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4 Finds and sites discovered in Unit IV-C-I

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Citation

Roebroeks, W. (1988). 4 Finds and sites discovered in Unit IV-C-I. In *Analecta Praehistorica Leidensia 21 : From find scatters to early hominid behavior: A study of middle palaeolithic riverside settlements at Maastricht-Belvédère (The Netherlands)* (Vol. 21, pp. 27-78). Leiden University Press. Retrieved from <https://hdl.handle.net/1887/27917>

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4.1 Introduction

In the pit three sites (B, C and G) were discovered which were stratigraphically situated *beneath* the Unit IV-C-II calcareous tufas. Their embedding Unit IV-C-I matrix produced many faunal remains, both within and outside the limits of the excavations, which made this unit a focus of interest in the multidisciplinary work.

Of the three sites presented here the 'richest', Site C, will be treated in most detail, while the interpretation of the other two sites will be limited to site-specific problems, at least in this chapter.

More general implications of the analyses of these sites will be discussed in chapter 8, which deals with the environmental and chronological context of the Unit IV-C sites, and in chapter 9, where general behavioural aspects of the hominids responsible for the assemblages recorded at the Unit IV-C sites will be discussed.

4.2 Site C

4.2.1 INTRODUCTION

Site C was discovered on August 21, 1981 during the excavation of Site B, when F. Brounen found a flake in Unit 4.5 sediments, about 30 m south of Site B (see fig. 22). The section that contained the flake had already been sampled for molluscs and small mammal remains. A small trench led to the main excavation. The site was excavated in three campaigns, from September 1, 1981, to February 11, 1982, from July 12, 1982, to September 2, 1982, and from April 5, 1983, to June 17, 1983. In 36 weeks a total area of 264 m² was excavated.

The excavation was carried out in the usual way: all finds macroscopically identifiable in the field were recorded three-dimensionally and individually numbered and all flints were stored separately in small plastic bags. The sediment of 38 m² was sieved through a 2-mm mesh sieve.

The excavation was complicated by the major problem of karst, which had caused a -mostly gradual- subsidence of the geological Units III, IV, V and VI-A. The layers above Unit 4.5 could therefore only partly be dug away mechanically and substantial amounts of sediment had to be removed by hand. Because the karst-subsided Unit 4 sediments had been followed in the 1981-1982 campaigns, the excavation site had become a depression in its environs,

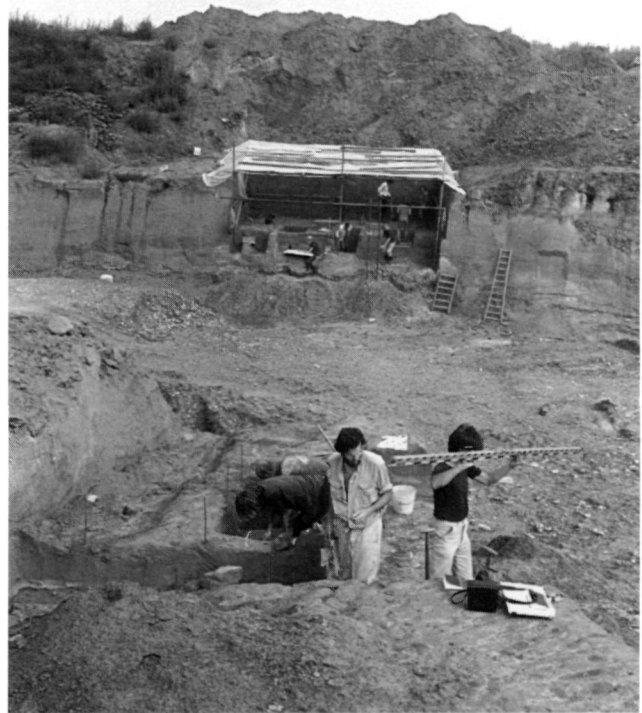


Fig. 22. Site C: the first trial squares in the northern part, September 1981. In the background the Site B cutting is visible (photograph: P.J.R.Modderman).

which could hardly be protected from the huge amounts of (rain-)water that occasionally flooded the pit. In the winter of 1982/1983 the southern part of the excavation was covered by 1 to 3 m of water, causing the deposition of thick layers of sandy clay, which all had to be removed by hand at the beginning of the 1983 campaign. However, this incident had no consequences for the archaeological record, which was protected by the original Unit V layers still present on top of Unit IV.

We tried to systematically record larger areas without finds on our distribution plans by also excavating the areas around artefact concentrations as far as this was possible in

view of the karst-generated disturbances mentioned above.

While the excavation was being carried out, J.P. de Warimont and others spent several days sampling those areas which were too affected by karst to be excavated in the usual way. These areas are indicated on the general distribution maps of Site C. The area yielded only two small flakes, probably because the Unit 4 find matrix was completely mixed with other layers.

4.2.2 STRATIGRAPHY

The Site C flint assemblage was found in a matrix of well-sorted fine- to very finely-grained yellowish-brown (2.5 Y 5/3) to greyish-olive (5 Y 5/3) sands, with a silt and clay content of at least 15% by weight. Especially in the eastern part of the excavated area the sands became finer in a lateral transition to greyish-olive silty clays. Some of the finds, particularly those recovered from the northern and eastern parts of the excavated area, were discovered immediately underneath the calcareous tufa of Unit IV-C-II. Figure 23 gives a schematic representation of the section observed in square H-13, where Dr M. Aitken (Oxford) inserted TL dosimeters in 1982 for the measurement of the Environmental Dose rate. The sequence recorded in this section is representative of the Site C area in general, varying mainly in the grain size of the sediments designated as 2 and 3 in figure 23. In some parts this 'ideal' section was badly disturbed, especially in the neighbourhood of the centres of karst-generated disturbances. Figure 24 shows the section recorded in September 1981 at the eastern boundary of the northern part of the site. Here Unit IV sediments had sunk into a sinkhole and had been replaced by Unit V sediments (see also figure 25 for a photograph of this phe-

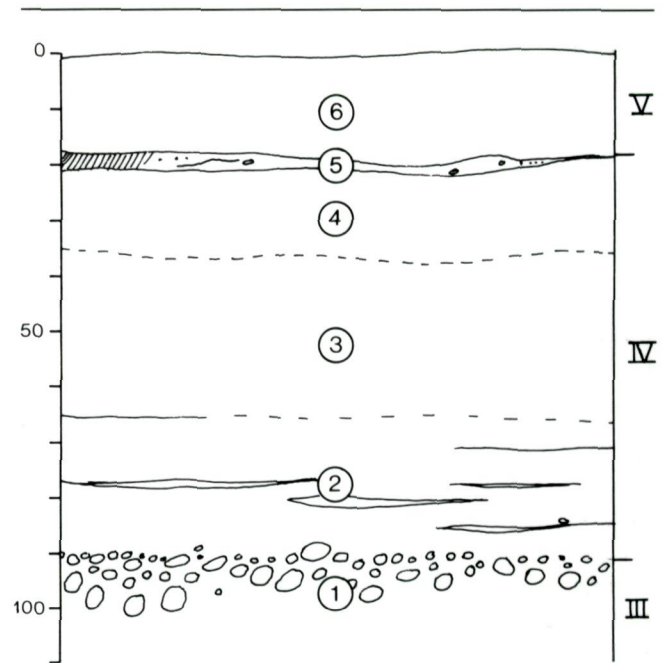


Fig. 23. Site C: section in square H 13

- 1 the top of the Unit III gravels
- 2 laminated very fine sand (2.5 Y 7.2)
- 3 loamy very fine sand (2.5 Y 5/3) with a few reddish yellow (5 Y 6/8) mottles, containing artefacts
- 4 sandy loam with the same basic colour as 3, but with a much darker appearance as a result of the abundance of Mn and Fe mottles
- 5 sandy loam, reddish brown
- 6 red silt loam (7.5 YR 6/6)
- 2-5 all form part of Unit IV-C, while 6 probably represents a Unit V-B deposit

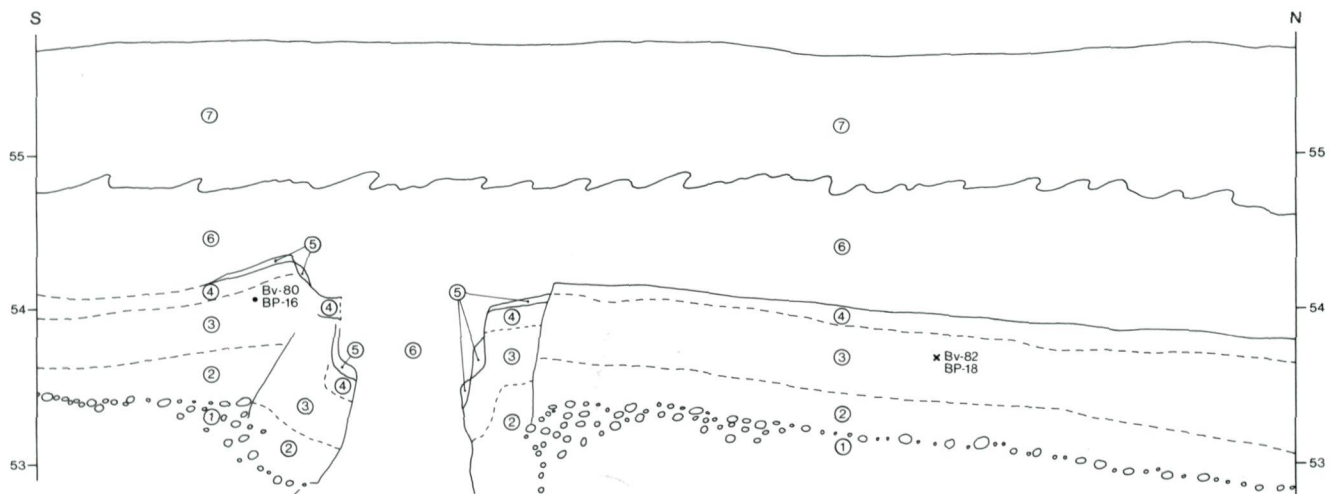


Fig. 24. Site C: section recorded at the northeastern boundary of the excavated area, as indicated. For the legend see figure 23. The BV- and BP numbers indicate the positions of artefacts and faunal remains.

nomenon). The combined data indicate that the Site C assemblage has to be placed in lithological Unit 4.5.1 and in lithostratigraphical Unit IV-C-I.

4.2.3. THE FINDS

4.2.3.1 Introduction

During the Site C excavations the following find categories were recorded: flint artefacts (fig. 26), burnt flints, bone material, charcoal and haematite. Figure 27 (separate sheet at the back of this volume) gives the horizontal distribution of all find categories, which will be presented successively in the following sections.

4.2.3.2 The flint assemblage

In total, 3067 flint artefacts were recorded three-dimensionally in the course of the Site C excavations. Figure 28 and table 5 give the size distribution of the flint material, showing that the majority of the finds (73.9%) are small flakes with maximum dimensions of less than 2 cm. The sieve residue of 38 m² also contained 536 chips with maximum dimensions of less than 1 cm (see section 4.2.5.2). The total weight of the Site C artefact assemblage is only 7230 g.

As a general characterization it can be said that the flint industry is to a large extent the product of a prepared-core technique, including several 'classical' Levallois flakes. Some of the larger non-cortex flakes show signs of soft-hammer flaking. Many of the butts are faceted: for the total number of flakes the *Index Facettage* is 50.4, the *Index Facettage stricte* being 43.7. For the larger flakes (≥ 5 cm) the *Index Facettage* is 62.8, and the *Index Facettage stricte* 55.3. The *Index Laminare* of these larger flakes is 20.5. The edge angles of the flakes are small, generally not more than 40 degrees. The flakes have straight edges when viewed in cross section.

The assemblage contains only three tools (i.e. artefacts displaying signs of intentional retouch) which are all three scrapers (fig. 39). In addition to these intentionally modified artefacts, 18 of the larger flakes display macroscopical signs of use, varying in intensity. The technological characteristics of these 'used' flakes and the three tools are given in table 6 (see also fig. 29).

Most of the flints show a light colour-patination, while many of the pieces display a soil-sheen, varying in intensity. Several pieces, however, show hardly any macroscopical surface modifications.

On the basis of the specific properties of the flint material (texture, cortex, inclusions, colour), the flint artefacts could be attributed to six different Raw Material Units (RMUs), which are interpreted as incorporating the products of six different flint nodules. Contrary to the first interpretations (Roebroeks 1984a), these RMUs did not all have their own spatial scatter. The data obtained in the refitting programme, which are to be presented below, in section 4.2.4,

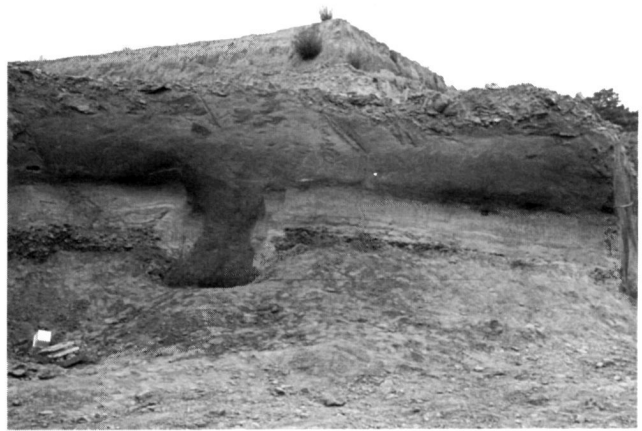


Fig. 25. Photographic representation of the karst disturbance shown in figure 24.



Fig. 26. Site C: a vertical view of square C 18, during excavation: two large flakes are indicated, to the left a plunged Levallois-flake (C 18/10, see figure 34) made from Raw Material Unit 4 (RMU 4), and to the right a RMU 6 flake (C 18/5). A poorly preserved bone fragment is visible in the top left corner. Two karst-generated fault lines can be seen running through the square in the lower half of the picture.

led to a reinterpretation of the flint distribution. In this paragraph the different RMUs will be described in terms of their general characteristics and attention will be drawn to their horizontal distributions within the excavated area (fig. 30).

It must be stressed that it was not always possible to unambiguously attribute individual elements to a specific RMU. The numerical data given in this section are therefore in the first place to be seen as approximations.

Raw Material Unit 1

This RMU consists of a relatively fine-grained blueish-white flint, with many small (<1 mm) dark blue dots, and a mod-

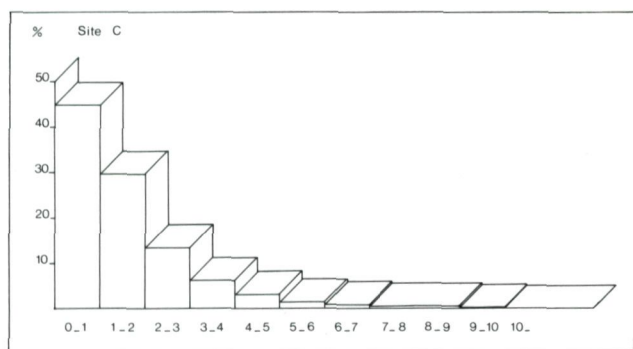


Fig. 28. Site C: size distribution of the Site C flint artefacts, based on maximum dimensions, in cm.

erately to severely rolled cortex. The approximately 90 RMU 1 elements consist mainly of debris, with a few rough flakes and flake fragments with cortex. The total weight is approximately 675 g. The horizontal distribution of the elements of this RMU is schematically indicated in figure 30.

Raw Material Unit 2 (figs. 31-32)

RMU 2 consists of a relatively coarse-grained yellow-brown flint with a fresh cortex. This RMU is represented by much debris, a large number of cortex flakes, a few larger flakes from a 'Levallois' core, two cores (three after refitting: see figs. 32 and 49) and core fragments. The total weight of elements of this RMU is about 3000 g. A comparison with the RMU 3, 4, 5 and 6 products shows that this flint nodule had been worked in a 'rougher way', which may be a consequence of the flint's grain size. All flakes seem to be the product of hard-hammer flaking, as suggested by the well pronounced bulbs. Facetted butts are less common than in the case of the other RMUs:

	RMU 2 (flakes > 5cm)	other RMUs (flakes > 5cm)
IF	42.4	73.7
IFs	36.4	65.5

The horizontal distribution of the elements of this RMU is schematically indicated in figure 30.

Raw Material Unit 3

RMU 3 consists of a fine-grained blueish-white flint with a slightly abraded cortex. It is not always possible to differentiate between this RMU and RMU 4. Allowing for a certain amount of variation within one flint nodule, it would even be possible to regard RMUs 3 and 4 as a single unit. This was in fact the interpretation in the field, supported by the almost complete overlap in the horizontal distributions of the flaking debris of the two RMUs (fig. 30). However, we are here dealing with the remains of two completely

Table 5: Some quantitative data on the Site C flint assemblage (three-dimensionally recorded finds only).

max. dimensions in cm	n	% of total
0-1	1368	44.6
1-2	898	29.3
2-3	404	13.2
3-4	188	6.1
4-5	93	3.0
5-6	44	1.4
6-7	27	0.9
7-8	18	0.6
8-9	16	0.5
9-10	7	0.2
10-	4	0.1
total	3067	99.9
burnt flints	132	4.3
pieces with cortex	509	16.6
tools	3	0.1
flakes showing use retouch	18	0.6
cores	4	0.1

different flint-knapping stages, as will be shown in the section dealing with the refitting evidence. In view of their differences in grain size, cortex and inclusions, the knapping products resulting from these two different stages have been interpreted as two different RMUs. Besides by the usual fine debris, RMU 3 is represented mainly by flakes with cortex and a few larger regular flakes which all seem to have been produced by hard-percussion flaking. The total weight of this group is approximately 800 g.

Raw Material Unit 4 (figs. 33-36)

RMU 4 consists of a fine-grained flint (finer than RMU 3), blueish-white in colour, with a very coarse-grained light brown part, and a relatively fresh and thick cortex.

This RMU comprises a dozen larger (> 5 cm) flakes, an exhausted 'Levallois' core (fig. 33) and much fine debris. The RMU 4 flakes rarely show a cortex. The majority of the larger flakes were recorded outside the main debris concentration, in the neighbourhood of some larger bone fragments. Many of the flakes show signs of soft-hammer flaking. The total weight of this RMU is approximately 1300 g.

Raw Material Unit 5

RMU 5 consists of a very fine-grained dark grey flint with a fresh cortex. Its horizontal distribution, partly overlapping that of RMU 6, is indicated in figure 30. The elements of this RMU are mainly smaller (< 5 cm) 'soft-hammer' flakes, including only a few cortex flakes. The total weight of this RMU is only 470 g. About 10% of the elements of this RMU shows signs of burning.

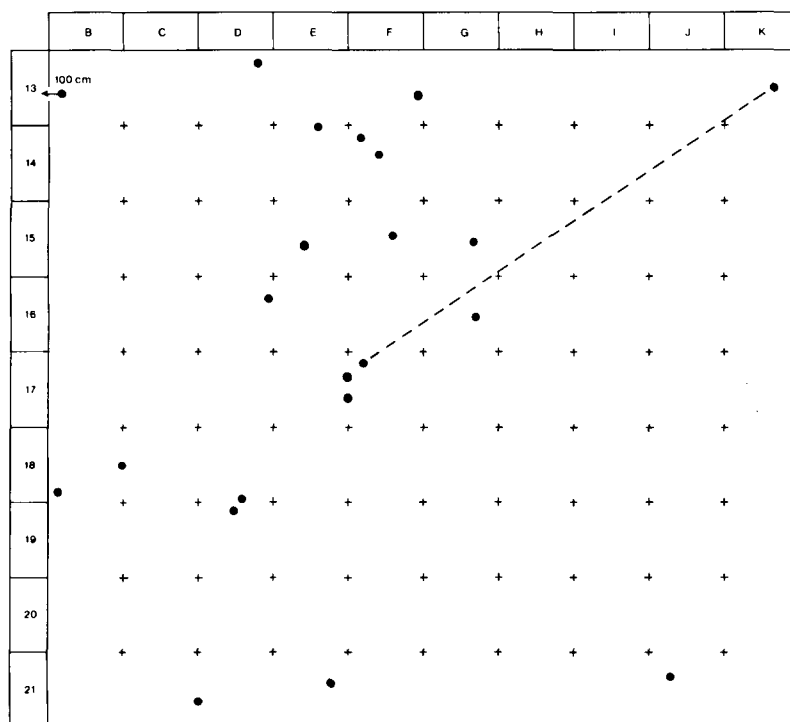


Fig. 29. Site C: horizontal distribution of tools and flakes showing signs of use retouch (see Table 6). Grid in square metres.

Table 6: Some technological characteristics of tools and flakes displaying use retouch from Site C (dimensions in mm).

find no.	length	width	max. dimens.	number of scars	striking platform	remarks
Bv 793	72	40	73	6	faceted	
Bv 897	64	38	65	4	missing	
Bv 946	67	44	70	6	missing	
Bv 1010	97	74	97	8	dihedral	
Bv 1155	78	39	78	10	faceted	
Bv 1202	100	55	100	5	faceted	
Bv 1265/						
Bv 1248	101	48	107	5	faceted	
Bv 1508	82	30	83	8	plain	
A 13/6	61	30	61	3	dihedral	
B 18/4	88	40	88	10	faceted	
B 18/7	75	58	80	4	faceted	
D 16/5/						
Bv 1483	52	35	86	6	dihedral	
D 18/5	63	33	69	7	dihedral	meat polish
D 19/1	86	48	86	10	faceted	
D 21/1	43	31	47	3	plain	scraper
E 17/10	65	29	67	8	missing	scraper
E 17/11	80	43	85	5	dihedral	
E 21/26	40	26	46	9	plain	scraper
F 17/2/						
Bv 732	77	35	78	12	missing	
G 16/14	56	27	57	4	missing	
J 20/17	39	31	39	4	missing	

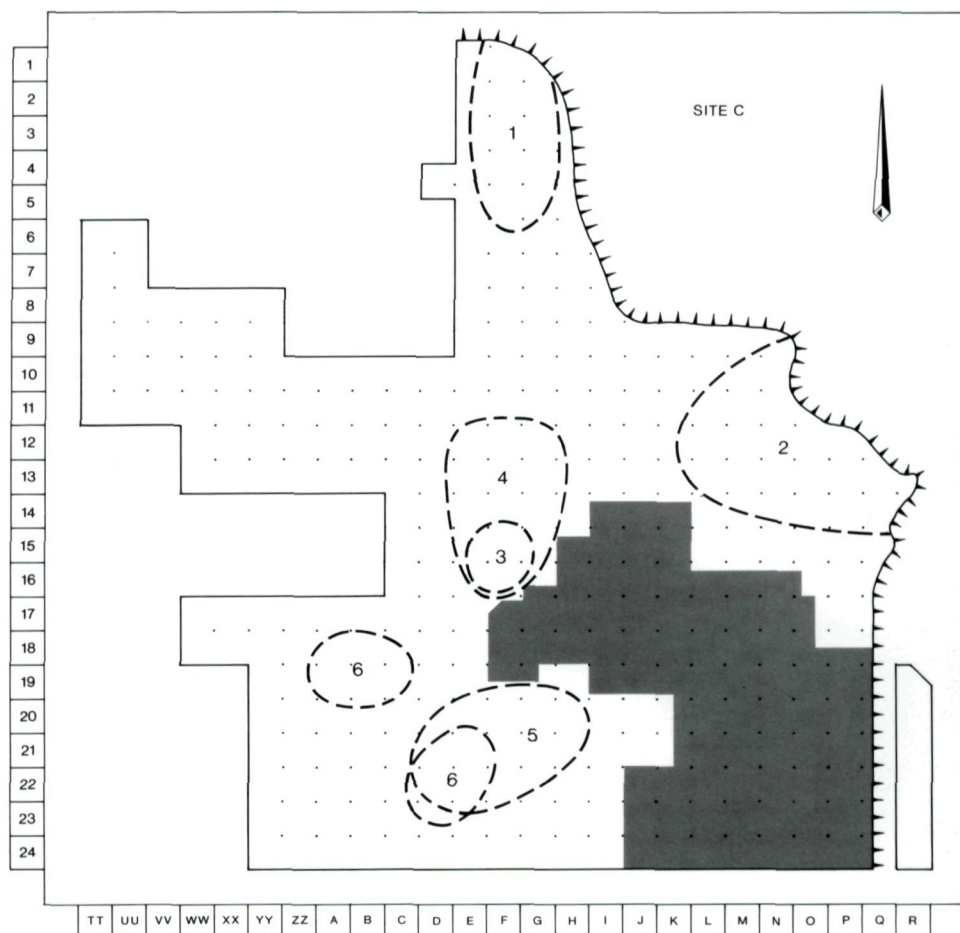


Fig. 30. Schematic horizontal distribution of the main concentrations of RMU's 1-6. Grid in square metres. The area disturbed by karst is coloured grey.

Raw Material Unit 6 (fig. 37)

RMU 6 consists of a grey fine-grained flint with a cortex severely abraded by fluvial transport. Its horizontal distribution is indicated in figure 30. Of this RMU we have a few dozen cortex flakes, while a dozen larger flakes, found outside the RMU 6 concentration, are considered to have been struck from the same flint nodule on the basis of their grain-size, colour and inclusions. The side scraper E 17/10 (fig. 39) is also ascribed to this RMU.

The overall majority of the Site C flint material could be ascribed to these six groups. Three larger flakes, found in the southern part of the site, were definitely not from the RMUs presented here and probably derive from one or more other flint nodules (fig. 38). It is furthermore worth mentioning that two of the three scrapers (i.e. E 21/26 and D 21/1, fig. 39) could not be positively related to one of the RMUs either, although they may have been produced from RMUs 5 and 6, respectively.

Artefacts produced from the different RMUs are shown in figures 31-39 and 47-64, in which they are grouped per RMU.

The refitting evidence of the Site C material will be presented below. Here it suffices to state that we managed to refit a large part of the Site C material, and that, on the whole, conjoining pieces tended to cluster spatially. In total, 21.5% of all flint pieces was refitted, that is, 70.4% of the total weight of the Site C flint material.

4.2.3.3 Burnt flints

In total, 159 burnt flints were recorded in the Site C excavation, 132 of which were (generally small, i.e. < 2 cm) artefacts (= 4.3% of the total number of artefacts). The overall majority of the burnt artefacts were found in the southern part of the site, as shown in figures 27 and 40. Most of these burnt artefacts can be ascribed to RMU 5. Some RMU 6 flints were also found within the southern distribution of burnt flints, but these show no traces of burning at all.

Several of the burnt flints from Site C were submitted to the Oxford Research Laboratory for Archaeology and the History of Art for the purpose of TL dating (see chapter 8, table 21).

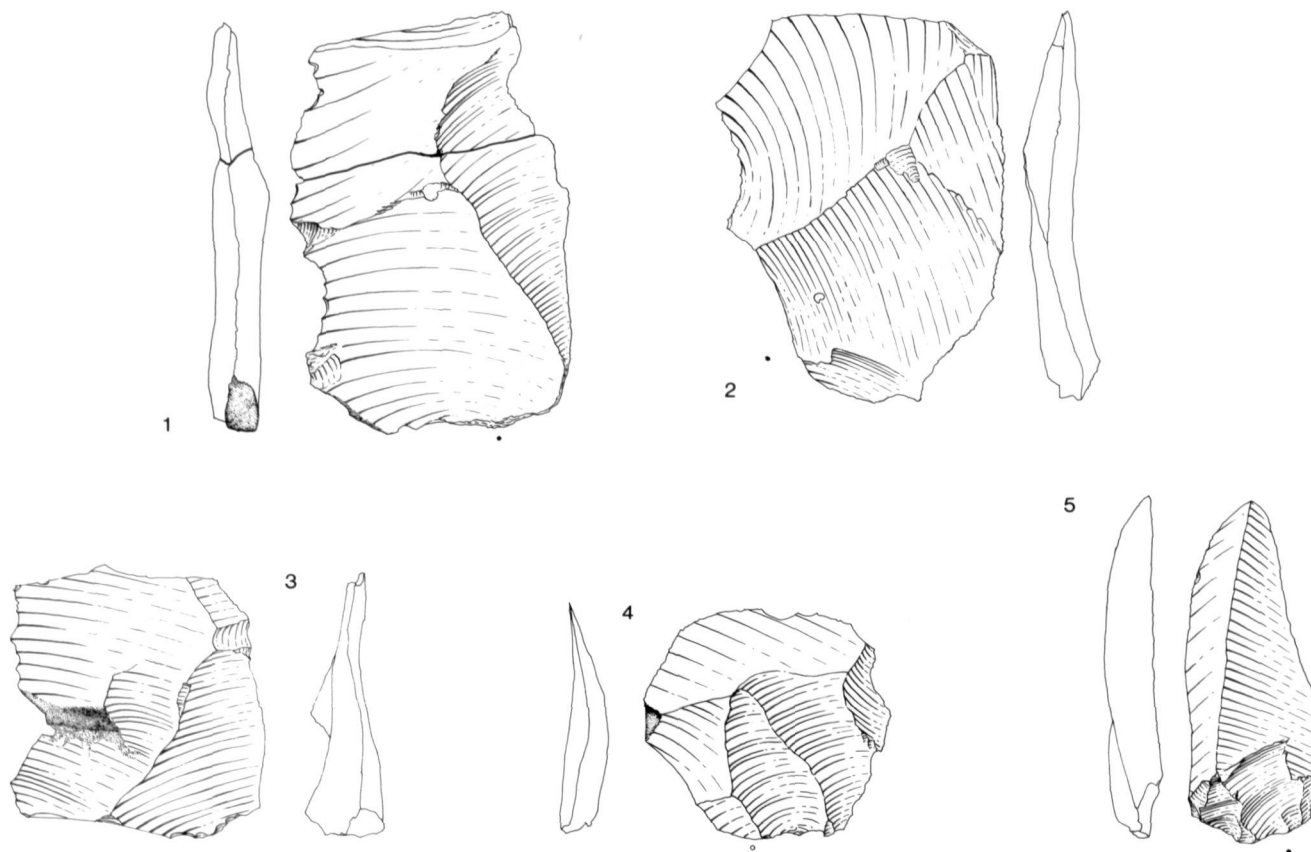


Fig. 31. Site C, RMU 2: 1-5 flakes, scale 2:3.

