly clear that this type of settlement was also the normal type on the loessic soils. Parts of other wandering farmsteads were found in the immediate surroundings of the Janskamperveld excavation and in the towns of Geleen and Sittard as a whole. The typological position and functional interpretation of the main building will be dealt with extensively. The settlement features can be dated to the early Iron Age. Immediately to the south of the excavation some graves dating to the late Bronze Age and early Iron Age were found. They probably form part of a larger burial ground. This has no temporal or spatial relation with the Roman burial site found during the Janskamperveld excavation.

16.1 Introduction

Compared to the wealth of material from both the Neolithic and Roman periods, the Iron Age remains at the site of Geleen-Janskamperveld seem to be rather poor. However, from a scientific point of view these are very important. Since the beginning of large scale excavations in the 1950s, research in the loessic regions of Germany, the Netherlands, Belgium and Northern France had mainly been directed towards the early Neolithic, giving at least some attention to the Roman period. Although in most of these excavations some Iron Age features were uncovered, a focus on this period only emerged in the 1980s.[2] So when the first monograph on the Iron Age of the loessic area appeared,[3] the author could only work with four large scale excavations of Bronze and Iron Age settlements of which two were situated on heights and therefore need not necessarily represent the 'normal' open settlements of the time. Needless to say her conclusions were very preliminary.

Large scale research in the loessic area of the Netherlands had through Modderman mainly been a Leyden affair, even before the Institute of Prehistory was founded there in 1962. Before the excavation of Janskamperveld was started, the Leyden Institute had undertaken an excavation of an Iron Age settlement at Geleen-Krawinkel,[4] and it was involved in the excavation by the Archaeological State Service (ROB) of a medieval settlement at Sittard-Haagsittard, during which some Iron Age features were found.[5] Only the archaeological service of the city of Maastricht had also been excavating Iron Age sites in southern Limburg (Dijkman 1989). None of these sites had delivered houseplans, only pits and granary-type buildings were found. However: rarely more than a small part of the site was excavated.

When the large scale excavations at Geleen-Janskamperveld started in 1990, the view on the Iron Age settlement structure of the loessic area was therefore still based on a limited number of sites, of which the most important could be labelled hillforts. Pits used for storage or for loam extraction were found regularly, but almost nothing was known of the buildings on the farmyards. Therefore a discussion had started on the topic whether large buildings (whether considered to be houses containing both a living and a byre section or not) had existed on the loess or not (Joachim 1980 & 1982, Simons 1989, Roymans/Fokkens 1991, Roymans 1996). So when during the excavation of an early Neolithic settlement at Janskamperveld larger ground plans were uncovered that seemed to date to the Iron Age, this data was destined to leave an impact. Unfortunately however, almost no-one seemed to notice it in the mass of Neolithic and Roman age data incorporated in the preliminary reports.

16.2 The features

During the excavation at Geleen-Janskamperveld several postholes could be distinguished as not belonging to the Bandkeramic settlement. An important feature of these postholes is their yellowish or light grey colour, which distinguishes them clearly from the brownish postholes of the Neolithic period. Also, several of the postholes of structure 1 cut through Bandkeramic features. On the basis of the find material found in some of them, they can be dated to the Iron Age. These postholes can be grouped into four structures and two clusters, which will be analysed in this section.[6] We have

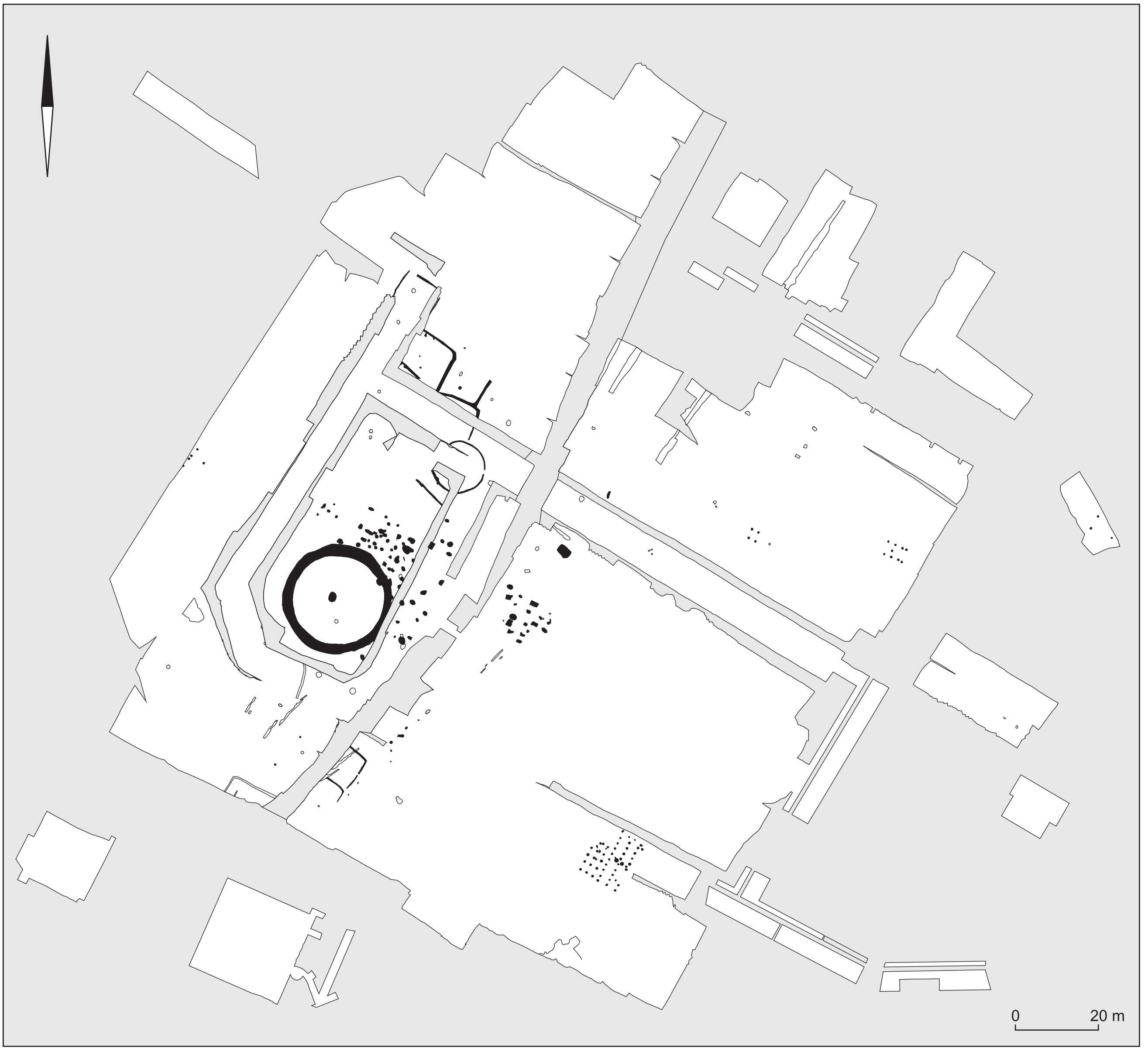

Fig. 16-1 The distribution of all Iron Age and the main Roman features at Geleen-Janskamperveld as discussed in this chapter (scale 1:1500).

to keep in mind that probably more than 60 cm of the original surface has disappeared due to erosion, soil formation, etc. before reaching the level at which features were visible in the trenches. Therefore, only slightly dug-in structures will have been missed. Nevertheless, the conservation of the features is quite good for the loessic region.

Structure 1

This structure consists of three alignments of nine postholes and is oriented north-south. Not only the colour of the features, but also the orientation of the building distinguishes it from the bandceramic settlement structures. Next to that, three of the features cut through a Bandkeramic settlement ditch and a Bandkeramic pit. The northern wall of the house

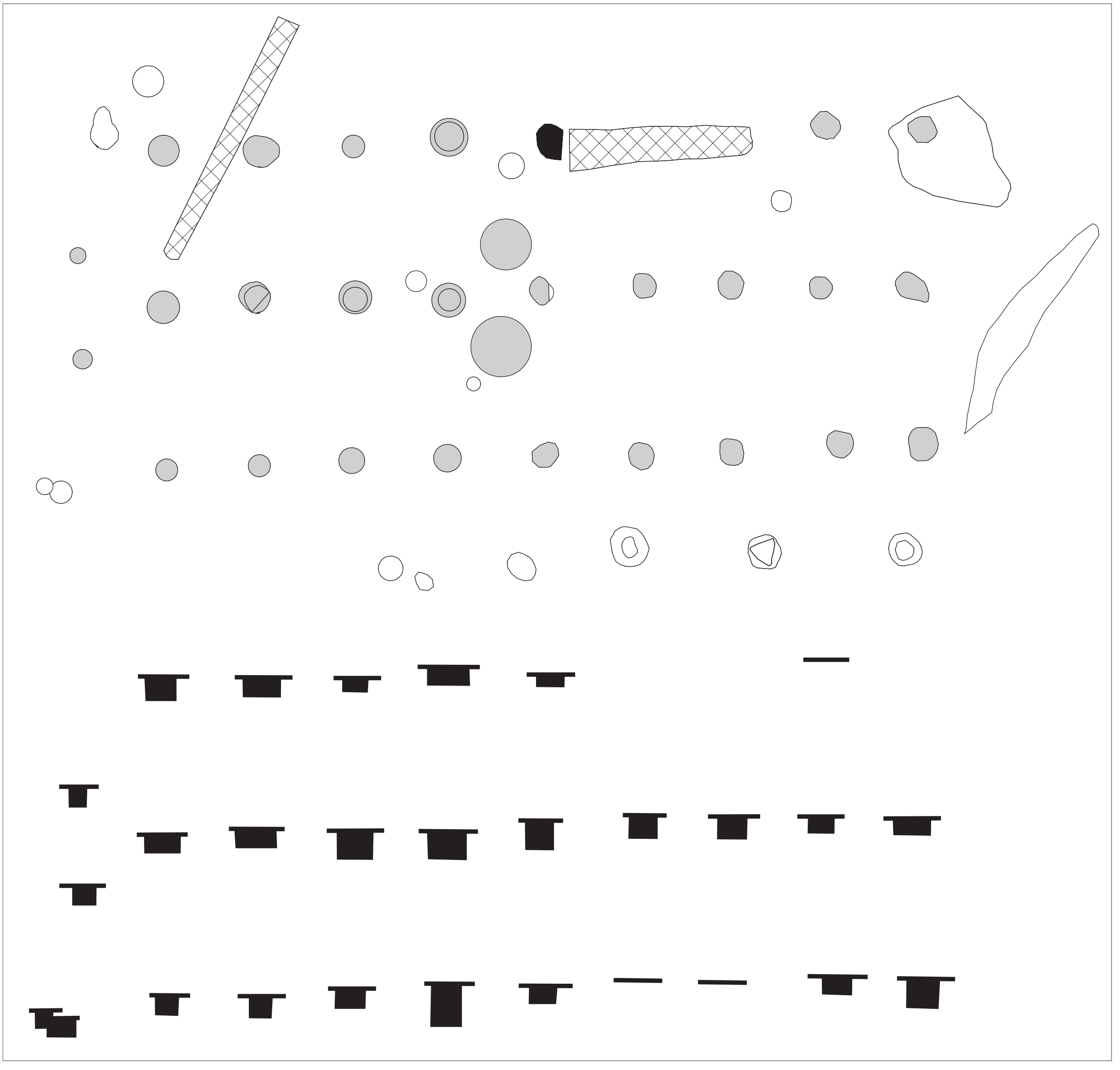

Fig. 16-2 Structure 1 (ground plan 1:100 Bandkeramic features not indicated; feature depths 1:50 (the last after Lawende 1992). In black indicated feature 13004 containing almost all of the material found within the structure.

shows two postholes in the middle positioned in front of the last wallposts. This might point to a rounded ending of the building. Although part of the eastern wall has been destroyed by a ditch of (sub-)recent date the ground plan still shows a great deal of regularity. The distance between the postholes (from edge to edge) is about one meter in the length of the building and about two meters in the width. The size of the building is 12,6 × 4,8 m. Its original size probably wasn't much larger considering the fact that structure 2 is situated within 0,8 m of structure 1 (measured from the edges of the postholes), which indicates that the walls weren't situated at a great distance from the roof-supports. It can therefore be classified as a two-aisled building. In the centre of the building two pits were found, one in each aisle (features 13013a and 13021). Feature 13021 measured 65 cm in diameter and 20 cm in depth. Feature 13013a was 80 cm in diameter, but according to the excavation notes was too shallow to be drawn.[7] Considering their position within the building, we expect them to belong to the building, and expect feature 13013a to be only the last remains of a pit within the house. Due to its size this structure might be interpreted as the main building of the Iron Age settlement. A further discussion on its possible function will be kept to section 16.5.

Material was found in three postholes. Interesting is the amount of material found in feature 13004: 37 pieces and a lot of smaller remains of heavily secondarily burnt ceramics, weighing 1308 g, and 81,7 g of burnt loam (partly with imprints of twigs). This is quite a lot of material, considering the fact that the feature was only 50 cm in diameter and 10 cm in depth.[8] It is interesting that exactly opposite this feature in the western wall of the building is situated the deepest posthole of the entire structure with a depth of about 30cm (all other postholes have depths between 0-20 cm). We wonder if we can call it a coincidence that the deepest posthole is situated on a line in the middle of the building, on which line we can find a posthole containing a large amount of burnt ceramics and loam and the two pits lying within the structure. We expect the entrance of the building to have been in this area. If we take the distance from the edges of the postholes, the entrance is 1,1 m wide. This is on the small side, but within the range of entrances known from other regions of the Netherlands. For example the entrances of Iron Age houses in the central and eastern parts of the Netherlands have widths of 1,2 – 1,8 m (Hermsen 2003). In Oss we see comparable widths, especially during the Roman period (Schinkel 1998, Wesselingh 2000) and in the Bronze Age of the Netherlands entrances have widths of 1,0 – 1,6 m, most of them measuring 1,3 – 1,4 m (Van Hoof/Meurkens 2007, 37-38).

The amount of burnt material in feature 13004 stands out in the total amount of Iron Age finds from the site. Actually the amount of material is that large, that you might wonder whether there was any sediment in this small posthole. Interestingly, in several other similar buildings large amounts of burnt ceramics were found in one or two of the postholes, usually on the corner of the structure. This is the case at Echt-Mariahoop (Willems 1983, 234-238) and Inden-Altdorf (Kranendonk 1992). But also in some granaries in the region large amounts of burnt ceramics, loam and even grinding stones were found.[9] The amount of material is often so high that you might wonder if there was still room for the wooden post itself. Although the amount of material in Geleen-Janskamperveld is somewhat less than on for example Echt-Mariahoop, the posthole it came out of is also very small. Therefore we presume this phenomenon to belong to abandonment rituals (cf. Van den Broeke 2002). In the Iron Age of the loess region no clear foundation depositions are known, but abandonment depositions in the form of large amounts of burnt material in specific postholes or in pits on the settlement are found regularly (Van Hoof 2002).

