STUDIA PRAEHISTORICA BELGICA

NFWO
contactgroep prehistorie
FNRS
préhistoire groupe de contact

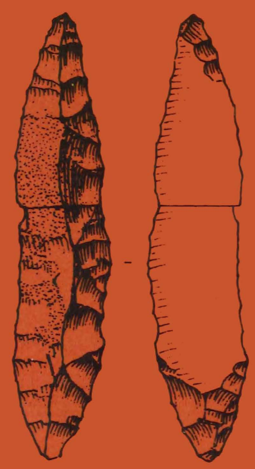
1

# CONTRIBUTIONS TO THE STUDY OF THE MESOLITHIC OF THE BELGIAN LOWLAND

# CONTRIBUTIONS A L'ETUDE DU MESOLITHIQUE DE LA BASSE BELGIQUE

Edited by - Edité par

PIERRE M. VERMEERSCH



Koninklijk Museum voor Midden Afrika

Musée royal de l'Afrique centrale

Tervuren

1982

STUDIA PRAEHISTORICA BELGICA 1

# CONTRIBUTIONS TO THE STUDY OF THE MESOLITHIC OF THE BELGIAN LOWLAND

# CONTRIBUTIONS A L'ETUDE DU MESOLITHIQUE DE LA BASSE BELGIQUE

edited by - édité par

PIERRE M. VERMEERSCH

ROBERT LAUWERS & PIERRE M. VERMEERSCH

UN SITE DU MÉSOLITHIQUE ANCIEN À NEERHAREN - DE KIP

ROBERT LAUWERS & PIERRE M. VERMEERSCH

MÉSOLITHIQUE ANCIEN À SCHULEN

DIRK HUYGE & PIERRE M. VERMEERSCH

LATE MESOLITHIC SETTLEMENT AT WEELDE - PAARDSDRANK

Koninklijk Museum voor Midden-Afrika - Musée Royal de l'Afrique Centrale

Tervuren

1982

Studia Praehistorica Belgica

Coördinatie / Coordination

N.F.W.O. Contactgroep
"Prehistorie - Préhistoire"
Groupe de Contact F.N.R.S.



Édité avec le concours de l' / Uitgegeven met de steun van
U.R.A. 28 du Centre de Recherches Archéologiques, C.N.R.S.

Scan en uitgegeven door / Scanné et édité par
Studia Praehistorica Belgica – 2012



Uitgegeven en gedrukt door / Edité et imprimé par

Koninklijk Museum voor Midden-Afrika
Musée royal de l'Afrique centrale

Tervuren, Belgium

# TABLES DES MATIERES / TABLE OF CONTENTS

# PREFACE

In the early part of the century the attention of many Belgian prehistorians was drawn to the repeated discoveries of mesolithic artifacts in the northern sandy area of the country. Since this first recognition of the presence of so-called Tardenoisians, a whole series of sites were located and prospected. However, because of the inadequate recovery techniques applied, homogeneous and representative artifact samples were nearly inexistent. As may be inferred from the recent synthesis by J. G. ROZOY, 1978, *Les derniers chasseurs: L'Epipaléolithique en France et en Belgique,* mesolithic research in Lowland Belgium is still seriously hampered by this lack of concrete data. For the study of the so-called Limburgian, the author was forced to base his arguments much too often on assemblages of which the recovery circumstances are unsatisfactorily reported.

In order to fill this considerable void of information, the *Laboratorium voor Prehistorie* of the *Katholieke Universiteit te Leuven* has devoted a large part of its research to prospecting and excavating new mesolithic settlements. The three site reports presented in this volume should be considered as a substantial contribution to a better understanding of the mesolithic occupation of the Belgian Lowland. Both the sites of Neerharen-De Kip and Schulen can confidently be attributed to the Early Mesolithic, whereas the site of Weelde-Paardsdrank finds its place near the end of the mesolithic sequence. At the time of their discovery, all three sites had unfortunately been partially destroyed, either by erosion or by ploughing and quarrying activities. As such, they cannot serve as optimal sources of information for the solution of the many questions still arising in mesolithic research. We did however try to extract all evidence relevant to the understanding of the sites themselves. For this purpose specialists in different fields of research were asked to collaborate. Nevertheless, the results of our research are not impressive and numerous problems remain unsolved, such as those related to the reconstruction of the natural environment, the stratigraphical position of the occupation floor, the nature of the subsistence patterns and the dating and delineation of the cultural-typological units. Even if some of these problems can now be better understood, many more sites need to be excavated to give clear solutions. Prospecting and excavating sites is, indeed, a most urgent task for Belgian prehistorians. Due to the demographic expansion and the intensive agriculture more and more settlements will be destroyed and thus lost for ever. We therefore hope that the publication of these 'Contributions' may contribute to an increased and vivid interest in the study of mesolithic settlement.

Pierre M. Vermeersch

# LIST OF FIGURES, TABLES AND PLANS

## UN SITE DU MESOLITHIQUE ANCIEN A NEERHAREN - DE KIP

LISTE DES FIGURES page



LISTE DES TABLEAUX



## MESOLITHIQUE ANCIEN A SCHULEN

LISTE DES FIGURES

LISTE DES TABLEAUX



## LATE MESOLITHIC SETTLEMENT AT WEELDE - PAARDSDRANK

LIST OF FIGURES

LIST OF TABLES

LIST OF PLANS (in annex)

DIRK HUYGE & PIERRE M. VERMEERSCH

# LATE MESOLITHIC SETTLEMENT AT WEELDE - PAARDSDRANK

WITH CONTRIBUTIONS BY

CH. DICKENS
E. GILOT
F. GULLENTOPS
F. JANSSENS
A.V. MUNAUT
W. VAN NEER

# PREFACE AND ACKNOWLEDGEMENTS

The occurrence of mesolithic settlement at Weelde-Paardsdrank was brought to our attention by Mr. R. Foblets of Brasschaat, who first surveyed the area in the beginning of 1966. The construction of a fire-alley during World War II, traversing the pine plantations, had revealed the presence of considerable quantities of lithic material near the top of a continental dune. Mr. Foblets, who visited the site on numerous occasions between 1966 and 1970, was able to acquire an important collection of over 2500 lithic artifacts of clear mesolithic affinity. At the suggestion of, and with the active collaboration of Mr. Foblets, excavations were carried out at the site during the summers of 1976 and 1977. These excavations were conducted by the *Laboratorium voor Prehistorie* of the *Katholieke Universiteit te Leuven* under the direction of one of us (Pierre M. Vermeersch) and with the collaboration of many undergraduate students.

The authors are deeply indebted to Mr. R. Foblets for his continuous help before and during the excavations, also to Mr. and Mrs. R. Walter for their most efficient camp organization during both campaigns. An exhaustive contribution to this report was prepared by Professor F. Gullentops and Mrs. Ch. Dickens, who dealt with the chapters on geography and stratigraphy. Pollen analysis was performed by Professor A.V. Munaut of the *Laboratoire de Palynologie, U.C.L.* Mr. E. Gilot (*Laboratoire de carbone-14, U.C.L.*) was responsible for radiocarbon dating. The analysis of pottery finds was written in collaboration with Mrs. F. Janssens. The sparse faunal remains were studied by Dr. W. Van Neer (*Onderzoeksfonds K.U.L.*). The plans and sections and the drawings of the lithic industry were skillfully executed by Messrs. R. Geeraerts and A. Nijs (*Departement Archeologie en Kunstwetenschap, K.U.L.*). The excellent typing was done by Mrs. J. Vermeulen, Mrs. C. De Bruyn and Mrs. M. Vanderveken. Professor G. King revised large parts of the manuscript. Our friend and colleague P. Gendel (*Onderzoeksfonds K.U.L.*) was so kind as to read the quasi-entirety of the final version of the text and made most alert remarks as to its structure and contents. The authors warmly acknowledge the collaboration of all those involved in the publication of this report.

## 1. GEOGRAPHICAL SITUATION (F. GULLENTOPS)

The site of Weelde-Paardsdrank is situated in that part of the Northern Campine often called *Turnhoutse Kempen*. The geographical coordinates are : 51°23'27" N - 4°58'00" E. The location of the site is indicated on fig. 1. The *Turnhoutse Kempen* is a low interfluvium (25-30 m above O.D.) separating the northern drainage system towards the river Meuse from the southwestern drainage system towards the river Scheldt. Due to the very flat relief and the presence of the impervious Campine clays in the immediate subsoil the superficial evacuation of precipitation is slow. This evacuation is moreover hampered by the rather thin cover of pleniglacial loamy coversands in which several very silty layers occur. The interfluvium is essentially characterized by humid sandy soils. In striking contrast, however, are areas covered by tardiglacial dunesands with slight but irregular topography. These areas are very dry but at the same time comprise numerous small depressions with marshy vegetation, the typical Campine vens, which in winter sometimes contain ponds. A major dunesand belt begins at Beerse and stretches ENE over 40 km to the N of Helmond. At Weelde this belt reaches its greatest width. The site is situated in its northern part.

