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13 Hazendonk layers over and over again

Luc Amkreutz
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Milco Wansleeben

13.1 Introduction

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

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

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

13.2 A history of the riverdune research

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

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

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

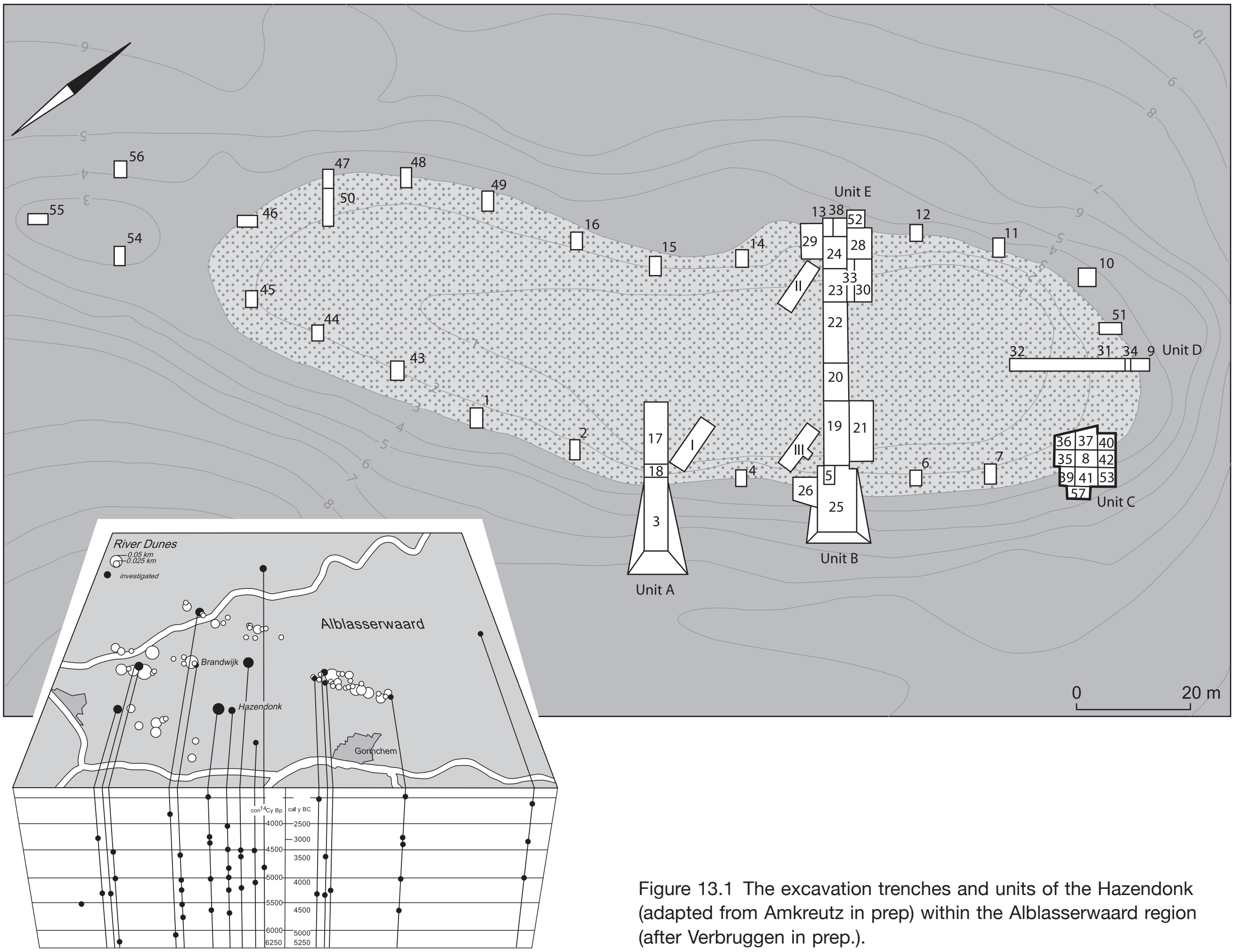

Figure 13.1 The excavation trenches and units of the Hazendonk (adapted from Amkreutz in prep) within the Alblasserwaard region (after Verbruggen in prep.).