Structure 2

Adjoining structure 1 to the west is a cluster of postholes that were originally (Lawende 1992) taken together as one ground plan. This then would have dimensions of 7,9 × 3,5 m and would seem to be a smaller building of the same type as structure 1. However, a closer analysis of the plan shows that the northern six postholes are not really aligned on the southern nine postholes. These southern postholes almost all show discolorations of the actual posts (yellowish) within the post holes (grey), which the northern six do not. And finally the sizes of the two groups of postholes show some differences. Therefore, it seems necessary to distinguish between a southern (2a) and a northern structure (2b). Structure 2a has a square ground plan, consisting of nine posts on three lines. Its size is 4,1 × 3,5 m. It can be classified as a nine-post outbuilding, mostly seen as used for grain storage. This kind of building can be found regularly on Iron Age settlement sites. Structure 2b still offers some interpretational problems. It might be interpreted as one four-post outbuilding of 2,0 × 2,0 m. That however would mean that several of the post-holes could not be attributed to any structure, although some might be interpreted as the remains of repair works to the building. A second option might be to see these postholes as the remains of a second, slightly turned fourpost outbuilding built on the same location and measuring 1,6 × 1,4 m.[10]

Structure 3

At a distance of about 90 m to the north of the aforementioned structures a cluster of eleven postholes was found. Of these eight seem to form two lines of four posts. However, the easternmost posts are not aligned on the others. Therefore two interpretations seem to be possible for this structure. First of all it can be identified as a six-post outbuilding of which the eastern wall has been repaired. The original dimensions of this building therefore would have been 3,7 × 3,1 m, after repair 4,7 × 3,1 m. A second possibility is that two four-post outbuildings have been built on the same site. These would have measured 3,7 × 3,1 m and 2,9 × 3,1 m. We slightly prefer the first possibility. In this construction we find a post on the central axis of this building. Therefore we might interpret this building as a two-aisled small outbuilding, known from several Dutch early Iron Age settlements (see fig. 16.7), which we will argue further on in this study to form outbuilding type Oss IID.

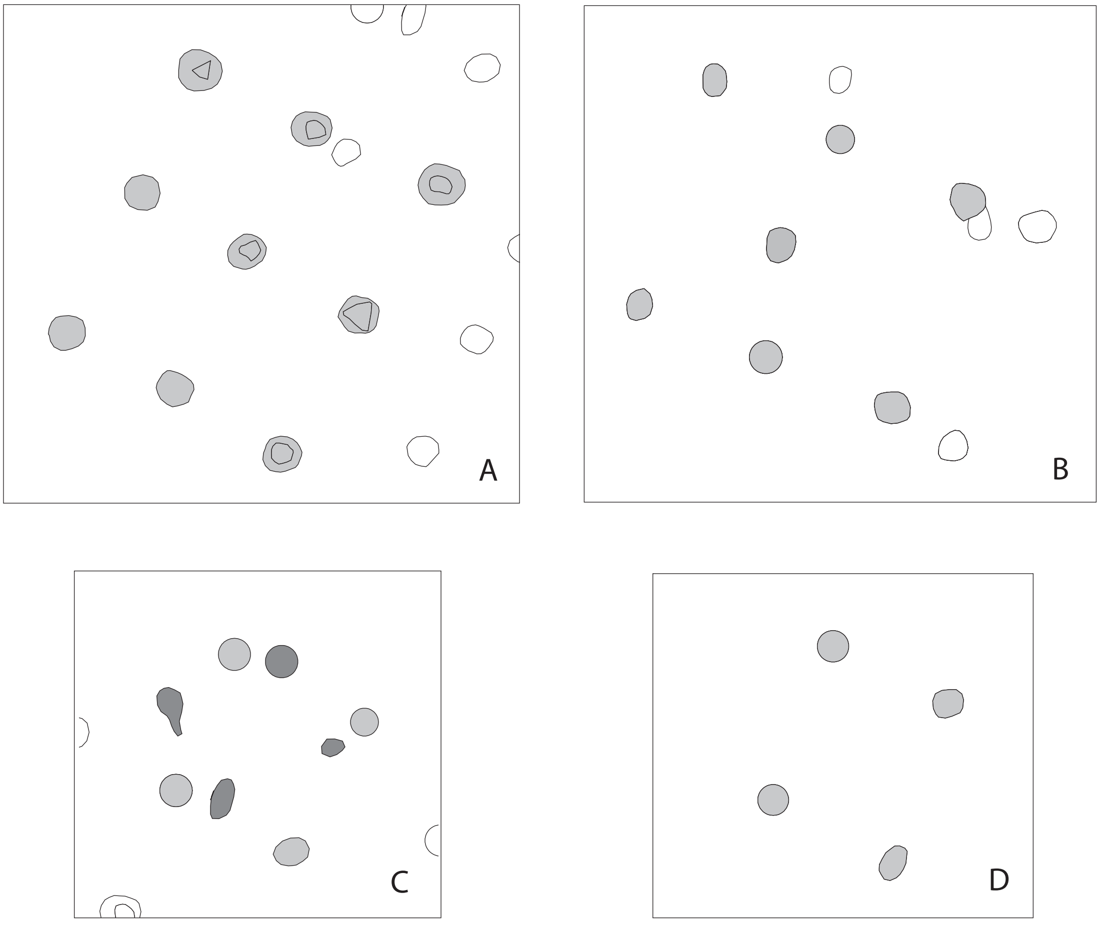

Fig. 16-3 Outbuildings found at Geleen-Janskamperveld (scale 1:100; bandceramic features not indicated). A: structure 2A; B: structure 3 (primary construction highlighted); C: structure 2B (with two possible building phases indicated); D: structure 4.

Structure 4

At a distance of 30 m to the west of structure 3 another six postholes have been found, in which a four-post outbuilding could be identified. It measured 2,2 × 1,7 m.

Other clusters of postholes

In trench 21 (n=2) and 62 (n=2) about 45 m to the east of structures 3 and 4, and in trench 38 (n=5) on the western border of the excavated area, some features with the same colour characteristics were found. No structures could be identified from these. However, in trench 38 four of these features form a straight line of 5,2 m length before reaching the edges of the excavated area. Therefore, we might assume that it forms part of a structure, but cannot ascertain the size or function of this building.

Furthermore within the excavated area 22 pits were found with colour characteristics that might date them in the Iron Age or Roman period. Only three of them contained Roman material (Wesselingh 1992). Therefore it is not sure whether some of these pits might belong to the Iron Age habitation.

Finds

Only in structures 1 and 2 some ceramics were found that could provide a date for the settlement. All other structures were only dated to the same period on the basis of the colour characteristics. Therefore, synchronicity of the structures cannot be proven. The lack of other late prehistoric (or later) settlement remains, however, does make synchronicity probable.

Most finds from structure 1 come from feature 13004. It consists of 37 larger pieces of ceramics and some smaller remains (total of 1308 g). Most of the material is secondarily burnt, which makes the analysis more difficult. The material consists of several sherds of a large vessel with a small ear,

Fig. 16-4 Ceramics and loam fragments from feature 13004

mainly showing a temper of ground ceramics. It seems that all this material might be interpreted as belonging to one large storage vessel with several small ears on the shoulder. Such ceramics have been found in early Iron Age contexts.[11] In the filling of the northeastern corner post 13010 18 sherds were found (141,5 g), showing some quartz-temper. One of the sherds was decorated with lines or comb-decoration. One of the roofbearing posts (13017) contained a piece of thinwalled reddish ceramics. It shows some characteristics of the ceramics that salt containers were made of, but a definite attribution could not be ascertained on the basis of this small sherd. Finally some 81,7 g of burnt loam was found within feature 13004. Some of these pieces showed imprints of twigs.

In three of the postholes belonging to the possibly two-phased fourpost outbuilding 2b a total of six sherds was found. They show the same characteristics as the ceramics found in structure 1. In one of the postholes belonging to structure 2a one sherd was found, again showing the same characteristics. Therefore, we can attribute the settlement features to the early Iron Age. If the piece of ceramics from feature 13017 would indeed be a cylindrical salt container, this would date the site in the 6th century BC. However, this attribution is not clear enough and therefore we should stick to the wider date range.

16.3 The place of Geleen-Janskamperveld in the regional Iron Age landscape

Until now, Geleen-Janskamperveld is the only Iron Age site in southern Limburg where large areas have been excavated around a large building. For the research of the Iron Age in this area, therefore, we were fortunate that these features were found in the middle of a large Bandkeramic settlement. Iron Age sites in the region are rarely excavated, and almost never on a large scale (cf. Van Hoof 2007).[12] However, the cities Sittard and Geleen (recently fused into one administrative unit) form an exception in the amount of research carried out on sites from the Bronze and Iron Ages. Only the city of Maastricht sees an equally intensive research on these periods, however until now resulting in more insight into the burial grounds than into the settlement structure. Therefore it will be interesting to compare the data of Geleen-Janskamerveld with that of other sites excavated in the towns of Geleen and Sittard.

Before the excavations at Geleen-Janskamperveld started, an excavation by the University of Leyden had been carried out on the Iron Age site of Geleen-Krawinkel in 1986 and 1987. The data of this site are only published in preliminary reports (Abbink/Van Ieperen 1988; Van Hoof 2000) but the analysis carried out by the current author is reaching its final stages. The site of Sittard-Haagsittard has only provided a storage pit and some postholes and will therefore not play a major role in this study. Since the excavations of Geleen-Janskamperveld have been carried out, important new sites have been excavated at Sittard-Hoogveld, -Nusterweg, Nieuwstadt-Sittarderweg and Geleen-Hof van Limburg (small scale excavations taking place at Geleen-Tuinboulevard and -de Haese). The site of Sittard-Hoogveld, excavated by the University of Amsterdam in 1998 and 1999, consists of a large Iron Age urnfield and settlement features of the Bronze and Iron Ages (Tol et al. 2000; Tol/Schabbink 2004). Only separated by a railway line, the site of Sittard-Nusterweg seems to belong to the same Iron Age settlement area as Sittard-Hoogveld. On the site of Nusterweg next to a large number of postholes, remains of early Iron Age kilns for ceramic production were found (Wetzels 2002). The excavations at Nieuwstadt-Sittarderweg uncovered an Iron Age habitation site, just outside of the community of Sittard-Geleen (Bink 2004). The site of Geleen-Hof van Limburg (of which a part is still planned to be excavated in the near

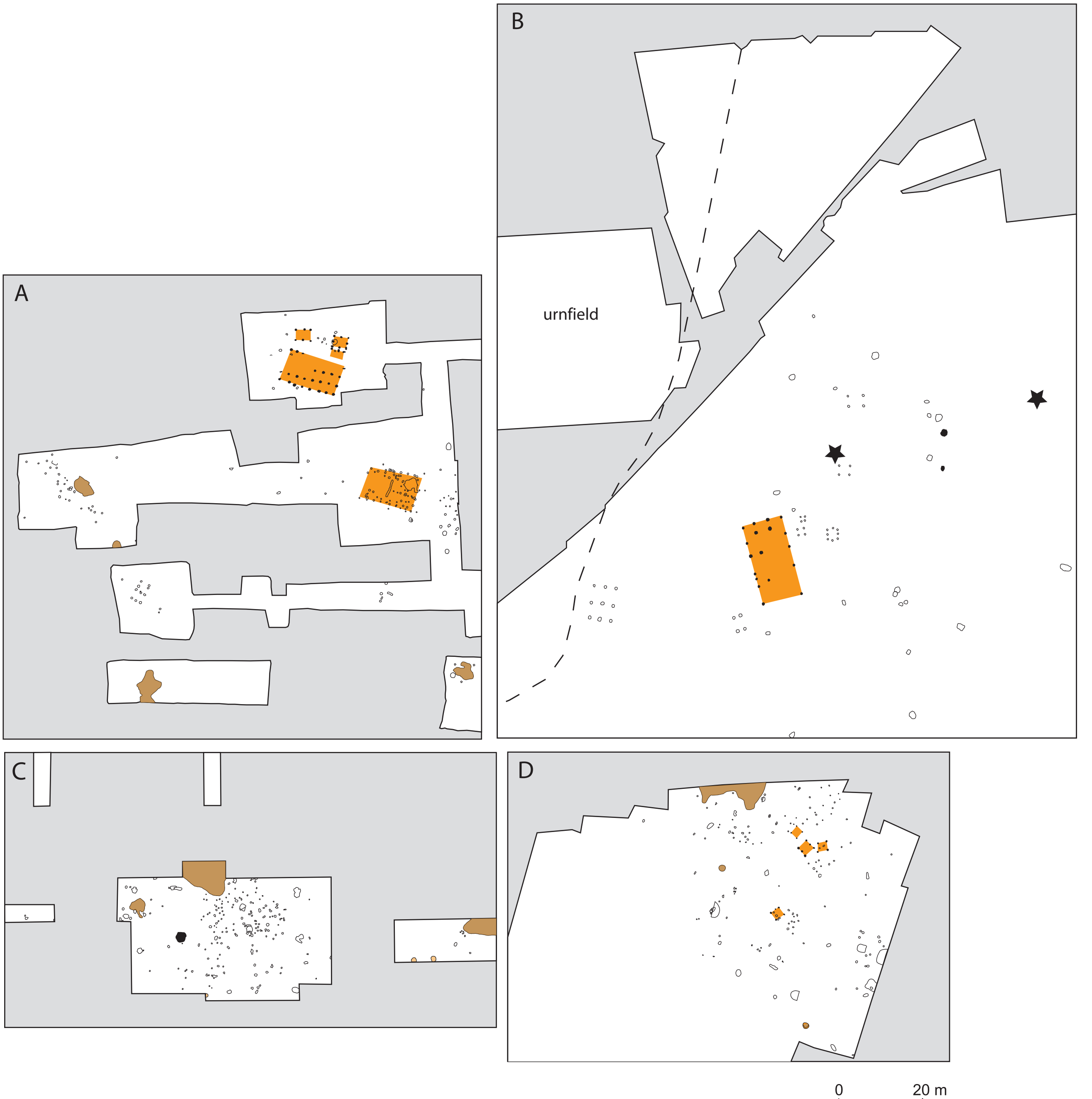

Fig. 16-5 The settlements of Sittard-Hoogveld (A; Tol/Schabbink 2004), Neerharen-Rekem (B; De Boe et al. 1992), Geleen-Krawinkel (C; Abbink/Van Ieperen 1988) and Geleen-Hof van Limburg (D; Van Hoof et al. in prep.) compared. Highlighted are the evident Iron Age buildings, the loam extraction pits, pits with layers of charred grain and pits showing evidence for abandonment rituals. On the image of Neerharen-Rekem the late Bronze Age and early Iron Age urnfield and spread graves (stars) are indicated.

future) has seen the excavation of part of an early Iron Age settlement with its surroundings. Because of the Neolithic features found outside of the Iron Age settlement, a large area around the excavated part of the Iron Age site could be researched (Van Hoof *et al.* in prep.). At a small distance from this site some small-scale excavations were carried out at Geleen-Tuinboulevard that have also delivered settlement features from the early Iron Age.[13] Finally just west of Janskamperveld (across the main road) small scale excavations were carried out at De Haese, again delivering settlement features from the early Iron Age.[14]

Only on three of these sites were large buildings found: at Geleen-Janskamperveld, Sittard-Hoogveld and Nieuwstadt-Sittarderweg. Most of these large buildings show a ground plan similar to that of Geleen-Janskamperveld: two-aisled with a regular setting of postholes placed relatively close to each other (one at Sittard-Hoogveld and three at Nieuwstadt-Sittarderweg). At Sittard-Hoogveld a second building was found that forms a three-aisled variant of this building type. An almost identical building had been found within 10 km of the town of Geleen across the Meuse river in Neerharen-Rekem (Belgian Limburg; De Boe *et al.* 1992, 488-489). One of the interesting observations on all of these sites with house plans is that contemporary features are quite rare in the immediate surroundings of these buildings.

At Neerharen-Rekem a group of storage pits was found at 40-50 m from the Iron Age building.[15] In between the house and the pits some smaller granaries were found, probably belonging to the Iron Age, although some of them might belong to the Roman settlement that was later built in the same area. Some 30-40 m to the south of the main building a few pits containing ceramics from the 5th century BC were found. So at this site in a radius of about 50 m around the main building some granaries and storage pits existed. No other contemporary settlement features have been found on the large scale excavation. At the settlement of Rosmeer some early Iron Age pits have been found immediately around the main building, and again several clusters of pits have been found at distances of 25-35 m from this main building (De Boe/Van Impe 1979).

