The Organisation of Flint Tool Manufacture in the Dutch Bandkeramik

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In the first part of this study a model for the process of Bandkeramik flint tool manufacture will be presented. The socio-economic structure of flint knapping in the Dutch Bandkeramik Culture will be discussed in the second part.
In Elsloo and Beek the domestic mode of production prevailed. Moreover, a Principal Components Analysis provided evidence for the existence of specialised flint knappers, working in a loose mode of production. Finally, the occurrence of a supralocal mode of production could be inferred.

To P.J.R.Modderman

1. Introduction

The Dutch Linearbandkeramik settlements form the north-westernmost part of the culture's total settlement area. They are predominantly situated on the loess-covered river terraces in the province of Limburg, the southernmost part of the country. Inhabitation started here at about 4400 bc in radiocarbon years, i.e. at about 5300 B.C. after calibration (Modderman 1982). In other words: the Oldest LBK pottery (the so-called Quitta Stufe 1 material) has not been found. The region was settled by people with the subsequent Flomborn ware (Modderman 1970, 1985). These settlements were therefore started at about the same time as those on the Aldenhovener Platte (Lüning 1982), and considerably earlier than those in the Belgian Hesbaye (Cahen, Caspar, Otte 1986). Habitation lasted for approximately 350 years and ended rather abruptly. Extremely little is known of the succeeding cultures (Louwe Kooijmans 1980, Brounen 1985).
At the moment thirty-five LBK sites are known, twenty-eight of which are clustered on the so-called Graetheide, a loess plateau situated between the Geleen brook and the river Meuse. The two sites on the west bank of the river Meuse belong to another settlement group, which has its centre in Belgium. The nearest neighbours to the east are located at a distance of some 30 km, on the Aldenhovener Platte (Bakels 1978, Lüning 1982). The five sites in the north lie on a different substrate, i.e. sandy and loamy soils, in a river valley landscape. These may possibly represent short-term activities outside the normal site territories (Bakels 1982).
Four of the settlements on the Graetheide were extensively excavated: Sittard, Geleen, Elsloo, and Stein (Modderman 1958-1959, Waterbolk 1858-1959, Modderman 1970). The others are known only from surveys and small-scale rescue excavations. Most of the sites are located along the edges of the plateau. In the southern part a clear pattern of site territories is visible. They vary in size from 60 to 170 hectares and are surrounded by natural boundaries such as water courses and dry valleys (Bakels 1982, *fig. 4*).
The villages and the fields belonging to them were situated in a primeval forest, where lime was the most common species (Bakels 1978). In Sittard, Geleen, and Stein between three and six houses were inhabited at the same time. In Elsloo, the largest and best-analysed village, a different situation prevailed, in which eleven to seventeen houses stood together contemporaneously (Modderman 1970, Van de Velde 1979, Modderman 1985).
Most raw materials were available within the sites' territories. Notable exceptions were the rocks used for adzes (which could not be found within a six hours' walking distance) and flint (which occurred just to the south of the Graetheide plateau (Bakels 1978, 1983). Refer to Modderman (1985) and De Grooth and Verwers (1984) for a more detailed summary.

2. The data

For the present study flint material from two Dutch Bandkeramik sites was analysed: Beek-Kerkeveld and Elsloo.
In Beek fifteen rubbish pits and several postholes were found in the spring of 1976 during small-scale rescue excavations at a new building estate by members of the 'Heemkunde Vereniging Beek'. They can all be dated in Modderman's (1970) Phase IIc, i.e. in a late phase of the Younger LBK.
Two of the rubbish pits contained a singularly large amount of flint waste. Pit B-k 7 was an elongated loam pit such as regularly found alongside Bandkeramik houses. The other, pit B-k 8, situated at about 2,5 meters to the north-east, had an irregular shape. Both were covered with about 75 cm of colluvium. During the rescue excavation

the distribution of the finds within pit 8 could unfortunately not be observed. In pit 7 most of the rubbish was found in the north-western part, in the topmost 20 cm of the pit filling. Soil samples from both pits contained hundreds of chips (pieces smaller than 15 mm), indicating that flint was worked in the immediate surroundings of the pits, probably in the open space between them. Not including the chips there were 4899 flint artefacts found in both pits together, with a total weight of almost 51 kg. Tools (hammerstones and hammerstone fragments included) formed about 1% of the assemblage.

The material was eminently suitable for refitting. General descriptions of this method are provided by Cahen (1976) or Cziesla (1986), for example. Here it was mainly used to reconstruct the original reduction sequences of the different nodules worked. The method also provided helpful information on the formation process and the subsequent transformations of the archaeological record (Schiffer 1976, 1985). First, it showed that the two pits were open at the same time, as both contained debris from the same nodules (a total of ten such refits were found). It also made clear that both pits contained material that had originally been discarded in the same way: In general, waste from all stages of production was discarded in either of the two pits. Occasionally a single flake or core ended up in the adjacent pit. The quantitative distribution of waste over the two pits at first seemed to indicate a different pattern: core preparation taking place mainly close to pit 7 and blade production at pit 8 (*table 2*).

Table 3, however, giving the average weight of the waste categories, shows that while mainly big preparation flakes, originating from the first knapping stages, were collected from pit 8, pit 7 yielded not only these big pieces, but also many small preparation flakes, stemming from subsequent corrections during blade production.

Thus, the difference does not seem to be the result of former differential discard patterns, but of our recent excavation method. Pit 7 could be excavated in a somewhat more leisurely way than was pit 8, to the detriment of the latter's small finds. So, unfortunately, the Beek material is of limited direct quantitative use.

Again, refitting provided an excellent remedy, as it allowed for estimates of the amount of nodules worked and the rate of preservation of the find complex. The two Beek rubbish pits contained the waste of at least twenty-five different nodules, with a total of sixteen cores (including hammerstones) still present.

Beek-kerkeveld was the first Dutch Bandkeramik settlement known where, besides the common 'Rijckholt' flint, the coarse grained Valkenburg flint was worked as well (Bakels e.a. 1977, see below for a fuller description of these two types of raw material). The two flint types were unevenly distributed in the pits: pit B-k 8 contained 99%

Table 1

type	pit	B-k	7	pit	B-k	8	N
	R	V	O	R	V	O	
cores	4			4	1		9
hammerstones	3			3		1	7
hammerstone fragments	7			2			9
preparation flakes	629	6		210	364		1209
preparation blades	11			4	17		32
rejuvenation flakes	80	1		29	69		179
rejuvenation blades	19	1		16	15		51
blocks	35	1		14	37		87
flakes	891	5		402	867		2165
blades, entire	106	2		71	117	1	297
blades, proximal	111	1	4	105	198	1	420
blades, medial	46		1	35	65	1	148
blades, distal	81		1	62	98		242
arrowheads	1			2			3
borers			1	2		1	4
end-scrapers	5		1	9	5		20
sickle blades				2			2
end-retouched blades	1			1	1		3
side-retouched blades	1			6			7
side-scrapers				1			1
splintered pieces	1				2		3
retouched flakes					1		1
total	2032	17	8	980	1857	5	4899

Table 1 Beek-kerkeveld, flint assemblage from pits 7 and 8; R = Rijckholt flint, V = Valkenburg flint, O = other flint types (mainly Rullen and 'light grey Belgian', with some pieces of unidentified flint), N = row totals.

Table 2

type	Pit B-k 7 Rijckholt		Pit B-k 8 Rijckholt		Valkenburg	
	N	%	N	%	N	%
cores/hammerstones	7	0.4	7	0.7	1	0.1
preparation pieces	640	32.3	214	22.7	381	22.0
rejuvenation pieces	99	5.0	45	4.9	84	4.6
flakes	891	45.0	402	42.7	867	47.9
blades	344	17.4	273	29.0	478	26.4
total	1981	100.1	941	100.0	1811	100.0

Table 2 Beek-kerkeveld: distribution of flint waste

Table 3

type	Pit B-k 7 Rijckholt		Pit B-k 8 Rijckholt		Valkenburg	
	W	av.W	W	av.W	W	av.W
cores/hammerstones	1795	256.4	2116	302.3	60	60.0
preparation pieces	9732	15.2	5745	26.9	10881	28.6
rejuvenation pieces	3741	37.8	1566	34.8	4592	54.7
flakes	2106	2.4	785	2.0	2469	2.8
blades	1068	3.1	1060	3.9	1864	3.9
total	18442 g		11272 g		19886 g	

Table 3 Beek-kerkeveld: weight of flint waste

of the Valkenburg variety as opposed to 32% of the Rijckholt flint. Refitting showed that both types of flint were worked with the same methods. The efforts in refitting were concentrated on the Rijckholt material, its nodules being more easily identifiable than the very uniform Valkenburg ones. Thus six nodules could be reconstituted to a great extent. They produced between 0 and 80 blades. Not including the chips the estimated total debitage of these cores varied between 10 and 250, with a mode of 150-200.

Direct extrapolation of these figures for the minimum of twenty-five nodules knapped close to the two pits, would suggest that all the material originally present was preserved and recovered on the spot, as twenty-five nodules would have given a total debitage of 3750-5000 artefacts. The actual rate of preservation as derived from the number of waste pieces belonging to the reconstituted cores, however, is about 50%. Thus, the minimum estimate of twenty-five nodules is much too low. It seems probable that the remains of perhaps as many as fifty nodules, closely resembling each other and therefore unidentifiable, are present in the debris.

The good state of preservation seems to be due to the thick colluvial layer that prevented erosion. The date of its formation is unknown, but in the lower part of it a fragment of a Middle Neolithic polished axe was found.

Such good preservation conditions did not prevail in Elsloo. Here, owing to erosion and large-scale mechanical excavation methods, 5-10% at the most of the material originally present was recovered. This figure seems so be constant all over the site.

In terms of the relative importance of flint working, comparisons between Elsloo and Beek (or more generally speaking between all Bandkeramik sites or even between different pits within the same site) are only valid if these differences in recovery conditions are taken into account.