4.2.3.4 Faunal remains

In this section no attention will be paid to the small mammal remains and the molluscs found in calcareous parts of the Unit 4 sediments of Site C. This topic will be treated in the section dealing with the palaeoenvironmental data of the Unit IV deposits. Only the larger mammal remains will be discussed. The bone material found at Site C is on the whole poorly preserved (see figs. 26 and 42). The higher and more sandy part of the site produced several bone 'ghosts' and no intact bone fragments, whereas the lower and loamier parts of the site, although containing few bone remains overall, yielded relatively better preserved fragments. Thus, the differential decay of the bone material seems to be related to the composition of the embedding matrix, which suggests that the bone material had decomposed *in situ*.

The horizontal distribution of the Site C faunal remains is given in figure 27.

Only a few of the faunal finds could be identified: in square H-7 two complete upper milk molars of the rhinoceros

Dicerorhinus hemitoechus were found (fig. 41) in an amorphous mass of bone and tooth fragments. The two molars (upper premolars DP2 and DP3 *sin.*, cf. Van Kolf-schoten 1985) fit together very well and show the same amount of wear. In square H-7 and in the neighbourhood of square H-7 more rhinoceros tooth fragments were found, which had very probably belonged to the same young rhinoceros.

A 41-cm long bone found in square F-24 was identified as the tibia of *Cervus (M.) giganteus*, while a bone from square D-23 was identified by Van Kolf-schoten as part of a vertebra of an animal in the order of magnitude of roe deer (pers.comm., 1983).

A few remarks must be made with respect to the rhinoceros remains. The fact that the Site C rhinoceros had deciduous teeth makes it possible to estimate the maximum age of the animal. In an article on rhinoceros and mammoth remains found at La Cotte de Saint-Brelade (Jersey, Channel Islands), Scott (1980) cites studies made by Borsuk-Bialynicka (1973) of the woolly rhinoceros *Coelodonta*

antiquitatis. Borsuk-Bialynicka cites the case of a present-day rhinoceros which lost its last deciduous tooth (DP4) at the age of eight months. Although the ages at which different teeth are replaced in present-day rhinoceros may differ from those of extinct species, these data clearly indicate that the remains in the Site C faunal assemblage had belonged to a very young rhinoceros.

Finally it is worth mentioning that the rhinoceros remains found at Bilzingsleben (German Democratic Republic) consist mainly of lower jaws and stray teeth from -according to the excavators- smashed upper and lower jaws (Mania 1983).

4.2.3.5 Charcoal

In the course of the Site C excavations several thousands of charcoal particles were found, most of which measured less than 3 mm. The overall majority of the charcoal remains were found in two concentrations: a small one in the eastern part of the site, and a large one in the west (fig. 27).

The eastern concentration contained approximately 150 small charcoal fragments, in an ovaloid concentration of about 0.5 m², in squares P/Q-15. About 20 of these pieces were submitted to Dr W. Schoch at the *Labor für Quartäre*

Hölzer of the Swiss Federal Institute of Forestry Research. The small size and relatively poor state of conservation of the fragments allowed only a very general identification of two pieces from this sample: one derived from coniferous, the other from deciduous wood (Schoch, in litt. 1982). This charcoal scatter was discovered in the borderzone of the RMU 2 flint artefact distribution. No burnt flints were

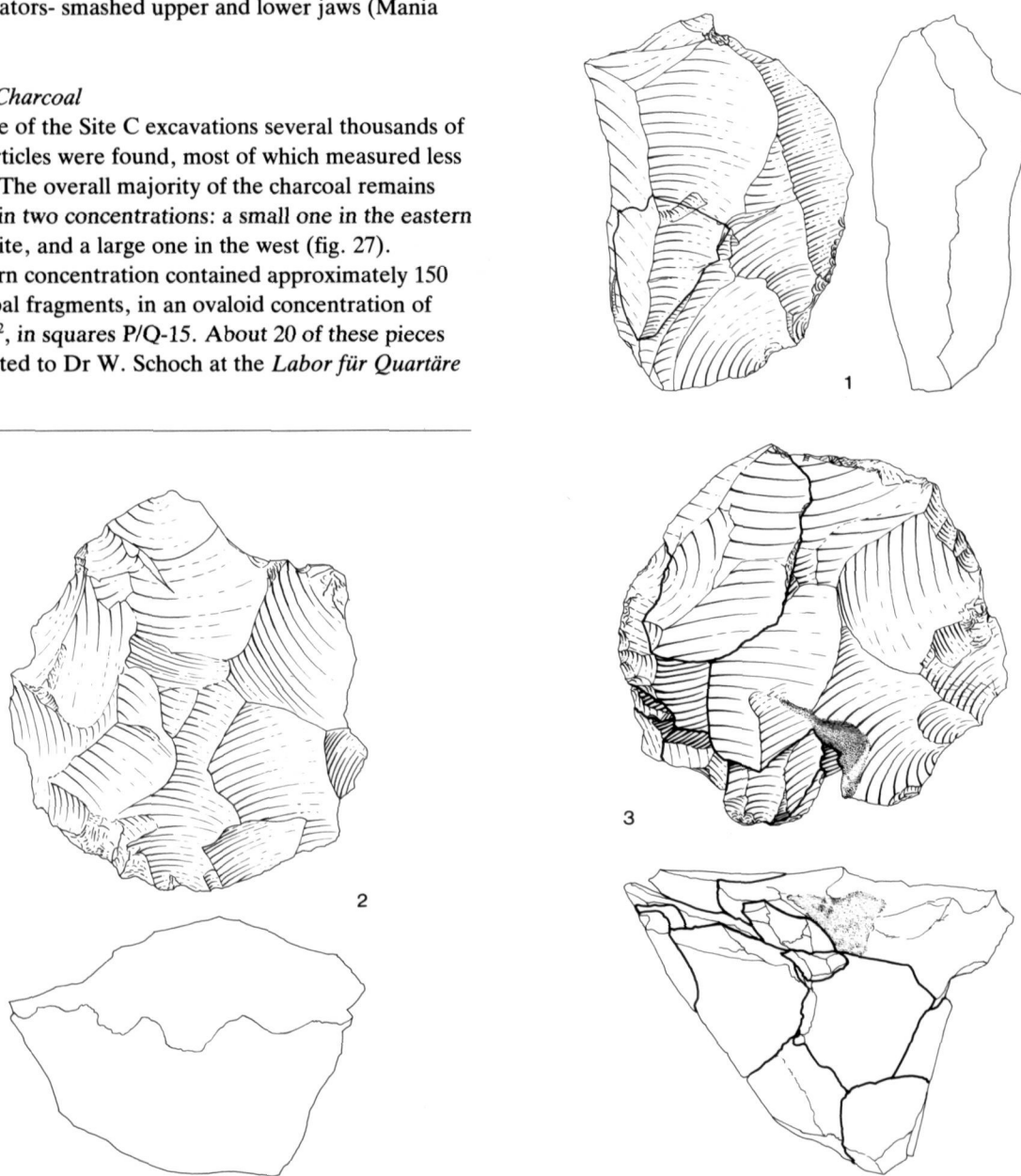


Fig. 32. Site C, RMU 2: 1, core Bv 409 with conjoined flake; 2, core Bv 557; 3, conjoined fragments forming a core (scale 2:3)

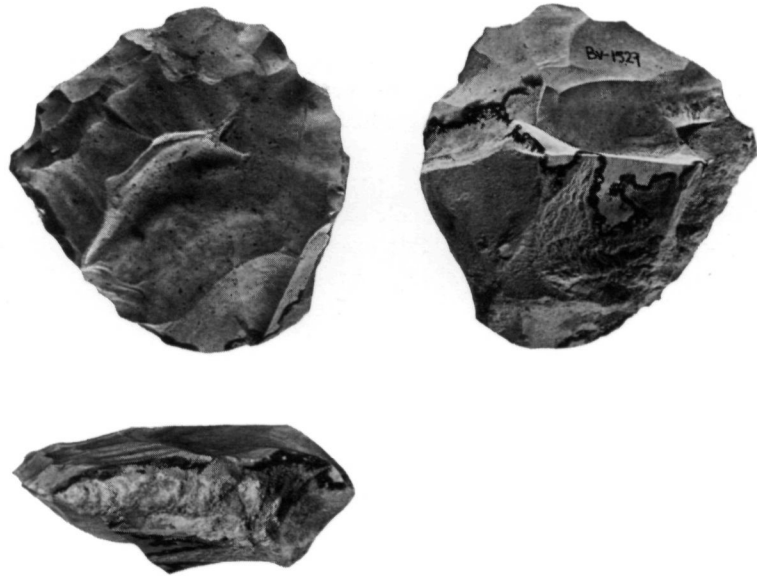


Fig. 33. Site C, RMU 4: 'Levallois' core (Bv 1527), scale 2:3.

observed among the RMU 2 material, or rather: no flints could be identified as such.

In the western charcoal concentration about 5800 pieces were recorded, most of which were smaller than 3 mm. However, this concentration which was excavated in the summers of 1982 and 1983, also contained a few larger fragments, of up to 1 cm. Figure 27 gives the spatial distribution of this charcoal concentration, which lay segregated from the main flint artefact distribution. The charcoal particles displayed a vertical distribution of 10-20 cm. A sample consisting of 20 particles from square WW-10 and 40 from square YY-12 was submitted to Dr W. Schoch. All pieces were positively identified as deciduous wood. The state of preservation of most of these did not allow identification according to species. However, a large number of particles clearly displayed uniform anatomical characteristics (distribution of the pores, etc.), indicating that all fragments were of the same wood species. Fortunately, the sample contained several pieces that were large enough to allow a positive identification of species: two pieces from square WW-10 and six pieces from YY-12 were identified with certainty as *Fraxinus* sp., ash (Schoch, in litt. 1982).

One of the first questions we asked ourselves while excavating the charcoal concentration was, of course, whether we were dealing with the results of a fire at the site of the charcoal particles, or whether other causes were to be considered, for instance the fluvial deposition of a large burnt log of wood. As the matrix did not show any signs of the effects of heat, we cannot exclude these other possibilities, which, however, have to be excluded before we may consider human involvement. The presence of a few burnt

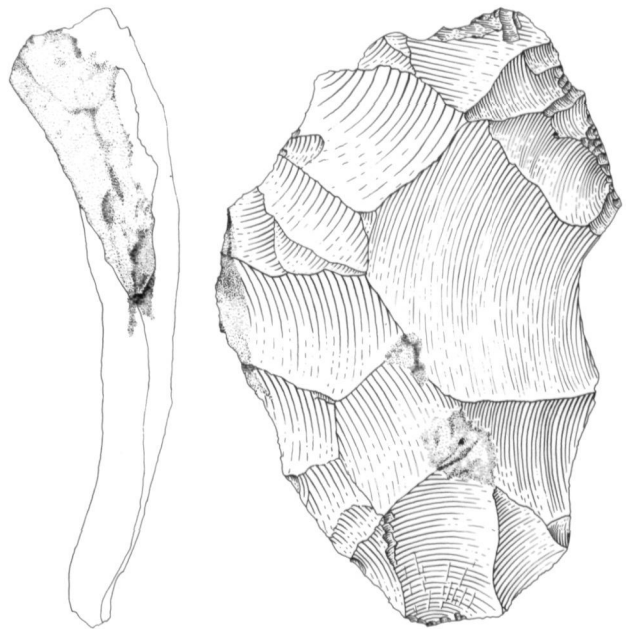


Fig. 34. Site C, RMU 4: Plunged Levallois flake (C 18/10), scale 2:3.

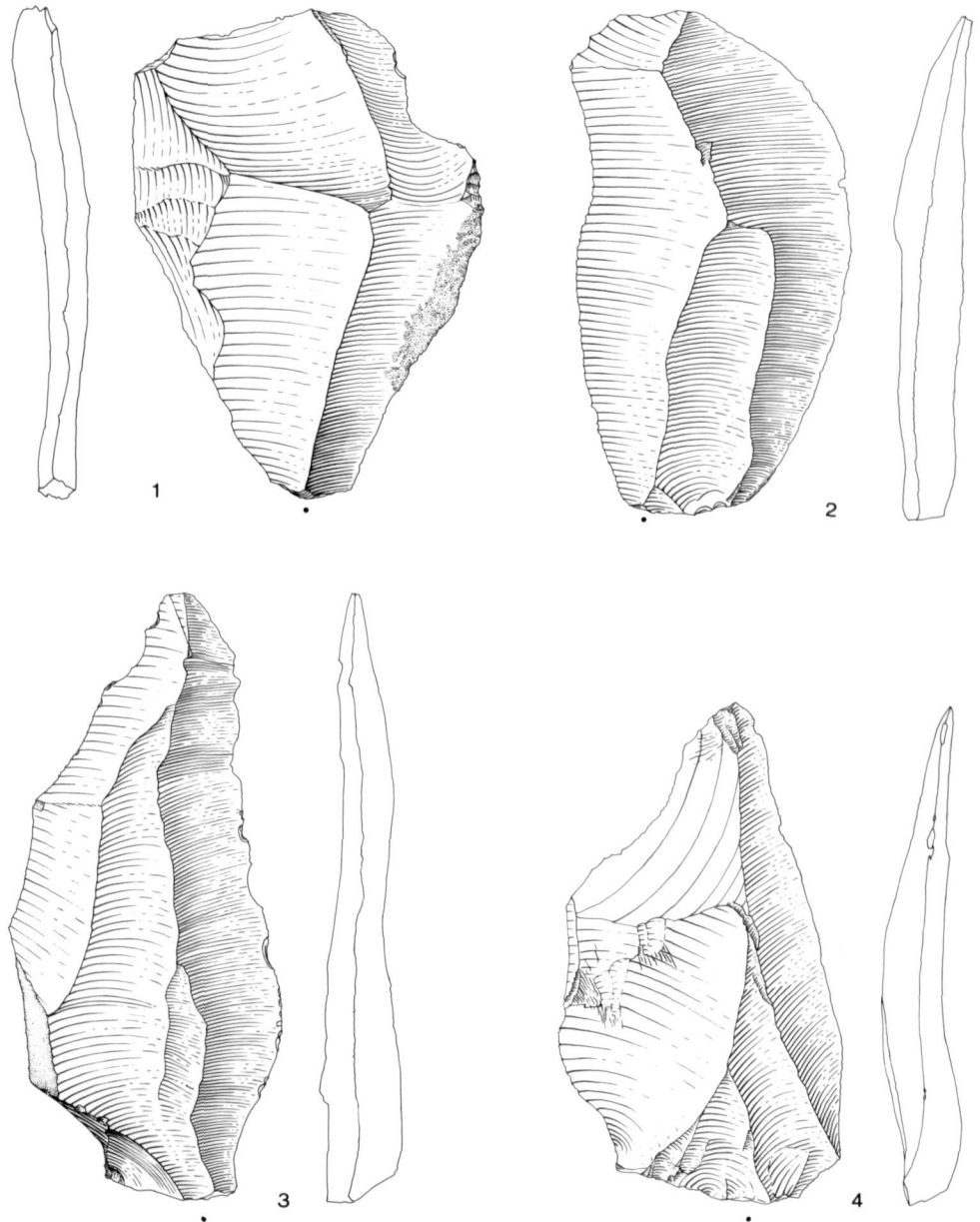


Fig. 35. Site C, RMU 4: 1-4 flakes, scale 2:3.

flints (no artefacts!) within the charcoal concentration indicates that the concentration was very probably formed as a result of a fire on the spot. Two burnt flints (XX 12/2 and YY 13/3) -broken during heating- could be fitted together (fig. 40), but then burnt flints were found over larger areas of the site. To summarize, if the charcoal concentration was the result of a fire on the spot, then this fire burned outside the recorded distribution of flint artefacts and bone material.

During the excavation of the charcoal patch a concentration of stones was discovered in square WW-10, i.e. at the northwestern periphery of the charcoal patch. Because this heap of stones (fig. 43) with a diameter of about 40 cm was initially thought to be a structure made by hominids, it was excavated with great care and the positions of the individual stones, which measured up to 11.5x6x6 cm, were recorded. However, the size range of the stones forming the concentration proved to be very large, from very small (< 1 cm)

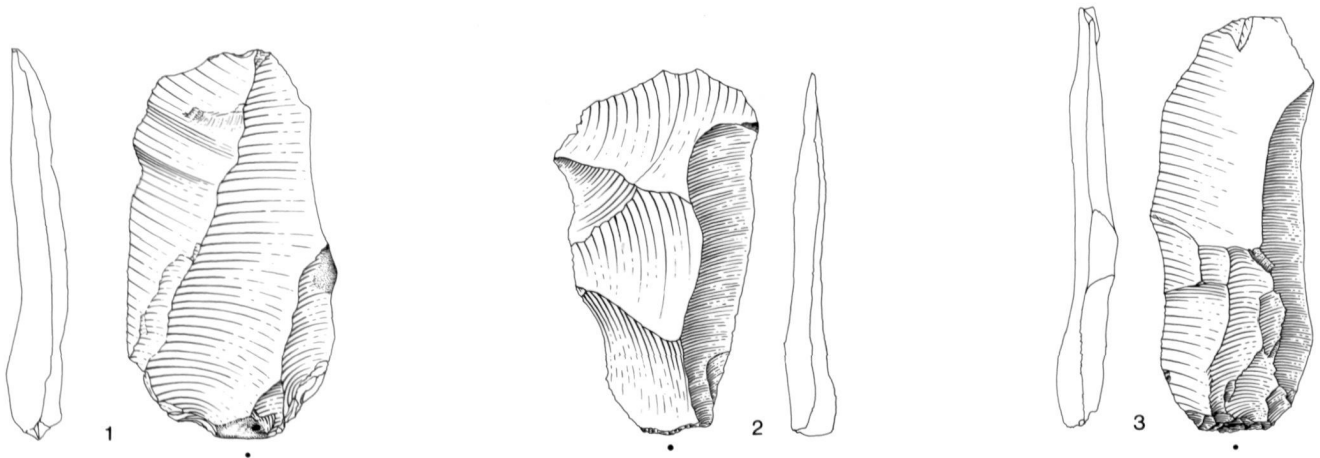


Fig. 36. Site C, 1-3 flakes (1, RMU 3?, 2-3 RMU 4), scale 2:3.

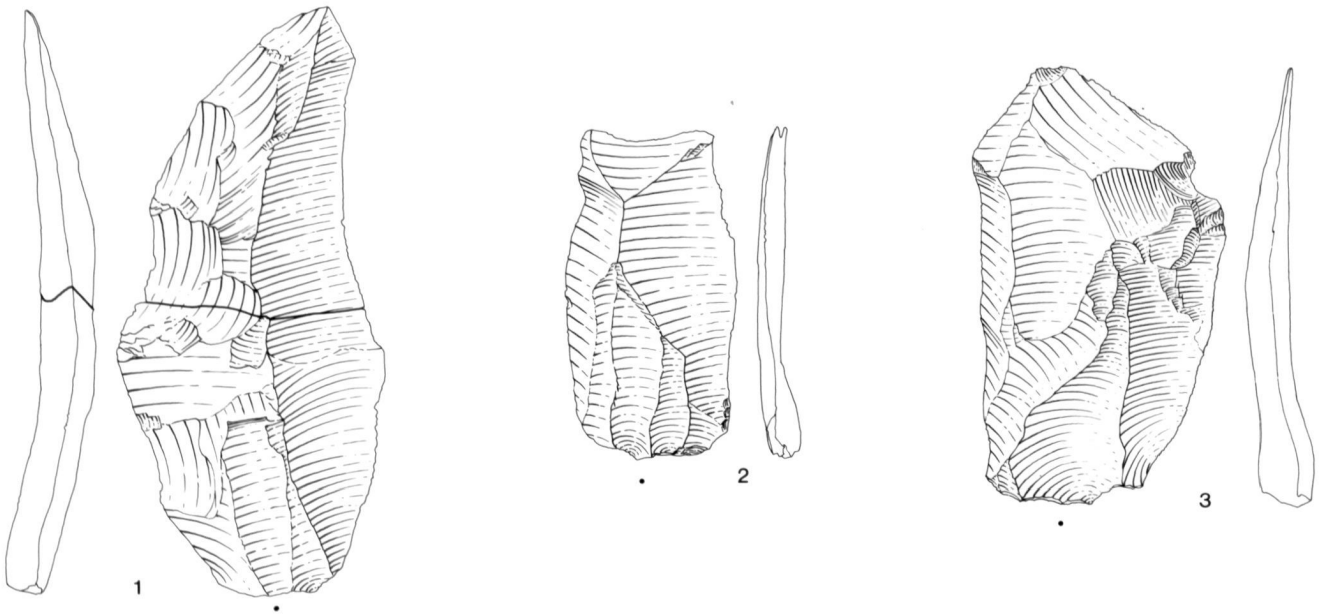


Fig. 37. Site C, RMU 6: 1-3 flakes, scale 2:3.

pebbles to large boulders, which suggested that we were dealing with a natural phenomenon: spatially limited concentrations of stones displaying a large size range occurred -usually at erosional levels- all over the pit. The charcoal patch and the stones were both situated in the western part of Site C and in the uppermost part of the Unit IV sediments. We were therefore very probably dealing with stones from an erosional level at the boundary of Units IV and V. A comparable concentration, having a diameter of about

200 cm and containing many more larger elements, was found about 4 m northwest of the first one, in square TT/ UU-6. This too contained very small stones mixed with larger ones. The origin of this concentration was also ascribed to natural causes, an interpretation corroborated by geologists' assessment of the structures (J. Vandenberghe pers.comm., 1983).

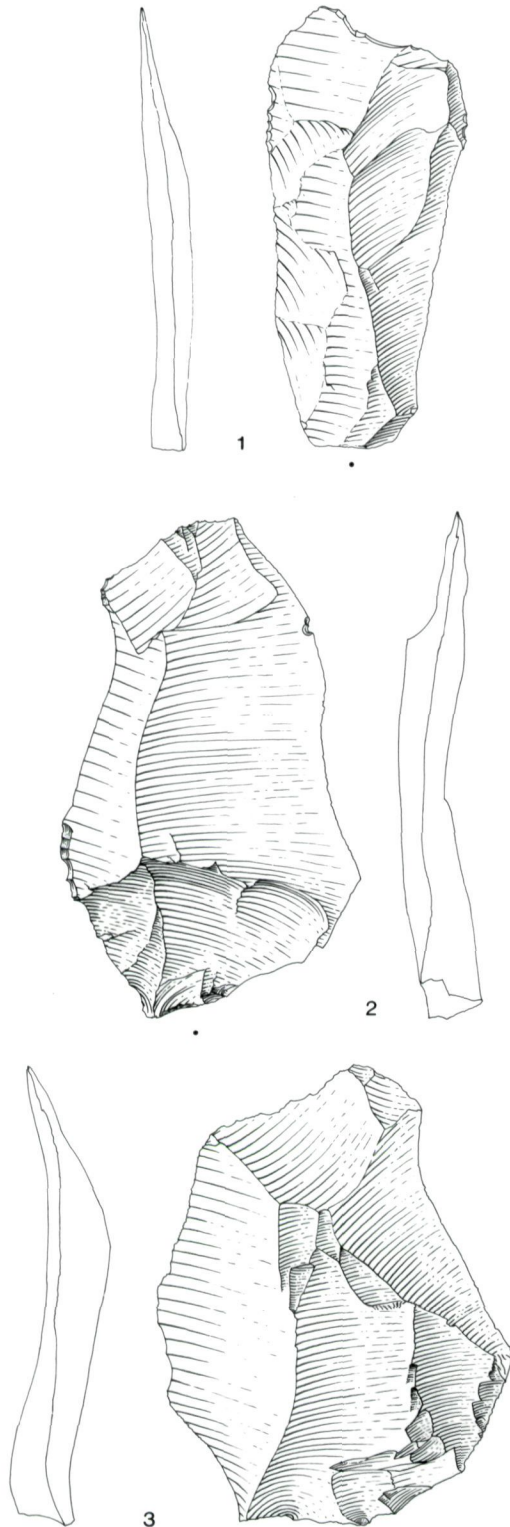


Fig. 38. Site C, 1-3, flakes not attributable to RMU 1-6, scale 2:3.

4.2.3.6 Haematite

In the course of the Site C excavation 14 small dots of reddish material were recorded, the spatial distribution of which is shown in figure 44. The reddish material was observed between the sand grains of the Unit 4 matrix, in dots ranging in diameter from 0.5 to 1.5 cm. The contrast in colour between the bright red material and the yellowish-brown (2.5 Y 5/3) to greyish-olive (5 Y 5/3) sediment enabled the recovery of the tiny fragments.

Three of these fragments were submitted to Dr C.S. Arps (National Museum of Geology and Mineralogy, Leiden) for X-ray diffraction analysis. This analysis (Arps, this volume, appendix III) demonstrated that the material was *haematite*. Figure 157 (Arps, this volume) shows the results of the analysis of sample D23/16: the dark lines indicate the diffraction pattern of the quartz particles of the Unit 4 matrix, while the fainter lines form the haematite diffraction pattern. Since haematite does not occur naturally in the soil unit, its possible origin must be discussed here.

Dutch and Rhineland prehistoric haematite sources have been the object of several publications dealing mainly with Bandkeramik raw materials (Bakels 1978; Horsch/Keesman 1982). The haematite sources closest to Maastricht are situated south of Namur in the Belgian Maas valley, i.e. approximately 70 km southwest of Belvédère. We therefore have to evaluate the possibility that small haematite fragments were transported from the Namur region by the river Maas and were finally deposited in the Maastricht region. Two observations are important in this context:

1. An important tool in the State Geological Survey's lithostratigraphical classification work is sedimentary petrography. In South Limburg Mr P.W. Bosch has been studying Maas sediments in this way for many years. According to him, small (< 0.5-1 cm) haematite fragments indeed occur in the Maas gravels of South Limburg in very small, non-quantifiable amounts. Their numerical presence is so small that, according to Bosch (pers.comm., 1986), it is virtually impossible to collect them in any numbers from natural exposures of Maas sediments nowadays.
2. The Unit 4 sediments received much attention in the course of the 1980-1988 Belvédère research in the form of excavations (Sites B, C and G) and the investigation and drawing of several hundreds of metres of Unit 4 sections. In all these activities haematite was never found outside the Site C context. This seems to indicate that the Site C haematite distribution is not part of a larger, natural 'background noise' distribution.

On the basis of these observations the horizontal and vertical association of the haematite spots and the flint assemblage at Site C can be explained by assuming human interference: the haematite must have been imported to the Site C area.

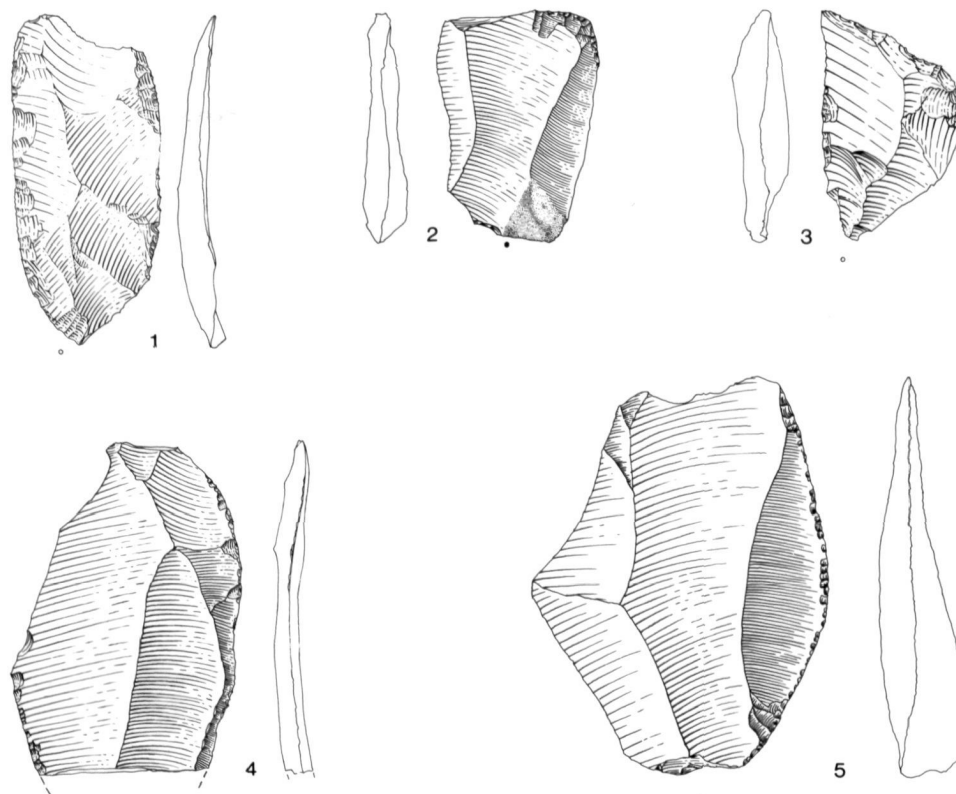


Fig. 39. Site C: 1-3, scrapers (1, E 17/10 RMU 6; 2, D 21/1 RMU 6?; 3 E 21/26 RMU 5?), 4-5 flakes showing signs of use retouch, scale 2:3.