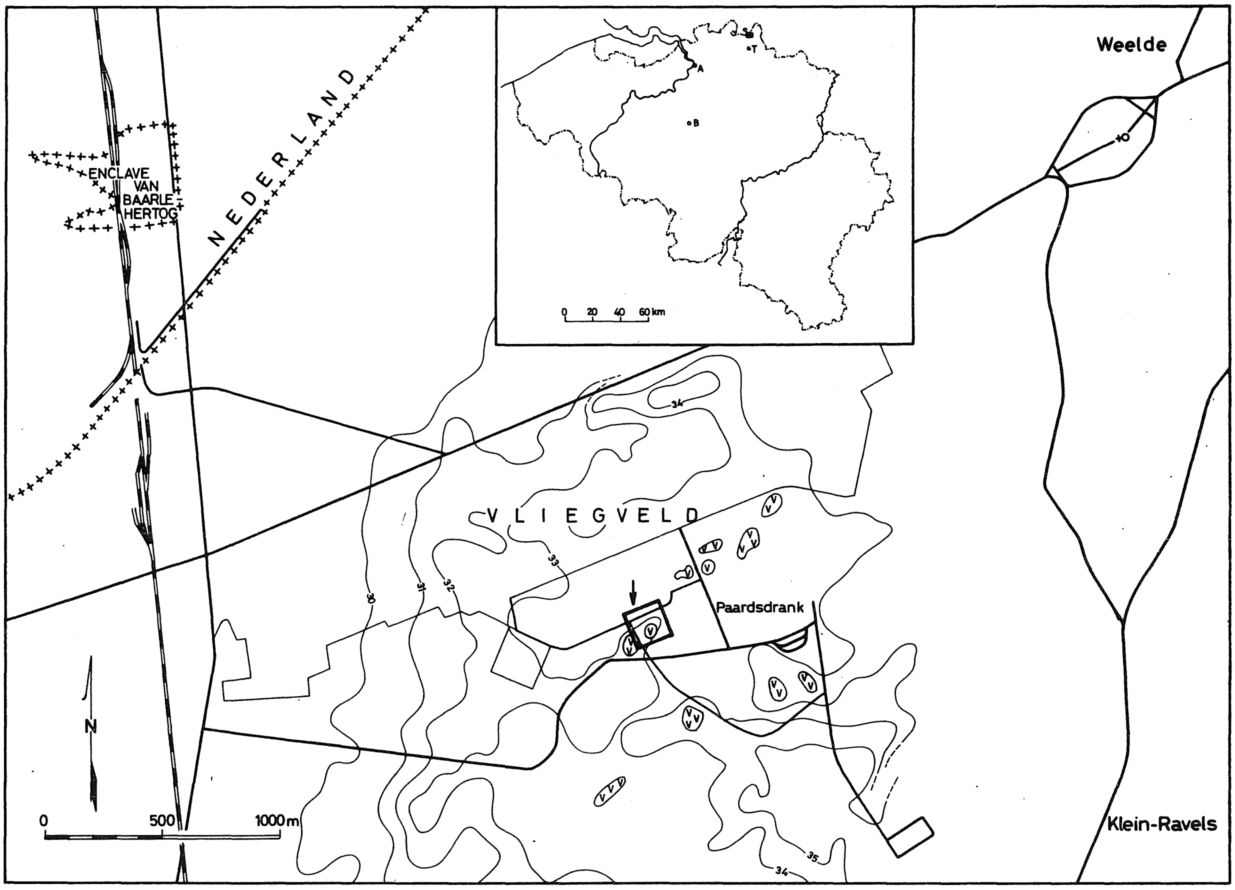



Fig. 1. Map showing the location of the site.

## 2. THE EXCAVATION

Prior to the excavation a topographic recording of the site was effectuated (fig. 2). Contour lines are shown with a 0.25 m interval, the indicated heights being relative to an artificially constructed 10 m level (point X of fig. 2) consisting of a wooden post overtopping the surface by 0.05 m. A base-line, 140 m in length and oriented 70° E, was positioned into the fields by means of two white-red painted metal posts driven into the ground at both its extremities (points A and B of fig. 2). After the excavation these posts have remained on the site. The starting point (A) of the base line is located at the intersection of two fire-alleys (see fig. 3). The line itself runs parallel with the southern edge of the fire-alley in which the sectors 1 and 4

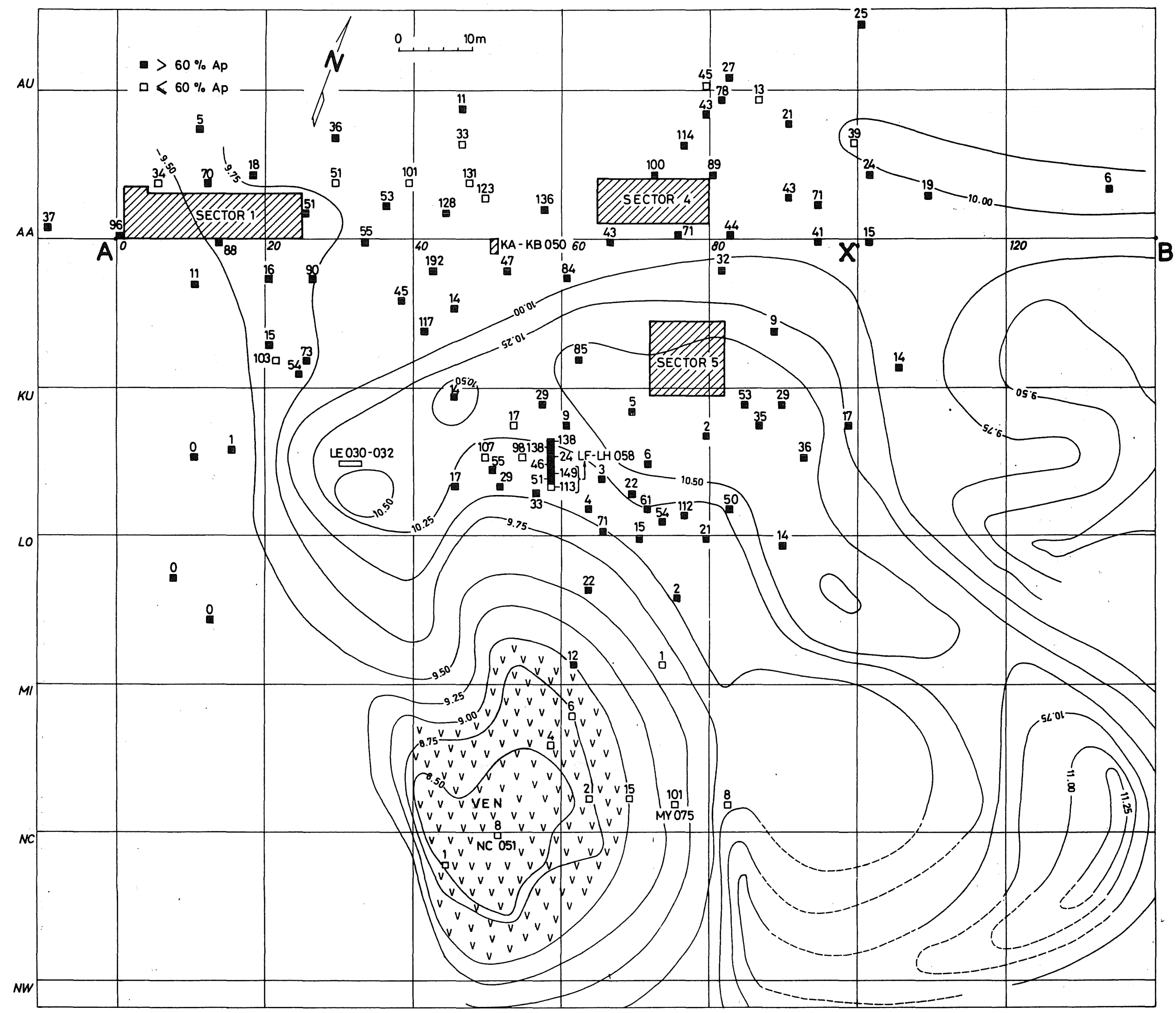



Fig. 2. Topographical sketch of the dune with indication of the excavated squares and location of sectors 1, 4 and 5.

are situated and serves as the abscissa (X-axis) of the grid-system. Thus, the square situated between 0 m (point A) and 1 m bears the indication 000; the square between 1 m and 2 m is designated 001. The ordinate (Y-axis) of the system is constructed perpendicular to the base line at point A and is divided according to an alphabetical system. In northern (positive) direction the first square is designated AA, the second AB and so on till AZ, then changing over to BA, BB, etc. In southern (negative) direction the first series of squares is designated KA till KZ, the second LA till LZ, the third finally MA till MZ.

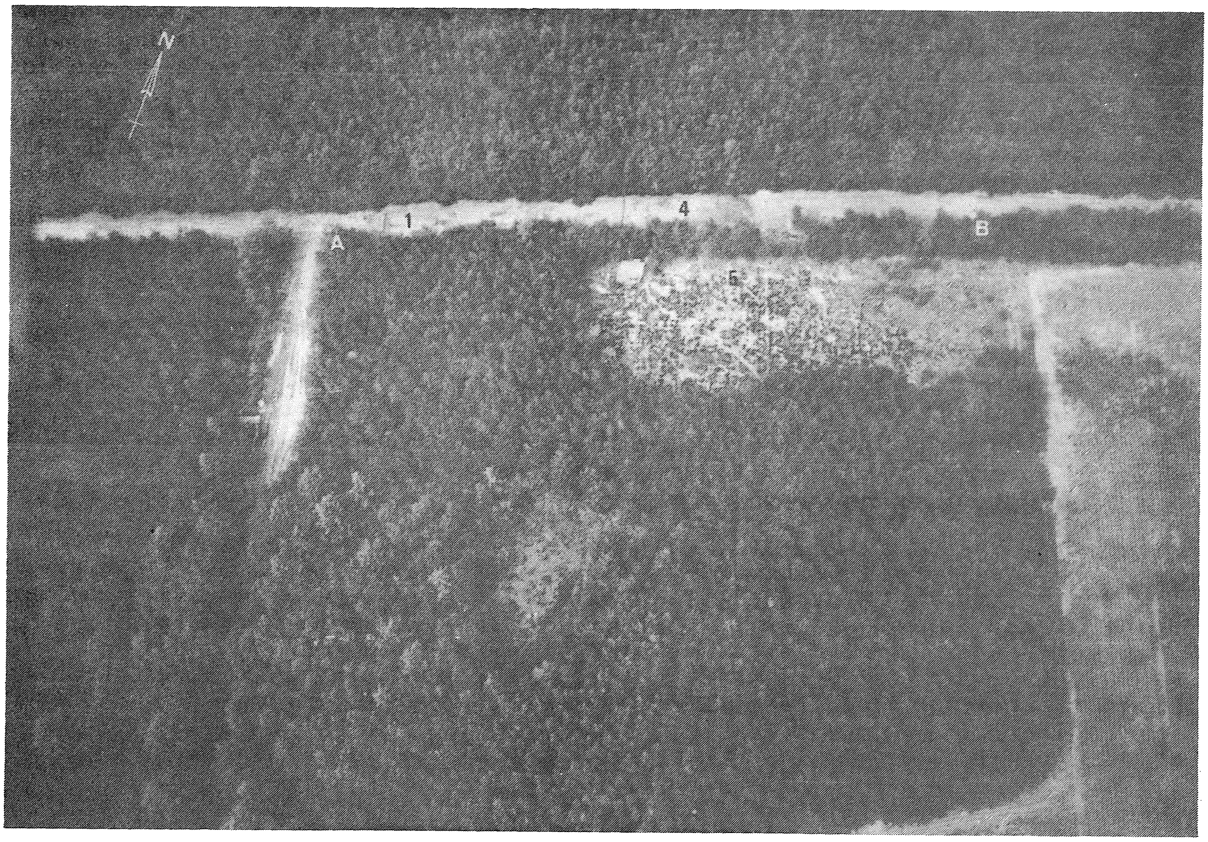



Fig. 3. Aerial view of the site showing the approximate position of the base-line and location of sectors 1, 4 and 5.