At Sittard-Hoogveld no clear contemporary features have been found with the two-aisled late Bronze Age building, which is very similar to the one at Geleen-Janskamperveld. Unfortunately, large parts around the buildings on the site have not been excavated. However, for the early Iron Age habitation the settlement lay-out is somewhat clearer. The early Iron Age features consist of one evident and one possible main building situated at about 20 m distance from each other. Immediately surrounding the clear, three-aisled main building are some smaller granaries. The immediate surroundings of these structures are quite empty. Only at distances of 50-100 m from the two main buildings are new features found that are arranged around the zone with the main buildings. These features consist of some postholes, belonging to at least one granary, and some polylobal pits that contained large amounts of ceramics and stone. The form and contents of these pits are identical to the upper layers of the loam-extraction pits known from early Iron Age sites like Geleen-Hof van Limburg, – Krawinkel or the adjacent German loessic soils (Simons 1989, Van Hoof 2002). The single pits underneath these upper layers are easily missed, since they were back-filled with the original soil and normally do not contain ceramics or other finds. Since weather conditions during excavation of these features weren't always ideal, these lower layers might not have been noticed in the field. We therefore believe these features to belong to the category of loam-extraction pits, typical for the loessic region.[16]

At the site of Nieuwstadt-Sittarderweg, situated on the sandy soils just north of the loessic area, surrounding the two-aisled main buildings are some granaries and other outbuildings. Only a limited number of pits and ditches was found in the vicinity. Most of these features even date to the middle and late Iron Age. Therefore, again, the number of features that was clearly contemporaneous with the main buildings is very restricted. At the sites of Geleen-Krawinkel and – Hof van Limburg only parts of the settlement could be excavated as of yet. On both sites some granaries have been found associated with large loam extraction pits. At Hof van Limburg it is very clear that these loam extraction pits surround the granary area. To the other side of the loam extraction pits no Iron Age features were found.[17] At Geleen-Krawinkel the excavation was very limited, but some of the trial trenches might indicate a similar lay-out with large loam extraction pits dug on the edges of the settlement, something also noted in the adjacent German area.[18] Within this settlement a large cluster of postholes (probably belonging to several times rebuilt outbuildings) was found, accompanied by a grain storage pit and some pits filled with large quantities of burnt ceramics, burnt loam, grinding stones, etc.[19]

On all of these sites only granaries and other small outbuildings are found immediately next to the main building. Only very rarely are pits found within 10 m from the main building. Pits and other groups of granaries can be found at distances of 30-100 m from the main building. Especially the pits used for loam-extraction seem to be situated on the edges of the settlement.[20] At Geleen-Janskamperveld immediately next to the main building two to three granaries were found (structures 2a+b). At a much larger distance, structures 3 and 4 can be found in a zone at 80-100 m from the main building where some more postholes were found. The furthest of these Iron Age postholes (for example the line of postholes on the limits of trench 38) are found at distances of up to 130 m from the main building. No clear Iron Age pits were found at Geleen-Janskamperveld. However, the limits of the excavation lie only 20 m to the south of the main building. Therefore, more features belonging to this farmyard might have existed outside of the excavation limits.

It is clear that the Iron Age settlement zone stretched over a far larger area than has been excavated (fig. 16.6). To the south at a distance of 230 m of building 1 a pit containing large amounts of early Iron Age ceramics was found during construction works in 1977 (Van den Broeke 1980; fig. 16.6 nr. 1: Haesselderveld). At about 275 m to the east of structure 1 a possible storage pit was found in 1993. According to Harry Vromen the colour indicated an Iron Age origin of this feature (fig. 16.6 nr. 3).[21] Recently at a comparable distance to the west Iron Age features have been found during small scale excavations in the building area of De Haese (fig. 16.6 nr. 2).[22] Unfortunately due to the nature

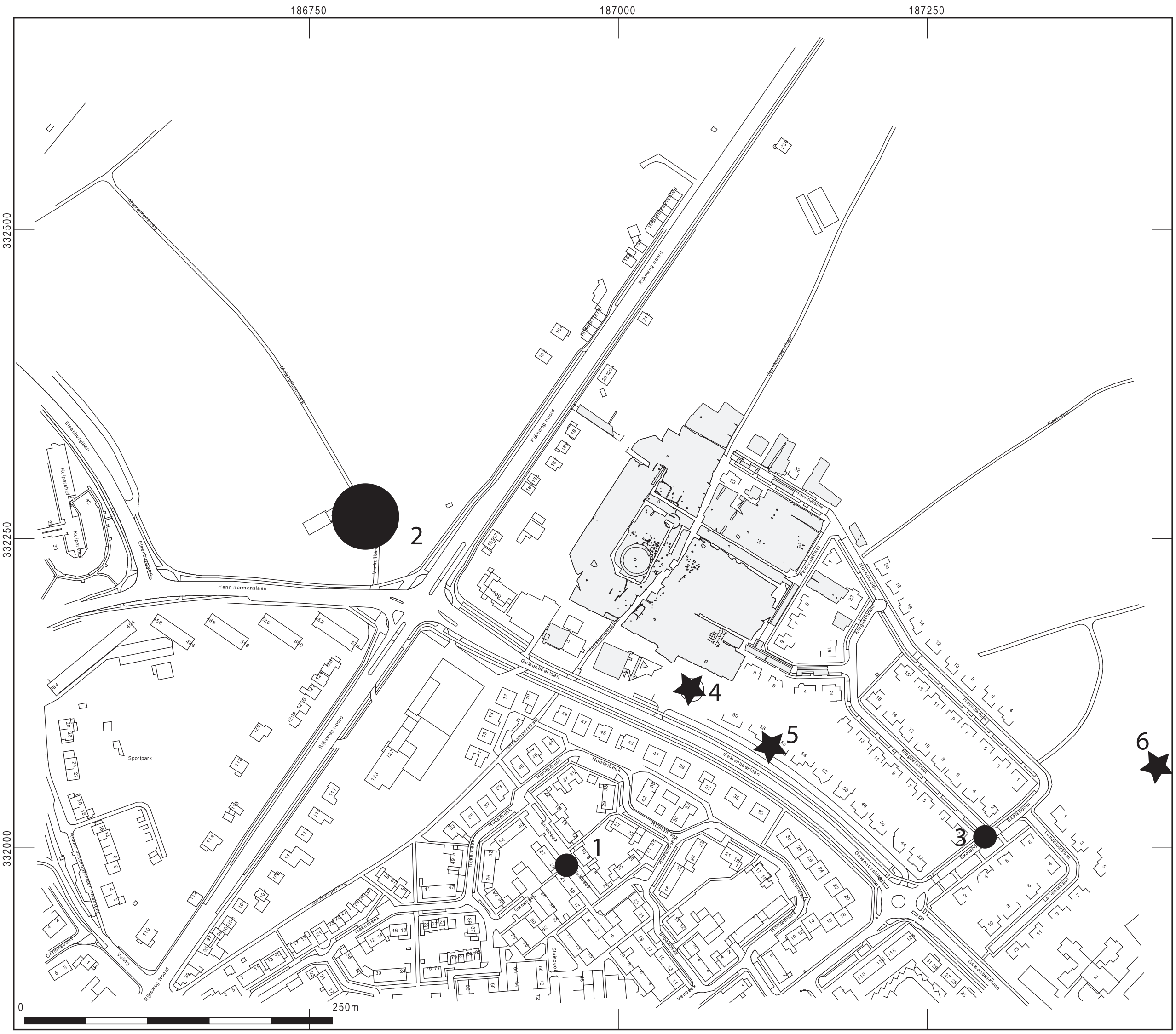

Fig. 16-6 The Iron Age and Roman features of Janskamperveld and its immediate surroundings. Circles indicate Iron Age settlement remains (1: Haesselderveld, 2: de Haese, 3: pit found in 1993), stars indicate late Bronze Age and early Iron age graves (4: Geleenbeeklaan 70, 5: find Schute 1990 (approximate location); 6: find Vromen 1993).

of these rescue excavations, not much can be said about the structure of the larger settlement area. But it is clear that the features found at Geleen-Janskamperveld form only part of a substantial area in which clusters of Iron Age features can be found. This fits in nicely with the model of wandering, mostly one-phased farmyards based on the Iron Age settlement evidence of the sandy soils of the southern Netherlands.[23] At Sittard-Hoogveld a two-phased farmyard from the early Iron Age has been established, but the wandering of farmyards has led to the construction of houses from the middle Bronze Age until the early Iron Age within the same area. Only at the site of Nieuwstadt-Sittarderweg and possibly at Echt-Mariahoop – both situated just north of the loessic soils – have several occupation phases from the early Iron Age led to the existence of houseplans at short distances from each other. Interestingly all other late prehistoric features in the larger settlement area around Janskamperveld seem to date to the early Iron Age.

16.4 A burial ground at Geleen-Janskamperveld

At the sites Neerharen-Rekem and Sittard-Hoogveld, not only have houses been excavated, but also the burial grounds belonging to the same periods (Tol *et al.* 2000; De Boe *et al.* 1992). At Neerharen-Rekem the southernmost graves and the northernmost settlement features are found only a few meters away from each other. At the site of Sittard-Hoogveld the excavations of the settlement site and the burial ground are located at 250 m from eachother. The zone in between has not seen any excavations, therefore we know little of the distribution of Iron Age settlement features around the burial ground. In both cases these burial grounds have an older origin (starting with early or middle Bronze Age graves), but the largest part of the burials date to the late Bronze Age and early Iron Age. Interestingly, again on both burial grounds, within or on the edges of these large urnfields some small clusters of late Iron Age graves occur. At Geleen-Janskamperveld also a large burial ground was found. Most of the ca. 100 graves date to the Roman period (Wesselingh 1992). Some of the graves in this burial ground, however, indicate older roots. Five of these graves have been described by Lawende (1992), one has been added by Wesselingh (1992: grave 8). On the basis of their grave gifts they might date to the late Iron Age or the beginning of the Roman period. Four graves contain hand-made ceramics. Only in one case is this an urn (a hand-made open form with inward-turned rim), in the other three graves only some sherds were found. In two of these graves other grave goods were also found, in one case an iron knife, in the second seven sling shots.[24] The other two graves contain no grave goods. From the smaller circular ditch an Iron Age sherd was collected, having a deliberately roughened surface.[25] In the northern zone where these ditch structures were identified, in pit 11028 a sherd with V-shaped fingernail impressions was found, that seems to date to the early Iron Age.

Although the grave goods might only hint to a first phase of the burial ground, the structure of this burial ground shows this much clearer. The plan of the burial ground shows a dense cluster of burial pits dating to the period 70-225 AD (dates according to Wesselingh 1992). Some of the oldest burials from this cluster have been dug into the upper filling of a large circular ditch, and other circular and square ditches are visible on the edges of the burial ground. It is in the northern zone with square ditched structures that five of the six late Iron Age or early Roman graves were found. The grave containing the sling shots was located within the large circular ditch. Thus, it is evident that there was a burial ground consisting of loosely spread graves, surrounded by square and circular ditches pre-dating the highly clustered Roman burial ground dating to 70-225 AD. This stratigraphical position is underscored by the fact that one of the square ditches in the north has been cut by a Roman age pit (pit nr. x11 of Wesselingh 1992). The grave goods indicate a date in the late Iron Age or the beginning of the Roman period for these burials.

The most striking feature in this burial ground is a large circular ditch with a diameter of about 25 m. The ditch itself has a width of 2,0 – 2,7 m, a depth of 1,5 m and a V-shaped cross-section. The ditch shows a laminated, natural fill, which means that it filled up gradually. Some Roman burials dating between 75 and 125 AD were dug into the top of this filled-up ditch (Wesselingh 1992, 17-18). Only one grave (containing the sling shots) was found within this ditch. This grave can be dated to the early phase of the burial ground, which means that the later, concentrated burials respect the body of this large monument. This might indicate that a burial mound was still visible. Within the circular ditch a 3,5 m deep pit was found containing some Roman sherds, nails and a layer of charcoal. The Roman graves cluster on the northeastern side of this large structure. The monumental character of this structure indicates its special role. Although it clearly predates the clustered Roman burial ground, it might very well belong to the earlier late Iron Age / early Roman burial ground with its square and circular ditches. It even lies in the centre of this burial ground. Although the diameter of this burial structure equals some elite prehistoric burials, large and deep, V-shaped ring ditches are not known in Dutch prehistoric burial grounds. Therefore this structure might be interpreted as a monumental 'founder burial', forming the centre for both phases of the early- and middle-Roman burial ground. Possibly the central burial was robbed (which would make the 3,5 m deep feature within the ring ditch the robber's pit). This would mean that an Iron Age beginning of this burial ground can not be established with certainty. The oldest phase with its square and circular

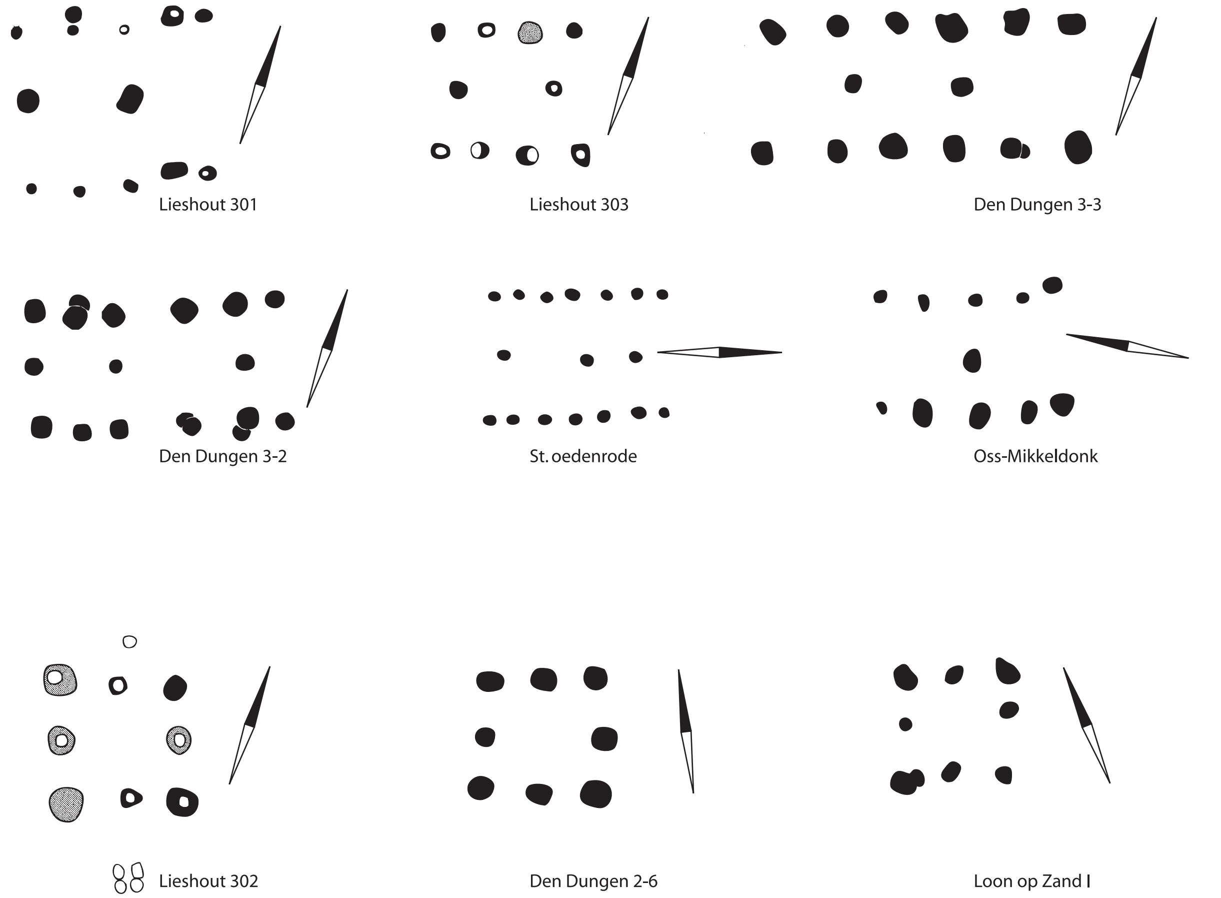

Fig. 16-7 Examples of granary type Oss IID; scale 1:200 (Hiddink 2005a, 104).

ditches might very well date to the early Roman period, which was after 70 AD replaced by a highly clustered burial ground clearly grouped around the largest, most monumental burial structure of this burial ground.

