A SMALL CRESWELLIAN SITE AT EMMERHOUT (PROVINCE OF DRENTHE, THE NETHERLANDS)

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ABSTRACT: A small Late Palaeolithic site is described, that can be placed in the Creswellian tradition. The findspot can be dated to the Allerød Interstadial, or to slightly earlier or later, on the basis of its stratigraphical location in coversand. The site is tentatively interpreted as a hunting camp, because of the fact that projectile points account for more than half of the tools.

KEYWORDS: Late Palaeolithic, Creswellian tradition, coversand stratigraphy, refitting analysis, small sites, specialisation.

1. INTRODUCTION

During the years 1960-1968 large-scale excavations were carried out by the Biological Archaeological Institute of the University of Groningen, in the new quarters Angelsloo and Emmerhout of the town of Emmen. The work was directed by Prof. J.D. van der Waals. Especially widespread remains dating from the Bronze Age were found, including many ground-plans of houses (Van der Waals & Butler, 1976).

During the excavations in Emmerhout, in 1967 a flint concentration dating from the Late Palaeolithic was discovered in one of the excavation trenches. This concentration was excavated by A. Meijer, a former field assistant of the B.A.I., and A.E. Lanting, then a B.A.I. student.

Though the concentration could only be investigated partially (c. two thirds), as a result of a large (sub)recent disturbance, the site is of interest since we are familiar with only a very few 'Creswellian' findspots in the Netherlands. In the Northern Netherlands we can point to two other important sites of this tradition, namely Siegerswoude in the province of Friesland (Kramer *et al.*, this volume), and Zeijen in the province of Drenthe (Stapert, in prep.).

For their part in the realization of this article I am greatly indebted to the following persons: P.B. Kooi (B.A.I.), A.M. Huiskes and A.E. Lanting, for information concerning the excavations in Emmerhout; G.J. Boekschoten (Institute of Earth Sciences, *Vrije Universiteit* Amsterdam) and A.P. Schuddebeurs (Norg), for the petrological indentification of the stones; A.L. Zandbergen (Emmen), for his assistance in refitting the gneiss fragments; Sheila van Gelder-Ottway, for correcting my English text; F.W.E. Colly (B.A.I.) and the C.F.D. of the State University Groningen, for the photos; J.M. Smit and J.-E. Dilz (B.A.I.), for making neat ink drawings of my pencil ones. Many thanks especially to Jan S. Krist (B.A.I.), who expertly helped me with the refitting analysis of the flint artefacts. I am much indepted to Emily Moss (Boston), for critically reading and improving chapters 2, 6, 8 and 9, and for stimulating discussions. Her functional analysis of the flint material of the Hamburgian site of Oldeholtwolde (Moss, in press) contributed much to our understanding of the Late Palaeolithic in the Netherlands. To all these people I am very grateful.

2. THE FINDSPOT AND ITS PHYSICAL GEOGRAPHICAL SETTING

The findspot of the Late Palaeolithic flint concentration has the following coordinates on the Topographical Map of the Netherlands: sheet 17H (Emmen) 259.46/534.30. The site is located approximately 2.5 km to the east of the centre of Emmen (figs. 1 and 2). The flint concentration was present in the excavation trench in which the Bronze Age house ground-plan no. Emmerhout 6 was located (Van der Waals & Butler, 1976: Abb. 12). The location of the concentration in the terrain, and within the excavation trench no. 6, is shown in figures 3-5.

Fig. 1. Map of the Netherlands, showing the location of the site at Emmerhout. Drawing J.M. Smit.

The geology of the area is described by Ter Wee (1979), on which publication figures 4 and 6 are based. The site is located in the southernmost part of the Hondsrug Complex, a series of oblong elevations in the eastern part of the province of Drenthe, running approximately NNW-SSE. Part of the Hondsrug, to the east of Emmen, has been pushed, probably by the ice-sheet during the Saalian, during which the till (boulder-clay) present in the area was deposited. The Hondsrug shows a remarkable straight edge along the western border of the Hunze valley that is present to the east of it (the Hunze valley originated as a deep melt-water valley during the Saalian). The reason for this phenomenon is not understood; although it is suggestive of the presence of important tectonic faults in the subsoil these have not been demonstrated (Ter Wee, 1979; also: Rappol, 1984).

The Hondsrug Complex consists of 2 parallel ridges, the Hondsrug proper and the *Rug van Sleen* (Sleen-ridge) to the west of it (fig. 4). The Hondsrug proper has altitudes above 20 m +N.A.P. (Dutch Datum Level), and it reaches partly above 25 m +N.A.P. The Sleen-ridge is less important, with maximum heights just over 20 m +N.A.P. Between the Hondsrug proper and the Sleen-ridge important brook systems are present; in the Emmen region the Sleenerstroom (fig. 4) runs southward through the oblong depression between the ridges.

Within the Hondsrug proper again two ridges exist in this area, parallel to each other–they are clearly visible on figure 4. Between these two ridges a depression is present, in which there are brooks; there is one, for example, to the SSE of Emmen. The findspot is situated on the western slope of the eastern of the two ridges that constitute the Hondsrug proper. The eastern ridge is clearly in evidence on the contour map (fig. 5), to the east of the site.

In general coversands, wind-blown sands dating for the most part from the Late Glacial of the Weichselian, are not well developed on top of the Hondsrug Complex, in contrast to the area to the west of it. There are only a few places here, where the coversand is thicker than 2 m (indicated with symbol no. 5 on the map, fig. 4). One of these occurrences is present immediately to the W and S of the site. This is not a real coversand dune, however, as is evident from the contour map (fig. 5), though it has an oblong form. The site itself is located in an area that can, according to the geological map, be described as: coversand, less than 2 m in thickness, on top of till. From the excavation profiles (see 3.; fig. 7) we know, that the coversand at the site is at least 1 m in thickness; the till was not exposed. It is of interest to note that in general Late Palaeolithic findspots tend to be situated in places where there was coversand present; they are rarely known in places where till is the uppermost layer. Possibly the reason for this phenomenon is that till surfaces were too wet for occupation, at least during the summers.

A schematic section of the site and its immediate surroundings, based on the contour map of the Netherlands (1:10,000, sheet 17H), and the geological map (Ter Wee, 1979), is presented in figure 6. The site has an altitude of c. 24.5 m +N.A.P., and is located at a place that was probably well drained, as a result of the sloping surface of the till underneath the coversand. The slope of the surface at the site is very low, c. 0.2%. The oblong occurrence of thicker coversand to the W and S of the site has at its western border a relatively steep slope, that is still clearly visible in the landscape. It is possible that a minor brook (not indicated on the geological map) was present in the depression to the west of it during Late Glacial times.

The site itself is clearly not located along the fringe of a valley, or near a depression in which water could have been present (for example a pingo

Fig. 2. Map of the town of Emmen and its surroundings, in which the location of the Late Palaeolithic site at Emmerhout is indicated (with an asterisk). Drawing J.M. Smit.

rampart). Such types of location are generally found with larger findspots of Late Palaeolithic age. Large findspots are mostly interpreted as residential camps ('base camps'), occupied by one or several families for some time; they tend to be located near sources of water, food, and fuel (Binford, 1982; 1983). The findspot at Emmerhout, however, certainly does not represent a possible 'base camp', as it is quite small (see 4., 6. and 9.). It seems probable, therefore, that the site was not occupied by a large group, or for a long period, but that it represents a camp of short duration, probably inhabited by only a few persons. We will come back to this question after having described the material found at the site (see chapter 9).

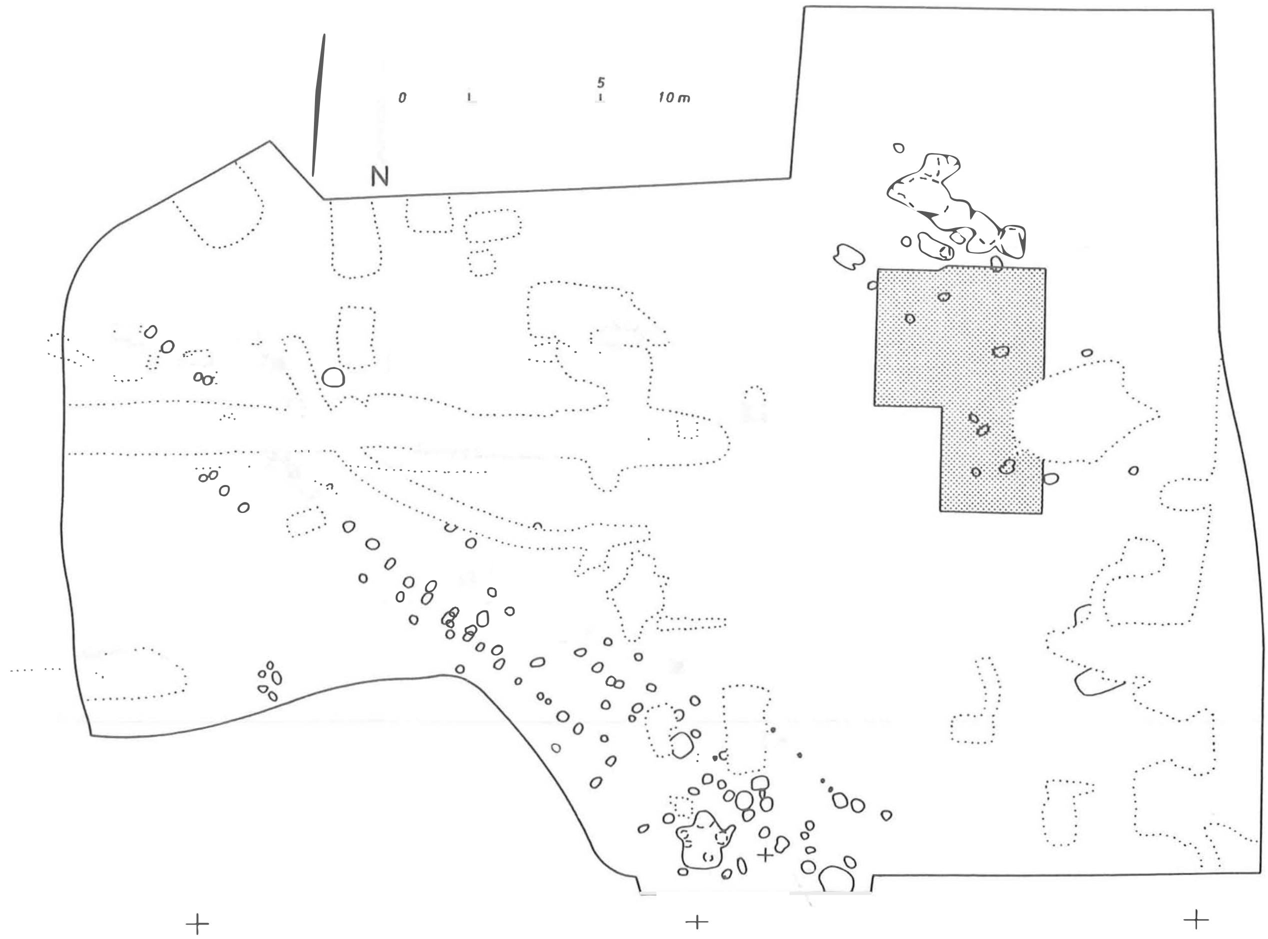


Fig. 3. Excavation trench no. 6 of Emmerhout, 1967. Visible are the post-holes of Bronze Age house no. 6. In addition, several pits can be seen, particularly in the southwestern part of the trench. Recent disturbances are indicated with stippled lines. The shaded area represents the part in which the Late Palaeolithic concentration was present: see also figure 7. Drawing J.M. Smit.

3. THE EXCAVATION, STRATIGRAPHY

The information in this chapter is mainly based on the daily excavation reports by A. Meijer and A.E. Lanting, and on comments by the latter, made in 1984 at the request of the author. The excavation trench Emmerhout no. 6 was opened on June 13th, 1967; the topsoil was removed by a machine.

On June 14th surface no. 1, just underneath the topsoil, was cleaned by shovel. Some potsherds (Bronze Age) were found, and a small scraper (probably also dating from the Bronze Age). In the cleaned surface many recent disturbances were visible; they are indicated in figure 3 by stippled lines. In the afternoon part of the trench was dug out deeper. On June 15th practically the whole trench was deepened (probably c. 10 cm), and the thus created surface 2 was partly cleaned. Some vague post-holes were noted, and a few sherds were collected.

On June 16th a large part of the trench (where post-holes were seen earlier, including the part that later yielded the flint concentration) was deepened again (c. 10 cm), by a machine. House Emmerhout no. 6 now became clearly visible from its post-holes (fig. 3). A group of pits close to one another was found in the SW part of the trench (indicated in fig. 3).

On June 19th A.E. Lanting was not present at the excavation. A. Meijer describes in his field report that surface no. 3 (that had been created on June 16th) was cleaned by shovel. During this work a number of "Palaeolithic flints came to light (among which were points and scrapers), that were present in a concentration". Since the trench had been deepened twice since June 13th, it can be concluded

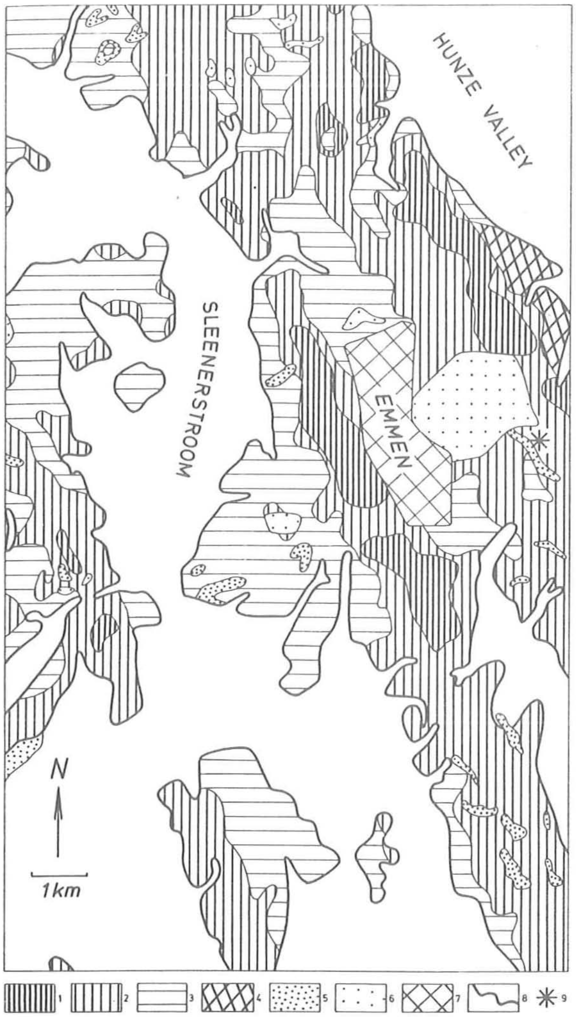


Fig. 4. Geological map of the area around the town of Emmen, after Ter Wee (1979). Part of the Hondsrug Complex is clearly visible. Note the two higher ridges near Emmen, constituting the Hondsrug proper, and the less prominent ridge to the west of it: the Sleen-ridge. Legend: 1. till (boulder-clay) at or near the surface, Saalian; 2. till, covered by less than 2 m of coversand; 3. fluvioglacial deposits belonging to the Peelo Formation (Elsterian), covered by less than 2 m of coversand; 4. ice-pushed sediments (Middle- and Lower-Pleistocene, and Pliocene Formations), covered by less than 2 m of coversand; 5. more than 2 m of coversand (Twente Formation, Weichselian); 6. recent sand drifts (Kootwijk Formation, Holocene) on till, locally with an intercalation of less than 2 m of coversand; 7. built-up area; 8. (left white) fluvio-periglacial deposits and slope deposits (both belonging to the Twente Formation, Weichselian), locally covered by less than 2 m of coversand, or by peat (Holocene); 9. Late Palaeolithic site at Emmerhout. Drawing J.M. Smit.

that the flints were present at least 20 cm underneath the topsoil, especially because flints were not noticed during the cleaning of surfaces 1 and 2.

On June 20th, A. Meijer writes in his report that more flint artefacts were collected by him, using a shovel. The locations of these finds (that were mostly numbered in pencil) were measured by A.E. Lanting and put on a map (figure 7 is mainly based on his field map).

In his field report A.E. Lanting remarks, that "the flints were present in a relatively loose layer of yellow sand, under which a more compact yellow sand layer is present, in which orange-coloured spots occur that are harder". In 1984 A.E. Lanting commented that the flints were present in the basal part of the upper (loose) sand layer.

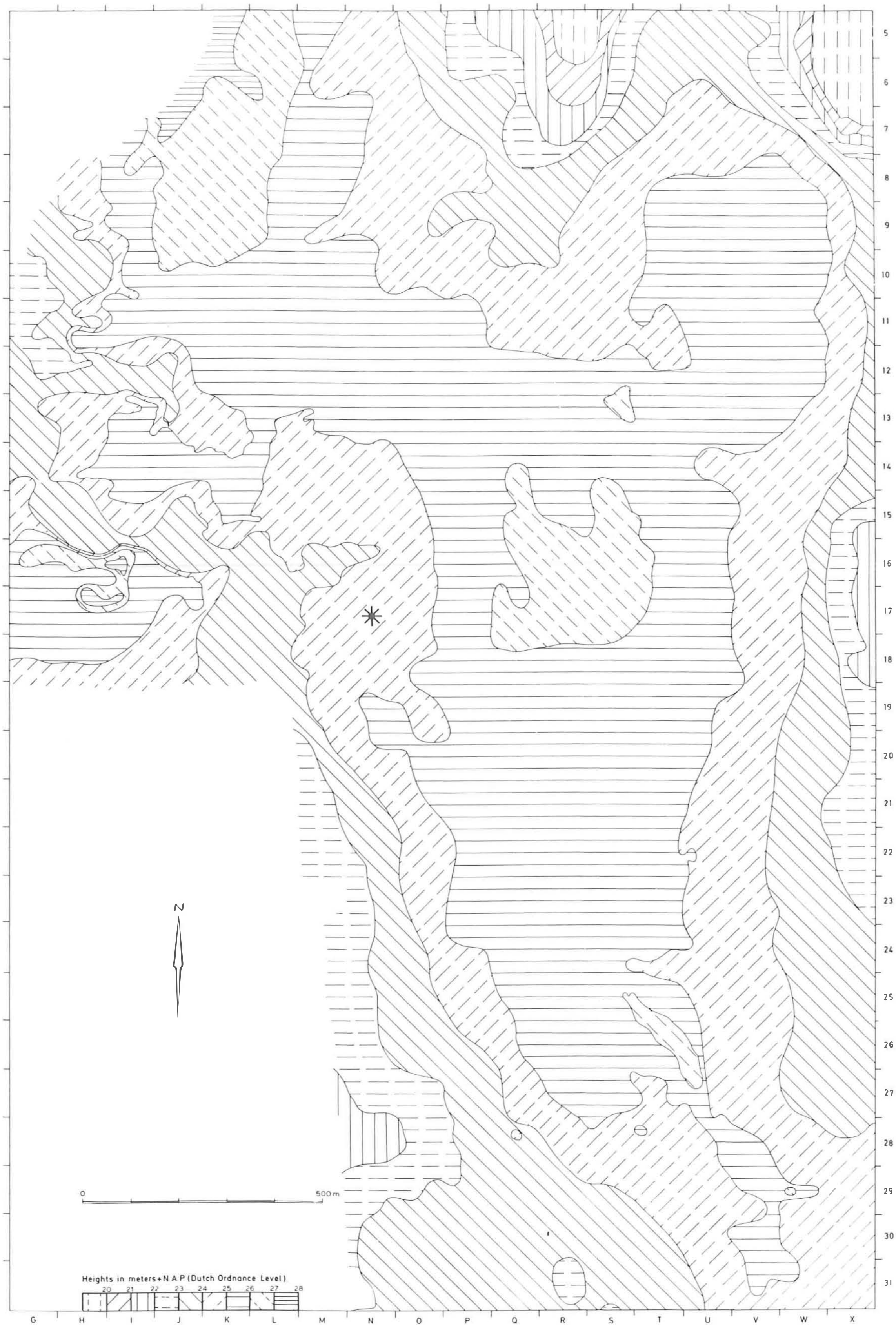
Furthermore two pits were noted during the work on June 20th, they are indicated by broken lines on figure 7. A smaller one is present immediately to the E of the flint concentration, its diameter is c. 64x33 cm. The second one has an egg-shaped outline, its diameter is c. 235x150 cm, and it reaches a depth of at least 90 cm. It is present approximately 2 m to the SE of the main flint concentration (fig. 7). These pits were filled by the same loose type of sand that constitutes the upper sand layer. A.E. Lanting (comments, 1984) is of the opinion that the top of the pits coincides with the transition between the two sand layers. It is probable, therefore, that the pits were formed before the deposition of the upper sand layer.

On June 21th a few more finds were recovered. Part of the filling in the large pit to the SE of the flint concentration was dug away, but no finds were made. Profile AB (fig. 7) was created. On June 22th again part of the filling in the large pit was removed, in such a way that profile CD was formed. Profiles AB and CD were drawn. No finds were encountered in the filling of the pit. The only find indicated on the map of Lanting (fig. 7) that is clearly located within the outer limits of the pit (a point), was evidently found during the cleaning of surface 3, and was therefore present high in the filling of the pit. After June 21th no more finds were made. As stated above, excavation was done by careful shovelling, by A. Meijer. The sand was not sieved.

The lowermost coversand layer present at the site is characterized by the fact that it is somewhat 'hard' (therefore cemented or somewhat loamy). Furthermore this layer is clearly horizontally layered, as is indicated on the field drawing of profiles AB and CD. This layer was at least 100 cm thick, the bottom of it was not reached.

The uppermost coversand layer at the site consists of loose sand, and is not visibly layered. Its max. thickness can be estimated as 35-50 cm.

In many other places in this area the same sequence is found within the coversand (Ter Wee,


N
0
500 m
Heights in meters + N.A.P. (Dutch Ordnance Level)
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G H I J K L M N O P Q R S T U V W X
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1979). Locally between the two coversand layers the 'Usselo Layer' is present, a fossil soil dating from the Allerød Interstadial (Van der Hammen, 1952). At other places the two layers are separated by a gravel band or 'desert pavement' (Ter Wee, 1979). According to Ter Wee (*ibid.*), the layered coversand is Younger Coversand I, deposited during the Early Dryas Stadial (the short stadial between the Bølling and Allerød Interstadials). The not clearly layered (mostly somewhat coarser) coversand is always the uppermost coversand layer, and according to Ter Wee it was deposited during the Late Dryas Stadial; it is named Younger Coversand II.

At Emmerhout the 'Usselo Layer' was not observed. At the transition between the two layers only an infiltration band (brown) was noticed. It therefore seems evident, that the top of the lower coversand layer (including the once present Allerød soil) has been eroded away by the wind.

Summarizing, we can state that the following sequence of events took place at the site:

a. Deposition of the lower (layered) coversand layer; Early Dryas Stadial.

b. Erosion; end of Allerød Interstadial and/or beginning of Late Dryas Stadial.

c. Deposition of the upper (not layered) coversand layer; Late Dryas Stadial.

Since the flint artefacts were found in the basal part of the Younger Coversand II, it is possible that they derive originally from the top part of the Younger Coversand I that was subsequently removed by erosion. This leaves us with the following dating for the finds on the basis of the observed stratigraphy: end of the Early Dryas Stadial, the Allerød Interstadial, or the beginning of the Late Dryas Stadial. Stated in a different way: the finds date from the Allerød Interstadial, or from slightly earlier or later. This dating is still formulated within the 'traditional' chronostratigraphical zonation of the Late Glacial, as summarized by *e.g.* Zagwijn (1975), though we are aware of the work of Usinger (*e.g.* 1975) and Coope (*e.g.* 1975). Whatever the precise climatic circumstances were during the zone we call Early Dryas Stadial (*e.g.* Van Geel & Kolstrup, 1978; Kolstrup, 1982), its existence as a distinct 'phase' seems to be indicated by the widespread occurrence of Younger Coversand I, stratigraphically located between soils or sediments, where present, dating from the Bølling and Allerød Interstadials respectively (*e.g.* Van der Hammen & Wijmstra, 1971; for a discussion of differences in lithology of Younger Coversand I between locations in the Northern and Eastern Netherlands, see Stapert, 1986). Unfortunately, we cannot be sure that the presence and absence of coversand deposition were strictly correlated with stadials and interstadials respectively, as defined by pollen analysis (in fact we have good reason to think that this correlation is not very strict), and this is one of the main problems with 'stratigraphical' dating of Late Glacial findspots in coversand.

Fig. 5. Contour map of the surroundings of the Late Palaeolithic site at Emmerhout (that is indicated with an asterisk), based on data of A.M. Huiskes (B.A.I., Groningen). It can be seen that the site is located on the western slope of a ridge, that is the more easterly of the two ridges that constitute the Hondsrug proper. Drawing J.M. Smit.

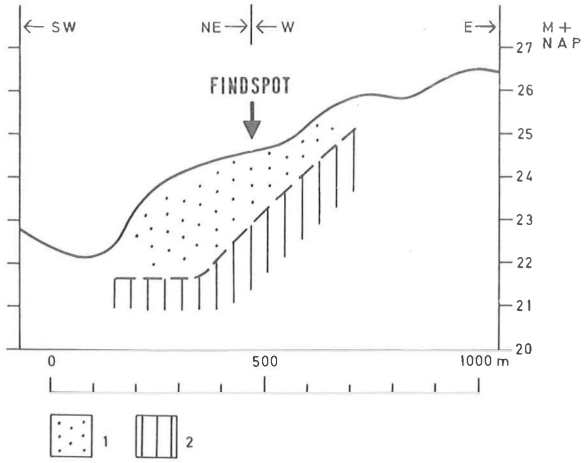


Fig. 6. Schematic section of the site and its immediate surroundings, based on Ter Wee (1979). Legend: 1. coversand; 2. boulder-clay. Drawing D. Stapert/J.M. Smit.

Concerning the large pit, on top of which an artefact was found, the following can be said. The two profiles show a quite irregular cross-section, that seems to rule out a man-made origin. On the basis of the cross-sections it seems probable, that this pit originated as the result of an ancient treefall (Kooi, 1974). In that case it would seem to be probable that the tree grew here during the Allerød Interstadial. According to Lanting (comments, 1984) the artefact was not found at the bottom of the pit, but clearly high in its filling. This could indicate a dating for the artefact in the Late Dryas Stadial. However, as there is only one find clearly located within the outer limits of the pit, one cannot attach too much importance to this. It is not impossible that an artefact that was already present

there before the tree fell, could have ended up high in the filling of the pit, as during a treefall part of the soil is turned upwards. Therefore, we have to be content with the dating of the site that can safely be deduced from the stratigraphy: approximately Allerød Interstadial.
Regarding the Creswellian site of Siegerswoude, its stratigraphy at least allows us to conclude that it cannot be older than the end of the Early Dryas Stadial (Kramer *et al.*, this volume).

4. THE FLINT ARTEFACTS

4.1. General remarks

The finds consist of 350 flint artefacts, in addition to 21 stones or fragments of stone (see 5.). Generally speaking, the flint used is of good quality. All artefacts are made of northern moraine-flint, originating from the till (boulder-clay) that was deposited in this area during the Saalian. The same is true for the stones. Since at the findspot till is not exposed, the people must have brought the flints and stones that are present on the site from elsewhere. At a distance of 1 to 2 km to the NE of the site till is exposed at the surface, according to the geological map (fig. 4), on top of the eastern of the two ridges that constitute the Hondsrug proper. It is possible, however, that during Late Glacial times flints and other stones could also be collected at shorter distances from the site.

Most artefacts are made of light-grey coloured and fine-grained types of flint. Two artefacts, however, a core-preparation blade and one of the blade end scrapers (fig. 10: no. 14), are made of a peculiar and beautiful type of white flint, containing many small fossil-fragments (fig. 8). They cannot be conjoined. Since this type of flint is not represented among the waste material, we can conclude that these two artefacts were not made at the site. The people who camped here probably brought these artefacts (and presumably several more: see 7.) with them during travel from elsewhere. The same phenomenon has also been demonstrated at several other Late Palaeolithic findspots, for example at the Magdalenian findspots of Pincevent in France (Leroi-Gourhan & Brézillon, 1966; 1972) and Sweikhuizen in the Southern Netherlands (Arts & Deeben, 1983; 1984; in press), and at the Hamburgian site of Oldeholtwolde in the Northern Netherlands (Stapert *et al.*, 1986).

As the flint used is of good quality, it seems less probable that these people camped here during a period when the terrain was completely covered by vegetation. Many *Federmesser* sites in the northern half of the Netherlands, that can mostly be dated in the Allerød Interstadial, are characterized by flint material of poor quality. Perhaps this suggests a dating for Creswellian sites in the beginning of the Allerød Interstadial, at least before the *Pinus*-phase, while *Federmesser* sites can possibly be dated in the *Pinus*-phase?

Fig. 8. The two artefacts manufactured from white flint. On the left a scraper (fig. 10: no. 14), on the right a core preparation blade. Foto F.W.E. Colly.

The artefacts are covered by a low 'gloss patina' or 'soil sheen', but apart from this they have generally been well preserved. A few artefacts show patches of 'friction-gloss' (Stapert, 1976).

From the excavation map (fig. 7) it can be deduced that c. one third of the areal extent of the findspot has not been investigated, as a consequence of the presence of a large recent disturbance. Furthermore, part of the material originally present will have escaped attention, as the sand was not sieved. Finally, the excavation was done using a shovel, which is certainly not the best method to investigate sites of this kind. However, it should be noted here that A. Meijer is an excellent excavator, and will not have missed many flints, not even smaller ones. All in all, we should estimate that probably c. half of the material originally present at the site is lost to us. Therefore, the proportions with

Table 1. Flint artefacts (fragments counted as 1, irrespective of whether or not they fit together with other fragments; classifications done before the refitting work).

	Total number	% of total	Fragments		Burnt pieces	
			number	% per group	number	% per group
Blades (incl. fragments)	86	24.6	56	65.1	0	0
Flakes (incl. fragments)	138	39.4	57	41.3	3	2.2
Burin spall	1	0.3			0	0
Cores (incl. fragments)	7	2.0			0	0
Blocks or nodules	9	2.6			0	0
Chips (smaller than 1.5 cm)	77	22.0			4	5.2
Subtotal non-tools	318	90.9			7	2.2
Tools (incl. fragments)	29	8.3 (without chips 10.7%)	19	65.5	2	6.9
'Chips with retouch'	3	0.9			0	0
Total	350	100.1			9	2.6

which several categories (for example tool types) are present, should be taken as estimates only.