During the 1976 excavation campaign numerous (1x1 m) squares or test-pits were excavated all over the site in an attempt to localize high artifact density areas. On the basis of the results some sectors (1, 4 and 5) were selected for further investigation. The excavation of one of these, sector 4, was accomplished in the course of the 1976 campaign. The 1977 excavation was for the most part confined to the sectors 1 and 5. The three sectors correspond with the shaded areas on the topographical sketch of the site. In view of the grid-system defined above, they may be designated as follows :

Sector 1 : squares AA-AF 001-024 and AG 001-003 with the exception of AF 007, AF 020, AC 001-003 and a baulk of 0.45 m width in AD 007 which have been left unexcavated

Sector 4 : squares AC-AH 065-079

Sector 5 : squares KL-KU 072-081 with the exception of KL-KM 072-073, KT-KU 074, KU 075, KU 077 and a baulk of 0.40 m width in KR 072-074 which have been left unexcavated.

With some exceptions (squares KA-KB 050 and MY 075), which are discussed immediately hereafter, the archaeological material from the isolated squares is not included in the present study. Reference will however be made to some of the test-pits which are instructive from a stratigraphical point of view (such as squares LF-LH 058). In order to give an idea about the general distribution of archaeological material all over the site each excavated square features the total number of finds. This number comprises all artifacts from flint or other raw materials, sandstone and quartz fragments collected from all soil horizons, Ap included. As may be judged from the distribution it is clear that next to sectors 1, 4 and 5 some other high artifact density areas do or did exist. Most of these however prove to be profoundly destroyed, as generally more than 60 % of all the archaeological material was recovered from the disturbed horizon (Ap).

In the course of the excavation different excavation techniques have been applied. After the removal and sieving of the disturbed top soil (Ap) squares of 1 x 1 m or eventually trenches of 2 x 1 m were taken down horizontally. In search for preserved habitation features the podzolic soil horizons of sector 4 were excavated horizontally in surfaces of 6 x 5 m. The quasi-totality of excavated soil was sieved either manually or mechanically (meshes of 0.4 cm). As far as possible all *in situ* finds were recorded three-dimensionally, the heights being relative to the artificial 10 m level.

## 2.1. SQUARES KA-KB 050 (fig. 4)

In these squares, below the humic iron podzol and also below the brown forest soil (cf. infra 3.), disturbance of the original layering of the eolian sand was observed. This was visible as a light grey, more or less circular discoloration of the yellow C-horizon and the subjacent stratified dunesands. From its centre, numerous small fragments of charcoal were recovered; those from 85 to 150 cm were submitted for radiocarbon dating (Lv-854D). Below the $B_2$ir-horizon of the podzol all the lithic material in these squares was situated inside the area of the discoloration. As was the case for the charcoal fragments, the lithic material could be found over the whole depth of the discoloration with, however, a concentration between 40 and 60 cm.

The flint utilized is rolled and displays many frostcracks. It is often of inferior quality and heterogeneous in colour and structure. Ninety-five flint artifacts and six specimens of wommersom-quartzite are burned. As a whole the lithic material of these squares is similar to that of the sectors 1, 4 and 5. Its composition is summarized in tables I and II.

Table I. General composition of the archaeological material from squares KA-KB 050. F :flint; W : wommersom-quartzite.

| | F | W | Tot. | % |
|---|---|---|---|---|
| Cores | 16 | 1 | 17 | 2,7 |
| Core rejuvenation products | 5 | - | 5 | 0,8 |
| Flakes and debris | 318 | 36 | 354 | 55,7 |
| Blades and blade fragments | 59 | 17 | 76 | 11,9 |
| Chips | 137 | 15 | 152 | 23,9 |
| Tools | 19 | 8 | 27 | 4,2 |
| Microburins | 1 | 4 | 5 | 0,8 |
| Total | 555 | 81 | 636 | 100,0 |
| % | 87,3 | 12,7 | 100,0 | - |

Table II. Tool inventory of squares KA-KB 050.
F : flint; W : wommersom-quartzite.

| | F | W | Tot. |
|---|---|---|---|
| Thumbnail scraper | 1 | – | 1 |
| Denticulated end-scraper | 1 | – | 1 |
| Retouched flake | 5 | 1 | 6 |
| Borer | 1 | – | 1 |
| Backed blade | 1 | – | 1 |
| Retouched blade | 3 | 2 | 5 |
| Single notched blade | 3 | – | 3 |
| Blade broken in a notch | 1 | 2 | 3 |
| Truncated blade | 1 | 1 | 2 |
| Rhombic trapeze | 1 | – | 1 |
| Rectangular trapeze | – | 1 | 1 |
| Symmetric trapeze | 1 | 1 | 2 |
| Total | 19 | 8 | 27 |

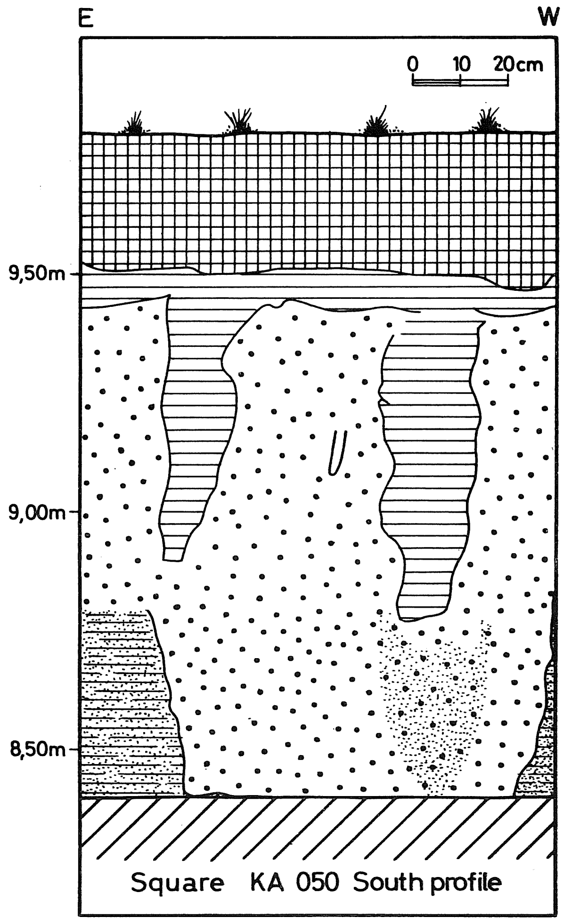



Fig. 4. South profile of KA 050.

As charcoal and artifacts are associated together, and as the latter are clearly of mesolithic type, it seems that the discoloration should be interpreted as a pit of mesolithic age. Taking in account its small dimensions, an interpretation of this disturbance as a tree-fall feature (NEWELL, 1980) can be excluded. As the surrounding area was not excavated, the function of the pit and possible connection with the sectors 1, 4 and 5 remains unclear. In all probability the presence of several trapezes points to a quasi-contemporaneity with the assemblages from these sectors.

## 2.2. SQUARE MY 075 (see also 3.2.3.2)

The stratigraphy of this square is as follows (from top to bottom) :

0- 36 cm : disturbed sands
36- 39 cm : peaty sand
39- 41 cm : very white leached sand
41- 45 cm : light greyish humic sand
46- 60 cm : greyish white leached sand
60- 90 cm : greyish white leached sand with mainly vertically oriented grey humic zones
90-100 cm : greyish humic sand
100-150 cm : grey brown fine-bedded silty sand with iron accumulation.

All the artifacts recovered within this square were situated in the upper part of the light greyish humic sand, just underneath the very white leached sand. So, in contrast to the other sections of the site (see furtheron 4.1.), the archaeological material is confined to a very narrow vertical distribution.

The material collected is listed in table III.

Table III. Composition of the archaeological material from square MY 075. F : flint; W : wommersom-quartzite.

| | F | W | Tot. |
|---|---|---|---|
| Core rejuvenation products | 1 | - | 1 |
| Flakes and debris | 26 | 1 | 27 |
| Blades and blade fragments | 7 | 3 | 10 |
| Chips | 31 | - | 31 |
| Tools | | | |
| Double end-scraper | - | 1 | 1 |
| Retouched blade | 1 | | 1 |
| Microburins | 1 | - | 1 |
| Total | 67 | 5 | 72 |

As the "style de débitage" of the blades is Montbani-like, it seems probable that this square forms part of an unexcavated concentration of mesolithic material, similar to the assemblages from the sectors 1, 4 and 5. Its extension, however, seems rather limited as squares in the immediate vicinity yielded only a few artifacts (see fig. 2).

# 3. STRATIGRAPHY AND ANALYSES

## 3.1. THE DUNE TOP (F. GULLENTOPS and Ch. DICKENS)

The density of the artifacts having shown the existence of settlement on the dune top, and the artifacts being always present at some depth in the soil profile (cfr. infra 4.1), the question arose whether a closer study of the dune sequence could furnish some stratigraphical clues. To this purpose three profiles were therefore studied in detail.

### 3.1.1. Profile LF-LH 058 (fig. 5)

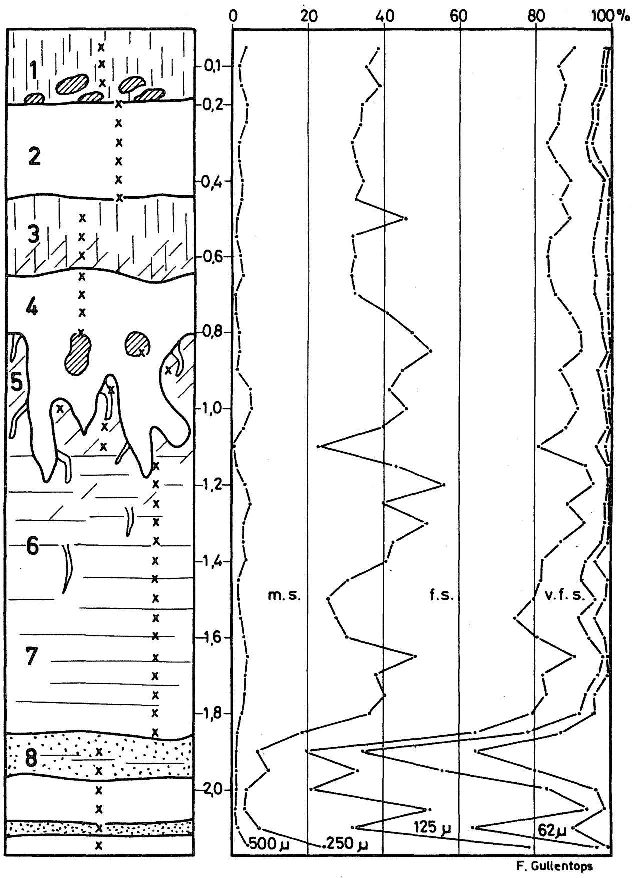



Fig. 5. Profile of LF-LH 058.