The total area of the Elsloo site is estimated to be ten hectares, of which one-third has been excavated, exposing the remains of 95 houses. Twenty-six of these can be dated in the Older LBK, 56 in the Younger Period. Extrapolating for the whole site, some 200-250 houses must have been built in the course of time. In the Older LBK the village occupied an estimated area of 2-3 hectares, almost completely uncovered, with up to eleven houses standing at the same time. In the Younger LBK the settlement expanded over a much larger area, of which only about one-third has been excavated. In the younger phases as many as seventeen houses must have stood contemporaneously (Modderman 1970, 1985). The internal relative chronology, based on stratigraphical observations, the development of house plans, and pottery decoration, was first outlined by Modderman (1970). Later, Van de Velde's (1979) analysis led to a subdivision in ten microphases, each representing one house generation. As the total lifespan of the village

Table 4

type	ceramic phase 1	2	3a	3b	4	5	total
cores	27	9	8	8	15	11	78
hammerstones	36	13	7	33	13	20	122
hammerst.fragments	51	26	30	62	13	31	213
preparation pieces	540	196	84	423	76	109	1428
rejuvenation pieces	130	49	41	130	34	62	446
flakes	791	400	254	872	234	450	3001
blades	177	115	97	413	149	258	1209
blocks	38	24	8	35	17	23	145
arrowheads	4	1	3	10	2	4	24
borers	4	1	7	8	7	6	33
end-scrapers	59	39	33	166	38	73	408
sickle blades	16	6	9	35	16	21	103
end-retouched blades	1	2	3	6	5	2	19
side-retouched blades	7	2	2	16	3	7	37
splintered pieces	9	1	7	5	2	7	31
burins	0	0	0	1	0	0	1
retouched flakes	3	1	0	0	0	0	4
side scrapers	10	4	2	4	2	3	25
heavy implements	1	0	0	0	0	0	1
total	1904	889	595	2227	626	1087	7328

Table 4 Elsloo, frequencies of artefacts from dated pits

Table 5

type	ceramic phase 1	2	3a	3b	4	5	total
cores	1.4	1.0	1.3	0.4	2.4	1.0	1.1
hammerstones	1.9	1.5	1.2	1.5	2.1	1.8	1.7
hammerst.fragments	2.7	2.9	5.0	2.8	2.1	2.9	2.9
preparation pieces	28.4	22.1	14.1	19.0	12.1	10.0	19.5
rejuvenation pieces	6.8	5.5	6.9	5.8	5.4	5.7	6.1
flakes	41.5	45.0	42.7	39.2	37.4	41.4	41.0
blades	9.3	12.9	16.3	18.6	23.8	23.7	16.5
blocks	2.0	2.7	1.3	1.6	2.7	2.1	2.0
tools*	6.0	6.4	11.1	11.3	12.0	11.3	9.3
total	100.0%	100.0%	99.9%	100.2%	100.0%	99.9%	100.1%

Table 5 Elsloo, percentages of main artefact categories from dated pits.
*tools other than hammerstones and - fragments

was 300-350 years, every house generation could have lasted 25-35 years, a time that corresponds vey well with estimates based on the durability of building materials (Bakels 1978, Lüning 1982).
In his initial chronological ordering Van de Velde divided the material into six ceramic phases, but in his further research he worked with five phases (numbered 1 through 5), whereby the two middle phases were grouped together . In this periodisation the traditional division between Older and Younger LBK falls somewhere in the middle of Phase 3. As this division may be meaningful in terms of flint working techniques, I will use the original six-fold division in this study, redividing Phase 3 into 3a and 3b according to Van de Velde 1979, fig. 17, for the general presentation of the data, and the 10 microphases (numbered 0-9) in the more detailed analyses.
The houses at Elsloo are clustered into three or four house groups, or wards, showing continuity over time. Each ward consisted of houses of different kinds. There was always one tripartite longhouse present (Modderman's (1970) type 1: Grossbauten), as well as several bipartite (type 2: Bauten) and single-unit (type 3: Kleinbauten) houses. In the course of time the house groups moved gradually, some of them vanishing from the excavated part of the settlement, and others coming in. Those house groups might represent the dwelling areas of different lineages within the social formation. Thus, Elsloo seems to have been inhabited by three or four different lineages, whereas the smaller sites on the Graetheide can be interpreted as settlements of a single lineage (Van de Velde 1979, 1986). Every house was surrounded by its own activity area. As the average distance between houses within the clusters was 25 m, the average farmstead could have had a radius of 12 m around the house. Habitation in Elsloo was even denser and more clustered than in Langweiler 8 on the Aldenhovener Platte, where an estimated radius of 25 m was found (Lüning 1982). In other Bandkeramik settlements, however, much more space was available for every farmstead: in Darion only two or three houses occupied contemporaneously a settled area of approximately 1.8 hectares (Cahen 1985). Supporting this theory of a very dense habitation is the fact that in Elsloo, unlike Darion or Langweiler 8 and other Aldenhovener Platte sites, most of the refuse was found in pits dug alongside the houses.
The data set used in this study consists of the flint material found in 218 rubbish pits, belonging to 75 houses, dated according to Van de Velde. One hundred thirty-four unassignable and undated pits with flint were not analysed. They contained less finds than did the house-pits (house pits: median 10, maximum 511 ; undated pits: median 6, maximum 122; pits without flints in both cases excluded. The median was chosen as measure of central tendency because of the markedly skewed frequency distributions). In *tables 4* and *5* the distribution of the different artefact categories is summarized (to be discussed more fully in the subsequent paragraphs).

3. The process of Bandkeramik flint working

The manufacture of flint tools is a reductive process that can be summarized in a flow model in the following way (see *fig. 1*, modified and adapted from Collins 1975, fig. 1). Seven activity sets can be distinguished (outlined with rectangles). Every activity produces its own characteristic product groups. These are outlined with parallelograms. Blanks intended for further reduction are listed on the left, waste pieces on the right. In practice, however, many stages in the process can be skipped. Decortication flakes, for example, were shaped into tools, many blades were utilised without further trimming and cores often served as hammerstones.
Two rather important feedback loops exist in this model: the correction and rejuvenation of cores, and the recycling of worn implements. These can either be maintained in their original function or modified into other tools. Transportation is possible after each stage in the process, e.g. the transport of nodules from an extraction site into the settlement, or of retouched tools to the places where they were used.
Because every step in the process produced its own characteristic waste, the study of the debris found at a given site allows us to reconstruct the manufacturing steps performed there, provided the relation between the former activity area and the discard area is known, as well as what happened to the material after disposal (Schiffer 1976, Schiffer 1985).
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 lower layers some accidentally washed-in surface material from all stages previous 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 in press a).
The analysis of the data from Beek and Elsloo made it possible to give for Dutch Bandkermik flint working the following step-by step description of the reduction process.
1. Acquisition of raw material.
The nearest sources of raw material were the gravel beds of the river Meuse. The heavily-rolled nodules found there were full of hidden cracks and were consequently rarely used. Most flint was acquired in the limestone area south

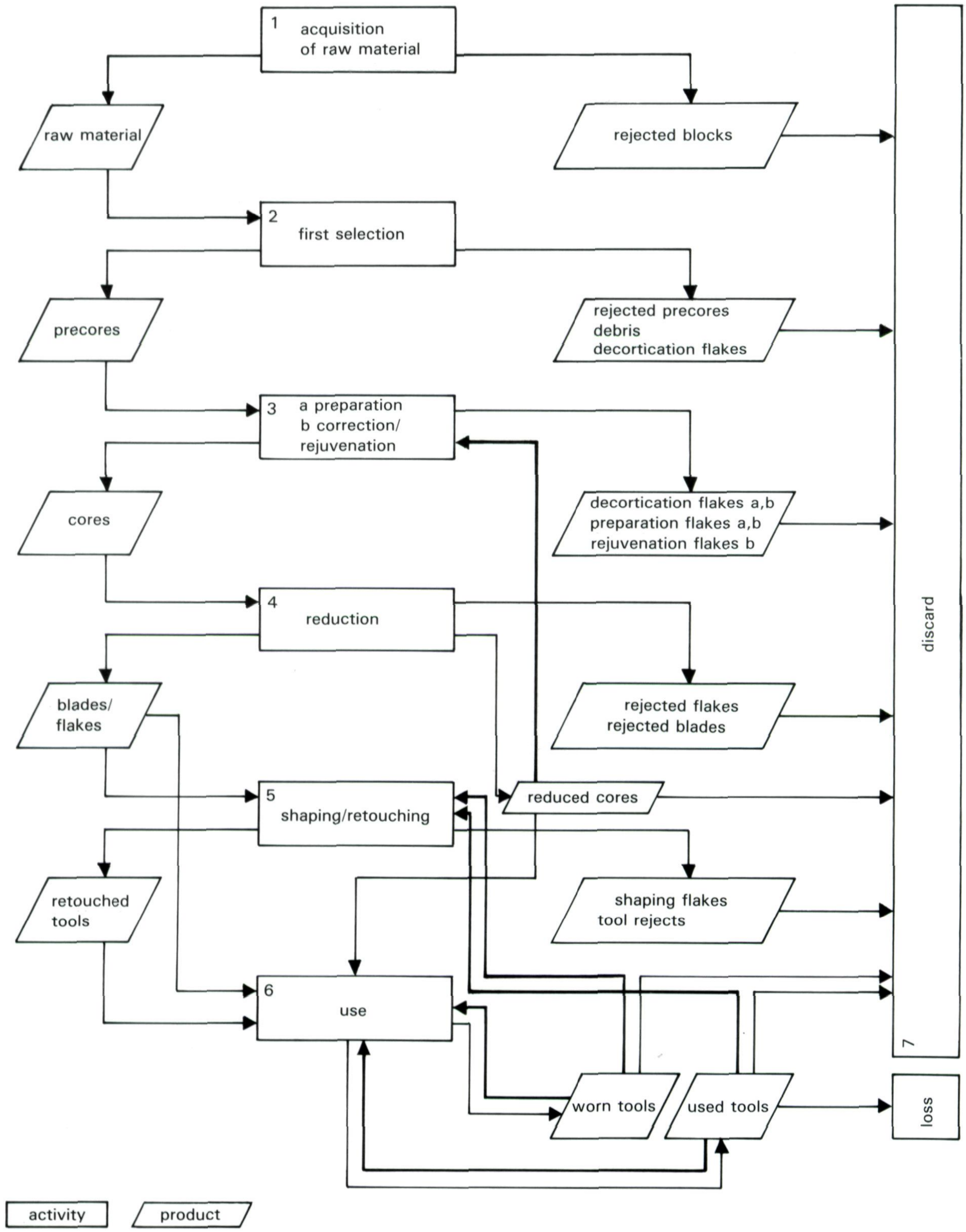

Fig. 1 Flow model for bandkeramik flint manufacture

Fig. 2 Beek. Different reduction stages from reconstituted nodule 1.03; top. first preparation; bottom. first rejuvenation, second rejuvenation, final core. 1:2.