The flint material can be subdivided as shown in table 1, in which also figures are given concerning the occurrence of fractures and traces of burning. Of course, the numbers of specimens indicated as showing traces of burning, must be regarded as minimum figures; the number of burnt pieces is however quite low. As at many other Late Palaeolithic sites, relatively large numbers of broken tools and blades are present.

It is customary for reports on Palaeolithic sites to include lists in which frequencies of various subgroups of artefacts are presented. However, such lists involve several problems that are often hidden. These can make it difficult to compare sites realistically with respect to, for example, the proportion of 'tools' or the proportions in which several type-classes are represented.

First of all the excavation technique is of importance. For example, if all excavated soil is sieved, the number of retrieved smaller pieces, especially chips (defined in this article as pieces smaller than 1.5 cm), is increased remarkably. From the Hamburgian site of Oldeholtwolde, where all the soil was sieved, the total number of collected flint artefacts is c. 10,400, but only 1668 are larger than 1.5 cm! (Stapert *et al.*, 1986). More than 3550 flint artefacts there are even smaller than 0.5 cm (so-called 'micro-chips'), and probably many more of them have been missed, since the smaller ones are as big as the sandgrains between which they were present. Of course, a lot of chips are produced during flintknapping (*e.g.* Newcomer, 1971). It is thought, however, that many 'micro-chips' originated as a result of tool-retouching: at Oldeholtwolde a few small concentrations were encountered composed essentially of chips. The presence of many of these tiny chips at Oldeholtwolde, and the fact that they are found in small heaps, make it clear that the site was not disturbed by wind erosion, since the small and angular 'micro-chips' could easily have been picked up by the wind.

If the proportion of the 'tools' (including 'chips with retouch') with respect to all collected flint artefacts is calculated for Oldeholtwolde, this results in c. 4.6%. But if the proportion of tools (without fragments smaller than 1.5 cm) with respect to all flint artefacts larger than 1.5 cm is calculated, the resulting figure is c. 20.5%!

A remedy for this problem could be to use percentages for tools (without fragments smaller than 1.5 cm) with respect to all artefacts larger than 1.5 cm, for comparisons between sites. Even then the proportions arrived at for sites where the soil was not sieved will probably not be really comparable to those for sites where sieving was done.

Therefore, site reports have to mention whether or not the excavated soil was sieved (and the mesh width used). Also, it has to be specified exactly how the given percentages were calculated. As mentioned above, during the excavation at Emmerhout no sieving was done. The above-mentioned proportion of tools, calculated on the basis of all artefacts larger than 1.5 cm is 10.7%. In this case complete and broken artefacts have all been counted as 1.

Another problem concerns the degree of fragmentation of the artefacts. It is well known that the proportion of broken artefacts varies considerably between different sites. If the fragmentation was only the result of processes that affect smaller pieces on average in the same degree as bigger ones, it would not severely distort calculated proportions, but only absolute numbers. However, there are good reasons to suppose that this is not the case.

Fragmentation can be the result of many different processes, among which are the following: a. Natural processes (especially secondary frost-splitting); b. Trampling; c. Accidents during manufacture, and dropping; d. Use; e. Intentional breaking; f. Burning; g. Ploughing, *etc.*; h. Excavation damage; i. Laboratory damage.

Secondary frost-splitting is clearly in evidence at many Late Palaeolithic sites, for example Oldeholtwolde (Stapert *et al.*, 1986) and Orp (Vermeersch *et al.*, 1984). It seems clear that larger pieces are more often affected than smaller ones by this process. In general the fragments produced by this process will remain close to each other on the site. Also the other mentioned processes will most probably result in a relatively higher proportion of fragments among the larger pieces.

Intentional breaking, though difficult to recognize, seems to be well documented for several Late Palaeolithic sites, and was probably a widespread practice (Bergman *et al.*, 1983). Especially blades were broken intentionally. Evidence for the possible presence of this practice can also be found indirectly, by measuring the distance between the locations of pairs of fragments that fit together (Stapert *et al.*, 1986). For the site of Oldeholtwolde it was found, that pairs of fitting fragments can be separated by large distances, up to more than 6 m. This indicates that fragments were transported on the site after the moment of breakage, probably to places where they were used. Of course, fragments that originated because of other mechanisms (*e.g.* during manufacture), could also have been considered as being still usable (for possible examples see under 7.). What concerns us now is the fact that especially larger pieces, like blades, were broken intentionally or otherwise.

Of course archaeologists try to refit broken pieces, though this almost never succeeds completely. In many cases we have no idea how the fragmentation occurred. In publications it is often not even mentioned whether fracture-surfaces are old or recent. If refitting of broken pieces is carried out, the following categories are produced: more or less complete unbroken tools, more or less complete tools composed of several fragments, incomplete tools composed of several fragments, and fragments of tools that cannot be fitted to other fragments. Since we know that several of the processes resulting in fragmentation do not affect each subgroup of artefacts to the same degree, the question arises how we should calculate proportions of subgroups in such a way that different sites can be compared.

Use can also lead to fragmentation, but some types break more often than others. For example, it seems that implements used as (part of) projectiles are on the average clearly more fragmented than other types (see however: Odell & Cowan, 1968). This is true especially for *lamelles à dos*, that are practically always found in a fragmented state, which is one of the reasons for the fact that they can occur with very high proportions. Use of tools of other types can also lead to breakage, but more often only small pieces break off, such as borer-tips, fragments of burin-edges, *etc.* Mostly these broken-off pieces are smaller than 1.5 cm, so that they will be included in the category of 'chips with retouch'. Usually only few of these can be refitted to the tools from which they derive. Besides, many 'chips with retouch' probably do not come from tools, but are the result of core-preparation, *etc.* It is probably a good idea to distinguish between broken and damaged tools. From damaged tools only tiny fragments (chips) have been broken off, but the tool is still recognizable. Thus, if a borer-tip has been broken off during use, but the tool is still recognizable as a borer, the tool is not broken, but damaged.

In view of the above, it seems to me that percentages of different classes of artefacts should be looked upon as being very crude instruments for comparing different sites, if these problems have not been taken into account in some way. It should in any case be specified how the percentages were

Table 2. Flint tools.

	Numbers				Percentages			Burnt pieces
	A	B	C	D	A	B + C	B + C + D	
Points	17	5	4	4	58.6	50.0	56.5	0
Truncated blades	1	1	0	0	3.4	5.6	4.3	0
Blade end scrapers (one double)	3	3	0	0	10.3	16.7	13.0	0
Borers (one double)	4	2	1	0	13.8	16.7	13.0	0
Burins (one double)	2	1	0	1	6.9	5.6	8.7	0
Retouched blades	2	0	1	0	6.9	5.6	4.3	2
Total	29	12	6	5	99.9	100.2	99.8	2

A Total number of pieces (more or less complete tools and fragments all counted as 1, irrespective of whether or not fragments can be fitted together).
B Number of unbroken (though mostly damaged) tools.
C Number of complete or incomplete tools composed of several fragments.
D Number of tool-fragments not fitting together with other fragments.

calculated, and frequencies of fragments should be presented for each subgroup of artefacts that is distinguished.

In table 1 it can be seen, that especially blades and tools frequently occur as fragments. As indicated above, one of the reasons for this phenomenon could be the practice of intentional breaking.

In table 2, in which the tools of Emmerhout are presented, frequencies and proportions are given in several ways. Of course, we are dealing here with a site where only very small numbers of artefacts are present. Therefore 'statistical' reliance is not claimed here. It is only intended to present the material in a somewhat more detailed way than is usually done. It is clear that types which often occur as fragments will be present with a relatively higher percentage if complete pieces and fragments are all counted as 1, irrespective of whether or not the fragments fit to other fragments.

As a proposal for discussion I would suggest that percentages based on the sum of tools of the categories B+C+D (table 2) are somewhat more 'realistic' when one wants to compare different sites among each other. However, more research along these lines is needed, with larger and better excavated sites than Emmerhout.

4.2. The tools

There are 29 tools or fragments of tools present (table 2). Furthermore there are 3 chips (pieces smaller than 1.5 cm) with retouch.

4.2.1. *Points and probable point-fragments*

In total there are 17 points or probable fragments of points. Eight fragments fit together to form four more or less complete points. Taking this into account, there are 9 almost complete points (fig. 9: 1-9), and 4 probable fragments of points (fig. 9: 10-13). These implements are described briefly here below; the numbers refer to figure 9.

No. 1. This point consists of 2 fragments (fieldnumbers 1, 48) that fit together. Part of the tip of the point is broken off anciently, possibly as a result of the point having been used as a projectile. The present length of the specimen is 4.9 cm, its max. width 1.5 cm, and its max. thickness 0.4 cm; its weight is 3.5 g. The tool belongs to the so-called Creswell points. Between the more or less straight-backed part of the tool, and the oblique truncation, a non-retouched part of the edge, c. 4 mm, is present. The tool therefore can be placed in type AC1 of Campbell (1977), which is the dominating type of point at this site. The truncation is made at the bulbar end of the blank. The angle between the truncation and the non-retouched edge is c. 35°. The truncation is on the left, when the pointed part is facing upwards.

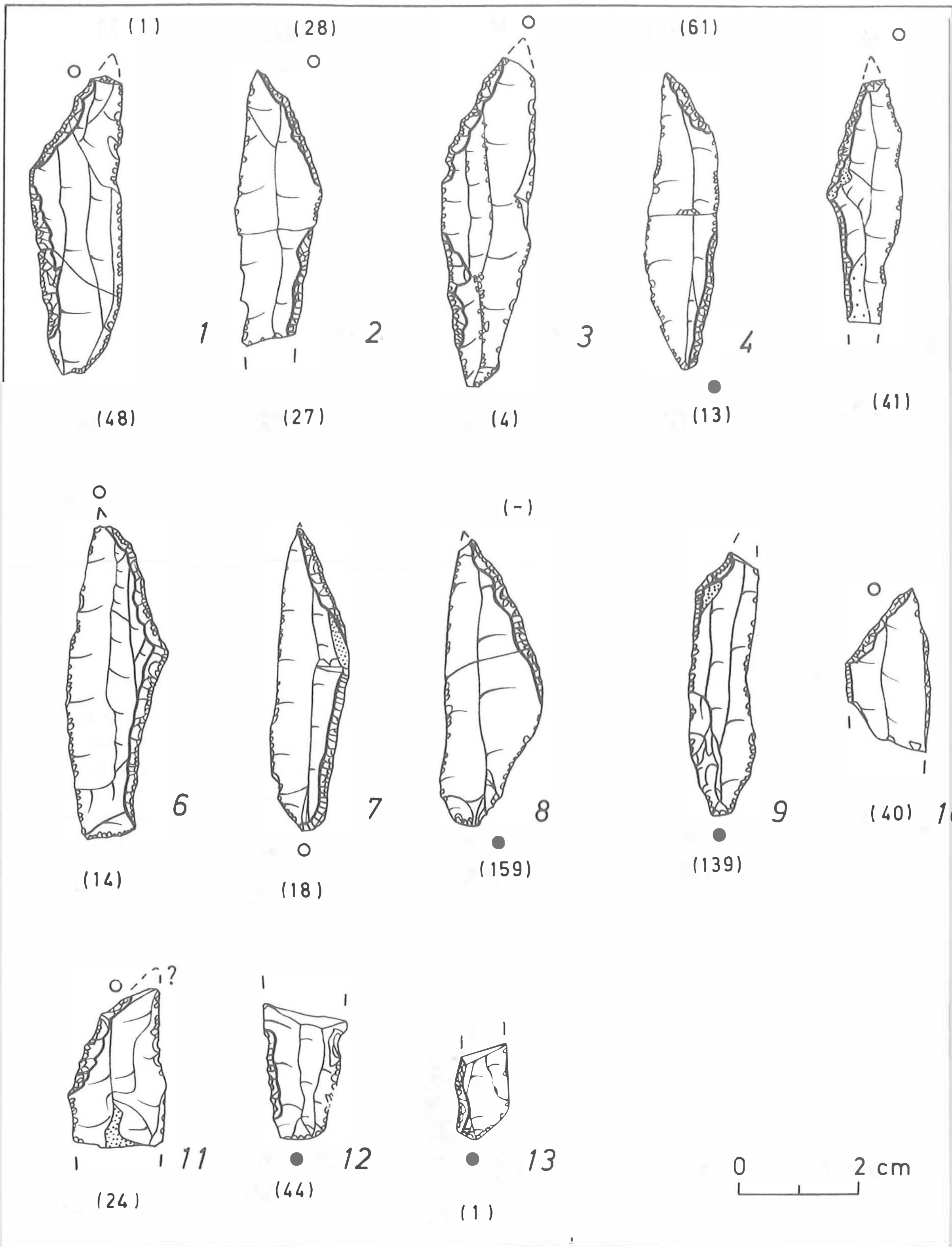


Fig. 9. Points and probable point-fragments of Emmerhout. Retouch interpreted as intentional outlined somewhat thicker. An infilled circle indicates the point of percussion, an open circle the direction of a point of percussion no longer present. Irregular stippling indicates remnants of cortex, regular stippling remnants of old frost-split faces. Burning is indicated with an asterisk. Drawing D. Stapert/J.M. Smit.

The fracture runs obliquely. Measured in the middle of the fracture, the basal part has a length of c. 1.6 cm. The steep retouching of the back and the truncation is applied exclusively from the ventral face, as is also the case with all other points. Near the base, part of the backed edge (c. 6 mm) is not retouched.

No. 2. Here again two fitting fragments are concerned (field-numbers 27, 28). In this case the tip looks undamaged. Edge damage is present along the non-retouched edge, as is also the case with all the other points. Between the straight-backed part and the oblique truncation a non-retouched part of the edge is present, c. 6 mm. Therefore this point can also be placed in type AC1 of Campbell. A small part of the basal end of the point is missing, the fracture occurred anciently. The present length of the specimen is 4.6 cm, its max. width 1.4 cm, and its max. thickness 0.3 cm; its weight is 1.7 g. The angle between the truncation and the non-retouched edge is c. 30-50°, depending on how the measurement is taken. The truncation is present at the bulbar end of the blank, and located on the right. The top-fragment has a length of c. 2.6 cm. The point is manufactured out of a glassy fine-grained type of flint of excellent quality.

No. 3. Also in this case a non-retouched part of the edge, c. 8 mm, is present between the backed part and the truncation, while moreover near the basal end of the point part of the backed edge has remained unretouched (c. 7 mm). Campbell's type AC1. The tip of the point has splintered off in ancient times, possibly because of the point having been used as a projectile. The present length of the tool is 5.4 cm, its max. width 1.5 cm, and its max. thickness 0.5 cm; its weight is 3.9 g. The truncation is at the bulbar end of the blank, on the left. Some ridges between dorsal negatives are partly damaged. This could presumably be either the result of rubbing the core with a stone before striking off the blade (see *e.g.* Newcomer, 1975a; 1975b), or of application of the 'contre-coup' technique, using a small hammerstone (Tixier *et al.*, 1980). A possible indication for the last mentioned possibility is the fact that the damaged parts of the dorsal ridges are located near the retouched parts of the left edge. However, it is difficult to understand in that case why only one of the points shows this phenomenon. The angle between the truncation and the non-retouched edge is c. 30°.

No. 4. This point consists of 2 fragments fitting together (field-numbers 13, 61). The tip-part looks more or less undamaged, but a tiny piece has been broken off anciently (too small to indicate on the drawing). Between the truncation and the approximately straight back a non-retouched part of the edge is present, c. 1.7 cm, where edge damage can be seen. Edge damage is also present along the non-retouched side of the tool, as is the case with all other points too. Campbell's type AC1. The length of the top-fragment is 2.3 cm, that of the basal fragment 2.6 cm; the max. width of the tool is 1.2 cm, and its max. thickness 0.3 cm; its weight is 1.4 g. In this case the truncation is present at the distal end of the blank, and on the right. The angle between the truncation and the unretouched edge is c. 40°.

No. 5. From this point a small part of the base is missing, the fracture surface is not recent. Also from the tip a small part is missing, while splintering occurs there on the ventral face; these phenomena most probably originated as a result of the point having been used as a projectile ('impact damage': see Barton & Bergman, 1982; Moss & Newcomer, 1982; Bergman & Newcomer, 1983; Moss, 1983b; Fischer *et al.*, 1984; Odell & Cowan, 1986). The present length of the specimen is 4.1 cm, its max. width 1.3 cm, and its max. thickness 0.4 cm; its weight is 1.5 g. Dorsally a small remnant of cortex (cream-coloured) has been preserved, while moreover part of an old frost-split surface is present (near the base). The flint used is of an excellent glassy kind.

The point has a form that is reminiscent of shouldered points, as known in this region from the Hamburgian tradition, because of the fact that the backed part is slightly concave. It is obvious that between typical shouldered points and Creswell points there exists a typological 'overlap'. Houtsma *et al.* (1981) define the two types of point as follows: shouldered points have the nick between the truncation and the shoulder below the middle of the tool (pointed part facing upwards), while with Creswell points the nick is present above the middle. Furthermore, shouldered points often have either the truncation or the shoulder retouched ventrally, which is uncommon with Creswell points (though it occurs: Campbell, 1977; 1980). The two specimens from Emmerhout that are reminiscent of shouldered points (fig. 9: nos. 5 and 6) both should be placed, according to the above-mentioned definition, in the category of Creswell points; this is true at least for no. 6, that is unbroken. Since there is not or hardly a non-retouched part of the edge between the truncation and the back, points nos. 5 and 6 would in that case be classified as type AC2 according to Campbell. With point no. 5 the angle between the truncation and the non-retouched edge is c. 35°. The truncation is situated on the left, and at the bulbar end of the blank.

No. 6. This point is more or less complete. From the tip a small part has been broken off anciently, probably as a result of the point having been used as a projectile. The present length of the specimen is 5.2 cm, its max. width 1.7 cm, and its max. thickness 0.5 cm; its weight is 3.7 g. The right edge has been retouched completely, while the backed part is formed somewhat concavely, so that the piece is reminiscent of a shouldered point, as no. 5. As mentioned above, we tend to classify these two points nevertheless as Creswell points (Campbell's type AC2). The angle between the truncation and the non-retouched edge is c. 30°. The truncation is on the right, and located at the bulbar end of the blank.

No. 7. This is a complete Creswell point, only a tiny part of the tip has been broken off. The length of the tool is 5.0 cm, its max. width 1.2 cm, and its max. thickness 0.4 cm; its weight is 2.0 g. This is a typical example of Campbell's type AC1, as there is a small non-retouched part of the edge between the truncation and the back, of c. 3 mm. At that spot, however, a remnant of cortex has been preserved (cream-coloured), that provides a natural backing. The point has been fashioned out of excellent glassy flint. The angle between the truncation and the non-retouched edge is c. 30°. The truncation is on the right, and located at the distal end of the blank.

No. 8. This point consists of two fragments that fit together (the basal fragment has the field-number 139 or 159 (not well readible; it is probable, however, that the field-number is 139), the top-fragment is not numbered). The fracture is of the *languette* type (Lenoir, 1975), suggesting perhaps that the fracture occurred during the manufacture of the point (*e.g.* during retouching work). From the tip a tiny part has been broken off (not recently). The length of the point is 4.7 cm, its max. width 1.6 cm, and its max. thickness 0.4 cm; its weight is 2.5 g. The basal fragment has a length (measured from the middle of the somewhat oblique fracture) of 2.8 cm.

This point can be placed in the category of the so-called 'obliquely blunted points' of Campbell (type AB6). Houtsma *et al.* (1981) call this type 'long B point' and give the following definition for distinguishing it from the obliquely truncated blades (type AA1 of Campbell): angle between the truncation and the longitudinal axis of the tool is 45° or less (Campbell gives no definition but means essentially the same). In the case of point no. 8 the angle referred to is c. 30° (the angle between the truncation and the non-retouched edge is c. 36°). The truncation is on the right, and located at the distal end of the blank.

No. 9. From this tool a relatively large part of the tip has been broken off (the fracture-surface is not recent). It is essentially a blade with an oblique truncation. The angle between the truncation and the longitudinal axis of the tool is c. 40°, and consequently the implement has to be classified as a point (see no. 8). Just proximally from the truncation some retouch is present along the same edge over c. 5 mm, so with some difficulty this could be called an atypical Creswell point, of Campbell's type AC2. The present length of the specimen is 4.3 cm, its max. width 1.0 cm, and its max. thickness 0.3 cm; its weight is 1.5 g. Dorsally a small remnant of cortex (cream-coloured) has been preserved. The tool is manufactured from excellent fine-grained flint of a glassy kind. The truncation is on the left, and at the distal end of the blank.

No. 10. Here we are concerned with a top-fragment of a point, most probably of a Creswell point of type AC2 of Campbell. The tip is undamaged. The point-fragment has a length of 2.6 cm, its max. width is 1.4 cm, and its max. thickness 0.3 cm. The fracture-surface is not recent. The angle between the truncation and the non-retouched edge is c. 46°. The truncation is present at the bulbar end of the blank, on the left. The specimen has been manufactured out of excellent glassy flint.

No. 11. This is most probably a top-fragment of a point (either a Creswell point of Campbell's type AC1 or an obliquely blunted point). The angle between the truncation and the non-retouched edge is 30-40°. From the tip probably a small part has been broken off anciently. Dorsally a remnant of cortex (cream-coloured) has been preserved. The length of this point-fragment is 2.7 cm, its max. width is 1.6 cm, and its max. thickness 0.5 cm. The fracture surface is not recent. The truncation is located at the bulbar end of the blank, on the left.

No. 12. This is probably a basal fragment of a point (like no. 13). The left edge has been retouched over a distance of 1.2 cm, not completely as far as the base, and also not completely as far as the fracture. This could therefore be a fragment of a point like no. 3. The notch along the right edge is most probably excavation damage. The fragment has a length of 2.2 cm, its max. width is 1.4 cm, its max. thickness 0.4 cm. The truncation, if this indeed is a point-fragment, must have been on the left, at the distal end of the blank.

No. 13. Also this small piece is probably a basal point-fragment. It concerns a proximal fragment of a blade with the left edge retouched. The length of the fragment is 1.5 cm, its max. width 0.9 cm, its max. thickness 0.3 cm. If this is indeed a point-fragment, then the truncation must have been present at the distal end of the blank, on the left.

The mean max. length of the 9 more or less complete points (fig. 9: nos. 1-9) is 4.8 cm (S.D. 0.4); we should estimate that the real mean max. length was c. 0.5 cm greater, because of the broken-off fragments of tips and bases. It is interesting to note that these points are approximately 1 cm longer, on average, than the complete blades of Emmerhout (see 4.3.). The mean max. width is 1.4 cm (S.D. 0.2), and the mean max. thickness 0.4 cm (S.D. 0.1). The mean weight of these 9 damaged points is 2.4 g (S.D. 1.0). These size attributes would seem to indicate that these points are particularly suited to use as arrowheads. For example, with the average North American bow, "the weight of the arrowheads most probably used would be within a range of 2 grams to 5 grams" (Van Buren, 1975: p. 15). Nevertheless, use as spearheads cannot be excluded (see also: Odell & Cowan, 1986). Unfortunately, arrowheads and spearheads cannot be separated by use wear analysis (Fischer *et al.*, 1984).

4.2.2. *Obliquely truncated blade*

No. 24 (fig. 10). A blade with a truncation at the distal end. Since the angle between the truncation (at least its most distal part) and the longitudinal axis of the tool is c. 50°, the specimen cannot be classified as an obliquely truncated point. From the tip a tiny part has disappeared, possibly as the result of use. Along the non-retouched edge severe edge damage is present, almost exclusively dorsally. The tool is made out of a core preparation blade. Dorsally a remnant of an old frost-split face has been preserved (not covered with wind-gloss). The length of the tool is 4.2 cm, its max. width is 1.2 cm, and its max. thickness is 0.6 cm.

4.2.3. *Blade end scrapers*

Within the material from Emmerhout there are three blade end scrapers present, of which one is most probably a double scraper (fig. 10: 14-16). None of these tools is broken, though one (no. 16) is damaged. Of all three scrapers one or two sides are partly or completely retouched. In the northern Netherlands blade end scrapers with one or two retouched sides are especially well known from Hamburgian sites; they occur hardly or not at *Federmesser* sites.

No. 14. This scraper is manufactured from a remarkable type of white flint, containing many small fossil-fragments (fig. 8). Apart from this scraper, there is only one other artefact (a core preparation blade, see under 4.3.) present made of this kind of flint (fig. 8). The two artefacts cannot be conjoined. As stated earlier, there is no waste material of white flint, so it seems clear that these two artefacts were not manufactured at the site, but were transported from elsewhere. Therefore, we have good evidence here for import/export of artefacts. Perhaps we can speak here of 'curated tools' in the sense of Binford (1983 (1977)). It is probable, that some more tools were also brought to the site from elsewhere, that cannot immediately be recognized as such because they are made of the same kinds of flint as used on the site. From the refitting analysis of the flint material from the Hamburgian site of Oldeholtwolde, we know that all the points present at that site were probably brought there from elsewhere, as well as several tools of other types and some larger blades (Stapert *et al.*, 1986; see also the discussion under 7.).

The scraper no. 14 is complete and seems to be undamaged. Its length is 7.2 cm, its max. width 1.8 cm, and its max. thickness 0.5 cm. The scraper angle is c. 60°. The scraper edge is present at the distal end of the blade, which is also the case with the two other scrapers. With the help of a magnifying glass no clear rounding of the scraper edge can be seen.

Along the left edge a remnant of an old frost-split face has been preserved, that is covered by wind-gloss. This indicates that the white flint, like the other flint material at the site, was collected from the boulder-sand in the Northern Netherlands. This is a weathering residue of Saalian till in which many

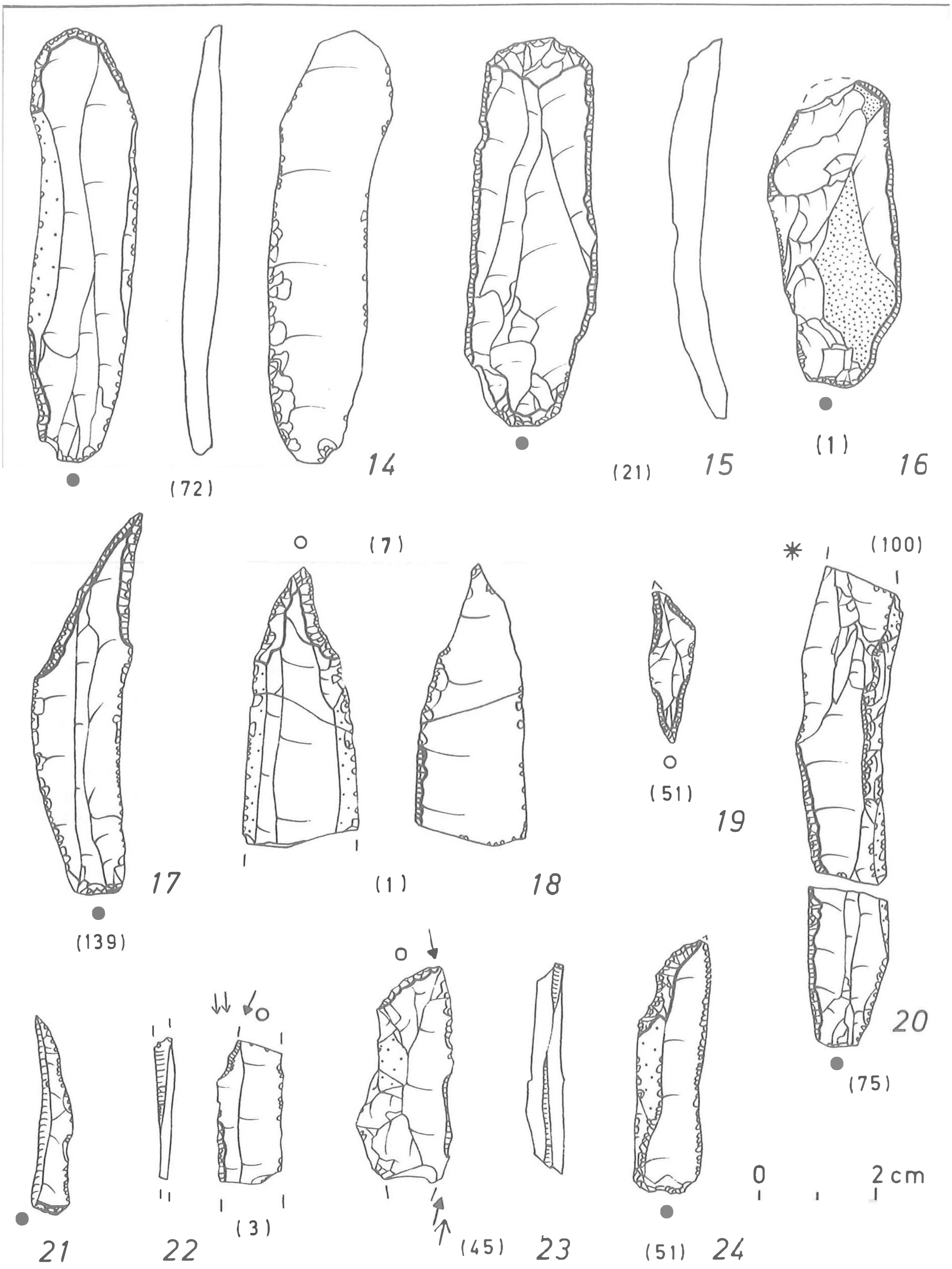


Fig. 10. Scrapers (nos. 14-16), borers (nos. 17-19), burins (nos. 22, 23), burin spall (no. 21), and broken retouched blade (no. 20) of Emmerhout. Legend as in figure 9. Drawing D. Stapert/J.M. Smit.

flints with wind-gloss are present (Stapert, 1976). Therefore, there is no reason to postulate a separate source for this type of flint. Still, this kind of white flint is quite rare among the flints in the till, and it could well be that the Late Palaeolithic people were attracted by its beauty and rarity. Among the material from the Hamburgian site at Oldeholtwolde one heavily used blade of white flint is present, that also clearly belongs to the group of flint artefacts brought to the site from elsewhere (see also Moss, in press).

Along the left edge near the base retouch is present over c. 2 cm. Along the right edge ventrally much retouch is present of which the character is not clear. This retouch is very flat, 'invasive', and also irregular ('splintery'). Perhaps here we are concerned with edge damage (not intentional retouch), that could be the result of use or, alternately, was caused by movement in a haft. However, it is also possible that this retouch was intentional and meant to facilitate hafting (E. Moss, pers. comm.).