#### 3.1.1.1. Description

1. The upper 20 cm represent a recently, and only once, tilled $A_o$, lumps of the original topsoil being preserved at the base. The top 5 cm are somewhat lighter coloured, due to a beginning of recent podzolisation under the pine plantation.
2. Grey, very loose sand, nearly white at the base : $A_{1-2}$ of a heather podzol.
3. Sharply defined, black compact sand : $B_h$ of this podzol.
4. Down to 80 cm and lower in some irregular pockets is a loose, light yellow-brownish sand without structures or layering : A-horizon of an earlier brown podzolic forest soil homogenized by bioturbation.
5. Between the pockets the layering of the original dune sand is well preserved. There is a slight precipitation of iron oxides, sometimes con-

centrated in stains, representing the BC-horizon of the forest soil. Typical, tortuous structures, slightly more than 1 cm thick disturb the layering. They are filled with homogenized yellow-brown sand and are clearly animal burrows.
6-7. The burrows reach down to 150 cm, in a much less ferruginized sand, which shows in 7 its original light yellow colour.
8. From 180 cm loamy sands with two layers of sandy silt appear.

3.1.1.2. Grain size analysis

This profile was analysed by means of a rapid wet sieving technique on 32, 63, 125, 250 and 500 µm sieves on a Rhewum shaker. The silty sands at the base are very apparent and covered by a complex of fine to medium sands. The 250 µm line shows a very irregular pattern at the base with three coarsening cycles, followed above 80 cm by a very regular beaviour. The limit coincides with the pedological homogenized facies, as under 80 cm the samples were taken in the undisturbed sands. The finer sands, between the three coarse bulges, contain also more very fine sand (v.f.s.) and silt. In the homogenized upper part two cycles in the fines are visible; the lower has the same surplus of v.f.s. and silt and is also of sedimentary origin; the upper has essentially a bulge in the fraction finer than 32 µm, due to pedological colloids.

3.1.1.3. Interpretation

It may be safely concluded that at the base, the wurmian pleniglacial loamy coversands are reached, covered by 180 cm of dunesands. Their lowest undisturbed part shows three cycles of dune activity starting with the arrival of coarser winnowed sands, followed by the deposition of more silty, somewhat finer sand.

A typical Holocene pedological sequence is present as found by SCHEYS et al. (1954), consisting of a grey brown podzolic deciduous forest soil succeeded by a heather podzol, the change having probably occurred in the Subboreal (MUNAUT, 1967). The animal burrows do not traverse the podzol and are related to the earlier forest. The separation of the two soils is not always as clear and may be enhanced by the covering of the first soil by some new eolian sand. The original forest soil surface might then have been situated at the small grain size fluctuation around 40-50 cm deep.

3.1.2. Profile LE 030-032 (fig. 6)

3.1.2.1. Description

1. The upper 30 cm is a fine-bedded recently blown sand with only a very slight greyish $A_h$ development at the top.
2. Grey, loose, homogenized sand, A-horizon of a heather podzol.
3. Compact black sand, $B_h$ of this podzol; the top is peaty by decomposition of modern roots, which cannot penetrate the hard B and extend horizontally.
4. Greyish loose sand with rather regular humic illuviation veins. This horizon descends in a pocket into the next layer.
5. Brownish-yellow layered sand with brownish horizontal iron streaks. BC-horizon or earlier grey-brown podzolic soil. The structure is disturbed by cylindrical burrows.
6. Characteristic succession of a nearly white layer (A) with small black charcoal dots overlaying a slightly rusty yellow-brown horizon (B), forming a complete micropodzol. Burrows are very conspicuous because some bring down the yellowish sand 5 into the white A while others bring down the white sand into the rusty B.
7. Finely layered, loose, yellow sand, unweathered.
8. Finer sand with loamy streaks.

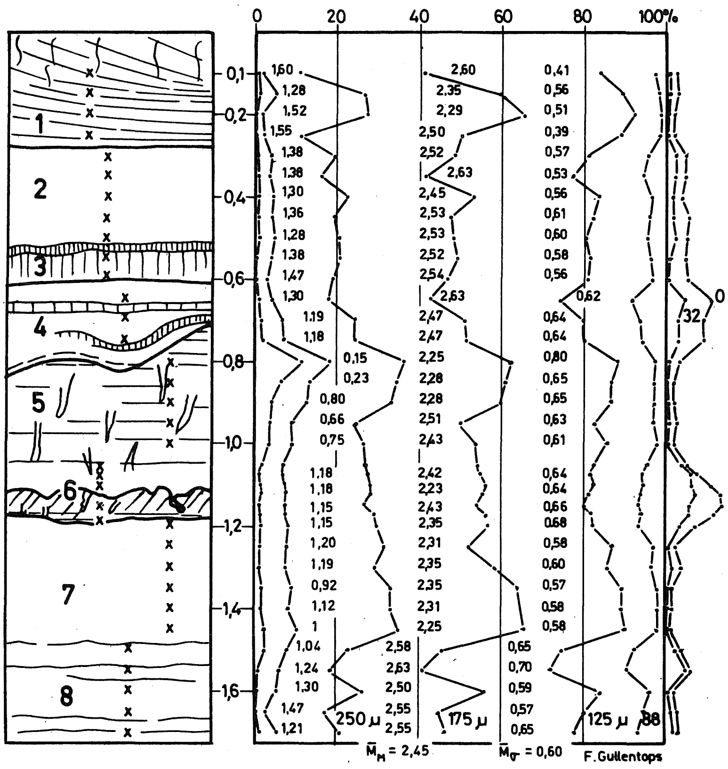



Fig. 6. Profile of LE 030-032.

3.1.2.2. Grain size analysis

After wet sieving on 32 µm, the residue was dry sieved on 0.5 $\phi$ sieves. The suspension fraction <62 µm is separately figured, the sand fraction recalculated to 100 %. On the cumulative curves of the sand fraction the median $M_{dz}$ was read off and the spread of the sand graphically determined as $\sigma_{gz} = \frac{\phi 84 - \phi 16}{2}$. The values of both parameters are given in the figure.

The comparison with the wet sieving of the first profile shows that dry sieving is much more thorough, so that all the curves are displaced towards the fines.

The overall median of the sand is 2.45 $\phi$ , with extremes of 2.63 and 2.23 $\phi$ . Most curves are nearly straight on probability paper, but sorting is not very good. The spread varies between 0.70 and 0.51 $\phi$ with a mean of 0.60 $\phi$ . It is best for the coarser, winnowed sands without silt; it is worst for the finer sands with some silt adjunction and some very fine sand surplus. Two extreme cases are present : a spread of 0.80 $\phi$ (at 80 cm), due to strong adjunction of a coarse population, and, at the top, two spreads around 0.40 $\phi$ in the new deflation sand.

From the base up we recognize :

8 : a slightly silty fine sand
7 : a coarser winnowed sand
6 : the same sand cyclicy enriched with about 20 % silt and v.f.s.

5 : again the coarser winnowed sand with a growing admixture of a coarse population
4 : a finer sand again, enriched in silt and v.f.s.
3-2 : rather homogeneous fine sand with importance of soil colloids
1 : the recent eolian cover represents a nice cycle, starting and ending with a fine well sorted sand surrounding a core of coarser sand.

3.1.2.3. Interpretation

This profile does not reach the pleniglacial loamy coversands. The basal horizon 8 has however the same grain size characteristics as the top of the lowest finer sand at 140-160 cm. They are both covered by a winnowed sand. It is now succeeded by the micropodzol which has all the elements of the Usselo-soil, of Allerød age. The soil is developed in the more silty end of the cycle. The curves show perfectly how the sandy saltation population remains constant, while the independant suspension population augments. This population is not limited however to the "suspension" fraction under 62 µm but also brings in a surplus of very fine sand, essentially smaller than 88 µm.

In the first profile this Usselo-soil was not detected. However, there may be a residue of it in the finer sand around 90 cm, but the micropodzol itself has then been incorporated in the B-horizon of the later forest soil and was wiped out.

Horizon 5 is not only a thoroughly winnowed sand, but even contains a growing coarse fraction population. This shows the very strong wind activity in Younger Dryas times. The upper horizons are all reworked by pedological or eolian activity. The young heather podzol is well developed, with on top a very recent eolian layer, which we estimate to be contemporaneous with the tilling in the first profile and which was probably caused by it.

An interesting point is the presence of the typical burrows, which are known in the Dutch pedological literature as "fingers". They are very well illustrated by H. DE BAKKER and A.W. EDELMAN-VLAM (1976), who explain them as burrows of cockchafer grubs * . It is however clear that they are related to the Holocene forest soil and disturb preformed soil-horizons. They are best seen in the Usselo-soil because colour contrasts are strongest there. However, we have never encountered them in the Usselo-layer when it had been covered by too thick Younger Dryas sands. The depth of burrowing must be related to the depth of winter-freezing, which is currently in the Campine only very rarely deeper than 1 m and which will have been less under Atlantic forest cover. The existence of burrows up to 120 cm, or even 150 cm in the first profile could thus be considered as further evidence that the soil surface has been heightened by later eolian sand. It may be pointed out that these grubs must play an important role in homogenizing the soil and preparing it for root penetration, as in both profiles they are the deepest disturbance factors.

3.1.3. Profile KQ 072 (sector 5)(fig. 7)

3.1.3.1. Description

1. Disturbed humic $A_0$-$A_1$-horizon with lumps of darker sand still discernable .
2. Light grey $A_2$-horizon in loose sand.

* Ir. H. de Bakker informs us that Prof. R. Tüxen was probably the first to have thought of chafers (see pp. 19 and 25 in Schrift des Bodens-Sprache neuer Malerei, Schriften der Humboldtschule, Hannover, 1964). We thank Ir. H. de Bakker for his help.