But are there no indications of a clear prehistoric burial ground in the vicinity of the settlement at Geleen-Janskamperveld? Actually, there are. During construction works along the road to the south of the Geleen-Janskamperveld excavation (the Geleenbeeklaan) several graves were found. At nr. 80 three graves were found that might form the southern extension of the late Iron Age / early Roman burial ground of Janskamperveld. Near nr.70 (about 50 m south of building 1; fig. 16.6 nr. 4) a burial pit was found by Harry Vromen. The feature was visible in the side of a trench for service-pipes as a feature of 92 cm wide and 35 cm deep. In the grave were found a cremation, a bronze ring and a bracelet of sapropelite.[26] Further to the east, in a similar trench a cremation in a late Bronze Age urn was found in 1990 by Ivar Schute (fig. 16.6 nr. 5).[27] Finally at about 430 m to the southeast of building 1, a cremation grave was found by Harry Vromen in 1993 (fig. 16.6 nr. 6). Within a feature with a diameter of 35 cm and a remaining depth of 5 cm remains of a cremation and Iron Age ceramics were found.[28] This all indicates that the site of Geleen-Janskamperveld is situated in a cultural landscape where settlements and burial grounds from the late Bronze Age and early Iron Age can be found. Unfortunately, the archaeological research undertaken in the area around Janskamperveld was very limited. Therefore we know very little of the burial grounds and settlement sites surrounding it.

16.5 The Janskamperveld – houseplans in a wider view

16.5.1 The definition of a building type

When the buildings of Geleen-Janskamperveld were found, not much material was available to compare it with. Since Iron Age settlement sites in the Dutch loessic area had hardly seen any excavation taking place (at the large-scaled excavations of the Bandkeramic settlements of Elsloo, Stein and

Sittard by the late professor Modderman only a few outbuildings, some pits and some graves were found) and no comparable plans had been published in the then quite recently published thesis of Simons (1989), attention was drawn to a small number of plans known from the sandy soils of the southern Netherlands (cf. Lawende 1992). This has led to the incorporation of the Janskamperveld houseplan in a group of buildings known as Oss – granary type IIB (Schinkel 1998, 258). Therefore, a first step in analyzing the building (whether regarding its typological position or its function) will be to look at the discourse about this outbuilding type and the position of the Janskamperveld plan within this discourse.

The granary type IIB has been defined by it showing a ground plan of three lines of postholes and having twelve or more postholes in total. Until now three buildings of this type have been recognized at Oss. Two of them were found on the location Westerveld, one at Mikkeldonk. All three of them can hardly be dated on the basis of the few crumbs of ceramics found in the postholes. The hand-made sherds could date in the entire period late Bronze Age through Roman period. Although the three buildings show some basic similarities in their ground plan, we can also distinguish some clear differences between the three structures. The first of them is S445 from Oss-Ussen (Westerveld), measuring 6,1 × 2,9 m. This structure is situated near the late Iron Age houses 113 and 114 and early Iron Age house 112.[29] Therefore, the structure will be an outbuilding belonging to one of these Iron Age houses. Its structure is however far less regular than that of the building at Geleen-Janskamperveld. This building should probably be attributed to another type of outbuilding, seen on several Iron Age sites in the Netherlands. It is indeed built up of three lines of posts, and it has more than three posts on the outer lines. However: in general they show less posts on the central line. We might include this type in the Oss typology as granary type IID. Good examples of this group are known from Deventer-Swormink (Ten Bosch 1995), Oss-Mikkeldonk (Fokkens 1991, 106), Den Dungen (Verwers 1991), Sint-Oedenrode (Van Bodegraven 1991), Lieshout (Hiddink 2005a, 102-104; structures 301, 303 and 382), Someren (Hakvoort *et al.* 2004; structure 302 that might be split up into two of these buildings), Loon op Zand (Roymans/Hiddink 1991), Hilvarenbeek (Hakvoort 2004), Venray (Van der Velde/Kenemans 2003, 34; possibly Stoepker *et al.* 2000), Sint-Gillis-Waas (Bourgeois 1991) and Geleen-Janskamperveld structure 3 (see this report). Their dimensions range from 3,75-10 × 2,3-4,5 m, but only a few examples are larger than 25 m^2 (see fig. 16.8). They form a clearly defined outbuilding type that seems to date almost exclusively to the early Iron Age. One building was found at Someren that probably belongs to this category of buildings, but due to the amount of central posts looks a lot like the building of Geleen-Janskamperveld (Roymans/Kortlang 1993, 30-31). However, it still has less posts on the central axis than on the outer rows and therefore probably belongs to the type IID.

The second building attributed to granary type IIB known in Oss is outbuilding S455, again from Oss-Ussen (Westerveld). This building has the same regular lay-out of postholes as the buildings of Geleen-Janskamperveld and Echt-Mariahoop. Its dimensions are 8,5 × 4,4 m and its orientation is north-south (Schinkel 1998, 258). The first thing that is striking are the dimensions of this granary. Of the 486 granaries uncovered in Oss-Ussen only eight Roman *horrea* and two other granaries have a surface area of more than 20-21 m^2: this outbuilding S455 and outbuilding S320 (measuring 6,5 × 5,3 m) that was also found at Westerveld. This last one has been found in between two Roman houses and was dated on the ground of ceramics from its postholes to the late Iron Age or the Roman period. A Roman age for this structure is also highly likely because of the fact that its postholes were founded so deep that the lower parts of the posts were preserved below the water table. This is something that in Oss is only known from structures dating to the Roman period or at most from 50 BC. The category of larger outbuildings (of which twelve structures are known in Oss-Ussen) is also only dated to the Roman period and the last half century BC.

This means that if S455 would date to the early Iron Age, its size would be totally exceptional in the context of Oss-Ussen. But there are some doubts about the early Iron Age date of this structure (that was only based on its structure being similar to that of the building type of Geleen-Janskamperveld). First, of course, there is the size of the building. But secondly there is the orientation. Of all houses and outbuildings known in Oss-Ussen only a few show a north-south orientation (all others are oriented more or less east-west). Although some houses can have a strong inclination towards northeast-southwest, real north-south oriented buildings stick out immediately on the map of the site. These buildings are eight houses, a *horreum* and an outbuilding and they have all been found on the Westerveld settlement. This settlement belongs to a special group of Roman sites where buildings were constructed on two axes, more or less in a square, and where special buildings (probably the residences of the local elite) were constructed.[30] Because of its situation just outside the ditches of the Westerveld settlement, and the fact that the only other north-south oriented buildings in Ussen are Roman buildings from this Westerveld settlement, we believe that this building should be attributed to this Roman settlement. It might very well belong to the Roman houses 118 and 119 that have the same north-south orientation and are situated at about 25 m from S455. This seems more likely than that it belongs to the nearest Iron Age

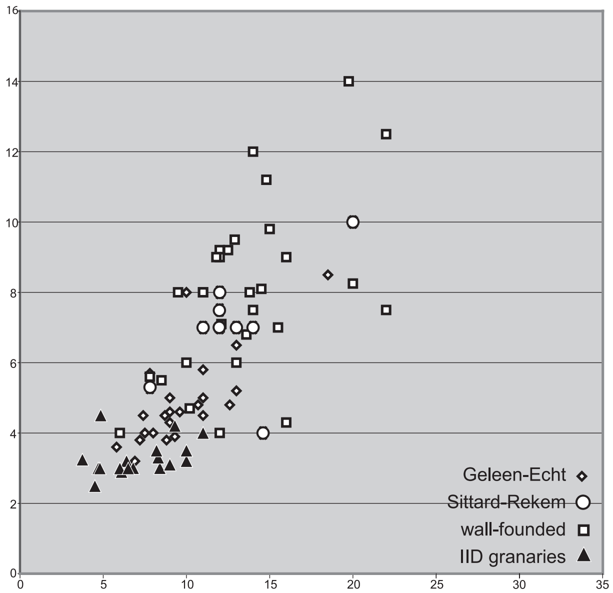

Fig. 16-8a Dimensions of granary type IID compared to the buildings of types Geleen-Echt, Sittard-Rekem and those with tightly placed wallposts from northern France and southern Germany.

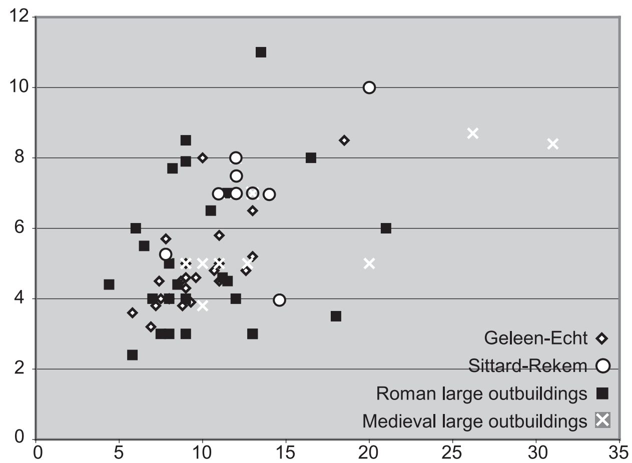

Fig. 16-8b Dimensions of the buildings of types Geleen-Echt and Sittard-Rekem compared to those of Roman and Medieval two-aisled large outbuildings.

house (house 112 situated at about 75 m to the west of S455, of course oriented east-west).[31]

If we accept the attribution of S455 to the Roman period, it becomes clear that in Iron Age Oss there is no category in between the granaries of up to 21 m^2 and the houses. Even outside of Oss outbuildings dating to the early Iron Age only rarely are larger than 25 m^2 (see above). Larger outbuildings such as *horrea* only come into existence in the Roman period or at least after 50 BC, at the same moment when houses with extremely deep founded central posts come into existence. From the same moment onwards large granaries of type IIB can be found, next to these *horrea* and other outbuilding types. Maybe some of the shorter houses of the late Iron Age / Roman house type 5A belong to this same group of large outbuildings.[32] Other granaries of Oss type IIB can be found on Roman settlements throughout the Netherlands. A large number of them is known from Wijk-bij-Duurstede "De Horden" where the houses follow the Oss typology. Smaller numbers of these buildings are known from Beegden, Weert, Breda, Fochteloo, Peelo and Zeijen.[33] In the Netherlands and northern Germany similar outbuildings can be found on early medieval sites (see further). Therefore we see no problem in attributing S455 to the Roman period, which means that a direct link between this structure and structure 1 of Geleen-Janskamperveld does not exist and that the granary type IIB just like all large outbuildings in the southern Netherlands should be dated from the Roman period onwards.

This leaves us with the two-aisled structure found at Mikkeldonk (house 133; 10,7 × 4,8 m).[34] Its size and ground plan are quite close to that of Geleen-Janskamperveld. Also the association with a smaller granary is identical. Although large areas surrounding this structure have not been excavated, there are no indications of there being a Roman settlement on this location. Although no datable material was found in the features, the structure has been tentatively dated to the early Iron Age because of its parallel structure to the building of Geleen-Janskamperveld and to the fact that several early Iron Age farmyards were excavated in the vicinity. It's only just north of the loess soils that similar structures can be found in central Limburg.[35] Here good examples are known from Echt-Mariahoop and Nieuwstadt.[36] Other examples are known from the loessic soil in Dutch southern Limburg, in Belgian Limburg along the Meuse river and in the adjacent German loessic area between Aachen and Cologne.[37]

The building of Sittard-Hoogveld was dated by ^{14}C-analysis in the late Bronze Age. The structures of Echt and Inden-Altdorf were clearly dated to the early Iron Age on the basis of large amounts of ceramics found in one or two of the postholes. The other buildings are mostly dated to the early Iron Age on the basis of surrounding features. Only the relatively small building at Stieldorferhohn was dated to the transition of the middle to the late Iron Age. All these buildings show a rather similar ground plan built up of three rows of postholes with regular setting. Also, they all seem to date to the same period: the late Bronze Age and the early Iron Age. The building type might have continued to be used later on, but only one example is known to date to the second half of the Iron Age. Because of the fact that this was a rather small building, and that buildings with a similar

Fig. 16-9 Site where two-aisled buildings with regular post-settings are clearly associated with 'normal' main building types: Dalem in the 7th-8th centuries AD (Zimmermann 1991, 40).

structure are known as outbuildings on Roman sites, more examples need to be known to shed more light on the attribution of the building from Stieldorferhohn.

Also in geographical terms this type can be defined quite narrowly. In the Netherlands and its immediate surroundings almost all known examples were found on the loessic soils and the southern borderzone of the sandy soils in the Rhine-Meuse interfluve. Only the structure found at Oss-Mikkeldonk, and a possible parallel at Sint-Denijs-Westrem (Bourgeois 1991) are known further to the north (we might include the Someren exemple in this group, although this might be attributed to the outbuildings of type IID as proposed earlier). Therefore, these buildings can be attributed to a separate building type. Their structure is quite different from that of the new granary type Oss IID, and their geographical and temporal extension is different from the Roman and early medieval outbuildings of Oss type IIB (although for the few northern outlyers of this group, the reasons for dating them to the Iron Age and not for example to the early Middle Ages should be thought through more firmly). Therefore, these buildings with a two-aisled ground plan built up of regularly placed postholes, dating from the late Bronze Age and early Iron Age and almost exclusively found on the loessic soils and the southern edge of the sandy soils are attributed to the type Geleen-Echt.

Whilst the difference in ground plan to Oss type IID is quite clear, the differences with typeIIB are much less evident in the ground plan. There are however three major differences: they are dated differently, their geographical extension is different, and – most important – their site context is different. Whilst all Roman and early medieval buildings of type IIB are found in the vicinity of large houses of types regularly found in the Netherlands, the buildings of Geleen-Echt type are always the largest structure on the site. In the same region where the buildings of Geleen-Echt type were found, two buildings were excavated that show a similar ground plan, but then three-aisled. These two fairly identical plans were found at Sittard-Hoogveld and at Neerharen-Rekem.[38] At Sittard the house itself was ^{14}C-dated, at Neerharen-Rekem grain from one of the storage pits was ^{14}C-dated. The dates of both sites are quite close to each other.[39] Ceramics from Neerharen-Rekem date this site more precisely in the 5th century BC. Therefore the three-aisled building type might be a development of the two-aisled Geleen-Echt type, dating to the transition from the early to the middle Iron Age. We shall refer to the three-aisled buildings in the rest of this text as the Sittard-Rekem type.

In conclusion it seems that the granary type Oss IIB has been a container for very different types of buildings. The smaller, two-aisled Iron Age granaries with less posts on the central row than on the outer rows can easily be defined as a new type, which logically can be labeled IID in the Oss typology. The original type Oss IIB can be split in two. One group of classical IIB type that can be found on several Dutch sites as outbuildings next to normal Dutch house types. These buildings however do not date to the early Iron Age but to the Roman and early medieval periods. Then there are the two-aisled buildings that look similar to Oss type IIB but can be dated to the early Iron Age and late Bronze Age. These buildings seem to be almost exclusively restricted to the loessic soils and the southern border zone of the sandy soils in the Rhine-Meuse interfluve. They will be referred to as the type Geleen-Echt. Although based on a limited number of house plans, these buildings might evolve into a three-aisled building type of similar ground plan with regularly spaced postholes. These buildings of Sittard-Rekem type have been dated around the transition from the early to the middle Iron Age.

16.5.2 A functional interpretation of the building-types Geleen-Echt and Sittard-Rekem

The Dutch evidence

After having looked at the typological position of the largest building of Geleen-Janskamperveld, we should look at the functional interpretation of this category of buildings. The discussion on its functional interpretation has always been closely connected to its typological position. If we split up the granary type Oss IIB in different branches, what does that then mean for the functional interpretation of the Geleen-Echt type of buildings? In France Olivier Buchsenschutz considers these buildings to belong to a group of very large outbuildings, probably used to store surplus grain in large bulks (pers.comm. at AFEAF 2007, compare Buchsenschutz 2005, 59 and Gouge 2005, 276-280 for this type of buildings).[40] The main arguments for this interpretation are twofold:

- the analogies in ground plan of Schinkels ‘granaries of type IIB’ with outbuildings known from the coastal area of the Northern Netherlands and with *horrea*-type large granaries
- an argumentation centered on the structure and position of the actual buildings themselves.