Before we discuss the location(s) where the haematite was collected by Middle Palaeolithic man two remarks have to be made:

1. The bed of the river Maas as known to these Middle Palaeolithic groups was several kilometres wide, large parts of which may have been dry during certain periods of the year, when Maas sediments were exposed over much larger areas than nowadays.
2. Because the amount of energy invested in the procurement of goods is dependent upon the value attached to these goods, even materials present in -what nowadays seem to be negligibly- small amounts may have been looked for systematically in the Middle Pleistocene by people whose eyes and minds were certainly more adapted to the screening of the substrate than those of present *Homo sapiens sapiens*.

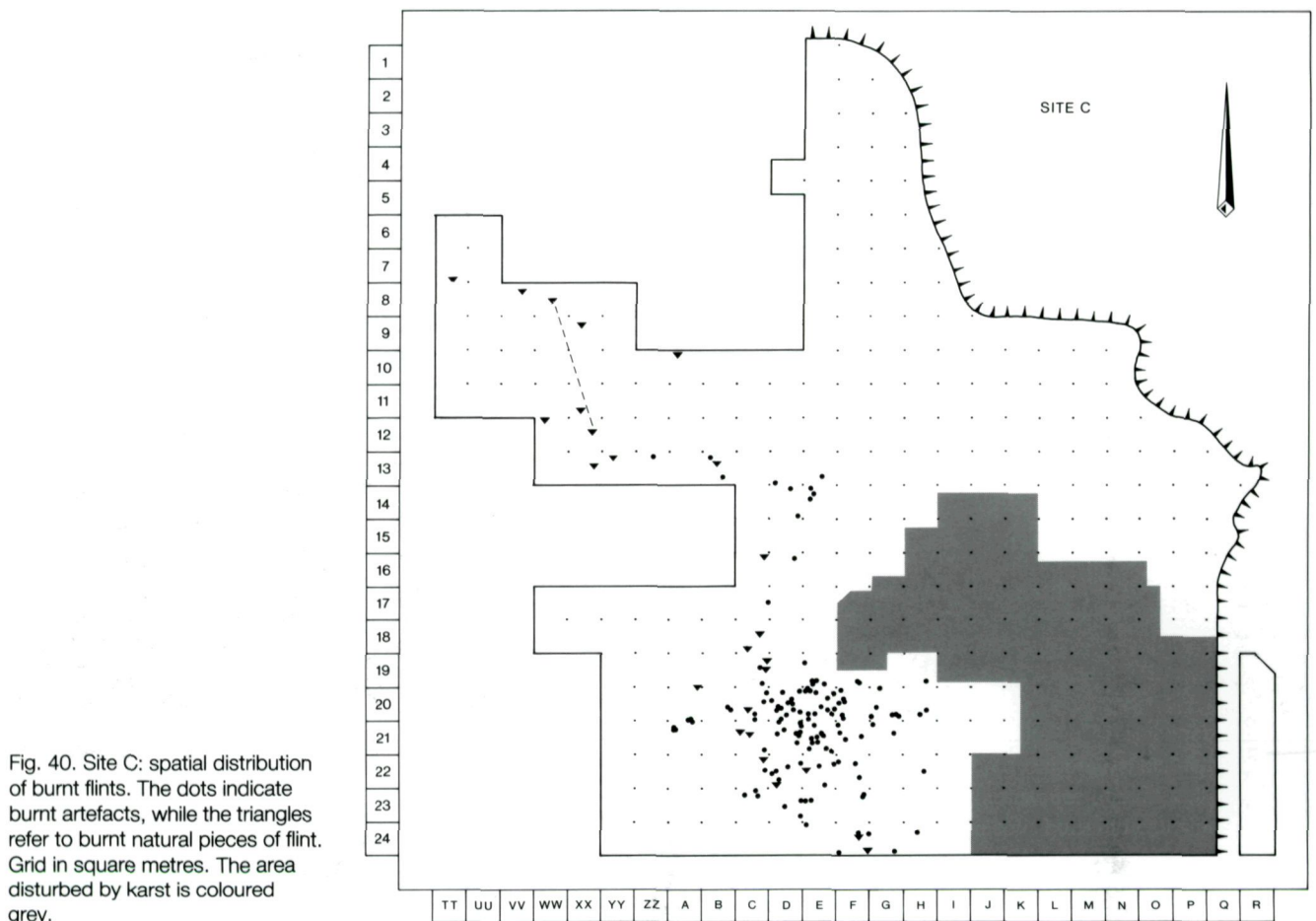
In the author's opinion, it is therefore impossible to state that the Site C haematite was obtained from the haematite sources near Namur in the Belgian Maas valley, although this possibility may not be altogether excluded.

It is difficult to assess what kind of activities were responsible for the haematite distribution at Site C. In the literature prehistoric 'red ochre manipulation' has often been interpreted as evidence of 'non-utilitarian behaviour' (Ed-

wards/Clinnick 1980; Wreschner 1980, 1982a). Velo (1984) opposed this approach, stressing the non-symbolic properties of the iron compounds of ochre, which are used as a medicine by Australian aboriginals: ochre moistened with water is applied to sores in any part of the body, and is also used in cases of internal pains (Velo 1984).

The Site C haematite spots may well be ascribable to activities related to the preparation of a hide, because treatment with ochre may inhibit or slow down the decay of hides, as discussed by Keeley (1980: 170-172).

However it may be, the presence of haematite at Site C provides unambiguous evidence of the use of red ochre at about 250 ka. Until quite recently, the Terra Amata site was thought to have provided evidence of red ochre manipulation at about 380 ka. There are however two problems involved in this Terra Amata evidence. First, the TL age of 380 ka has somehow found its way into the literature, but the age determination itself has never been published (De Lumley 1976a: 823). A published TL age determination by Wintle and Aitken (1977) suggests a younger age for the site (230 ± 40 ka), which is in accordance with Bonifay's (1975) chronostratigraphical interpretation of the site. Secondly, and more important in this context, Wreschner (1982b) now interprets the Terra Amata ochres as the



results of natural agents and incidents. In his opinion the sites of Becov (Czechoslovakia, see: Marshack 1981) and Ambrona (Spain) are the only sites with an estimated age of around 250 ka where the presence of ochre can be related to human activities. Maastricht-Belvédère Site C provides a third case of human red ochre manipulation around 250 ka (see section 8.3 for the dating evidence)¹

4.2.4 THE REFITTING PROGRAMME

4.2.4.1 Introduction

In order to obtain data on the technological aspects of the flint assemblage and especially on the site-formation processes (both human and non-human) that caused the horizontal and vertical distribution of the finds, a substantial amount of time and energy was invested in the refitting of the Site C flint material in 1983-1985. The Site C flint assemblage seemed to have a good conjoining potential, because the knapping had been done at the site, and most of the flint-knapping areas were uncovered during the excavation.

By the end of 1984, we had obtained a good impression of our main point of interest, the formation processes be-

hind the artefact scatters. The distribution plan of the conjoining elements showed 'star-like' constellations, of different shapes and densities. The RMU 2 material displayed the lowest density, which was only partly due to the less dense horizontal distribution of its elements. An important factor was certainly also the less 'attractive' character of this material in term of conjoinability: it is a coarse-grained flint with few inclusions, which are often of help in this respect.

In 1985 the Site C material was again studied on this basis, with special attention for this less attractive RMU 2 group. Much more important, however, was the evaluation of the impression obtained in 1983-1984 that the Site C material lacked products of specific flint-working stages: for instance, for one RMU there were virtually no cortex flakes, while another appeared to lack debris associated with the production of a series of larger-lakes. In order to evaluate these impressions we systematically worked on this problem to determine whether the material was really absent or we were just lousy at conjoining flint artefacts. In this final phase the line patterns of conjoining elements gradually grew into very dark spots, because a relatively large number of mostly small flakes could be conjoined.

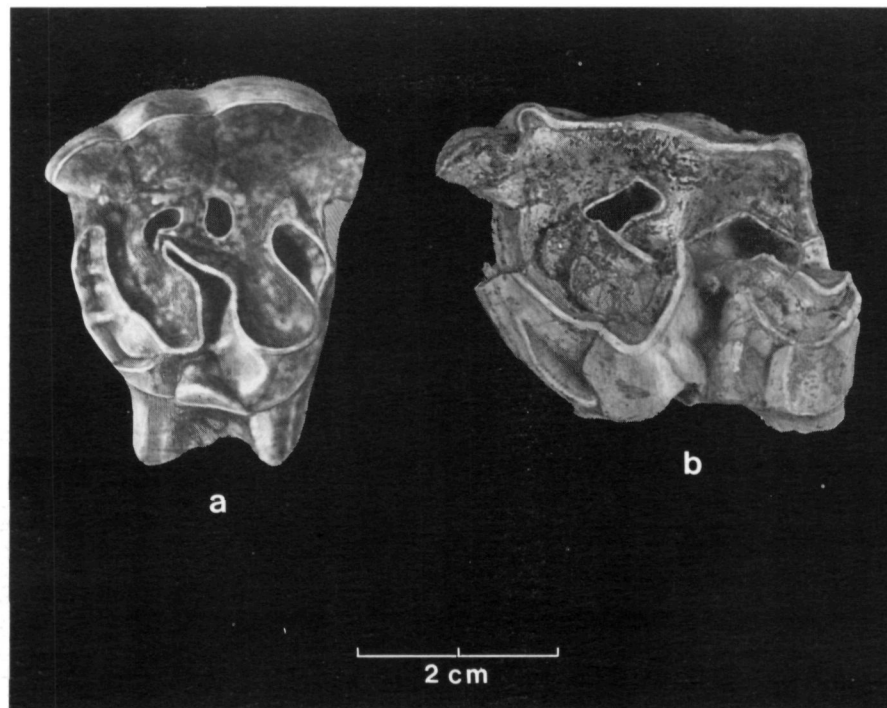


Fig. 41. Site C: two milk molars of the steppe rhinoceros *Dicerorhinus hemitoechus*, from square H-7. a occlusal view of DP2 sin b occlusal view of DP3 sin (after Van Kolfschoten 1985)

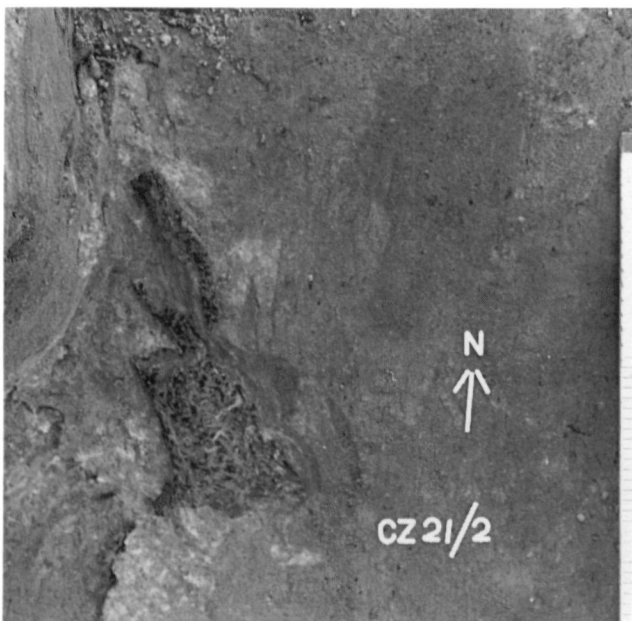


Fig. 42. Site C: a typical example of the form in which 'bone' fragments were found at Site C (C 21/2) (length is abt. 15 cm).



Fig. 43. Site C: vertical view of the (non-artificial) stone concentration in square WW-10 (smaller stones have already been removed). The largest pebble has a length of 11.5 cm. (The arrow points northwards.)

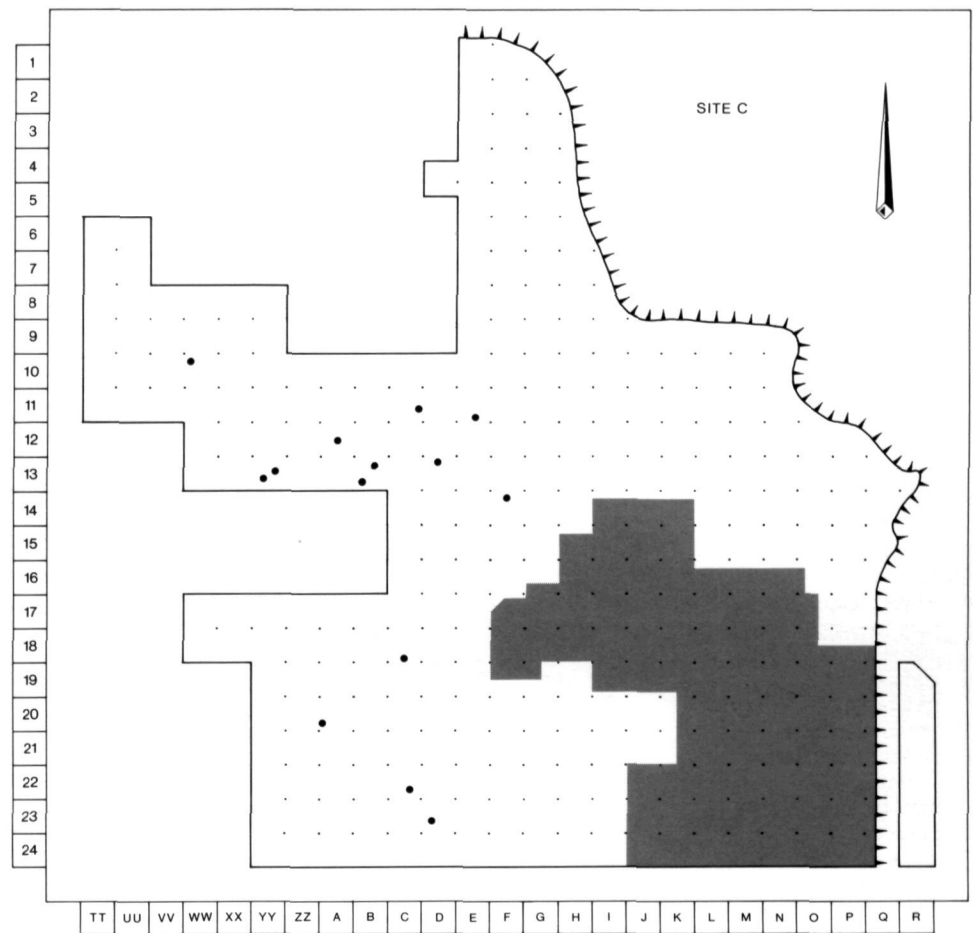


Fig. 44. Site C: spatial distribution of haematite dots. Grid in square metres. The area disturbed by karst is coloured grey.

The greater part of the refitting work to be presented here was carried out by Mr P. Hennekens, with the assistance of the author and Mr K. Groenendijk. Mrs M. de Grooth (Bonnefanten museum at Maastricht) and Mr J.P. de Warrimont occasionally joined in. Before this work was started, Mrs A. van Gijn (Leiden) studied a sample of the flint material for traces of wear (Van Gijn, this volume, appendix I).

Unfortunately, the Site C refitting studies could not benefit from a recent paper by Cziesla (1986), in which he stresses the importance of distinguishing between several types of refitting, notably *Aufeinanderpassungen*, *Aneinanderpassungen* and *Anpassungen*. These terms, which are difficult -if not impossible- to translate are used by Cziesla in the following way:

– *Aufeinanderpassungen* refer to the ventral/dorsal conjoining of, for instance, a series of flakes in a reduction sequence.

– *Aneinanderpassungen* concern the reconstruction of basic products, blanks and tools, i.e. the conjoining of broken flake fragments, broken tools, etc.

– *Anpassungen* refer to the conjoining of elements produced during the retouching of a blank into a tool or during the resharpening of a tool, for instance refitting a burin spall to the burin from which it derives.

This subdivision certainly presents considerable advantages, and should be used in future conjoining studies. The Belvédère Site C work, however, dates from the pre-Cziesla (1986) period and thus no detailed attention was paid to specific types of refitting. This is, of course, reflected in the cartographic representation shown in figure 47, in which each of the contact surfaces is linked to the other contact surfaces by means of lines (see: Cziesla 1986 for this form of graphic representation).

However, the horizontal distribution of several groups of conjoining elements isolated from the 'black areas' in figure 47 (separate sheet at the back of this volume) has been presented with dashed lines indicating refitted broken pieces (*Aneinanderpassungen*) after Cziesla (1986). The continuous lines connect ventrally/dorsally fitting artefacts, while the arrows, directed towards the core, show the detaching sequence. This has been done with a limited number of

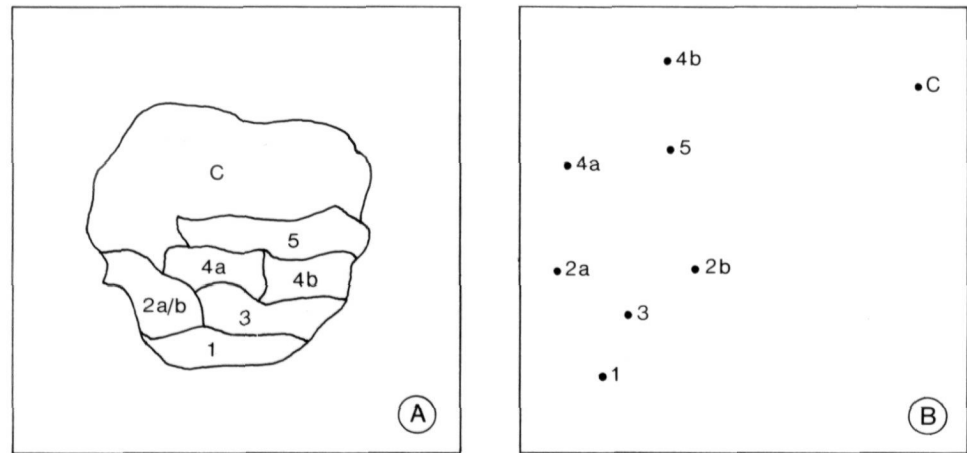
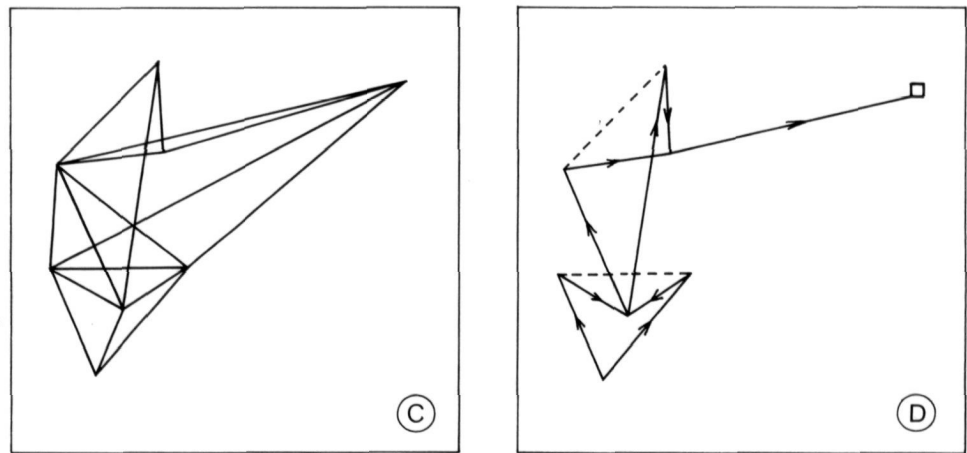


Fig. 45. The two models used for the graphic representation of the Site C refitting data (after Czesla 1986: figure 7).

- A a hypothetical example of a core showing the conjoined elements (view of the striking surface) and (B) the spatial distribution of the conjoined elements (c: core, 1: flake, 2a/2b: blade broken into two pieces, 3: blade, 4a/4b blade with split bulb, 5: flake).
- C all contact surfaces linked by lines.
- D broken artefacts indicated by dashed lines, dorsal/ventral refits are traced back to the core, following the reduction sequence, as indicated by the arrows.



conjoining groups, namely those whose reduction sequence could be reconstructed fairly easily. It was impossible to reconstruct a detailed reduction sequence for the large RMU 5 group of conjoining elements shown in figures 60 and 61, because the original (flat discoidal) core had a continuous working edge with two striking surfaces.

Likewise, an attempt was made to record the horizontal distribution of conjoining broken elements (figs. 65 and 66), as far as this did not involve the 'deconstruction' of larger compositions by submersion in acetone.

For clarity's sake, figure 45 (after: Czesla 1986) gives a graphic illustration of the two forms of representation used here.

As already mentioned above, the refitting was done mainly by Mr P. Hennekens (especially from 1984 onwards). His detailed work - in which he did not avoid the fine debris - is only summarized in this volume. Here I will present the final results of the refitting programme, without going into details. Readers who would like to study the conjoined material are welcome to do so at the Leiden Institute of Prehistory.

The administration of the conjoining elements was all done by hand by the author in 1983-1985. As two cards were put into a card system for every two conjoining elements (a fits onto b; b fits onto a) for each contact surface, this grew into a tremendous, hardly manageable paper work for a block of 150 conjoining elements. This is one of the reasons why Mr M. Wansleben (IPL) developed computer software for the recording and graphic presentation of the refitting data, from which work at other sites (Site J and Site K) will benefit. This program (Pasprogramma IPL) is available from the Institute of Prehistory and is used in combination with a program for data entry in the field.

4.2.4.2 Results and interpretation

In total, 659 pieces (= 21.5% of the flint artefacts recorded three-dimensionally) were refitted. Figure 46 gives the size distribution of the refitted artefacts, showing that a considerable percentage (30.7%) is smaller than 2 cm. 70.4 wt. % of all artefacts could be fitted together.

Figure 47 gives the horizontal distribution of refitted elements for the whole site as described above. This general

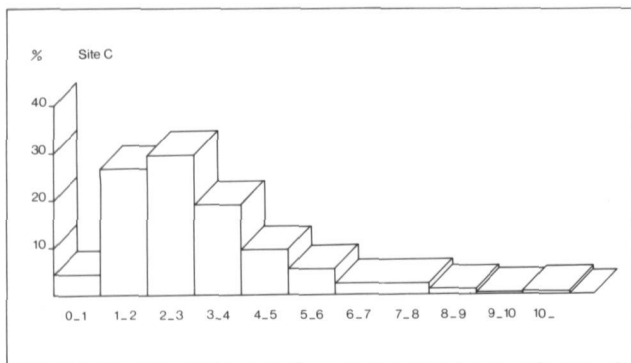


Fig. 46. Size distribution of the refitted Site C flints, based on maximum dimensions, in cm (see fig. 28).

Fig. 47. (Separate sheet at the back of the volume) Site C: horizontal distribution of all refitted artefacts, each line connecting the contact surfaces of two refitted artefacts (see figure 45, model C). Scale 1:80 (reference grid in square metres).

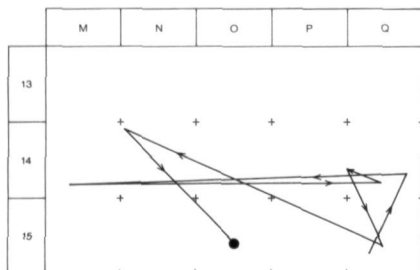


Fig. 48. Site C, RMU 2: horizontal distribution of flakes refitted to core Bv-557 (fig. 32-2). Grid in square metres.

picture will be detailed here, in a short discussion of the refitting evidence for each RMU.

Raw Material Unit 1

More than 60% of the total weight of this RMU was refitted. A comparison of the distribution of this RMU with the boundary of the excavation (fig. 30) shows that only part of the original distribution was sampled in the Site C excavation. The results of the refitting work show that part of the RMU 1 debris originated in the northern part of Site C. Conjoining groups generally consist of two to three refitted flakes or flake-fragments, usually with a cortex. The largest number of flakes that could be fitted together was five.

It is difficult to draw further conclusions from the refitting data, because only -a presumably small- part of the original distribution was recorded.

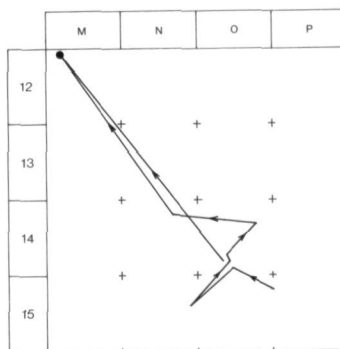


Fig. 50. Site C, RMU 2: horizontal distribution of flakes refitted to core Bv-409. Grid in square metres.

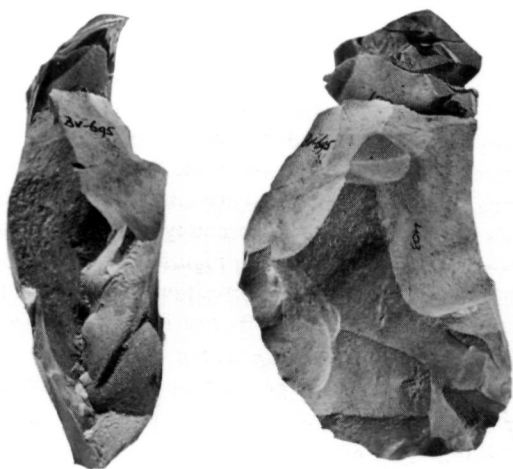


Fig. 49. Site C, RMU 2: core Bv-409, with eight conjoined flakes, scale 2:3.

Raw Material Unit 2 (figs. 32, 48-51)

It was possible to refit 83% of the approximate total weight of this RMU (3000 g). Several larger groups of conjoining elements were obtained, which show that the associated debris represents several flint-knapping stages: rough shaping of the flint nodule by cortex removal, platform and surface preparation of the core, flake production, etc. Some of the blocks of conjoining elements are shown in figures 32 and 49.

Some small 'classical' Levallois flakes were found, in addition to a few larger ones and flakes of which only part of the dorsal side shows scars of centripetal preparation, the other part presenting the scar of a flake of larger dimensions. From this we may infer that the technology was not directed at the production of one flake, but of a whole series, the reduction sequence of which will be detailed below for RMU 4.

The refitting research showed that -at least part of the- removal of the cortex of the original nodule took place within the excavated area, mainly to the south of square

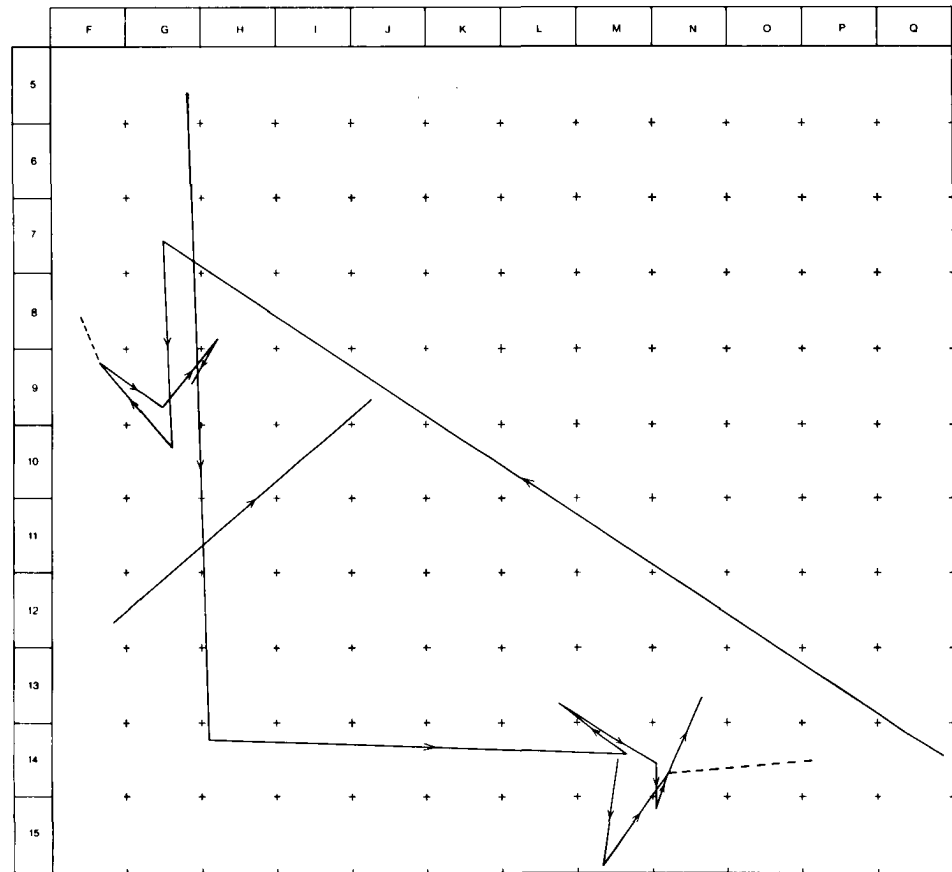


Fig. 51. Site C, RMU 2: horizontal distribution of conjoined flakes produced during decortication. Grid in square metres.

H-7 (which contained the rhinoceros remains). After this rough shaping the resulting flint block was transported to the eastern part of Site C, where it was subsequently reduced. In this reduction process three cores were ultimately produced, one of which was completely reduced by the removal of irregular flakes, which ultimately destroyed the core block (fig. 32-3). The second core (Bv 557) was discarded after a very rough surface and platform had been obtained (fig. 32-2). It should be stressed that this core need not be interpreted as a *Vollkern* (*sensu* Luttropp/Bosinski 1971) but could also be seen as an exhausted core. A third core of RMU 2, with eight flakes conjoined, is illustrated in figure 49, while the horizontal distribution of the flakes conjoined to this multi-platformed core (Bv 409) is shown in figure 50. The few regularly shaped flakes made from this RMU display faceted butts and the dorsal negatives of core preparation (fig. 31). Figure 51 shows some of the spatial relations between the area around square G-9 and the eastern part of Site C, where the greater part of the RMU 2 material was concentrated.

The refitting evidence shows that part of the debris and some of the larger flakes produced during flint-knapping are missing. This is probably due to the fact that (a minor) part

of the artefact scatter was destroyed prior to excavation; therefore no behavioural inferences can be drawn from this.