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

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

13.3 Technological optimism

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

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

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

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

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

13.4 Unraveling the Hazendonk

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

13.4.1 Stratigraphy

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

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

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

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

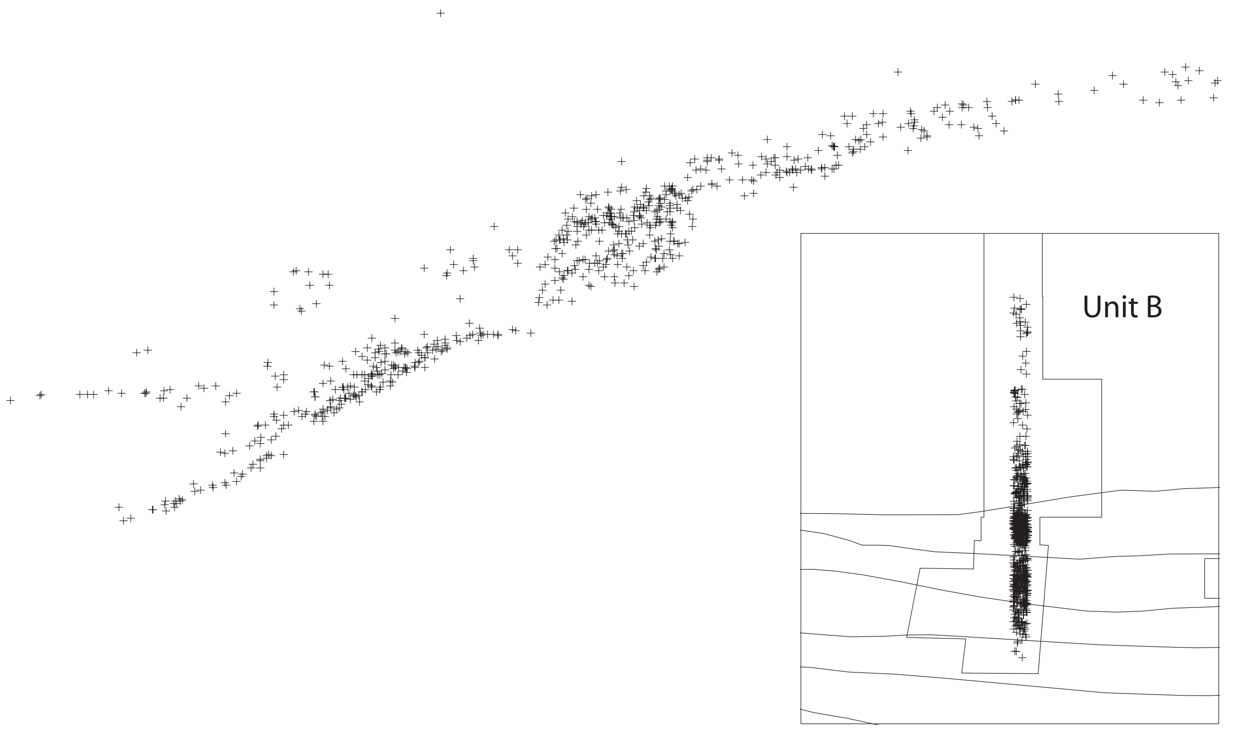

Figure 13.2 A section of the Hazendonk with individual finds plotted as a 3D 'point cloud'.