No. 15. This is a blade end scraper of which both sides are retouched completely. It is probable (though not certain) that this is a double scraper. Also the bulbar end seems to be transformed into a scraper edge, but the problem here is that often much retouch is present at the bulbar end of blades that is the result of core preparation prior to striking off the blade (*e.g.* Newcomer, 1975a). The tool is manufactured from excellent fine-grained glassy flint (light greyish in colour). The length of the tool is 6.4 cm, its max. width is 2.3 cm, and its max. thickness is 0.7 cm. The angle of the distal scraper edge is c. 52%, that of the scraper edge at the bulbar end of the blade cannot be measured accurately, but is 50-60°. With a magnifying glass no clear rounding of the scraper edges can be seen.

No. 16. This implement can only with some difficulty be accepted as a scraper, since a relatively large part of the scraper edge has disappeared; the fracture-surface is not recent. Broken-off scraper-edges are known from several other Late Palaeolithic sites; the fractures probably originated as a result of use, *i.e.* as the consequence of downward pressure of the scraper ege during work. Of the scraper edge only a minor part has been preserved. The fact that the right edge is retouched completely, and also a small part of the left edge, gives some support to the hypothesis that we are indeed concerned here with a blade end scraper. Dorsally several remnants of cortex (thin, coloured grey) have been preserved. The present length of the tool is 5.1 cm, its max. width is 2.1 cm, and its max. thickness is 0.7 cm. The scraper angle cannot be measured. With the help of a magnifying glass no rounding of the remaining part of the scraper edge can be seen.

4.2.4. *Borers*

There are three borers present, of which one is double (fig. 10: 17, 18, 19).

No. 17. This is a fine specimen of an asymmetrical borer. The tool is intermediate between a straight Zinken (Campbell's type DB1) and a long single borer (Campbell's type EA1). On the left edge of the borer-tip retouch has been applied from the ventral and the dorsal faces, on the right only from the ventral face. The borer-tip is present at the distal end of the blank. The cross-section of the borer-tip is trapezoidal. Along the non-retouched parts of both edges quite a lot of edge damage is present, especially along the left edge dorsally. The specimen seems to be undamaged. The length of the tool is 6.2 cm, its max. width is 1.6 cm, and its max. thickness 0.5 cm. No clear rounding of the borer-tip can be observed with a magnifying glass. The tool is made of excellent fine-grained glassy flint.

No. 18. This is a rather typical example of a straight *Zinken* (Campbell's type DB1). The tool is incomplete (the basal part is missing), and consists of two fragments (field-numbers 1 and 7). The borer-tip is present at the bulbar end of the blank, and seems to be damaged: some splintering is present, and a few tiny fragments of the tip have been broken off ventrally. The retouch has been applied from the ventral face. Dorsally, along the right and left edges of the tool remnants of old frost-split faces have been preserved, of which the one on the left is covered with wind-gloss. Especially along the right edge ventrally a lot of retouch is present, that seems to be partly rough edge damage (use?), and partly fine intentional retouch. The present length of the specimen is 4.6 cm, its max. width 1.9 cm, and its max. thickness 0.6 cm. Also this tool is made of a good glassy kind of flint. No clear rounding of the borer-tip can be seen with a magnifying glass.

No. 19. A fine double micro-borer. From one of the borer-tips a tiny fragment has been broken off, presumably as the result of use. Also the other borer-tip seems to be damaged somewhat. Also this borer is made of very good glassy flint. The length of the tool is 2.5 cm, its max. width 0.8 cm, and its max. thickness is 0.3 cm.

4.2.5. *Burins and burin spall*

There are two burins (one double) present, and one burin spall (fig. 10).

No. 22. This tool is fragmentary, at least two fragments are missing. At the bulbar end of the blank a burin has been created of which the type cannot be ascertained anymore. The burin has been renewed at least twice. The preserving part of the left edge has been retouched (possibly 'termination retouch'). Edge damage is present along the non-retouched edge, and also at the upper fracture-surface. The tool is made of excellent glassy flint. Its present length is 2.4 cm, its max. width 1.1 cm, and its max. thickness is 0.3 cm.

No. 23. This is a double burin, from which the lower burin edge has been broken off; the fracture-surface is not recent. The upper burin (at the bulbar end of the blank) has been created by striking off a spall from a retouched fracture-surface. It can just be seen that the fracture probably originated intentionally as a small percussion cone seems to be present at the dorsal ridge. Edge damage is present along the spall negative (dorsally), and also splintering at the burin edge. The burin edge is c. 2 mm wide, and the burin angle is c. 80°. The lower burin (of which the type cannot be ascertained) was renewed at least once. The tool is made of reasonably fine-grained flint, coloured grey, opaque. Dorsally a remnant of an old frost-split face is present (not covered with wind-gloss). The present length of the tool is 3.6 cm, its max. width 1.6 cm, and its max. thickness 0.6 cm.

No. 21. This burin spall does not fit together with either of the two burins described above. It is a complete primary spall, that certainly derives from a burin on retouched end. Along the edge of the original blade some edge damage is present, suggesting use of the blade prior to the creation of the burin. The length of the burin spall is 3.2 cm; it must have created a burin edge c. 3 mm wide.

4.2.6. *Partially retouched blade*

No. 20 (fig. 10). This fragmentary tool consists of two fragments (field-numbers 75, 100). The fracture was probably the result of burning. It concerns a thick core preparation blade, of which the left edge has been partially retouched. Distally a fragment of the tool is missing; the fracture-surface is not recent. Dorsally a few remnants of old frost-split faces have been preserved (not covered with wind-gloss). The present length of the specimen is 7.6 cm, its max. width 1.5 cm, and its max. thickness 1.3 cm.

4.2.7. *'Chips with retouch'*

These are pieces smaller than 1.5 cm, that give the impression of being fragments of tools. As the three examples cannot be fitted together with damaged tools, and also are not typical broken-off borer-tips or other clearly recognizable tool-fragments, we cannot be sure that they really are tool-fragments. They could also have been created during core preparation or some similar activity.

4.3. Blades and blade-fragments

In total there are 86 blades or blade-fragments present at Emmerhout. These can be subdivided as indicated in table 3. In this table the results of our attempts to refit broken pieces have been taken into account. Thus, in the case of two blade-fragments

Table 3. Blades and blade-fragments.

	Complete	Proximal fr.	Medial fr.	Distal fr.	Total
Normal blades	21	20	10	14	65
Core preparation blades	8	4	1	4	17
Decortication blades	1	0	0	1	2
Plunging blades	0	1	0	1	2
Total	30	25	11	20	86
Percentage	34.9	29.1	12.8	23.3	100.1

Table 4. Some measurements of 'normal' blades and blade-fragments.

	Complete	Proximal fr.	Medial fr.	Distal fr.
Number	21	20	10	14
Mean max. length	4.3 cm	2.6	2.8	3.3
Stand. deviation	1.1	0.8	1.4	1.0
Mean max. width	1.6 cm	1.4	1.2	1.4
Stand. deviation	0.4	0.3	0.3	0.3
Mean max. thickness	0.4 cm	0.4	0.3	0.4
Stand. deviation	0.1	0.1	0.1	0.2
Mean number of straight sides in side-view	1.3	1.5	1.5	1.5
Stand. deviation	0.7	0.6	0.5	0.8

Notes: Fragments have been measured individually, irrespective of whether or not they fit together with other fragments. Max. length and max. width are measured as the sides of a circumscribing rectangle, which are respectively parallel to and perpendicular to the striking direction of the blade.

fitting together, of which only one shows core-preparation retouch, both have been included in the category of core-preparation blades. Fragments are counted as 1, irrespective of whether or not they fit together with other fragments.

There are 65 'normal' blades or blade-fragments present, of which only 21 are complete. For some measurements of the normal blades see table 4. The mean max. length of the complete 'normal' blades is only 4.3 cm; the range is 2.8-7.2 cm. One of the reasons for the fact that complete blades are relatively short could be that especially somewhat longer blades are broken. As stated above (4.2.) there are many possible mechanisms that cause fractures. One of them is intentional breaking (Bergman *et al.*, 1983), which would at least explain why blades occur as fragments more often than other categories of artefacts. On the other hand, long and thin objects such as blades would also be more susceptible to breaking because of other mechanisms, as for example frost-splitting. In the case of Emmerhout there are a few fractures that probably have originated as a result of intentional breaking of the blades, given the criteria of Bergman *et al.* (*ibid.*). There are no indications of use of the 'micro-burin technique' to break blades.

From table 4 one gets the impression, that proximal blade-fragments are somewhat shorter than distal fragments, just as is the case with the Hamburgian material from Texel (Stapert, 1981). The numbers of artefacts are much too small, however, to permit reliable conclusions to be drawn in this respect.

Many blades show fine edge damage along the edges, which is presumably the result of use. According to Moss (*e.g.* 1983a) especially straight edges of blades, as seen in side-view, would have been used by Palaeolithic men, "...regardless of the appearance of the edge from a dorsal or ventral view...". In table 4 we have noted the mean occurrence of straight edges in this sense. These observations are not really objective, because it is sometimes difficult to decide if an edge is more or less straight or 'too' curved. There is a slight tendency, however, for fragments to have on average more straight edges than complete blades. But fragments would have a greater chance of showing straight edges than complete blades. It is in any case clear from this exercise that the blades of Emmerhout are on the average of good quality.

It was possible for 8 'normal' blade-fragments to be fitted together in 4 pairs:

proximal fr./medial fr.	1
medial fr./distal fr.	1
proximal fr./distal fr.	2

The two resulting complete blades have max. lengths of 7.6 and 5.4 cm; the two still incomplete blades have max. lengths of 7.1 and 4.8 cm. This certainly suggests that the mean length of the blades in their original complete state was greater than 4.3 cm, probably more than 5 cm.

For two pairs of fitting blade-fragments the distance between the locations of the two fragments is known: 23 and 105 cm. Especially in the last case it seems to be out of the question that the fracture could be the result of trampling or such like, or secondary frost-splitting. Such large distances between the locations of fitting blade-fragments possibly constitute an indication of the presence of the practice of intentional breaking of blades. For the Hamburgian site of Oldeholtwolde it was found that rather many fitting blade-fragments were present more than 1 m apart, up to more than 6 m (Stapert *et al.*, 1986). It is also possible that one or both fragments of a blade that broke during manufacture, or use, were transported to another part of the site for some (perhaps another) task.

Among the core-preparation blades, there is one made of a peculiar type of white flint (fig. 8; section 4.1.), that was undoubtedly transported to the site from elsewhere. Part of the dorsal surface of this blade is formed by an old frost-split face covered by wind-gloss, indicating that the raw material was collected from boulder-sand (erosion residue of till), as is also the case with the other flints. Along the edges (both are straight in side-view) some edge damage is present, suggesting that it was used. Edge damage can, however, also be the result of transport, together with other objects, for example in a bag (Moss, 1983b). The max. length of this blade is 6.2 cm, its max. width 1.9 cm, and its max. thickness 0.8 cm.

At Emmerhout 7 more complete core-preparation blades are present. Furthermore, there are 9 fragments of core-preparation blades, of which 3 pairs fit together. In all cases a proximal and a distal fragment are concerned, that fit together to form a complete blade. The mean max. length of the 11 complete (after refitting) core-preparation blades is 5.6 cm, the max. length ranges from 3.8-8.3 cm. The mean max. width is 1.7 cm, and the mean thickness 0.6 cm. As usual, core-preparation blades are on average longer and thicker than 'normal' blades. In all 11 cases the core-preparation retouch is unidirectional.

All the fragments that fit together were found close to one another: in the flint-working area (see under 6.). The fracture-surfaces do not show signs of being possibly the result of intentional breaking. Three fragments of core-preparation blades remain isolated: 2 distal fragments and 1 medial fragment.

One complete decortication blade and one distal fragment of another are present. Decortication blades are blades of which the dorsal face consists for more than three quarters of old faces (cortex or old frost-split faces). Finally, one complete plunging blade is present, fitted together out of a proximal and a distal fragment that were found c. 131 cm apart. The fracture is of the '*languette* type' (Lenoir, 1975), and therefore probably arose as a result of end-shock during manufacture. One of the fragments was present in the flint-working area (see also 7.2.).

5. THE STONES

During the excavation of the Late Palaeolithic site at Emmerhout 21 stones, or fragments of stones, were found. Here the term 'stones' signifies all stones consisting of material other than flint. They are listed in table 5. There are 14 slab-like stones (many of them are fragments of originally larger stones), 3 rounded stones, and 4 small fragments. Petrographic identifications of the stones have been made by Prof. G.J. Boekschoten and A.P. Schuddebeurs.

5.1. Slab-like stones

Among the 14 slab-like stones there are 10 that all consist of the same type of gneiss, yellowish-grey in colour with a somewhat schistose structure. It seems very probable that all 10 fragments derive from only one very large slab originally. Among these gneiss fragments there are three groups of stones that fit together. The largest group consists of the nos. 32, 35, 68B, 86 and 121 (figs. 11, 12). On the drawing those parts of the circumference that are old, are indicated by a thin line around the stone. The largest diameter of this refitted group is approximately 32 cm, but it is clear that the original slab was even larger. Of the remaining 5 gneiss fragments (fig. 13) 2 pairs fit together: 33/34 (fig. 14) and 65A/65B, while one, no. 68A, remains isolated. Since the 10 gneiss fragments cannot be refitted completely, it is clear that several additional fragments are missing, that presumably have been present in the disturbed part of the site. For the meantime we assume that the people who occupied the site collected one huge gneiss slab at one of the boulder-clay outcrops in the surroundings, which subsequently became fragmented on the site. There are no fragments present that can be fitted on top of each other (at least, we did not succeed in refitting them that way). There are no clear indications that the original slab was fragmented deliberately, but

Table 5. Stones.

No.	Max. l.	Width	Max. th.	Weight	Type	Remarks
Slab-like stones						
68B	24.5 cm	16.2 cm	2.5 cm	966.9 g	Gneiss	Fragment of orig. larger stone
62	21.0	14.2	3.5	924.7	Granite, gneiss-like	Complete; surface shows a few somewhat darker zones (burnt?)
67	19.0	12.3	2.5	598.5	Sandstone (Dala)	Complete
32	12.5	8.1	1.8	231.4	Gneiss	Fragment of orig. larger stone
23	12,2	8.9	1.9	217.5	Tuffite or ash-tuff	Fragment of orig. larger stone
35	13.0	8.2	2.0	198.0	Gneiss	Fragment of orig. larger stone
68A	9.0	7.8	2.5	168.4	Gneiss	Fragment of orig. larger stone
34	10.9	7.7	1.1	92.2	Gneiss	Fragment of orig. larger stone
33	11.6	6.8	1.0	84.1	Gneiss	Fragment of orig. larger stone
121	7.3	6.9	1.9	80.6	Gneiss	Fragment of orig. larger stone
86	7.1	5.5	1.7	65.9	Gneiss	Fragment of orig. larger stone; on the field-drawing 2 stones are indicated
120A	6.7	6.0	0.6	30.9	Sandstone (Dala)	Fragment of orig. larger stone
65A	5.0	4.9	0.9	21.3	Gneiss	Fragment of orig. larger stone
65B	5.5	3.8	0.9	20.2	Gneiss	Fragment of orig. larger stone
			average 1.8	subtotal 3700.6		
Rounded stones						
78	7.5	7.0	5.8	344.5	Pegmatite	Possibly hammerstone (damaged parts)
120B	7.7	7.0	5.4	287.4	Migmatite	Burnt? (cracks, red-coloured spots); perhaps used as hammerstone
Not numbered	3.2	2.9	2.1	30.1	Quartz	Small but definite hammerstone (findspot unknown)
				subtotal 662.0		
Fragments						
65C	2.7	2.5	0.7	5.3	Granite	
139	2.7	1.8	0.5	3.0	?	(Findspot not indicated on the field-drawing)
Not numbered	Very small			}	?	
Not numbered	Very small			} 0.4	?	
				subtotal 8.7		
Total number: 21				total weight 4371.3		

In several cases there are two or three stones with the same field-number. These have been designated by us A, B, C. There is only one stone numbered 86, while two are indicated on the field-drawing. The same is true for no. 120. On the field-drawing at number 122 two small stones are indicated, but there are no stones numbered 122 present in the B.A.I. collection (perhaps one of the stones numbered 120 derives from this spot?). The maximum diameter of the stones was measured as the length, and used as the longitudinal axis of a circumscribing rectangle, the short sides of which constitute the width; the max. thickness was measured perpendicularly to the plane of the circumscribing rectangle. Several slab-like stones fit together: 32/35/68B/86/121; 65A/65B; 33/34 (see figs. 11-14). In all cases the same type of gneiss is concerned, and the three groups could easily derive from only one very large slab originally, together with no. 68A that cannot, however, be fitted together with other stones.

of course this cannot be excluded with certainty. I do not see reasons to believe that stone fragments such as these were used as 'tools', for example as 'burins', as suggested by Burdukiewicz (1986).

None of the 10 gneiss fragments shows clear signs of having been burnt, *e.g.* patches with red or black discolorations. However, especially the occurrence of vague greyish/blackish discolorations, caused by charring, would be difficult to demonstrate. We are familiar with blackish discolorations on many of the slab-like stones deriving from the hearth on the Hamburgian site of Oldeholtwolde (Stapert, 1982; Stapert *et al.*, 1986). These blackish patches are sometimes rather vague, and become more and more so after several years of storage. Furthermore, the slab-like fragments of Emmerhout show greyish

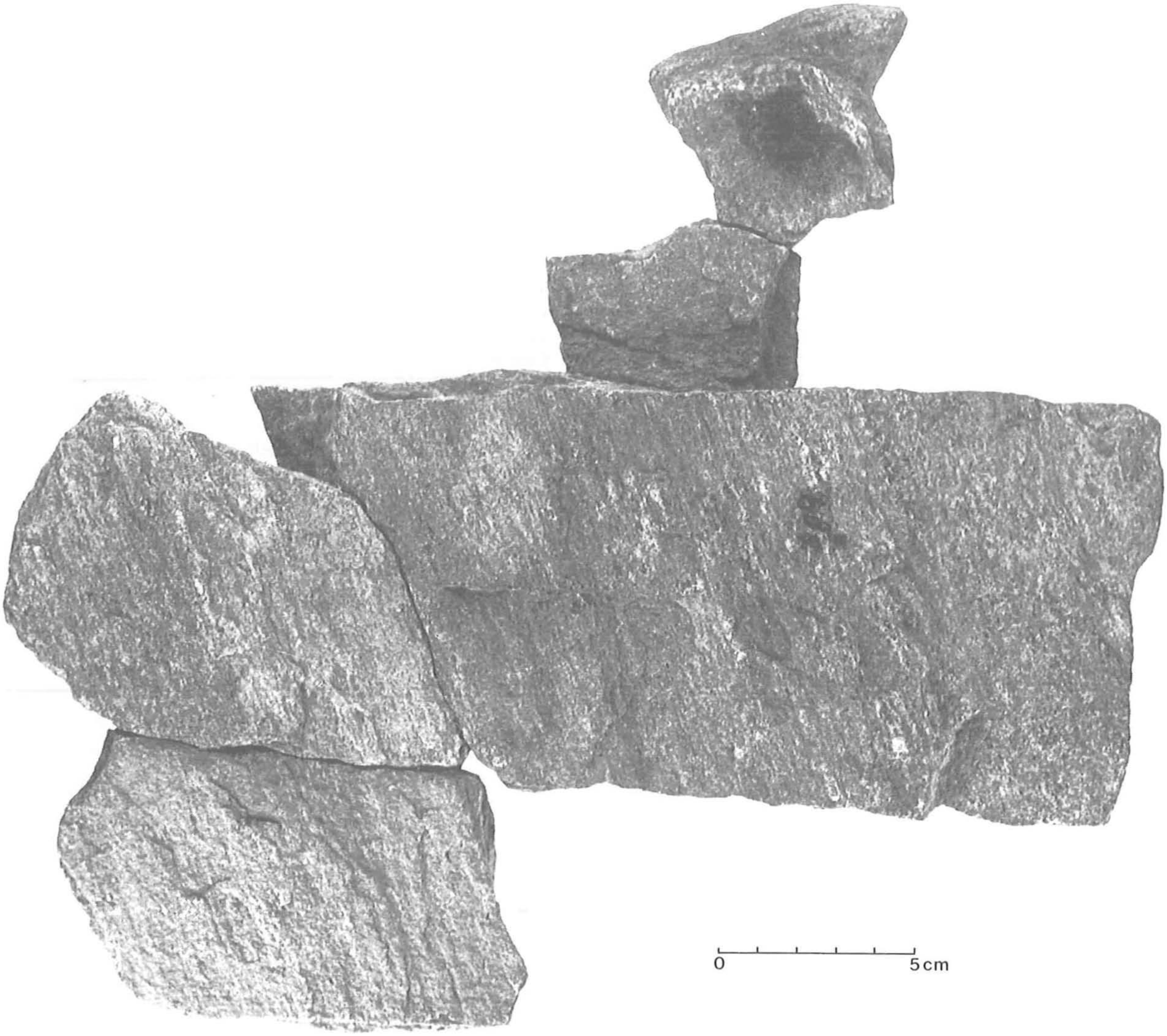


Fig. 11. Refitted group of 5 gneiss fragments (nos. 32, 35, 68B, 86, 121). The greatest diameter of this reconstructed slab is 32 cm, but it is clear that the complete original slab was even larger (also figs. 13, 14). Photo by F.W.E. Colly.

discolorations due to soil processes, generally on only one of the two faces. For example, nos. 33 and 34 both have one greyish-coloured face, while the other face shows the original yellowish colour. In the refitted state one yellow-coloured face joins a greyish face, implying that one of these fragments was positioned in the soil upside down with respect to the other one. These discolorations caused by soil processes make it very difficult to see if any original darker zones caused by charring were present on the faces. Therefore, we cannot exclude with certainty the possibility that the fragmentation occurred as the result of heating the slabs in a fire, a practice we know at the site of Oldeholtwolde. It is at least suggestive in this connection, that these slab-like stones from Emmerhout are very similar to the hearth stones of Oldeholtwolde. The gneiss fragments do not show any signs of having been used for some other purpose, for example as anvil stones and such like.

Apart from the gneiss group, there are 4 other slab-like stones present. No. 62 (fig. 15) is a large slab of rose-coloured granite, which seems to be more or less complete: only one of the short sides is a fracture edge, the rest of the circumference is old. On one of the faces two somewhat darker zones are

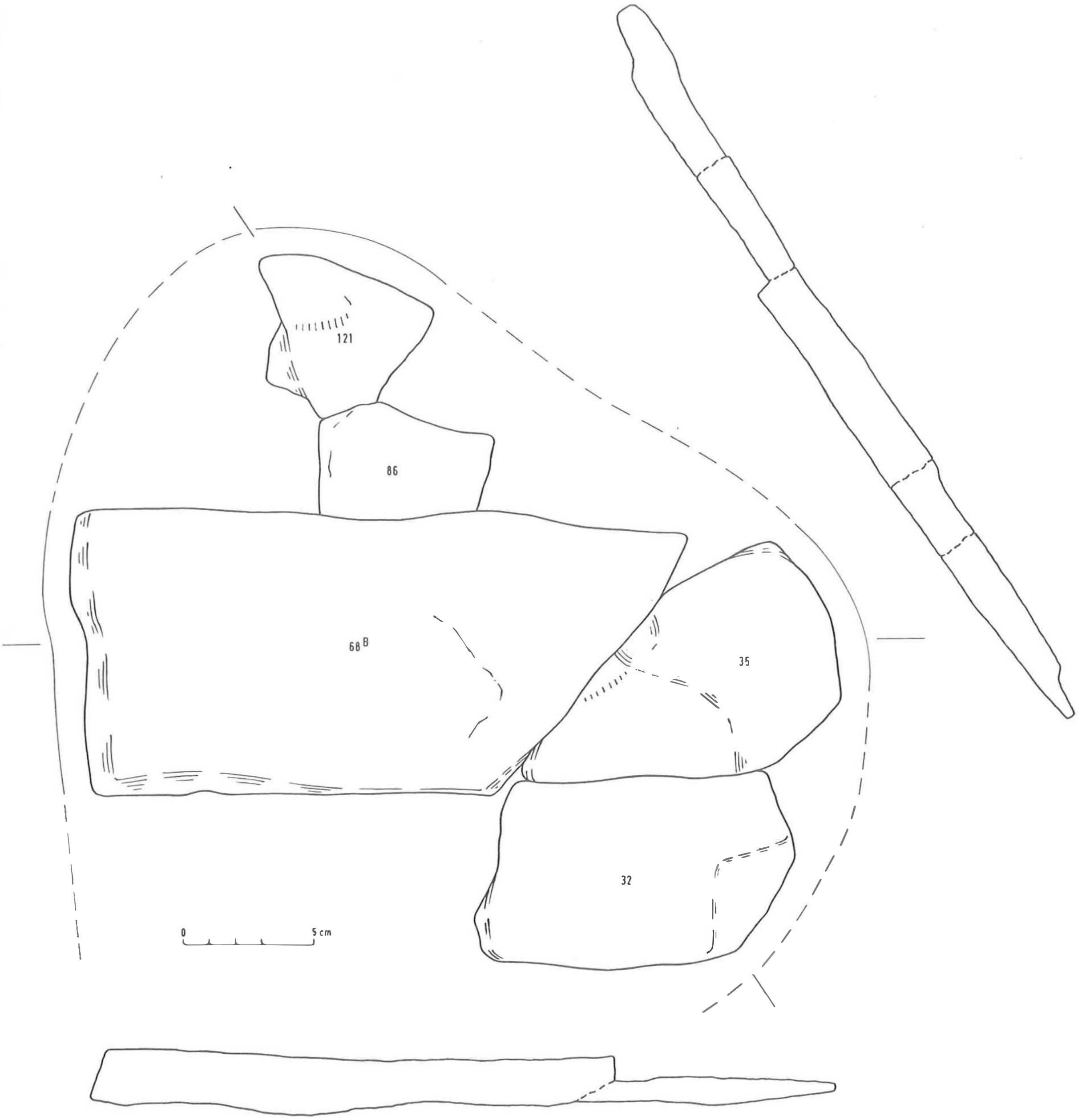


Fig. 12. Drawing of the refitted gneiss group that is illustrated in figure 11. An uninterrupted line around the circumference indicates those parts of the edges that are old. Drawing J.M. Smit.

present. As in this case we are not concerned with a face that is completely discolored (as is the case with most of the gneiss fragments), these darker zones are not necessarily the result of soil processes. In this case, therefore, the darker zones could be the result of use in a hearth, as at Oldeholtwolde, but again we cannot be sure of this. In addition there are a few oblong furrows present in both faces of this stone. The coarser ones have lengths of 5-7 cm, and are a few mm to almost 1 cm wide. It seems possible that these arose as a result of human activities, for example cutting soft materials that were laid down on top of the stone. However, they could also be accidental effects of splitting, as the stone is somewhat schistose, and also because some of these furrows occur close to one of the edges. One

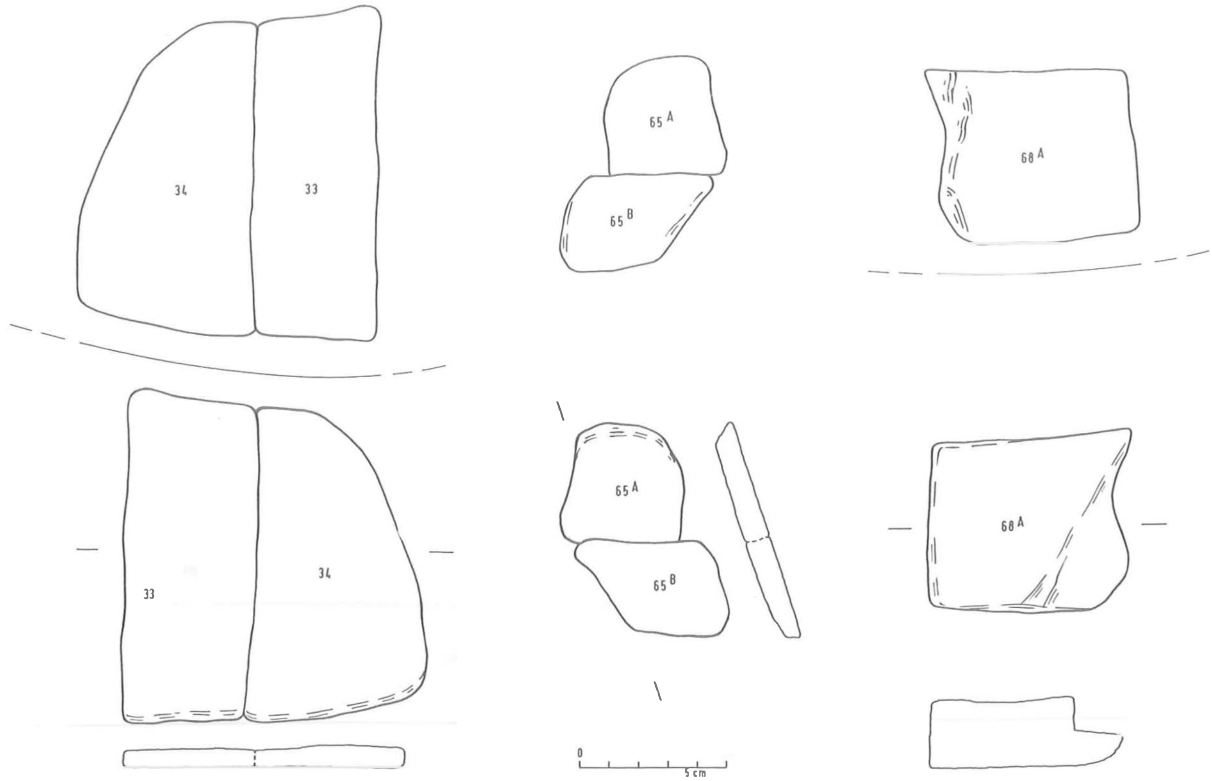


Fig. 13. Drawing of the remaining 5 fragments of the gneiss group (see 5.1.). Two pairs fit together: nos. 33/34 (fig. 14), and nos. 65A/65B, while one, no. 68A, remains isolated. It is probable that these 5 fragments, together with the refitted group illustrated in figures 11 and 12, all derive from one large original slab of gneiss. Drawing J.M. Smit.

of the small fragments of stone in the collection (no. 65C) possibly derives from this granite, but cannot be fitted together with it.

No. 23 (fig. 16) is a slab of tuffite or ash-tuff (essentially comparable to coarse sandstone in structure), brownish/grey in colour. About half of the circumference of this stone is old, so it seems certain that we are concerned with a fragment of an originally larger stone. Again a few darker zones are present on the faces, but they are even more vague than in the case of no. 62.

No. 67 is an egg-shaped slab of red Dala sandstone (fig. 17). Almost the whole circumference is old, so this slab is essentially complete. It greatly resembles the Dala sandstone slabs found in the hearth at the site of Oldeholtwolde. No clear dark zones can be demonstrated, however, nor any other modifications.