Raw Material Unit 3 (figs. 52-54)

75 wt.% of the elements from RMU 3 could be fitted together. A group of 40 (mainly cortex) elements formed the largest composition (fig. 52). RMU 3 consists of the remains of a decortication/rough core shaping process; the products of further knapping, such as large regular flakes or a core, are absent. In this interpretation the 'prepared core' was transported off the excavated area. Initial decortication of this nodule took place approximately 5 m to the south of the main debris concentration. Figure 53 shows a photograph of a few refitted decortication flakes, while figure 54 shows the horizontal distribution of the conjoined pieces as a 'horizontal' reduction sequence.

Figure 52 shows the largest composition of refitted RMU 3 elements, consisting of 40 pieces, which were all found in the debris concentration where the reduction sequence of figures 53 and 54 ended. Spatially, the debris completely overlaps that of RMU 4.

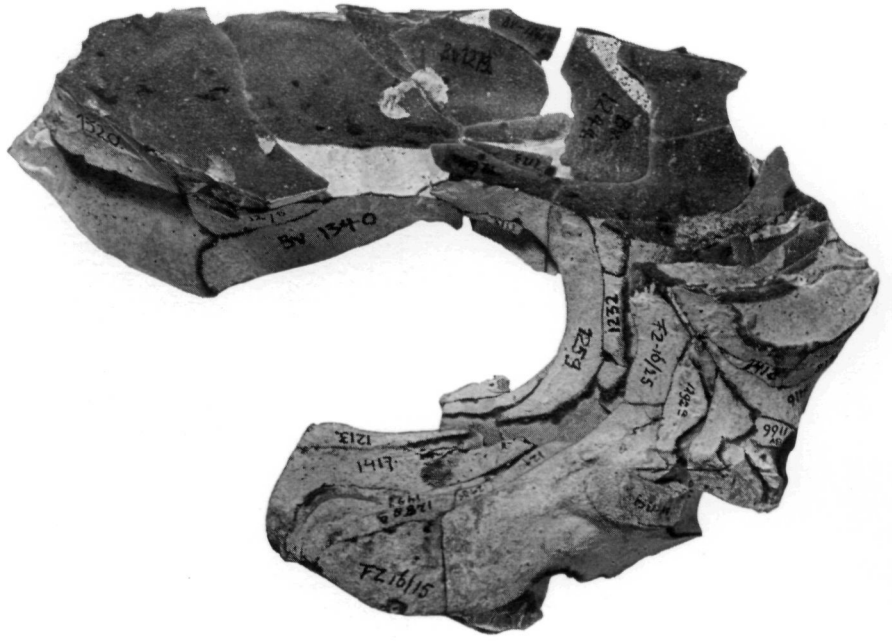


Fig. 52. Site C, RMU3: conjoined decortication flakes (n = 40), scale 2:3.

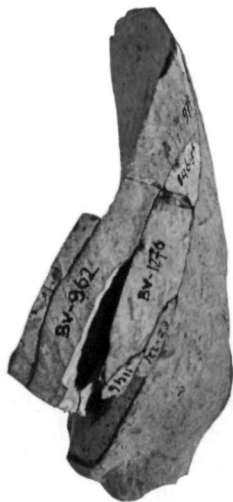


Fig. 53. Site C, RMU3: conjoined decortication flakes, lateral view, scale 2:3.

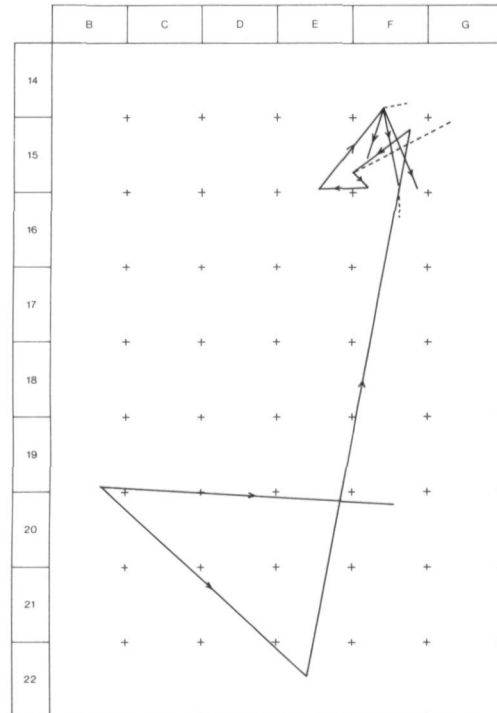


Fig. 54. Site C, RMU 3: horizontal distribution of the block of conjoined decortication flakes shown in figure 53. Grid in square metres.

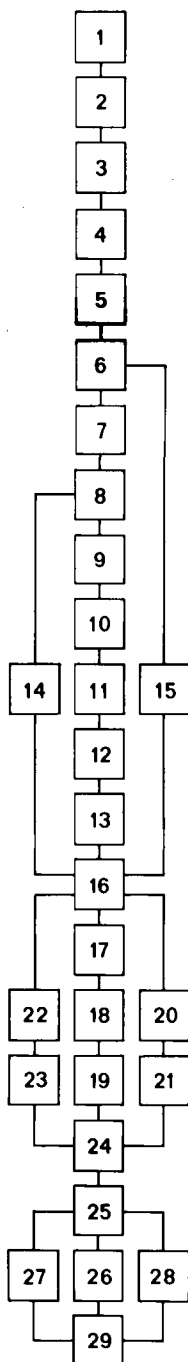


Fig. 55. Site C, RMU 4: reduction sequence of elements conjoined to core Bv-1527. The numbers refer to the individual finds and their technological characteristics as given in Table 7, and are the same as those used in figures 58 and 59. Number 1 is the highest flake in the 'stratigraphical' sequence, 29 is the core.

Raw Material Unit 4 (figs. 55-59)

Of the 1300 g of this group 50 wt. % could be refitted to form several conjoining groups; the largest, comprising 35 elements, included the 'Levallois' core Bv 1527 shown in figures 33, 56 and 57.

Figure 55 gives the reduction sequence as could be reconstructed from the flakes conjoined to core Bv 1527 (figs. 56 and 57). The numbers used in this figure are the same as those used in table 7, which gives some technological data on the conjoined elements, and also correspond to the numbers in figure 58, which shows the horizontal distribution of these elements.

Because core Bv 1527 (figs. 33, 56 and 57) has a continuous working edge it was not always possible to establish the exact 'stratigraphical' position of the individual flakes in the reduction sequence. This is why the sequence in figure 55 has to be read as a 'Harris-matrix'. The reduction sequence is illustrated in a series of photographs, beginning with the most complete block (28 elements refitted to the core), and ending with the core (fig. 56).

Most of the flakes appeared to fit onto the striking surface of the core, whereas only a few flakes could be conjoined to the striking platform, which is rather 'continuous' in the case of this core. The flakes produced in reshaping the striking platform have not been mentioned in the reduction sequence described above. If we look at the horizontal distribution of the conjoined elements and their position in the reduction sequence we can clearly see the core 'moving' over the area indicated in figure 58, small 'preparation' flakes having been produced to the north of the main debris concentration in several stages.

Table 7 shows that the core produced a rather regular alternation of smaller 'preparation' flakes and larger flakes, as visualized in figure 59.

In the series of photographs showing the actual reduction we note the absence of a few larger flakes, which were probably picked out of the flakes produced within the excavated area and discarded outside the excavated area of Site C.

In addition to the flakes produced in the flaking sequence described above there are a number of flakes of this RMU that could not be conjoined to the core sequence shown above. Some technological characteristics of flakes with maximum dimensions of 5 cm or more are given in table 8. The numbers used in this table are the same as the numbers used to indicate the flakes in figure 58, which shows their positions within the excavated area.

Seven of these larger flakes show signs of use, but no flake shows clear traces of intentional retouching. None of the flakes which could be conjoined to the core shows signs of use.

It must be stressed that the majority of these larger flakes were found outside the concentration of the RMU 4 debris,

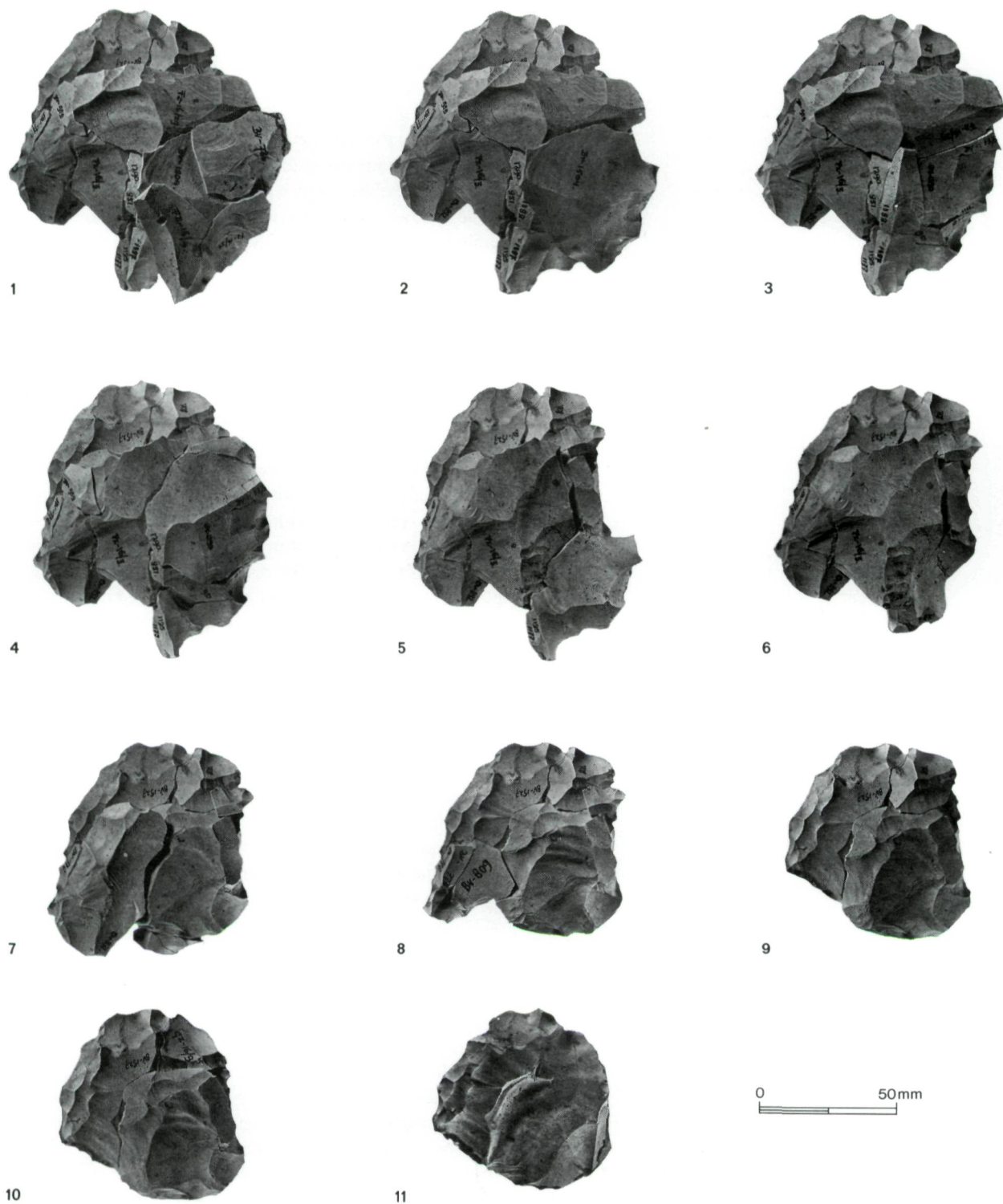


Fig. 56. Site C, RMU 4: core Bv-1527 (see figure 33) in various stages of refitting. (The orientation of the core differs slightly from that in figure 33). Scale in cm.

Table 7: Site C: Reduction sequence of core Bv 1527 (Raw Material Unit 4). (dimensions in mm)

find no.	length	width	max. dimens.	number of scars	striking platform
01 F 16/24	23	33	34	4	facetted
02 F 16/4	56	36	57	4	facetted
03 Bv 786	36	35	37	6	cortical
04 Bv 1504	53	46	54	7	dihedral
05 Bv 1397/ Bv 1399	54	11	54	8	punctiform
06 F 16/29	63	35	66	10	facetted
07 Bv 1373	15	09	17	2	missing
08 Bv 1290	45	46	46	7	facetted
09 Bv 1111	18	14	18	3	plain
10 E 17/9	24	16	25	3	missing
11 Bv 951/ Bv 1363	43	42	45	6	missing
12 Bv 1195/ Bv 1342	42	42	55	5	missing
13 Bv 1177	19	14	21	2	dihedral
14 H 11/2	24	25	31	4	facetted
15 Bv 959	18	26	21	3	missing
16 F 16/3	58	39	60	7	missing
17 Bv 892	57	30	57	8	facetted
18 Bv 778	30	14	30	3	punctiform
19 Bv 809	33	28	35	5	dihedral
20 Bv 1286	28	21	29	4	facetted
21 Bv 1167	17	15	19	3	plain
22 H 13/8	16	12	16	4	punctiform
23 Bv 806	27	24	27	4	facetted
24 F 16/36	51	51	51	14	facetted
25 Bv 1498b	13	15	17	3	missing
26 G 16/9	22	26	26	3	punctiform
27 Bv 1494	22	21	25	2	plain
28 Bv 1338	19	11	19	4	missing
29 Core Bv 1527					

Table 8: Site C: Raw Material Unit 4, non-conjoinable flakes. (dimensions in mm)

find no.	length	width	max. dimens.	number of scars	striking platform	remarks
30 Bv 780	120	57	121	6	plain	
31 Bv 1202	100	55	100	5	facetted	use ret.
32 Bv 997	98	56	100	9	dihedral	
33 Bv 1010	97	74	97	8	facetted	use ret.
34 E 17/11	80	43	85	5	dihedral	use ret.
35 C 18/10	120	82	125	18	plain(?)	plunged
36 F 17/2/ Bv 732	77	35	78	12	missing	
37 Bv 946	67	44	70	6	missing	use ret.
38 Bv 793	72	40	73	6	facetted	use ret.
39 Bv 1273	65	39	67	11	facetted	
40 J 21/21	63	42	64	11	dihedral	
41 Bv 1094	53	29	53	6	missing	
42 G 16/14	56	27	57	4	missing	use ret.
43 E 16/4	56	37	57	4	facetted	
44 Bv 1265/ Bv 1248	101	48	107	5	facetted	use ret.

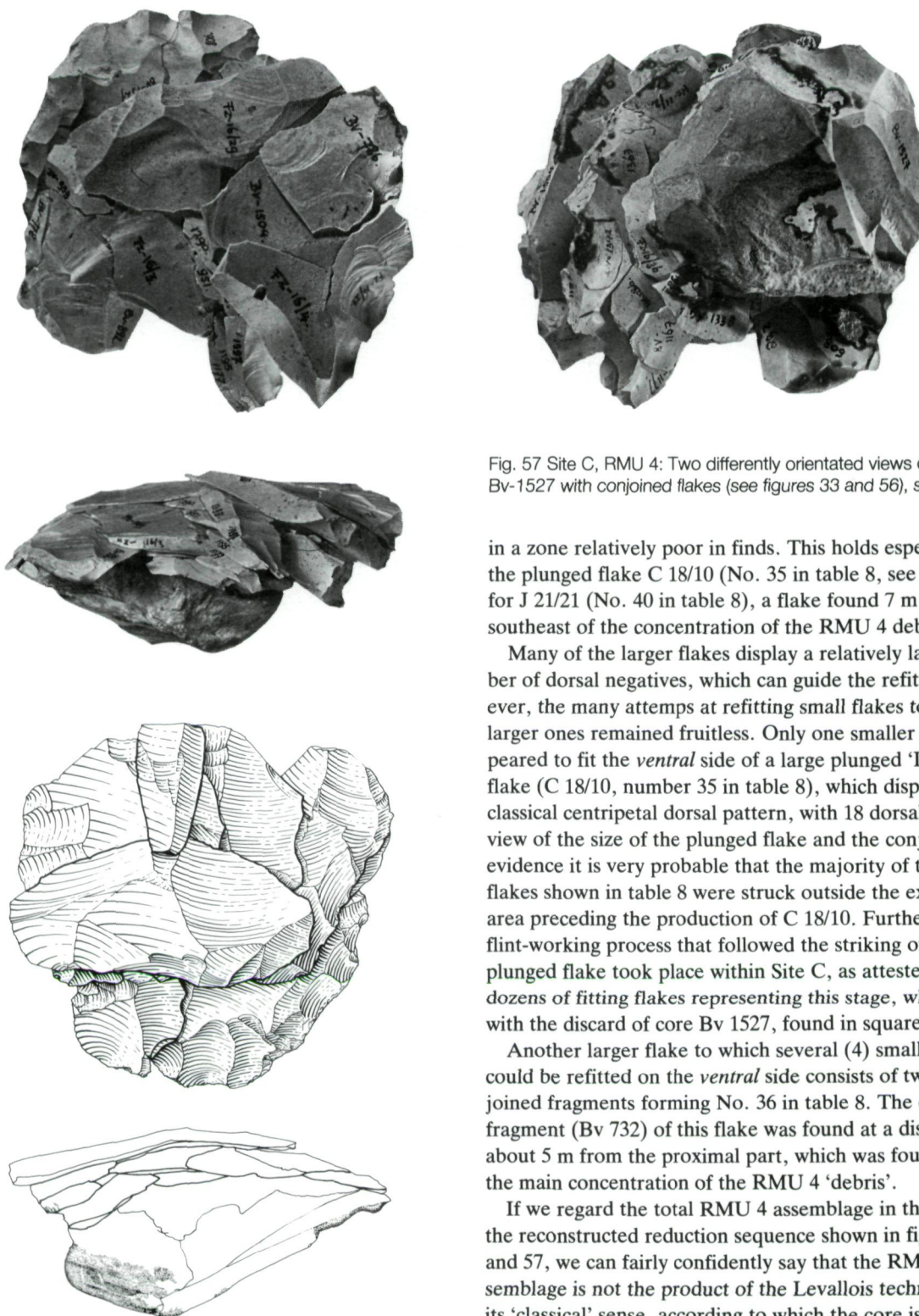


Fig. 57 Site C, RMU 4: Two differently orientated views of core Bv-1527 with conjoined flakes (see figures 33 and 56), scale 2:3.

in a zone relatively poor in finds. This holds especially for the plunged flake C 18/10 (No. 35 in table 8, see fig. 34) and for J 21/21 (No. 40 in table 8), a flake found 7 m to the southeast of the concentration of the RMU 4 debris.

Many of the larger flakes display a relatively large number of dorsal negatives, which can guide the refitter. However, the many attempts at refitting small flakes to these larger ones remained fruitless. Only one smaller flake appeared to fit the *ventral* side of a large plunged 'Levallois' flake (C 18/10, number 35 in table 8), which displays a classical centripetal dorsal pattern, with 18 dorsal scars. In view of the size of the plunged flake and the conjoining evidence it is very probable that the majority of the larger flakes shown in table 8 were struck outside the excavated area preceding the production of C 18/10. Furthermore, the flint-working process that followed the striking of the plunged flake took place within Site C, as attested by the dozens of fitting flakes representing this stage, which ended with the discard of core Bv 1527, found in square G-16.

Another larger flake to which several (4) smaller flakes could be refitted on the *ventral* side consists of two conjoined fragments forming No. 36 in table 8. The distal fragment (Bv 732) of this flake was found at a distance of about 5 m from the proximal part, which was found close to the main concentration of the RMU 4 'debris'.

If we regard the total RMU 4 assemblage in the light of the reconstructed reduction sequence shown in figures 56 and 57, we can fairly confidently say that the RMU 4 assemblage is not the product of the Levallois technology in its 'classical' sense, according to which the core is abandoned after the manufacture of one, or occasionally two flakes (Bordes 1980; Boëda 1986).

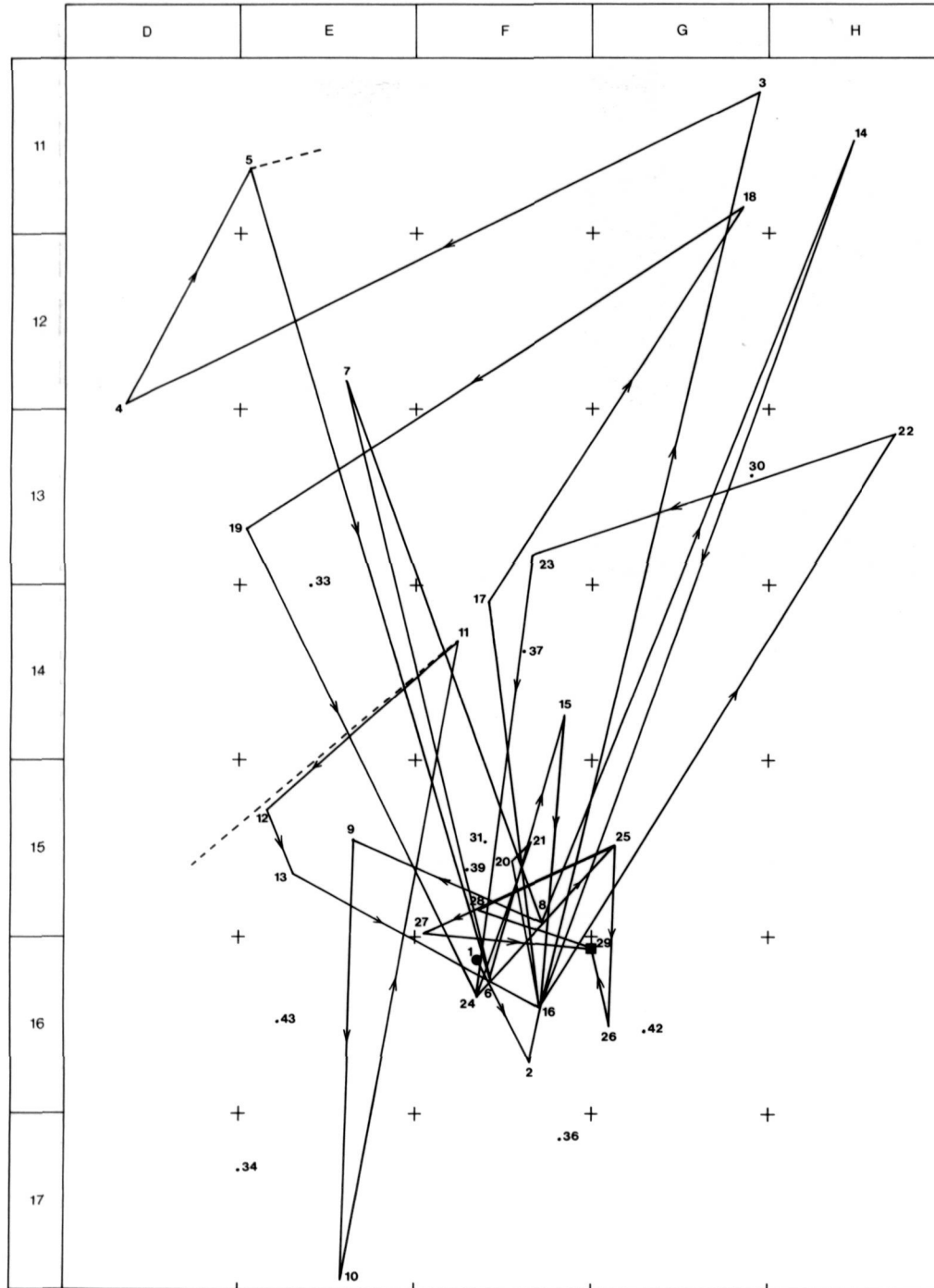


Fig. 58. Site C, RMU 4: horizontal distribution of flakes conjoined to core Bv-1527. The numbers are the same as those used in tables 7 and 8. Grid in square metres.

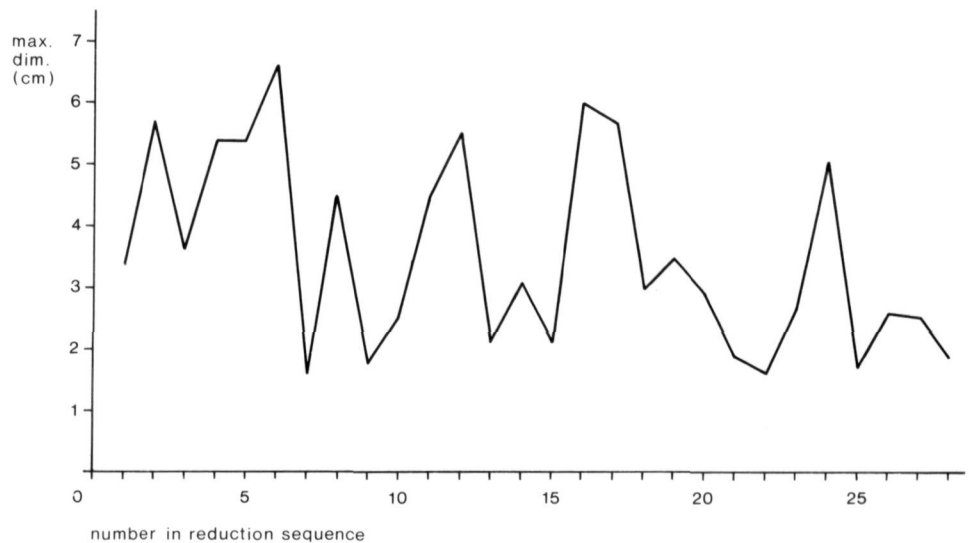


Fig. 59. Site C, RMU 4: graphic representation of the maximum dimensions of flakes conjoined to core Bv-1527, arranged according to their place in the reduction sequence (see Table 7).

Besides a few large 'classical' Levallois flakes, we have also smaller ones, and flakes of which only part of the dorsal side shows scars of a centripetal preparation, the other part displaying one scar of a flake of larger dimensions. From this and from the refitting evidence we may infer that the technology was not directed at the production of one flake, but at that of a whole series of flakes in the various phases of the reduction sequence. This type of reduction has been described as *débitage Levallois recurrent* by Boëda (1986) on the basis of his study of the cores from level IIa at Biache-Saint-Vaast (Tuffreau 1986). Like the classical Levallois, this *débitage* is based on a careful preparation of the convexity of the working face of the core, after which, however, not one but two or three flakes are detached from the working face by the preparation of several striking platforms. After this the sequence can be repeated, until the core is exhausted.

The refitting data of core Bv 1527 form a good archaeological corroboration of Boëda's (1986) interpretation of the *débitage Levallois recurrent*, which can be seen as an optimization of the possibilities of a block of flint.

Raw Material Unit 5 (figs. 60 and 61)

Of the total weight of approximately 470 g, 85% could be refitted, the greater part of which resulted in one block of 162 elements, with a weight of 320 g. This block is shown in figures 60 and 61.

The block comprises the remains of a rather flat discoidal core with a continuous working edge and one major striking surface.

According to the refitting data, this RMU found its way into the excavated area in the form of an already reduced

core, with only few cortex remaining. Inside the excavated area the RMU was soft-hammer flaked in an uninterrupted reduction cycle in which small flakes were produced, many with faceted butts. This seemingly 'useless' constant reduction resulted in a very small core, which, however, was not recovered inside the excavated area. The working of this RMU was certainly not related to the production of a hand-axe-like implement, as the typical handaxe-finishing flakes are completely absent, and the resulting core was of very small dimensions (estimated maximum dimensions 5 cm). The scraper E 21/26, which might belong to this RMU, could not be conjoined to any of the RMU 5 flakes.

This RMU is by far the most 'spectacular' from the refitter's point of view. However, attempts at establishing a reduction sequence as constructed for the RMU 4 core failed due to the complexity of the reduction caused by the continuous working edge. The flakes that clearly belong to this RMU were all recorded in the southern part of the site, and seem to have all been struck from an 'imported' core, whose striking surface had already produced several larger flakes *outside* the excavated area of Site C.

Raw Material Unit 6 (figs. 62-64)

RMU 6 found its way into the excavated area in flaked condition. Inside the excavated area the RMU was roughly shaped by the hard-hammer removal of cortex flakes, one of which was very large (10x5x4 cm; weight 197 g). It appeared impossible to conjoin the flakes produced in this stage to larger flakes of this RMU.

Of the estimated weight of this RMU 70% could be joined together to form two blocks, one of 21 and one of 25 conjoining elements.

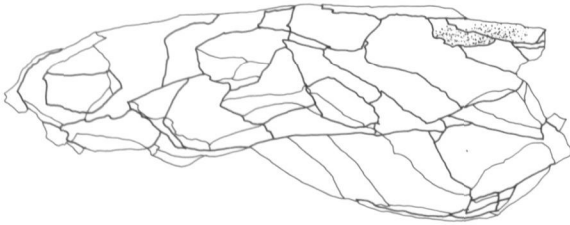
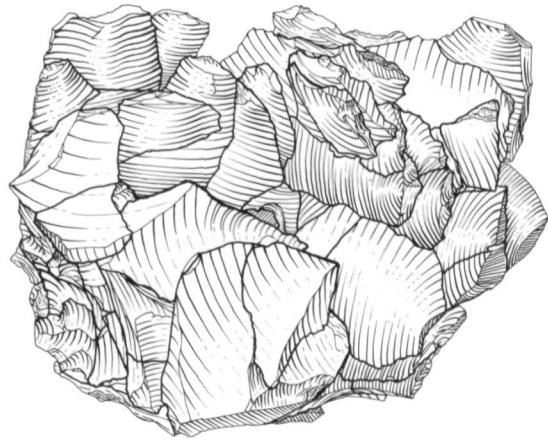
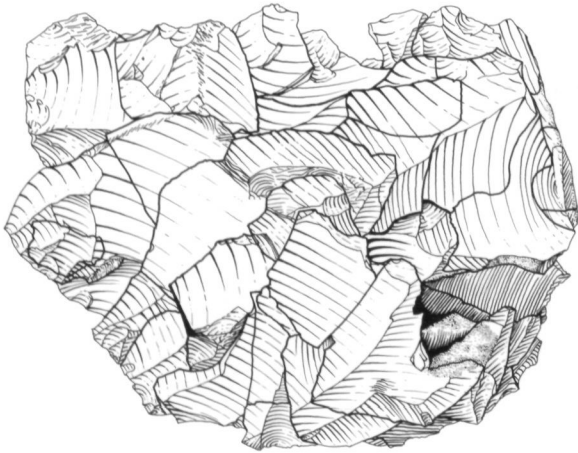


Fig. 60. Site C, RMU 5: composition of 162 conjoined elements, comprising the remains of a flat discoidal core (see the text), scale 2:3. For clarity's sake only some of the total number of conjoining elements are shown here (cf. fig. 61).