We shall first go into the parallels alluded to by Buchsenschutz (which will bring us back to one other branch of the granaries of Oss type IIB), before considering the argumentations on the French buildings themselves.

The first group of buildings used as an analogy by Buchsenschutz are the outbuildings in the Dutch and German northern coastal settlements as Ezinge, Jemgum and Middelstum.[41] Although we should state that the northern Dutch and German ‘*terpen*’[42] settlements, because of their very specific lay-out, can not easily be compared to other Dutch or German sites, it is still interesting to look at this

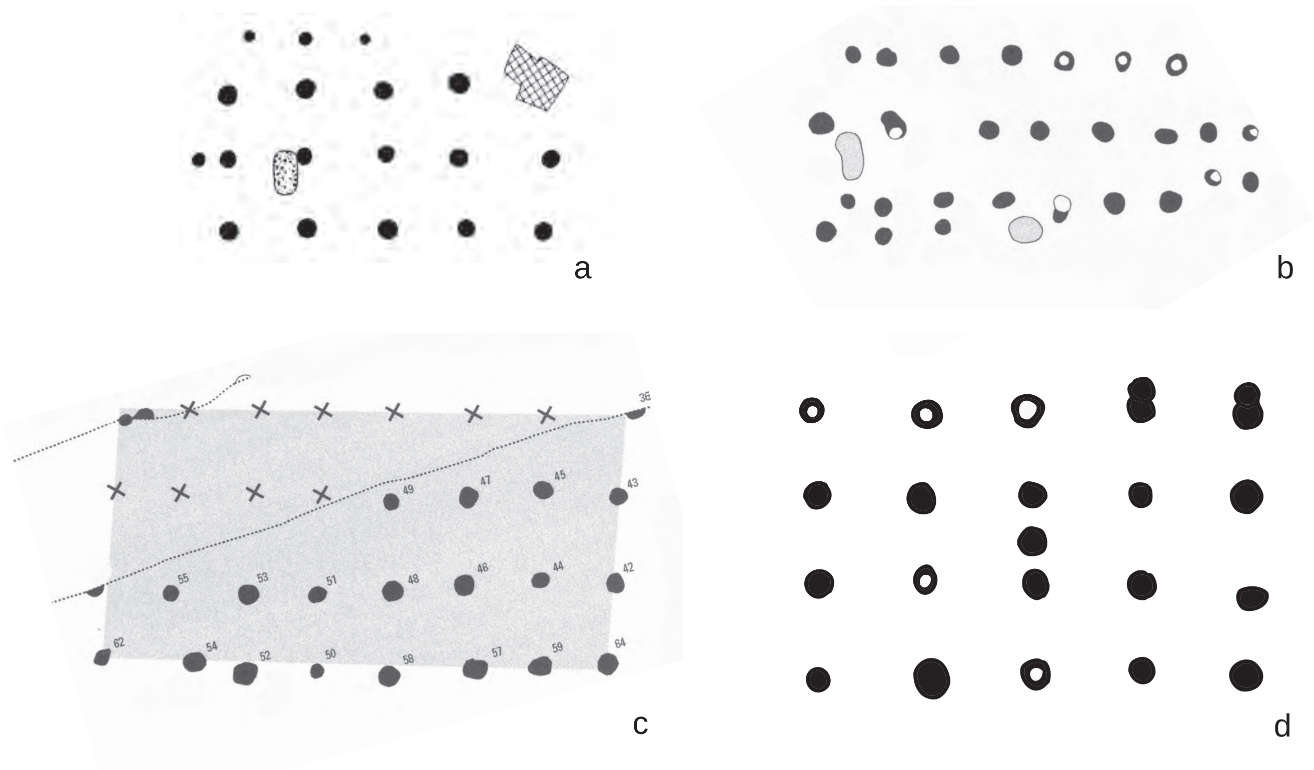

Fig. 16-10 Buildings of the two-aisled Geleen-Echt type (a: Echt-Mariahoop (Willems 1983, 235), b: Sittard-Hoogveld (Tol/Schabbink 2004, 27) and of the three-aisled Sittard-Rekem type (c: Sittard-Hoogveld (Tol/Schabbink 2004, 31), d: Grisy-sur-Seine (Gouge/Séguier 1994, 53). Scale: 1:200.

building type. In the first flatland or very early '*terp*' phases (i.e. before the creation of a village '*terp*' with radial structure) of several of the settlements in the area, platforms or possible outbuildings were found. These outbuildings belong to layers dated to the 6th-5th centuries BC. The outbuildings are always situated near the main building of the farmyard: a large three-aisled house with byre-section.[43] The platforms at Ezinge and Middelstum have dimensions of respectively 17 × 5 m and 15 × 5 m, the one at Jemgum could only be partially excavated (>7 × 4,2 m). Only looked at in a very general way, they seem to be quite similar to the structures known from southern Limburg in dimension and lay-out (lack of clear indications of divisions within the building that consists of a rather dense frame of postholes). However: when looked at in a bit more detail, important differences can be seen in the construction of these structures.

The platform of Ezinge has been reinterpreted several times. The main difference in interpretation is whether we are dealing with one large or several smaller structures (cf. Boersma 1999). This discussion shows that the structure of these buildings is not as clear-cut as it is on sites like Janskamperveld. The reason for this is that whilst the southern structures show an extremely regular build-up, those from the north show crooked lines of posts. Whilst the lines of posts in the width of the structure seem to be rather straight, those in the length of the structure are actually bent lines (cf. Boersma 1999, 90). Also the number and position of posts on every line in the width of the building does not confirm to a simple build-up in aisles (for example in Ezinge the number of posts on these rows differs from four to six, their position on the line showing such great variation that this cannot only be explained by later repairs). Therefore these structures do not seem to have the same build-up in which straight lines were necessary (probably to join horizontal beams), but show a more eclectic structure. If these buildings were indeed platforms, this might explain why straight lines weren't as necessary as in the southern buildings. Because of these very important differences in build-up of the structure and because of the fact that the '*terp*' platforms are always situated next to a main building, we believe that they cannot be seen as belonging to the same category of buildings as the main building of Geleen-

Janskamperveld. If we accept these '*terp*' platforms, and the Iron Age two-aisled outbuildings as described before (the type Oss IID) to be different phenomena than the Geleen-Echt type of buildings, this means that this type has no clear parallels within the Iron Age of the Netherlands and its immediate surroundings.

So if we do not consider the platforms from the '*terp*' settlements of the coastal region to be related to the building type found at Geleen-Janskamperveld, how does this building fit in with the large *horreum*-like granaries? Large outbuildings of the *horreum*-type from the Roman period, or those known from medieval settlements like Hesel, Großoldendorf, Dalem, Peelo or Valkenburg seem to show more similarities in construction than the platforms from the '*terp*' settlements.[44] They are mostly two- or three-aisled and show a regular build-up of small 'compartments'. There are however some important remarks to make on this point. First of all: comparably large outbuildings are not known from the Netherlands, Belgium or northern and western Germany before the Roman period (except for the platforms that are only found in '*terp*' settlements). It seems that the introduction of large '*horrea*' in the Roman period was a direct consequence of economic developments, e.g. the production of large amounts of surplus grains, partly needed to pay the Roman taxes and feed the army in the region (although this can not be a 1:1 relation, since large outbuildings also appear north of the Rhine frontier). Large surplus production of grain has of yet not been recognisable at Iron Age sites in the Netherlands and its surrounding areas, or at least it seems not to have led to the development of very large granary-types like the *horrea*. In areas where surplus production in the Iron Age can be seen archaeologically, storage of the surplus products took place in larger numbers of storage pits and small granaries than on other settlements (e.g. Gransar 2000; Mordant/Gouge 1992). No specific large storage buildings were developed (for the possibly different Northern French situation see further). Therefore the world of Roman and medieval settlements might not that easily be equated with the Iron Age evidence.

A second important problem with this analogy however, is that these outbuilding types can always be found in the immediate surroundings of the main houses on these sites. And exactly that is missing in the area where buildings of the same type as found at Geleen-Janskamperveld have been found. There are no candidates for the houses to which these outbuildings should belong. No other large structures have been found at Janskamperveld, Nieuwstadt or Neerharen-Rekem where large areas around the Iron Age buildings have been excavated. And on none of the other settlement sites in the area has another type of large building been identified. Therefore, we are left with a problem: if these buildings are the first large granaries used for the storage of surplus grain known from the Netherlands, where then are the houses that people lived in? The only other structures known until now from the area are four- to nine-post granaries, and these have only been considered to be houses in the absence of larger buildings.[45]

Finally, we should look at the structure of the *horreum*-type buildings. They are considered to belong to the group of granaries with raised floors, supported by the posts that stood in the archaeologically retreivable postholes. If the buildings of type Geleen-Echt would have the same structure, their floors should also have been raised above the original ground surface. This causes some problems for the building found at Echt-Mariahoop where a hearth was situated within the building (Willems 1983, 234-238). The position of the hearth next to a central post, at a right angle to the orientation of the house (the hearth has a rectangular ground plan) and the lack of other features seem to indicate that it belongs to the house. The same problem exists for the Geleen-Janskamperveld building where two pits are located next to each other exactly within the aisles, and therefore seem to belong to the structure. Furthermore, the real Roman *horrea* found on the sandy soils follow a different structure than the Geleen-Echt buildings. Actually, they are quite rare on these settlements (where mostly small granaries are found), and can be divided in two groups following the Oss-typology.[46] Type IIIA is formed by a nine-post granary surrounded by wallposts, their dimensions ranging from 4,75-8,5 × 3,5-6,2 m. Type IIIB consists of the larger *horrea* that follow the same ground plan: a rectangular build-up of posts and small ditches surrounded by wall-postst, their dimensions range from 9-11,5 × 6,5-8,5 m. So there are several important differences:

– the structure of the ground plan is different: the real *horrea* do not consist of clear two- or three-aisled structures, but of a square made out of posts and ditches surrounded by wallposts,

– the ratio of length:width in these *horrea* is different from those in the buildings of Geleen-Echt type (the three-aisled Sittard-Rekem type is much larger, whilst the widths of the two-aisled Geleen-Echt type never comes near the width of the larger type IIIB *horrea*).

This means that the only large outbuilding type comparable to the Geleen-Echt buildings is the two-aisled outbuilding type known from Roman age sites (a large number from Wijk-bij-Duurstede, with a few examples at Oss, Breda, Weert, Beegden, Fochteloo, Peelo and Zeijen) and from early medieval sites not extending south of the Rhine-Meuse delta (Valkenburg, Peelo, Hesel, Großoldendorf and Dalem).[47] They have a very similar build-up of three lines of posts with regular layout. Most of these outbuildings consist of 12 posts, however some examples with up to 27 posts are known. The

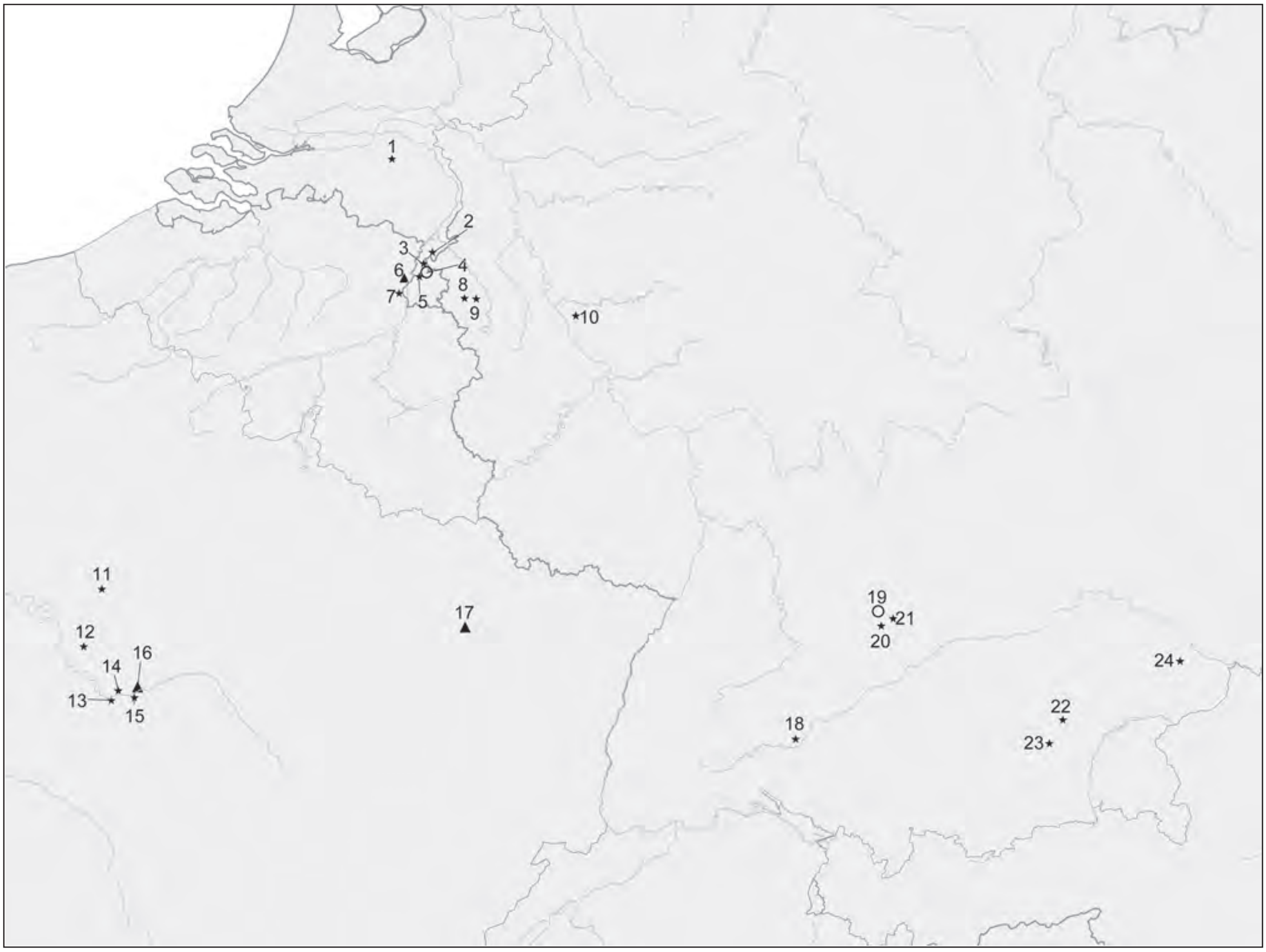

Fig. 16-11 Distribution of buildings of the types Geleen-Echt (stars) and Sittard-Rekem (triangles). Circles indicate sites where both types were found.
1: Oss-Mikkeldonk; 2: Echt-Mariahoop; 3: Nieuwstadt; 4: Sittard-Hoogveld; 5: Geleen-Janskamperveld; 6: Neerharen-Rekem; 7: Rosmeer; 8: HA 502; 9: Inden-Altdorf; 10: Stieldorferhohn; 11: Fresnes-sur-Marne; 12: Lieusaint; 13: Marolles-sur-Seine; 14: Balloy; 15: Bazoches-lès-Bray; 16: Grisy-sur-Seine; 17: Vigny; 18: Heuneburg; 19: Goldberg; 20: Riesburg-Pflaumloch; 21: Nördlingen; 22: Kirchheim; 23: Unterhaching; 24: Aiterhofen

Roman ones are somewhat narrower (widths of 3,0-4,4 m) than the medieval ones (widths mostly 5,0-7,0 m, only one of 3,8 m known), whilst their lengths are quite comparable (7,5-18 m for the Roman ones, 9-20 m for the early medieval ones).[48] Interestingly this means that the widths of the Geleen-Echt type lie a bit in between these two groups: 3,8-5,8 m, with lengths of 8-13m. These outbuildings are normally considered to have raised floors, which would give some problems for the Geleen-Echt type where hearths and pits were found that seem to belong to the building. Evidence for there being (or not being) raised floors is of course scarce, therefore we might not give too much weight to this argument. However, although these buildings show remarkable similarities to the Geleen-Echt type of buildings, we still are confronted with the two problems alluded to before: their different chronological (and therefore social-economical) setting and their different setting within a settlement (always accompanied by typical main-buildings known throughout the Dutch archaeological record and interpreted as houses with a byre section).[49] And this leads us to an interesting observation. Whilst the search for parallels has always been directed towards outbuildings and granaries, some of the best parallels of the two-aisled buildings of Geleen-Echt type and of the three-aisled buildings of Sittard-Rekem-type can be found in the main buildings of the early middle ages in the southern Netherlands. So if we want to look for parallels outside of the chronological limits of the Dutch Iron Age, why stop at the outbuildings? If outbuildings from the Roman and early medieval period are considered to be fair game for analogies, why not the main buildings of this period? We shall return to this question later on. In conclusion we can state that the *horreum*-type buildings (the redefined granary type Oss IIB) show many similarities in ground plan to the buildings of Geleen-Echt type. However, we still see some major problems in interpreting both building types in the same way.[50] These problems lay in:

– their different chronological position, and therefore their different social-economical context (Roman and medieval periods versus Iron Age),

– the differences in their settlement context (always associated with main buildings (houses) versus never associated with a possible main building),

– the differences in the structure of the building above ground (raised floors versus hearths and pits on floor level).