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

13.4.2 Lithology

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

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

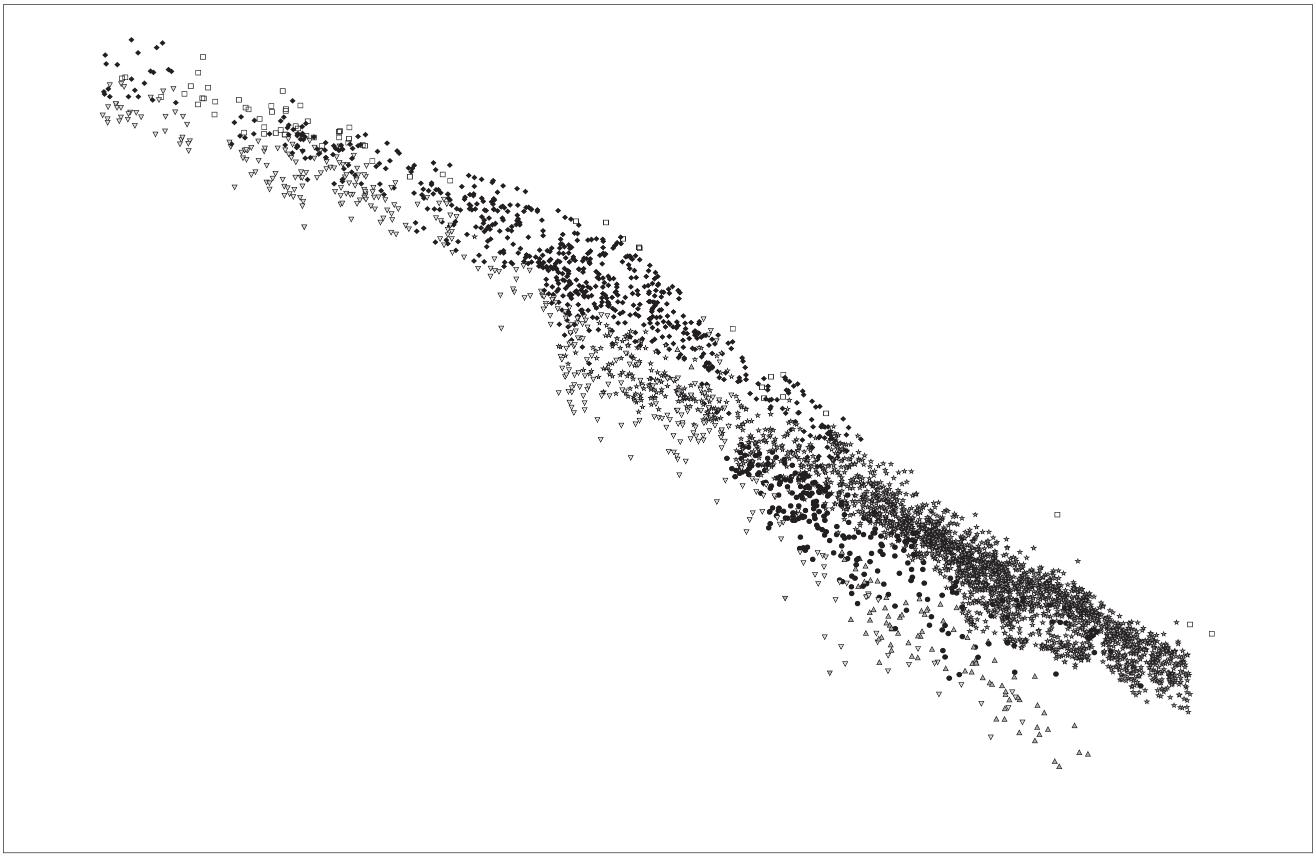

Figure 13.3 Artifacts plotted as points for the excavation at Brandwijk. Different symbols represent different lithological layers.