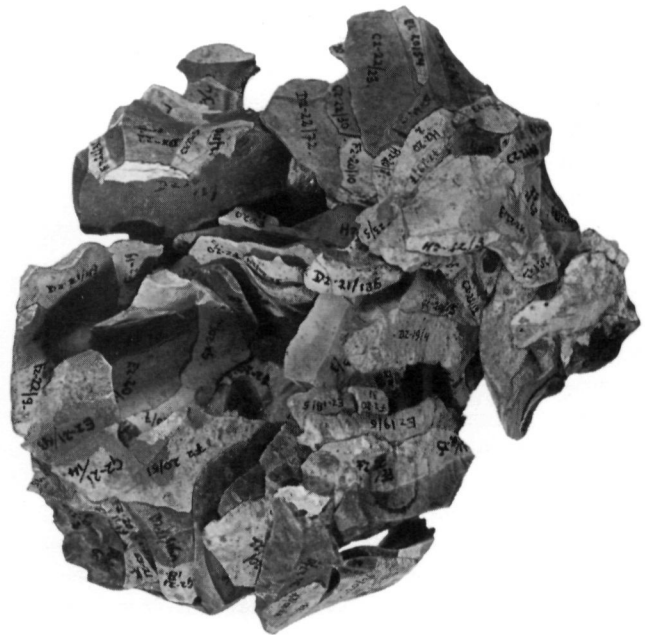
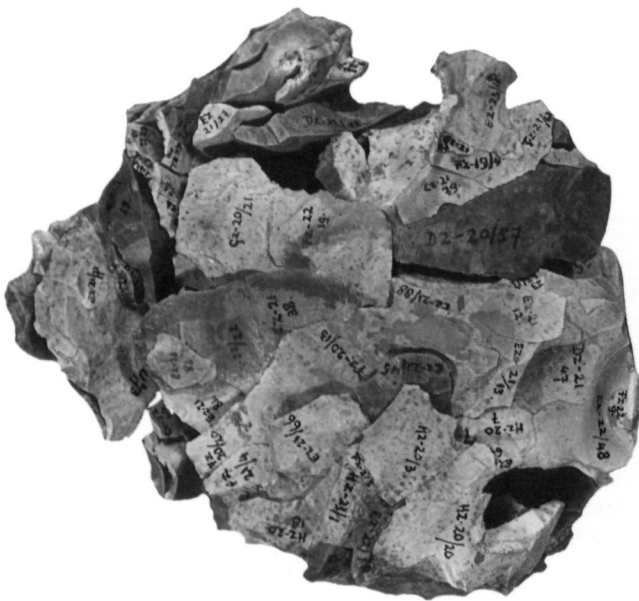


Fig. 61. Site C, RMU 5: composition of 162 conjoined elements, comprising the remains of a flat discoidal core (see the text), scale 2:3. Maximum composition.

The two blocks are illustrated in figures 62 and 63, which show that they contain several decortication flakes, block 1 (fig. 62) consisting almost entirely of decortication flakes. The horizontal distribution of their conjoining elements can be seen in figure 64. The horizontal distribution of two reconstructed detachment sequences is shown for block 1 (fig. 62), because this block consists of two pieces of flint which were split across an internal cleavage plane. It appeared impossible to reconstruct the detachment sequence of block 2 (fig. 63) due to the complex way in which the block had been reduced. Therefore, the horizontal distribution of the individual flakes constituting the block is shown here. As can be seen in figure 64, the flakes of the two blocks have different distribution patterns.

Figure 64 also shows the findspots of the larger RMU 6 flakes (and tool E 17/10), which could not be refitted to the blocks. These flakes were found north of the elements of RMU 6 blocks 1 and 2.

No flint-working debris could be refitted to the larger flakes and in the absence of any flint debris formed during the production of these flakes and in the absence of a RMU 6 core, we therefore have to assume that the production of the larger RMU 6 flakes took place outside the excavated area. The flakes were struck from a prepared core, after a fine facetting of the striking platforms. They were subsequently carried into the excavated area where, ultimately, they were found in the neighbourhood of bone fragments. A larger flake produced during the initial shaping of RMU 6 (block 1) within Site C (C 18/5) was picked out of the core shaping debris and taken to square C 18, where it was found lying beside the plunged RMU 4 Levallois flake C 18/10 (see fig. 26).

In this interpretation of the RMU 6 refitting data we therefore see a roughly shaped core enter Site C, where the flint block was worked into a core; this core was then taken outside the excavated area, where flakes were produced (and used?), some of which later returned to Site C.

4.2.4.3 Discussion

HORIZONTAL DISTRIBUTION OF CONJOINED ELEMENTS:

One of the reasons for investing time and energy in the conjoining of the material from Site C was the hope that with this method information could be obtained on the post-depositional processes that affected the original flint scatters. We have seen above, in the figures showing the horizontal distribution of conjoined elements, that, on the whole, the members of conjoining sets lay close together. But we have also seen that some of these members were found lying in one case up to 10 m apart. Some of these larger distances have already been interpreted in terms of 'transport' by hominids inside the excavated area, but what if any- evidence do we have of this?



Fig. 62. Site C, RMU 6: composition of Block 1, scale 2:3.

What we in fact need here is a kind of yardstick with which to 'measure' the spatial integrity of prehistoric flint scatters like those of Site C presented above. Newcomer and Sieveking (1980) have started developing such a reference database in a number of flint-knapping experiments in which they have recorded the horizontal distributions of waste flakes in order to collect data with which to interpret flint scatters found on prehistoric sites. The most important variable determining the size and shape of the flint scatters proved to be the flint knapper's position: the further away from the surface the flaking was done, the larger and more diffuse the spreads. Sitting positions led to rather concentrated patterns, while standing resulted in more diffuse spreads, with individual flakes travelling up to 4 m.

When using these data to interpret prehistoric flint scatters it is tempting to interpret scatters which have a larger horizontal distribution than those of Newcomer and Sieveking (1980) as having been affected by a variety of post-depositional processes. In such an interpretation only the

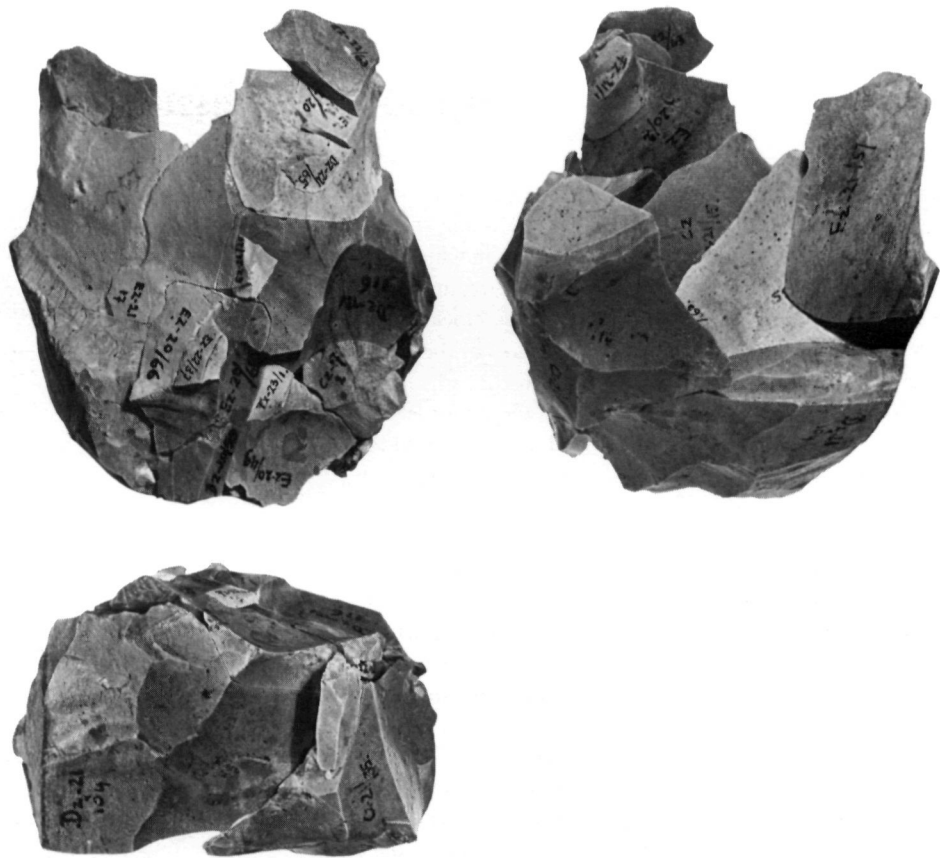


Fig. 63. Site C, RMU 6: composition of Block 2, scale 2:3.

RMU 3/4 flint scatter could be considered a primary scatter, very probably produced from a standing position (Newcomer and de Sieveking 1980: flaking experiment 19, fig. 8). However, one of the factors which may have been responsible for the larger distances over which flakes were distributed could be the behaviour of the hominids who produced the flint assemblage: by picking out flakes from the debris generated in flint-knapping and using these at another spot (than the concentration of debris) they may have 'transported' artefacts inside the excavated area. Another possibility is that the knapper did not stay at exactly the same spot all through the flint-knapping process, but moved from one area to another, thus producing a larger and more diffuse scatter.

A method for monitoring the influence of non-hominid processes consists of looking at the horizontal distribution of conjoined fragments of broken 'waste' flakes (*Aneinanderpassungen*), preferably of very small elements (with maximum dimensions of less than 2 cm), as these were very probably not selected for use by hominids and were therefore left in their primary positions. These could provide

more reliable evidence of what went on at the site in terms of natural site-formation processes than the ventral/dorsal refits of larger flakes.

In figures 65 and 66 we have presented the horizontal distribution of a number of conjoined broken elements from Site C. A distinction has been made between sets of elements that are smaller than 2 cm and sets of members of which one or more have larger maximum dimensions.

Figures 65 and 66 and table 9 show that in a total of 74 cases more than 60% of all members lay less than 1.5 m apart, which suggests that the various flint scatters were still largely intact. The two cases in which the distances exceed the 4 m established as the maximum distance travelled by individual flakes in the Newcomer and Sieveking experiments concern sets including larger elements, one of which, a small distal fragment of a blade-like flake, was found about 5 m from the basal part of this flake (flake 36 in table 8). Another case -not recorded in figure 66 and table 9 because one of the members was found in the erosional level overlying the Site C Unit 4.5.1 matrix- is a small flake fragment found in square I 24 (I 24/1), which could be

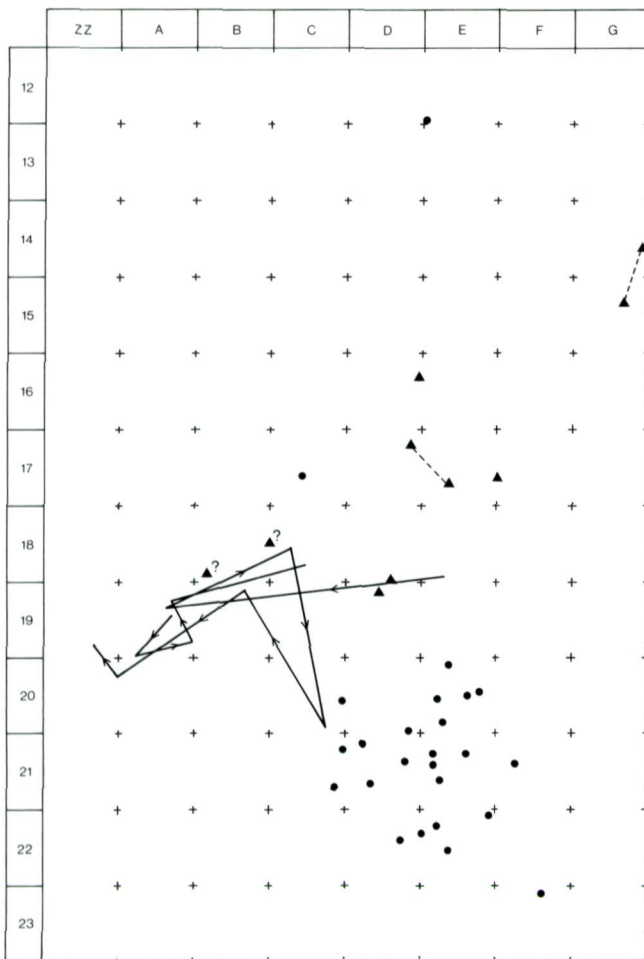


Fig. 64. Site C, RMU 6: horizontal distribution of conjoined elements and isolated larger flakes. Two detachment sequences are shown for Block 1, while the individual dots show the position of the conjoined elements constituting Block 2. The triangles stand for the larger RMU 6 flakes, as discussed in the text, while the question marks show flakes of which it is not certain whether or not they belong to RMU 6. Grid in square metres.

conjoined to D 21/90, found lying about 5 m away. The small I 24/1 fragment was embedded in the stone layer deposited after the erosion of the Unit 4.5.1 sediments, and had probably been transported over a short distance in that erosional phase.

Most of the flakes discussed here were probably broken in the process of knapping. It is unlikely that the weight of the sediment was responsible for this, because only a small number of conjoined flake fragments were found lying close to each other, thus suggesting breakage in the geological matrix.

The data provided by the conjoining of broken flakes may not be regarded as proof of a 'spatial integrity' of flint

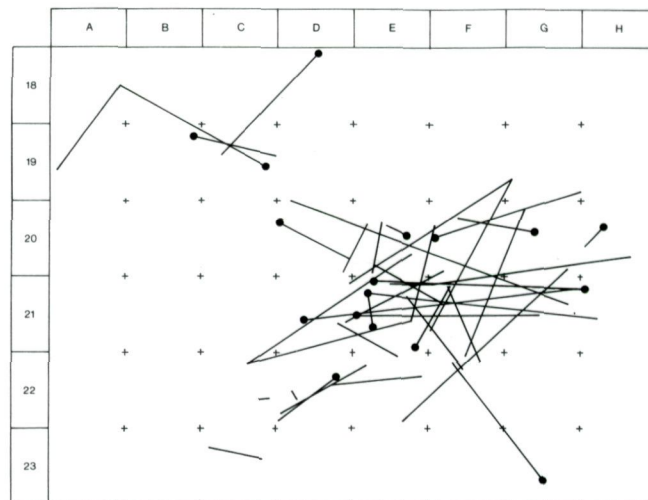


Fig. 65. Site C: horizontal distribution of conjoined broken flake fragments. The dots indicate fragments with maximum dimensions of more than 2 cm. The cluster in the top left hand corner consists of RMU 6 flake fragments, while the large cluster consists mainly of RMU 5 artefacts. Grid in square metres.

scatters, in this case of those of Site C. More experiments must be carried out before the question can be answered as to whether or not a horizontal distance of 2.75 m between the conjoining fragments of a split bulb indicates post-depositional disturbance.

Awaiting the results of such experimental studies, we can fairly confidently say that the Site C scatters underwent some form of horizontal disturbance, which can, however, have been only minimal as appears from the results of the conjoining studies. From the data provided by the refitted broken flake fragments we can infer that the larger distances observed in some cases between ventral/dorsal refits of larger flakes can indeed be interpreted in terms of hominids selecting flakes for use and/or moving to a different flint-knapping site. The latter possibility seems to apply to the RMU 2 and RMU 3 flint-working areas, which moved

Table 9: Site C: Horizontal distribution of conjoined broken flake fragments, grouped according to size.

horizontal distance (cm)	sets with members		% of total
	0-2cm	≥2cm	
0 - 50	9	6	20.3
50 - 100	6	11	23
100 - 150	11	5	21.6
150 - 200	3	5	10.8
200 - 250	4	2	8.1
250 - 300	3	2	6.7
300 - 350	1	-	1.3
350 - 400	1	3	5.4
400 -	-	2	2.7

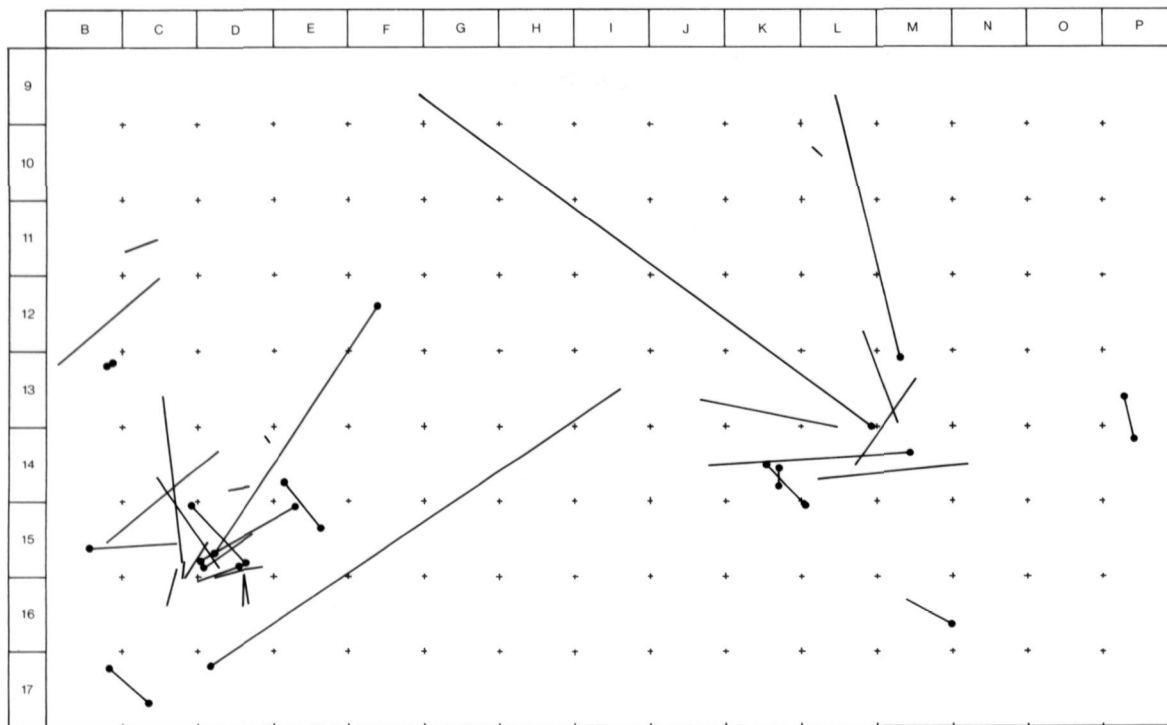


Fig. 66. Site C: horizontal distribution of conjoined broken flake fragments. The dots indicate fragments with maximum dimensions of more than 2 cm. The cluster in the left of the figure consists of RMU 3 and 4 fragments. RMU 2 flake fragments are visible to the right. Grid in square metres.

from the northern to the eastern part of the site and from the southern to the central part, respectively, as can be seen in figures 51 and 54. The RMU 4 products were distributed partly around the main concentration of debris, while the RMU 5 material showed no indications whatsoever of 'transport' of selected items inside the excavated area. The RMU 6 conjoined flakes were clearly clustered in two areas, again indicating that the flint-knapper(s) moved to a different knapping spot.

VERTICAL DISTRIBUTION OF CONJOINED ELEMENTS:

Figure 67 gives vertical plots of refitted flakes from Site C. To account for the steep slopes caused by post-depositional karst, the depth of refitted artefacts within a continuous narrow (1-m wide) strip is shown for the squares of grid E. Furthermore we have to stress the fact that the vertical distribution of conjoining elements as shown in figure 67 is influenced by the fact that the slope of the karst subsidence is not only south-north, but also east-west oriented; this resulted in a wider vertical distribution, even within an only 1-m wide strip.

As can be seen in figure 67, most of the conjoined artefacts were found over vertical distances of 5 to 20 cm, but larger vertical distances are, however, not exceptional. No

attempts were made to quantify the average vertical dispersion, as this is highly problematical in view of the karst processes which affected the site. In the field, however, we gained the distinct impression that heavier pieces tended to lie near the lower margin of the vertical distribution. The karst disturbances make it impossible to quantify this impression. The degree of vertical displacement of conjoining elements at Belvédère Site C agreed fairly well with previous findings at other sites with a (very) fine sand matrix (e.g. Cahen/Moeyersons 1977; Bunn *et al.* 1980; Barton/Bergman 1982; Villa 1982; Villa/Courtin 1983; Hofman 1986).

It is not possible to point out one agent as primarily responsible for the vertical dispersal observed at Site C. We may however exclude biological activity as a major agent, as neither macroscopical nor microscopical bioturbation was observed in the matrix of Site C. As stated above, the matrix was pedologically classified as the B3tg/Cg horizon of a gleyic luvisol (Mücher 1985).

In recent years the effect of trampling has been stressed in this context (e.g. Gifford/Behrensmeier 1977; Villa 1982; Villa/Courtin 1983). At Belvédère Site C, however, trampling cannot have played a significant role, because the site was very probably used for a short while only. Moreover, it

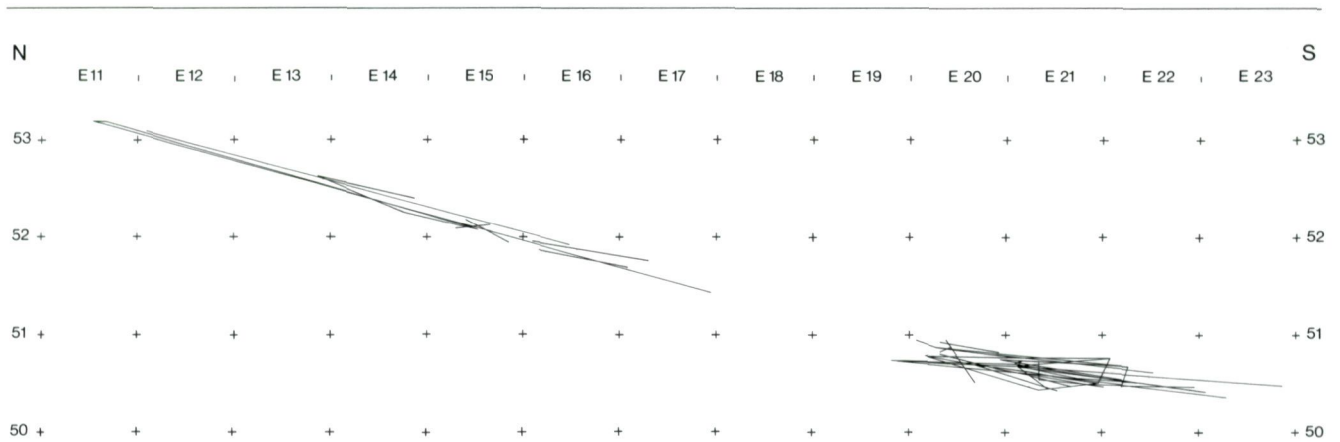


Fig. 67. Site C: vertical distribution of conjoining elements in a north-south 1m-wide strip ('E' squares). Grid in metres. Graphic representation according to figure 45, model C.

is very likely that in the Unit 4 sedimentary environment the palaeosurface of this open-air site was covered with sediment shortly after occupation.

As suggested for the British Upper Palaeolithic site Hengistbury (Barton/Bergman 1982), the vertical distribution could have been caused by differential inertia and the weight of the artefacts themselves. From the sections we know that the matrix of Site C had been affected by frost action (see 4.2.5.5). Finally, Cahen and Moeyersons (1977) have shown that alternate wetting and drying of sediments can lead to vertical movements of artefacts.

The cumulative effect of these three agents (weight, frost action, alternate wetting and drying) was probably largely responsible for the post-depositional vertical movement of artefacts at Site C.

TRANSPORT ACROSS THE SITE AND BEYOND:

The refitting programme clearly showed that flakes of RMU 4 and 6 were struck outside the excavated area, and were subsequently imported to the site. As these RMU 4 and RMU 6 imported flakes were found in the neighbourhood of the larger bone fragments, it is tempting to regard these flakes as having been imported together with the (meat and) bone material, or at any rate to be associated with it. Quite apart from this interpretation, the site can be interpreted as an area where preparatory flint working took place, the core product of which was taken to another spot, where it was reduced. Flakes produced in that stage subsequently returned to Site C.

In addition to evidence that can be used for extremely 'reconstructional' behavioural inferences, the refitting work produced sound indications of the chronological relations of some of the flint-knapping activities. As we already know,

the majority of the burnt artefacts were found in the southern part of Site C and most were of RMU 5. About 10% of the 162 elements that formed the reconstructed RMU 5 'core' was severely burnt. These burnt flakes were randomly distributed within the concentration of RMU 5 debris. There were no relations observable between knapping stages and burning of artefacts. This means that this burning occurred after the flint working. As stated above, part of the RMU 6 debris distribution coincides with the western part of the RMU 5 distribution. However, none of the flints of a block of 25 refitted RMU 6 elements was burnt; in fact, not one RMU 6 flint showed signs of burning. If we do not wish to ascribe these differences to pure chance -as is indeed not our intention-, we have to assume a chronological difference between an earlier formation of the RMU 5 distribution and its burning and a later formation of the RMU 6 pattern, a time difference that may, however, have been as short as only one night.

The refitting programme discussed above provided clear evidence of the dynamics of the flint processing in- and outside the excavated area of Site C in terms of the horizontal transport of the different RMUs and their products. The presence and absence of the products of different flint-working stages are related to the complex character of cultural site-formation processes. The evidence provided by RMUs 3 and 4 and RMUs 5 and 6 demonstrates that the spatial clustering of artefacts does not necessarily have to be related to actual association in use (cf. Cahen *et al.* 1979). The refitting evidence led us to conclude that each RMU recovered inside Site C had a different 'life', reflecting different attitudes of Middle Palaeolithic man in regard of flint-working and -handling processes.

The Site C refitting evidence suggests that the Unit 4

sediments at Belvédère might contain spatial flint configurations ('sites') with only a few indications of flint knapping 'on the spot', i.e. sites into which prepared cores were introduced and where flakes were struck from these cores, which were then, sometimes, discarded after use. The core and (some of) the flakes were subsequently taken away, to be used at another site. This 'dynamic' model, centred around the differential transport of flint artefacts, *might* offer an explanation for the complete absence of hammerstones at all of the Unit IV sites excavated so far (1987).

4.2.5 NATURAL SITE-FORMATION PROCESSES

4.2.5.1 Introduction

Inferences on natural site-formation processes have to precede conclusions on the rôle of human behaviour in the formation of the archaeological record. Therefore, in this paragraph the natural processes that affected the cultural material of Site C and the methods for determining their occurrence and effects will be reviewed in a more systematic way than has been done above.

4.2.5.2 The burial stage

As stated above, the archaeological remains were encased in a fine sand-silt-loam matrix, indicative of low-energy deposition of the fluvial sediment in the unstable phase of the first K-cycle. Micromorphological sediment analysis showed that the archaeological remains were buried very calmly and gradually (Mücher 1985).

The molluscan evidence, obtained at the boundary of the excavated area in a low topographical position (section Mol.2 in: Meijer 1985), indicates that the local sedimentary environment was a calm one. This is apparent from the *Bithynia* ratio, i.e. the ratio between the opercula and shells of *Bithynidae* present in the sediment (see fig. 130, based on Meijer 1985).

As this *Bithynia*-ratio can be a useful indicator of site-formation processes in the case of sites in a fluvial environment, it will be discussed here in some detail, following Meijer 1985. It is assumed that when the opercula and shell ratio is not 1:1, a certain degree of sorting has taken place as a result of movement of the water (Sparks 1964; Gilbertson/Hawkins 1978). River sediments generally contain more opercula than shells, and in most cases shells are even completely lacking, which is explained by the different behaviour of the *Bithynia* elements: after the animal has died the shell starts to float on the surface of the water, and after a while the operculum becomes detached and sinks, while the shell continues to float and is later incorporated in sediments elsewhere. Over-representation of opercula in a sediment therefore indicates a net loss of shells, which is usually caused by sorting processes. The shells, however, are much more vulnerable to dissolution, which means that the ratio can also be a product of leaching processes. In

places where the river flows less quickly and the water becomes stagnant or where a floating vegetation captures floating shells, shell accumulation may take place. In such 'shell-trap' environments shells without opercula outnumber the opercula of the individuals living there.

Of course the *Bithynia* ratio only gives an impression of the sedimentary environment of a limited area during the formation of the analysed sediments: in our case it provides information on a water body present at the boundary of the areas sampled in our excavation of Site C. Short periods with higher water energy may have occurred without noticeable changes in the *Bithynia*-ratio.

The molluscan evidence furthermore indicates that the whole area must have been covered by a dense undergrowth, which very probably limited horizontal displacements of archaeological remains in the burial stage.

The archaeological evidence suggests that displacement of materials must have been minimal; three lines of evidence will be reviewed here, the refitting data, the size distribution of the flint material and the sieve residue.

1. The fact that, as shown above, conjoining pieces tend to be clustered spatially clearly indicates that there was very little post-depositional disturbance, certainly when combined with the size distribution of these fragments as presented in figure 46. The majority (abt. 60%) of the fitted elements were smaller than 3 cm.

