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IN SEARCH OF BANDKERAMIK SPECIALIST FLINT KNAPPERS

In this paper the socio-economic aspects of Bandkeramik flint knapping will be discussed.

The sites used as cases are situated in the northwesternmost part of the Bandkeramik Culture's total settlement area: Langweiler 8 on the Aldenhovener Platte in the Rhineland (Lüning 1982; Boelicke *e.a.* in press) and Elsloo in the adjacent Dutch province of Limburg (Bakels 1978, 1982; Modderman 1970, 1985). For a full report on this research I refer to De Grooth (1987a and in press). Summaries comparable to this one are to be published in the Proceedings of the 1987 Neuwied conference on refitting The Big Puzzle and of the Vth International Flint Symposium held in the same year at Bordeaux.

In both areas Bandkeramik habitation commenced at about 5.300 B.C. and lasted for some 300 - 350 years (Modderman 1985). Most Bandkeramik settlements in these two regions possessed four coeval houses at the most. The two sites to be discussed in this paper, however, were much bigger: in Langweiler 8 one hundred-and-thirteen houseplans were excavated, in Elsloo ninety-five. Clearly these were not constructed all at the same time, but gradually during a period of several centuries.

The internal relative chronology of Elsloo, based on stratigraphical observations, the development of house plans, and pottery decoration, led to a division into ten microphases, each representing one house generation of about 30 years (Van de Velde 1979). Every house was surrounded by a farmyard of varying size, where most of the activities seem to have taken place. The size of the farmyards seems to be related to the density of habitation. In Elsloo the largest concentrations of manufacturing waste were found in rubbish pits situated close to the houses.

The houses at Elsloo are clustered into three or four house groups, or wards, showing continuity over time. They 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 (Van de Velde 1979, 1986). For Langweiler 8 such a detailed analysis is not available at present, but it will be published shortly (Boelicke *e.a.* in press). The preliminary reports, however, show that this settlement may have consisted of at least two wards, with a maximum of eleven contemporary houses (Stehli 1982).

In both regions 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 (Bakels 1978). The inhabitants of both regions predominantly used the so-called Rijckholt flint from the Upper Cretacious Gulpen Formation, found in the Dutch limestone area south of the river Geul. This area lies at a distance of 10-15 km from Elsloo and of 40-45 km from the Aldenhovener Platte (Bakels 1978; Felder 1975; Löhr *e.a.* 1977).

Between different settlements, but also between farmyards within a single site, the amount of flint artefacts recovered shows a strong variation. In some cases this variation can be explained by distortions caused by post-depositional processes and excavation methods. On the other hand, it seemed certainly worthwhile to search for meaningful differences, resulting from the existence of some kind of specialisation in flint working between sites as well as within sites. The present study concentrates on the search for bandkeramik specialist flint knappers within single settlements. Before presenting some of its results, I will first outline the theoretical framework that enabled me to analyse the available evidence in a systematic way.

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 (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 be recognisable in the archaeological record.

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 or for Darion in Cahen 1985). For every nodule the conjoinable artefacts (belonging to all stages of the reduction sequence, so with blanks and tools included) would be distributed within a single household area.

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 concentrations of manufacturing waste in the rubbish pits of one of the lineage's households, and the conjoinable tools and blanks distributed all over the lineage's ward.

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, with conjoinable tools and blanks scattered over the total settlement.

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. Refits would give little information on the mode of production, but merely indicate that the artefacts probably had been brought into the settlement at the same moment.

At first sight it may seem ideal to use small, short-lived sites like Langweiler 16 (Lüning 1982) or Darion (Cahen 1985) for this type of analysis, as they show little distortion caused by overlapping habitation phases. However, because they existed merely for a very short time, the pattern found for any one such settlement should be tested in other comparable sites, to assess whether it was structural, that is recurred through time and space, or just idiosyncratic. Such structural patterns can be more readily discovered in continuously inhabited sites. Moreover, as has been pointed out earlier, the small settlements need not necessarily have been completely self-supporting, but may have been partly dependent on each other or on larger sites. In that case, evidence for the **lineage** and the **loose** modes of production would only be found when studying a whole group of related settlements. Therefore, it was decided to concentrate on Langweiler 8 and Elsloo, the largest and most long-lived sites, as it was most likely that the full range of modes of production known in Bandkeramik times would have been practised there.

In Langweiler 8 about 10.000 flint artefacts were recovered, belonging to all stages of the reduction sequence, but representing only 10-15% of the material originally present (Zimmermann 1981 and in press).