A European context

If we return to the Iron Age but start looking outside of the Netherlands for analogies, we come to the second argument of Buchsenschutz. Both in southern Germany and in northern France similar houseplans have been found, mainly dating to the late Bronze and early Iron Age. The only sites where a two- or a three-aisled plan with regular build-up can be associated with another type of large building that could be interpreted as the house, are at Grisy-sur-Seine (Mordant/Gouge 1992) and Aiterhofen (Schauer 1995). These sites have been interpreted as elite courtyards where surplus grain was stored. This seems to be confirmed by the large amount of outbuildings and storage pits at the site of Grisy-sur-Seine (fig. 16.12). One of these large storage facilities would be the three-aisled building of 12 × 8 m with regular post setting. There is however one important problem with both sites: both of them clearly show two phases in their ditch-layout, at what point in Grisy-sur-Seine even the orientation of the ditches changes. However: for the interpretation of one large building to be the main building and the other one to be a large granary, both large buildings have to be contemporaneous. We see some hazards in the fact that the only two sites in this large area where two different large building types have been found next to each other are clearly two-phased settlements. Therefore, we shall first direct our attention to the relation between the different large building types in the northern half of France and the southern half of Germany.[51]

We shall start with the central part of northern France (Piccardy and Île-de-France), a region where since the 1990's large-scale excavations of Iron Age habitation sites has taken place. On these sites mostly about 90% of all structures is made up of 4- and 6-post granaries, an additional 5% of 9-post ones. Their dimensions are rarely larger than 6 × 5 m, with some outliers reaching 7,5 × 7 m (Gransar 2000; Gouge 2005, 275). This leaves about one in every twenty structures that has a larger and/or more complex ground plan. One part of these larger structures can be ascribed to the two-aisled buildings with regular postsetting of the Geleen-Echt type (Balloy, Bazoches-lès-Bray, Marolles-sur-Seine, Lieusaint) or to its larger three-aisled variant of Sittard-Rekem type (Grisy-sur-Seine, with possible parallels at Fresnes-sur-Marne, Pont-de-Metz and Vermand). Another part however, belongs to a type with a dense setting of wall-posts and a fairly open inner structure, with only a few roof-bearing posts that can divide this area in one to four aisles (Grisy-sur-Seine, Bazoches-lès-Bray, Barbey, Verberie).[52] Almost all of these buildings can be dated to the early Iron Age and the transition to the middle Iron Age, only some of the Geleen-Echt type and the house of Verberie dated somewhat later. The Verberie house has however been dated to the La Tène period on the basis of pits from that period cutting through features of the house! This means that an early Iron Age (or late Bronze Age because of the other features on the site) date might not be that farfetched.

The number of known house plans from the early Iron Age in this area is still rather small. Therefore, it is still difficult to have a clear view on the relation between the two main large building types in the area. But what is evident, is that the number of two- and three-aisled structures with regular post-setting is quite small. The two-aisled type (Geleen-Echt type; n=4) consists of relatively small buildings and most of them are dated to the second half of the Iron Age.[53] The three-aisled type (Sittard-Rekem type) is only clearly represented at one site, the other three possible examples either seem to be two nine-post granaries (Fresnes-sur-Marne) or have a different build-up that falls between the Sittard-Rekem type and the other main building type (Verberie-type).[54]

In the north-east of France again 90% of all excavated buildings belong to the four- or six-post granaries (Koenig 2005; Brénon *et al.* 2003, 252). The larger buildings from the late Bronze Age and early Iron Age in this region can be divided into four groups (Brénon *et al.* 2003, some examples can be found in De Hingh 2000). The first two groups are the most frequently found and consist of one- and two-aisled buildings with dense wall-posts. Therefore they seem to be the local pendant of the Verberie-type of central northern France. Especially of the one-aisled variant several small examples were found, which according to Brénon *et al.* means that this type can be divided in smaller buildings found next to larger ones, therefore being outbuildings, and larger buildings that are the main buildings on these sites. A variation on these types is type 3 consisting of a central post

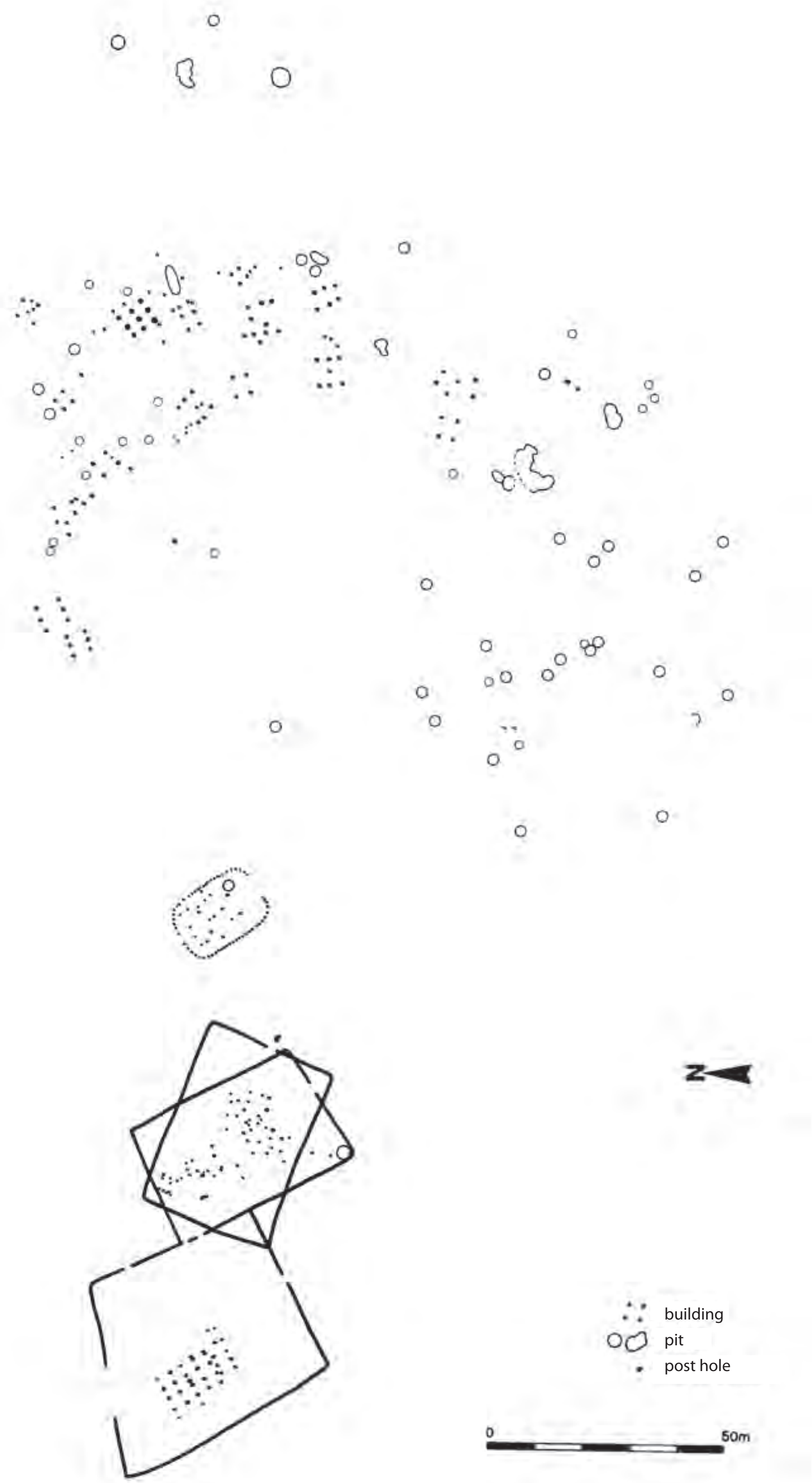

Fig. 16-12 The settlement of Grisy-sur-Seine «Les terres du bois mortier» (Gouge/Séguier 1994, 54).

construction surrounded by dense wall-posts (which forms a three-aisled variant on the Verberie type). Finally, one example of a three-aisled building with regular post-setting was found at Vigny. Interestingly the structure of a late Bronze Age site as Rosières-aux-Salines (Koenig 2005) with larger two-aisled buildings of 9,7-13,7 × 4,3-5 m looks very similar to Grisy-sur-Seine "Les Rouqueux" in Île-de-France (Mordant/Gouge 1992) or Unterhaching in sourthern Germany (Keller 1995/6).

So, in northern France it seems quite possible that the buildings with regular post-settings might be seen as large granaries, connected to large buildings with closely set wall-posts and rounded edges (the Verberie-type). This connection would then be illustrated very clearly at Grisy-sur-Seine. The number of clear examples from the early Iron Age and transition to the middle Iron Age (three with regular post-settings, four with dense wall-posts for central northern France but a lot more for northeastern France) is still very limited. Therefore, hopefully, future research will shed more light on this problem. Buchsenschutz' hypothesis therefore seems to be a reasonable possibility in this area.

The southern German evidence shows again a large number of two-aisled buildings from the late Bronze Age and the early Iron Age. The site-plan of the late Bronze Age settlement at Unterhaching shows a two-aisled building looking very similar to the Geleen-Echt type and some two-aisled buildings with dense wall-posts surrounded by a large number of smaller structures.[55] In this respect it looks very similar to the late Bronze Age settlements of Rosières-aux-Salines (Koenig 2005) and Grisy-sur-Seine "Les Rouqueux" (Mordant/Gouge 1992). At early Iron Age sites like Riesbürg-Pflaumloch (Krause 1989) and possibly Kirchheim (Fuhrmann *et al.* 2004) large buildings with regular post setting can be found, not clearly associated with contemporary larger buildings (the large possibly three-aisled building of Riesbürg is built over the surrounding ditch to which the building with regular post setting is clearly oriented; in the preliminary report of Kirchheim the connection between this building and a stone platform is not very clear). On the early Iron Age site of the Heuneburg with its outer settlement (e.g. Kurz 2000, Gersbach 1995) 15-post structures have been found, in part associated with larger buildings built on horizontal beams that have also been found on the Heuneburg itself. The ground plan of this last building type is built up of small squares. Interestingly in some of these houses hearths have been found within these squares.

On the Goldberg (Parzinger 1998) the same house types recognized in northern France can be distinguished. There are buildings with dense wallposts that are one- or two-aisled (houses 1, 2, 3, 24) and buildings with regular post settings with two or three aisles (houses 4, 5, 8, 21). Here we might interpret the site as follows: central in every habitational unit could be a two-aisled building with dense wall posts, often containing remains of a hearth (buildings 3, probably 7, 9, 2, 24 and possibly 25 or 27). In the neighborhood are clusters of three- (and sometimes two-)aisled buildings with regular post settings and large one-aisled structures. These might be seen as granaries or other types of outbuildings (Parzinger 1998, 105). The same association of a building with dense wall-posts and fairly open inner structure with buildings with regular post settings can be seen on the enclosed 'chiefly' settlements (*Herrenhöfe*) of Aiterhofen and Nördlingen-Baldingen east.[56]

In the early Iron Age of Bavaria again buildings with dense wall-posts have been found on sites like Unterbiberg, Poing, Eching (Schefzik 2001), Wittislingen (Pöllath 1998), Enkering (Schaich/Rieder 1998) and Unterschleißheim (Haller/Wernard 1993). In Eching and Germering these buildings have a large number of roof bearing posts, therefore showing many similarities to the Geleen-Echt type. On these large-scale excavations the buildings are associated with up to 12-post granaries and other outbuildings.

The southern German evidence thus shows a more diverse image than the northern French evidence. In Germany buildings with regular post settings are encountered more frequently than in northern France. The larger ones are often only surrounded by smaller granaries and outbuildings, the smaller ones are mostly associated with other types of large buildings. The most frequent of these other buildings are one- or two-aisled buildings with dense wall-posts. In part they look a lot like the buildings from northern France (e.g. the Goldberg buildings), others are rectangular and mainly consist of two lines of wall-posts with less posts on the line of roof-bearing posts. Buildings like those in Eching and Germering seem to cross the divide between the two-aisled buildings with dense wall-posts and those with regular post setting. The other group of large buildings is only known from the Heuneburg and its outer settlement and consists of a plan of horizontal beams on which the structure was built. Interestingly this last group of buildings shows many of the characteristics seen in the buildings with regular post settings that are considered to contradict a dwelling function for these buildings (the partitioning of the building in small squares, a lack of evident entrances and internal divisions). However, just like the building of Echt-Mariahoop several of them contain hearths.

So, in conclusion, the settlement sites excavated in northern France and southern Germany give the following image of the late Bronze Age and early Iron Age. There are mainly two types of larger buildings. Those with an open central area, mainly leading to a dense setting of wall posts, and those that are divided into small square segments, either by a regular spacing of postholes or by horizontal beams. Of both types smaller and larger buildings can be found. The smaller buildings are normally associated with a larger main building, and therefore interpreted as outbuildings or large granaries. The larger ones of all types can be the main building on a settlement. This means that the interpretation of a specific structure is still mainly dependent on its own characteristics (e.g. size) and its context (associated buildings). The same actually can be said of the northern Netherlands, northern Germany and southern Scandinavia, where many of the larger outbuildings look exactly like short versions of the three-aisled main buildings associated with them.

Living in different worlds?

Interestingly this overview of buildings from northern France and southern Germany has provided many examples of buildings with lengths of eight to more than twenty meters and widths ranging from four to more than ten meters. They form the main buildings on settlement sites, and have dimensions that are totally comparable to those of the main buildings found in the Netherlands, northern Germany or Scandinavia in the Iron Age. Also their association with many smaller buildings like 4-, 6- and 9-post granaries is identical, as is their position on mostly one- or two-phased settlement sites that are then replaced. Only in exceptional cases were extensive settlement sites found that seem to consist of several contemporary settlement units (many of them seem to date to the late Bronze Age). This indicates that the difference between the settlements on the north European plain and those in the loessic and other Central European landscapes isn't that fundamental as has been proposed by Roymans and Joachim. This was gradually becoming clear for the northern borderlands of the loessic zone like in the region of Osnabrück (Both *et al.* 2005). But also for regions much further to the south this image is becoming fairly clear for periods other than the Iron Age. In some periods the large houseplans are more or less identical in both regions, for example in the early Bronze Age when large identical two-aisled buildings can be found in Austria, the Czech republic and southern and eastern Germany and in Denmark,[57] the middle Bronze Age when large two- and three-aisled buildings that look a lot like the Dutch and northern German houses can be found on the loessic soil of southern Limburg, in Burgundy and southern Germany[58] or in the Roman period when large three-aisled buildings are known from the northern Netherlands and Germany but also from Hessen, the northern parts of Bavaria and from east of the Rhine near Bonn.[59] In the early Middle Ages phosphate analysis has even shown that houses with byre section existed in southern Germany,[60] where already during the late Neolithic (around 3500 cal BC) dung layers had been found in a specific part of the houses.[61] So it is clear that the idea that on the loess people live differently than on the sandy soils and therefore that buildings from this area can only be interpreted as having separate living, working, byre and other functions on farmyards that therefore contain several buildings but no large ones sharing all of these functions, needs a lot of adjustment.