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

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

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

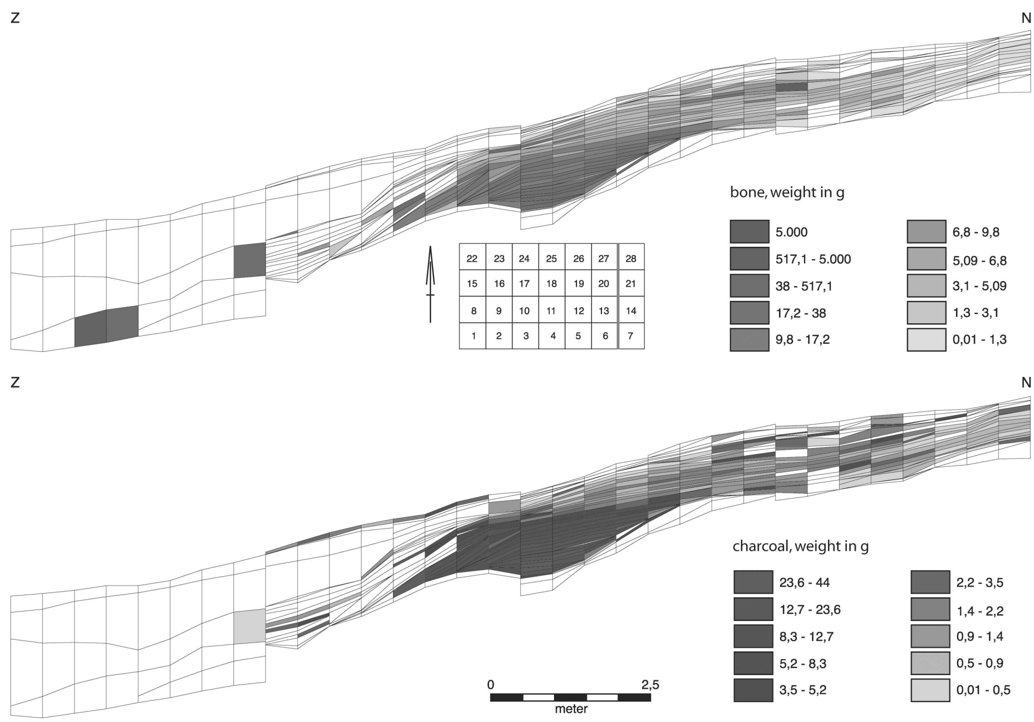

Figure 13.4 Find density (in weight) for bone and charcoal as recorded for a profile of Hardinxveld-Giessendam Polderweg (adapted from Louwe Kooijmans/Mol 2001).