3. Hard compact sand with very sharp upper limit, black to brownish black underneath.
4. Yellowish brown slightly compact sand with irregular humic fibres.
5. Loose clear brownish yellow sand with humic fibres.
6. Slightly loamy sand, brownish grey at the top to light grey at the base, with scattered charcoal points. Brownish burrows penetrate the horizon from above, greyish ones penetrate up and down (see fig. 7bis). Typical A-horizon of the Usselo-micropodzol.
7. Rusty yellow, more compact sand, precipitation of iron very marked at the top. A few very fine humic fibres descend to 110 cm depth.
8. The sand is now very distinctly layered, yellowish with only a few rusty spots, rather white at the base.
9. Appearance of horizontal loamy layers in very fine sand.

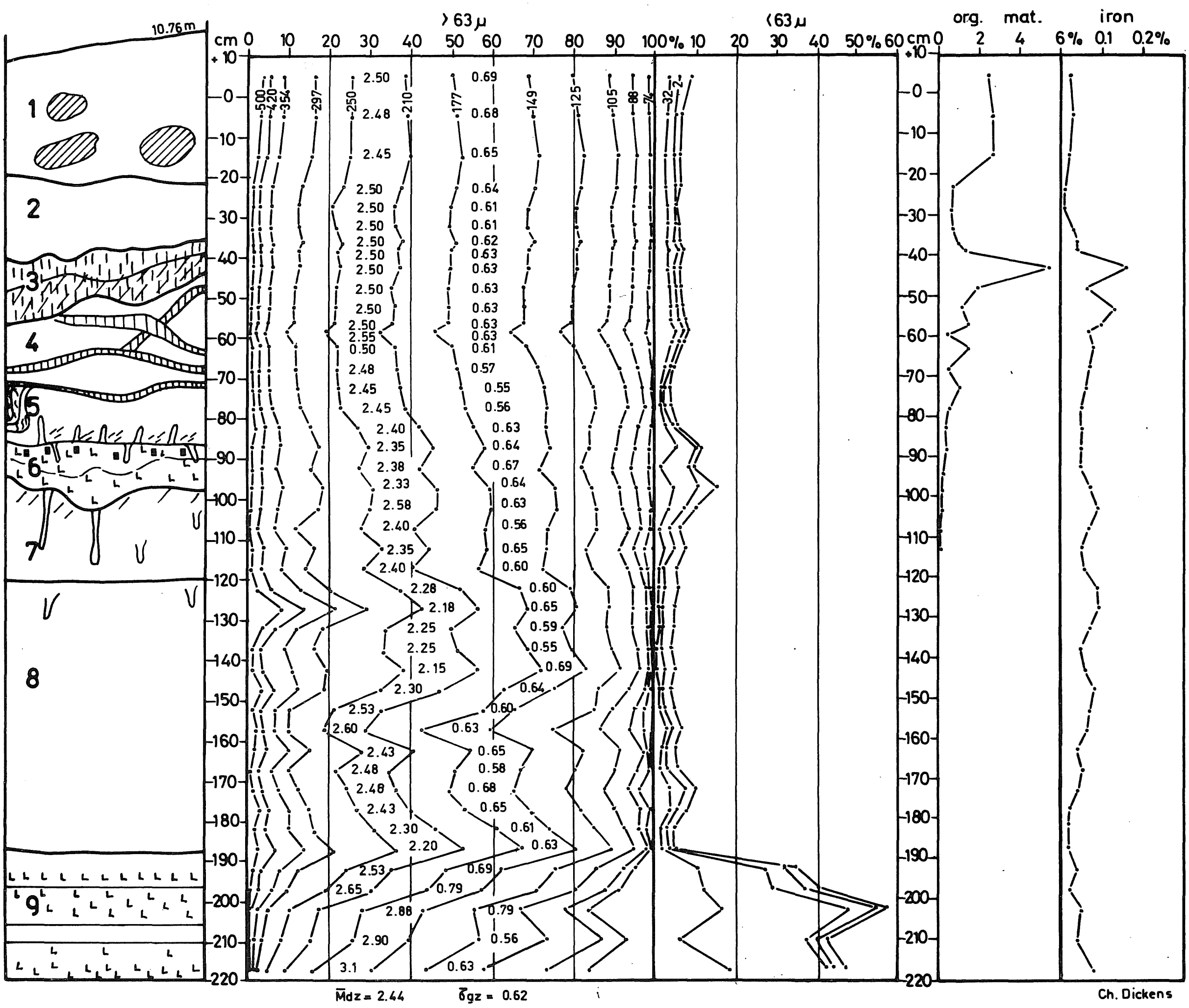



Fig. 7. Profile of KQ 072 (sector 5).

Fig. 7 bis. Cockchafer burrows in KQ 072 (sector 5).

3.1.3.2. Analysis

Grain size has been completely determined, by wet sieving on 32 µm, by sedimenting the 16 and 2 µm fractions, and by dry sieving the sand on quarter- ϕ sieves.

At the base fine sands appear with a median around 2.90ϕ and a suspension admixture between 35 and 55 %, most of it being coarse and medium silt. The sorting is bad (up to 0.79ϕ) due again to the presence of much very fine sand under 88 µm, proving that this fraction belongs essentially to the suspension population.

A clear cut at 190 cm separates this suspension population from a much coarser sand with a median around 2.43ϕ and a spread of 0.62ϕ. After a first coarse layer comes a fine cycle with more fines. Then, a coarser winnowed sand followed again by a finer sand with a maximum of silt coinciding again with the Usselo-soil.

As long as sedimentation layers were observed, the zig-zag pattern is very conspicuous; it becomes less marked in the Usselo-soil but remains visible, to disappear above 80 cm. In this upper part a slight general cyclic behaviour can be noted, but it is weakened by the pedological homogenization. Nevertheless, the upper 25 cm are clearly coarser with a coarser median, a worse sorting due to the increase in both coarse and fine tails. The artifacts were found in this profile essentially between 30 and 45 cm, giving more importance to this very small difference above 30 cm.

The organic material content was determined by wet combustion ($H_2O_2$) and weight loss. This crude method gave reasonable results. The impoverished $A_2$ is clear between the reworked $A_0$-$A_1$ and the peak of the $B_h$. The lower zig-zag pattern reflects the fine humic fibres.

The soluble iron content was determined by a photometric method. Under the lixiviated A-horizon, the B-horizon shows a double maximum, of which the upper coincides with the humic illuviation. The iron B of the Usselo micropodzol can be noted at 105 cm, while between 180-190 cm the whitish base of the dunesand shows a real minimum.

3.1.3.3. Interpretation

The tardiglacial dunesands are very distinct from the underlying loamy coversands. If the Usselo-soil is distinguishable without doubt, it might be considered that the lower fine cycle, corresponding also to a minimum in iron, is due to a similar succession and is then a residue of the Opgrimbie soil (PAULISSEN et al., 1969) of Bølling age.

There are a number of converging arguments, which lead us to believe that the late dunesands above the Usselo-soil have been deposited in two phases : pedological homogenization of 85 cm and burrows to 125 cm, reach rather deep; the thick A-horizon of the heather podzol; the slightly coarser sand of the upper 25 cm and finally the presence of the artifact concentration between 30-45 cm near an original surface. We therefore conclude that the Younger Dryas dunesands were sedimented to about 30 cm. A Holocene brown forest soil developed on it, with 50 cm deep homogenization and burrows reaching 100 cm deep; this was followed by a vegetation (birch woodlands) with increased raw humus production and infiltration of the humic fibres, and finally by heather creating the typical podzol. The upper sand layer was brought in before this final podzolisation, when the formation of an A-horizon was already well under way.

3.1.4. Conclusions

3.1.4.1. The dunesands form a fairly homogeneous unit, quite distinct from the much finer underlying loamy coversands. This contrasts with the dunesands of the Meuse valley (PAULISSEN, 1973; PAULISSEN, MUNAUT, 1969; GULLENTOPS, also this volume p. 29) of which the sand fraction is similar to the underlying coversands, which may indicate that the dune sands have originated from the local coversands. Weelde however follows the trend set by the other available analyses on the northern Campine at Brasschaat and Beerse (DE PLOEY, 1961). This author concluded that the tardiglacial dunesands represent a new invasion of coarser sand.

It is certain that the major dune-building phase went on during the Younger Dryas under the influence of dominating WSW winds (GULLENTOPS, 1957). It is however not certain that the sand invasion was brought in from that same direction, as DE PLOEY (1961) has concluded. Indeed, the Weelde dunesands seem to be part of a long string of dune fields extending W-E from the coast (VANDENBERGHE et al., 1974) to Eindhoven (VAN DIEPEN, 1968). In the west, I. HEYSE (1979) brings forward good arguments to explain them as transverse dune ridges under northern winds. An extension to the Campine of this invasion-direction could account for the string of dune fields on the interfluvia without hampering to much the S-N running brooks.

3.1.4.2. The contiguous sampling at 5 cm intervals in the dunesands disclosed a cyclical pattern with three grain size types. Best represented is an almost lognormal distribution with a standard deviation of $0.6\phi$. These sands are well bedded and the individual layers clearly better sorted. This means that each 5 cm sample approximates a lognormal mixture around the general mean of individually better-sorted populations. This model corresponds to a normal population of wind velocities each bringing its own saltation population.

Another type shows a coarse tail clearly formed by a separate population which is so different from the normal ones that it should be explained by different forces. If such a coarse population was only one layer thick it could be explained as a deflation residue. However, it is present in successive samples tending to a maximum, together with coarsening of the normal saltation sand. Therefore we interpret this tail as a fraction population brought in by certain conditions of wind velocity and surface roughness, corresponding to a maximum of eolian activity.

The third type has a separate fine tail culminating in the coarse silt fraction and clearly brought about by falling out of a suspension population, which remained definitely captured. It is always present in the Usselo layer and by extension we consider it to be characteristic of a minimum of eolian activity. It cannot yet be concluded that the silt might haven fallen during the climatic optimum itself and was then mixed by pedological activity in the soil layer. We consider it more likely that this grain size type characterizes the end of an eolian cycle with cessation of eolian activity during the climatic optimum. The study of the detrital fraction of Allerød peat layers may solve this dilemma.

The grain size evolution contributes greatly to the understanding of the sediments but can also have micro-stratigraphical implications.