of the river Geul, at a distance of 10-15 km, i.e. between two and three hours' walking distance from the villages. As their slightly weathered cortex shows, many nodules were collected from residual slope deposits. Others, possessing a fresher cortex, may have been broken out of the chalk in some form of open-cast mining (Bakels 1978). No Bandkeramik extraction sites are known, however.
In this area two types of flint were collected: the well-known Rijckholt flint from the Gulpen Formation and the Valkenburg flint from the Maastricht Formation overlying the Gulpen chalks. Both belong to the Younger Cretaceous 'Maastrichtian' and have more or less the same distribution (Felder 1975a). Rijckholt flint varies in colour between light grey and greyish black, the colour being seldom uniform, even in the smaller pieces. Within the range of the greys there are larger and smaller blots and smears. In addition, the grey contains many white dots. As the weathering of the pieces increases, the colour becomes lighter. The aspect of the fractures varies from smooth to slightly granular (Bakels 1978). The Valkenburg flint is light grey to bluish grey in colour and completely opaque, the grey often containing white dots. Valkenburg flint is coarser grained than the Rijckholt material. Fractures generally have a very granular look, though they may be relatively smooth to the touch (Felder 1975b). In most Dutch Bandkermik sites Rijckholt flint was used almost

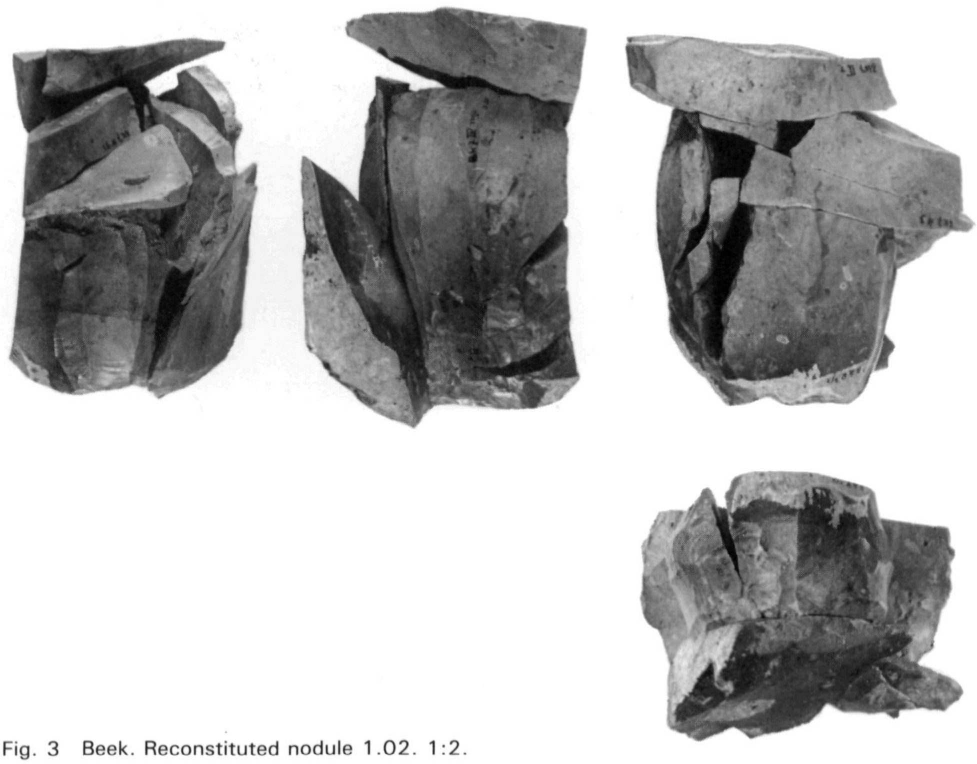

Fig. 3 Beek. Reconstituted nodule 1.02. 1:2.

exclusively. As stated above, in Beek-kerkeveld Valkenburg flint was worked extensively, with the same techniques that were used on the Rijckholt material. A small proportion of Valkenburg flint was found in Elsloo (0.7%, cf. *table 6*) as well as at other Graetheide sites. The same applies to the Aldenhovener Platte (Zimmermann 1981 and in press).

2.First selection.

The selection of blocks suitable for further reduction took place after they had been brought back to the settlements, as is shown by the presence there of unworked blocks and nodules that were discarded after one or two flakes had been struck off.

3.a Preparation.

The amount of preparation waste clearly shows that preparation of pre-cores was certainly done in the settlements. Sometimes a rough crest was prepared on the core face to guide the first blade (*fig. 4: 1.01*). Striking platforms were made by removal of one or several large decortication flakes. In one case in Beek, eleven preparation flakes were needed before a suitable striking platform emerged (*fig. 6: 2.01*). Crest preparation was not always necessary, preparation of the core face often consisting only of removal of bulges and decortication, with flakes struck from several directions (*fig. 2*). At this stage a large amount of material was removed, clearly indicating that flint was never in short supply. All preparation was done in the hard hammer mode.

4. Reduction.

The preferred blanks were blades, with a length of 8 - 12 cm. Flakes were produced rather often at this stage, however (*table 4, 5*) . Flint-working techniques improved with time, as is witnessed by the fact that blades formed about 9-16% of the assemblage in the Older LBK, increasing to over 23% in the Youngest LBK phases (*table 5*). At this stage of the process the soft hammer mode was used exclusively.

The two Beek rubbish pits contained waste of at least twenty-five different nodules, with a total of sixteen cores (including hammerstones) still present. The reconstructed nodules produced an average of 40 blades each, so a minimum of 1000 blades could have been present. Seven hundred seventeen of these blades (complete and proximal fragments) were discarded, which leaves at least 300 blades, or twelve blades to every nodule, which were transported and used elsewhere. If knapping such a nodule took an average of 30 minutes (Cahen 1984), the two Beek-kerkeveld pits would represent 10–25 hours of work.

3.b Rejuvenation.

The flaking angle of the cores was regularly improved by soft hammer removal of tiny flakes from the striking sur-

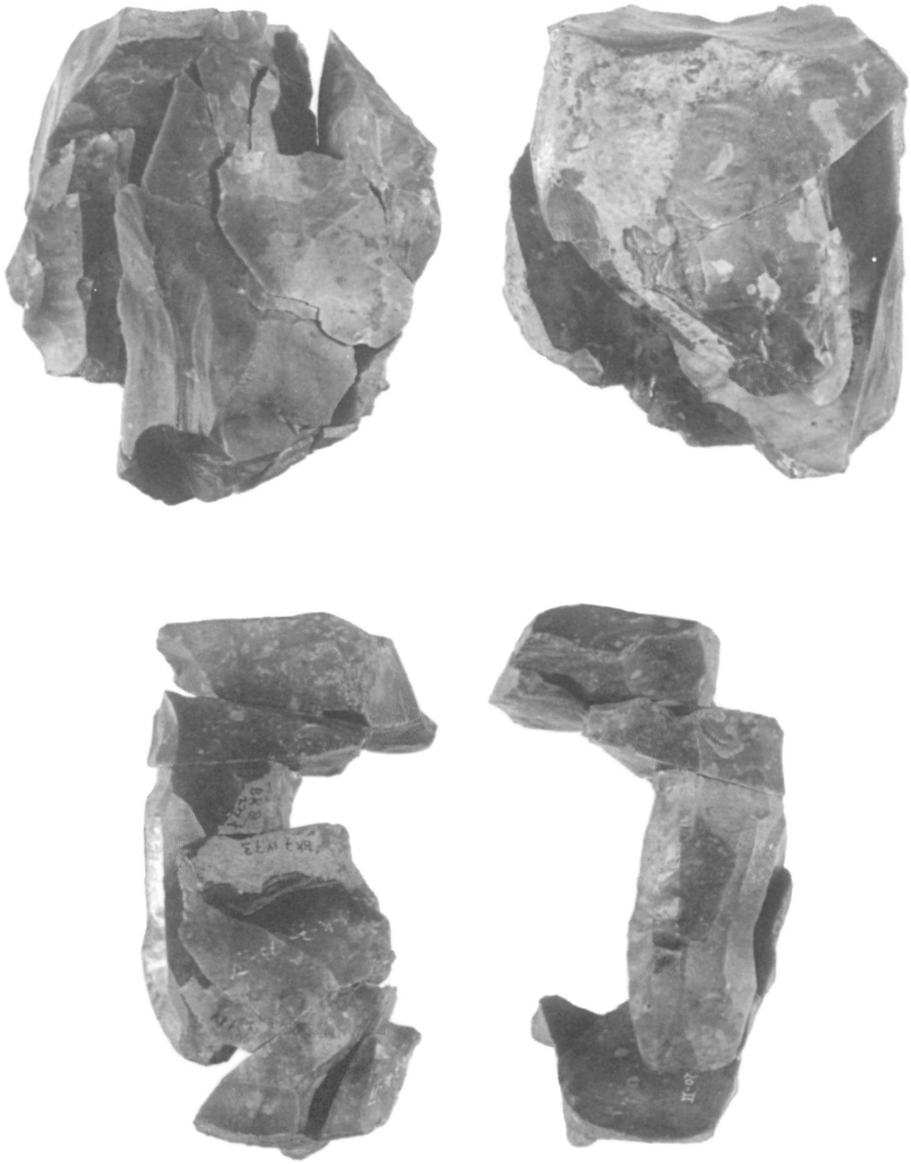

Fig. 4 Beek. Reconstituted nodules 1.01 and 1.04. 1:2.

face (*fig. 7: 2.05*). 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 (*fig. 2)*. The removal of tablets also took care of damages on the upper part of the core face when, owing to a wrong striking angle or irregularities in the flint, hinge fracturing had occurred (*fig. 6: 2.05*). Other damage of the core face was corrected with axial or lateral flanks (Cahen 1984) (*fig. 3*). With both types of core rejuvenation rather a lot of material was wasted. In the course of extensive corrections a second striking platform on another part of the core was sometimes prepared (*fig. 4: 1.04*). Often in these reduction stages a second core face was worked as well, adjacent or opposite to the original one. Careful preparation of the distal parts of the cores occurred in these stages as well, so as to increase the output of good cores. One of the refitted Beek cores showed six subsequent rejuvenation stages. The reduction of ten cores was ended when further correction would cause the core face to become too short. One