Finally, no. 120A is a small and very thin fragment of a slab of red Dala sandstone. We did not succeed in fitting it on top of one of the faces of no. 67, which it resembles very much. It does not show darker zones or other modifications.

Concerning the use of the slab-like stones from

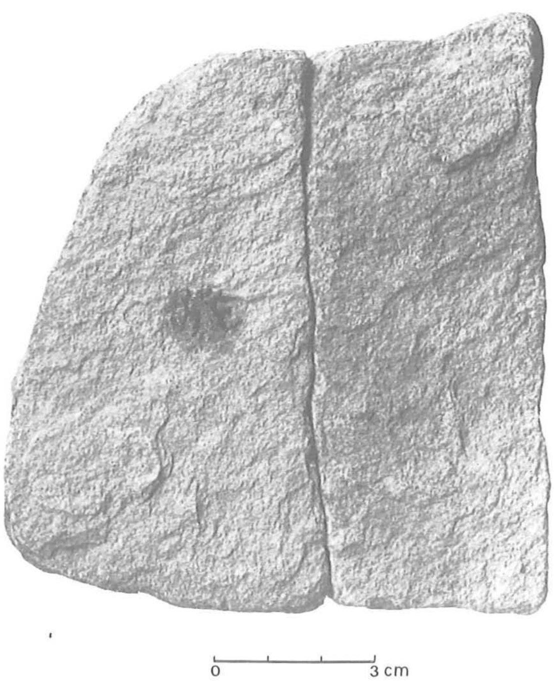


Fig. 14. Gneiss fragments nos. 33 and 34, fitting together. For cross-section and scale see figure 13. Photo F.W.E. Colly.

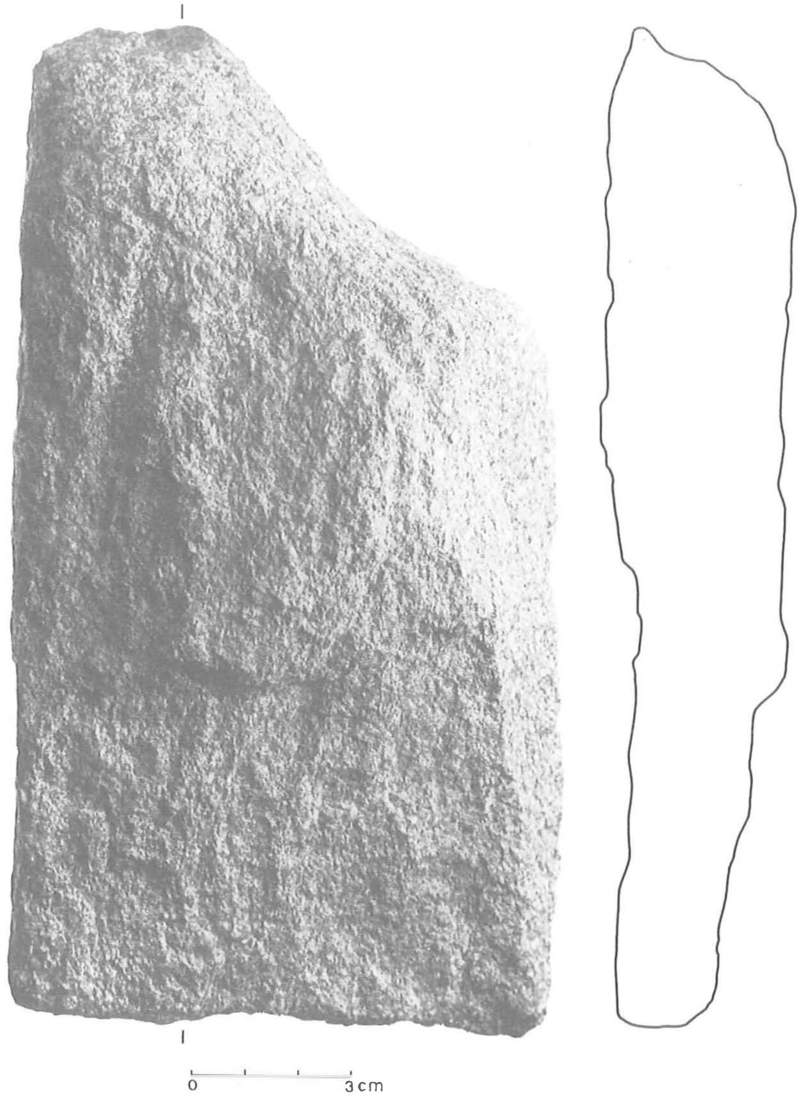


Fig. 15. Large slab of granite, no. 62. Scale in cm. Photo by F.W.E. Colly.

Emmerhout, we are left in uncertainty. There are a few vague indications for use in a hearth (see also under 6. and 7.), and no clear indications of other uses. The horizontal distribution of these stones (see 5.3.; fig. 21) gives no reason to suppose that the stones were 'structural elements', for example used as weights to keep the hide-covering of a tent down on the ground. Besides, such a use would not explain the remarkable slab-like form of them, which clearly points to some specific use. Of course, other uses than hearth stones can be postulated, for example as 'table stones' (Binford, 1983), and such like, that would not result in any visible traces on the stones. For the meantime, however, use in a hearth seems to me to be the most probable hypothesis concerning the use of the slab-like stones.

Like the hearth stones of Oldeholtwolde, the mean thickness of the slabs of Emmerhout is approximately 2 cm. As the faces of many of the slabs, *e.g.* of the gneiss group, do not make the impression of being very old, we think that the slabs were created by splitting them off larger stones, at the spot were they were collected out of the boulder-clay (not on the site). The schistosity of gneiss makes it very well possible to obtain thin slabs, while in the case of Dala sandstone natural bedding planes facilitate splitting. The dominating occurrence of sandstones and gneisses at Oldeholtwolde and Emmerhout is without doubt due to the fact

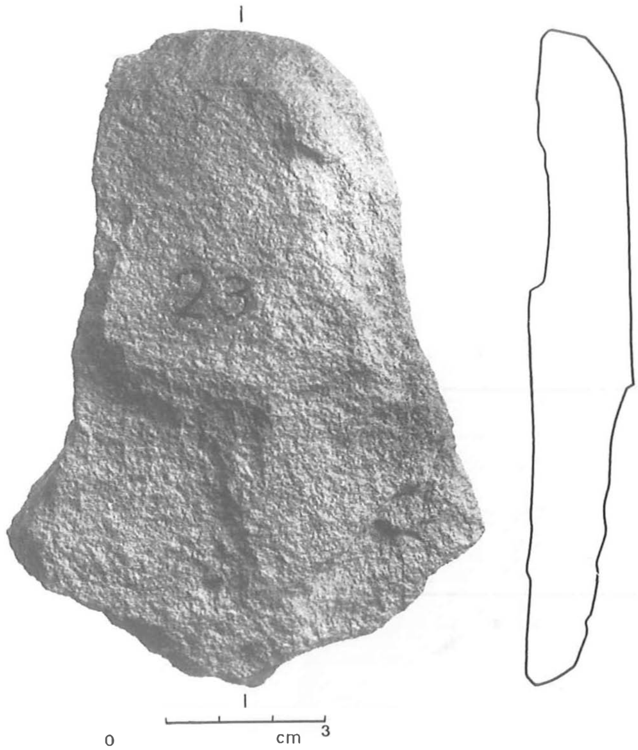


Fig. 16. Slab of tuffite or ash-tuff, no. 23. The maximum length of this slab is 12.2 cm. Photo F.W.E. Colly.

that these types of rock can be easily split into slabs.

5.2. Rounded stones

There are three rounded stones present in the Emmerhout collection, the location of two of which are noted on the field-drawing. The location of the third, a small hammerstone, is not known.

No. 78 is a rounded white pegmatite, partly consisting of very coarse particles like huge felspar crystals (larger than 1 cm, see fig. 18). As there is some intergrowth of quartz and felspar, one can speak of a graphic structure. Parts of the surface have crumbled away, thus suggesting that the stone was used as a hammerstone. However, with such coarse-grained stones one cannot be sure of this. There are no clear signs of burning present.

No. 120B (fig. 19) is a rose-coloured migmatite, much more fine-grained than the pegmatite, and showing a weakly developed schistosity. From one end of this stone parts have been split off. In the same area there occur several zones with a bright red colour, while also several cracks are present here. These phenomena suggest that the stone has been burnt. Furthermore there are some damaged parts present, which point to the possibility that the stone was used as a hammerstone, but again we cannot be certain of this.

Finally, there is a small rounded quartz pebble (fig. 20), that has clearly been used as a hammerstone. Damaged parts occur especially at the two ends, but also around the sides. The weight is only 30.1 gr. Unfortunately the location of this hammerstone is not known, as the pebble has not been numbered.

5.3. The horizontal distribution of the stones

On figure 21 all the stones that are indicated on the field-drawing can be found. There are, however, several problems involved in interpreting this distribution map.

On the field-drawing 14 stones are indicated with their outlines. At no. 86 two stones have been drawn, but there is only one stone in the collection numbered 86. At no. 120 one stone is indicated, while there are two stones present numbered 120. One of them is the migmatite (numbered by us 120B), and considering the outline of the stone on the drawing it is this migmatite that is represented in the field-drawing. The other stone (numbered by us 120A) is the thin fragment of Dala sandstone. At

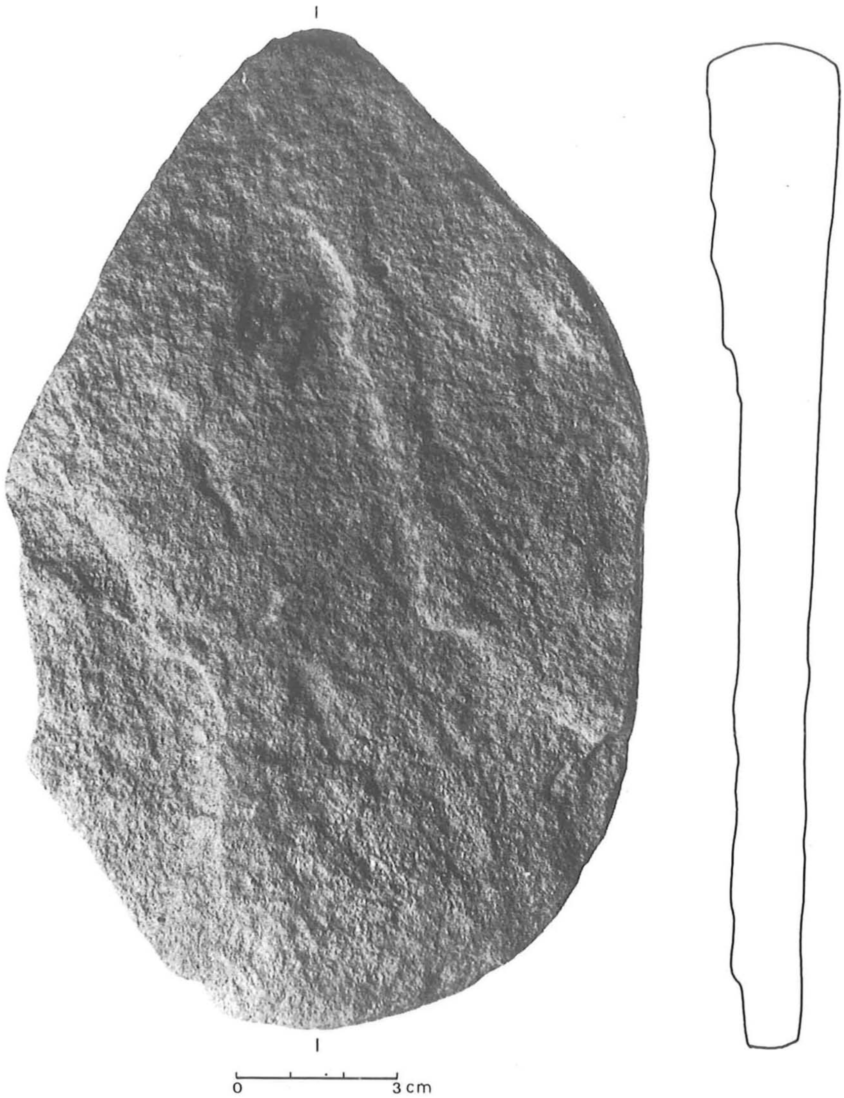


Fig. 17. Large slab of Dala sandstone, no. 67. Almost the whole circumference is old. The maximum thickness of this slab is 2.5 cm. Scale in cm. Photo by F.W.E. Colly.

no. 122 two small stones are indicated in the drawing, but there are no stones numbered 122 in the collection. It is possible that one of the two stones indicated in the drawing represents the fragment of Dala sandstone (presumably the left one). At no. 68 one large stone is indicated in the field-drawing, which is undoubtedly the large fragment of gneiss, numbered 68B by us (fig. 11). The much smaller gneiss fragment, numbered 68A by us, is not indicated separately in the field-drawing. We think it possible that this last fragment is represented in the field-drawing by one of the stones indicated at no. 86 (there is only one stone present in the collection numbered 86, as stated above).

At no. 78 (the pegmatite) the field-drawing does not show the outline of a stone, but at the spot it is indicated that a stone was there, so we can feel certain that the pegmatite does indeed derive from that spot. There are three small fragments of stone numbered 65 in the collection, none of which is indicated in the field-drawing, neither by outline, nor by the indication 'S', as is the case with other stones. No. 65 is, however, indicated with a small cross in the field-drawing, and we suppose, therefore, that all three fragments derive from that spot. At no. 9 in the field-drawing it is indicated (with 'S') that a stone was found there, but there is no stone numbered 9 present in the collection (there is, however, a broken blade numbered 9). Perhaps the

Fig. 18. Rounded white pegmatite stone, no. 78. Scale in cm. Photo by F.W.E. Colly.

Fig. 19. Rounded rose migmatite stone, no. 120B. Scale in cm. This stone is possibly burnt. Photo by F.W.E. Colly.

small hammerstone (which is not numbered) derives from this spot, as the other not-numbered stones in the collection are very small fragments, that would not have been indicated as stones in the field-drawing.

There are two conspicious groups of slab-like stones. One is present approximately in the centre

Fig. 20. Rounded quartz pebble, used as hammerstone. Scale in cm. Photo by F.W.E. Colly.

of the find concentration, and consists of nos. 23, 32, 33, 34 and 35. These 5 stones are very similar to one another. Their maximum diameters range from 10.9-13.0 cm, and their widths from 6.8-8.9 cm. They seem to have been arranged roughly in a circle, with a diameter of approximately 20-25 cm, with an opening towards the northeast. In the centre of this circle there was a concentration of flint artefacts present (numbered 24 and 25). This concentration consists of a top-fragment of a point (described under 4.3.1.: No. 11; fig. 9), 2 blades (of which one is probably burnt), 1 broken blade, 4 flakes (of which one is burnt), and 3 chips (of which one is burnt). Just to the north of this group of stones two more point-fragments were present, and another chip. Immediately to the south a broken blade and a flake were found. The reason for the presence of a group of flint artefacts inside the centre of the circle of stones escapes us, if indeed there is a specific reason at all.

The second group of slab-like stones consists of the nos. 62, 67 and 68B (perhaps also 68A?). This is a remarkable group, as the 3 stones that were certainly present there are the largest ones in the collection: their maximum diameters are 21.0, 19.0 and 24.5 cm respectively. They were found lying on top of each other, as indicated in the field-drawing. Unfortunately they were located close to the edge of a disturbed area, that was present immediately to the west. Perhaps more stones were lying here originally. In the immediate surroundings of this group of large slabs no flint artefacts were found. It seems possible that this heap of stones constitutes a stock, intended for later use, for example in a hearth. As stated above, one of the three slabs (no. 62) possesses a few darker zones on one of its faces, that could have originated in a hearth.

There are no good indications of the presence of a

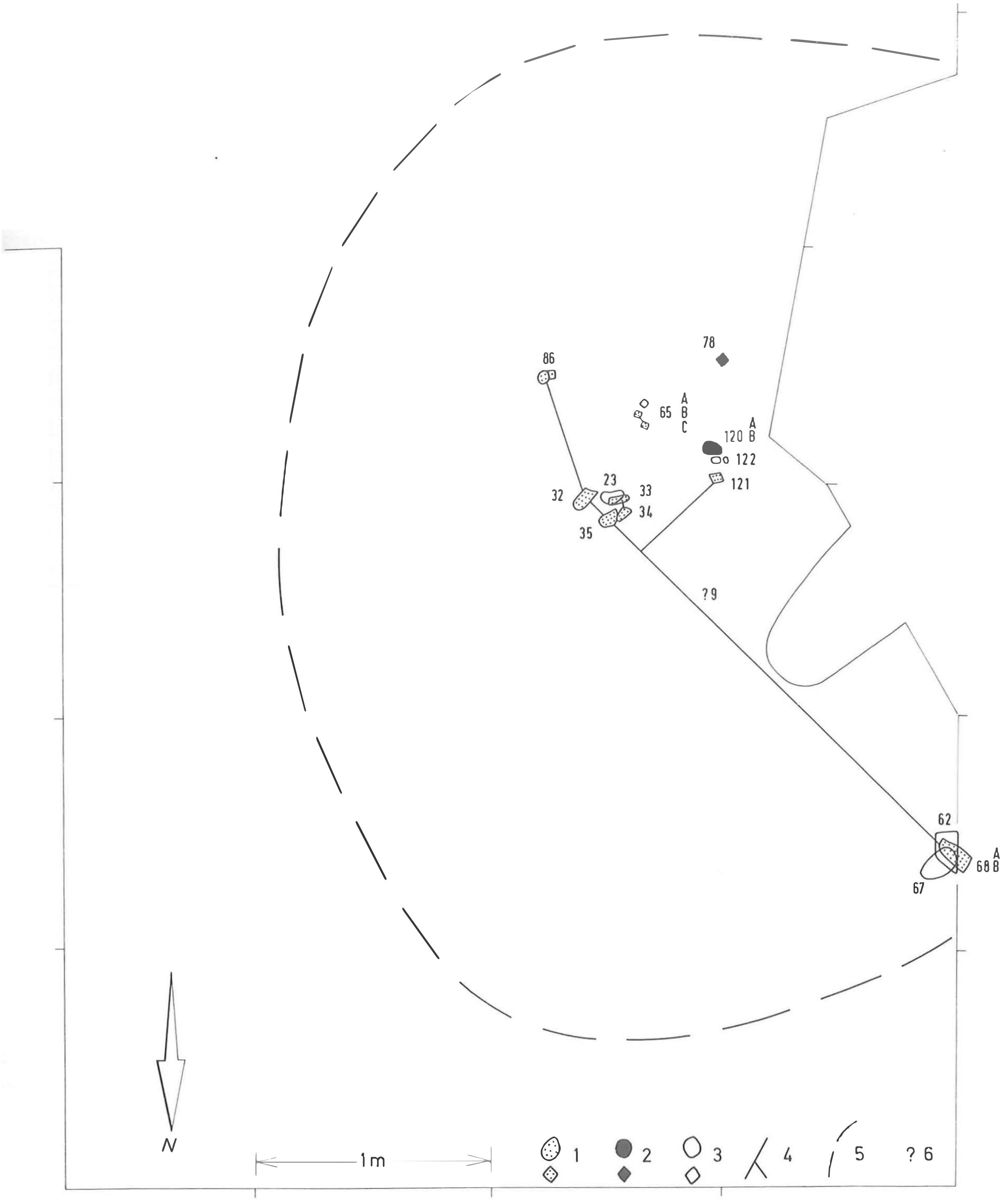


Fig. 21. Horizontal distribution of the stones. Legend: 1. gneiss fragments. If the circumference of a stone is not drawn on the field-map, then its location is marked with a small rhomb; 2. rounded stones (nos. 78 and 120B); 3. slab-like stones, not consisting of gneiss; 4. lines connecting stones that are part of refitted groups (all gneiss); 5. approximate outline of the main concentration of flint artefacts (see also fig. 7); 6. location no. 9 in the field-map where it is indicated that a stone was found there; however, there is no stone numbered 9 present in the collection. Perhaps the (unnumbered) small hammerstone was found here. Drawing by D. Stapert/J.M. Smit.

constructed hearth at Emmerhout. During the excavation no charcoal was noticed. However, it is possible that charcoal that was present originally was removed subsequently by wind erosion, as the finds occur at an erosion level in the coversand (see under 3.). As there are some burnt flints present, it seems obvious that a fire was stoked by the occupants.

The horizontal distribution of the gneiss group, and the refittings, are indicated in figure 21. Four of the gneiss slabs are part of the circle of stones. The largest slab is present in the group of the three large slabs in the northwestern part of the excavation. Four smaller fragments were found scattered in the southern part of the concentration. The horizontal distribution suggests, that after the moment when the original slab was brought to the site, fracturing occurred, and subsequently moving around of the fragments on the site. Again these phenomena are indicative of the possible existence of a hearth at the site, as we know from the site of Oldeholtwolde (Stapert *et al.*, 1986).

For two of the rounded stones (nos. 120B, 78) the find locations are known. They were found within 0.5 m of each other, to the southwest of the circle of stones (fig. 21).

The ring of stones is somewhat similar to one found at Oldeholtwolde. There such a structure was present almost 1 m north of the hearth. It had a diameter of approximately 30 cm, while the enclosed space (diameter approximately 10 cm) was empty (Stapert, 1982; Stapert *et al.*, 1986). All the stones that constituted the ring had lain at some time in the hearth, before ending up in the ring. It is possible, therefore, that the ring was a structure of hot stones. One of the stones is a quartz pebble, that was probably used as a 'cooking stone', and many small fragments of quartz were found concentrated immediately to the east of the ring of stones. Also several other possible cooking-stones were found at Oldeholtwolde. Perhaps one can envisage some kind of receptable (for example a hide) in which water was heated (see *e.g.* Julien, 1984; Julien *et al.*, in press).

At Emmerhout the ring consists of 5 stones; none of them is a possible cooking stone, or even clearly heated. The rounded stone that probably was burned (no. 120B) was located approximately 0.5 m to the southwest of the ring. We cannot be certain that its burning is connected with the function of the ring. Near this stone (120B) two burnt flints were found. Also among the flints that were present within the ring of stones, two certainly and one possibly burnt flints occurred. Summing up, we cannot prove that the ring of stones had a hearth function, but it appears to be probable. For a discussion of other possible uses of such stone rings in Late Palaeolithic sites, see Gaussen (1980).

6. THE HORIZONTAL DISTRIBUTION OF THE FLINT ARTEFACTS

As stated above, during the excavation at Emmerhout in total 350 flint artefacts were recovered. Many but not all of the finds have been given pencil numbers in the field. Most of the pencil numbers were later copied in ink. On the field map the locations for the numbered finds were indicated by small numbered crosses. As is also the case with the stones (see 5.), however, several problems exist with respect to the horizontal distribution of the flint artefacts (fig. 7). On the field map numbers between 1 and 130 can be found. At many numbered locations several artefacts (all bearing the same number) were collected. At the adjacent locations numbered 1 and 2 many flint artefacts were found lying close together, 93 and 33 respectively. These locations can be interpreted as spaces with diameters of approximately 15 cm, as indicated in the field drawing. It is clear that the area represented by locations 1 and 2 together, probably some 30 cm across, forms a residue of flint-working. This is also evident from the refitting analysis (section 7.). Such compact concentrations of flint-working waste are also known from other Late Palaeolithic sites. At Oldeholtwolde several of these were found, in a circle around the hearth (Stapert *et al.*, 1986). They are also known from Pincevent, and can perhaps in some cases be interpreted as dumps from a seated flint-worker who knapped flint on a hide covering his knees that was subsequently emptied on the ground (Karlin & Newcomer, 1982). For another hypothesis, derived from an experimental study concerning the origin of similar heaps of flint-working waste, found on the site of Marsangy, see Boëda & Pelegrin (1985). They demonstrated that compact flint waste concentrations may form when a knapper works sitting; in many cases two 'sub-concentrations' originated as a result of flints dropping to the ground on both sides of one of the legs of the flint knapper.

At Emmerhout the area represented by locations 1 and 2 is the only one of this kind, and we assume that most of the flint-working that took place on the site was done here. The 93 flint artefacts numbered 1 include (all counts presented in this chapter were done irrespective of whether or not fragments fit together with other fragments): 1 point-fragment, 1 probable point-fragment, 1 fragment of a borer, 1 blade end scraper (damaged), 1 'chip with retouch', 2 core-fragments, 6 complete 'normal' blades, 14 fragments of 'normal' blades, 4 complete core preparation blades, 4 fragments of core preparation blades, 25 flakes, 19 flake-fragments, 13 chips (of which one is burnt), 1 block. The 33 flint artefacts numbered 2 include: 3 complete 'normal' blades, 4 fragments of 'normal' blades, 1 complete core preparation blade, 1 fragment of a core preparation blade, 8 flakes, 5 flake-fragments, 11 chips.

The following numbers do not occur as locations on the field map: 27 (a point-fragment and a chip bear this number) and 111 (one blade). The point-fragment no. 27 fits together with the point-fragment no. 28, which suggests that the two fragments were found close together. One number, no. 119, is not indicated on the field map and is also not represented by finds.

Two numbers have been indicated twice as locations on the field map: 71 and 110. There are two finds numbered 71: a large nodule and a blade-fragment. One find, a flake, is numbered 110. It is probable that the blade numbered 111 derives from one of the two locations numbered 110 in the field map. Locations 71 and 110 have been indicated by a special symbol on figure 7.

There are 8 numbered locations on the field map that are not represented by finds bearing the same number. These locations have been indicated by a question mark in figure 7. One location is marked on the field map without a number, this location is indicated by a circled question mark in figure 7.

Nineteen flint artefacts bear number 139, which is not indicated on the field map. These include: 1 point-fragment (on figure 9 the field-number of this artefact is erroneously given as 159), 1 point, 1 borer, 1 core-fragment, 3 complete normal blades, 1 complete core preparation blade (this is one of the two white flint artefacts, see 4.1.), 1 complete decortication blade, 1 blade-fragment, 8 flakes or flake-fragments, 1 block.

One flake-fragment bears number 150 which is not indicated on the field map.

In total 52 artefacts are not numbered. These include: 1 point-fragment, 1 burin spall, 1 blade-fragment, 8 flakes or flake-fragments, 1 block, 38 chips and 2 'chips with retouch'.

Taking all these problems into account, we have to conclude that for 78 flint artefacts the find locations are not known, *i.e.* 22.3% of the 350 artefacts collected during the excavation. Chips make up 50% of the artefacts for which the find locations are unknown. Of the remaining 272 artefacts for which we know the find locations, 126 (*i.e.* 36% of the total number of 350 flint artefacts) derive from the locations numbered 1 and 2 on the field map: the flint-working area. For 146 artefacts we have other known find locations. For an overview of our knowledge concerning the horizontal distribution of the flint artefacts see table 6.

It is clear from this state of affairs, that the interpreted distribution map (fig. 7, to be found in the fold-out at the back of this volume) should be

Table 6. Locations of flint artefacts.

	Total number	Locations unknown	Locations nos. 1 and 2	Other known locations
Blades and blade-fragments	86	8	37	41
Flakes and flake-fragments	138	19	57	62
Burin spall	1	1	0	0
Cores and core-fragments	7	1	2	4
Blocks and nodules	9	3	1	5
Chips	77	39	24	14
'Chips with retouch'	3	2	1	0
Tools and tool-fragments	29	5[a])	4[b])	20
Total	350	78	126	146

N.B. All fragments counted as 1, irrespective of whether or not they fit together with other fragments.
[a]) 3 point-fragments, 1 point, 1 borer;
[b]) 2 point-fragments, 1 fragment of a borer, 1 (damaged) blade end scraper.

considered with a fair degree of caution, as almost one quarter of the collected material comes from unknown locations.

As is evident from the map, the main flint concentration probably had a roughly circular form originally with a diameter of approximately 4 m, of which about two-thirds have been excavated. However, several flint artefacts were present clearly outside the main concentration.

We can now proceed to discuss briefly the horizontal distribution patterns of several categories of artefacts. Nine points or point-fragments occurred relatively tightly clustered in the centre of the concentration, just to the north of the ring of stones described under 5. In the flint-working area (locations 1, 2) 2 point-fragments were found, while another point lay close to this spot. Finally, one point was found clearly outside the main concentration, in the pit to the SE of the concentration.

For 1 point and 3 point-fragments the find locations are not known. The truncated blade was present in the cluster of points in the centre of the concentration.

Of the 3 blade end scrapers one damaged one was present in the flint-working area, while another was found close to this spot. The third scraper was present at the southern limit of the main concentration (no. 72, made of white flint).

The double micro-borer was found in the centre of the concentration. A tip-fragment of a borer was present at the eastern periphery of the concentration; it fits together with another fragment in the flint-working area. One borer has no recorded find location.

One of the two burins was present in the centre of the concentration, the second one occurred clearly outside the main concentration, to the E of it. The find location of the burin spall is unknown. The two fitting fragments of a retouched blade, both burnt, were found more than 1 m apart in the southern half of the main concentration.

Of the cores and core-fragments 2 were found in the flint-working area of locations 1 and 2. Four others were all found at the outer limits of the main concentration. Also from other Late Palaeolithic sites a peripheral location for reduced cores is a well-known phenomenon (*e.g.* Oldeholtwolde: Stapert *et al.*, 1986; see also Julien *et al.*, in press). Used-up cores were probably seen as a nuisance when lying in areas where many activities took place.

Apart from locations 1 and 2, some flint-working probably took place elsewhere, for example at the northern limit of the concentration, and possibly also in the centre of the main concentration.

As for the clearly burnt flints, 9 in total, the find locations for 7 of them are known; 6 are indicated by black symbols in figure 7; one burnt chip was found at location 1. Two more burnt chips are unnumbered. The distribution of these few burnt flints does not permit us to locate the hearth with certainty, if one was indeed present, though 4 of the burnt flints are associated with stones. Two of them were present inside the ring of stones in the centre, and two others were found near the group of stones that includes the probably burnt migmatite (no. 120B; see 5.). If there was indeed a hearth present on this site, as seems to be indicated by the presence of burnt flints, the best guess we can offer for the moment is that it was present at the ring of stones (see also discussion that follows).

Two or three relatively empty zones within the main concentration can be discerned: in E6 and in E8-F8 (fig. 7). To the south of the empty zone in E6 several blades or blade-fragments were found at the periphery of the main concentration. They were probably not produced there but brought there (see under 7.). Blades were also present elsewhere around the empty zone in E6, including the two burnt fragments of a retouched blade. However, at other places on the site too blades and blade-fragments occur.