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

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

13.4.3 Typology

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

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

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

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

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

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

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

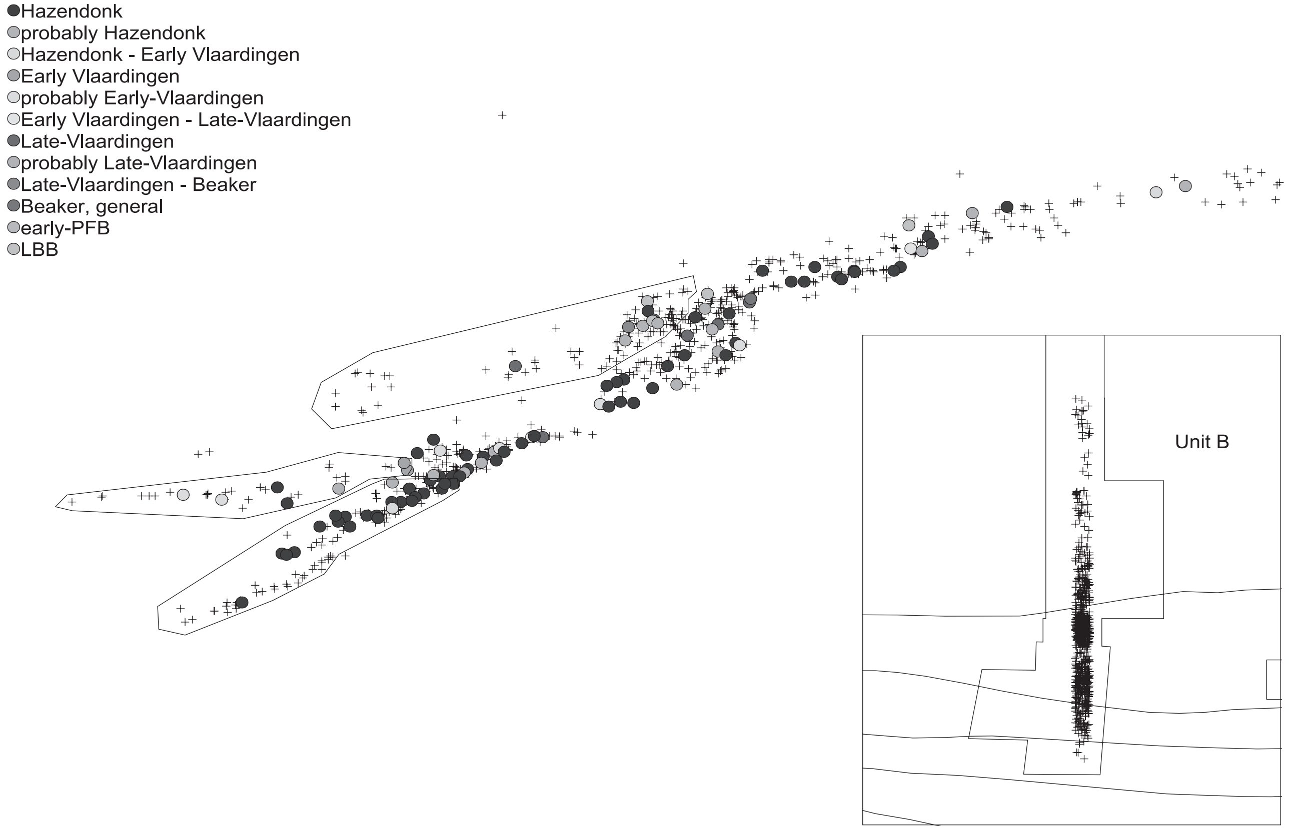

Figure 13.5 Section as plotted with the now digitally available dataset: the artefact positions and typologically dated pottery guided the original excavator in distinguishing phases (encircled levels).

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

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

The effect of this admixture can best be illustrated with two heavily-debated vessels (fig. 13.6). Vessel a consists of 9 sherds. According to Verhart (pers. comm.) the vessel should typologically be attributed to the Hazendonk phase 2, while Raemaekers (1999) argues in favour of an attribution to the Hazendonk phase 2/3. On the basis of the new attribution to the phases, two sherds of the refit could be attributed to the Hazendonk phase 3, while the others could not be attributed at all, mainly favouring the dating by Raemaekers. Vessel b consists of 18 sherds. According to Raemaekers (1999) the vessel should typologically be attributed to the Hazendonk phase 3, while Verhart opts for phase 2. The refits indicate that two sherds could now be attributed to Hazendonk 2, while the others could not be attributed at all. In this case the attribution by Verhart would be favoured. These examples serve to show the relativity of the typological arguments over stratigraphical or lithological attributions. With respect to pottery, refits and typological characteristics can be used to arrive at a correct attribution, but it is evident that for instance stone tools, faunal remains and botanical data often lack these opportunities. For those categories (see for example Zeiler 1997), there is no additional chronological characteristic that can be used for confirmation.