3.1.4.3. The early Holocene deciduous forest soil can be followed by the pedological homogenization which destroys the sedimentological grain size variations to an irregular depth. Chemical iron illuviation penetrates deeper in the physically undisturbed sand, while isolated burrows, reported to be due to cockchafer grubs, penetrate more than 1 m deep. When the Usselo layer is within this reach, the colour differences make the burrows most apparent. Because they prepare the soil for capillary root penetration these burrows must be considered as an important soil factor. They disappeared with the podzolisation.

A new historical eolian layer is very clearly demonstrated by layering and grain size. An earlier eolian holocene activity gets only faint grain size support, but seems indicated by the thick podzol A-horizon, the too deep buried burrows and finally by the presence of the artifacts, whose concentration at a given depth must be considered as proof of a later sandcover. This widens the problem of the pollen content of podzol soils as discussed by A.J. HAVINGA (1962) and shows that in some cases part of the pollen may be resedimented as was put forward by F. FLORSCHUTZ (1941).

3.1.4.4. The sands at Weelde can be put in a chronostratigraphically situated time scale. The Tardiglacial succession is clear and the eolian tardiglacial activity was completely stopped by the climatic improvement of the Holocene (GULLENTOPS, 1957). This model is based on the perfect stop caused by the Allerød improvement developing its characteristic soil everywhere. The Preboreal vegetational and climatic change was much more drastic and should have had at least the same effect. The later eolian activity postdates the prehistoric settlement and is most probably related to the beginning of podzolisation.

## 3.2. THE PAARDSDRANK VEN (F. GULLENTOPS and Ch. DICKENS)

Immediately to the south of the site exists a small marshy depression, as is shown in fig. 2. It is one of the numerous vens present in the Campine. These vens are small depressions that may either be shallow perennial ponds or just marshes flooded during the winter. They have been studied by J. LORIE (1916) who thought that they were caused by eolian deposits blocking small valleys. This may be true for some of them but certainly does not explain them all. Their origin needs further study as their evolution might throw light on the later development of the paleohydrology of the region.

The Paardsdrank ven seemed a good example to start this research and, in view of the presence of the prehistoric site, we hoped its study might contribute to the comprehension of the habitational history * .

Fig. 2 shows that the ven has the shape of a fairly fresh deflation basin with a depositional rim on the east side. Thirteen profile pits were dug along two lines meeting in the centre of the ven, and studied for original sedimentological structures and later pedological evolution. Two of these were also analysed in the laboratory.

3.2.1. Profile MF 061 (fig. 8)

This pit is situated on the rim of the ven depression.

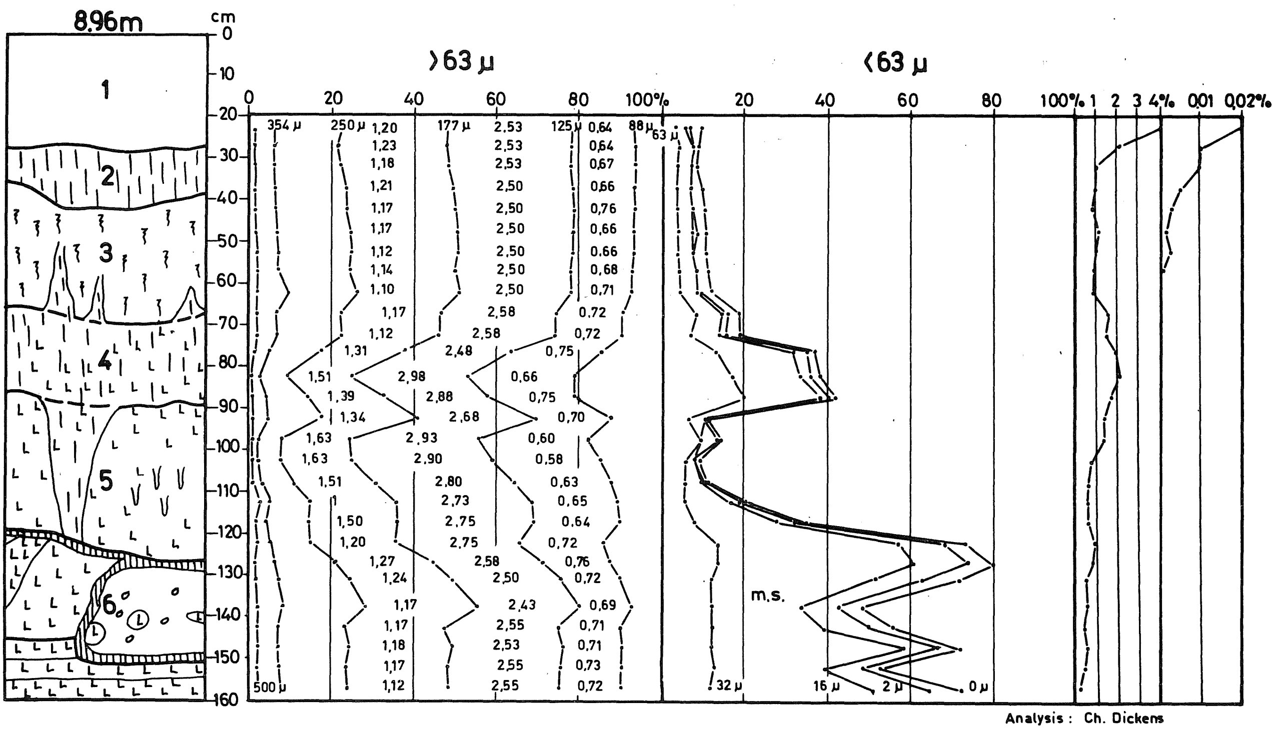



Fig. 8. Profile of MF 061.

3.2.1.1. Description

A reworked black and white mottled sand (1) covers remains of the original dark grey $A_1$ characterized by clearly washed white sand (2) grains, while (3) is a white-grey $A_2$-horizon, in which vertical humic fibres are present. In the upper part they are black and mineralized, in the lower part brown-humic and still fibrous. These fibres are remnants of gramineae-roots, probably *Molinia*. Horizon 4 is strongly packed, very loamy and enriched in humus (Bh) giving it a dark brown colour, mottled rusty at the base. Horizon 5 is a finely layered, slightly silty yellow

---

* The first results of these analyses were presented in 1978 at the Oulu-meeting of the ICCP-project for the study of the Paleohydrology of the Holocene.

sand, somewhat bleached at the top with some ill-defined burrowing structures. Horizon 6 is a mixture of rusty loamy sand with compact olive-green sandy loam in layers and pockets due to cryoturbation and capricious limonitic fibres.

3.2.1.2. Analysis

The grain size shows that the three upper horizons are thoroughly homogenized. The numerical characteristics of the sand fraction, median, graphical deviation and $2\sigma$ coarse tail, are those of the tardiglacial sands of the dunetop. The suspension fraction is also homogenized around 10 % so that the earlier variations can no longer be recognized.

The horizons 4 and 5 stand out clearly as a finer sand, characterized by a considerably lower content of median sand, a finer coarse tail, a median around 2.80 $\phi$ and doubled content of very fine sand. The upper half (horizon 4) has a suspension content of up to 40 % identifying it with the loamy coversands at the base of the dunetop profiles. The coversand shows here the same type of cyclic pattern, ending with high silt content, as was established in the later dunesand.

The lower cryoturbated horizon is quite different in that it has a high suspension content (more than 50 %). Its sand fraction is coarser with numerical characteristics equal to those of the upper sands. The suspension fraction is much finer and is dominated by the median silt, without the synchronous development of the very fine sand.

3.2.1.3. Interpretation

Only a thin layer of tardiglacial dunesands exists in this profile, in which a wet podzol type developed lacking the black B-horizon of the heath-podzol. It was invaded by large gramineae. In the subsoil the pleniglacial ends with a very fine coversand cycle of which the silt has the same coarse characteristics as the soil-layers of the Tardiglacial. It differs fundamentally from the loesslike silt which characterizes the cryoturbated base.

3.2.2. Profile NC 051 (fig. 9)

This pit is situated in the centre of the ven depression.

3.2.2.1. Description

Horizon 1 is a recent artificial coverage in which separate lumps of black and white sand are still preserved. It covers a layer (horizon 2) of mineralized peat with a maximum thickness of 20 cm. This layer rests with sharp contact on fine loamy sand, dark grey at the top, brownish with a rose tinge further down and with numerous vertical black root remains. Horizon 6 is more loamy and rusty brown, passing in horizon 7 towards greenish yellow. The base is formed by a thin very coarse sand layer cutting the top of the cryoturbated hard loam layer. During digging, much groundwater seeped out of the coarse sandlayer. Seven artifacts were found, rather concentrated from 44 to 53 cm.

3.2.2.2. Analysis

Best recognizable is the homogenized soil profile covering most of horizons 3 and 4. Its grain size characteristics represent the mean of the silty very fine coversand with a sand median of 2.85 $\phi$ and a coarse tail of 1.44 $\phi$. Characteristic is the nature of the suspension fraction with considerable coarse silt and adjunction of very fine sand. This soil profile is covered by a not yet homogenized layer, a bit coarser in general and consisting of some eolian sand also present in the peat as well as in the artificial cover. Under the soil the basis of the fine coversand is still preserved.

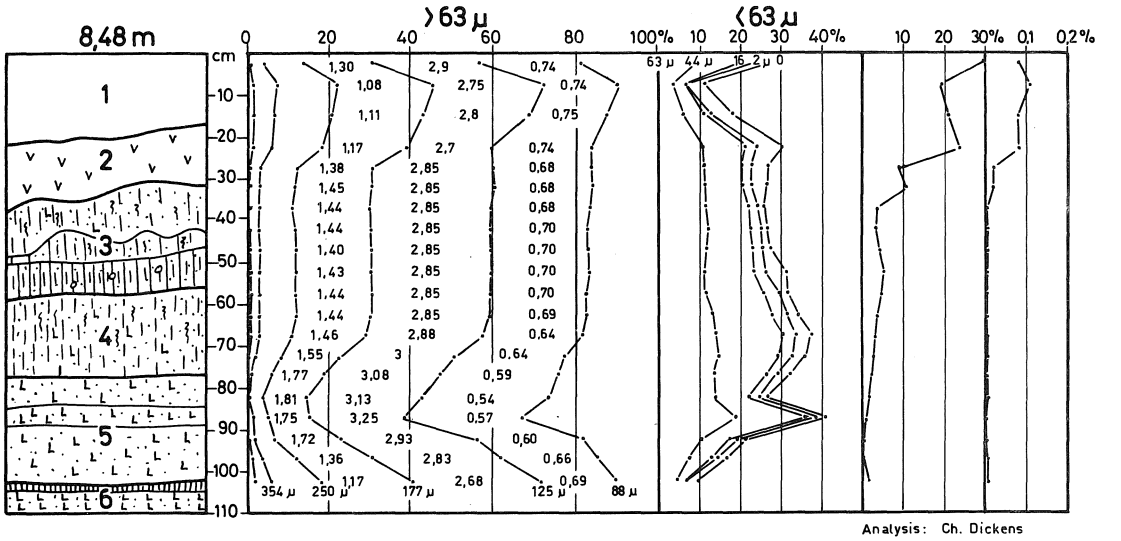



Fig. 9. Profile of NC 051.