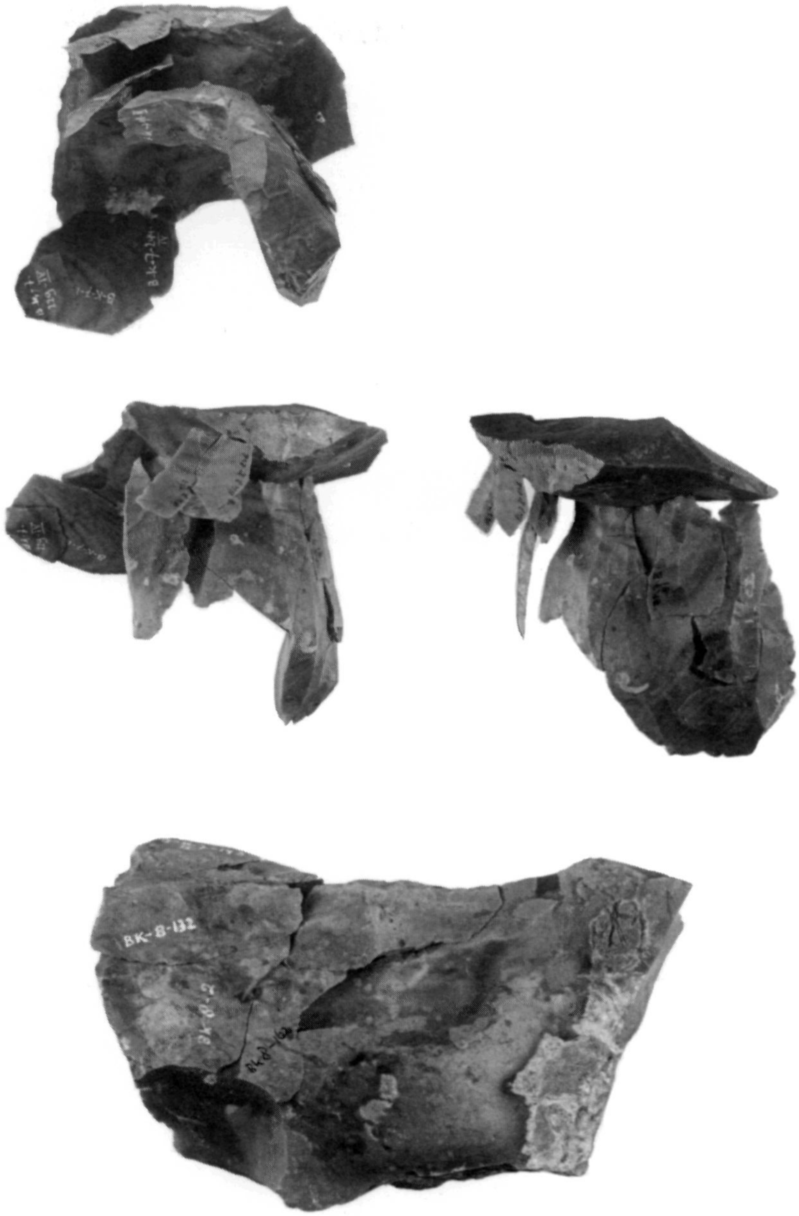

Fig. 5 Beek. Reconstituted nodules 1.05 and 1.06. 1:2.

core was too thin to allow further reduction (*fig. 4: 1.04*), and four cores were worked till they produced only short flakes.

5. Shaping.

Most retouched tools show a direct steep retouch, only arrowheads sometimes displaying bifacial or inverse flat surface retouch. Recycling of worn tools was not a common practice.

6.Use.

At the moment very little is known about the way tools were used. In Dutch Linearbandkeramik rubbish pits the following morphological tool types are found: arrowheads, borers, end-scrapers, side-scrapers, truncated blades, retouched blades, sickle blades, splintered pieces, and hammerstones. Other forms, like burins, denticulates, 'quartiers d'orange' (Cahen, Caspar, Otte 1986) and 'pièces

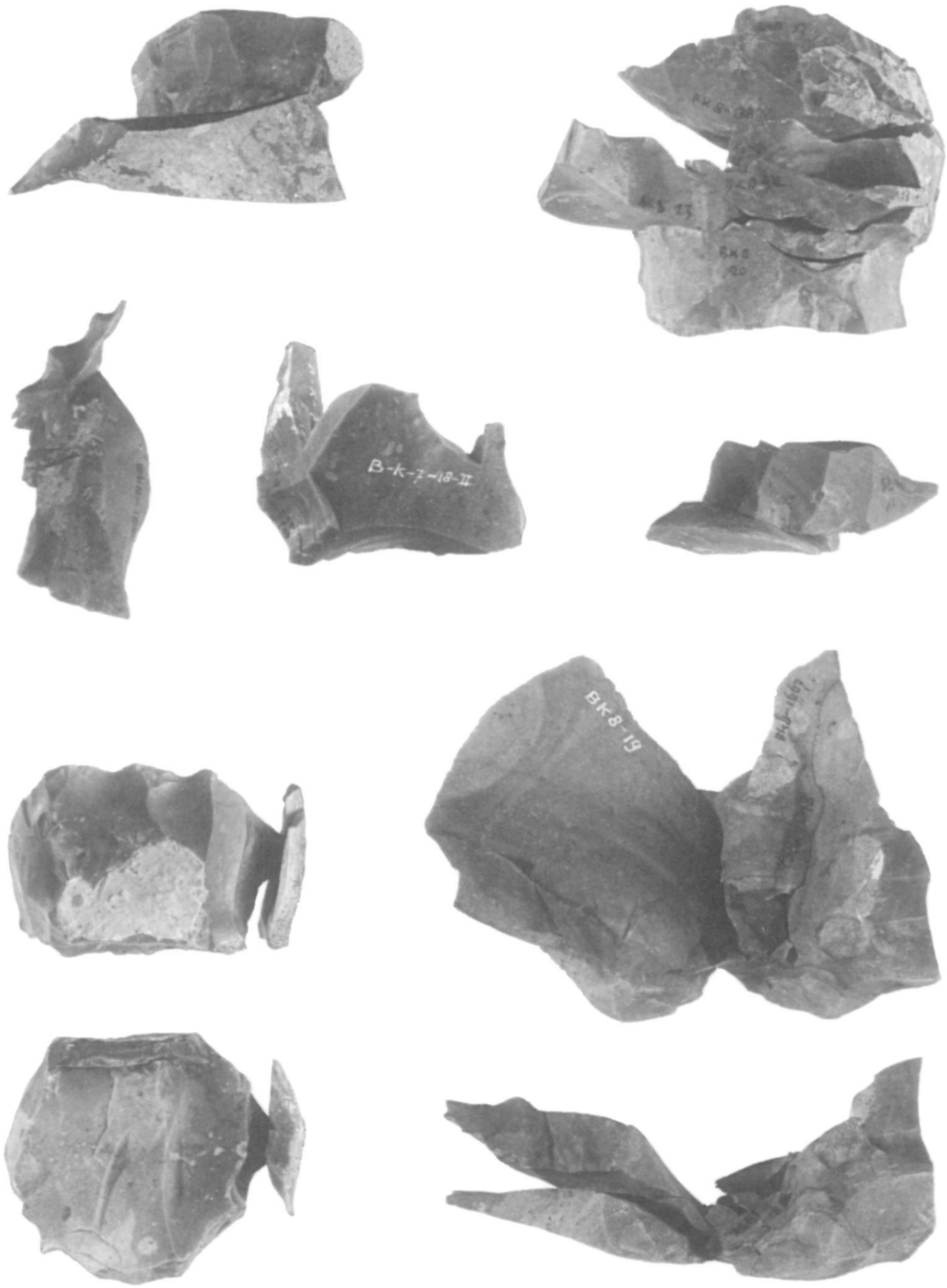

Fig. 6 Beek. Conjoined artefacts from different stages. 1:2. Top: 2.03, 2.05; middle: 2.06, 2.09, 2.07; bottom: 2.01, 2.04

sculptées' (Ulrix-Closset and Rousselle 1982) are all extremely rare if not completely absent (A full, though rather over-detailed typo-morphological description of the material is given by Newell 1970).

At least part of the tools were used close to the place of manufacture. Almost all the tools found in the two rubbish pits in Beek belonged to nodules reduced on the spot, even though none could actually be refitted. Moreover, three out of six refitted cores had been used as hammerstones before being discarded. The secondary function

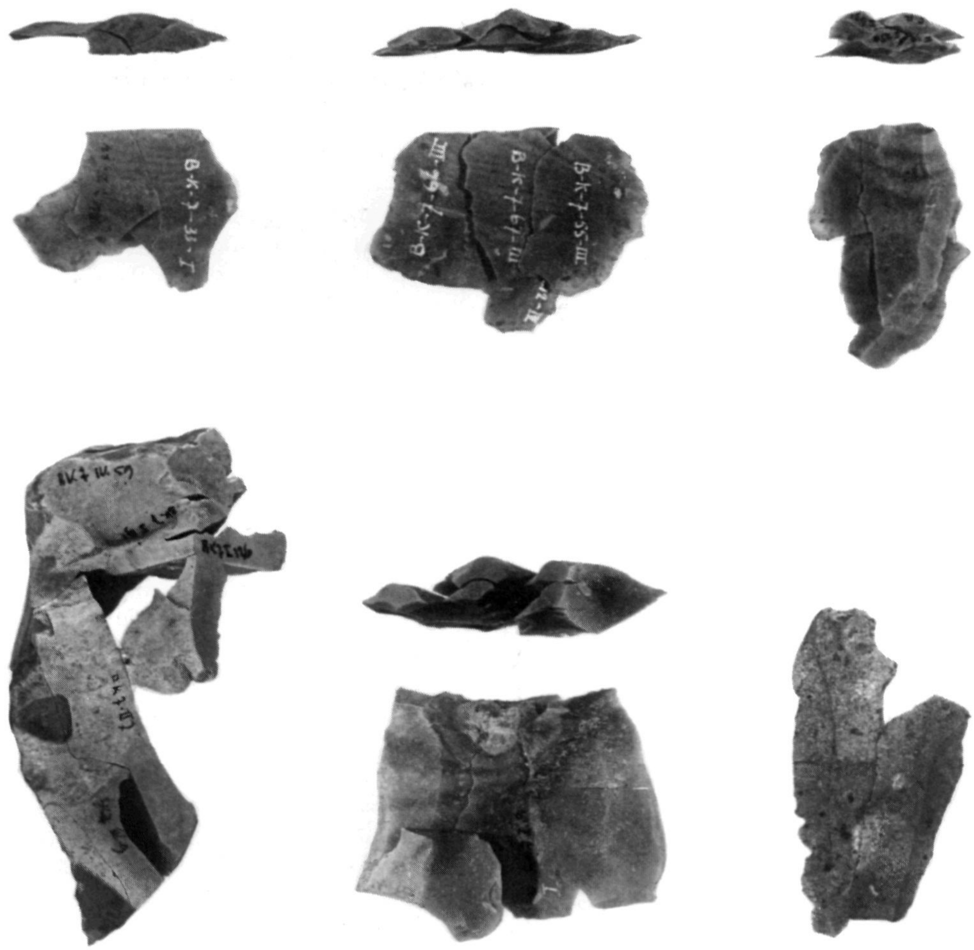

Fig. 7 Beek. Conjoined artefacts from a single production stage. 1:2. Top: 1.05; bottom: 3.01, 3.03, 3.29

as hammerstones of other cores prevented refitting, though the waste belonging to them was present. The same holds true for Langweiler 8 on the Aldenhovener Platte,where an end-scraper and a hammerstone found together could be refitted. (Interestingly the core had been used as a hammerstone before the flake that served as blank for the end-scraper was struck off. After further reduction the core was once more turned into a hammerstone). In another case refitting was possible between a distal blade fragment and a core subsequently used as a hammerstone and discarded in the same pit. In this case about 2 cm of flint were removed during use (De Grooth 1981 and in press a). A preliminary micro-wear analysis of part of the Elsloo flint assemblage being performed by A.van Gijn and her students at the Leiden Institute of Prehistory will shortly provide a better insight in the tools' functions.