As stated above, immediately to the north of the ring of stones a cluster of points and point-fragments was present. It is located south of the empty zone in E8. In fact, the other points or point-fragments occur around this empty zone (including two point-fragments at location 1), except the point found in the pit (in B-C/2-3). At other Late Palaeolithic sites it was also found that points, or *lamelles à dos* in the case of Magdalenian sites, were present near or in hearths. Examples of this phenomenon are the Magdalenian sites in the Paris Basin (Julien *et al.*, in press; see on Verberie also: Audouze *et al.*, 1981; Audouze & Cahen, 1984; Symens, 1986). It is interesting that near one of the two concentrations of heated stones at the site of Orp (Vermeersch *et al.*, 1984) a cluster of *lamelles à dos* was present, suggesting that this group of heated stones represents the remnants of a hearth. Probably heat played a role in repairing the curated projectiles of which the flints formed a part, for example in the process of hafting with resin (for Pincevent, see Moss & Newcomer, 1982; Moss, 1983b; Leroi-Gourhan, 1983; Julien, 1984).

Some of the distribution patterns at Emmerhout seem to suggest the following possibilities:

1. If the points and point-fragments were clustered near a source of heat, this would indicate that the ring of stones had a hearth function.

2. The person who performed a task involving the points was sitting approximately in the empty space in E8.

3. If another person was sitting in the empty space in E6 (or the same person at another time), he or she perhaps had work to do involving the use of blades.

If the interpretation that the empty zones in E6 and E8 were occupied by a person is accepted as a possibility, this certainly supports the idea that the ring of stones in between these two empty zones had a hearth function.

The same person who was possibly occupied with work involving the points and point-fragments may have been also responsible for the flint-working that took place immediately to the NE of the empty space in E8 (locations 1 and 2). It can be suggested further that some more flint-working was done just north of the ring of stones, perhaps in connection with the work involving the points.

In summary, we can suggest the following interpretations (for some further suggestions, see 7.2.):

a. The ring of stones had a hearth function.

b. To the south of the ring of stones a person habitually sat in the empty zone in E6, doing work that required the use of blades.

c. To the north of the ring of stones a person habitually sat occupied with repairing projectiles, involving the use of heat, and who also did the flint-working that is documented at locations 1 and 2, and elsewhere in the northern half of the concentration.

Suggestive as some of these propositions may seem to be, they are nevertheless speculative for the most part. In the first place, only two thirds of the site were excavated. Furthermore almost a quarter of the collected finds have unknown find locations, and finally, no sieving was done. Even if the site had been excavated more thoroughly, we should still have to admit that such propositions are speculative to a large degree. Several other phenomena remain unexplained.

As is the case with the stones, the horizontal distribution of the flint artefacts does not provide us with any clear indications as to whether the main find concentration was covered by a tent, or not.

The probable diameter of the main concentration, approximately 4 m, and its roughly circular form certainly suggest that it may have been created inside some covering structure. Unfortunately we cannot confirm this possibility nor can we disprove it. The only argument for the existence of a tent or some other covering structure during the occupation, as far as I can see, is the fact that all finds outside the main concentration, in the southern part of the excavated area, are separated from the main concentration by an empty zone 1-2 m wide (fig. 7). This could suggest the presence of a tent wall around the main concentration: an untestable explanation.

At the end of this chapter it should be said that inspecting distribution maps like figure 7 encourages over-interpretation. It is only against the background of better excavated sites like Pincevent and other findspots in the Paris Basin, or Oldeholtwolde, that several phenomena in the horizontal distribution (some clearer than others) can be recognized as such, because they are repeated. This is true for example for: the presence of a central hearth, the occurrence of empty zones around the central hearth, the occurrence of (parts of) projectiles near the central hearth, excentrically located cores and scrapers.

I feel confident that when more small sites have been published, several such phenomena will eventually show up over and over again, so that it will at least become possible to describe them more completely in a comparative sense. Also this would lead to better and more testable hypotheses regarding site formation.

7. REFITTING ANALYSIS OF FLINT ARTEFACTS

7.1. General remarks

Refitting of flint artefacts has gradually come to be a major technique in studying lithic assemblages, providing information on various aspects (*e.g.* Audouze *et al.*, 1981; Barton & Bergman, 1982; Cahen *et al.*, 1980; Hofman, 1981; Van Noten *et al.*, 1978; Stapert *et al.*, 1986; Villa, 1982). For example, in the study of Magdalenian sites in the Paris Basin the technique is of great importance (Leroi-Gourhan & Brézillon, 1966; 1972; Boëda *et al.*, 1985; Julien *et al.*, in press; Bodu, pers. comm.).

Refitting of flint artefacts should preferably be done with material from completely and well excavated sites. Not only is it a time-consuming (and sometimes frustrating) job, but really satisfying results can hardly be expected when only part of an assemblage is studied. Nevertheless an attempt has been made to perform a refitting analysis with the limited and incomplete material of Emmerhout. One important reason was to investigate the possible presence of 'imported' artefacts on the site. With the material of the Hamburgian site of Oldeholtwolde it was found that all the projectile points, and rather many tools of other types and larger blades as well, were probably imported to the site. Tools of some types, however, were probably all made on the site, like the notched pieces (Stapert *et al.*, 1986). As indicated under 4., the material of Emmerhout includes a scraper and a blade manufactured out of white flint that is not represented by waste material, which suggests that these artefacts were not made on the site, but were imported from elsewhere. Furthermore, as at Oldeholtwolde, most of the projectile points are damaged, which is also suggestive of use prior to occupation of the site. The refitting analysis was intended especially to test these propositions. If imported artefacts were made of the same general types of flint as worked at the site, refitting may be the only way to demonstrate their possible presence, and this is, generally speaking, the situation in the northern half of the Netherlands. Of course, refitting also provides information regarding other issues, such as the flint technology, the possible existence of intentionally broken artefacts, and patterns in the horizontal distribution of activities on the site.

A recent discussion of theoretical and practical potentialities of refitting work is given by Cziesla (in press). It is important to distinguish different types of refitting, that reflect different processes. We propose the following categories (roughly following Cziesla, *ibid.*):

1. Refitting of broken pieces. There are many mechanisms that can cause fractures, both natural and human-induced, including the following: accidents during manufacture, use, trampling, intentional breaking, secondary frost-splitting (see under 4.1.; Stapert *et al.*, 1986).
2. Refitting of 'conjoining' pieces (ventral/dorsal). This category reflects the actual working of cores to produce blades.
3. Refitting of burin spalls to the burins from which they derive.
4. Refitting of broken-off pieces of tools (borer-tips, scraper-edges, *etc.*) to the tools from which they derive. This category in principle concerns fractures that originated as a result of use, but in some cases as a result of resharpening (Audouze *et al.*, 1984).

The refitting analysis with the material of Emmerhout resulted only in cases of the first two categories mentioned, which will be discussed separately.

7.2. Refitting of broken pieces

In total 48 broken artefacts could be refitted. There are 22 cases of pairs of broken pieces fitting together that are summarized in table 7. Apart from these, there are 4 small flake-fragments that fit together to form one flake; this fragmentation was most probably caused by secondary frost-splitting, as all horizontal distances between the locations of these fragments are smaller than 25 cm.

In table 7 the horizontal distances between the locations of the pairs of broken pieces fitting together are indicated. For 4 cases the distance is not known, including 2 cases of pairs of point-fragments fitting together. For one of these 2 pairs of point-fragments (field-numbers 27, 28), it seems clear that they were found lying close together, suggesting that secondary frost-splitting possibly caused the facture. An alternative explanation might be that both fragments were still attached to a shaft when brought to the site, and were subsequently removed and discarded on the spot.

Six pairs of fragments fitting together consist of artefacts found in the flint-working area (locations 1 and 2, see under 6.). For those cases both fragmentation during manufacture, including dropping *etc.*, or fracturing as a result of secondary frost-splitting could supposedly be responsible for their presence. It is interesting to note that 3 pairs consist of core preparation blades, which suggests that accidents during manufacture are the most probable cause of the fragmentation. Furthermore, in this subgroup 2 pairs of flake-fragments and 1 pair of 'normal' blade-fragments occur.

For three cases (10-12) of pairs of broken artefacts fitting together the distances between the two locations are less than 25 cm. This subgroup includes a pair of fitting point-fragments. As these artefacts were found outside the flint-working area, secondary frost-splitting seems to be the most probable cause of the fragmentation. In the case of the point-fragments, it is also possible that both fragments were still attached to a shaft when brought to the site, as suggested above.

There are 9 cases for which the horizontal distance (see the maps: figs. 30 and 31) between the locations of two fitting fragments is greater than 0.5 m. It is thought, provisionally, that in the case of

Table 7. Pairs of broken pieces fitting together (N = 22).

Description	Field-numbers	Horizontal distance between 2 locations
1. Proximal borer-fragment/medial borer-fragment	1/7	c. 206 cm
2. Medial normal blade-fragment/distal normal blade-fragment	1/109*	c. 154
3. Proximal plunging blade-fragment/distal plunging blade-fragment	2/9*	c. 131
4. Proximal flake-fragment/distal flake-fragment	90/102*	130
5. Proximal retouched core preparation blade-fragment/medial retouched core preparation blade-fragment	75/100	125
6. Proximal normal blade-fragment/distal normal blade-fragment	93/128	106
7. Proximal point-fragment/distal point-fragment	1/48	c. 102
8. Proximal flake-fragment/distal flake-fragment	1/15*	c. 87
9. Core-fragment/core-fragment	1/63*	c. 64
10. Proximal normal blade-fragment/medial normal blade-fragment	103/130*	23
11. Proximal point-fragment/distal point-fragment	13/61	21
12. Proximal flake-fragment/distal flake-fragment	10/39	16
13. Proximal core preparation blade-fragment/distal core preparation blade-fragment	1/2	Less than 30
14. Proximal flake-fragment/distal flake-fragment	1/2*	Less than 30
15. Proximal normal blade-fragment/distal normal blade-fragment	1/1*	Less than 15
16. Proximal core preparation blade-fragment/distal core preparation blade-fragment	1/1	Less than 15
17. Proximal core preparation blade-fragment/distal core preparation blade-fragment	1/1	Less than 15
18. Proximal flake-fragment/medial flake-fragment	1/1*	Less than 15
19. Proximal point-fragment/medial point-fragment	27/28	?
20. Proximal point-fragment/distal point-fragment	?/139 (159?)	?
21. Proximal flake-fragment/distal flake-fragment	?/139*	?
22. Proximal flake-fragment/medial flake-fragment	?/150	?

Not included in this table are 4 small flake-fragments, fitting together to form one flake. The fragmentation probably occurred as a result of secondary frost-splitting; all distances are smaller than 25 cm. Classification of fragments in the table is adapted to the results of the refitting analysis. When one of two fragments fitting together was located in the flint-working area (locations 1 or 2), the horizontal distance has been measured using the centre of locations 1 or 2, and the distance is marked with 'c.' Broken pieces marked with an asterisk could also be conjoined (ventral/dorsal) with other artefacts.

fitting fragments found far apart, one or both of the fragments may have been used after the moment of breaking, at another spot. One of the reasons for this hypothesis is the fact that in those cases we are mainly concerned with tool- and blade-fragments (Stapert *et al.*, 1986). It is supposed that the fragmentation in these cases could be either the result of intentional breaking (Bergman *et al.*, 1983), of accidents during manufacture, or of use. Regarding the 9 cases in Emmerhout, three consist of tools (borer, point, retouched blade), and three of blades, while furthermore two broken flakes and a broken core belong to this subgroup. It seems impossible to suppose that the fragmentation in these cases arose as a result of secondary frost-splitting.

The largest recorded distance between two fitting fragments (c. 206 cm) concerns a still incomplete borer (fig. 10: no. 18). One of the fragments occurred in the flint-working area (locations 1 and 2). The fracture-surfaces that fit together do not show clear indications of having originated intentionally. The second fracture (without fitting fragment) could be the result of intentional breaking, but I find it difficult to be sure of that.

The second case of pairs of broken artefacts fitting together, for which the distance between the two locations is greater than 50 cm, concerns a broken blade. This pair is part of the conjoined group O (see 7.3.). It is clear from the results of the 'conjoining' operation that this blade derives from core no. 22, and that it was produced in the flint-working area (locations 1 and 2). One of the two fragments is still present there, but the second fragment was found immediately south of the ring of stones described under 6. Therefore, it seems probable that the fracture originated during manufacture, and that one of the fragments was subsequently carried to the area south of the ring of stones, for some specific purpose there. Such cases seem to support the idea that blade-fragments, whether broken intentionally or by accident, were still usable in some cases.

More or less the same is true for the third case in this subgroup. This concerns a broken plunging blade, also deriving from core no. 22 (conjoining group O). In this case the thick distal fragment (bearing a rim of a core platform) was transported from the flint-working area to a spot c. 0.5 m northwest of the ring of stones, over a distance of c. 131 cm. The fragment shows some edge damage, possibly resulting from use. The fragmentation in this case most probably occurred during manufacture as a result of 'end-shock', as the fracture is of the *languette*-type (Lenoir, 1975; Crabtree, 1972).

The fourth case is a broken flake (field-numbers 90 and 120), which is part of conjoing group D. The two fragments were found 130 cm apart. We suppose that the fracture arose during manufacture (see 7.3.).

The next case (5) concerns a broken core preparation blade that also is somewhat plunging. The blade, that was retouched prior to the moment of breaking, consists in the refitted state of a proximal and a medial fragment– a third, distal, fragment is therefore missing. It is probable that the fracture between the two fitting fragments arose as a result of heat, as the fracture-surfaces are somewhat *craquelé*. Since the blade is only slightly burnt, without the development of many cracks, one or several of the resulting fragments evidently could still be used after the moment of breaking, as the two fitting fragments were found 125 cm apart. Both were present near the 'empty zone' south of the ring of stones. This suggests that the task performed in this area, involving the use of blades (see 6.), most probably also implied the use of heat.

The sixth case concerns a broken normal blade; the two fragments were found 106 cm apart. The blade is made of the same kind of flint as the conjoining group C: two blades of which one was found in location no. 1. It seems probable, therefore, that the blade was produced in the flint-working area (though no core of this type of flint was found), and was subsequently carried to the area south of the ring of stones. The blade is quite thick, and bears dorsally a negative of a short hinged blade–it could therefore be described as a 'core correction blade'. It is quite long in the refitted state, c. 7.5 cm. We suppose that the blade possibly broke during use, and that at least one of the fragments was subsequently used again–at another spot but still near the empty zone south of the ring of stones.

An interesting case is presented by the next pair: a broken point (field-numbers 1 and 48), of which the fragments were found c. 102 cm apart. One of the fragments was present in the flint-working area, the other within the concentration of points north of the ring of stones (described under 6.). However, it seems improbable that the point was manufactured on the site, as it cannot be conjoined (ventral/dorsal) with other artefacts (none of the tools can: see 7.3.), and also because the point is damaged, suggesting use prior to occupation of the site. Therefore, we think that both fragments were still attached to a shaft when brought to the site, and were subsequently removed and discarded. However, the point is made of a kind of flint that is reminiscent of conjoining groups E-M (see 7.4.). We are unable to offer a suggestion for the reason why the two fragments ended up lying so far apart.

The next case concerns a broken flake, that is part of conjoining group F. All other artefacts in this group were found in the flint-working area, but one of the two fitting fragments (no. 15) occurred c. 87 cm away, to the south. It seems probable that the flake broke during manufacture, one of the fragments falling to the ground somewhat farther away.

The last case of fitting fragments found more than 0.5 m apart concerns two core-fragments, one lying in the flint-working area, the other (no. 63) c. 64 cm to the east of it. The fragments fit together to form a core, to which a flake and a block could be conjoined (conjoining group E, see 7.3.). It seems evident that the core broke during the exploitation because of a hidden internal frost crack. Possibly one of the fragments was subsequently thrown away.

What conclusions can be drawn from the above discussion of broken pieces fitting together? In the first place quite a lot of fractures probably arose during manufacture in the flint-working area. Some of the resulting blade-fragments were evidently considered as being still usable, and subsequently transported especially to the area south of the ring of stones. One large retouched blade brought to that area broke because of contact with fire, and at least one of the resulting fragments was nevertheless used again at another spot in the same area. These results support to a certain extent the conclusions arrived at in chapter 6, *i.e.* that the ring of stones probably had a hearth function, and that in the empty zone south of it a person did work involving the use of blades, and also of blade-fragments. It can now be suggested that the same person also used fire during this work. In combination with the fact that the possibly burnt stone (no. 120B, see 5.) was also located near this empty zone, it could provisionally be suggested that the work done in this area -involving fire, heated stone and blades–could have been the preparation and cooking of food. Perhaps a little flint-working was also done south of the ring of stones (see 7.3.), but the evidence for this is scanty.

One hypothesis taking account of most of the facts presented above and under chapter 6 would thus be that one person was sitting south of the hearth (ring of stones) preparing food, and another north of the hearth occupied with flint-working and repairing projectiles. This would seem to indicate the possible presence of a man and a woman, for example a nuclear family (see *e.g.* Grøn, 1983). Of course, this can only be a speculative statement, as use traces have not been studied with this material. And even if they had been studied we would still have to admit that "*... l'observation des microtraces d'usage n'a pas, jusqu'ici, permis de déterminer le sexe des artisans*!" (Julien, 1984: p. 166).

7.3. Conjoining groups

In this chapter we will discuss the results of the 'conjoining' operation, *i.e.* the 'ventral/dorsal' refitting of artefacts. As stated above, several groups of broken artefacts fitting together are part of larger conjoining groups. Each conjoining group, and the horizontal distribution of its components, is described and mapped separately. Table 8 lists all artefacts included in conjoining groups. A total of 91 artefacts could be conjoined with at least one other artefact. The largest conjoined group (N) consists of 17 artefacts.

In view of the fact that the site was only excavated for approximately two-thirds, and that no sieving was done, the percentage of conjoinable artefacts is considered to be rather high (91 out of 350: 26%; if the percentage is calculated on the basis of all artefacts larger than 1.5 cm, one gets 33.7%). The refitting work in total took about two weeks for two persons.

Table 8. Flint artefacts that could be conjoined with other artefacts (ventral/dorsal).

Type	Total number	Present in location 1	Present in location 2
Cores	2	0	0
Core-fragments	3	2	0
Blades	11	3	2
Blade-fragments	13	3	2
Flakes	34	19	2
Flake-fragments	27	12	3
Block	1	0	0
Total	91	39	9

One of the most interesting results of the conjoining operation is the fact that none of the tools could be conjoined with other artefacts. This state of affairs suggests that most of the tools were imported to the site from elsewhere. Of course, the fact that we are not in possession of all material originally present at the site should make us very cautious in this respect. Furthermore, for at least one tool, a burin, it is probable that it was produced on the site (see below). Still, we can feel convinced that several points and some other tools (at least one scraper) were imported, and this is of some importance for 'functional' interpretations of small sites like Emmerhout (see the discussion under 9.).

For mapping the results of the refitting analysis we followed the propositions of Cziesla (in press). Broken pieces fitting together are connected in the maps (figs. 30 and 31) by broken lines. Conjoining pieces are connected by solid lines; an arrow indicates the sequence of detaching from the core (therefore directed towards the core). In the case of conjoined groups consisting of an 'unbroken' sequence (for example a series of blades, or of 'tablets'–flakes creating or renewing a striking platform–) a minimal number of lines is drawn, representing the most probable sequence of detaching from the core. In cases where two more or less independent 'unbroken' sequences are present, fitting on to the same core (for example two series of blades on different sides of the core, or a series of blades and a series of 'tablets'), 2 series of lines moving towards the core have been drawn on the maps, irrespective of whether or not, for example, a series of blades 'touches' a series of 'tablets' fitting on to the same core (*e.g.* the conjoining group N). This procedure was adopted to avoid confusion, though in some cases the resulting networks of connecting lines do not necessarily reflect the actual sequence of detaching from the core.

We cannot be sure about how many original nodules of flint have been exploited as cores on the site. In total there are 19 conjoining groups present (labelled A-S). However, several 'clusters' of conjoining groups derive, clearly or possibly, from one original nodule. The minimum number of original nodules exploited as cores on the site is 4, the maximum number can be estimated as 6 or 7. We decided to present the results of the conjoining operation assuming that only 4 original nodules were worked on the site, constituting Clusters I-IV. The conjoining groups that can be placed in each of

Table 9. Clusters of conjoining groups.

Clusters	Conjoining groups	Number of built-in artefacts	Cores	Core-fragments	Blades	Blade-fragments	Flakes	Flake-fragments	Block
I	A	8	1	0	2	2	3	0	0
	B	3	0	0	1	2	0	0	0
		Total 11							
II	C	2	0	0	2	0	0	0	0
	D	3	0	0	0	0	1	2	0
		Total 5							
III	E	4	0	2	0	0	1	0	1
	F	7	0	1	0	1	2	3	0
	G	6	0	0	1	0	5	0	0
	H	2	0	0	0	0	2	0	0
	I	2	0	0	0	0	1	1	0
	J	3	0	0	0	0	3	0	0
	K	2	0	0	0	0	1	1	0
	L	2	0	0	1	1	0	0	0
	M	8	0	0	2	0	2	4	0
		Total 36							
IV	N	17	1	0	2	3	3	8	0
	O	11	0	0	0	4	3	4	0
	P	2	0	0	0	0	2	0	0
	Q	4	0	0	0	0	3	1	0
	R	2	0	0	0	0	1	1	0
	S	3	0	0	0	0	1	2	0
		Total 39							
Total	19	91	2	3	11	13	34	27	1

these clusters, and the number of artefacts contained in each of them, are listed in table 9. Concerning clusters I and II, we feel sure that the non-conjoinable artefacts associated by us with these clusters really derive from the same original nodule as the conjoining groups placed in each of these clusters. However, with clusters III and IV the grouping of non-conjoinable artefacts in them is less certain, and in some cases only tentative. As can be seen in table 9, there are 2 large clusters present (III and IV), and 2 rather small ones (I, II), of which one (II) is without a core.

Cluster I

Within this cluster the conjoining groups A and B are placed, while there are, in addition, 14 associated non-conjoinable artefacts. This cluster consists of artefacts made of a rather characteristic type of flint. It possesses a thin white cortex that is only slightly weathered. Underneath the cortex a somewhat darker zone is mostly present over a thickness of c. 4 mm. The greyish flint (locally somewhat yellow) shows many small whitish specks, and also contains Bryozoa. The flint is of an opaque non-glassy kind, but is reasonably fine-grained.

Conjoining group A. This group consists of 3 flakes and 4 blades or blade-fragments fitting on to core no. 95 (fig. 22). The core has a max. length of c. 6.3 cm, the max. width is 2.3 cm, and the max. thickness c. 1.8 cm. The core possesses two prepared opposite platforms, and both have been used. On to one of the two platforms 3 flakes, one blade-fragment and a blade could be fitted. We have no conjoining artefacts at the second platform. From the second platform at least 6 blades have been struck, of which only one blade (hinged, no. 111) and a distal fragment of another (hinged, no. 71) were found, that can be fitted on to the core. It is clear that quite a lot of artefacts deriving from this core are missing, especially blades. The core has only one production face, the back of it consists of cortex.

Conjoining group B. This group consists of one blade (no. 87), conjoining with two blade-fragments fitting to each other (nos. 103, 130); it is very probable that the blades derive from core no. 95.

Associated non-conjoinable artefacts. There are 14

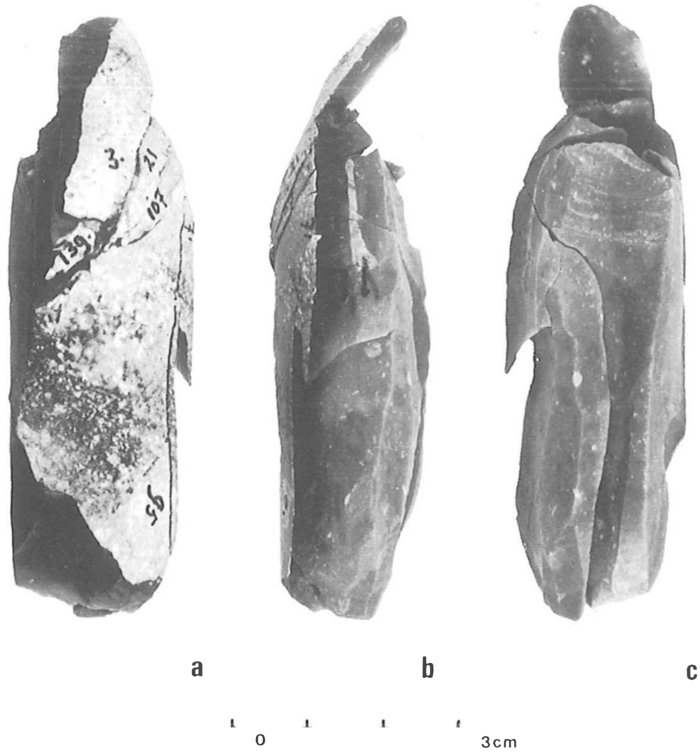


Fig. 22. Conjoining group A, including core no. 95: three views. Photo by C.F.D., Groningen University. Scale in cm.

non-conjoinable artefacts that probably derive from the same original nodule as the artefacts contained in the conjoining groups A and B. One of these artefacts is the burin no. 45 which was therefore most probably produced on the site. In addition there are a core-fragment (no. 139), a blade (no. 57), 7 flakes (three bearing the field-number 139, one unnumbered, and nos. 3, 8 and 20), and 4 flake-fragments (field-numbers 1, 5, 59 and 139). Cluster I is quite small, and it seems that not only a series of blades is missing, but also a proportion of the waste artefacts resulting from the working of the core.

Horizontal distribution. Core no. 95 was present c. 1.5 m to the southeast of the flint-working area (locations 1 and 2). Since 3 of the conjoining flakes, that originated during the preparation of one of the platforms, were found immediately north and east of the flint-working area, it seems probable that at least part of the exploitation of this core took place here. There is also one non-fitting small flake from location 1, that probably derives from the core. However, there is evidence that some work on this core took place outside the main find concentration, in the area where blade no. 3 was found (see the map, fig. 30). Four small non-conjoining flakes or flake-fragments (field-numbers 3, 5, 8, 20) within cluster I were found in this area (they are indicated on the map). From the detaching sequence of conjoining group A it can be deduced that some preparatory work probably took place in the area around the findspot of blade no. 3, after which the core was apparently transported to the flint-working area for further exploitation. Two conjoining blades of group A were probably both found at the northern periphery of the site: the distal fragment no. 71 (classified as a flake-fragment before the refitting work), and blade no. 111. Both blades hinged, and after the production of one more blade (not found), the core was discarded. As indicated under 6., the location of blade no. 111 is not known exactly, as there are two locations numbered 110 on the field-map of which one should be 111. However, these two locations are less than 30 cm apart, and blade 111 is located on the map (fig. 30) in between these two locations.

There is also a problem with blade no. 71, as there are two locations on the field-map numbered 71 (see under 6.): one at the northern periphery, the other at the southern periphery of the main find concentration. As it seems probable that the two blades fitting on to core no. 95 were present close to each other (both hinged), the location at the northern periphery has been chosen for the map (fig. 30). There are two flint artefacts numbered 71: the blade-fragment mentioned above, and a nodule without any traces of working. This nodule, the only one of its kind in the Emmerhout collection, has a max. length of c. 7.4 cm. We assume that it was found at the southern limit of the site at the location marked on the map. We think it possible that the nodule was collected for eventual use as a core.

The blade and the two fitting blade-fragments of group B were found around the empty zone south of the ring of stones, and were possibly brought there from either the flint-working area or, less probably, from the area around location no. 3.

As indicated above, burin no. 45 and several other non-conjoinable artefacts most probably derive from core no. 95. The burin was present approximately 0.5 m north of the ring of stones, and one of the non-conjoining flakes (no. 59) was found close to the burin. Finally, there is one non-conjoinable blade (no. 57), that was present c. 0.5 m south of the heap of large stones (described under 5.) at the western border of the site (its location is indicated on the map).

Several artefacts of cluster I, whether conjoinable or not, bear the field-number 139 for which we do not know the location. All in all, the horizontal distribution pattern of the artefacts of cluster I is not easy to interpret.

Cluster II

In this cluster the conjoining groups C and D are placed, together with 6 associated non-conjoinable artefacts; it is the smallest of the 4 clusters, while this cluster is also without a core. The flint is very characteristic, being light-grey with locally a whitish/bluish shade, and containing many small white and darker specks. The flint is opaque, but of good quality, and is reasonably fine-grained. None of the 11 artefacts of cluster II carries remnants of the cortex, while there is only one (blade no. 114) that dorsally preserved part of the original outer surface of the nodule–an old frost-split face covered by windgloss. It can be deduced from the blades that the original nodule must have been rather large, and that in addition to the core, quite a lot of blades are missing (probably of good quality), and also waste material of the exploitation.

Conjoining group C. This group consists of two good blades, nos. 1 and 88. From the dorsal faces of the two blades it is evident that at least 4, and probably many more, blades deriving from the same core are missing.

Conjoining group D. This group consists of a flake, composed of the fitting fragments nos. 90 and 102, on top of which a small flake (no. 121) can be fitted. The two fitting flake-fragments were found 130 cm apart (see 7.2.).

Associated non-conjoinable artefacts. Undoubtedly deriving from the same core as the conjoining groups C and D, is a large blade composed of the fitting fragments 93 and 128 (see 7.2.). Furthermore, there are a proximal blade-fragment (no. 114), and 3 small flakes (nos. 81, 126 and 129). The fact that there are so few artefacts in this cluster suggests that the exploitation of the core (that is missing) took place to a large extent outside the site.

Horizontal distribution. Most of the artefacts of cluster II were found in the area to the south of the ring of stones, except two blades (nos. 1 and 114). Though one blade was present in location 1 (the flint-working area), it seems improbable that the (missing) core was worked there, as all the waste flakes of this cluster, supposedly resulting from working the core, were present to the south of the ring of stones. Therefore, we think that at least some of the exploitation took place in the southern half of the site, implying that blade no. 1 was transported to the flint-working area, and was not produced there. Blade-fragment 114 (a proximal fragment with a max. length of 3.7 cm) was found clearly outside the main find concentration, to the south of it (see the map: at location 114 also a flake was found that is part of conjoining group J). We are unable to offer any plausible explanation for the large distances separating flake-fragments 90/102, and flake 121; also the excentric location of blade 114 is difficult to understand.