3.2.2.3. Interpretation

In the centre of the ven only a few decimeters of tardiglacial dunesand can have existed, which were completely homogenized with the underlying silty very fine coversands by soil formation. The formation of the wet forest soil lasted till peat growth stopped the process. Analysis of the peat will allow dating of this change. The artifacts were already dispersed in the soil before the depression turned into a ven.

3.2.3. Transverse sections through the ven (fig. 10)

The other pits along the two transverse sections were studied in the field and the samples were only burned for determination of organic content and colour change. All the results are generalized on the composite figure.

3.2.3.1. Most pits reached the heavy loam layer (more than 50 % silt + clay) recognizable by its colour and the cryoturbated structure. Its top is not absolutely horizontal and forms a slight depression under the ven. It is covered by the loamy fine coversands whose thickness varies between 60 and 90 cm preserving the depression under the ven. The dunesands are however responsible for most of the topography and the section shows that they are almost lacking from the ven.

3.2.3.2. In most pits a superficial reworked horizon can be recognized. In the two most easterly profiles, layering demonstrates a partly recent eolian origin of this cover. The light grey eluvial horizon, which can be followed on both sides of the ven, is 60 cm thick on the east side and seems to be lacking under the ven. The podzol-B can also be followed but changes into a marsh soil under the ven. This last soil was quite strongly developed prior to the peat formation, its homogenization zone (60 cm) being not much less than the homogenization depth assumed for the early brown forest soil on the dune.

A special problem arises with pit MY 075. It shows the thickest A-horizon of the podzol soil with an almost intact $A_0$. This horizon

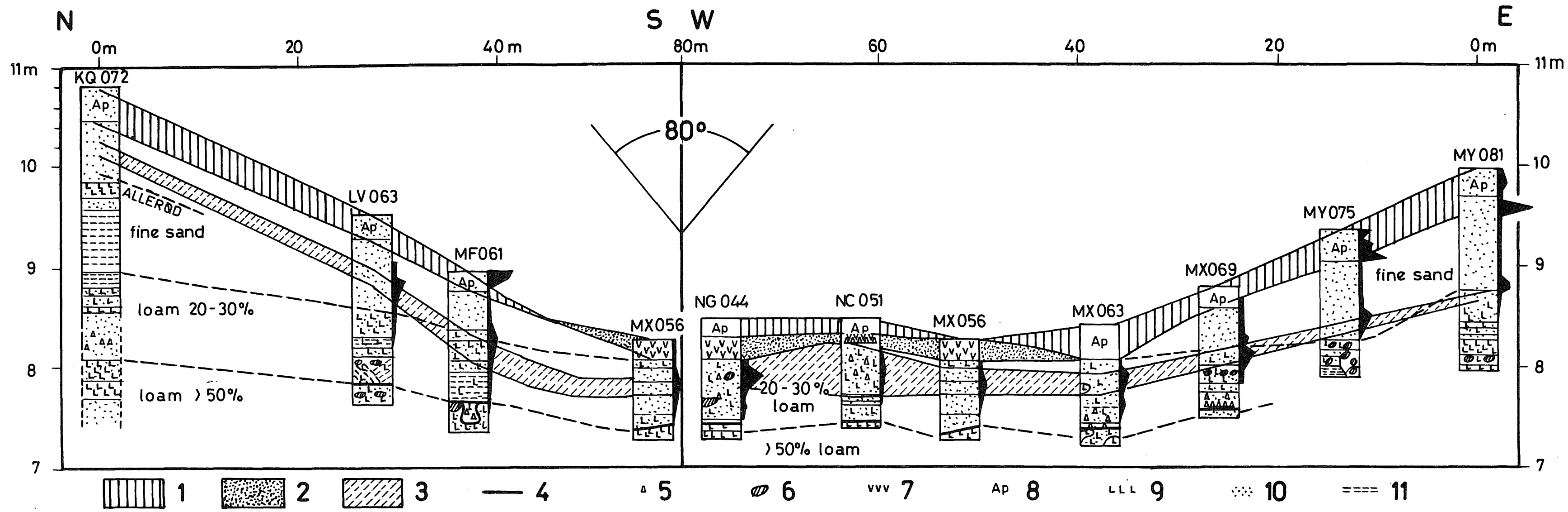



Fig. 10. Transverse section through the ven.

1 & 8 : $A_p$-horizon
2 & 7 : peat
3 : $B_h$-horizon
4 : iron pan
5 : granules
6 : compact silt lens
9 : loam
10 : sand
11 : layered sand

is covered by a 1 cm thick, nicely layered, pure white sand, clearly blown over the original soil. This sand is in its turn covered by 30 cm of humic dark sand in which straight mottled structures still show the artificial origin. As these structures are not yet homogenized their origin is recent. At the base is a high organic concentration essentially due to horizontally spread ligneous rootlets. As their maximum thickness is only a few mm we believe them to be heather roots spread on top of the absolutely sterile white sand layer. This confirms the recent character of this top layer. The problem is that on top and in the underlying $A_0$ a layer of artifacts was found, surmounting the podzol soil. In the absence of any biological disturbance we can only conclude that these artifacts reached this position only shortly before the blown sand and the artificial top layer.

3.2.4. Conclusions

The profile shows a continuous layer of sandy loam in the subsoil, strongly cryoturbated and certainly of full-weichselian age. It is covered by a layer of alternating sands and loamy sand, which has all the characteristics of the upper weichselian fine loamy coversands. This layer has a very regular thickness of about 80 cm and its surface forms a depression under the ven.

These coversands are covered by dunesands, the tardiglacial age of which can be established by following the profile in the dune top to the north, where the Usselo-layer could be distinguished by its soil formation and earlier similar oscillation recognized in sedimentology.

At the end of the Younger Dryas the drastically changing climate must have had at least the same influence on eolian activity as the climatic amelioration of the Allerød. The eolian activity was brought to an end and the Preboreal amelioration brought about a soil formation, which under deciduous trees turned later towards mild brown forest conditions with strong activity of cockchafers grubs. The depression, collecting groundwater run-off on the impermeable loam layer, immediately became wetter and saw the development of a marshy forest soil. This soil had reached quite mature conditions at the end of the Atlantic as shown by the pollen analysis (cfr. infra 3.3.) and the date of 4810 ± 50 B.P. (Lv-987) for the humus at the top of the soil. As this date was obtained on a humus mixture it is certainly slightly previous to the end of the soil formation. At the beginning of the Subboreal, the depression had become a ven and peat started to grow (4220 ± 80 B.P., Lv-986). In this case this does not seem to be due to an impermeability resulting from soil formation (ZONNEVELD, 1965), as the subsoil was already sufficiently impermeable. The cause must be sought in a real absolute rise of the water table at about 4200 B.P. This rise could have been caused by local conditions, such as a hampering of the local drainage by renewed eolian activity, or by general climatic change to more wetter conditions.

The study of the dune top profiles suggested a slight eolian activity just before or at the beginning of the podzolisation. Has this eolian activity (during a dryer spell) influenced the drainage or are a wetter climate coupled with human (neolithic) influence on the vegetation responsible for both the drainage change and the eolian activity. As the pollen analysis has shown no trace of a landnam, we believe the second hypothesis to be more likely. Other vens will have to be studied to look for similar developments and new facts.

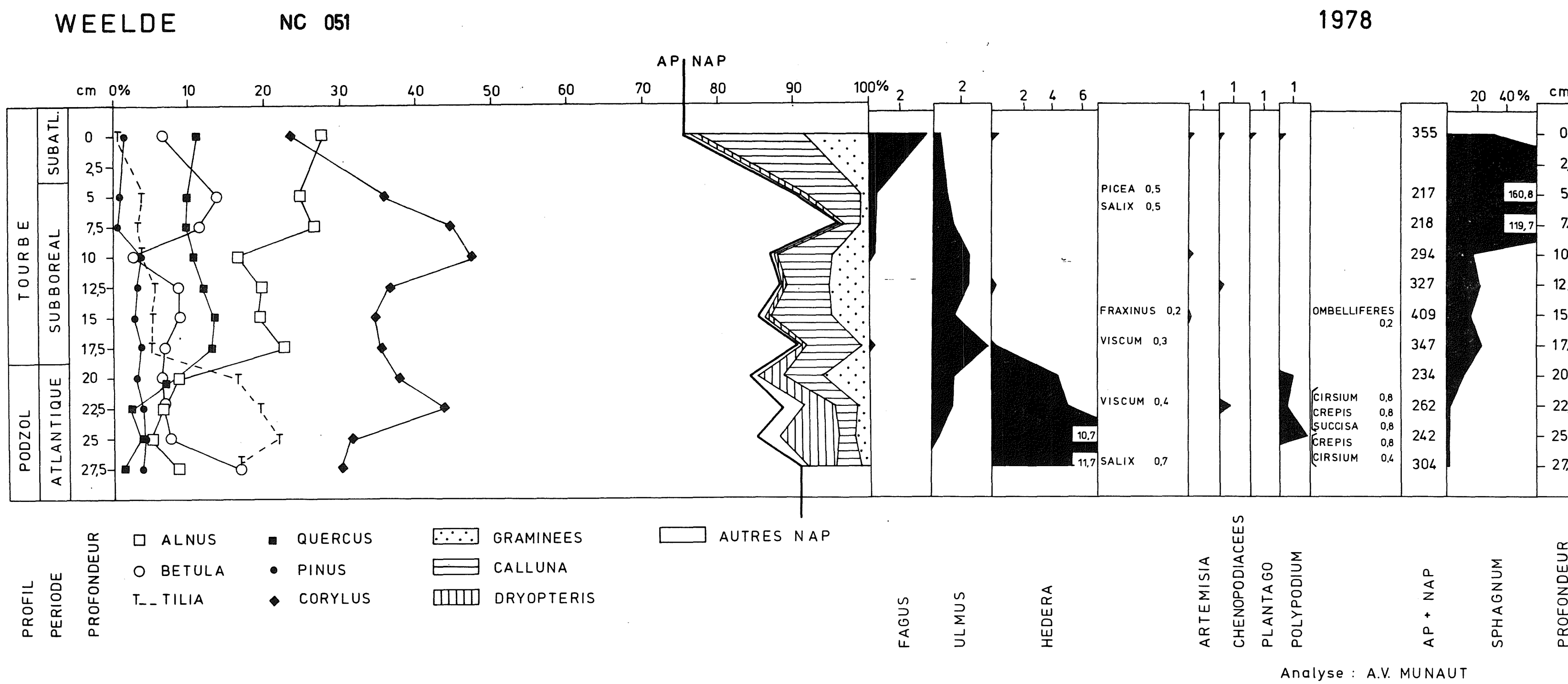



Fig. 11. Diagramme pollinique du profil NC 051.