7. Discard/Loss.

The manufacturing waste was discarded in rubbish pits close to the area where flint knapping took place. Some of the tools produced landed in those same pits after use. As was mentioned earlier, little can be said about tools lost or discarded as primary refuse in the former cultural layer.

4. The origins of the Dutch Bandkeramik flint industry

Before turning to a discussion of the social context of manufacturing something must be said on the origins of the industry. Comparison of the Dutch material with recently published assemblages from other regions, especially in Central Europe, e.g. Bavaria (Davis 1975, De Grooth 1977), Poland (Kaczanowska and Lech 1977) and Hungary (Biró in press) shows that all of these industries are basically very similar. In the light of this fact it becomes clear that the exceptional position of the Dutch, or more generally speaking, the Rhine-Meuse industry as propounded by Newell (1970) must be reconsidered. I see no reason to adhere to Newell's opinion that this industry is the result of the meeting of local Late Mesolithic groups (now archaeologically known as the De Leijen-Wartena complex) and migrating Bandkeramik people.

5. Socio-economic organisation

This research on the socio-economic structure of Dutch Bandkeramik flint working began with the study of the two rubbish pits in Beek-kerkeveld. The large amount of waste material, combined with the small number of tools (less than 1%) would seem to indicate that tools and blades could have been made here that fulfilled the needs of the whole settlement (De Grooth 1976, Bakels e.a. 1977). A first test of this hypothesis in Beek, however, proved to be negative: the tools and blades found in the site's other rubish pits were not related to the waste in the 'rich' pits. On the contrary, most pits contained preparation and rejuvenation waste as evidence that flint had been knapped in their surroundings as well.
As only a small part of the Beek-kerkeveld site was excavated, this first refutation was not necessarily conclusive. The Liège- Place St.Lambert site, where one pit, containing some 51 kg of extensively refitted debris, was described as an 'atelier de taille' or workshop serving the whole settlement (Cahen 1984), seemed to offer supporting evidence. Here too, however, only a small part of the site (an area of ca 25 x 25 m, with eight Bandkeramik rubbish pits) was excavated, so that little is known about the relationship between the different activity areas within the site. In fact, this kind of problem should ideally be studied in completely uncovered, long-lived settlements, as they are the only ones where structural patterns, i.e. patterns that recur throughout time, can be distinguished from incidental ones. Such sites, unfortunately, are not available on the Graetheide. The excavated part of Elsloo, however, seems to be extensive enough to serve our purpose. In this section, therefore, an analysis in socio-economic terms of the flint from Elsloo will be given.
The socio-economic system of a society can be defined by the different modes of production known to it. For community societies (Fried 1975), i.e. societies with a neolithic level of technological development, Van de Velde has described four relevant modes of production. They are not mutually exclusive and all four are thought to have existed in Bandkeramik villages in general and in Elsloo in particular (Van de Velde 1979). Like other economic activities, the manufacture of flint tools could have been organised according to all four modes of production. Each one would result in a different spatial distribution of flint waste and tools in the settlement and thus could be recognised in the archaeological record, if the transformations in the archaeological record (Schiffer 1976) are accounted for.

1. In the *domestic mode of production* the family, living in a single household, is the unit of production and consumption. Division of labour is based on age and sex alone. If the domestic mode of production prevailed in a settlement, every household (though not necessarily every household member) made its own flint tools, according to its needs. This would have resulted in an even distribution of flint waste and tools over the total settlement area, though within every single farmstead rubbish may have been concentrated in specific activity areas (cf. the pattern outlined for the Aldenhovener Platte settlements in Lüning 1982).
2. In the *lineage mode of production* the unit of production and consumption is formed by a group of related families belonging to the same lineage or 'clan'. Not every person within a given age or sex group has the same rights and obligations. If flint working were mainly organised in this way, one would expect to find for every settlement phase systematic differences in the amount of flint waste per farmstead within the household clusters.
3. The *loose mode of production* is characterised by the existence of 'ad hoc' specialists, functioning because of accidental, non-hereditary skills. The presence of this kind of specialised flint knapper in a community would result in a very high concentration of flint waste belonging to a single farmstead in every habitation phase.
4. Finally, the *supralocal mode of production* was practised when some needs could not be met locally and one had to turn to relatives in other settlements, nearby or distant, for help. In that case, no production waste would occur in the rubbish pits, but only finished tools and suitable blanks.

There is ample evidence for the *domestic* mode of production in Elsloo. Over 7300 flint artefacts have been found in the rubbish pits assigned to datable houses, 86% of which was debris and 14% tools. In every settlement phase, the pits of most houses contained flint waste from all production stages. Even when little flint is present in a house's refuse pits we find preparation and rejuvenation pieces and cores, the most characteristic manufacturing waste. In this respect there exist no obvious differences between settlement phases (*table 5*).
The different modes of production are not mutually exclusive. So, the traces left in the archaeological record by the *lineage* and the *loose* modes of production could be covered and partly obscured by refuse produced in the *domestic* mode. The result would be a multivariate patterning which cannot be readily distinguished by visual inspection or simple statistical aids. Principal Components Analysis (PCA) was chosen as a suitable technique to identify such possible underlying patterns of co-variation in the data-set, as PCA 'rearranges the data to a smaller set of *Factors* or *Components* that may be taken as source

variables accounting for the observed interrelations in the data' (Doran & Hodson 1975; see Harman 1967 for a technical description).
The PCA was performed on the IBM mainframe at the Leiden University CRI with the PRINCOMP and FACTOR procedures available in SAS.
Because we are interested here in the variability between houses and because no indication of differentiation in the intensity of flint knapping within the farm-yards could be found, the contents of all rubbish pits associated with a hut were lumped together to provide better samples. A frequency diagram of the number of flint artefacts per pit shows a Poisson-like distribution for pits with fewer than 6 pieces, such as would be the result from accidental waste accumulation. To minimize the influence of such 'noise', only pits with at least 5 flint artefacts were included. Thus, seventy-one houses could be used as the cases in the analysis.
Specialisation in flint working as outlined above would be visible either in a bipolar Principal Component (PC), with preparation/rejuvenation waste and tools/blades showing opposite high loadings; or in specific PC's for the waste material on one hand and blades and tools on the other; or in a combination of both patterns. If such PC's (interpretable in terms of production vs consumption of flint tools) could be identified, then in a subsequent step, the cases that show many of the characteristics compounded by those PC's could be found through computing their so-called 'factor-scores'. The final step is to try and interpret the results in terms of habitation phases and house-groups and see how they fit in with the hypotheses.
Initially the PCA was performed with all variables. The SAS default mineigen criterion selected 8 PC's, with 66% of the variation accounted for. The scree plot indicated a major jump between the 4th and 5th PC (42 % of the variation). It was decided to retain the first 4 PC's, as the rest had only single variables loading on them. That gave the following summary of the factor pattern:

	PC 1	PC 2	PC 3	PC 4
cores	-0.05	-0.24	0.38	-0.01
hammerstones	0.72	0.52	-0.06	0.16
hammerst.fragments	0.21	0.16	-0.34	0.22
blocks	-0.35	0.15	-0.42	-0.09
arrowheads	-0.07	-0.04	0.42	0.07
borers	-0.22	0.36	0.19	-0.58
end-scrapers	-0.53	0.18	0.21	0.22
sickle blades	-0.25	-0.09	0.05	0.47
end-retouched blades	-0.28	0.47	0.15	-0.53
side-retouched blades	0.56	0.63	0.03	0.07
splintered pieces	-0.23	0.22	-0.32	0.09
burins	-0.11	0.08	0.24	0.08

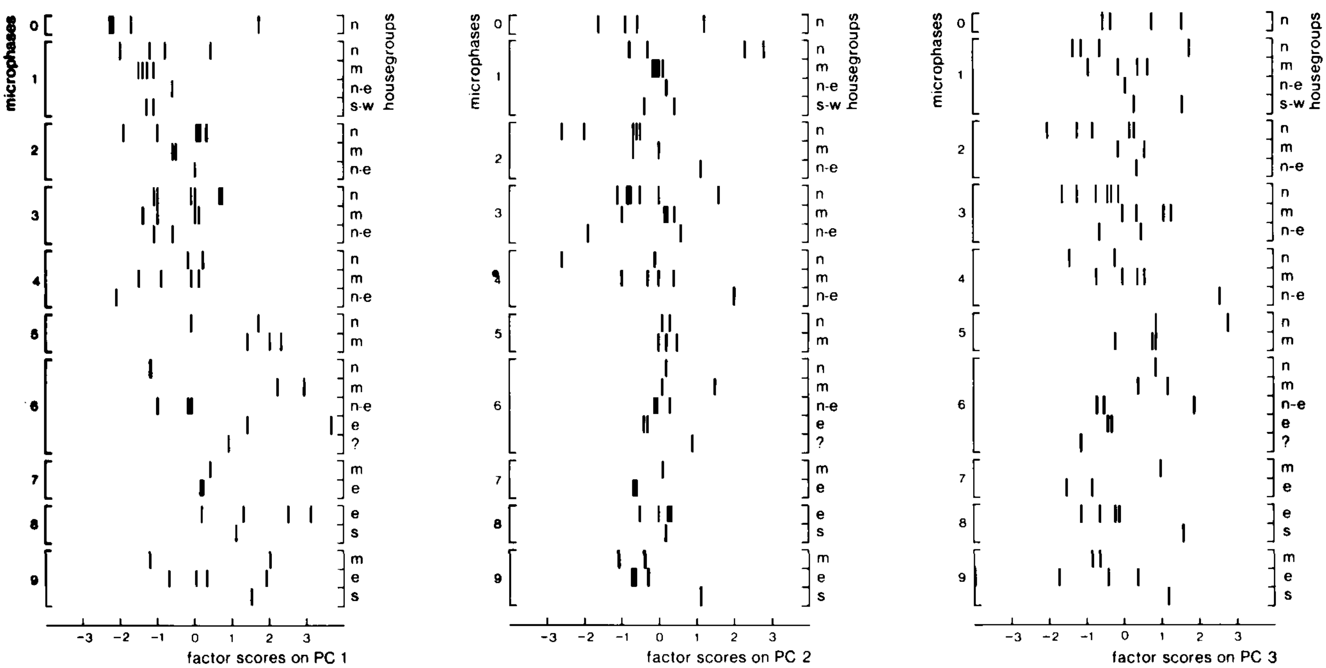

Fig. 8 Elsloo. Distribution of factor scores on the first three Principal Components, per house group and microphase. Selected set of variables; house groups and microphases according to Van de Velde 1979 and in press.