Notwithstanding the expected draw-backs caused by the low rate of preservation, refitting was chosen as one of the methods of analysis. A total of 65 artefacts (that is less than 1%) were refitted, belonging to 30 different sets. All sets were found within single farmyards, most even in the same rubbish pit, or in two adjacent ones. Moreover, for some inhabitation phases several such sets in different coeval farmyards occurred. So all refitting evidence points to the existence of the **domestic** mode of production. At least in some cases manufacture, use and discard took place on the same spot: one set of conjoined artefacts found together consisted of an end-scraper and a hammerstone. Interestingly the core had been used as a hammerstone before the flake serving as blank for the end-scraper was struck off. After further reduction the core was again turned into a hammerstone. In another case a core was used as hammerstone on the same spot where it had been reduced, as was shown by the refitting of a regular flake and a splinter sprung off during hammering, both from the same pit.

Clear indications for the **supralocal** mode of production were provided by artefacts made from the so-called "light grey Belgian" flint from the Hesbaye (Löhr *e.a.* 1977), mostly imported as blanks and finished tools.

No refits concurrent with the **lineage** or **loose** modes of production were found but, because of the low rate of preservation, this negative evidence may not be regarded as conclusive: only positive evidence (that is actual refits) counts, and the lack of refits concurring with one of the predicted patterns may not be used to falsify the hypotheses concerned.

For Elsloo another approach was chosen, analysing the actual distribution of discarded tools and waste for every settlement phase. As in Langweiler 8 there is ample evidence for the **domestic** mode of production in Elsloo. Over 7.300 flint artefacts have been found in the rubbish pits assigned to datable houses, 86% of which was debris and 14% tools (Table 1). The rate of preservation was similar to that of Langweiler 8. 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.

The different modes of production, however, 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 and Hodson 1975; see Harman 1967 for a technical description). Because we are interested here in the variability **between** households and because in Elsloo no indication of differentiation in the intensity of flint knapping **within** the farm-yards was found, the contents of all rubbish pits associated with a house were lumped together to provide better samples. To minimize the influence of «noise», only pits with at least 5 flint artefacts were included. The raw data counts were then transformed into percentages. In all, seventy-one houses could be used as the cases in the analysis.

To get a clear picture of the variation in production, the PCA was run with a limited set of variables, containing those artefact classes that loaded high in a pilot 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 the places where they had been made, to be utilised elsewhere. Microwear analyses performed by Jean-Paul Caspar for Belgian sites and Annelou van Gijn for Beek-Molenveld in Limburg (Van Gijn in preparation) show that a high proportion of unretouched blades were indeed utilised.

The analysis resulted in the following factor pattern (Table 2):

The first three Principal Components (PC's) account for 76% of the total variation. 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 opposition of "production" and "consumption" of tools.

On the second PC hammerstones and rejuvenation pieces are opposed to flakes. Where rejuvenation of cores played an important role, fewer flakes (failed 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 moderate negative ones for flakes and hammerstones. Thus, like the first PC, it has something to do with tool production. It marks houses where a proportionally high amount of preparation waste had been discarded.

As a next step for every component the cases' «factor scores» were computed, marking the houses that show many of its characteristics. This showed the first two PC's to be connected with technological development through time: 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 of end-scrapers (PC 1). On the other hand, the Younger LBK phases saw a relatively increasing parsimony in the use of raw material, as rejuvenation and the intensive secondary use of exhausted cores as hammerstones became more important. There is, however, no significant increase in the recycling of worn tools visible. PC 3, however, really seems to reflect specialisation. In nine out of ten microphases the factor scores show a recurring asymmetric distribution, one or two houses at the most having markedly high values. This pattern is consistent with the **loose** mode of production. Moreover, nine out of twelve cases also score high on PC 2. 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 over-all amounts of tools and waste per household are highly correlated (de Grooth 1987b).

Finally, the increase during the later phases of the Younger LBK of the amount of finished tools and blanks made from second-best local (e.g. Valkenburg flint cf. Felder 1975) and non-local (Rullen and "light grey Belgian" flint from the Hesbaye cf. Löhr *e.a* 1977) material, may point to the existance of a **supralocal** mode of production. The highest amount of non-Rijckholt 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. On the other hand, it is very likely that Elsloo as a whole, like the other Dutch settlements, produced a surplus of blanks and tools for the benefit of kin groups in regions where flint was in short supply, perhaps in exchange for the adzes that form the best examples for the supralocal mode of production in our regions (Bakels 1987).

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Table 1 : Elsloo, frequencies of artefacts from dated pits.

type	ceramic phase according to Van de Velde (1979)						
	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 2: Elsloo, PCA analysis, 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

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