All of this only leads us back to the buildings of the Geleen-Echt and Sittard-Rekem types with two important lessons: we should look at the context of the buildings, and we should look at these buildings without preconceived expectations of whether we should or should not expect living, byre and other sections to be combined under the same roof.[62] The buildings of Geleen-Echt and Sittard-Rekem types of the Rhine-Meuse interfluve are only found together with smaller granary-type buildings. This makes them the only candidate for the principal building on the farmyard. Three possible other Iron Age main buildings are known from the loessic area north of Ardennes and Eiffel. However, the building at Hermalle-sous-Huy (Frébutte *et al.* 2007) is for the moment too much of an outlier to be able to understand its position in the settlement system of the region, and the two four-aisled buildings excavated at Jülich-Stetternich and HA 59 are difficult to date (Heimberg 2002/3, 71 & 75). They probably predate the Roman age villa and burials they were found next to, but their exact attribution is not secure enough to incorporate them in this discussion.[63] A large two-aisled building of 25 × 8 m excavated at FR 98/24 can most probably be dated to the late Iron Age. A precise date is made difficult by the fact that it was found on an excavation where many other periods were represented – amongst them middle Neolithic settlement locations with two-aisled house plans –, and unfortunately this site has until now only been published in preliminary reports (Arora 2001, Geilenbrügge 2007). However, all these buildings seem to be the principal building on their respective settlements, therefore they would assume a similar role as the Geleen-Echt and Sittard-Rekem structures. Some authors have suggested that possibly lightly founded buildings were used in the region, which haven't been traced archaeologically due to the heavy erosion on most loess soils. Although perhaps a tempting idea, we think we should stick to the data available and see no reason not to consider the large buildings of the Geleen-Echt and Sittard-Rekem types to be the principal buildings on these settlements.

If we accept these buildings to be the main buildings on settlements from this area, the question is of course what was their function. The hearth found in the building of Echt-Mariahoop and the pits found in the building of Geleen-Janskamperveld point to a function as living area. However, does that mean that was the only function of the building? Of course, within Dutch discourse the main question would be whether it combines a living area and a byre section underneath one roof. Since – except for the lowland areas and the northern Netherlands – no direct evidence of byre sections (such as layers of dung or small walls in the byre

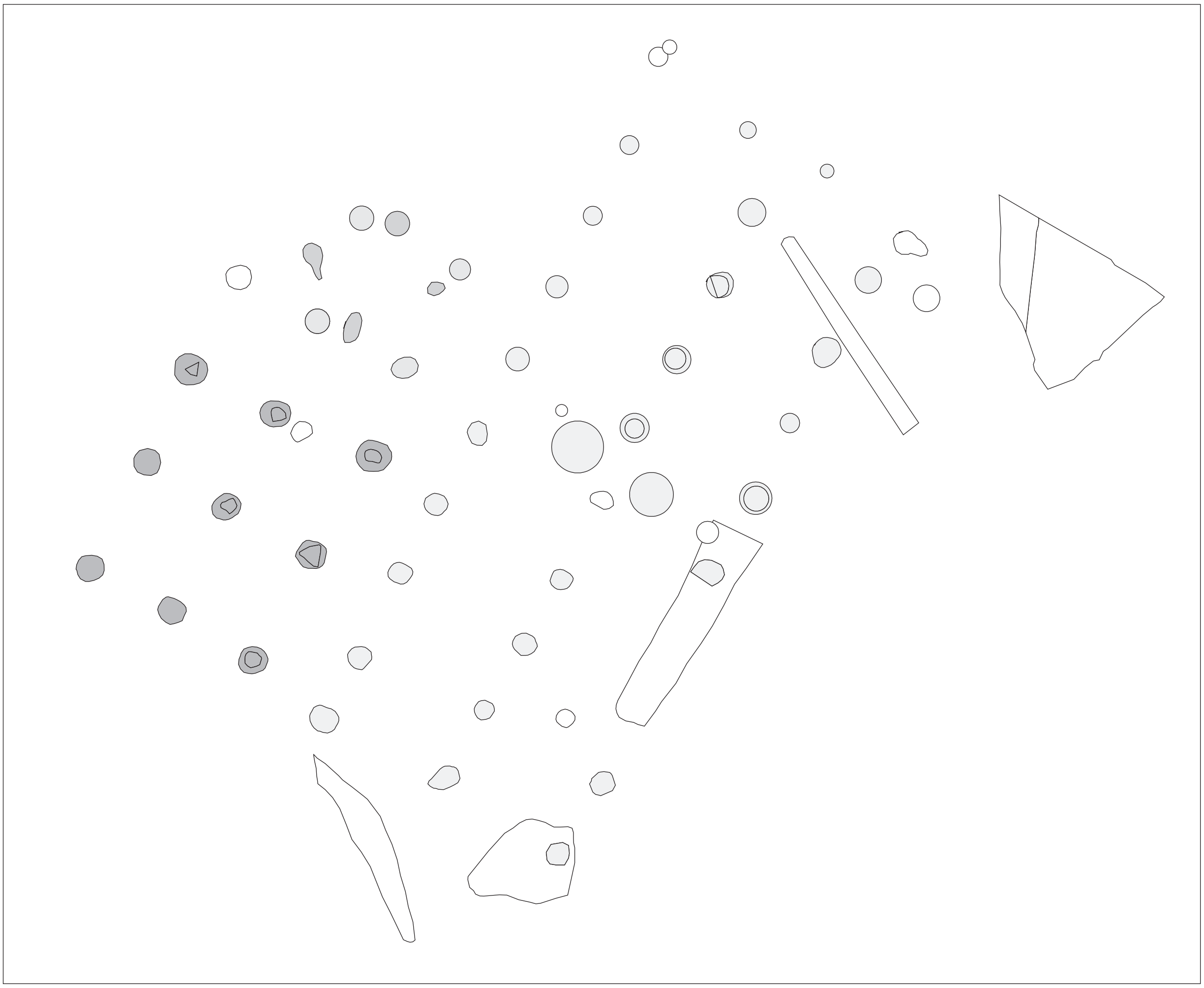

Fig. 16-13 The main building and its surrounding smaller structures of the Iron Age habitation at Geleen-Janskamperveld (scale 1:100, Bandkeramic structures not indicated).

section) is known from Dutch settlements, some secondary arguments are normally used. The principal arguments are: the length of the building and a division of the building (mostly this means the occurrence of entrances in the long walls of the house). As can be seen in fig. 16.8 the lengths and widths of the buildings of Geleen-Echt and Sittard-Rekem types aren't that different from the dimensions of early Iron Age houses in other parts of the Netherlands (which only rarely reach lengths of 20 m, most of them being 10-15 m long, cf. Fokkens 2002, 139). The evidence for a division of the building is much less clear.[64] The decentral position of the hearth at Echt-Mariahoop and the possible entrances of building 1 at Geleen-Janskamperveld could be indications of there being such a division. It is interesting to note that the absence of clearly identifiable entrances on the sandy soils of the (southern) Netherlands never seems to be a real problem in identifying the structure as a house with living area and byre section. For house types in which such entrances can be found regularly, that of course is understandable, but for building types that notoriously lack clear entrances this is a different affair.[65] Especially the early medieval buildings known in the southern Netherlands are not at all that different from the Geleen-Echt and Sittard-Rekem types of buildings, showing no clear internal divisions and no clear entrances.[66] We should not forget that entrances might not always be visible in the distribution of wall foundations and wall posts. We presume no-one will assume that the IA-houses of the Bandkermic with their continuous wall foundations couldn't be entered. So, maybe even in the Iron Age the differences between the loess area of southern Limburg and the sandy soils of the southern Netherlands weren't that fundamental. Just as in the middle Bronze Age when a house found at Sittard-Hoogveld shows the same type of plan as the middle Bronze Age houses known from the southern and central Netherlands (Tol/Schabbink 2004), in the Roman period when houses of the typical southern Dutch / Flemish types can be found on the loess in Belgian and Dutch Limburg (Van Hoof in prep.) or in the Middle Ages when 'boat-shaped' houses of normal southern Dutch type were built at Sittard-Haagsittard.[67] This doesn't automatically mean that houses of the Geleen-Echt and Sittard-Rekem types should be interpreted as houses with a byre section, but what should be clear is that the same is true for most house plans in the southern Netherlands. There is almost no real evidence for byre sections existing in the southern Netherlands before the Roman period. A more open-minded approach, not immediately equating "large house = living area + byre section" and "loess = the Other = no joined living and byre section", has already led to interesting new insights into the settlement structure on medieval sites (Hiddink 2005a, 160-161; Knippenberg *et al.* in prep.). The interpretation of the Iron Age houses on the loess is far from clear, but these buildings don't seem to be all that different from the buildings on the sandy soils of the southern Netherlands and northern Belgium (cf. Van Hoof 2002).

16.6 Conclusion

The excavations at Geleen-Janskamperveld were the first large-scale excavations on the Dutch loessic soils where large parts of an Iron Age habitation site were uncovered. Since then fifteen years have gone by that haven't seen any excavations on a comparable scale taking place on habitation sites from later prehistory. So the amount of data available for this period is still very limited. However, in the neighbouring towns of Geleen and Sittard smaller scaled excavations (especially those at Sittard-Hoogveld, where settlement remains were excavated near a completely excavated burial ground) have been carried out, on the basis of which a first attempt can be made to sketch an image of the late Bronze Age and early Iron Age cultural landscape in southern Limburg.[68] Unfortunately, almost no data are available for the loessic soils of Belgium, the Netherlands and the area between Aachen and Cologne (except perhaps for the region around Inden) that provide data with which this image can be compared. What happens to the main buildings after the 5th century BC is even entirely unknown in this area!

The settlement of Geleen-Janskamperveld consists of a large two-aisled main building, close to which some granaries were built. At distances between 80 and 130 m to the north and west of the main building small groups of granaries were found. This image of loosely arranged farmyards fits in nicely with what is known from other sites on and immediately north of the loess like Sittard-Hoogveld and Neerharen-Rekem, where similar distances of outbuildings and pits to the main building can be observed. But it also complies perfectly to the model of wandering, one-phased, loosely arranged farmyards on the Dutch sandy soils: the so-called *zwervende erven*. The ceramics found at Geleen-Janskamperveld date the settlement in the early Iron Age. In the immediate surroundings of Janskamperveld other early Iron Age pits and postholes were found during rescue excavations at Haesselderveld and De Haese. Therefore, it is clear that the Janskamperveld site only forms part of a larger early Iron Age cultural landscape in which several loose farmyards existed. Just south and east of the Janskamperveld excavations, remains of burials from this period were found. As of yet there seems to be no direct link between the late Bronze Age and early Iron Age settlement remains and burial ground, and the Roman burial ground excavated at Janskamperveld. This two-phased burial ground was clearly laid out around a grand circular monument. Although it is difficult to put a precise date on this large burial and most of the first phase of this burial ground, it seems most likely that it belongs to the early Roman period, dating before the clustered burial ground of 70-225 AD. There is therefore neither in time (graves from the middle and late Iron Age have not been found, except perhaps for the final phase of the late Iron Age), nor in space a direct link between the Iron Age and the Roman graves (the Roman graves are centered on the large circular monument, not on the prehistoric graves to the south of Janskamperveld).

Whilst the interpretation of most structures gives no evident problems, the interpretation of the main building has been the centre of a debate. It was taken as belonging to a category of large granaries (Oss type IIB), that was characterized based on small examples of this type found on the sandy soils of the (southern) Netherlands. A closer analysis of this category has shown that it can be split up into three groups. A first group of small, two-aisled outbuildings, mainly dated to the early Iron Age with less postholes on the central axis than on the outer ones (here labeled Oss type IID). A second group of large two-aisled granaries with regular post-setting, that can be found throughout the Netherlands and northern Germany on Roman and early medieval sites associated with 'normal houses' from this period (granary type IIB that therefore can now be dated differently than was originally assumed). And a third group of two-aisled buildings with regular post-setting that can be dated to the late Bronze Age and early Iron Age and is almost exclusively found on the loessic soils and the southern border of the sandy soils in the Rhine-Meuse interfluve (type Geleen-Echt). Although dating evidence is restricted, this building type might evolve around the transition from the early to the middle Iron Age into a three-aisled building type of similar regular layout (type Sittard-Rekem). What happens to the buildings in this area after the 5th century BC is still unknown, due to a lack of excavated settlement sites. The buildings found at Jülich-Stetternich, HA 59 and FR 98/24 could possibly fill this gap, but their chronological attribution is still unclear.

The buildings of Geleen-Echt and Sittard-Rekem types show many similarities to large outbuildings found on Roman and early medieval sites in the Netherlands and Germany, but also to the main buildings found on settlements from the Iron Age in Central Europe and the southern Netherlands. The main difference between the 'loessic' and 'sandy' types of early Iron Age buildings not being their size or the evidence for entrances, but their inner structure. However, a large number of the early Iron Age houses from the southern Netherlands due to their switching two-and-three-aisled ground plan and the large numbers of pits within the building, show as much of a compartmentalization as do the buildings of Geleen-Echt type. So many of the arguments why these different building types should be symbols of totally different social and economic organizations seem to have to do more with preconceptions of what we should find on the loessic and sandy soils of the southern Netherlands and Belgium, than on the house plans themselves. Yes, they are different, but not that different. Probably not more different than middle and late Iron Age houseplans from the southern and the northern Netherlands.

In conclusion it is clear that the early Iron Age settlements on the loess and southern fringe of the sandy soils in the Rhine-Meuse interfluve are very similar to those on the sandy soils of northern Limburg, Brabant and Flanders. They consist of loosely organized, short-lived farmyards, that rarely stay on one location for more than two building phases of the principal building. It seems that the only stable element in this cultural landscape was the urnfield (known for example from Sittard ans Stein, cf. Van Hoof 2000). The principal buildings in this region can clearly be identified as houses of Geleen-Echt type (late Bronze Age and early Iron Age) or of Sittard-Rekem type (transition from early to middle Iron Age). These buildings are of an equal size as buildings known from the rest of the Netherlands, the main difference being their regular outline of posts that create a strong compartmentalization of the building. This, however, does not seem to differ fundamentally from the 2/3-aisled buildings of the early Iron Age found in the southern Netherlands. We need much more large-scale settlement excavations in the region to test this model, to confirm the chronological differences between the Geleen-Echt and the Sittard-Rekem types, to understand what happens in the middle and late Iron Age, to understand what happens just north of the loess in central Limburg, etc. And we need bone assemblages to understand more about the economy in the region.[69] We have tried to start to build a general model, but many gaps in the story still need to be filled.

Notes

1 The author wishes to thank Alistair Allen, Walter Laan and Ivo van Wijk (all of Archol bv) for their help in producing the illustrations to this chapter.

2 Until the end of the 1980s the monograph of the local archaeologists father and son Beckers (Beckers/Beckers 1940) could be considered to contain all the essential data on the Iron Age of the Graetheide area. Recently a new overview of the Bronze and Iron Age data from the Graetheide region has appeared: Van Hoof 2000.

3 Simons 1989, actually the study was finished in 1985.

4 The excavation was undertaken in 1986 and 1987. Only preliminary reports have appeared (Abbink/Van Ieperen 1988; Van Hoof 2000 catalogue: Geleen-Krawinkel). An extensive report is being prepared by the author, taking over from the director of the excavation, the late dr. A.A. Abbink.

5 It was actually during this excavation, undertaken in 1990, that the first trial excavation at Geleen-Janskamperveld was undertaken by a team from the Haagsittard site (*Publications de la société historique et archéologique dans le Limbourg 127* (1991), 260-261 and *Jaarverslag Rijksdienst voor het oudheidkundig bodemonder-zoek 1990*, 77-80 & 120).