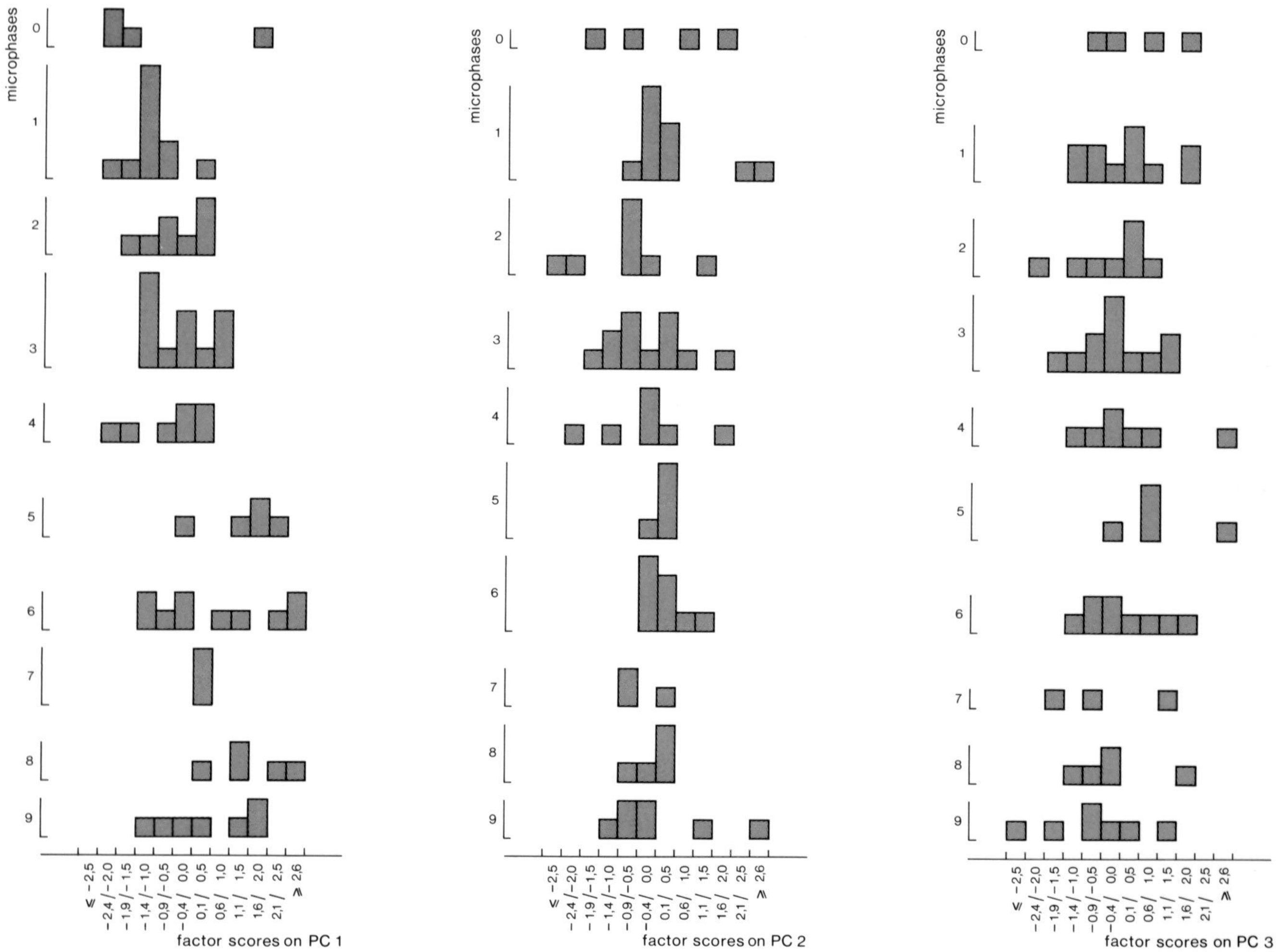

Fig. 9 Elsloo. Distribution of factor scores on the first three Principal Components, per micro inhabitation phase. Selected set of variables; micro phases according to Van de Velde 1979 and in press.

retouched flakes	0.40	0.02	-0.06	0.06
side-scrapers	-0.12	0.03	-0.07	0.49
heavy implements	0.09	-0.22	0.14	-0.11
preparation pieces	0.29	-0.55	0.65	-0.02
rejuvenation pieces	0.57	0.26	0.15	-0.19
flakes	0.02	-0.57	-0.60	-0.36
blades	-0.54	0.62	0.22	0.14

The first three PC's all seem to indicate the expected differentiation between artefact classes connected with tool production (rejuvenation pieces, preparation pieces and possibly hammerstones) and tool use (side-retouched blades, end-scrapers, possibly hammerstones and blades). As some variables load on more than one component a VARIMAX rotation was performed, giving the following as the highest loadings:

ROTATED FACTOR 1:	side-retouched blades	0.94
	hammerstones	0.83
ROTATED FACTOR 2:	blades	0.89
	flakes	-0.67
ROTATED FACTOR 4:	preparation pieces	0.89

(The single variable loading on factor 3 was retouched flakes; as they are very badly represented in the data set, this factor is left out of consideration).

The interpretation of the second rotated factor is perhaps the easiest. It seems to reflect the technological change leading to an increase in the proportion of blades manufactured in the Younger LBK.

The first rotated factor has to do with differences in the distribution of tools. Side-retouched blades and hammerstones account for almost all variability; end-scrapers do not load on any of the first rotated factors. The fourth

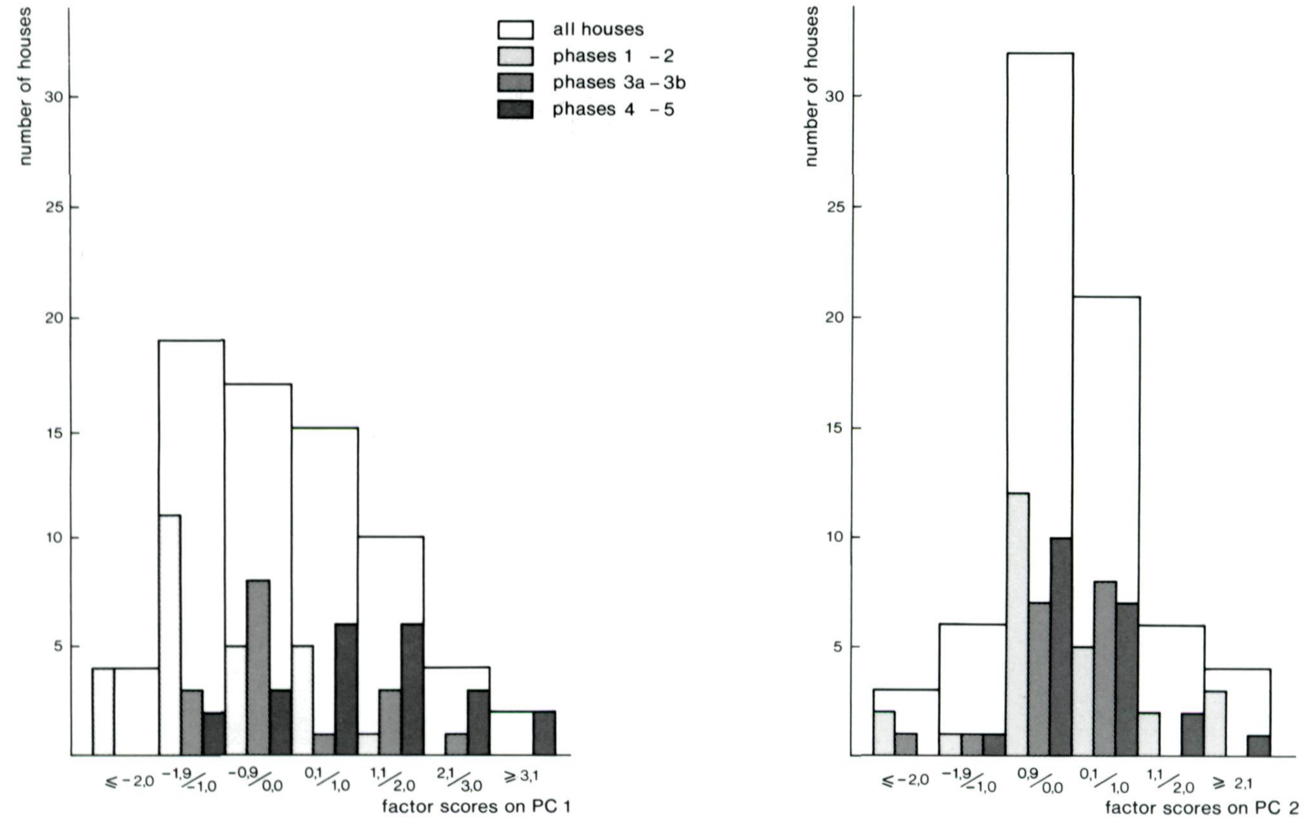

Fig. 10 Elsloo. Distribution of factor scores on the first two Principal Components, per ceramic phase. Selected set of variables; ceramic phases according to Van de Velde 1979.

rotated factor, with preparation pieces as the only loading variable, seems to represent the sought-for differences in the occurrence of manufacturing waste between houses.
To get a clearer picture of the variation in production, a new PCA was run with a limited set of variables, containing those artefact classes that loaded high in the original analysis and were well-represented in the data set. Of these, preparation and rejuvenation pieces form typical production waste. Hammerstones, end-scrapers, blades and, to a lesser extent, flakes are artefact categories that could be transported away from production sites to be utilised elsewhere.
This second analysis resulted in the following factor pattern:

	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6
hammerstones	-0.18	0.77	-0.42	-0.18	0.39	0.12
end-scrapers	0.68	-0.10	0.16	0.62	0.32	0.08
preparation pieces	-0.46	0.10	0.86	-0.11	0.06	0.17
rejuvenation pieces	-0.38	0.63	-0.08	0.54	-0.03	0.21
flakes	-0.49	-0.70	-0.44	0.12	-0.03	0.21
blades	0.86	0.17	-0.05	-0.28	-0.33	0.19

The SAS default mineigen criterion retained 3 PC's, accounting for 76% of the variation (PC 1 31%, PC 2 26%, PC 3 19% respectively).
These first three Principal Components again seem to be connected with specialisation. On the first PC we find high positive loadings for variables connected with tool use (blades and end-scrapers) and moderate negative loadings for the categories connected with production (preparation pieces, rejuvenation pieces). Flakes are linked with the manufacturing waste. Thus, this PC indicates an inverse relationship between 'production' and 'consumption' of tools.
On the second PC hammerstones and rejuvenation pieces show opposite loadings to flakes. Where rejuvenation of cores played an important role, fewer flakes (reject blades) occurred. In those cases, moreover, exhausted cores were more often re-used as hammerstones, indicating greater economy, or even parsimony in the use of raw material.
The third PC shows a high positive loading for preparation pieces and thus, like the first PC, has something to do with tool production.
As a next step the factor scores were computed, giving the values of the houses on the PC's (This procedure has as a

draw-back that, in the case of missing values, the mean for that variable is usually entered in the computation, thereby introducing extra noise. As in this PCA the variables occur rather frequently, I don't think it a real problem here).