Cluster III

For clusters I and II we feel quite confident that all artefacts placed by us in each of these clusters derive from one original nodule. With cluster III, however, it is possible that actually two or even three nodules were the source of the artefacts grouped into it. We have included 9 conjoining groups (E-M) in cluster III, and 53 associated non-conjoinable artefacts (disregarding the tools: see 7.4.), together in total 89 artefacts. Most of the conjoining groups contain only a few artefacts, the range being 2 to 8. The flint of this cluster is somewhat variable in colour and structure, but most common are different shades of bluish-grey to whitish, with lighter

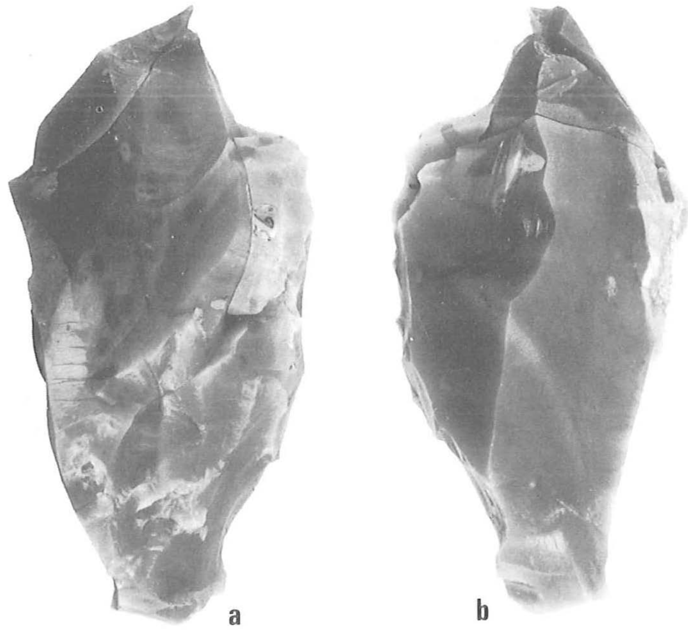


Fig. 23. Conjoining group E, including core-fragments nos. 1 and 63: two views. Photo by C.F.D., Groningen University. Scale in cm.

and darker zones. The flint is of good quality, and is semi-transparent and fine-grained. However, as is evident from several of the included conjoining groups, and the occurrence of two non-conjoinable core-fragments associated with this cluster, the knapper had to face severe problems resulting from the existence of internal frost cracks in the original nodule(s). Still, among the non-conjoining artefacts there is quite a large number of blades and blade-fragments, indicating that the exploitation was at least partially succesful.

Conjoining group E. This group (fig. 23) comprises two fitting core-fragments (nos. 1 and 63), a block (no. 56) and one flake (no. 36). The core constituted out of the two core-fragments has a max. length of c. 8 cm, the max. width being 3.8 cm, and the max. thickness 2.7 cm. The core broke during the work along a hidden frost crack, and block no. 56 most probably originated at the same time. After this fracture occurred the remaining core-fragments were discarded. In one of these fragments at least another internal frost crack can be discerned. Prior to fragmenting mainly preparatory working is documented on the core, and two attempts to strike off blades. Flake 36 served to create the only striking platform present on the core. Then one blade was struck from this platform (not found) that undoubtedly came off in two fragments. The second attempt caused the fracture of the core, also resulting in a flake (not found) and block no. 56. The outer surfaces of core-fragments nos. 1 and 63 mostly consist of frost-split faces, of which some are old as they are covered by windgloss. It is probable, however, that the other outer faces were the result of fragmenting along internal frost cracks in the original nodule–these faces are not covered by windgloss. Also the other core-fragments of cluster III show outer surfaces that most probably arose as a result of fragmenting along internal frost cracks. Unfortunately, we do not have enough material to rebuild the original core, for which reason we cannot exclude the possibility that the artefacts included in this cluster represent actually several original nodules.

Conjoining group F. The centre of this group (fig. 24) is a core-fragment (no. 1), that undoubtedly originated as a result of an internal frost crack. The fragment preserves part of a striking platform, and part of a production face bordering on to it. On top of the remnant of the striking platform a series of 'tablets' can be fitted–one small flake, two flake-fragments, and a flake composed of two fitting fragments (resp. field-numbers 1, 1, 2, 1 and 15). The fracture-surfaces of all flake-fragments can be seen in the refitted state to be continuous with the frost-split face that forms the back of the core-

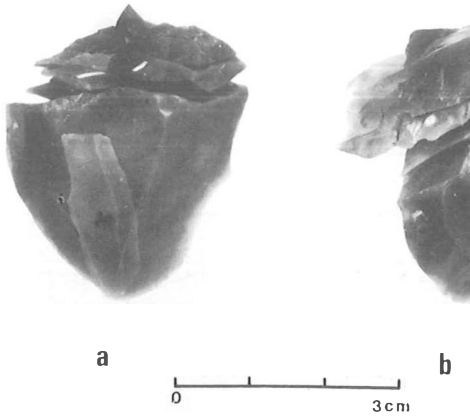


Fig. 24. Conjoining group F, including core-fragment no. 1: two views. Photo by C.F.D., Groningen University. Scale in cm.

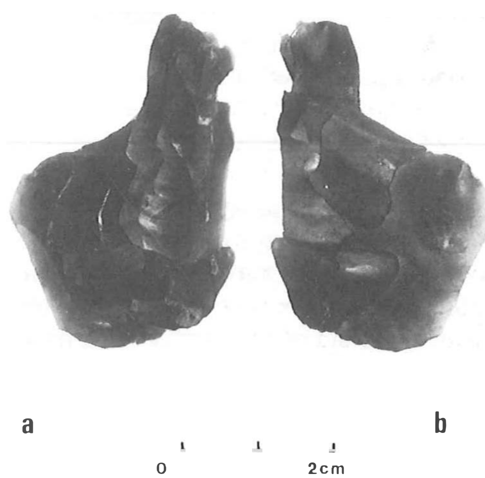


Fig. 25. Conjoining group G: two views. Photo by C.F.D., Groningen University. Scale in cm.

fragment, thus confirming that this face was the result of an internal frost crack. Unfortunately, a core-fragment fitting to this one was not found. One distal fragment of a rather small blade (no. 2) can be fitted on to the remaining part of the production face of the core, that must have been struck after the series of 'tablets' was removed. The remaining core-fragment has a max. length of c. 3.3 cm, its max. width is 3.2 cm, and its max. thickness 1.4 cm.

Conjoining group G. This group (fig. 25) contains 1 blade (no. 1), and 5 flakes (three with field-number 1, two with field-number 2). Together these artefacts most probably document the preparation of a striking platform. It can be seen that after the removing of a small flake and the small blade, the core from which they derive broke along an internal frost crack, as several flakes have striking platform remnants, consisting of frost-split faces, that are situated (in the refitted state) at some distance, inwards, from the striking platforms of the previously removed two artefacts. This illustrates once again, as with group F, frost-shattering during the exploitation of the core. This conjoining group is not indicated on the map, as all artefacts included were found in the flint-working area.

Conjoining group H. This small group consists of 2 small flakes, both with field-number 1; it is not indicated on the map. The flakes most probably originated during the preparation of a striking platform; they are very similar to the artefacts included in group G, and must come from the same core.

Conjoining group I. This small group consist of a small flake (field-number 19), and an unnumbered flake-fragment. Location 19, at a distance of approximately 0.5 m southeast of the flint-working area, has been indicated on the map (fig. 30). The flakes probably resulted from the preparation of a striking platform.

Conjoining group J. This group consists of 3 flakes (field-numbers 104, 114, 117). The outer (dorsal) surfaces of this small group consist of old frost-split faces (covered by windgloss), so these flakes resulted from an initial stage of preparing a core. All three flakes were found outside the main find concentration, to the south of it (fig. 30).

Conjoining group K. This group contains a burnt flake (no. 25, found inside the ring of stones), and a small flake-fragment fitting on top of it (no. 1). Dorsally remnants of old frost-split faces (covered by windgloss) are present, indicating that the flakes derive from the outer surface of the original nodule.

Conjoining groups L and M are considered to possibly derive from another nodule than groups E-K described above. However, the type of flint is similar in many respects, while no core-fragments are included in groups L and M. Within groups E-K no artefacts are present with remnants of cortex dorsally. Many of the artefacts included in groups L and M preserve cortex, and this is one of the reasons why it is thought possible that they derive from another original nodule.

Conjoining group L. This group consists of a small core preparation blade (no. 16), of which the dorsal face is covered by cortex and remnants of old frost-split faces (covered by windgloss), fitting on top of a

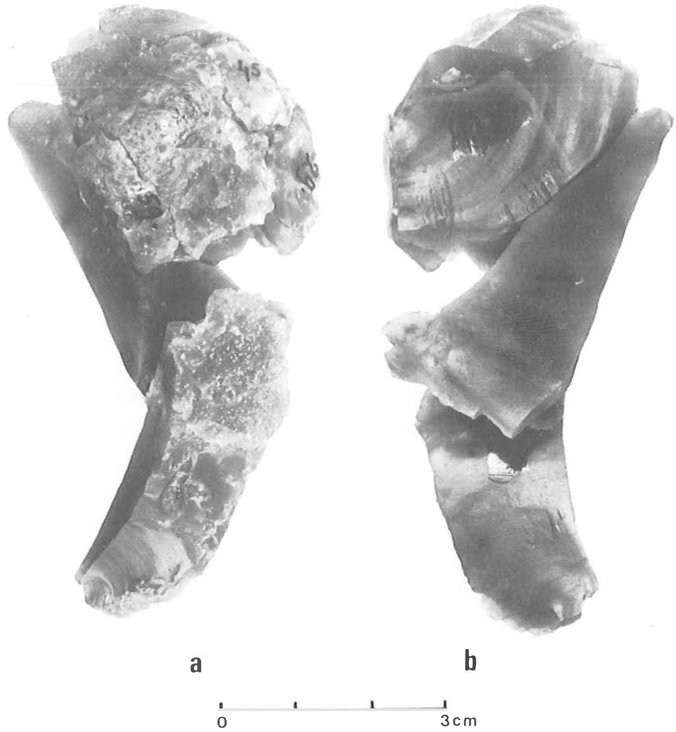


Fig. 26. Conjoining group M, two views. Photo by C.F.D., Groningen University. Scale in cm.

'normal' blade (no. 55). The cortex preserved on many artefacts of group L and M is thin, extremely weathered, and partly covered by windgloss. In between the two blades of this group, a further blade must have been produced, that is missing.

Conjoining group M. This group (fig. 26) comprises 4 small flake-fragments fitting together into c. one flake, two more flakes (nos. 1, 115), and two bad blades (nos. 1, 49). As most of these artefacts dorsally show remnants of cortex or old frost-split faces, they must derive from the preparatory stages of a core that is missing and that must have been rather large. Also no good blades of exactly the same type of flint are present. Therefore, assuming that groups L and M derive from another nodule than groups E-K, we can suggest that in that case the core, after having been prepared, was taken away from the site prior to the production of blades. Conjoining group M has a max. length of c. 8.5 cm, a max. width of c. 4 cm, and a max. thickness of c. 2 cm. The four small flake-fragments fitting together (field-numbers 26, 29, 45, 59) were found lying close together, the fragmentation was probably the result of secondary frost-splitting. The flake refitted from these 4 fragments can be conjoined with flake no. 115 (of which recently a small piece has broken off along an internal frost crack). This flake fits on to the dorsal surface of blade no. 1. Blade no. 49 fits on to the dorsal surface of a small flake (no. 1) that can also be fitted on to the dorsal surface of blade no. 1, without touching the other conjoining artefacts on top of this blade.

Associated non-conjoinable artefacts. There are in total 53 non-conjoinable artefacts associated with cluster III, disregarding tools (see 7.4.). Six of these are close to groups L and M, showing dorsally remnants of the typical cortex of these groups: one flake (no. 21) and 5 flake-fragments (two are unnumbered, three others have field-numbers 52, 59, 150). The remaining 47 artefacts can be described as follows: 2 core-fragments (nos. 92, 139), 2 blades (field-numbers 1, 2), 17 blade-fragments (6 have field-number 1, in addition nos. 2, 21, 42, 58, 65, 73, 76, 80, 82, 98, 105), 13 flakes (6 with number 1, further nos. 36, 38, 64, 70, 94, 96, 101, one is unnumbered), 13 flake-fragments (nos. 1, 10, 38, 39, 61, 65, 73, 76, 106, 112, 113, 139, one is unnumbered).

Horizontal distribution. Most of the conjoining groups of cluster III have components that were found in the flint-working area (locations 1, 2). Some groups even consist of artefacts that were all found there: groups G and H, or almost all: group F. It seems evident, therefore, that most of the exploitation of the core, or cores, of this cluster took place there. Also many of the associated non-conjoinable artefacts were found in or close to the flint-working area. When one considers the horizontal distributions of the various conjoining groups in detail, however, several complications arise.

For example, of the two core-fragments of group E one was found in the flint-working area and the other somewhat to the east of it, suggesting that the core was worked there. However, the flake and the block were found approximately 1 m to the northwest of the flint-working area, lying close together. Therefore, possibly some working of this core went on there, at the northern periphery of the site. As can be seen in figure 7, there is a small concentration of flint artefacts at that spot, including the fitting flake-fragments 10 and 39, flakes 36 and 38, and the flake-fragment 39, all associated with cluster III, though non-conjoinable.

Even more difficult to comprehend are the locations of the three flakes constituting group J: to the south of, and clearly outside, the main find concentration. If these flakes do indeed derive from the same original nodule as the other groups (of which we cannot be sure, unfortunately), this could mean that some initial working went on there, prior to the main exploitation stage that undoubtedly took place in the flint-working area.

Another deviation from the general picture, that most of the work took place in the flint-working area, is presented by groups L and M; in the case of these groups too we feel less sure that they really derive from the same nodule as the other groups in cluster III. Of group M, two artefacts were found in location 1 (a blade and a flake), suggesting that part of the work on the (missing) core took place there. Also a flake (no. 21), non-conjoinable but bearing the same type of cortex, was found close to the flint-working area. However, the locations of the other artefacts, and the detaching sequence within this group, suggest that, prior to that stage, some preparation of the core took place at a spot approximately 0.5-1 m southwest of locations 1 and 2 (fig. 30). At least 7 artefacts that may or may not be conjoinable but clearly belong together, were present at this spot. One flake (no. 115) was present in the disturbed area at the western edge of the site; it is possible, therefore, that it was not present there originally. Blade no. 55 was found at the northern limit of the site, and was possibly transported there, and not produced on the spot. Finally, there is no plausible explanation for the occurrence of the burnt flake (no. 25) inside the ring of stones.

Regarding the associated non-conjoinable artefacts the following can be said. We have discussed already the artefacts associated with groups L and M, so only the others will be mentioned here below. Core-fragment no. 92 was found, more or less isolated, in the southern half of the site; its location is indicated in the map. Two complete blades were found in the flint-working area. Of the blade-fragments, 7 were found in the flint-working area, and another (no. 21) nearby. One blade-fragment (no. 58) occurred at a spot approximately 1 m southwest of locations 1 and 2. Seven blade-fragments were present around the empty zone south of the ring of stones; they, or the blades of which they are fragments, could have been transported there. One blade-fragment (no. 42) was found isolated, approximately 5.5 m southeast of the main find concentration (outside the limits of the map, fig. 30, but indicated in figure 7). It is a distal fragment (of a tool?) with a max. length of 5.5 cm. Both edges show quite a lot of edge damage, indicating that the blade was possibly heavily used. Of the flakes 5 were found in the flint-working area. Two were found at the northern limit of the site; they have been discussed above. Three were found in the southern half of the site, while two others were present at a spot approximately 1 m to the southwest of locations 1 and 2. One of the flake-fragments was present in location 1. Three were found at the northern limit of the site, and one c. 1 m southwest of locations 1 and 2. Three flake-fragments were present in the southern half of the site, and three others near the disturbed area at the western border of the site.

In summary, the locations of the associated non-conjoinable artefacts support to a certain degree the conclusions arrived at during the discussion of the horizontal distribution of the conjoining groups placed in cluster III. The main stage of exploitation of the core, or cores, in this cluster took place in the flint-working area. Additional spots where some flint-working probably went on are located near the northern limit of the site, and approximately 1 m to the southwest of the flint-working area. Quite a lot of blades were probably transported to the southern half of the site, of which many became fragmented. Perhaps some initial preparation took place outside the main concentration of finds, to the south of it. One blade (or tool) associated with cluster III was present far away from the main concentration; it has been heavily used.

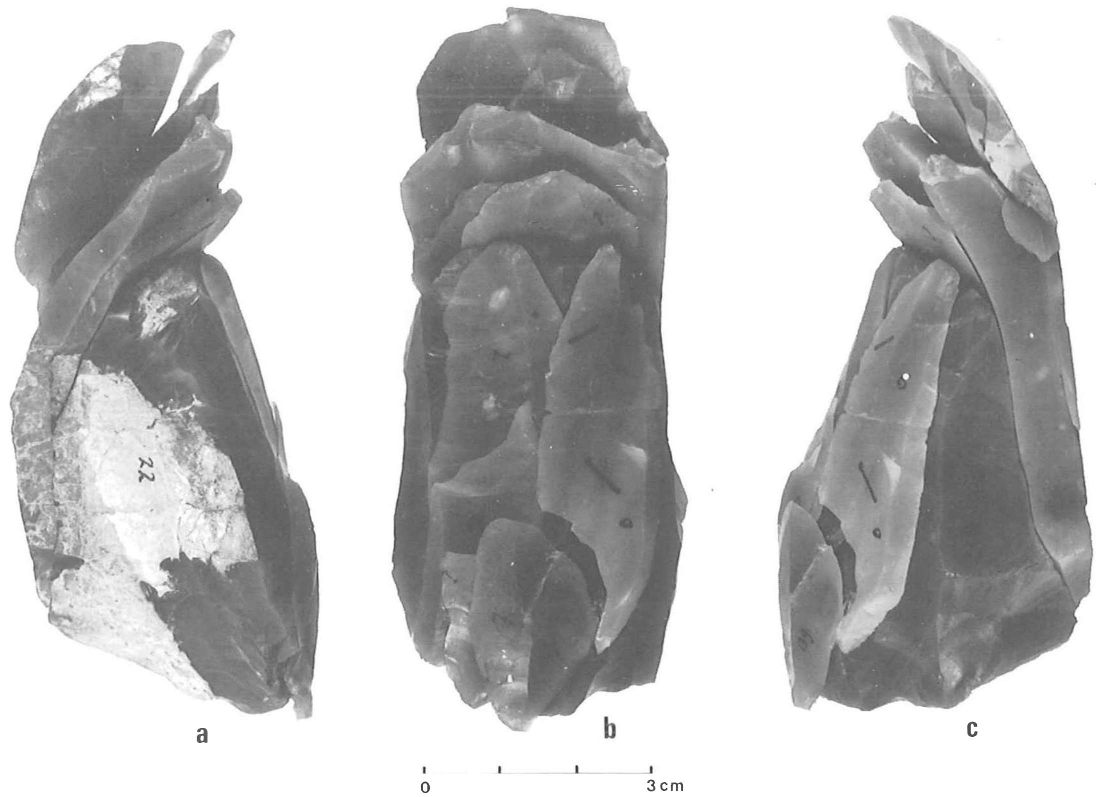


Fig. 27. Conjoining group N, including core no. 22: three views. Photo by C.F.D., Groningen University. Scale in cm.

Cluster IV
In this cluster 6 conjoining groups are placed (N-S), that contain in total 39 artefacts. The number of artefacts per conjoining group ranges from 2 to 17. A total of 77 non-conjoinable artefacts (disregarding tools: see 7.4.) are associated with this cluster, but we do not feel convinced that all of them indeed derive from the same original nodule as the conjoining groups N-S. Cluster IV is the largest of the four that we have distinguished. The flint is of excellent quality, homogeneous and fine-grained, of a somewhat 'glassy' kind, and of a yellowish shade of grey. Many artefacts of cluster IV have preserved remnants of the cortex, that is thin, yellowish in colour, only slightly weathered, and showing thin grooves. However, also remnants of old frost-split faces, covered by windgloss, are present.

Conjoining group N. This is the largest conjoining group of Emmerhout, consisting of a core (no. 22), and 16 blades or flakes fitting on to it (fig. 27). These can be divided in two groups: a series of 'tablets', creating one of the two opposite platforms on the core, and a series of blades and flakes fitting on to the only production face of the core. The second platform on the core, that is prepared and was used, is without fitting flakes.

The series of 'tablets' consists of 9 flakes or flake-fragments, of which the first ones completely removed the outer surface–an old frost-split face. During the production of blades from this striking platform, the platform was renewed at least twice by removing new 'tablets', resulting in a gradual diminution of the length of the blades deriving from this core. One of the 'tablets', resulting from the first renewal of the platform, is a huge flake (no. 21). During the second renewal of the platform two 'tablets' were removed. On to the production face of core no. 22 two blades, one blade constituted out of two fitting fragments, a proximal blade-fragment, and a flake (consisting of two fitting fragments) could be fitted–these were the last pieces to be struck from the core before it was discarded. It can be seen from the detaching sequence of these artefacts that both platforms were used alternately during the exploitation of the core.

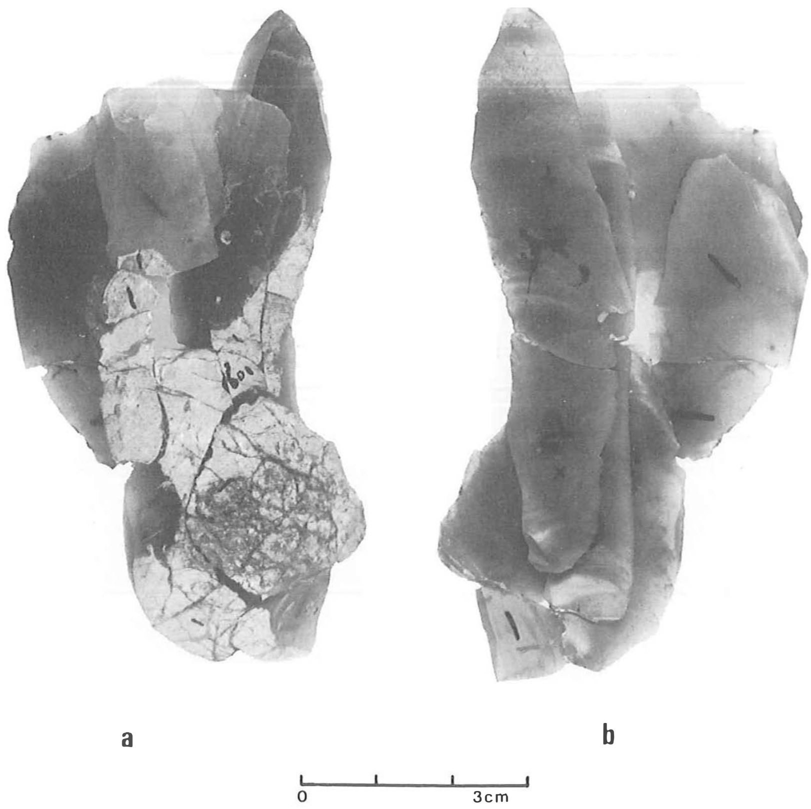


Fig. 28. Conjoining group O: two views. Photo by C.F.D., Groningen University. Scale in cm.

There are quite a lot of blades or blade-fragments present that clearly derive from this core but cannot be fitted on to it. This suggests that a number of other blades produced from this core is missing, that were possibly carried away from the site. The core has a max. length of c. 6.3 cm, its max. width is c. 4.2 cm. its max. thickness c. 3.0 cm.

Conjoining group O. This group contains two blades, both fitted together from two fragments (1/109 and 2/9), 3 flakes and 4 flake-fragments (fig. 28). All these artefacts bear cortex remnants on their dorsal faces, implying that they removed part of the outer surface of the core–the part that later became the (only) production face of core 22. Between this group, and the present production face of core no. 22, one has to imagine a space of some 2 or 3 cm, representing perhaps 20 or 30 blades. All flakes and flake-fragments in this group bear number 1. Both blades most probably broke during manufacture in the flint-working area (see 7.2.). One of them (2/9) is a plunging blade, and it is interesting that it is the thick distal fragment that was transported on the site after the moment of breaking (see below). Both blades are (in the refitted state) somewhat longer than 7 cm, while the remaining production face on core 22 is about 6 cm long.

Conjoining group P. Two flakes, both having field-number 1. Both preserve cortex remnants dorsally, and are therefore very close to the flakes of group O.

Conjoining group Q. A group of 3 flakes and 1 flake-fragment, all found in the flint-working area. It consists of a series of 'tablets' on top of each other, almost certainly removed during the preparation of the second platform on core no. 22 (the one on to which no flakes could be fitted). A few remnants of the cortex are preserved.

Conjoining group R. A small flake, and a small flake-fragment. Both preserve remnants of the cortex on their striking platform remnants. They were found in the flint-working area.

Conjoining group S. One flake and two flake-fragments (fig. 29). One has field-number 74, the other two are numbered 139, for which we do not know the location. Dorsally the group (in the refitted state) only bears old frost-split faces, while also the striking platform remnants of the flakes are composed of old faces, including cortex. These flakes therefore originated during the first prepa-

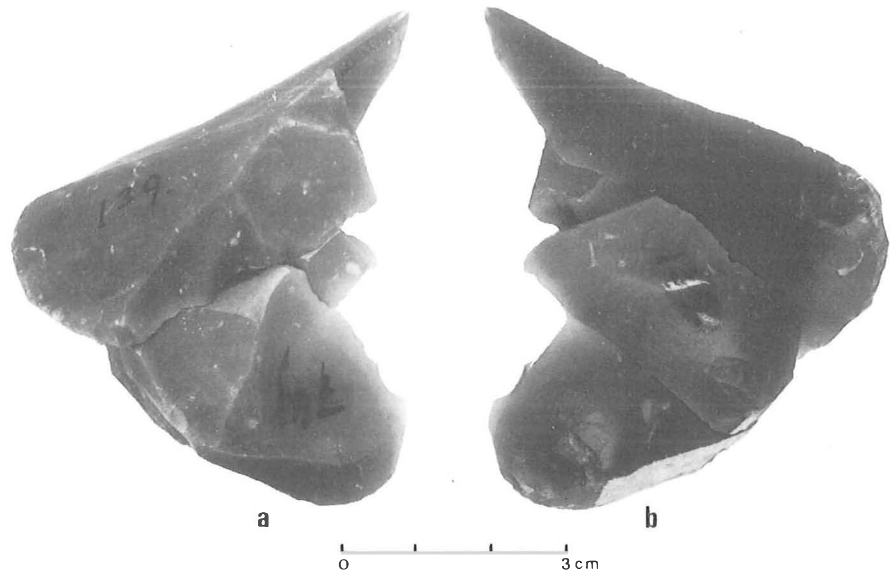


Fig. 29. Conjoining group S: two views. Photo by C.F.D., Groningen University. Scale in cm.

ratory stages of shaping the original nodule into a core.

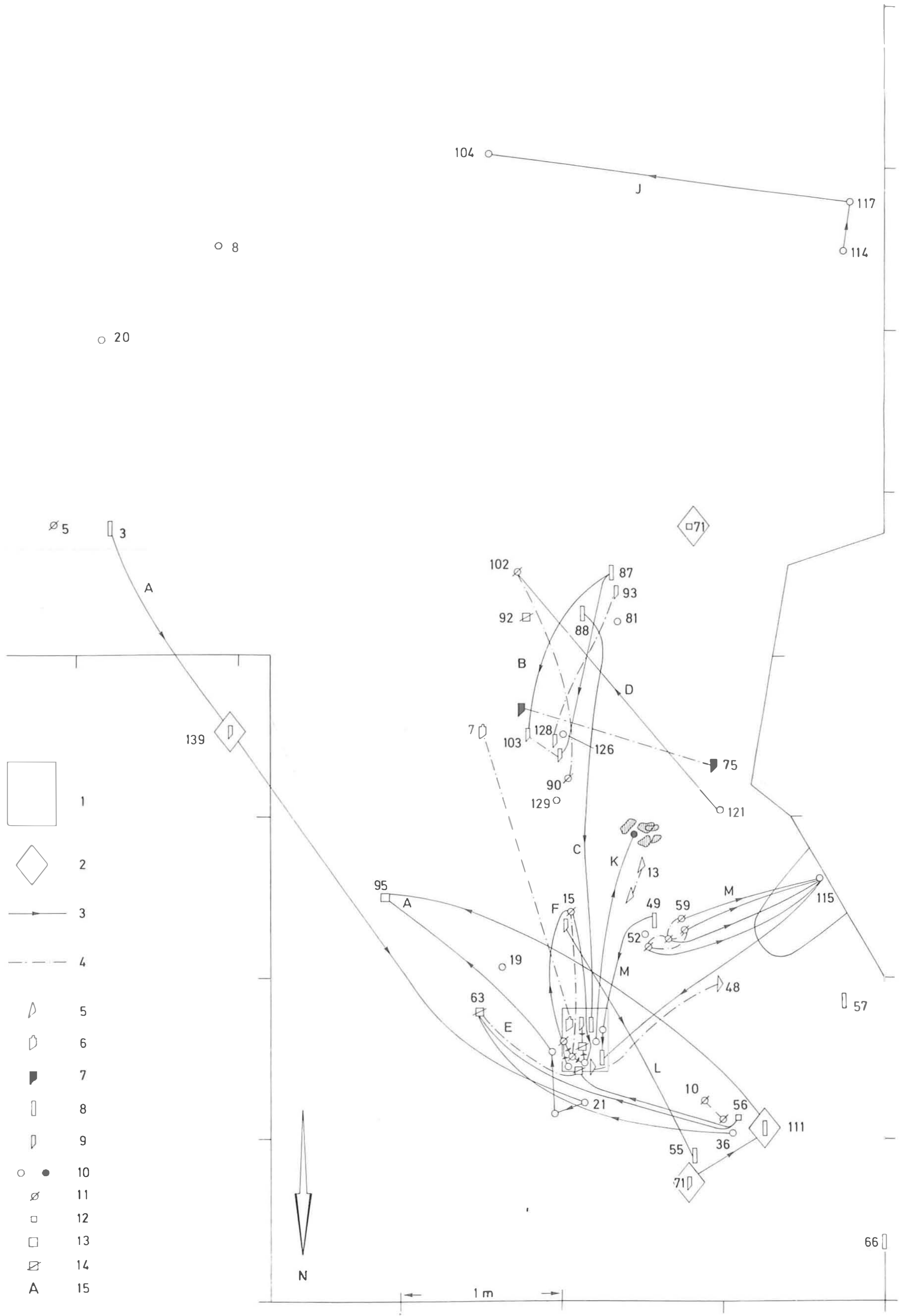
Associated non-conjoinable artefacts. In total there are 77 associated artefacts, disregarding tools (see 7.4.). These include 11 blades (field-numbers 1–three times–, 11, 25–twice–, 65, 108, 139–three times–), 18 blade-fragments (7 from location 1, 2 from location 2, further: 6, 12, 15, 25, 37, 38, 77, 84, 89), 22 flakes (4 from location 1, 6 from location 2, further: 16, 25–three times–, 77, 85, 90, 110, 118, 123, 139, one is unnumbered), and 26 flake-fragments (9 from location 1, 3 from location 2, further: 3, 8, 30, 45, 46, 50, 53, 60, 79, 83, 123, three are unnumbered). At least 13 of these pieces show remnants of the cortex.