6 A first analysis of these features was undertaken by Margot Lawende as a student assignment. A large part of the information in this section therefore is indebted to her paper (Lawende 1992).

7 Daily report of the excavators Richard Exaltus and Ivar Schute, Tuesday 16-4-1991.

8 On the digitized drawing of the site, it seems that this feature was cut by a recent disturbance. According to the field drawings however, this disturbance started somewhat more to the south, still destroying two postholes (therefore, the digital drawings have been somewhat adapted to the situation according to the field drawings for the images used in this chapter). Unfortunately, however, the original drawings with the depths of these features could not be found. Therefore we have to rely on the illustrations used in Lawende 1992.

9 Cf. Van Hoof 2002, 87-89.

10 In Lawende's study (Lawende 1992) some of the postholes of the second four-post granary were not included in her plan of structure 2. Therefore the illustration used by her could be split up into the nine-post structure 2a and two three-post structures as 2b. Since the original section drawings of these buildings have disappeared, we cannot refer to the depths of the features not incorporated in her study to see why these features were not incorporated in her reconstruction and to test the possible four-post structures.

11 In the immediate surroundings one such large vessel has been found at the site of Catsop-Hoogenbosch (Van Hoof 2000), other examples are known from Nijmegen (Van den Broeke 1999), Loon op Zand (Roymans/Hiddink 1991, 119), Bladel (Roymans 1977) and Deventer-Colmschate (Hermsen 2007, 226).

12 One of the major problems in this respect is that during prospections in the area (that mostly consist of extensive augering, sometimes joined with extensive surveying) Iron Age settlements are rarely recognized. Both prospection method and selection of sites to be preserved or excavated favor concentrated (settlement) sites with a high density of finds (a few sherds and a few features in a trial trench – which is the typical result on most prehistoric and many other small scale, extensive sites – are rarely considered to be 'interesting' enough). This means that Iron Age features are often only found during excavations of Neolithic or Roman settlements (as was the case at Geleen-Janskamperveld, but compare Van Hoof 2007 for Dutch Limburg or Geilenbrügge 2007 for the adjacent German area) when the strategies for the excavation are difficult to change. Unfortunately, even when an area was selected to concentrate on the Iron Age cultural landscape, as soon as Merovingian graveyards with nice grave finds or Roman sites with lots of find material are found, the scattered Iron Age features get pushed to the second level (Geilenbrügge 2002).

13 The publication of this site is being prepared by Harry Vromen.

14 The publication of this site is being prepared by Harry Vromen.

15 Grain from these features was dated to 2435±35 bp and 2530±50 bp (Roymans 1985).

16 This interpretation was deemed very probable by the excavator when confronted with the characteristics of this type of features from sites like Geleen-Krawinkel and –Hof van Limburg (oral communication Adri Tol, 18-1-2008).

17 Due to the fact that late Neolithic features were found on this location, a large area could be excavated outside of the Iron Age site (in total 1 ha was excavated). Therefore the borders of the settlement could clearly be established.

18 Frank/Keller 2007, 318; Simons 1989, 115-116.

19 For the different types of elements on these settlements compare Van Hoof 2002.

20 A similar lay-out can also be seen on settlements much further on the loess like Pößneck (Ebner 2001).

21 *Publications de la société historique et archéologique dans le Limbourg 129* (1993), 307 (where the feature was dated in the early Neolithic because of it being found near Janskamperveld) and letter H. Vromen to the Rijksdienst voor het Oudheidkundig Bodemonderzoek, dated 26-10-1998 (where the colour of the feature was used as argument for an Iron Age origin). Archis-waarnemingsnr. 32809.

22 Report being prepared by Harry Vromen.

23 Schinkel 1998, in the original Dutch version of his Ph.D.-thesis this system was labeled with the Dutch term '*zwervende erven*'.

24 The grave described by Wesselingh also contained a flint implement. This could however be material that was lying around on the surface of the Bandkeramic settlement. Therefore it should not be seen as a grave gift.

25 The sherd was found where the ring ditch cuts through feature 34023 (its position described in the field notes of the excavators under 6-6-1991).

26 Information provided by Harry Vromen, who also was kind enough to show the finds during the preparation of Van Hoof 2000.

27 Cf. *Publications de la société historique et archéologique dans le Limbourg 127* (1991), 228.

28 Letter H. Vromen to the Rijksdienst voor het Oudheidkundig Bodemonderzoek dd.26-10-1998.

29 Schinkel 1998, map 1 sheet 10 (northeastern part of this sheet).

30 For Westerveld: Wesselingh 2000. Other examples are Nistelrode-Zwarte Molen and Hoogeloon (cf. Slofstra 1991 and Jansen in prep.).

31 Schinkel 1998, map 1 sheet 11.

32 Examples of this group are H24 (7,7 × 5,4 m), H73 (5,9 × 4,6 m) and H83 (>7,0 × 5,5 m) (Schinkel 1998).

33 Vos 2002; Koot/Berkvens 2004; Kooi *et al.* 1987; Kooi 1993/4; Waterbolk 1977; Roymans *et al.* 1998, 4; *Publications de la société historique et archéologique dans le Limbourg 124* (1988), 355-358.

34 Jansen/Fokkens 1999, 57.

35 Although the research of burial grounds in central Limburg is on a very high level, for settlement research there exists a huge gap between the sites of Echt and Nieuwstadt on the southern fringe of the Limburgian sandy soils and those near Eindhoven (prov. North Brabant) and in northern Limburg where houseplans of 'normal' Dutch types are known. Even on the large-scale excavations near Weert no house plans dating before the last phase of the late Iron Age have been found (Hiddink 2005b). This, however, seems to be in large part due to the choices for other types of sites to be excavated. Therefore we do not know how far to the north the buildings of Geleen-Echt and Sittard-Rekem types can be found, nor how far to the south the houses of Oss type 2 / St.Oedenrode type can be found (cf. Van Hoof 2007).

36 Echt-Mariahoop: Willems 1983, 235; Nieuwstadt: Bink 2004.

37 Besides of Geleen-Janskamperveld examples are known from Sittard-Hoogveld (Tol/Schabbink 2004), Rosmeer (De Boe/ Van Impe 1979), Hambach 502 (Simons 1989), Inden-Altdorf (Kranendonk 1992) and Stieldorferhohn (Schuler 1999).

38 Tol/Schabbink 2004; De Boe *et al.* 1992.

39 For Sittard 2475±35 bp (Tol/Schabbink 2004), for Neerharen-Rekem 2435±35 bp and 2530±50 bp (Roymans 1985).

40 His conclusion is therefore very much in line with the traditional Dutch interpretation. The argumentation in the Dutch literature

however is very much based on the attribution of these plans to granary type IIB and to preconceived ideas about how different the sandy and loessic soils are, whilst the arguments of Buchsenschutz have developed from the ground plan itself, without the attribution to granary type IIB and without the sand-loess opposition. Therefore his arguments can be used as a starting point after having shown the problems with attributing the buildings of Geleen-Echt type to one granary type IIB.

41 Ezinge: Boersma 1999; Jemgum: Haarnagel 1957; Middelstum: Boersma 2005, 563-567.

42 *Terpen*, which depending on the region are also known as *wierden* or *Wurten*, are a typical phenomenon of the North Sea coastal areas. These settlements are located on humanly raised surfaces (slightly comparable to *tells*).

43 Because of the specific preservation conditions of the '*terp*' settlements, large parts of the wooden buildings are still standing. Therefore the functional interpretation of the different parts of these buildings is far less complicated than in other regions of the Netherlands. In large part the interpretation of house plans, comparable to those of '*terp*' settlements, in other parts of the country is based on analogies with these well preserved '*terp*' and other lowland settlements.

44 Roman *horrea*: Vos 2002; Koot/Berkvens 2004; Kooi *et al.* 1987; Kooi 1993/4; Waterbolk 1977; Roymans *et al.* 1998, 4; *Publications de la société historique et archéologique dans le Limbourg 124* (1988), 355-358. Medieval outbuildings: Bärenfänger 1994 & 2005; Zimmermann 1991; Bult/Hallewas 1990; Kooi 1993/4.

45 Cf. Joachim 1982. This model was however based on several hilltop-settlements (Eschweiler-Laurensberg and –Lohn (Joachim 1980) which have delivered large numbers of swords and other kinds of weaponry. Therefore we doubt whether these sites could be seen as 'normal settlements' and feel that much more attention should be given to recent data from open, 'flatland settlements' where larger structures have been found.

46 For comparison we give the numbers for some published sites: Oss-Vijver 1 of type IIIB; Oss-Zomerhof 3 of type IIIA; Oss-Westerveld 2 of type IIIA and 2 of type IIIB; Lieshout 2 of type IIIA; Nederweert 1 of type IIIA; Tiel-Hogeweg 1 of type IIIB and 2 of type IIIA. Oss: Wesselingh 2000; Lieshout: Hiddink 2005a; Nederweert: Hiddink 2005b; Tiel: Heeren 2006.

47 Early medieval examples: Bärenfänger 1994 & 2005; Zimmermann 1991; Bult/Hallewas 1990; Roman examples: Kooi *et al.* 1987, Kooi 1993/4 (nrs. 70, 71 and 208); Van Es 1965-6, 41; Koot/Berkvens 2004, 242; Roymans *et al.* 1998, 4.

48 The buildings from Weert that were first dated in the early Middle Ages, actually have a width that falls in the medieval range and not so much in the Roman range. The find material from these structures, however, seems to date in the Roman period.

49 The only exception is Valkenburg where no main buildings were identified. If we regard the bad preservation of the main buildings at some other early medieval sites like Hesel and look at the small sections of the all feature-map of Valkenburg that have been published, this might have to do more with the recognisability of these structures than with a different function of these buildings and the site as a whole (traders or fishermen on the banks of the Rhine) as proposed by the excavators and others (Bult/Hallewas 1990; Theuws 1996).

50 To illustrate the fact that similar ground plans may be the result of very different types of buildings, we just like to mention the fact that Roman sanctuaries for the god Mithras can show exactly the same plan as the classical houses with byre-section of the Northern Netherlands and Northern Germany (e.g. Kortüm/Neth 2003). If we wouldn't look at the context, the *Mithraeum* could be interpreted as a stone version of the northern housetype, which would of course lead to a false functional interpretation of the building.

51 These regions seem to be far away from the area where the group of Geleen-Echt type of buildings has been found. The problem however, is that house plans from the southern half of Belgium, Luxemburg, Rhineland-Palatinate and Hessen are almost if not completely absent. This lack of known buildings has mainly been caused by a lack of large-scale excavation of Iron Age habitation sites. For example, only recently has the first Iron Age houseplan of Wallony been excavated (Frébutte *et al.* 2007). Still, we see no fundamental problems in comparing the loessic soils of the Meuse-Rhine region north of the Ardennes and Eiffel with the areas to the south of this mountainous zone, just as we see no principal problems in looking to the north for comparisons as long as the context of the buildings is kept in mind. Evident borders of the region that is used as reference zone can be found towards Normandy and Brittany where round houses can be found during the period under consideration and towards the Rhône valley and the Alps that lead towards Mediterranean France and Italy where very different settlement and house types are known. Towards the east the border has yet to be established. The last few years it has become clear that in the Austrian Danube basin and Moravia (eastern part of the Czech Republic) the situation isn't that different from southern Germany.

52 In the diagram of Buchsenschutz these plans fall under the heading of '3 nefs Roten' (and 2-aisled variant) and 'poteaux/parois' (Buchsenschutz 2005, 59). We shall call this last type of buildings the Verberie-type because of its first find-spot. Grisy-sur-Seine, Bazoches-lès-Bray, Balloy and Barbey: Gouge 2005; Verberie: Blanchet *et al.* 1983; Pont-de-Metz and Vermand: Buchez 2005; Fresnes-sur-Marne: Marion 1994; Marolles-sur-Seine: Peake 2005; Lieusaint: Boulenger 2005.

53 A two-aisled house of 12 x 5 m is known from the late Bronze Age site of Grisy-sur-Seine "Les Rouqueux" (Mordant/Gouge 1992, 141-142). It differs from the Geleen-Echt type by there being less posts on the central axis. This house plan is known from several sites in the larger region dating to the late Bronze Age.

54 The building from Grisy-sur-Seine however, shows a very strong resemblance to the building of Sittard-Hoogveld. Their overall dimensions are almost identical. Also, the three aisles have exactly the same widths, and the distances between the postholes in the length of the buildings are for Grisy exactly 2/3 of those at Sittard, meaning that every second post at Grisy is on exactly the same location as every third of Sittard.

55 Keller 1995/6. In this publication the building with regular post-setting that looks quite convincing on the plan, but unfortunately was only partly excavated, has been split up in several smaller buildings.

56 Schauer 1995; Fries 2002, 562; the structure of the western enclosed settlement is less clear but seems to show a similar structure. The largest buildings in Schauers publication are now firmly positioned in an early Bronze Age building type.

57 Nadler 1997, Boas 1991.

58 Tol/Schabbink 2004; Dartevelle 1996; Dieckmann 1998; Nadler 2006. The loessic region between Aachen and Cologne has delivered some first indications of larger buildings: Päffgen/Wendt 2003.

59 Van Hoof in prep.; Gechter-Jones/Kempken 2006; Fiedler *et al.* 2002.

60 Fuchs 1997; Bauer *et al.* 1993; Eule 1998; *Archäologische Ausgrabungen in Baden-Württemberg 1989,* 212-217; *1991*, 187-195; *1993*, 227-231; *1999*, 170-173; *2000*, 154-156; *2003,* 170-172.

61 E.g. Pestenacker, Unfriedshausen and Weier (Schönfeld 1991, Weidemann/Schönfeld 1994, Robinson/Rasmussen 1989).

62 Whilst above we have paid attention to the house plans where byre sections are probable or proven for the loessic and other Central European regions, we should point to the reverse on the sandy soils: the *caveats* expressed in Zimmermanns work that in northern Germany sometimes living areas and byres are found in separate buildings (Zimmermann 1992), as might also be the case for several medieval settlements in the southern Netherlands (Knippenberg et al. in prep.).

63 Their structure shows many similarities with early Iron Age houses from the sandy soils of the Netherlands. Therefore in Dutch literature they are sometimes incorporated in overviews of house types from this period (e.g. Roymans/Fokkens 1991). In German literature there however is still an intense debate on whether or not they should be associated with the Roman features surrounding these buildings (cf. Lochner 1995; Lenz 1995; Lenz 1999, 76; Lochner 2007). Due to the fact that there are intersections between Roman grave structures (the surrounding ditch) and the building of Jülich-Stetternich and the fact that the building of HA 59 is oriented differently than all the buildings of the Roman villa, and is situated outside of the villa structure, a date before the middle Roman age for these buildings seems to be all that can be said with certainty. They might be dated in the earliest part of the Roman period or in the late Iron Age showing some similarities to late Iron Age houses recently uncovered in Weert and near Antwerp (Roymans/Tol 1996, 33; Roymans *et al.* 1998, 34; Bungeneers *et al.* 2004, 117-156).

64 Although Dutch archaeologists seem to be pre-occupied to equate a division in a house with a separation into a living and a byre section, there are of course many other possible divisions within a house.

65 This is especially the case with Oss type 5A (dating to the late Iron Age and Roman period; Schinkel 1998, Wesselingh 2000) and with the early medieval building types found in the southern Netherlands (Theuws 1996, 760-761).

66 Some close analogies from Limburg can be found in: Roymans/Tol 1996, 42; Roymans *et al.* 1998, 53-54. Some close analogies from Noord-Brabant: Verwers 1998-9, 268-269.

67 The site has only been published in preliminary reports, a final report being prepared by Henk Stoepker.

68 Although several other burial sites are known in and around Sittard, we shall not go into the details of these. Those interested are referred to Van Hoof 2000.

69 Only two Iron Age bone assemblages are known from southern Limburg, both from old river beds. One of these assemblages was found just south of the town of Geleen (Hiddink/De Boer 2005).

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