The variation in factor scores for all of the three PC's was unrelated to the different house types.

Within several house groups and microphases a considerable differentiation in factor scores for PC 1 and PC 2 can be seen. There is, however, no recurring asymmetric dichotomy either within the single wards, as was expected under the *lineage* mode of production (*fig. 8: a,b*), or within the microphases, in accordance with the *loose* mode of production (*fig. 9: a,b*). Rather unexpectedly, the only way to make sense of the first two PC's was to interpret them in chronological and technological terms (*fig. 10*). As time went on, fewer preparation pieces were needed to prepare cores that yielded a higher proportion of blades. Linked to this was an increasing need for end-scrapers (PC 1). On the other hand, the Younger LBK phases saw a relative increase in parsimony in the use of raw material, as rejuvenation and the intensive secondary use of exhausted cores as hammerstones became more important (PC 2).

PC 3, however, really seems to reflect specialisation. Within the wards no recurring pattern (pointing to a *lineage* mode of production) is found (*fig. 8: c*), but in nine out of ten microphases the factor scores show an asymmetric distribution, one or two houses at the most having markedly high values (*fig. 9: c*). This pattern is consistent with the *loose* mode of production. Empirically the houses of these 'ad hoc' specialists can be described as having factor scores of over 1.0. Moreover, nine out of twelve cases also score high on PC 2 (five of them are even in the upper quartile of the distribution). Thus, they can be interpreted as households, where a lot of flint was worked in an efficient way. Part of the blanks and tools manufactured here were transported away, to be used and discarded by the other households of the settlement. This *loose* mode of production was, however, of minor importance compared to the *domestic* one, as the amounts of tools and waste per household are highly correlated (De Grooth in press b).

The clearest indication of the existence of a *supralocal* mode of production in the Dutch Bandkeramik is provided by the adzes, which were obtained as finished tools from Germany as well as Belgium (Bakels 1978, 1987). The presence in the later phases of the Younger LBK of very low numbers of finished tools and blanks made from nonlocal flints, namely the Rullen and so-called 'light-grey Belgian' material (Löhr e.a 1977), may point to this mode of production as well (cf *table 6*). Most of the Valkenburg flint found in Elsloo belongs to the same phases. Up to the 5th microphase these infrequently-used, 'exotic' flint types occur in percentages of 2% at most, increasing to 5.3% in phase 5, 8.7% in phase 6, then decreasing to 3.1% and 3.7% and ending at 8.8% in microphase 9. Two observations might be of interest here: most Valkenburg flint occurred in pits contemporaneous to the Beekkerkeveld settlement and the highest amount of 'exotic' flint is to be found in those microphases where houses with high scores on PC 2, (the 'parsimony' component) prevail. It therefore seems likely that during the Youngest LBK phases the procurement of flint raw material in Elsloo became somewhat strained. (A similar conclusion was reached by Zimmermann (1981 and in press) for the Aldenhovener Platte).

On the other hand, it is very likely that Elsloo as a whole, like the other Graetheide settlements, produced a surplus of blanks and tools for the benefit of kin groups in regions where flint was in short supply. The preponderance of blades and tools in these regions' rubbish pits would testify to the supralocal mode of production (Gabriel 1974, Löhr e.a. 1977).

Table 6

phase	tr	wr	th	wh	tv	wv	to	wo	
1	1	0	2	4	0	10	0	0	17
2	0	1	1	11	0	4	0	0	17
3a	0	0	0	1	0	1	0	0	3
3b	7	4	20	27	0	6	0	0	65
4	2	3	5	11	2	16	1	5	46
5	1	6	9	18	3	6	1	4	49
total	11	14	37	72	5	43	2	9	197

Table 6 Elsloo, distribution of "exotic" flint types.
t: tools; w: waste; r: Rullen flint; h: light grey Belgian flint; v: Valkenburg flint; o: other flint types

Acknowledgements

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appendix 1
Beek-kerkeveld,
list of refitted artefacts

1. **Largely reconstituted nodules**

1.01 Size original nodule: at least 20 x 20 x 20 cm.
Size reconstituted nodule: 14 x 13 x 13 cm, weight 2000 g.
12 artefacts refitted (*fig. 4*).
Core in pit 7, debitage in pit 8.
Preparation:
A series of preparation flakes (6 present, 3-5 absent) formed an irregular crest. Striking platform created by removal of one big decortication flake.

Production:
12-15 blades, approximately 15 cms long, in 1 or 2 layers. In the second layer: occurrence of hinge fracturing close to the striking platform.

Rejuvenation:
In order to improve striking angle removal of large tablet (12 x 8 x 6,5 cm).

Production:
Blades could now have a length of ca. 8 cm. The first of the new series failed because of a hidden crystal-filled crack.

Rejuvenation:
Attempts to remove the crack by means of a series of axial core flanks (two present, size of the last: 12 x 9 x 3 cm) were to no avail. Rejuvenation had to stop when the core became too thin.

Production:
On both sides of the crack, a total of some 20 blades, 7-8 cm long, in 3 layers. The distal part of one of the last blades has been refitted.

Final core:
8 x 8 x 7 cm.
The core may have produced ca. 40 blades.

1.02 Size of original nodule at least 20 x 20 x 15 cm.
Size of refitted core: 16 x 16 x 12 cm, 2300 g.
13 artefacts refitted (*fig. 3*).
Core in pit 8, debitage in pit 7.

Preparation:
Creation of striking platform by removing at least two decortication flakes (one refitted). Little is known of the preparation of the core face, only two preparation flakes are present.

Production:
Core face extended over about 1/3 of the nodule. Length of blades 10-12 cm. The last one, with a length of only 5 cm, could be refitted.

Rejuvenation:
A radical correction of the core face by means of lateral core flanks (4 present, at least 3 missing) was followed by removal of the old striking platform (3 preparation flakes present). Further trimming of the new core face damaged its centre. The size of the core made further repair impossible.

Production:
At both sides of the core. One core face produced some 20 blades in 4-5 layers, the other probably only 2 or 3 blades.

Final core:
8 x 7 x 7 cm.
Amount of blades produced in the first stage unknown, the second production stage yielded 20-25 blades.

1.03 Size of original nodule: ca. 17 x 12 x 10 cm.
Size refitted core: 16 x 12 x 8.5 cm, 900 g. 26 artefacts refitted (*fig. 2*).
1 preparation flake in pit 8, the others with the core in pit 7.

Preparation:
A series of decortication flakes (7 present, at least 2 missing) removing an irregular lump, created simultaneously core face and striking platform.

Production:
In the first production stage only short flakes, not extending to the core's bottom, were struck off.

Rejuvenation:
The nodule was turned upside down. Again decortication and removal of lumps on the core face (5 decortication flakes refitted). Striking

platform formed with 1 big flake (refitted).

Production:
At first flakes and short blades with cortex on the dorsal face (6 refitted, at least 7 missing), then ca. 3 layers of blades, maximum length 10 cm, the core face extending over 3/4 of the core's surface.

Rejuvenation:
Unsuccesful attempt to correct striking angle with help of chips struck off from the platform, followed by removal of two tablets (1 refitted) and correction of the core face (2 preparation flakes refitted). Finally 1 big tablet (refitted) served to form a new striking platform.

Production:
3 layers of blades, 6-7 cm long. 1 proximal blade fragment could be refitted. A second core face on the back of the nodule gave only 2 flakes.

Rejuvenation:
In this third production stage the core's bottom was corrected.

Final core:
7 x 6 x 6 cm.
The core may have produced 35–40 blades.

1.04 Only the length of the original nodule is known: 16 cm.
Size of reconstituted core: 15 x 10 x 8 cm, weight 700 g.
9 artefacts refitted (*fig. 4*).
Core in pit 8, debitage in pit 7.

Preparation:
The first striking platform was created by removal of 1 decortication flake (refitted). No special preparation of the core face took place.

Production:
3 blades, 1 flake, all partly covered with cortex.

Rejuvenation:
After attempts at improving the striking angle with chips struck off the striking platform, removal of big tablet (refitted).

Production:
On the same core face. 2 flakes (refitted) terminated in hinge fractures halfway down the core face. No succesful blade production was possible.

Rejuvenation/Preparation:
The core was turned upside down, 2 preparation flakes formed a new striking platform (refitted).

Production:
Partly on the old core face, but from a different direction. Main production on new core face at the former back side of the core. 3/4th of the core's surface used for blade production.

Rejuvenation:
Correction of striking angle by removing chips from the striking platform.

Production:
Continued on the same core face, ca 5 layers of blades, 10 cm long.

Rejuvenation:
Removal of tablet (refitted).

Production:
As before.

Rejuvenation:
Trimming of the core's bottom with small flakes (1 refitted).

Production:
As before. Again 3-5 layers of blades, length ca 8,5 cm. Production stopped after some hinge fractures occurred when the core was to thin for further correction.

Final core:
8,5 x 4 x 3,5 cm.
This core may have produced 60 – 80 blades.

1.05 Size of original nodule unknown.
Size of reconstituted core: 19 x 16 x 16 cm, weight 1050 + 550 g.
14 + 33 artefacts refitted (*fig. 5*).
one blade in pit 8, the rest of the debitage and the core in pit 7.

Preparation:
1 very big (12 x 14 x 4 cm) preparation flake and some smaller ones (2 refitted) were removed to form the first striking platform.

Production:
Seems to have started without special preparation of the core face. 2 conjoined decortication flakes from the first layer, 2 blades from the middle and 2 blades from the end of the series could be refitted with their striking platforms under the first preparation flake.

Rejuvenation:
Was necessary because the core had become too curved. First 2 rejuvenation flakes struck from the bottom of the core and then an axial core flank served to improve the core face. Small-scale correction of the striking platform performed as well.