2. The size distribution of the three-dimensionally recorded flints has already been given in figure 28; abt. 75% of the flints has maximum dimensions of 2 cm, and 45% has maximum dimensions of 1 cm (this last percentage increases to 52.8% if we include the 536 chips recovered from the sieve residue of 38 square metres. As the ratio of the sieve residue and the three-dimensionally recorded flints of the sieved squares is in most cases about 1.35 and this residue is dominated by small chips, we could even suggest that the original Site C assemblage contained $1368 + (1.35 \times 1368)$ small chips, i.e. in total more than 3000 pieces with maximum dimensions of less than 1 cm). The horizontal distribution of the different size classes shows large and small flint fragments lying side by side (fig. 27).

3. The sediments of 38 m² of the 264 m² excavated -irregularly distributed over the excavated area- were sieved through a 2-mm mesh screen (for 'palaeontological sieving' a mesh-width of 0.5 mm was used). The sediment of another 20 m² that had been stored in the Belvédère brick factory to be sieved later became inaccessible when the town of Maastricht started to use the storage room for the overnight storage of large quantities of industrially polluted sediment, thus blocking the samples. Figure 68 shows the ratio of the sieve residue and the three-dimensionally recor-

ded flints of the southern part of the site. The majority (abt. 75%) of the three-dimensionally recorded artefacts are smaller than 2 cm, while the majority of the fragments in the sieve residue are smaller than 0.5 cm. The horizontal distribution of the sieve residue (fig. 68) corresponds very well to the distribution of the three-dimensionally recorded artefacts. Because this applies to all the screened square metres, we may infer that the flint assemblage of Site C was not the object of sorting processes resulting in a winnowing pattern.

To conclude, there are good reasons for assuming that the archaeological debris was hardly disturbed during the burial stage and that the spatial configuration may be used for behavioural inferences.

4.2.5.3 Soil formation

According to the micromorphological analysis of one section of Site C (Mücher 1985, Mi 6), the archaeological assemblage was situated roughly at the boundary of the Cg and B3tg horizons of a gleyic luvisol. In general terms this means that during the formation of the palaeosol the stable land surface lay at least 1 m, and more probably 1.5 m, above the level containing the archaeological remains (Mücher, pers. comm., 1985). We have to conclude that after the initial burial of the cultural remains sedimentation continued until about 1.5 m of sediment had been deposited.

During the formation of Palaeosol I, in the stable phase of the first K-cycle, the sediments of Unit IV were greatly decalcified (pH now varying from 6 to 8.6). Here and there, the presence of patches of calcareous tufa on top of Unit IV-C-I prevented the decalcification of the underlying sediments and saved faunal material from complete destruction. No clear signs of bioturbation were observed in the thin section of the sediments, which means that the observed vertical dispersion of artefacts must for the greater part have been caused by other processes.

4.2.5.4 Erosion

In an unstable phase preceding the deposition of the Unit V-B deposits the palaeosol present in the top part of Unit IV-C/V-A was severely truncated; at Site C the entire A horizon and almost all of the B horizon were eroded in an erosional phase which may have destroyed many 'Site-C-like' flint and bone scatters originally present higher up in Unit 4. If the erosion had continued for another 50 cm, the spatial configuration of Site C would have been completely destroyed. In the western part of the trench of Site C the erosional level lay very close to the upper limit of the vertical distribution of the finds.

In the southern part of the site a small erosional gully cut into the find scatter over an area of abt. 1.5 m² (squares

	C	D	E	F	G	H	I
21	36	152	90	49	19	8	2
22	65	$\frac{123}{102}$	$\frac{93}{63}$	$\frac{64}{46}$	12	$\frac{2}{4}$	0
23	18	$\frac{2}{15}$	$\frac{16}{7}$	$\frac{7}{10}$	$\frac{4}{2}$	$\frac{3}{1}$	0
24	0	0	0	$\frac{2}{2}$	$\frac{0}{2}$	2	0

Fig. 68. Site C: ratio of the sieve residue and the three-dimensionally recorded flint artefacts for the southern part of the excavated area. The ratios are shown in black, while the grey numbers refer to three-dimensionally recorded artefacts from squares which were not sieved. See the text for an explanation.

D-21, D-22 and D-23). Two artefacts were found at the point where the bottom of the gully reached the Unit 4 matrix; they could be refitted to material found deeper in the Unit 4 sediment. This erosional phase probably preceded the one mentioned above.

4.2.5.5 Frost action

The matrix of Site C underwent cryoturbation, which in all probability occurred after the formation of the Unit IV complex. Frost action may have been one of the processes responsible for the vertical dispersion of artefacts in the matrix. In studying molluscs from Unit 4, Meijer (1985) noticed that many *Bithynia* opercula were broken, but that the fragments were firmly cemented together; many thin-walled larger gastropods had been completely preserved but had been crushed in the sediment. Meijer (1985) ascribed these phenomena to post-depositional movements in the sediment; frost action may have been one of the agents of these post-depositional movements.

4.2.5.6 Karst formation

The greater part of the original stratification of the site was affected by the dissolution of the Palaeocene chalk of the underlying Unit 1.

At Site C the karst features could be dated relatively accurately on the basis of the following observations:

1. No great differences in sediment thickness were observed in Unit IV or in Unit V. Such differences are related to the presence of sediment-traps. This means that no visible karst-related processes took place during the deposition of Units IV and V.
2. It can be said for the Belvédère pit as a whole that the

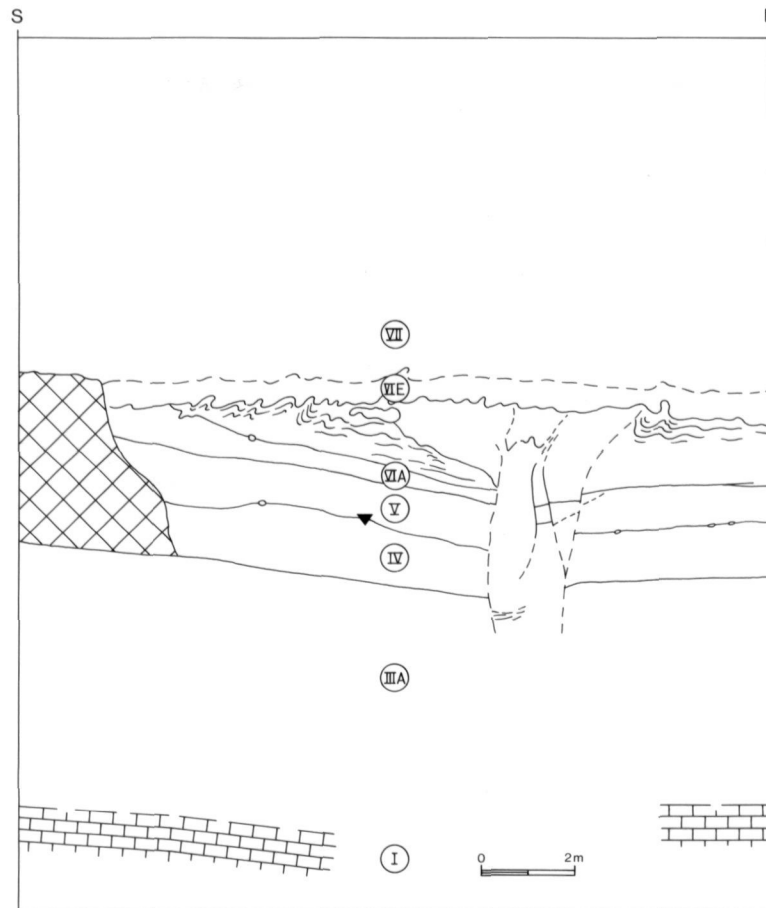


Fig. 69. Section in the southeastern part of Site C, showing a karst-generated disturbance. Indicated are the lithostratigraphical Units, while the triangle at the boundary of Units IV and V indicates the position of the core shown in figure 109. (after the original field drawing by W.M. Felder, State Geological Survey, Heerlen).

palaeosol present on top of Unit V (the 'Eemian' Sol de Rocourt) was truncated more or less evenly over the whole area studied so far.

3. The following units subsided into karstic depressions: Units III, IV, V and VI-A. The subsidence of these Units was in many cases accompanied by slump faulting (Vandenberghe 1985a).

4. The -practically levelled- Horizon of Nagelbeek (VI-E; Haesaerts *et al.* 1981) was observed everywhere on top of the fills of these depressions.

Figure 69 gives an illustration of these observations in the form of a drawing of a section immediately adjacent to the Site C excavation.

On the basis of these and similar observations at other sites, the majority of the karst features at Belvédère can be dated, the formation of Unit VI-A serving as a *terminus post quem*, and that of the Horizon of Nagelbeek as the *terminus ante quem*. According to the evidence obtained so far, the formation of karst features should therefore be dated between ± 100 and 20 ka, the last date being the estimated date of the formation of the Nagelbeek Horizon. Karst had no serious consequences for the spatial con-

figuration of the archaeological material embedded in the Unit 4 matrix because the matrix subsided gradually towards the centres of the karstic depressions; this subsidence is clearly illustrated by the vertical distribution of joined flint artefacts shown above in figure 67.

Near the centres of the karstic depressions, however, the original spatial configuration of the cultural debris will have been severely affected. Fortunately, at Site C these centres did not overlap artefact concentrations and therefore only the peripheries of the flint scatters were affected.

4.2.5.7 Conclusion

To summarize, we may state that the spatial configurations as recorded during the excavation of Site C may be regarded as the material manifestations of human behaviour; on the basis of the data presented above, the cultural material recovered within the area excavated is considered to have been found in a primary archaeological context.

4.2.6 SPATIAL ANALYSIS

Although it is tempting to regard the cultural material from Site C as having been produced simultaneously, i.e. genera-

ted in one continuous and very brief period of activity, we have no sound evidence to corroborate such a supposition. We therefore have to evaluate the possibility that the spatial pattern of Site C is the cumulative product of events that were spaced through time (Kroll/Isaac 1984).

The different knapping phases in which the flint scatters were produced were very probably of short duration. From the refitting evidence of the lithic debris we cannot infer any considerable overlapping of activities related to the manufacture and use of the flint artefacts. However, in square H-14 flakes of RMU 2 and RMU 4 were found very close to each other, at the same depth, as was also observed in the case of the fragments of RMUs 4 and 6 found in square C18 (see fig. 26). This could be interpreted as the result of the vertical dispersion of flints through the sediment though. An alternative explanation is that the horizontal and vertical distribution patterns of these flakes (and bone fragments) are the result of the contemporaneous use and discard of these stone 'tools' by man.

The fact that the different flint scatters inside the excavated area 'respect' each other might indicate a spatial organization of the activities at the site, pointing to the simultaneous production of different flint scatters as an interrelated series of activities.

The limited spatial analysis to be presented below is based on the *assumed* contemporaneity of the different artefact scatters. The word 'assumed' is stressed here because in the author's opinion the problem of 'contemporaneity' is often overlooked in the spatial analysis of lithic scatters.

This topic has been discussed by Kroll and Isaac (1984), who stress that many authors tacitly assume that stratigraphically concentrated archaeological finds can be interpreted as indicative of living floors whose spatial configurations were formed in a single, continuous period of occupation. In this way an artefact distribution is regarded as the blueprint of the camp-site's layout and no alternative hypotheses are given for the formation of the spatial configurations.

In this context Kroll and Isaac use the terms organized versus compound entity: sites may have been formed as organized entities, in which the total configuration is indicative of the associated use of space, or as compound entities, in which behaviourally meaningful patterns can best be determined if the individual 'site uses' can be resolved. Of course, sites like Site C can only be subjected to spatial analysis if it is assumed that all of the materials studied in the analysis were deposited in *one* consistent form of use of the site studied. This means that we have to assume that Site C may be regarded as an organized entity.

The first question in the (1984) spatial analysis of Site C was, whether we were looking at basically two independently deposited find categories, i.e. whether the excavated flint scatter was superimposed over an already existing, naturally

formed bone distribution (or vice versa). In this case one would not expect statistically significant spatial relations between the stones and the bones. This would more probably be the case if hominids had been involved in the formation of the flint assemblage *and* the bone assemblage.

An important observation in this respect is that all the bone material of Site C was stratigraphically concentrated at the same level as the flint artefacts. Horizontal nearest neighbour analysis of 41 larger bone fragments from the site gave a Clark/Evans ratio of 0.39, indicating a clustered distribution (Hodder/Orton 1976: 40).

Furthermore, the bone material was not only stratigraphically concentrated at the same level as the flints, but visual inspection revealed that bone fragments also tended to occur in the neighbourhood of larger flakes.

In order to analyse this inferred relationship, the distribution was recorded of 43 flints and 41 bone fragments measuring 5 cm or more. The sample of 43 flints used in this analysis in 1984 consisted of the tools and flakes with use retouch listed in table 6 and regular flakes with straight cutting edges, with maximum dimensions of 5 cm or more.

Generally speaking, spatial analytical methods can be divided into two categories: one considering the excavated area in relation to the artefacts, and the other dealing with the artefacts only. Both approaches will be discussed here.

The first approach is based on the presence and absence of artefacts in the grid squares and in a first approximation the contingency table 10 was drawn. Such contingency tables are extensively used in plant ecology and different measures of association have been suggested (Hodder/Orton 1976; Orton 1980), of which Chi-square, Q and V are the best known.

$Q (= ad - bc / ad + bc)$ and $V (= ad - bc / (efgh)^{1/2})$ both vary from +1 for positive association to -1, complete dissociation. Q and V equal 0 when there is no association, i.e. when expected and observed frequencies coincide. The data given in table 10 result in values of $Q = 0.6$ and $V = 0.2$, values which may be interpreted as indicating association. From the data of table 10 a Chi-square value of 10.78 was

Table 10: The distribution of flint artefacts and bone fragments (≥ 5 cm) at Site C.

		flints		
		present	absent	total
b o n e s	absent			
	present	8 (a)	18 (b)	26 (e)
	absent	22 (c)	216 (d)	238 (f)
	total	30 (g)	234 (h)	264 (n)

computed, indicating that for one degree of freedom the probability of independence of the two distributions is only 0.001. Therefore a statistically significant dependency could be inferred between the two distributions, which would mean that the flints and bones are related in one way or another. However, in the present case, the Chi-square value is largely determined by the contents of cell d of the table (no bones, no flint). A further increase in the number of empty quadrats would suggest an even stronger relation. As suggested by Van de Velde (this volume, appendix II), a useful approach could be to choose the sum of the quadrats covered by the individual distributions as the domain that is the sum of the table in cell (n) relative to which the two distributions are studied.

The adjusted table 11 constructed in this way gives Q and V values of -0.6 and -0.3, respectively, which in this case imply segregation. The Chi-square is now 10.39, which again means that for one degree of freedom the probability that the distributions are independent is abt. 1:1000. This time, however, segregation is indicated in accordance with the Q and V values.

Of course, not only the number of empty cells determines the results of the analysis; the outcome is also greatly dependent on the size of the quadrats used, in this case quadrats of one metre. However, on account of the -karst-determined-irregular shape of the excavated area, Whallon's (1973) method of dimensional analysis of variance could not be applied here (cf. Orton 1980: 146-149).

Of the techniques which concentrate on the artefacts themselves, and are therefore independent of the number of empty squares, nearest neighbour analysis should be mentioned. Nearest neighbour analysis of the flints and bones resulted in the following table (table 12).

This distribution yielded a Chi-square of 15.49 for one degree of freedom significant at the level of 0.001, which indicates segregation. For this kind of data Pielou (1961) suggested a coefficient of segregation (Hodder/Orton, 1976: 205): $S = (c + b)N / (eh + fg)$. S varies from +1, when the distributions are completely segregated, i.e. are situated in

different areas, to -1, when flints and bones are found in isolated pairs of one flint and one bone. $S = 0$ when the two find categories are randomly intermingled. In our case the segregation coefficient is 0.43, which points to a segregated distribution.

The nearest neighbour analysis therefore essentially yields the same results as the adjusted quadrat-count method, both indicating segregation of flints and bones. The initial quadrat counts (table 10) gave us what could be termed a 'bird's-eye view' of the distribution of the two find categories inside the excavated area, while the nearest neighbour and adjusted quadrat-count methods zoomed in on the distribution *per se*, yielding information on a finer scale than the first attempt.

Both attempts, while operating on different scales, seem to indicate that there are statistically significant spatial relations between the two find categories, suggesting hominid involvement in the formation of the spatial distribution; on a larger scale, the flints and bones seem to lie close together, while on a finer scale segregation is apparent, indicating that the bone fragments were 'tossed away' from the spot where the flints were discarded.

These interpretations are, admittedly, based on a very limited analysis, which started from the assumption that the finds were deposited during one continuous use of space. This assumption has not been falsified, but has not been 'proven' either!

Independent depositional events *can* lead to the same spatial pattern as an organized use of space. But such a supposition can only be verified with the aid of 'archaeological' evidence in the sense of established relations between individual flint scatters as determined by the conjoining of lithics (Cahen/Keeley/Van Noten 1979). This, of course, does not imply that the absence of such relations between flint scatters indicates the lack of any spatial organization of activities. We will return to this topic in the next section.

Table 11: As table 10, with adjustments according to Van de Velde (this volume, appendix II)

		flints		
		present	absent	total
b o n e s	present	8 (a)	18 (b)	26 (e)
	absent	22 (c)	8 (d)	30 (f)
	total	30 (g)	26 (h)	56 (n)

Table 12: Nearest neighbour distribution of the flints and bones (≥ 5 cm) of Site C, indicating the number of times that a flint artefact has as its nearest neighbour a flint (a) or a bone (c), etc.

		nearest neighbour		
		flint	bone	total
b o n e s	flint	30 (a)	11 (b)	41 (e)
	bone	13 (c)	30 (d)	43 (f)
	total	43 (g)	41 (h)	84 (n)

4.2.7 INTERPRETATION

The 'organized versus compound entity' discussion referred to above is of essential importance in the interpretation of the data of Site C in terms of human behaviour. One of the participants in this discussion is Binford, who repeatedly stresses the notion, that

'The archaeological record must be understood in terms of a different temporal perspective than is characteristic of our own or of ethnographer's experience in cultural systems.' (Binford 1987: 20).

Actually, we are here confronted with the major methodological problem

'... whether archaeologists can accurately reconstruct aspects of the lives and behaviors of early hominids that are not simply untested extrapolations from familiar modern patterns ...' (Kroll/Isaac 1984: 6).

One of the topics around which this discussion has been centred is that of the 'living floor' concept, which has been used by Binford (1987) in one of his attacks on the approach which places modern forms of behaviour back in time, using present-day hunter-gatherer groups as 'stones of Rosetta' to interpret archaeological patterns:

'The willingness ... to accommodate the data from the archaeological record to the researchers' prior beliefs regarding the character of early hominid life resulted in a decade of published material purporting to describe the character of culturally organized camp life among the early hominids. It is not surprising that this elaborate view was a simple derivative of the assumptions that guided the arguments justifying the recognition of living floors in the first place. Isaac argued that, at the very dawn of the appearance of tool-using hominids, 'men' were hunters living in social groups characterized by a male-female division of labor. The products of the hunt were returned to sleeping locations (home bases), where altruistic sharing took place among adults as well as with children. The women's role in provisioning was centered on gathering wild plant materials. Thus the social basis of later, more elaborate 'culture' was thought to be in place at the inception of tool use. It was this view of 'hunting and gathering' that both prompted the quest for and justified the indication of living floors, and in turn, living floors were then cited as evidence that this view was correct. Such a procedure is a methodological tautology.' (Binford 1987: 20).

The relevance of this reasoning to the interpretation of the data of Site C is obvious: were the individual flint scatters produced in one consistent use of the site in one short period of time or are they the results of functionally unrelated activities, independent depositional events? The point is that we have no data that allow us to choose unambiguously in favour of one of the two options.

Another 'frustration' is the discrepancy between the amount of time and energy invested in the recording of the charcoal concentration in the western part of the excavation and the information eventually gained from this, which is

virtually zero in terms of behavioural evidence! The charcoal was found at the same level as the flint artefacts, and the discovery of two pieces of burnt flint that had broken during burning suggested that the charcoal may be the result of a fire on the spot. But we cannot prove that this fire is associable with hominid occupation of the site, because the concentration bears no relation to archaeological finds in its immediate environs. Of course this does not mean that there was definitely no relationship, only that it is no longer visible in the archaeological record.

The lesson to be drawn from these 'frustrations' is that we have to realize once again that even well-preserved 'sites' do not represent the preserved buried remains of specific 'moments of the past', but are in fact to be seen as buried surface collections (Binford 1986).

In this context it seems meaningless to interpret the data of Site C in terms of one of the site 'types' as described by several authors (e.g. Binford/Binford 1966; Clark/Haynes 1970; Sivertsen 1980). An interpretation in terms of these 'types' is in fact dependent on one's assumptions concerning the humanness of the hominids who created the assemblages.

A negative approach as the one used here leads to very few nett results. When we are interested in the Pleistocene evolution of specific forms of behaviour, however, the absence of indications of, say, organized use of space in specific periods can provide valuable information on cultural changes in the Pleistocene and can focus research on more specific topics. If, for instance, analysis of more *pre-sapiens sapiens* sites should yield the 'same' results concerning the spatial relations between specific find categories as observed at Site C, then the presence of such a pattern could lead to a reevaluation of the interpretation of the individual sites.

The 'organized versus compound' problem is too often neglected, for instance in the publications dealing with Lower and Middle Palaeolithic 'hut structures' at Terra Amata (De Lumley 1969a), Bilzingsleben (Mania 1986), Lazaret (De Lumley 1969b) and Rheindahlen (Thieme 1983b). The spatial patterns at these sites have been classified and interpreted without sufficient evaluation of the dynamic processes which caused the actual static patterns. All these interpretations suffer from the 'organized entity syndrome'. For the Terra Amata case P. Villas' refitting studies have shown convincingly that De Lumley's theory concerning hut structures is not very well grounded (Villa 1978, 1982).

The lack of any indications of organized use of space at Middle Pleistocene sites is in marked contrast with the evidence provided by Upper Palaeolithic sites, where relations between individual flint scatters have often been established. Refitting studies of the lithic assemblages from the Late Upper Palaeolithic site at Meer (Belgium) have

clearly shown that the various flint concentrations were closely related, and that the site obviously represents a single occupational phase (Cahen/Keeley/Van Noten 1979). Conjoining studies also yielded evidence of relations between flint concentrations at two other Upper Palaeolithic sites, namely Pincevent (France) and Gönnersdorf (West Germany).

Furthermore, unlike that of earlier sites, the patterning of Upper Palaeolithic sites can, often be explained with the aid of a seating-plan model, in which a number of people are grouped around a hearth (Binford 1978; Gamble 1986). Gamble expects

'... such a basic activity to be a feature of sites bearing labels as diverse as hunting sites, ceremonial locations, home bases and overnight transit camps ...' (Gamble 1986: 256).

Such a seating-plan model of discard production around a hearth, with the outermost edges of the toss zone (Binford 1978) lying some 3 m from the centre of the hearth, is seen by many authors as the key with which to interpret sites. Gamble (1986) cites a number of archaeological examples of the three-metres spacing principle, *all* from the Upper Palaeolithic.

As far as the author knows, this 3-m spacing principle is not yet applicable to sites created by *pre-sapiens sapiens* hominids, i.e. it is not possible to divide 'sites' into more workable units of analysis along these lines. Relations between flint scatters comparable to those recorded at Meer and Pincevent have not been published as yet for Middle and Lower Palaeolithic sites. The structures recognizable at Lower and Middle Palaeolithic sites are separate debris concentrations, generated in depositional phases which cannot be convincingly related to one another. This state of affairs may, of course, be due to our selection of sites from the earlier time periods; so far only relatively few early primary context sites have been discovered. Another explanation is that the differences in spatial patterns are related to basic differences in organizational capacities between hominids of different time periods.

As for the individual depositional phases that led to the formation of the Site C entity, the conjoining studies have indicated that we have to regard Site C as a fixed point in a dynamic system of the transport of flints in the form of cores, finished flakes and tools. This topic will be discussed in more general terms in chapter 9.

The limited spatial analysis presented above has demonstrated that hominids were very probably involved in the formation of the spatial distribution of bones and stones at Site C, either in several depositional phases or in one consistent use of space. In view of the character of this spatial relation it seems legitimate to suppose that at least some of the flint artefacts at Site C were discarded in meat procurement activities (Van Gijn, this volume, appendix I). We will

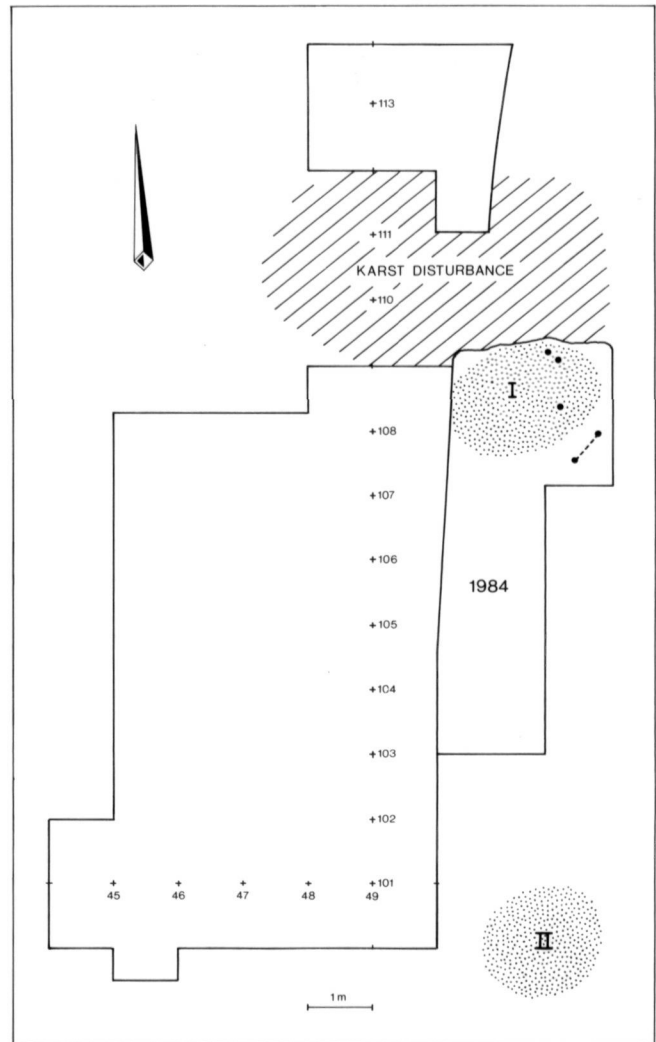


Fig. 70. Site G: position of the Site G excavation and the earlier (1984) find concentrations.

return to this topic in a general discussion of the Unit IV sites in chapter 9.

4.3 Site G

4.3.1 INTRODUCTION

In the context of the ESR dating programme of fossil material from Unit 4, Dr R. Grün and Mr O. Katzenberg (Cologne) visited the Belvédère pit on November 28, 1984. During this visit, Mr P. Hennekens observed a large concentration of molluscs in one of the new sections in the top part of Unit 4. The next day the section was sampled for the purpose of ESR dating of the molluscs; during the fieldwork on November 29 and 30, 1984, P. Hennekens, J.P. de Warimont and K. Groenendijk discovered five artefacts and a burnt flint (198411/bf) in association with bone fragments.

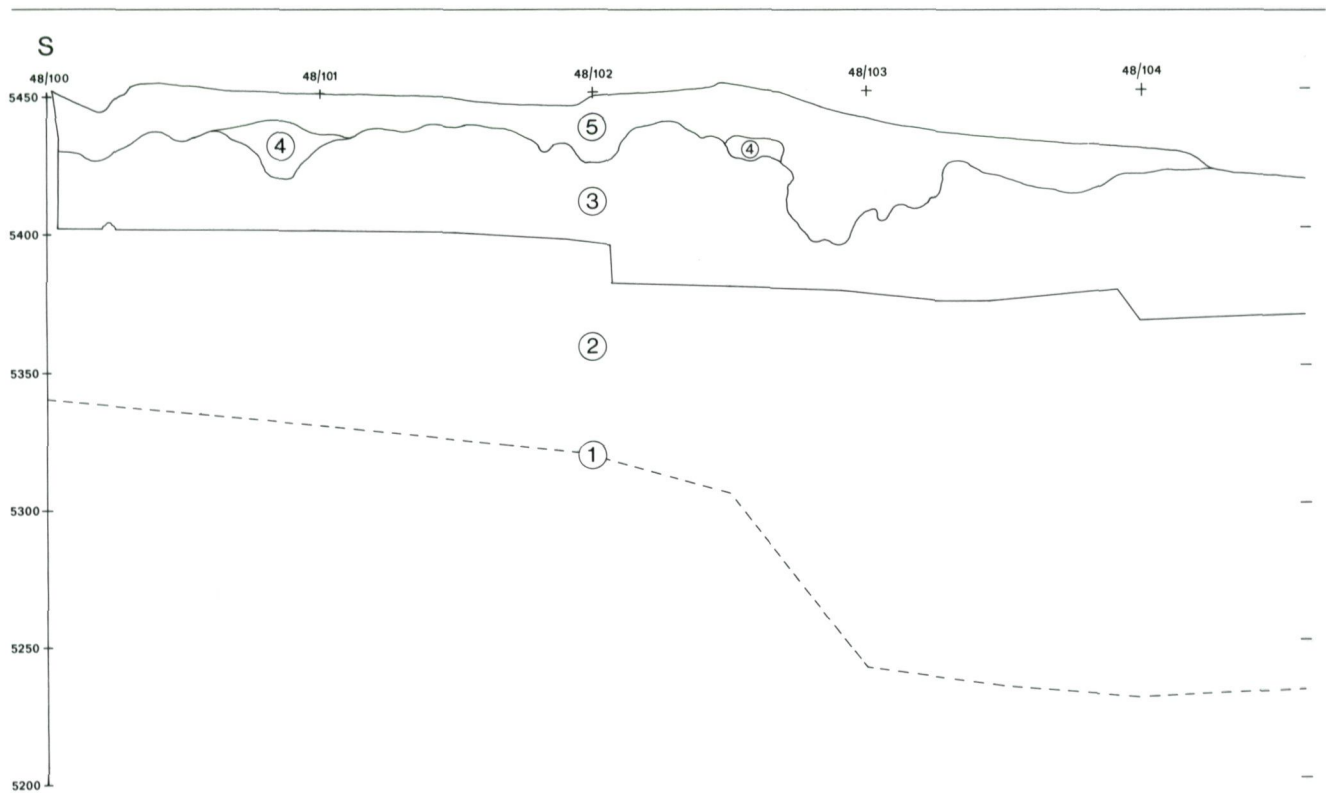


Fig. 71. Site G: idealized south-north section through the eastern profile of the '48' squares:

- 1 top of the (Unit 3) gravel, as inferred from the results of borings
- 2 fine laminated sands (2.5 Y 7/2), calcareous in parts, with intercalated gravel layers (Unit 4.4), gradually developing into
- 3 fine loamy sand (2.5 Y 5/3) with reddish yellow (5 Y 6/8) mottles, containing artefacts and faunal remains in its upper part. Calcareous in parts (Unit 4.5.1/IV-C-I)
- 4 silt loam (2.5 Y 7/3) with fine sand. Calcareous. At its base it here and there contained fine gravel and artefacts (calcareous tufas, Unit 4.5.2/IV-C-II)
- 5 silt loam (7.5 Y 6/6) containing Mn and Fe mottles and gravel at its base (Unit 5.1/5.2/IV-C-II/V)

This bone material had been well preserved underneath the calcareous tufa (Unit 4.5.2). A small trial pit of 11 m² was excavated, which showed that the bone concentration was limited to abt. 2 m², although the preservation conditions were the same all over the excavated area. In December J.P. de Warrimont found a second bone concentration to the south of the first one, this time without flint artefacts (fig. 70).