Horizontal distribution. Only groups N and O contain a few artefacts that were found outside the flint-working area of locations 1 and 2, and are therefore represented on a map (fig. 31). Groups P, Q and R consist entirely of artefacts found in the flint-working area. Group S has two artefacts for which we do not know the location (139), and one with field-number 74–this location is present c. 70 cm to the southwest of the ring of stones. It is therefore evident that most, if not all, of the work on this core took place in the flint-working area.

Of group N only the core and a large 'tablet' were found at a short distance from locations 1 and 2, respectively c. 75 and c. 25 cm to the north. The core was present at the northern limit of the site, and it can be suggested that it was thrown away some distance after having been discarded. Group O includes 2 blades that most probably broke during manufacture. Of both blades one of the resulting fragments was subsequently transported on the site: one to a spot just south of the ring of stones, and the other to a spot c. 0.5 m northwest of the ring of stones. These blade-fragments were evidently still regarded as usable after the fracture occurred (see 7.2.).

Of the 77 associated non-conjoinable pieces 34 were found in the flint-working area. Three blades were found in the flint-working area, and another close to it. Two blades were present inside the ring of stones; one of these is possibly burnt. One blade was found in the southern half of the site, while another was present at the western limit of the site, c. 0.5 m south of the heap of large stones (see 5.). Of the blade-fragments 9 were found in the flint-working area, and another close by. Two were present c. 0.5 m south of the flint-working area, and one c. 1 m southwest of it. One blade-fragment was found inside the ring of stones, but is not visibly burnt. Blade-fragment no. 77 was lying close to stone no. 120B. Two other blade-fragments were present at the northern limit of the site, and another in the southern half. Many flakes and flake-fragments were found in the flint-working area. Three flakes were present inside the ring of stones, but are not visibly burnt. One flake (no. 77), that is burnt, was lying close to stone no. 120B. Two flakes were present in the southern half of the site.

One flake was present immediately to the south of the ring of stones, and another at the northern


104
J
117
114
8
20
5
3
A
71
102
87
93
92
81
88
B
D
139
7
128
103
126
75
90
129
121
1
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M
115
52
19
M
48
63
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57
L
10
56
21
111
55
36
71
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1 m
66

limit of the site. Three flake-fragments (nos. 3, 8, 30) were found clearly outside the main concentration of finds, several metres southeast of it. We can think of no reasonable explanation for this situation. Two flake-fragments were present at the northern limit of the site, two c. 0.5 m north of the ring of stones, and one in the southern half of the site.

Though the general picture is clear–most if not all of the work on core no. 22 took place in the flint-working area–several locations of associated non-conjoinable artefacts are difficult to comprehend. One possible explanation could be that in some cases also simple flakes were regarded as usable, and for that reason transported on the site. However, these flakes are mostly rather small (for example, the three that occurred inside the ring of stones have max. lengths between 1.6 and 2.3 cm). Another possibility is that some working of the core took place outside the flint-working area, near the ring of stones in the centre of the site. However, we cannot feel certain in every case that the non-conjoinable artefacts really belong to the same original nodule. All conjoinable groups (except S) indicate locations 1 and 2 as the spot where the exploitation took place. Of course, it is only to be expected that quite a lot of good blades were used elsewhere on the site, a phenomenon also demonstrated by several other clusters.

7.4. The tools, some conclusions

As stated above, none of the tools can be conjoined (ventral/dorsal) with other artefacts. This would seem to be a good indication for the hypothesis that most of them were imported to the site from elsewhere. In that case one would expect the tools to be made of other types of flint than most of the artefacts present on the site. This is true for only a few of the tools, however. We have mentioned above that one of the scrapers (no. 72; fig. 10: no. 14), and a core preparation blade (no. 139) are made out of white flint that is not represented by waste material.

One probable point-fragment (no. 24; fig. 9: no. 11) is made of grey flint containing Bryozoa that is not represented by waste material, and that was therefore most probably imported. Finally, another blade (no. 66) is made out of a kind of flint that, though somewhat similar to that of cluster III, looks sufficiently different to me to suggest that it occurs isolated. This blade was found somewhat outside the main concentration of finds, at the northwestern edge of the excavated terrain (see the map: fig. 30).

However, all the other tools and blades can be grouped into one of the clusters that we have distinguished above. There are no tools that can be associated with cluster II. For one burin (no. 45; fig. 10: no. 23) it seems certain to me that it derives from core no. 95 (cluster I), as this is a very characteristic kind of flint. It is the only tool associated with cluster I. For the other tools the association with one of the clusters is less certain, because the types of flint, represented by clusters III and IV, are quite common in the boulder-clay of this area, and also because within both mentioned clusters there is rather a great variability of the flint in terms of colour, texture *etc.*

There are four tools that could belong to cluster III (point no. 4; fig. 9: no. 3; fitting point-fragments 1 and 48; fig. 9: no. 1; fitting point-fragments 139 (159?) and unnumbered; fig. 9: no. 8; fitting retouched blade-fragments 75 and 100; fig. 10: no. 20). The flint of the first two mentioned points is somewhat different from most of the artefacts placed in cluster III, but this could be due to variations in the original nodule. The last mentioned point, however, fits in easily. As the first two points (fig. 9: nos. 1 and 3) are damaged, most probably as a result of having been used as (parts of) projectiles, it seems possible to me that they were imported, and not made on the site. The third point (fig. 9: no. 8) could have been made on the site; not only is the type of flint similar to that of cluster III, but also the tip part of this point does not look very damaged. The fracture of this point could have occurred during the retouching work: the fracture-surfaces are slightly reminiscent of the *languette*-type. Finally, the two fitting retouched blade-fragments, though similar, do not exactly match the flint of most of the artefacts placed in cluster III.

All the remaining tools can, more or less easily,

Fig. 30. Horizontal distribution of refitted artefacts belonging to clusters I, II and III. Legend: 1. approximate area of locations 1 and 2: the flint-working spot; 2. finds for which the locations are not certain (see 6. and 7.); 3. lines connecting conjoined (ventral/dorsal) artefacts, the arrow shows the detaching sequence (directed towards the core); 4. lines connecting broken pieces that fit to each other; 5. point-fragments; 6. borer-fragments; 7. fragments of a retouched blade; 8. blades; 9. blade-fragments; 10. flakes; 11. flake-fragments; 12. blocks or nodules; 13. cores; 14. core-fragments; 15. conjoining groups (see 7.). Infilled symbols indicate burnt artefacts. Drawing by D. Stapert/J.M. Smit.

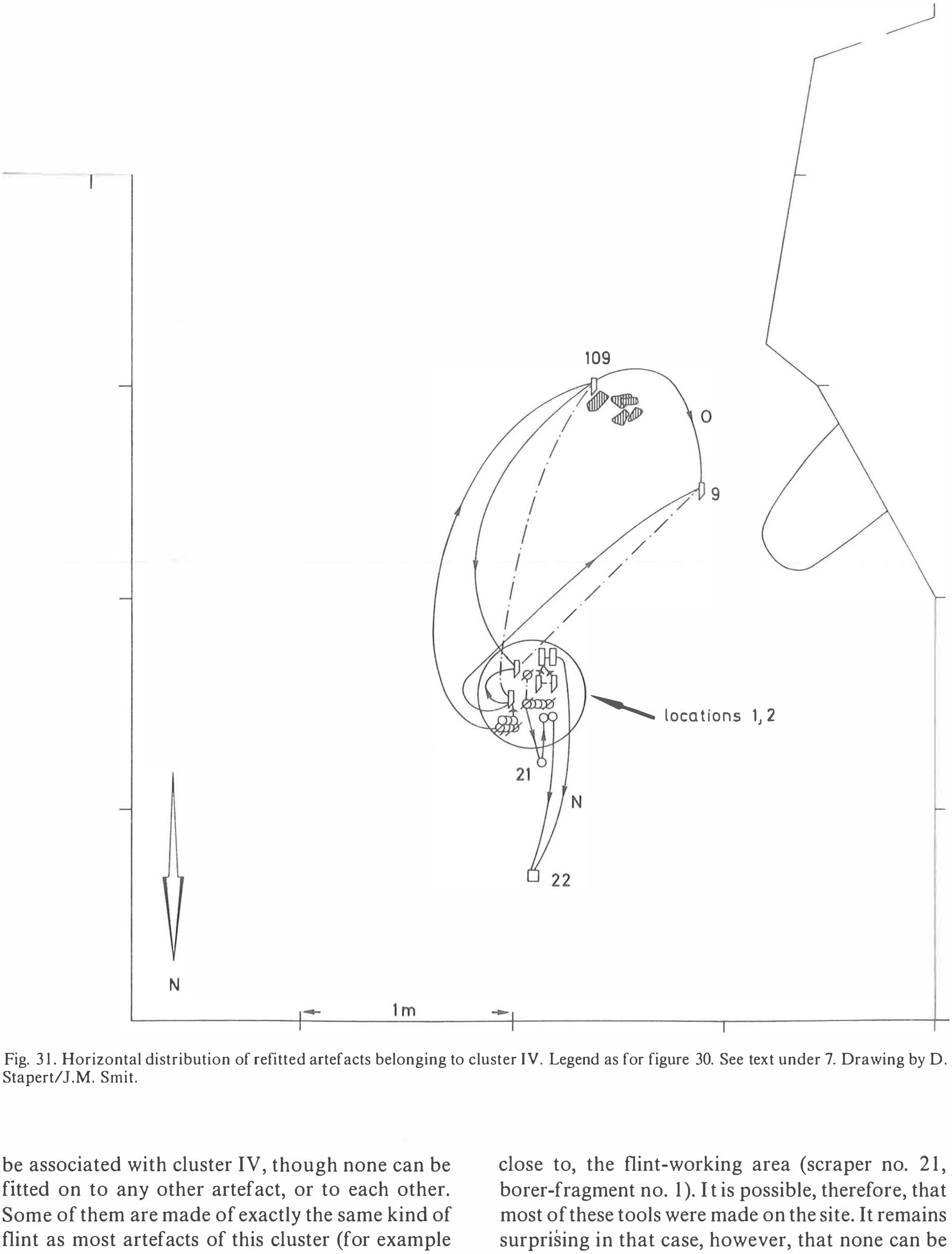

Fig. 31. Horizontal distribution of refitted artefacts belonging to cluster IV. Legend as for figure 30. See text under 7. Drawing by D. Stapert/J.M. Smit.

be associated with cluster IV, though none can be fitted on to any other artefact, or to each other. Some of them are made of exactly the same kind of flint as most artefacts of this cluster (for example the scraper no. 21 (fig. 10: no. 15), the three borers, and several of the remaining points or point-fragments). Some of these pieces were found in, or close to, the flint-working area (scraper no. 21, borer-fragment no. 1). It is possible, therefore, that most of these tools were made on the site. It remains surprising in that case, however, that none can be conjoined. As stated above, one of the difficulties in this matter is the fact that flint types such as those occurring in clusters III and IV are rather common in this area. One scraper (no. 1; fig. 10: no. 16), though made of flint that greatly resembles that of cluster IV, bears a cortex remnant that is different from all the cortex preserved on the other artefacts placed in that cluster, which is perhaps suggestive of this possibility. It was found, however, in the flint-working area. Most of the points are damaged by use, as indicated above. This could indicate the possibility that they were imported. But, of course, it does not prove that. Points could have been made on the site, used during hunting trips in the surroundings, and subsequently brought back to the site and discarded.

The conclusion is that 2 tools (a scraper and a point-fragment) certainly were imported (and two blades also), and that one tool (a burin) was most probably manufactured on the site, while for the rest of the tools we are essentially left in uncertainty, though it seems probable to me that several others, especially some of the points, were also imported.

All in all, this conclusion is not very satisfying. But perhaps far-reaching conclusions should not be expected when dealing with material of such a small site, that moreover was not excavated completely. In any case, the exercise described in this chapter has shown once again that carrying some artefacts during travel was a normal practice of Late Palaeolithic hunters. Information could be gained, furthermore, concerning the blade technology, which is essentially comparable to that of most Late Palaeolithic sites. For cores especially slab-like pieces of flint were selected. In every case where it can be observed, the cores had only one production face, and two opposite striking platforms that were used alternately. It was shown that problems resulting from hidden internal frost cracks plagued flint knappers of the period. The refitting analysis helped to elucidate patterns in the horizontal distribution of activities on the site, and this is probably its most rewarding contribution. One of the results is that broken blades were in many cases still considered as being usable, as they were apparently transported on the site after the moment of breaking. However, Moss (in press) found that fitting blade-fragments, found wide apart on the site of Oldeholtwolde, have the same wear traces. The analysis gave insight into the amount of flint-working done on the site. At least 4, and maximally 6 or 7, nodules were exploited as cores. One more nodule, brought to the site, was not used. The composition of the small cluster II suggests that also cores (in a prepared state) were sometimes carried during travel.

8. THE 'CRESWELLIAN PROBLEM'

In the title of this site report it is stated that Emmerhout is a Creswellian site. The Creswellian tradition was defined in England by Garrod (1926), to describe material from sites like Kent's Cavern and Mother Grundy's Parlour. Bohmers (1956) transferred the term Creswellian to the Netherlands, to describe several Dutch sites, like Neer II. Furthermore, he defined the so-called Cheddarian tradition, for sites that supposedly produced rather many Cheddar points, in addition to Creswell points. It seems clear, however, that there is no need for a separate Cheddarian tradition, either in England (*e.g.* Campbell, 1977; Collcutt, 1979), or in the Netherlands. At Zeijen, for example, there are only a few Cheddar points, but rather many Creswell points (Stapert, in prep.). Neer II cannot serve as an example of the Creswellian tradition, as this surface collection represents a mixture. An excavation at the spot, carried out by Bohmers, produced a small *Federmesser* collection.

Campbell (1977) distinguished 3 phases within his 'Later Upper Palaeolithic' (which is roughly equivalent to Garrod's Creswellian):

1. 'Creswell point phase' (suggested dating Late Glacial zones I-III).
2. 'Penknife point phase' (suggested dating zones II-IV).
3. 'Transitional to Mesolithic phase' (zones III-V?).

According to Campbell, phase 1 is characterized especially by an abundance of Creswell points, phase 2 especially by penknife points, and phase 3 especially by obliquely blunted points. In 1980, Campbell proposed a new subdivision:

1. *Creswellien inférieur* (suggested dating 23,000-15,000 B.P.).
2. *Creswellien moyen* (15,000-13,000 B.P.).
3. *Creswellien supérieur* (13,000-11,000 B.P.).
4. *Creswellien final* (11,000-9,000 B.P.).

Creswellien moyen and *supérieur* together are supposed to be roughly equivalent to the earlier defined 'Creswell point phase', while the *Creswellien final* is supposed to be more or less equivalent to the 'Penknife point phase' and the 'Transitional to Mesolithic phase' together. In 1986, Campbell even distinguished a fifth phase: a 'Proto-Creswellian', while he suggested datings that are somewhat different from the ones mentioned above. Some of his suggested datings seem to be astonishingly old. According to Jacobi (1980; 1981), Later Upper Palaeolithic occupation of England did not take place much before 12,000 B.P. (see however: Jacobi *et al.*, 1986). One of his arguments is that the Hamburgian tradition does not seem to be represented in England.

Gough's Cave would be a good example of the 'Creswell point phase' (or *Creswellien moyen*). According to Campbell (1980) 92 Creswell points were collected there, while further 47 Tjonger points, 19 shouldered points, 10 Cheddar points, 9 Zonhoven points and 3 penknife points are present. Mother Grundy's Parlour would be a good example of the 'Penknife point phase' (or *Creswellien final*). According to Campbell (1980) 17 penknife points are present, and furthermore *i.a.* 10 Creswell points, 9 Zonhoven points, 8 Tjonger points, 5 shouldered points, and 3 Cheddar points.

In both cases the variety of point types is striking, but we cannot be sure that we are dealing with material derived from only one occupation. In any case, at Gough's Cave and other English sites there is a clear predominance of Creswell points in several assemblages, and this would seem to make the definition of a Creswellian tradition a reasonable proposition in Great Britain.[1]

Campbell (1986: p. 22) even goes so far as to suggest that "...the Hamburgian and Tjongerian are simply specialised continental variants of a broader Creswellian sphere of influence and tradition...". A contrary view is held by Jacobi (1980), who tends to see the British Creswellian as part of the continental *Federmesser* tradition.

On the continent archaeologists have remained divided as to whether or not here also a separate Creswellian tradition should be postulated. 'Creswellian-like' sites in Holland and Belgium are in several ways intermediate with respect to the Hamburgian and *Federmesser* (Tjonger) traditions distinguished in the continental part of western Europe. The Hamburgian and Tjonger traditions have not been recognized as such in Great Britain (*e.g.* Jacobi, 1981: "There is an absence from Britain of any assemblage which could be described as of Hamburgian type"; see also: Jacobi, 1980; Campbell, 1986).

Thus, 'Creswellian-like' findspots on the continent have been included by some authors in the *Federmesser* tradition (Schwabedissen, 1954; Paddayya, 1971; Vermeersch, 1984; Arts, in press). Others see at least a strong relationship between the *Federmesser* and Creswellian traditions. Thus, Dewez uses the term *Creswello-Tjongérien*, and is of the opinion that the Tjonger (*Federmesser*) tradition is a *faciès de plein air* of the Creswellian (Campbell, 1980, after Dewez, 1979).

Other archaeologists see more reason to associate the 'Creswellian-like' findspots with the Hamburgian (Stapert, 1979a; Burdukiewicz, 1981: 'The Shouldered Point Technocomplex'; Otte *et al.*, 1984: *Tradition Creswello-Hambourgienne*). Various authors have suggested the presence of several subgroups (or *faciès*) within the Creswellian sites on the continent (*e.g.* Dewez, 1977). Thus, it has been proposed that there is an older subgroup, reminiscent of the Hamburgian, and a younger subgroup, more similar to the *Federmesser* tradition (Schild, 1984). In principle these two 'subgroups' could be compared with the 'Creswell point phase' and the 'Penknife point phase', respectively, of Campbell (1977).

Some archaeologists have tended, with some reserve, to see the Creswellian as a separate tradition on the continent (Bohmers, 1956; Dewez, 1980; Campbell, 1980; Otte, 1984; Stapert, 1984; 1986).

Given this state of affairs, there seems to be some reason for assuming an intermediate position, between the Hamburgian and *Federmesser* traditions, for the 'Creswellian-like' sites on the continent. It has been noted many times, for example, that there exists a typological 'overlap' between Creswell points and shouldered points, and of course also between Creswell points and Tjonger points. As stated above, one possible definition would be that shouldered points have the nick below the middle of the implement (pointed part facing upwards), and Creswell points above the middle (*e.g.* Houtsma *et al.*, 1981), but this does not really alter the fact that there is an overlap. It is also true to say that Creswell points often occur together on sites with either shouldered points, or *Federmesser*, or both. Possibly this also indicates an intermediate dating for the 'Creswellian-like' sites on the continent, somewhere in the Early Dryas Stadial (Dryas II), and/or the first half of the Allerød Interstadial (*e.g.* Stapert, 1984). Unfortunately, however, we have hardly any firm dates for the 'Creswellian-like' sites on the continent (see below).

As can be seen from the above discussion, for the various Late Glacial groups in northwestern Europe stone point typology has been used by archaeologists for defining traditions, especially given that artefacts manufactured of organic materials have not usually been preserved. This practice may be considered by some as being somewhat limited in scope.

However, there may be more sense to it than is generally believed. In the first place, if the points have similar functions we are dealing here with stylistic differences and not with different proportions of type-classes (see for the latter procedure: Bohmers, 1956; 1960; Burdukiewicz, 1981; 1986). In my opinion, varying proportions of, for example, burins or scrapers between various assemblages, should not be used to define traditions, as these most probably contain information about differences in the activities performed at the various sites (Stapert, 1982: discussion). Stylistic attributes, especially of projectile points, however, could be very well indicative of the existence of different groups of people, in space or in time. Wiessner (1983) distinguishes between emblemic and assertive style. Emblemic style attributes would indicate group identity, while assertive style would result from the need for individual identity (see also Wiessner, 1984). Arrowheads of the Kalahari San (Bushmen) are, according to Wiessner, suitable for carrying style as an emblem to mark boundaries:

> The projectile point, an artefact that is present in many lithic assemblages, was found to be well suited for carrying information about groups and boundaries because of its widespread social, economic, political, and symbolic import. This should be particularly true for projectile points used in large game hunting because, due to the highly variable returns, the meat sharing that ensues is often used to solidify socioeconomic ties. The stylistic information contained in San projectile points was a good indicator of linguistic boundaries.
>
> (Wiessner, 1983: 272)

Therefore, it seems to me that archaeologically speaking it makes good sense to define traditions on the basis of stylistic attributes of projectile points. It seems clear that shouldered and tanged points were used as projectile points (Moss, in press), as were Tjonger points and related forms (Keeley, 1978). Besides, the Roermond find, a Tjonger/Gravette point embedded in the lower jaw of a giant deer (Wouters, 1956; 1957/58) can no longer be used as evidence for the projectile character of backed points, as there is no clear prehistoric association between the point and the jaw (Stapert, 1977).

It seems very probable, that Creswell and Cheddar points were also projectile points. In the case of Emmerhout many Creswell points are damaged: often a tiny part of the tip is missing, and splintering can be seen to be present near the tip and along the edges. These phenomena indicate that these Creswell points may have been used as projectile points. It seems very probable that at least some of the points were brought to the site from elsewhere (see 7.), as was the case at the site of Oldeholtwolde (Stapert *et al.*, 1986): they were presumably used prior to occupation of the site.

It seems reasonable to assume, on the basis of the available use wear analyses, that shouldered points, tanged points of Havelte type, Creswell points, Cheddar points, and Tjonger points or related forms, all had similar functions. We seem to be dealing, therefore, with 'isochrestic' variation (Sackett, 1986).

There are not many assemblages in which only one type of point is represented (as would perhaps be expected if points only carried emblemic style attributes). They do exist, however. A good example is the 'Epi-Ahrensburgian' (Gob, 1984) site of Gramsbergen, where only B-points or 'Zonhoven points' were present, in relatively large numbers (Stapert, 1979b; Stapert & De Roller, in prep.). This site can probably be dated to the second half of the Preboreal and constitutes the very last 'Late Palaeolithic' industry in the Netherlands, almost at the transition to the Mesolithic.

For many English sites it is true to say that quite a lot of different point types are represented, as we have mentioned above. However, this could be the result of the fact that these assemblages are a mixture of several occupations that do not necessarily date from only one Late Glacial zone, and this is what one would expect especially for cave sites. Therefore, we would have to look at single-occupation sites for clarification. Small open-air sites, that were only occupied once, preferably in areas where continuous sedimentation took place, should be looked upon as being valuable in this respect (and also in other respects–see below). These conditions are fulfilled with many Late Palaeolithic sites embedded in coversand on the North European plain. Good examples in the Netherlands are the Hamburgian sites of Oldeholtwolde (Stapert, 1982; Stapert *et al.*, 1986) and Luttenberg (Stapert, 1986), where the finds were present in a layer of coversand, and not at a soil or erosion level separating 2 layers. Emmerhout is not such a good example, as the finds were located stratigraphically near an erosion level. Still, we can feel sure that we are dealing here too with a single event of short duration. For some large sites, like Usselo (Stapert & Veenstra, in press; Stapert & Zandbergen, in prep.), where the finds were present in the 'Usselo Layer' (a paleosoil), and consequently were left during a phase when the deposition of the coversand was arrested, we cannot be sure that only one occupation is represented. In fact, the large quantities of finds and the wide variety of point types make it much more probable that we are dealing at Usselo with several occupations. The same is true for the *Federmesser* site of Een-Schipsloot, where at least two occupations must have taken place (Houtsma *et al.*, 1981; Casparie & Ter Wee, 1981).

Even in the case of single-occupation sites of relatively short duration, in most cases we are not dealing with only one type of point. For example, at Oldeholtwolde we have shouldered points, tanged points (of Havelte type), and a few *Federmesser* (Tjonger/Gravette points). At the Hamburgian site of Jels in Denmark the range is smaller: especially tanged points are present, and a few *Federmesser*, but no shouldered points (Holm & Rieck, 1983; pers. comm.). I would estimate that Oldeholtwolde and Jels both belong to the 'Havelte group' of the Hamburgian, but that Jels is even somewhat younger than Oldeholtwolde.

For practical purposes, I would like to make a simple proposal. The Creswellian could be defined as being represented by single-occupation sites, where Creswell points (Campbell's types AC1-5) and/or Cheddar points (Campbell's types AC6-10) are the most numerous of all the point types present. Similarly, Hamburgian sites could be characterized by the fact that shouldered and/or tanged points (of Havelte type) are the dominating point type. *Federmesser* sites would be characterized by Tjonger/Azilien/Gravette points (Celerier, 1977) being dominant over all other point types represented. This procedure would at least supply us with a clear-cut definition, and we would know what we are talking about when discussing various traditions. Also, these definitions would seem to be meaningful in the light of the ethnoarchaeological observations made by Wiessner.

Thus, when ascribing sites to traditions, it should be clear that one is not dealing with multiple occupations. Only in certain circumstances would it be possible to classify precisely assemblages that are the product of several occupations, and I would suggest that in most cases ascribing such sites to specific traditions can best be avoided. A theoretical example can make this clearer. Suppose that an assemblage is made up of two occupations: one Hamburgian with 13 shouldered and 8 *Federmesser* points, and one Creswellian with 13 Creswell and 8 *Federmesser* points. According to my definitions the resulting assemblage would have to be classified as belonging to the *Federmesser* tradition.

With several Late Palaeolithic collections in the Netherlands, the variety of point types is partly the result of the presence of modern replicas alongside the old material. In most cases authentic blades were retouched recently into forms that are sometimes curiously shaped. Examples are the collections from the sites of Makkinga and Elspeet. Another example is the material that supposedly comes from a site near Norgervaart. This collection was sold by Mr. T. Vermaning to the Provincial Museum of Drenthe in 1969. The material was considered to be interesting because of the presence of 3 rather broad tanged points and 1 shouldered point, in addition to 8 Gravette points and 3 Tjonger points (Paddayya, 1973). However, the tanged points have been retouched and altered in the same way as those from Makkinga and Elspeet. They have been treated with a modern grinding machine, like the 'Middle Palaeolithic artefacts' supposedly from Hogersmilde and Hijken, and the 'Neolithic artefacts' supposedly from Ravenswoud, all of which were sold to museums by Mr. T. Vermaning (Stapert, 1975). It is interesting in this connection that Paddayya remarks that later inspection of the site indicated by Vermaning, failed to produce any artefacts.

One of the consequences of the definitions given above would be, that classification of sites without points is impossible. This would apply for example to 'special purpose' sites that only yielded scrapers, or burins, *etc.*

Looking at the point inventory of Emmerhout (see 4.3.), there are 10 classifiable specimens (fig. 9: nos. 1-10). Nine of these are–in the refitted state–only damaged; one (no. 10) is broken but nevertheless attributable to the category of Creswell points with a fair probability (there exists, however, a theoretical possibility that we are concerned with a fragment of a Cheddar point).

As mentioned above, two of the points (no. 5, 6) show a slight resemblance to shouldered points but have to be classified as Creswell points according to the definition of Houtsma *et al.* (1981). No. 9 is atypical, as backing is only present over a short distance, it could therefore also be called an obliquely blunted point. Using the typology of Campbell (1977) we arrive at the following classification:

Creswell points, type AC1	5
Creswell points, type AC2	3
Creswell point, type AC2, or obliquely blunted point, type AB6	1
Obliquely blunted point, type AB6	1
total	10

Summarizing, at least 8, and possibly 9, of these 10 points can be classified as Creswell points. Especially interesting is the fact that there are no *Federmesser* present. Also worth noting is the fact that there are no short scrapers present, as known especially within the *Federmesser* tradition, but long blade end scrapers with retouched sides. These occur in the Northern Netherlands especially within the Hamburgian tradition. According to the definition adopted above, Emmerhout has to be classified as belonging to the Creswellian tradition.

Within the new subdivision of the Creswellian, as proposed by Campbell (1980), Emmerhout would probably have to be placed in the *Creswellien moyen*. However, I do not believe that the dating of Emmerhout falls in the timespan of 15,000-13,000 B.P., as suggested by Campbell (*ibid.*). As stated under 3., I think there are good reasons (based on stratigraphy) to suppose that Emmerhout is to be dated approximately in the Allerød Interstadial, or slightly earlier or later, in any case after 12,000 B.P. in terms of the radiocarbon chronology.

This would fit in very well with the few dates that are available for other sites that have been classified as Creswellian. Gough's Cave produces C14-dates around 12,000 B.P. (Leroi-Gourhan & Jacobi, 1986), which would indicate occupation at the end of the Bølling Interstadial or in the Early Dryas Stadial.[2] The Belgian site of Presle is believed to date from the Early Dryas Stadial (Otte, 1984), or from the end of the Bølling Interstadial (Otte *et al.*, 1984, after Marsden, 1957; see also Dewez, 1986).[3] The 'Creswellian-like' site of Bois de la Saute is also believed to date from the Early Dryas Stadial (Otte *et al.*, 1984, after Taussaint *et al.*, 1979).

If my definition of the Creswellian tradition, as given above, were adopted, several 'Creswellian-like' sites mentioned in the literature would fail to qualify as Creswellian, which would perhaps also have consequences for the presumed dating of that tradition. I do not want to pursue this matter further here, but it might be worthwhile to note that according to my definition a site like Mother Grundy's Parlour would not be classified as belonging to the Creswellian tradition.

The use of my definition would also lead to differences with respect to other classification schemes, such as that of Burdukiewicz (1981; 1986). He proposed the term 'Shouldered Point Technocomplex' for assemblages 'with shouldered points', and this would include Hamburgian assemblages and part of the Creswellian assemblages. However, this would mean that assemblages with only a few shouldered points, irrespective of other point types represented by large numbers in those assemblages, would all fall in this 'technocomplex'. As far as I can see this procedure would obscure important differences that might be present between those assemblages.

The underlying theory for my definitions is that point style is indicative, at least to some extent, of group identity. If this theory holds true, then it is to be expected that the different traditions defined in that way would occupy either a different area, for as far as they are contemporaneous, or a different timespan in the same area. We will have to wait for more good absolute dates of single-occupation sites to test the value of this proposition. Meanwhile, I consider these definitions as simple and objective ways of dealing with some of the variability of our Late Glacial archaeological material.