Production:
Blade production continued (1 refitted).
The rest of the sequence is unknown.
The following series of conjoined artefacts belong to this nodule:
2 pairs of decortication flakes
1 pair and a series of 3 preparation flakes
2 preparation flakes and a core flank
3 flakes, 2 of which with preparation crest
1 blade and 1 production flake
3 production flakes (*fig. 7*)
2 series of 4 blades and production flakes (*fig. 7*)
2 blades
The core probably belonging to this nodule is completely exhausted, in its final stages it only produced flakes. Size: 6.5 x 5 x 3 cm.
Amount of blades unknown.

1.06 Size of original nodule: 17 x 9 x 9 cm.
Size of reconstituted core: 17 x 9 x 9 cm, 1100 g.
8 artefacts refitted (*fig. 5*).
1 of the decortication flakes in pit 7, the rest of the debitage and the core in pit 8.
This nodule has been reconstituted almost completely. Its small width made it rather unsuitable as a core. The second preparation flake was much too large, it removed about 1/3 of the nodule. Attempts to prepare a striking platform on the other side were in vain as well. From this nodule no suitable blanks derived.

2. Conjoined artefacts from different stages

2.01 A series of 7 decortication and preparation flakes from the preparation of one striking platform and 1 tablet (*fig. 6*)
2.02 A series of 8 decortication and preparation flakes and 2 production flakes
2.03 3 preparation flakes, 2 blades, 1 core flank and 2 blades from the next production stage (from the same nodule as 2.02) (*fig. 6*)
2.04 A preparation flake and a tablet (*fig. 6*)
2.05 2 proximal blade fragments and the rejuvenation tablet used to remove the rough spot which caused the blades to fracture (*fig. 6*)
2.06 2 preparation flakes and 2 rejuvenation tablets (*fig. 6*)
2.07 A crested blade on a core (*fig. 6*)
2.08 2 preparation flakes and 3 tablets
2.09 2 flakes and 2 crested blade fragments on a tablet (*fig. 6*)
2.10 2 flakes struck from different striking platforms

3. Conjoined artefacts from a single production stage

3.01 8 decortication and preparation flakes (*fig. 7*)
3.02 6 decortication and preparation flakes
3.03 5 preparation flakes (*fig. 7*)
3.04 4 decortication and preparation flakes
3.05-06 2 series of 3 decortication and preparation flakes
3.07-08 2 series of 3 preparation flakes
3.09-11 3 pairs of 1 decortication and 1 preparation flake
3.12-15 4 pairs of 2 decortication flakes
3.16-22 7 pairs of 2 preparation flakes
3.23 2 tablets
3.24 3 production flakes
3.25-27 3 pairs of 2 production flakes
3.28 3 proximal blade fragments
3.29 2 blades (*fig. 7*)

4. Conjoined Valkenburg artefacts

4.01 A preparation flake and a core flank
4.02 2 preparation flakes from different striking platforms
4.03 A decortication and a preparation flake
4.04 2 decortication flakes
4.05 2 large preparation flakes
4.06 2 core flanks
4.07-08 2 pairs of rejuvenation tablets

appendix 2: Elsloo, flints in rubbish pits associated with houses, dating according to Van de Velde (1979)

house nr	cores	hammerstones	hammerstone fragments	preparation pieces	rejuvenation pieces	flakes	blades	blocks	arrowheads	borers	end-scrapers	sickle blades	end-retouched blades	side-retouched blades	splintered pieces	burins	retouched flakes	side-scrapers	heavy implements
ceramic phase 1																			
04	7	1	13	296	31	296	83	7	1	1	15	8	0	1	0	0	1	0	1
05	2	6	8	72	30	126	38	1	2	1	14	4	1	1	0	0	0	2	0
17	0	3	1	9	7	38	4	12	0	0	2	0	0	0	1	0	0	2	0
19	0	2	0	12	3	25	7	1	0	2	1	0	0	0	0	0	0	0	0
20	1	1	0	29	8	45	8	6	0	0	3	0	0	2	0	0	0	0	0
32	6	7	8	61	15	101	16	4	1	0	9	2	0	1	1	0	1	2	0
50	2	0	6	12	8	52	4	3	0	0	6	0	0	0	3	0	0	0	0
61	3	0	0	3	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0
62	0	2	0	2	2	4	3	0	0	0	0	0	0	2	0	0	0	0	0
65	2	0	0	7	3	6	0	0	0	0	1	0	0	0	0	0	0	0	0
66	0	0	0	1	1	10	4	0	0	0	4	1	0	0	0	0	0	0	0
70	0	4	0	4	1	8	1	0	0	0	0	0	0	0	0	0	1	0	0
72	3	5	8	21	10	43	1	4	0	0	0	0	0	0	2	0	0	2	0
75	1	2	6	14	6	28	6	0	0	0	6	1	0	0	2	0	0	2	0
ceramic phase 1?																			
54	1	0	0	6	0	10	1	0	0	0	0	0	0	0	0	0	0	0	0
ceramic phase 2																			
10	0	0	0	2	0	3	1	1	0	0	0	2	0	0	0	0	0	0	0
22	1	4	5	40	16	93	36	4	0	1	10	1	2	0	0	0	0	0	0
26	0	0	3	19	1	24	2	2	0	0	2	0	0	0	0	0	0	1	0
28	4	1	0	8	3	16	10	0	1	0	2	0	0	1	0	0	0	1	0
36	0	0	4	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	1	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0
51	1	0	0	6	2	3	1	0	0	0	0	1	0	0	0	0	0	0	0
55	2	6	5	97	16	200	43	15	0	0	16	0	0	1	1	0	0	2	0
59	1	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	1	4	8	4	10	9	2	0	0	3	1	0	0	0	0	1	0	0
67	0	1	1	4	2	19	9	0	0	0	3	1	0	0	0	0	0	0	0
68	0	0	1	6	2	14	4	0	0	0	4	0	0	0	0	0	0	0	0
ceramic phase 3a																			
08	6	3	10	44	8	42	27	0	1	2	10	3	0	1	0	0	0	1	0
33	0	0	1	11	5	19	6	2	0	1	2	0	0	0	0	0	0	0	0
44	1	0	5	13	5	47	13	2	0	1	8	3	1	0	0	0	0	0	0
48	0	1	6	7	7	55	10	2	1	3	3	0	0	1	3	0	0	0	0
49	1	1	5	2	12	77	34	2	1	0	5	2	2	0	4	0	0	1	0
74	0	1	2	7	3	11	3	0	0	0	3	0	0	0	0	0	0	0	0
76	0	1	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0

house nr	cores	hammerstones	hammerstone fragments	preparation pieces	rejuvenation pieces	flakes	blades	blocks	arrowheads	borers	end-scrapers	sickle blades	end-retouched blades	side-retouched blades	splintered pieces	burins	retouched flakes	side-scrapers	heavy implements
ceramic phase 3b																			
15	3	6	8	84	19	112	105	4	3	2	65	11	2	3	0	1	0	1	0
16	0	0	0	2	3	13	13	0	2	2	8	0	0	0	1	0	0	0	0
24	0	0	0	5	1	8	4	0	0	0	1	2	0	0	0	0	0	0	0
27	1	4	5	53	12	56	81	2	2	3	42	3	2	1	0	0	0	0	0
31	0	4	6	31	14	64	23	2	0	0	4	7	0	2	1	0	0	0	0
34	0	1	3	22	8	41	19	1	1	1	11	5	0	2	2	0	0	2	0
37	1	2	20	55	13	66	50	5	2	0	10	0	0	2	0	0	0	0	0
38	1	5	4	85	29	304	47	13	1	0	6	5	1	1	0	0	0	1	0
56	1	0	0	4	0	1	2	0	0	0	2	1	0	0	0	0	0	0	0
58	1	11	18	84	33	212	86	9	1	1	31	6	1	6	1	0	0	0	0
ceramic phase 4																			
11	1	0	0	5	1	9	14	2	1	0	5	3	0	0	0	0	0	0	0
14	2	1	1	10	2	1	26	0	0	3	3	0	2	0	0	0	0	0	0
23	1	1	1	0	3	9	8	4	0	1	2	0	2	1	0	0	0	0	0
29	0	0	0	5	1	6	5	0	0	0	1	0	0	0	0	0	0	0	0
47	1	2	0	9	0	9	3	0	0	0	0	1	0	0	0	0	0	0	0
60	7	4	7	28	24	123	46	3	0	1	19	3	1	0	1	0	0	2	0
84	2	1	1	12	2	44	38	5	1	0	4	5	3	3	0	0	0	0	0
89	0	3	2	9	3	46	17	4	0	1	6	6	0	0	1	0	0	0	0
ceramic phase 3-4																			
57	0	0	0	0	0	4	0	1	0	0	1	0	0	0	0	0	0	0	0
ceramic phase 5																			
09	1	3	4	22	5	12	31	0	1	0	11	7	0	0	0	0	0	1	0
12	0	0	3	18	1	12	21	2	0	1	4	2	0	1	0	0	0	0	0
13	1	2	0	6	2	18	6	0	0	1	0	2	0	0	1	0	0	0	0
43	0	0	0	0	0	3	3	2	0	0	1	0	0	0	0	0	0	0	0
79	2	0	1	5	2	9	6	0	0	0	1	0	0	0	0	0	0	0	0
83	1	0	1	0	0	1	5	2	0	0	1	0	0	0	2	0	0	0	0
85	0	0	1	1	1	8	4	0	0	0	4	0	0	0	0	0	0	0	0
87	0	1	1	1	0	8	4	0	0	0	0	1	0	0	0	0	0	0	0
88	5	9	14	46	44	333	153	9	3	3	44	8	0	3	1	0	0	2	0
91	0	0	0	0	1	6	3	0	0	0	0	1	0	0	1	0	0	0	0
92	1	0	2	7	5	27	24	8	0	0	8	2	2	2	0	0	0	0	0
93	0	2	3	2	1	13	18	0	0	1	6	1	0	1	2	0	0	0	0
94	0	2	1	0	1	0	1	0	0	0	0	0	0	2	0	0	0	0	0

house nr	cores	hammerstones	hammerstone fragments	preparation pieces	rejuvenation pieces	flakes	blades	blocks	arrowheads	borers	end-scrapers	sickle blades	end-retouched blades	side-retouched blades	splintered pieces	burins	retouched flakes	side-scrapers	heavy implements
ceramic phase 5?																			
90	0	0	1	0	0	5	7	0	0	0	3	2	0	0	0	0	0	1	0
ceramic phase 3-5																			
35	1	4	4	4	5	13	9	0	0	0	6	1	0	0	1	0	0	0	0
39	0	1	1	2	0	5	3	1	0	0	1	2	0	0	0	0	0	0	0
52	0	0	0	5	1	4	1	0	1	0	1	0	0	0	0	0	0	0	0
69	0	0	1	7	4	23	15	0	2	0	0	0	0	0	1	0	0	0	0
71	0	0	1	3	0	11	2	0	0	0	0	1	0	0	0	0	0	0	0

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