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

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

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

13.5 The possibilities for a ceramic case-study anno 2007

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

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

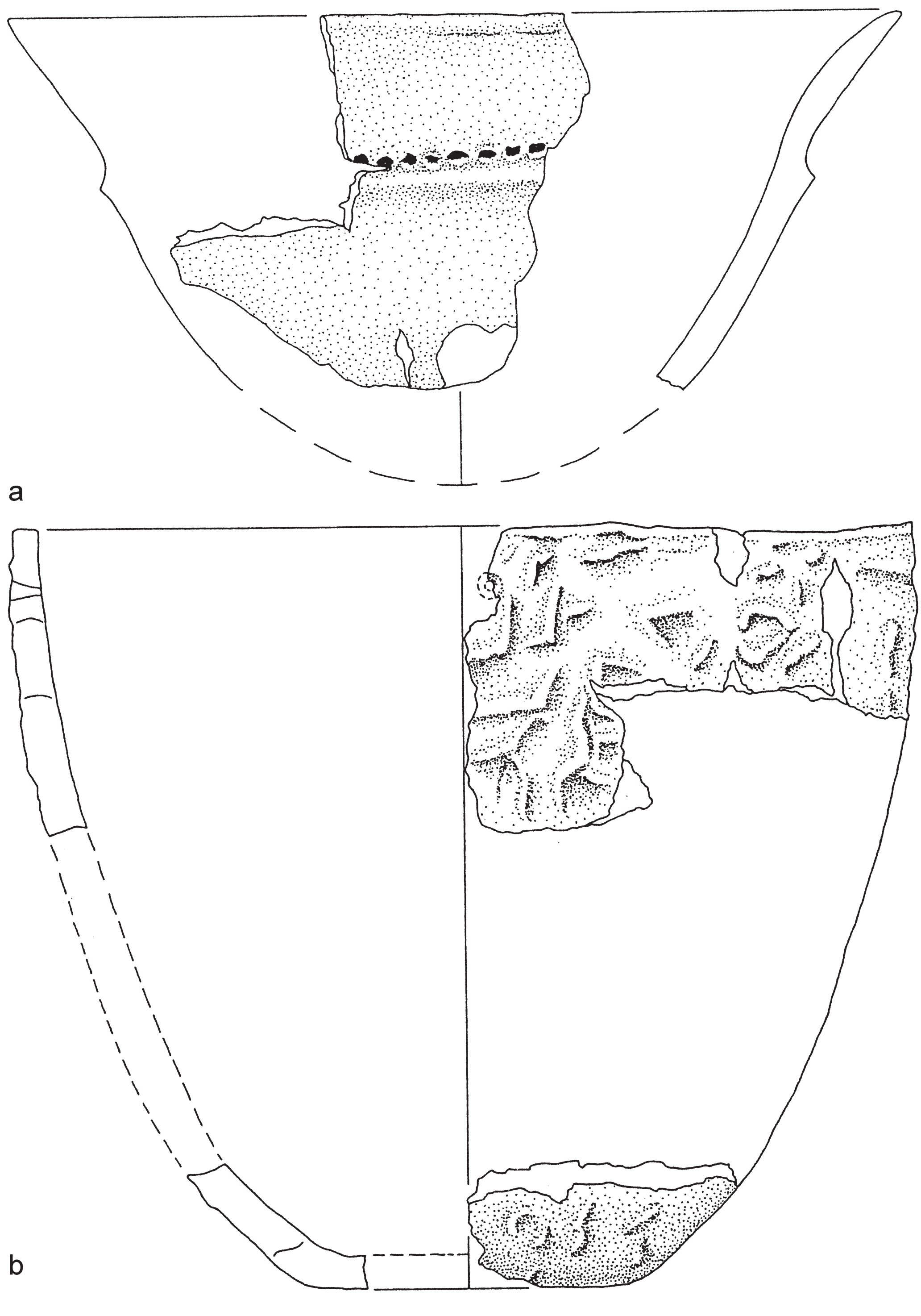

Figure 13.6 Heavily debated vessels for Units C of the Hazendonk: did they belong to the Hazendonk 2 or 3 phase? (scale 1:2)

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

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

13.5.1 Temper

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

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

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

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

13.5.2 Decoration

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

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

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

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

13.6 Conclusion

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

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

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

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

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

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

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