Looking at the three Creswellian sites in the Northern Netherlands, Siegerswoude II, Zeijen and Emmerhout, one has the impression that they are more similar to the Hamburgian than to the *Federmesser* tradition in several respects. For example, the quality of the raw material for flint artefacts seems to be better than at most *Federmesser* sites (this is contested by Arts, in press). We have suggested elsewhere (*e.g.* Stapert, 1981) that the occurrence of better quality flint may partly be connected with the presence of more open vegetations, allowing the possibility of selecting good flint. The difference between Hamburgian or Creswellian material, and *Federmesser* material (for example of the site of Usselo) seems to me to be striking. This would apply especially to the technical quality of the blades. This could be measured in at least two different ways. One would be the mean ratio of thickness and length, another the criterion of Moss (1983a) concerning the straightness of edges in side-view. It is intended to carry out several such measurements in order to establish differences in this respect, if they indeed exist. For the complete 'normal' blades of Emmerhout the mean ratio of max. length and max. thickness is 9.9, with a S.D. of 2.2 (this is not the same as the ratio of the mean max. length and the mean max. thickness).

For the *Federmesser* site of Usselo the mean ratio of max. length and max. thickness was found to be 8.4, based on measuring 813 'normal blades'. The S.D. was provisionally estimated to be 3.6, based on 82 randomly chosen measurements (pers. comm. A.L. Zandbergen). Student's t can be calculated as 2.41, implying that the difference between the two means is probably significant (p smaller than 5%).

Of course, more statistical work has to be done, but it seems clear to me that *Federmesser* blades generally are of lower quality than Creswellian or Hamburgian ones.

9. SMALL SITES

As stated above, the material of Emmerhout has only been partly recovered, probably about 50%. Nevertheless, it is clear that the site is very small. It is reasonable to suppose that the total number of artefacts originally present (disregarding chips) was below 1000, probably somewhere in the range of 400-600. In all other excavation trenches in Emmerhout and Angelsloo, which were quite extensive (see the map in: Van der Waals & Butler, 1976), no Late Palaeolithic flints were found. Therefore, it seems probable that this flint concentration was an isolated phenomenon.

Many other small sites are known from the Late Palaeolithic in Northern Europe. Tromnau (1975) and Bokelmann (1978; *et al.*, 1983) have drawn attention to this phenomenon, especially with respect to the *Federmesser* tradition. In Poland quite a lot of small sites have been published by Schild (*i.a.* 1977) and Chmielewska (*i.a.* 1961; 1978).

Small sites can generally be assumed to represent single occupations of short duration. This makes them interesting in several respects. We have suggested above that single occupation sites should be used to investigate the presence of different traditions, in time or space, as defined on the basis of stylistic attributes of projectile points. Many large sites should be interpreted as being the result of multiple occupations, making them much less useful in this respect. Multiple occupations can be expected at residential sites that are located near water, and where enough fuel (brushwood, trees) was present. Probable examples of large *Federmesser* sites for which these characteristics apply, and that are stratigraphically located in the 'Usselo Layer'–a soil, representing a period of non-deposition–are Usselo and Milheeze. These sites therefore most probably represent multiple occupations. For examples of repeated re-use of residential (and other types of) sites by the Nunamiut Eskimos, see the work of Binford (*i.a.* 1982; 1983). In such cases the large area of the sites and the great number of artefacts do not necessarily reflect activities of a large group of people, or a prolonged occupation.

A second reason why camps of short duration are valuable for archaeologists is the fact that 'settlement structures', or patterns in the horizontal distribution of artefacts, are often better preserved. With sites that have been occupied for a long time, or several times, it is to be expected that distributions of a palimpsest nature would be created. In such cases interpreting horizontal distributions of various artefact classes *etc.* can hardly be a rewarding task. Small sites, because they represent one-time events of short duration, seem to be much more promising in this respect.

A third aspect is that one might also expect small sites to reflect functional or technological variability, in the proportions with which several artefact classes are represented, as a result of different activities having occurred at different sites. Binford (*i.a.* 1980; 1983) described several types of such 'special purpose' sites, which are not necessarily small, but can through 'site complexes' even occupy larger areas than a residential camp. Binford gives examples of associations of hunting camps, hunting stands, butchering areas, hide-drying places, meat caches, *etc.* (Binford, 1983). We might expect 'special purpose' sites to be different from residential, or base, camps in the sense that one type of activity dominated, where other types seldom or never occurred. At base camps one would expect a whole range of activities to have taken place. This difference leads us to expect that 'special purpose' sites would possibly be characterized by one or two tool types being represented in high proportions, while other tool classes would be rarer. As we shall see below, this is indeed the case with many small sites of the Late Palaeolithic in Northern Europe. At base camps we would normally expect a whole range of tool classes to be present, though we should still anticipate differences between, for example, winter and summer camps. Generally speaking large sites do indeed show a wide range of artefact classes.

It is satisfying that these very general expectations, derived from anthropological information, are to a certain degree fulfilled in the archaeological record (Newell, 1973, found an essentially similar picture for the Mesolithic). However, this certainly does not mean that we can offer reasonable interpretations of archaeological sites as a direct result. We must agree with Binford that "at present, archaeology lacks methods for coping with the complicated archaeological residues typically created by hunting and gathering peoples" (1983: p. 131). I would suggest that detailed studies particularly of small sites, with the help of refitting and use-wear analyses, should enable us in the future to produce more than inspired guesses concerning the 'function' of these sites.

What types of sites do we know archaeologically in the North European plain (for other classification schemes: see Arts, in press; Burdukiewicz, 1986; see also Schild, 1984)?

1. *Isolated artefacts*. In almost all cases it concerns isolated projectile points. A famous example is the isolated shouldered point of Bjerlev in Denmark (Becker, 1970). Madsen (1983) mentions 15 isolated tanged points of Bromme type from eastern Jutland and also one isolated blade end scraper with retouched sides. During the investigation of a fossil Allerød forest (covered by tuff) near Miesenheim (Western Germany), one isolated *Federmesser* (Tjonger point) was found (Street, 1986).

From the northern part of the Netherlands there is an isolated Tjonger point of Odoorn (fig. 32)–found during an extensive excavation (the coordinates of the findspot are:
Topographical Map of the Netherlands, sheet 17F (Exloo): 253.500/540.325), so that in this case the isolated nature of the find is certain (J.N. Lanting, pers.comm.). Also from the southern part of the Netherlands isolated projectile points are known (Arts, in press). Possibly in these cases we are concerned with projectiles that the hunters were unable to retrieve after use. In most cases we suppose these projectiles to have been arrows, as these get lost more easily than spears or harpoons. We are in possession of good evidence that Late Palaeolithic hunters generally collected their projectiles after use, because we frequently encounter damaged or broken projectile points on sites (see also Moss, in press). Probably quite a lot of work had to be invested in producing shafts and other parts made of organic materials. Broken and damaged flint arrowheads or spearheads, and/or barbs, were replaced by new ones, so that the same tools could be used repeatedly. Therefore, in my opinion it is not so much the flint projectile points that were 'curated tools' in the sense of Binford (1976), but the shafts and other parts made of organic materials. In fact, the presence of damaged flint points at sites bears witness to the existence of the curated tools of which they were a part. If hunting tools had not possessed flint insets, we would remain completely unaware, on many sites, of their existence, and in those cases it would be extremely difficult to recognize hunting camps as such.

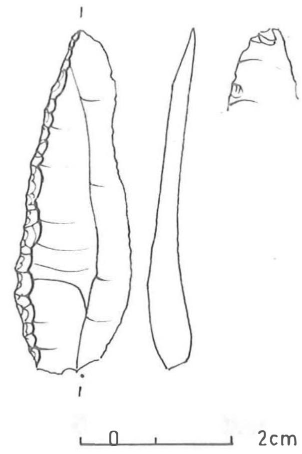

Fig. 32. The isolated Tjonger point of Odoorn. Drawing H.R. Roelink.

Perhaps many different tasks were carried out at our sites with the help of tools made of organic materials, that have left no trace. Especially the lack of organic material at sites in sandy soils in northern Europe should make us extremely cautious. It is my conviction that archaeology has always suffered from over-interpretation, and still does.

2. *Lithic raw material procurement sites*. This is a type of 'special purpose' site that in most cases would seem to be easily recognizable. So far only two are known in the Netherlands: Uffelte (Beuker, 1981) and Waubach (Arts, 1984). In Poland several sites of this kind are known (Ginther, 1984; Schild, 1976). Such sites are characterized by high numbers of waste artefacts (many of them bearing cortex), and very low numbers of finished tools. There are many examples of Late Palaeolithic sites in places where flints and other stones could not have been collected in the immediate surroundings, like Oldeholtwolde and Emmerhout. Therefore, there must exist many sites at boulder-clay outcrops where flints and other stones were collected, and where the initial stages of blade production (core preparation) took place, resulting in assemblages of mainly waste material.

3. *Small sites*. It is difficult to define these in an objective way. Tentatively I would define them as sites with fewer than 1500 artefacts larger than 1.5 cm. This is based on a general assessment of the literature, which suggests that in that range we see 'specialisation' in the proportions with which various tool classes are represented. A possible, though arbitrary, definition for 'specialisation' could be that one tool type-class accounts for more

than 50% of all the tools (the percentage preferably being calculated on the basis of the sum of the categories B, C and D; table 2). An alternative definition could be that one or several tool classes are not or hardly represented. There are several types of 'small sites' (see below).

4. *Medium-sized sites.* These are arbitrarily defined for the present as sites with between 1500 and 5000 artefacts larger than 1.5 cm. Oldeholtwolde (though rather small) and many other Late Palaeolithic sites in Northern Europe belong to this category. In general these sites do not show extreme specialisation: all known tool classes are represented, though of course there are differences in proportions between various sites. It is particularly this phenomenon that is important for distinguishing these sites from small sites, rather than the exact number of artefacts. It is suggested that these sites were generally occupied by families for a somewhat longer time. If these are single occupation sites, they could be called 'residential camps'.

5. *Large and very large sites.* Large sites have more than 5000 artefacts larger than 1.5 cm. Perhaps it would be useful to create also a category of very large sites, for example, sites with more than 20,000 artefacts larger than 1.5 cm. I suspect that very large sites, and also some large sites, are the result of multiple occupations. In the Netherlands, so far very large sites are known only for the *Federmesser* tradition, and not for the Hamburgian, Creswellian, or Ahrensburgian traditions. In my opinion this is not necessarily indicative of a deviating settlement system during *Federmesser* times. As suggested above, this phenomenon could very well have a geological reason, as most *Federmesser* sites can be dated in the Allerød Interstadial–a period of non-deposition of coversand. Therefore, favourable spots for residential camps, for example near a lake, could be re-used many times, and the residues resulting from the individual occupations would not be separated by sterile deposits. In my opinion the same could be true for very large Mesolithic sites, like Bergumermeer (Newell, 1980). The excavated part of this site (Bergumermeer B) produced approximately 120,000 artefacts (Odell, 1977).

It is even conceivable that the absence of coversand deposition made it rewarding to re-use facilities like hut- or hearth-constructions over and over again, and this would result in huge accumulations of flint artefacts.

Emmerhout clearly falls into the category of small sites showing 'specialisation'. From the literature it is evident that there are different types of small sites, depending on which tool class is predominant.

There are quite a lot of small sites where 'projectile points' show a clear predominance, while some other tool classes are rare or absent. An extreme example is the Danish Bromme site of Ommels Hoved (Holm, 1972), where 111 tanged points and 'a handful of unretouched blades' (Fischer *et al.*, 1984: p. 36) were found. Holm, and also Madsen (1983) are of the opinion that this site probably represents a 'kill site'. I do not feel so certain about this interpretation, however. Would one expect so many projectiles lying close together (25x5 m, according to Fischer *et al.*, 1984; but the finds show 'water wear' and have supposedly been moved after deposition) at a kill site? Perhaps this could happen in rather extreme circumstances, but to me it gives the impression of some kind of cache. Binford (1983) mentions that the Nunamiut sometimes cache weapons at hunting stands for future use.

Another possibility is perhaps that the site of Ommels Hoved represents a grave. At a Russian site (Deer Island in Lake Onega) a collection of arrows (compound shafts of bone and wood, willow-leaf shaped points) was found in a grave. The site belongs to the Masovian tradition, dated in the Late Dryas Stadial and the first part of the Preboreal (Schild, 1976).

The fact that so many tanged points occur together would also seem to indicate that they were possibly used as arrowheads, not as spearheads. The same would seem to be true for the remarkable Creswellian site of Siegerswoude (Kramer *et al.*, this volume), where among a total of 204 tools, 169 points or point-fragments were present. Other tool classes are represented by very low numbers, for example: 3 scrapers, 6 burins, and 6 borers. The total number of artefacts at this site is c. 1100, though a small part of the original material may be missing.

Some other sites where many projectile points were present are Løvenholm I in Denmark (Madsen, 1983), Texel (Stapert, 1981) and Swalmen (Early Mesolithic, Stapert, 1979b) in the Netherlands, Hohenholz in Germany (Bohnsack, 1956), Gouy (Bordes *et al.*, 1974) in France, Presles (Dewez, 1975/76, after Otte, 1984) in Belgium. None of these sites belongs to the *Federmesser* tradition.

From the *Federmesser* tradition we know of especially small sites dominated by scrapers. An extreme example, possibly of the *Federmesser* tradition, is Buinen in the Netherlands (Musch, 1974). Of the 140 tools 130 are short scrapers, while in addition 4 combination tools (scraper/burin), 1 obliquely blunted point and 1 retouched flake are present. Unfortunately the drawings of the flint artefacts are unclear, and are reduced by an unknown degree. The total number of artefacts at this site is stated to be 3455, but we are not informed about the number of chips smaller than 1.5 cm; in view of the extreme specialisation we prefer to call this a 'small site' within our classification scheme.

Some other (mostly *Federmesser*) sites where scrapers dominate are Geldrop III-4 (Deeben, in press), Urbar (Eiden & Löhr, 1973/1974), Rissen 18 (Bokelmann, 1978), Borneck Ost (Bokelmann, 1978), and in Poland (Schild, 1977; Schild & Królik, 1981): Calowanie NIV/CIXest, Rydno IV/57est, Tarnowa, Katarzynów.

Then there are small sites dominated by *burins*, but these appear to be relatively scarce: Rydno I/76, Calowanie NVI/CI, Calowanie NVIa/CIIIouest in Poland (Schild, 1977), and Klein-Nordende A (Bokelmann, 1983) and Schalkholz (Bokelmann, 1978) in Germany.

Several other small sites show more or less the same proportions for *burins* and *scrapers*, while projectile points are very scarce: Teltwisch 5 and Borneck in Germany (Bokelmann, 1978), Langå I in Denmark (Madsen, 1983).

The above list should not be considered to be exhaustive. Several more small sites in the Netherlands are as yet unpublished, like Kolderwolde (at least 3 sites), Rolde, Diever, Haule. Small sites with scrapers predominating are known particularly from the *Federmesser* tradition; the reason for this phenomenon is at present unknown. We assume that mainly hide preparation took place at these sites (Moss, 1983b; Keeley, 1978). Of course the presence of many hides at a site would also imply that large mammals had been killed and butchered, prior to the preparation of the hides. As Binford (1983) has stressed, such 'special purpose' sites often are part of large 'site complexes'. Unfortunately in most cases excavations did not extend very far outside the limits of the flint concentrations, so that we are not really informed about the possible presence of additional 'activity areas', perhaps 10 or more metres away. Perhaps we should anticipate hide-drying places, spread out over a large area. Binford (1983) gives an example of such a site of the Nunamiut Eskimo, at Kongumuvuk Valley, characterized by the presence of small rings of stones, used to keep hides on the ground. Also we do not know in general if short scrapers were hafted or not. It is not unthinkable, for example, that concentrations with many scrapers represent places where used-up scrapers were removed from their hafts, and replaced by freshly-made ones.

The role of burins is even more ambiguous, as many of them do not appear to have been tools in their own right. Moss (in press) states that most of the burin-edges at the Hamburgian site of Oldeholtwolde are unused. She suggests that the burin-blow often served only to facilitate hafting or handling.

The existence of this variety of small specialized sites in the Late Palaeolithic seems to suggest that we are dealing with foragers as defined by Binford (1980; 1982, see also Wiessner, 1982), a point which we will not consider in more detail here.

Furthermore, the existence of many small and medium-sized sites also suggests, that we may have archaeological residues of summer occupations (*e.g.* Mauss, 1979(1904/05). This can only be a very general statement for the moment, as in most cases organical remains have not been preserved. In my opinion the debate concerning the seasons of occupation at the sites of Meiendorf and Stellmoor has not yet resulted in any definite conclusions (Stapert, 1982). Perhaps the study of use traces can provide further clues in certain circumstances concerning the seasons of occupation at various sites (*e.g.* Pincevent: Moss, 1983b).

Returning to small sites dominated by projectile points, like Siegerswoude and Emmerhout, it seems logical to suggest that these were 'hunting stands', or 'kill sites'. However, we should be very careful with such explanations. From the refitting analysis of Oldeholtwolde (Stapert *et al.*, 1986) we know that probably all the projectile points present at the site were brought there from elsewhere, as were most of the scrapers and combination tools, some other tools, and a number of larger blades. At Emmerhout too, we have evidence that several tools and blades were imported (see 4. and 7.). At Pincevent imported artefacts can be clearly recognized, because they are made of non-local rose flint. At Pincevent habitation I these imported tools comprised quite a lot of blades, some scrapers and burins, and only 1 *lamelle à dos* (Leroi-Gourhan & Brézillon, 1966). At Pincevent section 36 there were 76 tools of rose flint, comprising 54 *lamelles à dos*, in addition to some scrapers, burins, borers and other tools, while 59 blades or blade-fragments were also present (Leroi-Gourhan & Brézillon, 1972). Burin spalls of imported flint were found, indicating that burins were made on the site from imported blades. This means that burins as such were not necessarily part of the set of artefacts carried during travel. It is interesting in this connection that Moss (*e.g.* 1983b) found a special type of 'bright spots' ('polish type G') on some artefacts, which she suggests could possibly be the result of friction between artefacts (presumably not only made of flint) in a carrying bag of some type during travel. In my opinion we should not hastily conclude, that imported flint artefacts are 'curated tools' in the sense of Binford (1976). I would like to consider artefacts made of organic materials, with or without flint insets, to be curated tools, but not the flints themselves. The blades that were carried during travel could perhaps be regarded as a stock of blanks, for repairing curated implements of which flints were a part. Of course, this is only a matter of definition. That curation was part of the technology of the Late Palaeolithic hunters seems to be well established.

What would be the consequences for archaeological interpretation if we imagine a site where imported tools were left behind in addition to waste material resulting from the production of other tools that were subsequently carried away. Would we not be inclined to interprete the 'function' of the site in terms of the tools present in it? For example, the imported group of Pincevent section 36 is comparable to the total set of tools present on the site of Emmerhout (substituting Creswell points for *lamelles à dos*). I consider it to be possible that the tool inventory of some small sites consists only of imported tools, while other tools could have been made at the site and subsequently taken away. The point is, that the activities represented by the imported tools could in theory be completely different from the activities actually performed at the site.[4]

Turning our attention to Emmerhout, we seem to have the following data:

a. Prior to, and perhaps during occupation of the site hunting was done. At the site damaged and broken projectile points were removed from their shafts, and probably new ones were made, inserted, and subsequently taken away from the site.

b. At a nearby place flints and stones were collected, which were brought to the site. The stones were possibly used in a hearth. As there are especially flat stones present, we suggest that perhaps meat or fish was roasted (at least, this is the idea we get from the hearth at Oldeholtwolde, in which flat stones were heated).

c. Disregarding the uncertain interpretation of the function of the flat stones, we still can at least say that a fire was tended at the site, in view of the presence of some burnt flints. Possibly the ring of stones in the centre of the site was a hearth. Perhaps brushwood was collected as fuel (all the charcoal in the hearth at Oldeholtwolde consists of Salix: Stapert *et al.*, 1986, after Casparie, pers. comm.; so we have at least willow smoke...).

d. Flint-working was done. At least 4 nodules were collected elsewhere and exploited as cores on the site. As stated above, it seems probable that several tools and blades were manufactured that were intended to be taken away subsequently. This would perhaps lead us not to expect many large and regular blades to remain on the site, and could be one of the reasons for the fact that the blades present on the site are rather small and mostly broken. Some of the larger blades could in fact be imported ones. In this regard it is interesting to note that in Oldeholtwolde for several groups of conjoining blades the cores from which they derived were absent. These could therefore be imported blades.

e. If a lot of work was done on the site involving the use of scrapers and/or burins, one would expect many used-up specimens to be present, which is not the case. The few scrapers and burins that are present do not necessarily indicate their use on the site. We know that one scraper was certainly imported, and probably some other tools too. However, at least one burin was undoubtedly made on the site. A few scrapers and borers seem to be a normal part of the collections of flint artefacts carried during travel, *e.g.* at Pincevent and Oldeholtwolde.

Taking all this evidence together, I would suggest that the interpretation of Emmerhout as a hunting camp seems to be the most probable one that we can offer. It is possible, of course, that the site was also used as a hunting stand, as Nunamiut hunters sometimes camp for one or a few days at their hunting stands (Binford, 1983). In any case it seems to be clear that Emmerhout is a 'special purpose' site, because it is small, shows 'specialisation', and also because the site is not located near a body of water, which seems to be mostly the case with base camps. As stones were brought to the site and became fragmented there as a result of use (probably in a hearth), I think that the site was occupied probably for a few days, at least longer than the time needed to do the flint-working. Nunamiut Eskimos, if away for hunting several days, tend to travel in small groups of at least 2 hunters (Binford, 1976), so we could perhaps envisage a few hunters staying here for a few days during a prolonged hunting trip. As stated under 7., however, the possibility that a nuclear family camped here for a short time cannot be excluded.

If rough analogies would be usable, we have evidence for the presence of only one male hunter (one flint-working area, associated with one cluster of projectile points–but the site has not been excavated completely), and possibly one woman. In this connection it is perhaps interesting to note that Greenland Eskimo hunters tend to bring one or several women with them during long hunting trips, for cooking and repairing clothes (O. Grøn and J. Meldgård, pers. comm.). In any case, it seems to me that Emmerhout can, in a general sense, be interpreted as a camp of short duration used in connection with hunting activities.

Siegerswoude presents us with essentially the same picture (here also only a few scrapers and burins are present, that were possibly imported), only with considerably more projectile points. Therefore, I would suggest that Siegerswoude is also a possible hunting camp, but perhaps occupied by a larger group of hunters. At the end of this article it should perhaps be pointed out that I do not consider my conclusion (*i.e.* that the sites of Emmerhout and Siegerswoude could be interpreted as hunting camps) as having been 'tested' in any 'scientific' way. I doubt if such propositions could ever be tested rigorously, as the kind of archaeological data we are dealing with does not seem to allow this. Therefore, this type of interpretation should be looked upon as being speculative. In my opinion there is nothing against speculation, if first the data that are available have been analysed.

10. SUMMARY

A small Late Palaeolithic site at Emmerhout is described. It could only be excavated for approximately two-thirds, as a result of a large (sub)recent disturbance. On stratigraphical grounds it is argued that the site dates from the Allerød Interstadial, or from slightly earlier or later. Of the total number of 350 flint artefacts collected, 29 can be classified as tools or tool-fragments (irrespective of whether or not fragments can be fitted together). Among the tool-fragments 6 pairs can be fitted together. Points or point-fragments are the most numerous among the tools, accounting for more than 50% (table 2).

Apart from the flints, 21 stones of other material were collected. Of these, 14 can be described as slab-like stones with a mean max. thickness of c. 2 cm, and 10 of these probably all derive from one large original slab of gneiss (several can be fitted together). The fragmentation occurred during the occupation of the site, perhaps as a result of use in a hearth. In the centre of the find concentration a small ring of flat stones was located, that is tentatively interpreted as the remnant of a hearth: inside the ring (but also elsewhere) several burnt flints were present. At least one of three rounded stones was used as a hammerstone, while another was probably burnt.

The excavated part of the site suggests that the diameter of the main find concentration was originally approximately 4 m, but clearly outside the main concentration also several finds were present. A dense concentration of essentially flint-working waste was situated approximately 1.25 m north of the presumed hearth. Both to the north and south of the assumed hearth relatively empty spaces can be discerned in the find distribution. Around the northern one especially points and point-fragments were found, while the southern one seems to be associated with relatively many blades or blade-fragments.

It was attempted to perform a refitting analysis with the flint artefacts. Among the fragments 22 pairs could be fitted together. In 7 cases fitting fragments were found more than 1 m apart. It is suggested that blade-fragments were in some cases considered as still usable.

Of the total number of 350 flint artefacts, 26% could be 'conjoined' (ventral/dorsal) with at least one other artefact. A total number of 19 conjoining groups was created, containing 2 to 17 artefacts per group. It could be ascertained that a minumum number of 4 original nodules were exploited as cores on the site (the maximum number can be estimated as 6 or 7). The most interesting result of the analysis is that none of the tools can be conjoined with any other artefact, suggesting that many were imported from elsewhere. However, for one burin it is very probable that it was produced on the site, and this is possible for many other tools also. For one scraper, one point-fragment and two blades importation is certain, as they are manufactured out of types of flint not represented by

waste material on the site. It seems probable that quite a lot of blades, that were produced on the site, were subsequently taken away.

For practical purposes definitions are proposed for the Hamburgian, Creswellian and *Federmesser* traditions, based on the occurrence of various point types. On the basis of these definitions it is suggested that there is good reason for a separate Creswellian tradition, at least in the Northern Netherlands, and that Emmerhout can be described as a Creswellian findspot.

Finally, small Late Palaeolithic sites are discussed in the light of anthropological information. It is argued that small sites mostly show 'specialisation' in the proportions in which several tool categories are represented. It is suggested that small sites like Emmerhout and Siegerswoude, characterized by a predominance of projectile points, could be hunting camps, though such interpretations will remain largely speculative–particularly because in most cases organic remains are not preserved at sites in the sandy soils of Northern Europe.

11. NOTES

1. R.M.Jacobi (letter of 19 January 1987) is of the opinion that at many British Creswellian sites Cheddar points outnumber Creswell points: "Campbell's figures which suggest the contrary depend on optimistic classification of *fragments* which may well be no more than halves of 'Cheddar points'. I would suggest that it is this 'dominance' of 'Cheddar points' which identifies the 'Creswellian'. No British find-spot included by Garrod in her definition of the 'Creswellian' is dominated by 'Creswell points'." Jacobi also writes me that according to him: " 'Shouldered points', as defined by Houtsma hardly exist at British find-spots. It is, therefore, a mistake to incorporate British find-spots into a 'Shouldered-point complex' as Burdukiewicz and Otte have done". I would like to thank Jacobi very much for his comments and for interesting discussions we have had earlier in London.
2. See also: R.M. Jacobi, E.B. Jacobi & R. Burleigh, 1986. Kent's Cavern, Devon: dating of the 'Black Band' and human resettlement of the British Isles following the Last Glacial maximum. *Quaternary Newsletter* 48, pp. 10-12.

   More recent A.M.S. datings for fossils of horse with clear patterns of cut-marks from Gough's Cave are older; they tend to cluster in the range of 12,300-12,500 B.P. (R.M. Jacobi, pers. comm.; from his article in press, titled: A.M.S. results from Cheddar Gorge. Trodden and untrodden 'life-ways'. See also: Burleigh, R., E.B. Jacobi & R.M. Jacobi, 1985. Early human resettlement of the British Isles following the last glacial maximum: new evidence from Gough's Cave, Cheddar. *Quaternary Newsletter* 45, pp. 1-6 (conventional datings), and: Gillespie, R., J.A.J. Gowlett, E.T. Hall, R.E.M. Hedges & C. Perry, 1985. Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 2. *Archaeometry* 27, pp. 237-246 (accelerator datings). For more accelerator datings see: Gowlett, J.A.J., E.T. Hall, R.E.M. Hedges & C. Perry, 1986. Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 3. *Archaeometry* 28, pp. 116-125).

   The AMS dates seem to indicate occupation of the cave during the Bølling Interstadial, well before the beginning of the Early Dryas Stadial. This must lead to a reconsideration of the inter-relationships between the Hamburgian and the Creswellian. These two traditions are at least partially contemporaneous. In the case of the Hamburgian we can distinguish at least two chronological 'groups', of which the later one, the Havelte Group, certainly post-dates the Bølling Interstadial. It is probable that also the Creswellian incorporates an earlier and a later 'group' (see also note 3).
3. A radiocarbon dating (Lv-1472: Leotard, J.-M., 1985: *Notae Prehistoricae* 5, pp. 131-132) suggests that Presle can be dated in the end of the Bølling Interstadial: 12,140±160 B.P. This dating fits in very well with the new English dates for Creswellian sites like Gough's Cave (*e.g.* Leroi-Gourhan, 1986). These datings seem to indicate that there exist Creswellian sites which are *older* than *Late* Hamburgian ones (Havelte Group, for example Oldeholtwolde: Stapert *et al.*, 1986). However, several Dutch Creswellian sites, Emmerhout and Siegerswoude, must be younger as far as can be ascertained from their stratigraphy: end of Early Dryas Stadial or Allerød Interstadial. These sites are dominated by Creswell points, and not by Cheddar points, as is the case with the British sites (see note 1).
4. W. Wegewitz (in: P. Zylmann (ed.), 1956.*Zur Ur- und Frühgeschichte Nordwestdeutschlands* (= Festschrift K.H. Jacob-Friesen). Hildesheim, p. 63) described a very small findspot at Buchholz-Buensen (Kreis Harburg). Only 64 artefacts were collected (*Schlagstelle* 2), among which were 54 flakes deriving from 2 cores of almost black flint. Furthermore, 2 Creswell-like points and 2 point-fragments were found, made of a different kind of flint, whitish in colour. An asymmetrical borer of this light-coloured flint was also present. The points and the borer must have been imported; while, according to Wegewitz, many flakes of dark flint are missing, presumably because tools have been made out of them that were subsequently removed from the site. This site illustrates once again that Upper or Late Palaeolithic flint concentrations generally incorporate three groups of artefacts: a. imported artefacts (among which projectile points are dominant in general); b. waste material from the production of blades and tools, that were made, used and discarded at the site; and c. waste material from the production of blades and tools that were subsequently taken away from the site. At the site of Buchholz-Buensen category b is missing, indicating that the people did not camp here. Perhaps a hunter only repaired his projectiles here, for example while looking out for game. This site stresses the point that small sites can be very useful in detecting such patterns of behaviour.

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Manuscript completed in 1986.

Fig. 7 can be found in the fold at the back of this volume.