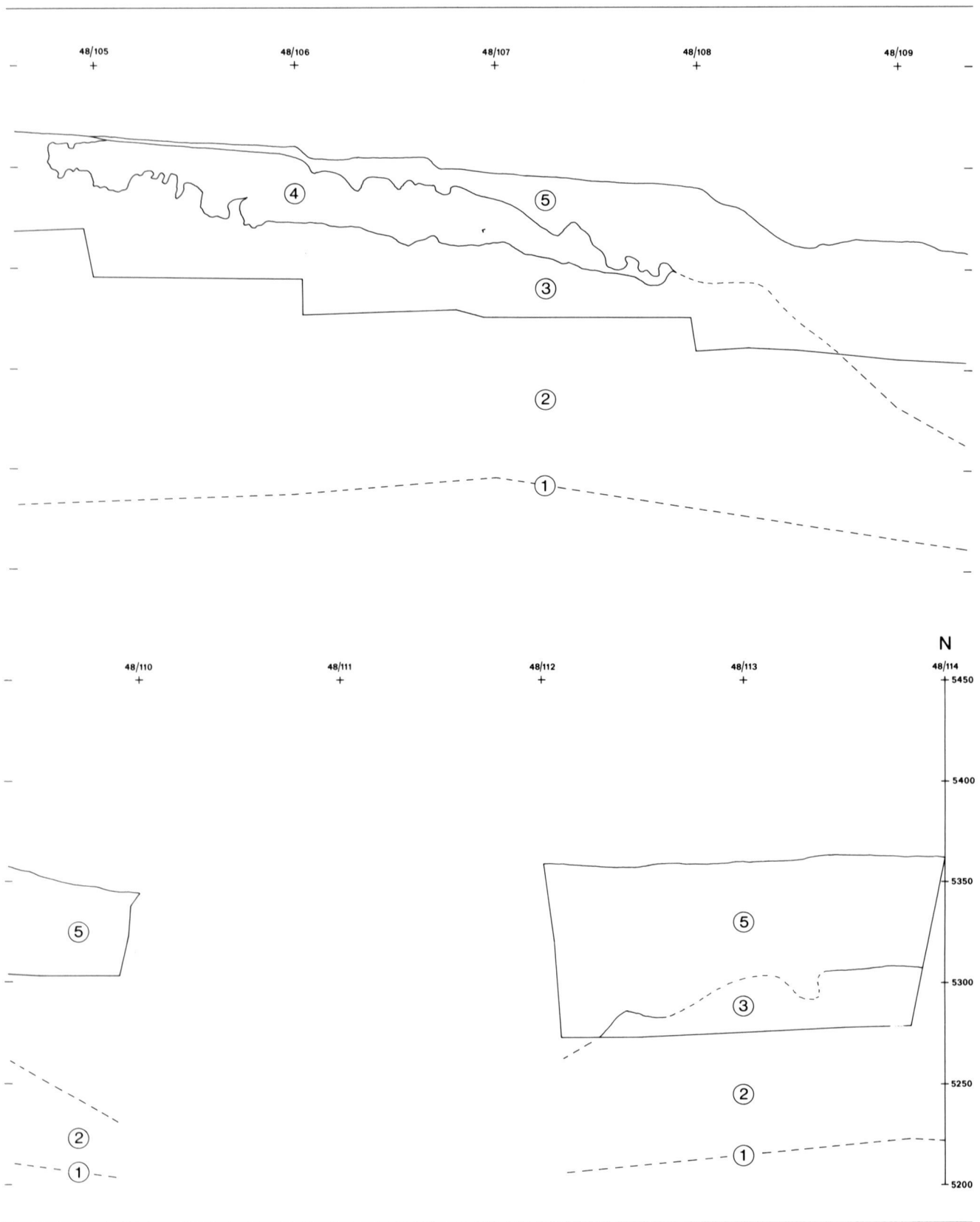
The value of these first observations is limited since the Unit 4 sediments had already been removed before the discovery of the site in the immediate neighbourhood of the investigated area.

Thanks to the friendly cooperation of the exploiter of the pit, Mr F. Blom, arrangements could be made to excavate part of the undisturbed Unit 4 sediments west of the first discoveries.

The excavation took place from 3 June to 7 August, 1985, with a crew of, on average, ten people. In total, an area of

50 m² was excavated. The excavation was done in the usual way, as described for Site C. In view of the local abundance of molluscs and remains of small mammals in the matrix, the soil from 14 squares was sieved through a 0.5-mm mesh screen, in 5-cm thick layers.

Another bone distribution had already been recorded earlier, in 1983, about 30 metres south-southeast of the first bone concentration mentioned above and in the same stratigraphical position. At this spot the top part of the Unit 4 sediments contained several poorly preserved bone fragments, in particular an ulna of *Elephas* sp. (Van Kolf-schoten 1985), and a few tiny flint scraps dispersed over an area of abt. 100 m². This 'site' was discovered during quarrying activities, and was destroyed that same day by the digging operations. No detailed recording had been possible, but the observations are of interest and relevance to the 1985 excavation.



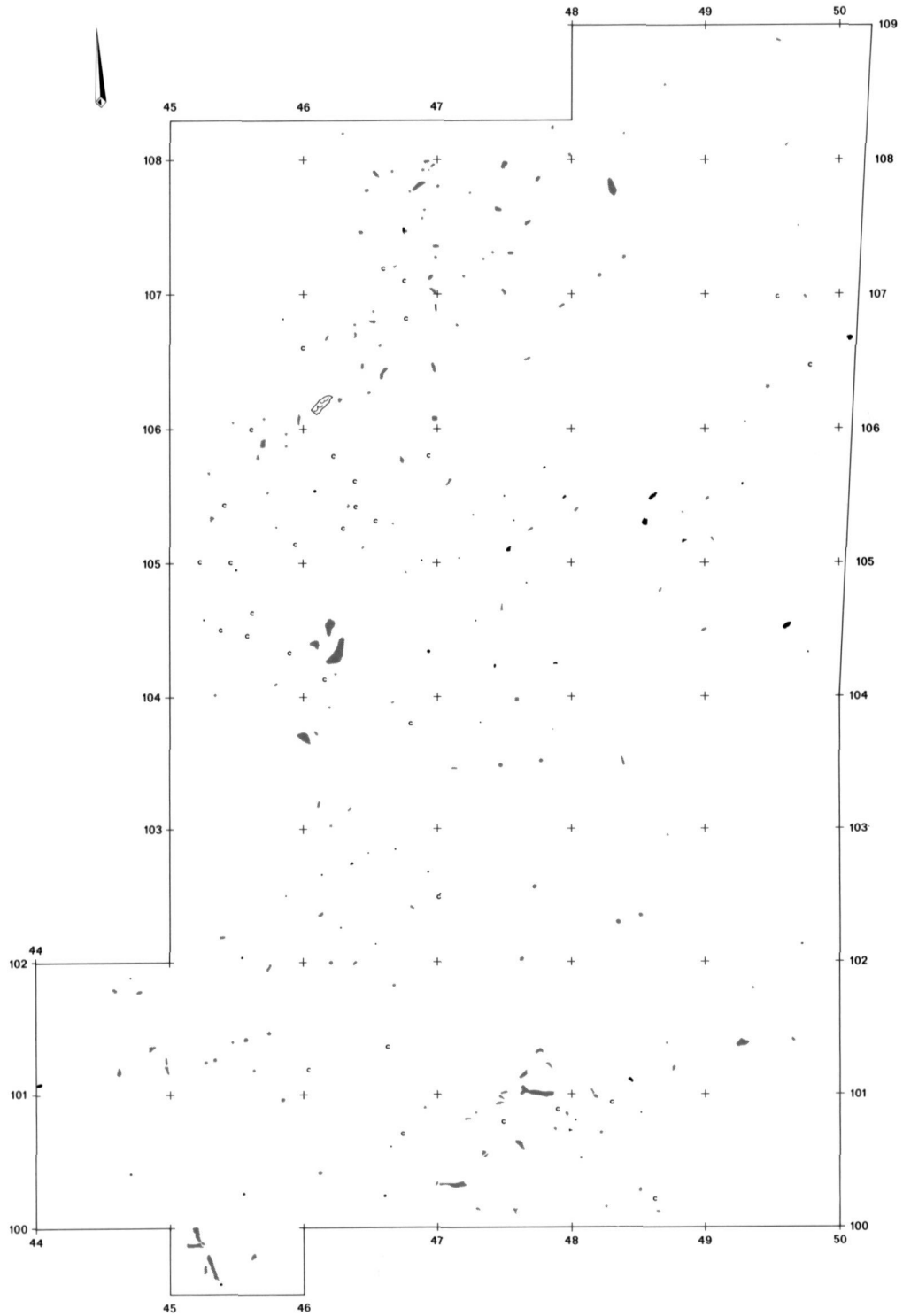


Fig. 72. Site G: horizontal distribution of recorded finds. Scale 1:50 (reference grid in square metres). Flint artefacts are indicated in black. The position of burnt flints are marked by the letter C, while faunal remains are indicated in grey.

4.3.2. STRATIGRAPHY

Figure 71 gives a schematic cross-section of the excavation, from south to north, indicating the lithological Units distinguished by Vandenberghe *et al.* (1985).

Two remarks have to be made with respect to figure 71:

1. The overall majority of the flint artefacts and bones recovered from Site G were found in the top part of the finely grained fluviatile sediments, underneath the calcareous tufa.
2. As at Site C, karst processes had disturbed parts of Site G, as is clearly visible in figure 71.

4.3.3 THE FINDS

4.3.3.1 Introduction

During the excavation of Site G the following find categories were encountered: flint artefacts, burnt flints, bone material of larger mammals, remains of small mammals and molluscs. These last two categories will not be discussed in this section, because they are not related to human activities. They will be presented in chapter 8, which deals with the palaeoenvironment of the Unit IV sites. Here the other find categories will be presented, along with their spatial distributions.

4.3.3.2 The flint material

In November 1984 four flint artefacts were found in the northern concentration of bone fragments: a small flake, a broken flake and two conjoinable fragments of a retouched blade (fig. 74-3).

In the 1985 excavation 54 flint artefacts were recorded, half of which were smaller than 2 cm (fig. 73).

The larger flakes had clearly been struck from prepared cores. The differences in raw materials show that the flakes had been produced from at least three different flint nodules. Almost all larger flakes have finely faceted butts. Particularly noteworthy is a 16.5-cm long backed knife (46/106-11) (fig. 75), the back of which is a lateral edge of the large prepared core from which it was struck ('*éclat débordant*' *sensu* Beyries/Boëda 1983).

Also a remarkable find is a large blade-like flake (fig. 74-1), found in two fragments lying 20 cm apart in horizontal direction in square 48/105. The basal fragment of the flake shows signs of far more intensive use than the other one, which indicates that the basal fragment continued to be used after the piece had broken.

The larger flakes from site G were studied for traces of wear by A. van Gijn (this volume, appendix I). Two 'fresh' flakes displayed clear traces of use. According to Van Gijn, flake 47/105-3 (fig. 74-5) had been used to cut meat. The backed knife mentioned above displayed an interesting wear pattern, described in detail by Van Gijn (this volume, appendix I). The traces of wear led her to the conclusion that the backed knife may have been used to cut the skin of

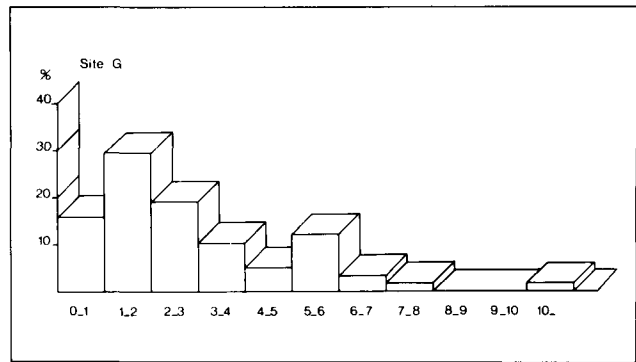


Fig. 73. Size distribution of the Site G flint assemblage, based on maximum dimensions, in cm.

an animal with a thick hide, like an elephant or a rhinoceros, probably during butchering activities. At the time of her study of the artefacts from Site G, Van Gijn had no knowledge of the presence of faunal remains at Site G. In actual fact, the backed knife was found amidst rhinoceros remains in the northern part of the site (see below).

In total, 23 artefacts were refitted, forming the following groups of conjoining elements:

- 6 groups of 2 conjoining elements
- 1 group of 3 conjoining elements
- 2 groups of 4 conjoining elements

Almost half of the conjoining elements consist of refitted elements of broken artefacts. The refitting indicated that some flint-knapping was done at the site: the two larger ventral/dorsal conjoining flakes 48/101-17 and 49/104-3 must have been produced inside the excavated area because some very fine flaking debris (< 1 cm) could be refitted to them (ventral/dorsal). Figure 76 gives the spatial distribution of the refitted elements. From the differences in the raw materials used at Site G and the refitting evidence it is clear that

- a) at least six larger flakes were introduced into the excavated area after having been produced elsewhere; e.g. the retouched flakes shown in figure 74 and the large backed knife mentioned above
- b) at least two larger flakes were produced inside the excavated area because some very fine (< 1 cm) knapping debris could be refitted to them.

4.3.3.3 Burnt flints

None of the flint artefacts showed signs of burning. However, a total of 32 burnt -natural- flints were recorded, concentrated mainly in the northwestern part of the site, as indicated in figure 72. Some of these -generally small- burnt flints were submitted to Oxford for TL dating. The rather concentrated character of the distribution of these finds indicates that we may be dealing with the consequences of a

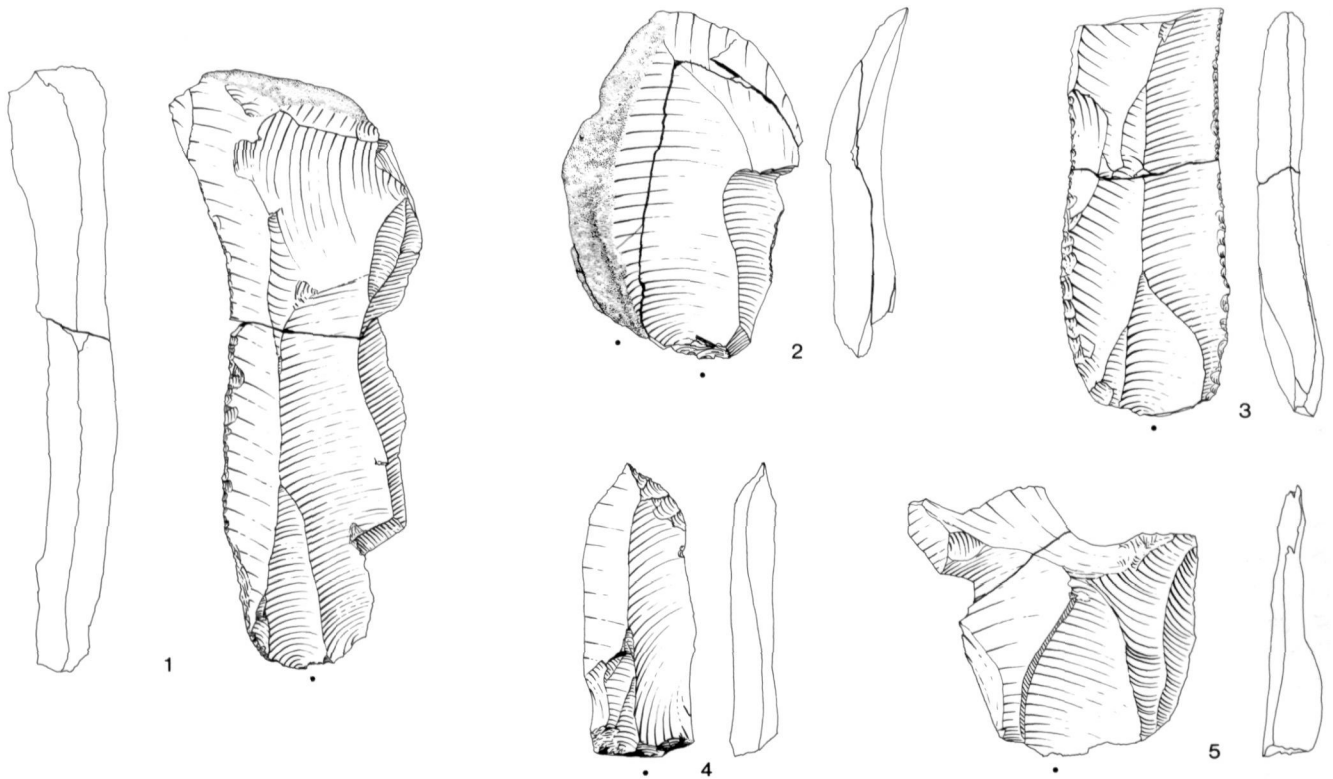


Fig. 74. Site G: flint artefacts, 1 retouched flake consisting of two conjoined fragments, 2 conjoined flakes, 3 retouched flake (side scraper) consisting of two conjoined fragments (from the area excavated in 1984), 4 retouched flake, 5 flake used to cut 'meat' (47/105-3). (Scale 2:3).

fire that burned inside or close to the area sampled in the Site G excavation.

4.3.3.4 Faunal remains

The faunal remains found at Site G, most of which were recovered in a poor state of preservation, were studied by Van Kolfshoten. Table 13 gives a survey of the identified species, the minimum number of individuals (MNI) for each species, and the number of identified elements (NIE).

The horizontal distribution of the faunal remains recovered from Site G is given in figure 72. Figure 77 gives a distribution plan of the identified dental elements.

Van Kolfshoten (pers.comm. 1986) kindly communicated the following comments on the individual species.

Rhinoceros:

Several molars and molar fragments were found in the northern part of Site G, which could be ascribed to two young rhinoceros individuals of the species *Dicerorhinus hemitoechus*. One young individual was represented by hardly worn deciduous molars from the upper dentition, another by worn deciduous molars and premolars, also from

Table 13: The faunal remains from Site G. Indicated are: identified species, minimum number of individuals (MNI) and number of identified elements (NIE).

Determinations by T. van Kolfshoten (pers.comm., 1986).

species	MNI	NIE
rhinoceros (<i>Dicerorhinus hemitoechus</i>)	3	15
roe deer (<i>Capreolus capreolus</i>)	2	8
red deer (<i>Cervus elaphus</i>)	2	10
straight-tusked elephant (<i>Elephas antiquus</i>)	1	2
bovid (<i>Bovidae</i> indet.)	1	1

the upper dentition. This part of Site G also yielded larger bone fragments, consisting mainly of fragments of upper limb bones. The absence of metapodes and phalanges is striking. A few skull fragments were also found. South of this 'rhinoceros concentration' two badly worn molars of one (or two) old rhinoceros (*D. hemitoechus*) individual(s) were found. Furthermore, rhinoceros remains were found in November-December 1984 in the northern (I) and southern (II) bone concentrations, namely a radius and a sacrum, respectively.

Red deer:

Molars and molar fragments of *Cervus elaphus* were found in the southeastern part of the site. Three molars had belonged to an adult individual. Fragments of shed antler, a humerus, a metacarpus and a skull were furthermore recorded inside the excavated area. In December 1984 the southern bone concentration east of Site G (II) yielded a metatarsum of red deer, while rib fragments found in the northern bone concentration (I) (November 1984) may also have belonged to *Cervus elaphus*.

Roe deer:

Two individuals are represented in the *Capreolus capreolus* remains: an adult individual is represented by one molar, while six molars and molar fragments had belonged to a young adult individual.

Bovid:

A young large bovid was represented by one molar.

Elephant:

Two molar fragments could be ascribed to *Elephas antiquus*.

The fragmented state of the bone material does not allow us to determine which animals are represented by which skeletal parts: roe deer, bovid and elephant could only be identified by means of molar fragments. It is remarkable that the identified rhinoceros remains consist only of fragments of upper limb bones and cranial parts. Other skeletal elements are missing, with the exception of the sacrum and radius found in 1984 in the two bone concentrations east of the excavation proper. The upper limb bones are mainly represented by medial (diaphyse) elements. The clustered rhinoceros molars of two young individuals are all upper jaw elements. The identified red deer elements are all fragments of upper limb bones and the skull. The rib fragments in the northern concentration may be from a red deer too. According to Van Kolfschoten (pers. comm., 1987), the typical fragmentation of the bone material cannot be ascribed to post-depositional processes, but may point to intentional fragmentation on the spot. The absence of gnawing marks on the few well preserved bones suggests fragmentation by man.

The faunal remains from Site G can be divided into two groups on the basis of their state of preservation. Group 1 is characterised by a type of bone preservation which is quite common to the majority of the bone fragments from Site G and to the bones from (calcareous) Unit 4 sediments: brittle, light and porous bone material, of a yellowish-brown colour, which easily breaks along irregular lines. Group 2 consists of fossilized, heavier bone fragments, with sharp edges and a dark brown colour. This bone material tends to



Fig. 75. Site G: Large flake (46/106-11) struck from the lateral side of a prepared core (*éclat débordant*). Scale 2:3.

break along internal, parallel lines.

In order to analyse these differences in bone preservation two bone samples (type 1: 46/106-15; type 2: 45/104-2) were subjected to X-ray fluorescence analysis. The penetration and emission depth of the X-ray bundle (diameter 1 cm) used to analyse the samples was about 0.5 mm. With this method we thus obtained information on the composition of a sample of about 0.5 mm x 1 cm². In order to penetrate deeper into the bone fragments, about 1 mm of the outer part of sample 2 was scraped off.

The results of the X-ray fluorescence analysis are shown in figure 80. Figure 80a shows the results after the bone fragments had been cleaned. Both samples contained large amounts of Ca and P, which are the principal components of bone. Al and Si are elements from the sediment. These were present in larger amounts in the porous type 1 sample than in the type 2 sample. The type 2 sample clearly contained significantly larger amounts of Fe and Mn than the

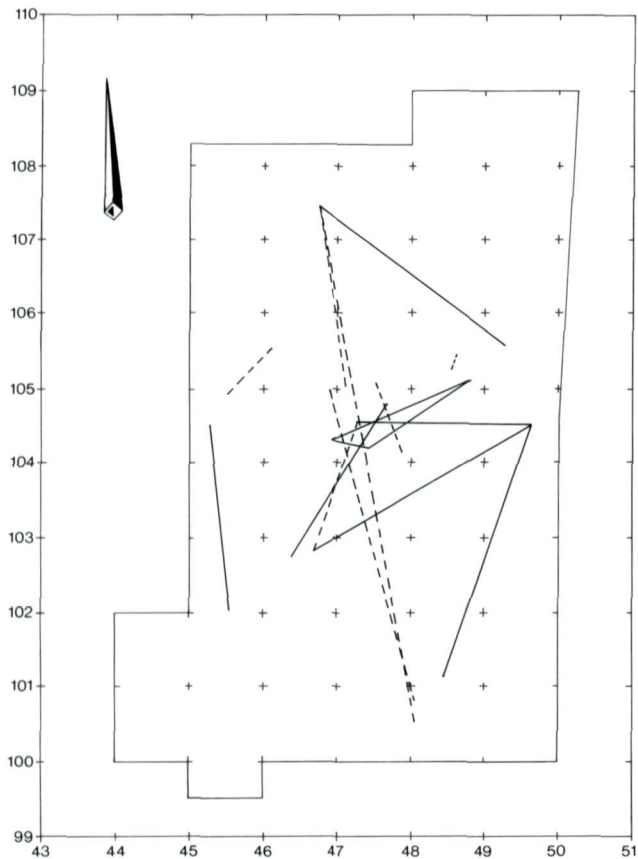


Fig. 76. Site G: horizontal distribution of conjoined flakes and flake fragments. Scale in metres.

other sample. Most remarkable is the presence of the rare element Yttrium (Y) in both samples.

Figure 80b shows the results of the first (= fig. 80a) analysis of the type 2 sample and those of the analysis after 1 mm had been scraped from the outside of this bone fragment; we note remarkable differences: Al and Si were no longer detected in the second analysis, while small amounts of K, Mn and Y were found. The same values were obtained for P and Ca, while the proportion of Fe was found to have increased. Figure 80c shows a detail of figure 80b.

On the basis of these data the remarkable differences in bone preservation are interpreted as caused by infiltration of Fe and Mn, related to soil-formation processes. A very rough estimate of the amount of Fe and Mn in the type 2 sample is 10% (J.P. de Warrimont, pers.comm., 1985).

4.3.4 INTERPRETATION

Site G obviously formed only a small -non-quantifiable- part of a larger flint and bone distribution, of which about 60 m² could be recorded. The presence of karst features in the excavated area indicates that any faunal material originally

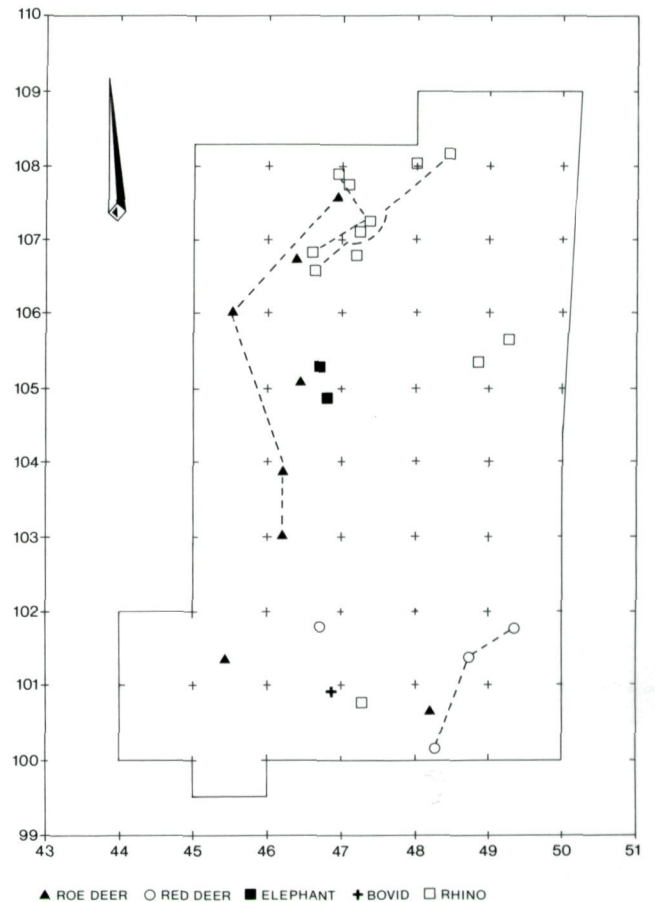


Fig. 77. Site G: horizontal distribution of identified dental faunal remains. Scale 1:100. The lines link the remains that had probably belonged to one and the same individual.

present there was very probably destroyed. It is clear that the formation of the Site G assemblage and its horizontal distribution involved a complex interplay of several factors, of which human activities are clearly attested by flint artefacts but other (non-human) factors certainly played a part too.

Binford (1981) has discussed the problems involved in the interpretation of this kind of assemblages in great detail. Two of the concepts used by him in this respect are the *historical integrity* and the *relative resolution* of 'materials stabilized in depositional association through the operation of geological processes' (1981: 19).

Historical integrity

'... refers to the degree to which inclusions within the deposit derived from the same or different dynamic conditions in the past. For instance, if all the materials in a deposit derived from the actions of hominids, we could argue that the deposit had considerable integrity ...' (Binford 1981: 19)

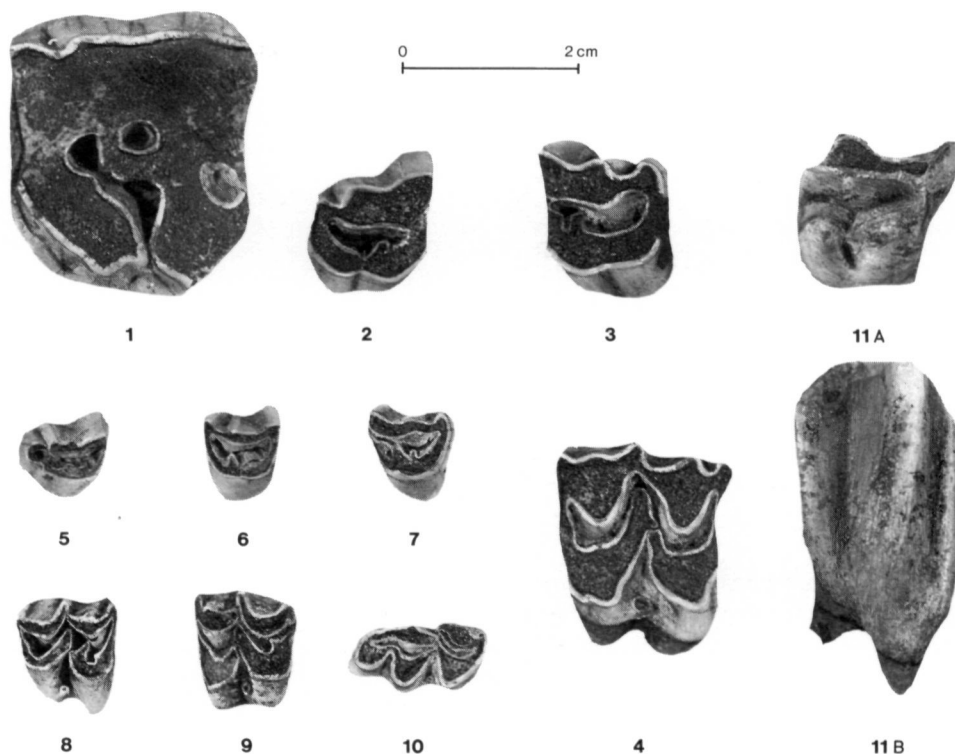


Fig. 78. Site G: some of the identified dental elements.

- 1 *Dicerorhinus hemitoechus*: dp2 sin., worn milk molar (46/106-12)
 - 2 *Cervus elaphus*: P3 sin. (48/101-9)
 - 3 *Cervus elaphus*: P4 dext. (49/101-16)
 - 4 *Cervus elaphus*: M1 dext. (48/100-14)
 - 5 *Capreolus capreolus*: P2 sin. (46/105-3)
 - 6 *Capreolus capreolus*: P4 dext. of a young individual (45/106-4)
 - 7 *Capreolus capreolus*: P4 sin. of a young individual (46/107-7)
 - 8 *Capreolus capreolus*: M1/M2 of a young individual (46/103-24)
 - 9 *Capreolus capreolus*: M1/M2 sin. (46/103-27)
 - 10 *Capreolus capreolus*: M3 dext. of an adult individual (48/100-22)
 - 11 a/b: P2 sin. of a young (adult) bovid (46/100-1)
- Photos published by courtesy of T. van Kolfschoten (Utrecht).

The relative resolution

'... of an accumulation of material is to the degree to which items and classes of materials may be referable to a specifiable and limited, hence unambiguous set of events or actions in the past. Assemblages with high resolution are assemblages in which all parts are referable to the set of events or conditions in the past. Resolution of assemblages may vary independently of the degree of integrity ... it should be clear that *integrity refers to the relative homogeneity of the agents responsible for materials in a deposit*, whereas *resolution refers to the relative homogeneity of the events or situational conditions* whose by-products are preserved in the deposit ...' (Binford 1981: 19).

It is very difficult to make positive statements about the historical integrity and the relative resolution of the Site G assemblage. Such sites are usually -at best- interpreted by means of arguments from elimination, which, as stated by Binford (1981: 83), have two basic premises:

- a) all the potential causes are known and listed
- b) all but one of those listed are not the cause of the phenomenon in question.

A major problem in this kind of argumenting is that

'... for an argument from eliminating to be valid, one must have available unambiguous means for monitoring the alleged 'causes' and therefore a way of actually determining the degree of participation by a suggested cause in a system of past determinacy ...' (Binford 1981: 83).

With these problems in mind, the following lines of reasoning can be constructed for the interpretation of the Site G assemblage.

The combined presence of flint artefacts and faunal remains at Site G can be explained in several ways, which can be reduced to three basic explanations (cf. Isaac 1981):

- 1) both find categories were washed together by 'fluvial activities' or other natural depositional processes like slope wash, gelifluction, ablation of the matrix
- 2) the faunal remains were deposited *independently* of the formation of the artefact assemblage
- 3) human activities were responsible for the combined presence of the two find categories

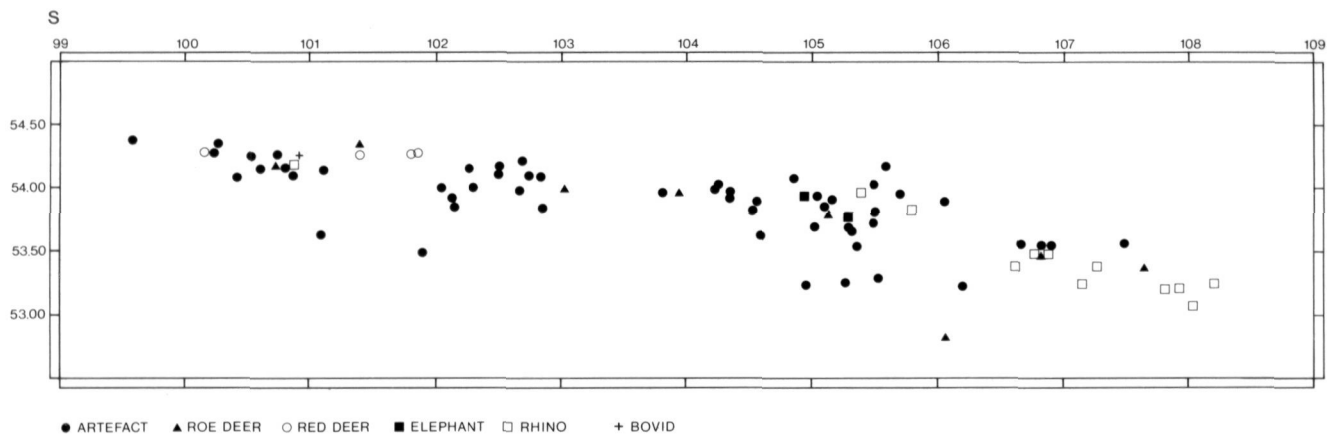


Fig. 79. Site G: vertical distribution of flint artefacts and identified faunal remains over the total site area.

To start with the first explanation, we must first of all take a look at the inferred site-formation processes, which are more or less the same as those described above for Site C. The finely grained Site G matrix contained larger bone fragments, a considerable quantity of molluscs, remains of small vertebrates and fine (< 1 cm) flint debris, which could be refitted to larger flakes. Fragments of two broken retouched flakes were found at a short distance from each other, while the spatial cluster of remains of two young rhinoceros individuals in the northern part of the site suggests a primary context for these remains too. The presence of individual molar (fragments) of a bovid, an elephant and an old rhinoceros is more difficult to explain and can tentatively be related to an erosional phase which *preceded* the formation of the rhinoceros cluster and the flint assemblage. These data indicate that no sorting of any importance had taken place, because the most 'temperate' geomorphic processes sort items according to size in relation to transport energy (Butzer 1982: 193-196). Therefore, the degree in which fluvial processes conditioned the contents of the Site G assemblage must have been minimal. The composition and the spatial arrangement of the Site G assemblage does therefore not seem to be the result of fluvial processes.

With respect to the second suggested cause we could assume that animals died a natural death at or in the neighbourhood of Site G and that Palaeolithic man discarded his artefacts independently of, and without any causal relation to the bone fragments.

This is the problem constituted by the natural background faunas with which archaeologists working in calcareous sediments are regularly confronted. These background faunas may have been formed in a series of very complex processes, in which, for instance, the stray molars mentioned above could have been deposited as a result of the

activities of hyenas (Scott 1986) or other carnivores.

Haynes (1988) has recently published the results of seven years of fieldwork in which he studied hundreds of non-cultural elephant bone sites in southern Africa, from the actual moment of death of the animal or even earlier, right to bone burial or destruction.

'My 7-year field studies around African water sources indicate that elephant bone sites are dynamically undergoing several different processes of site-formation and modification, such as recurring death events, or different degrees of scavenging and trampling over time. The sites change, and attributes of the bone assemblages also continue to change as old bones are trampled, weathered, scavenged, gnawed or destroyed and new bones are added. The sediments containing bones may be reworked and redeposited. Thus, a *brief* study of elephant bone assemblages in the field could never provide useful analogues with which to study fossil proboscidean sites. Site-formation is a process, rarely an event. Very few sites form in only a few moments, or are preserved at once by rapid burial. Far more often an extended amount of time is involved in bone site-formation and fossilization.' (Haynes 1988: 155).

As far as the complex formation processes of natural background faunas are concerned the presence of a relatively large number of identified animals -represented by a small number of remains- poses no problems, not even when allowance is made for the possibility that the Unit 4 matrix of the Site G assemblage was formed in a relatively short period.

This interpretation, however, cannot account for the entire Site G record for the following two reasons. First, according to Van Kolfshoten (pers.comm., 1986) the predominance of (very) young individuals is not in keeping with what may be expected in a naturally formed *thanatocoenose*.

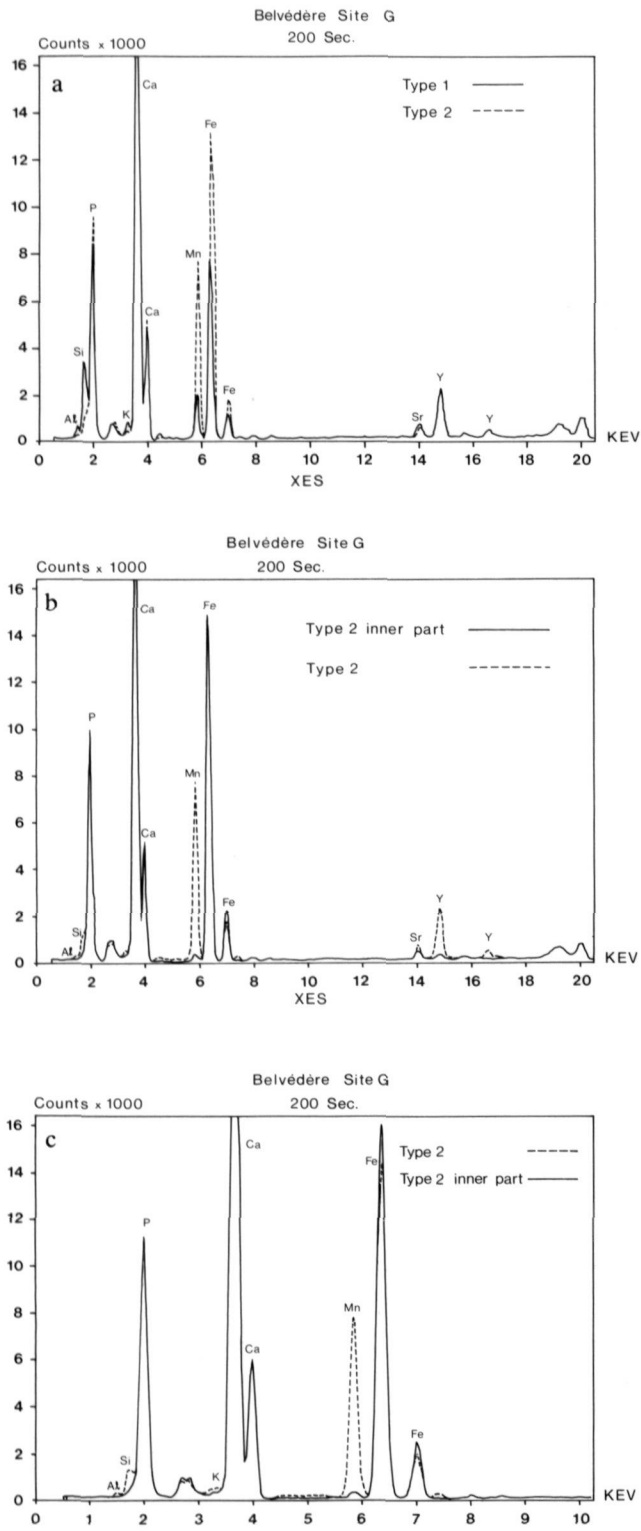


Fig. 80. a, b and c: the X-ray fluorescence analysis results obtained for bone materials from Site G. See the text for an explication.

In order to be able to evaluate Van Kolfschoten's assessment with data on the age composition of fossil assemblages from a comparable environment, I turned to the Lower Pleistocene fauna of Tegelen (province of Limburg, the Netherlands), the type locality of the Tiglian interglacial.

According to Meijer, who studied molluscan remains from Tegelen (Freudenthal/Meijer/Van der Meulen 1976), the fossil assemblages of Tegelen were formed in an environment comparable to the one in which the Unit 4 archaeological assemblages were formed (pers.comm., 1986). It is generally assumed that man was not present in north-western Europe at that time (however, for different views see: Lutschwager/Von Bemmell 1962, and this volume, chapter 9). Therefore, the Tegelen fauna can be seen as a natural *thanatocoenose*, formed in an environment comparable to that of Site G. A thorough study of the Tegelen macro-fauna from the point of view of age classes would provide us with independent reference data for the interpretation of archaeological sites in a similar environment. Such a major task, however, has to be undertaken by a palaeontologist. For the construction of table 14 I used Bernsen's (1927, 1930-1934) descriptions of the remains of larger mammals from Tegelen. Bernsen studied the age classes, which he roughly divided into very young (with deciduous elements), young adult (permanent dentition, hardly any wear), adult, and old (severely worn dentition).

The value of this table is limited, especially in view of the small number of individuals and the lumping of the species involved. The deer remains show a clear and striking dominance of older individuals. Further analysis of the Tegelen fauna might corroborate this preliminary result, which points to a predominance of older animals in a naturally formed *thanatocoenose* (an interpretation which will be further developed and *falsified* in chapter 9). This initially led to the assumption of hominid involvement in the formation of the faunal assemblage of Site G (Roebroeks *et al.* 1986).

Table 14: The age composition of the remains of larger mammals in the Lower Pleistocene Tiglian fauna as published by Bernsen (1927, 1930-1934).

	very young (I)	young adult (II)	adult (III)	old (IV)
Rhinoceros		1	1	1
Horse	2	1	1	1
Elephant				2
Deer	2	2	5	10
Macaca				1
Pig			1	
Bear			1	
Hyena		1		
Total	4	5	9	15

Secondly, and *more important*, there are archaeological indications of the existence of a 'behavioural' relation between the flint assemblage and parts of the faunal assemblage. According to Van Gijn (this volume, appendix I), flake 47/105-3 was used on meat, while the large *éclat débordant* (46/106-11) displayed a combination of traces of wear suggesting that it had been in contact with the hide of a pachydermatous animal. The presence of this artefact among rhinoceros remains gives us the best possible archaeological evidence for translating spatial association in behavioural terms.

The data presented above indicate that man was one of the agents responsible for the formation of the Site G faunal assemblage. The poor state of preservation of most of the bone fragments does not permit identification of any cut marks present, so we cannot indicate which elements are the result of human activities, and which are part of a natural background fauna. A relationship between the presence of young rhinoceros remains and the presence of artefacts at Site G is one of the few positive links that can be constructed from the Site G material.

The post-cranial rhinoceros remains consist mainly of fragments of upper limb bones. Metapodes and phalanges are absent, whereas phalanges in particular are usually well preserved under similar conditions. According to Van Kolfschoten (pers. comm., 1987), this indicates that the composition of the faunal assemblage is partly the result of selection by a collecting agent which concentrated on the meat-yielding upper limb bones which were transported to Site G, together with the heads. It is not possible to make positive statements on the topic whether the animals involved were actively hunted or scavenged. The fact that we are dealing with young animals may be a weak indication of the hunting hypothesis (see, however, chapter 9 for an alternative interpretation).

The Site G refitting evidence fits neatly into the model developed on the basis of the Site C evidence, which suggests that Site C was part of a larger flint-handling continuum, in which cores and finished flakes were transported from site to site; Site G can be interpreted as an area to which finished flakes and prepared cores were taken and from which some were then removed again, and where flint working as such played a minor role.

With respect to the Site G assemblage, we must mention in our final analysis of Unit IV that distributions like the low-density artefact scatter of Site G have a very small chance of being discovered in sections, as opposed to denser scatters of flint artefacts as at Sites C and F. Indeed, seemingly stray flakes were found all over the Belvédère pit in the Unit IV-C deposits. These may have formed part of low-density scatters like that of Site G. In fact, one of the major reasons for excavating Site G were the faunal remains and the few flakes found in an intensive prospection of the section. The findspot of a stray flake without bone

fragments in its neighbourhood certainly received a good deal of attention, but, in the absence of either faunal remains or more flints, this attention was maybe to a factor of 5 to 10 less than that paid to the first Site G finds. It is therefore very probable that the Site G assemblage is only a small part of a larger horizontal continuum, extending at least from Site C to Site G, characterized by a low flint artefact density and many faunal remains, which had only been preserved locally thanks to the calcareous matrix.

4.4 Site B

4.4.1 INTRODUCTION

On July 11, 1981, J.P. de Warrimont found a flake in the silty clays of calcareous Unit 4.5 (2.5 Y 7/3), in an exposure in the (then) northwestern part of the pit. A subsequent study of the exposures by De Warrimont, Groenendijk and the author produced more artefacts in various stratigraphical positions. Furthermore, molluscs, the remains of small mammals and fossils of larger mammals, including a skull of a giant deer, were found. Fragments of a shell of the European pond tortoise (*Emys orbicularis*) were also discovered. In view of the importance of these finds the exposures were mechanically cleaned and recorded over several dozens of metres in August 1981. At the end of August 1981 sediments overlying the find layers were removed to create the Site B cutting, which was excavated from August 24 to September 19, 1981 (fig. 81). The Site B cutting was made in an area which seemed to be devoid of karst features, about 30 m north of the (then future) northern boundary of Site C.

4.4.2 STRATIGRAPHY

Figure 82 shows the stratigraphy of Site B as recorded by the author and H.J. Mùcher, who studied the micromorphology of this section (Mùcher 1985, Mi 3). The Site B cutting revealed two archaeological levels. The lowermost was situated in the silty clays of Unit 4.5.1, which were generally of a greyish-olive colour (5 Y 5/3) with light yellow (2.5 Y 7/3) patches. The other was situated abt. 35 cm higher up in the profile, in a gravel layer at the base of Unit 5.2. This last level will therefore be discussed in chapter 6. The greyish-olive silty clays containing the artefacts were separated from the underlying gravels (Unit 3) by 50 to 70 cm of light grey laminated very fine sand. On top of the silty clay was a coarser deposit, consisting of a sandy loam. This deposit was capped by a gravel layer, containing stones of up to 15 cm.

Mùcher (1985) interpreted the change from clayey to coarser deposits as the consequence of a transition from a relatively calm 'backswamp-like' environment to a more variable environment. Pedologically the clays containing the artefacts are classified as a Cg horizon, probably of a severely truncated gleyic luvisol (Mùcher 1985).

Fig. 81. Site B: the first trial squares, September 1981

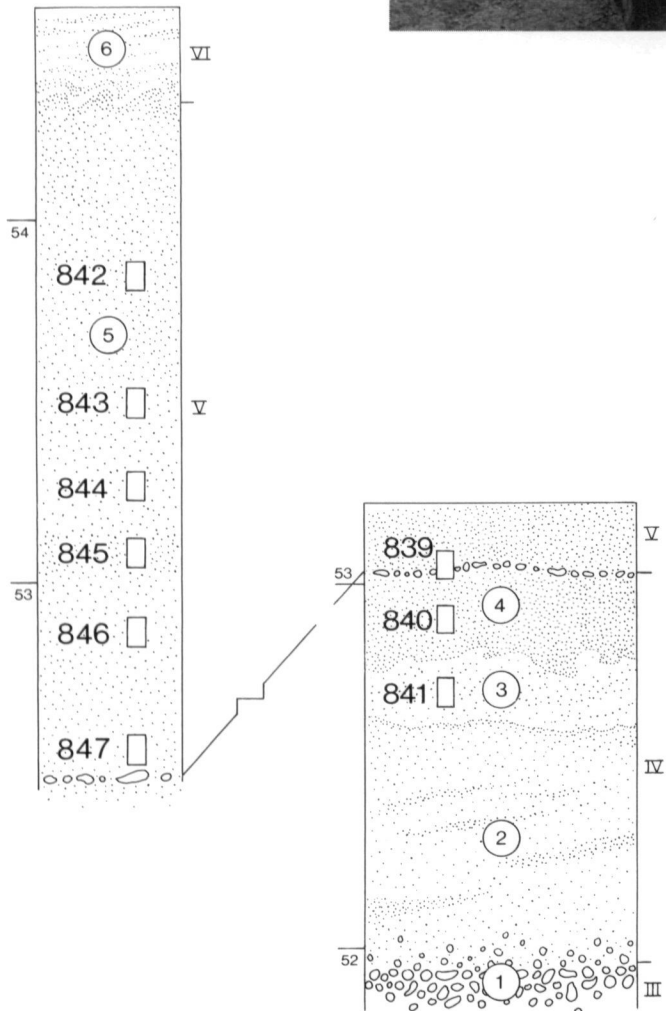
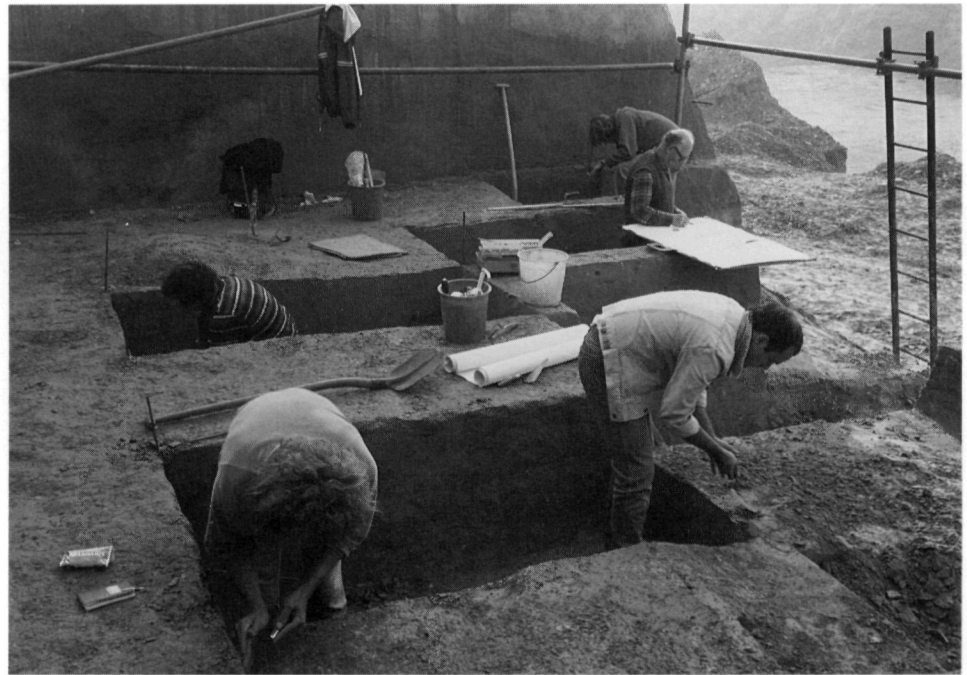


Fig. 82. Maastricht-Belvédère: Site B section sampled for micro-morphological analysis (see: Mùcher 1985).

- 1 the top of gravel unit 3
- 2 light grey (2.5 Y 7/2) laminated loamy very fine sand with light yellowish brown (2.5 Y 6/4) thin clay laminae (less than 5 mm thick).
- 3 olive (5 Y 5/3) silty clay with a massive structure, calcareous in parts, containing reddish yellow (5 Y 6/8) iron mottles. It shows an abrupt and wavy boundary with the horizon below.
- 4 olive (5 Y 5/3) slightly banded sandy loam and loam with reddish yellow (5 YR 6/8) iron mottles. It shows an abrupt and wavy boundary with the horizon below.
- 5 reddish yellow (7.5 YR 6/6) homogenous silt loam with a massive structure. It shows an abrupt and smooth boundary with the horizon below. (At a depth of 53.00-53.10 m +NAP was a horizontal band of brown (10 YR 5/3) silt loam with a massive structure. The layer shows abrupt and smooth boundary with the horizons above and below.)
- 6 pale brown (10 YR 6/3) laminated silt loam showing an abrupt wavy transition to the horizon below.

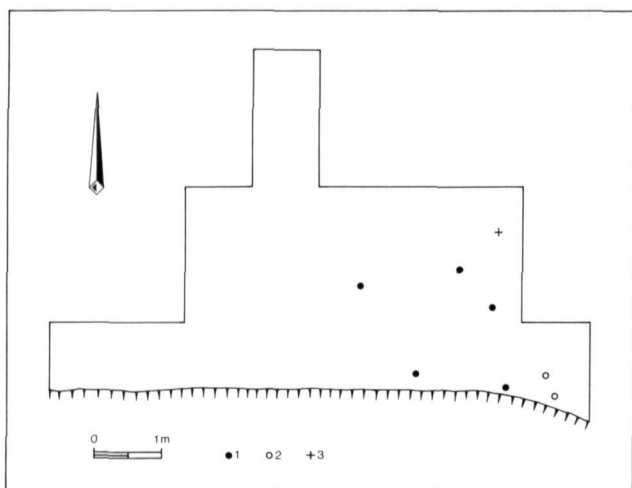


Fig. 83. Site B: Unit IV level, horizontal distribution of finds: 1. flint artefact, 2. bone fragment, 3. charcoal. Scale in m.

4.4.3 THE FINDS

In total, an area of 20 m² was excavated in the Unit 4.5.1 silty clays. This area produced only five flint artefacts and a few bone- and tooth-fragments. The horizontal distribution of these finds is shown in figure 83. Flake Bv 144 (fig. 84-2) was struck from a prepared core. A small flake from Site B (Bv 78) could be refitted to the the find from the first section (Bv 62). The estimated horizontal distance between these two elements was 1 to 2 m. The fact that these flakes could be fitted together indicates that some knapping had taken place at the site.

The Unit 4.5.1 sediments were calcareous in the eastern part of the cutting. Besides molluscs and remains of small mammal, tooth-fragments of red deer (*Cervus elaphus*) were found. Immediately east of the Site B cutting more red deer elements were found over a width of 1 to 2 metres during the sampling of the section for palaeontological purposes. In total, Van Kolfshoten identified five elements from Site B as the remains of red deer (1985). According to Van Kolfshoten the state of wear of a premolar (DP4) and a molar (M1) shows that we are dealing with a red deer which died when it was about half a year old, i.e. at the end of autumn or the beginning of winter. A few more fresh flakes were found in association with these mammal remains in this section, e.g. the flakes 1, 3 and 4 shown in figure 84.

4.4.4 INTERPRETATION

The finely grained character of the silty clays -indicating that the sediments were formed in a calm sedimentary environment- suggests that there might be a relation between the human activities manifested by the flints and the presence of remains of a young red deer. We did not succeed in fitting flakes from the Site B area to flakes from Site

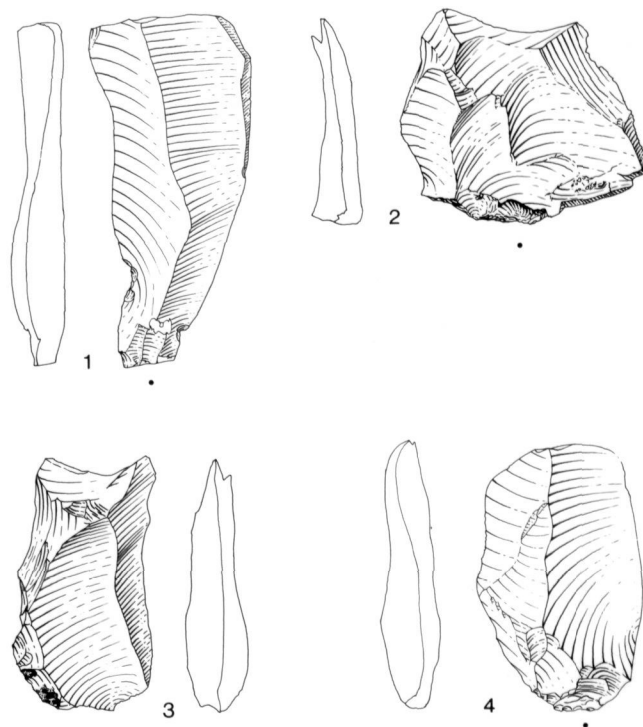


Fig. 84. Four flakes, found in Unit IV-C-I deposits in the W-E section in which Site B was situated (1, 3 and 4) and at Site B (2), scale 2:3.

C, which would have provided us with a strong argument for inferring an interrelationship between these two sites. The Site B cutting opened only a small area in the Unit 4 sediments, too small to allow a detailed interpretation of the scarce data. The few artefacts recovered were found in the southeastern part of the small cutting, which formed the border zone of the concentration of larger mammal bones found in the section immediately east of Site B. We suggest an interpretation along the same line as that developed for the Site G data.

In retrospect it would have been wise to have extended the Site B cutting in an easterly direction but during the excavation of Site B Site C was discovered and the excavation of this site was given priority. Site B was covered with several metres of backfill in 1982, which will have to be removed by future researchers planning to restudy the Unit 4 sediments there (Gonggrijp 1982).

note

¹ After this manuscript had been completed, Dr C. Arps suggested that the presence of the haematite concentrations *might* also have been caused by the heating of iron-hydroxides in the sediment. This is a very interesting suggestion, as the distribution of the haematite dots coincides with that of the burnt flints (see figures 40 and 44).