## 3.3. ANALYSES PALYNOLOGIQUES (A.V. MUNAUT)

### 3.3.1. Analyses palynologiques du profil NC 051

Le profil palynologique est situé au centre du "ven" et comporte la partie supérieure d'un podzol humique hydromorphe ainsi qu'une couche de tourbe épaisse de 20 cm, qui le surmonte. Le diagramme (fig. 11) représente pour chaque niveau analysé le pourcentage atteint par les différents types polliniques, exprimés par rapport au total (AP + NAP) du nombre de pollens et spores comptés (à l'exception de *Sphagnum*).

#### 3.3.1.1. Le milieu

Le diagramme est caractérisé par la dominance constante des pollens appartenant aux plantes arborescentes (AP). La bruyère (*Calluna*) est peu abondante et les céréales absentes. Quelques rudérales (*Artemisia*, *Plantago* et les Chenopodiacées) indiquent une influence humaine discrète : les spectres sont donc antérieurs aux grands déboisements de Campine.

On peut distinguer deux phases. Durant la première (enregistrée dans la partie supérieure du podzol entre 27,5 à 20 cm), le tilleul (*Tilia*) joue un rôle important. Le lierre (*Hedera*) y est bien représenté, de même que les fougères du type *Dryopteris* et *Polypodium*. Ces espèces croissaient à proximité immédiate du profil sur les sols sableux. L'installation d'une tourbière acide caractérisée par des pourcentages élevés de sphaignes (*Sphagnum*) correspond au recul de ces espèces. Au contraire, l'aulne (*Alnus*) et le chêne (*Quercus*) s'étendent, indiquant une humidité accrue des sols correspondant au début de la formation de la tourbe.

#### 3.3.1.2. La chronologie

Deux repères palynologiques permettent de localiser le diagramme dans le temps. Le premier correspond à l'extension subboréale de l'orme (*Ulmus*) datée à plusieurs reprises entre 4750 B.P. et 4280 B.P. (GILOT et al., 1969). Cette interprétation est confirmée par les datations obtenues par E. Gilot à Weelde même, soit : Lv-987 : 4810 $\pm$ 50 B.P. pour l'horizon $A_1$ du podzol entre 20 et 25 cm; Lv-986 : 4220 $\pm$ 80 B.P. pour la base de la tourbe (15 à 20 cm).

Le second repère est constitué par l'extension du hêtre (*Fagus*) au niveau 0 cm, qui indique le début du Subatlantique.

#### 3.3.1.3. Implication climatique

La formation d'une couche de tourbe sur un podzol humique hydromorphe développé dans une dépression d'un système dunaire peut être considérée comme un phénomène écologique. Celui-ci résulte d'une imperméabilité accrue des horizons d'accumulation du podzol, de la naissance d'une nappe phréatique perchée et de l'apparation d'une hydromorphie de surface. Cependant, la date obtenue pour le passage du podzol à la tourbe coïncide avec celle notée pour d'autres faits palynologiques qui auraient une importance régionale assez grande, puisqu'elle s'observe en Campine, mais aussi dans les plaines poldériennes bordant la mer du Nord. Il s'agit de l'extension de l'orme (*Ulmus*) couplée dans certaines circonstances avec celle du frêne (*Fraxinus*) et de l'if (*Taxus*).

L'interprétation proposée pour expliquer cette extension était l'apparition d'un climat plus humide de tendance plus océanique (MUNAUT, 1967). On ne peut évidemment au vu du seul exemple conclure que la modification hydrique observée à Weelde résulte d'une modification climatique. Cependant, l'observation dans ce diagramme de l'extension de l'orme qui ne peut croître dans un massif dunaire, mais sur des sols alluvionnaires voisins, montre qu'il y a tout au moins coïncidence entre les deux phénomènes.

3.3.1.4. Relation avec le site archéologique

Les observations stratigraphiques ont montré la continuité existant entre le podzol hydromorphe et le podzol humo-ferrique où a été trouvé l'industrie. Cependant, aucun artefact n'était visible dans le profil NC 051 et seules des relations indirectes peuvent être établies entre la palynologie et l'archéologie. Si on admet qu'une certaine épaisseur de sable s'est déposée sur le site postérieurement à l'habitat, il faut en conclure de l'absence de sable dans la tourbe que ce dépôt éolien est extrêmement localisé ou antérieur à 4220 B.P. De plus, le podzol humique hydromorphe est normalement constitué. Si un apport de sable s'est manifesté dans la dépression, cet apport s'est fait avant l'accomplissement de la pédogénèse; c'est-à-dire, avant 4810 B.P. Nous avons vu par ailleurs (MUNAUT, 1977) qu'un millier d'années suffisait pour qu'un podzol hydromorphe se développe sur une couche sableuse éolienne. Dans ce cas, le remaniement éolien (pour autant qu'il se soit manifesté en NC 051) doit être voisin ou antérieur à 6000 B.P.

De point de vue palynologique on connaît un certain nombre d'espèces herbacées qui traduisent la rudéralisation des régions pâturées ou la culture. Pour les cultures antérieures au Néolithique, de telles espèces indicatrices manquent. Il faut donc chercher dans un déséquilibre écologique souvent très local et fugace les traces d'un tel habitat. Il semble d'après des études en cours que des pourcentages élevés de lierre (*Hedera*) puissent être associés aux perturbations induites par la présence mésolithique dans les forêts post-glaciaires. On remarque que dans le diagramme pollinique le lierre montre des pourcentages décroissants dans la partie supérieure du podzol. On pourrait émettre l'hypothèse qu'il s'agit là du seul indice décelable d'une présence humaine qui serait de ce fait antérieure au blocage de l'infiltration pollinique dans le sable (par suite de l'affleurement de la nappe phréatique). Cette hypothèse devra être confirmée par des recherches ultérieures.

3.3.1.5. Résumé

Le podzol hydromorphe du profil NC 051 s'est développé avant la fin de l'Atlantique. Les pollens qui s'y sont infiltrés reflètent l'image d'une végétation arborée constituée de coudrier et de tilleul, suffisamment claire pour permettre un développment modéré de fougères. Le podzol est vierge d'occupation humaine et on peut admettre que la pédogénèse est contemporaine ou postérieure à cette occupation. La tourbe a commencé à s'édifier au Subboréal et si localement sa formation peut résulter de modifications édaphiques progressives, certains arguments (extension de l'orme sur un territoire géographique assez vaste) permettraient d'attribuer ce phénomène à une cause climatique plus générale (accroissement de l'humidité et de l'océanicité). Enfin, les grands déboisements subatlantiques caractérisés par l'extension des landes à bruyère ne se manifestent pas encore dans le diagramme, quoique l'arrivée du hêtre indique déjà le début de cette période.

3.3.2. Analyses palynologiques en relation avec les structures archéologiques

3.3.2.1. Les échantillons

Neuf échantillons ont été prélevés à différentes profondeurs dans un podzol. Leur provenance est reprise ci-dessous :

| Echantillon | Carré | Situation pédologique | Nature de l'échantillon et localisation archéologique |
|---|---|---|---|
| W1 | AC015 | BC | sable prélevé au-dessous d'un caillou présentant des traces de polissage; environ 65 cm sous la surface actuelle |

| | | | |
|---|---|---|---|
| W2 | ACO15 | BC | sable prélevé à 9 cm au nord du caillou (ci-dessus); même profondeur que W1 |
| W3 | KRO77 | AB | sable prélevé au-dessous d'un caillou; absence de radicelles; environ 40 cm sous la surface actuelle |
| W4 | KRO77 | AB | sable prélevé au même endroit que le précédent mais à 5 cm plus bas |
| W5 | ACO19 | $A_2$ | sable prélevé à côté mais au même niveau que la base du grès poli de W6 (ci-dessous); environ 35 cm sous la surface actuelle |
| W6 | ACO19 | $A_2$ | sable collant au-dessous d'un grès poli; environ 35 cm sous la surface actuelle |
| W7 | AGO66 | $B_2h$ | sable prélevé au-dessous d'un grand caillou |
| W8 | LHO58 | $A_2$ | sable collant au-dessous d'un grand percuteur en quartzite, présence de radicelles |
| W9 | ACO19 | $A_2$ | même provenance que W6 |

3.3.2.2. Les analyses palynologiques

Les échantillons W1, W3, W4, W6, W8 et W9 se sont révélés stériles ou quasi stériles. Seuls W2, W5 et W7 contenaient des pollens en quantité suffisante; les résultats figurent dans le tableau IV.

3.3.2.3. Commentaires

A l'exception de W7, tous les échantillons prélevés sous une pierre ou sous un caillou sont stériles. Par contre W2, situé au même niveau que W1, et W5 au même niveau que W6 et W9, ont fourni des pollens en quantité analysable.

W2, le niveau le plus profond situé à la transition pédologique BC montre un spectre où les arbres (66,7 %) l'emportent sur les N.A.P. Parmi ces derniers, le pourcentage atteint par *Calluna* indique cependant un paysage assez ouvert dans une forêt à dominance de *Tilia* et de *Corylus* sur les sols secs, d'*Alnus* dans les zones plus humides.

Quoique situé plus haut dans le profil, le niveau W5 (horizon $A_2$) correspond à une situation localement boisée en *Tilia*.

En ce qui concerne W7, l'importance prise par les espèces non arboréennes, livre l'image d'un paysage de landes en grande partie déboisées. De plus, les pourcentages atteints par les céréales (12,8 %) ne se retrouvent qu'en bordure de champs cultivés.

Tableau IV. Analyses palynologiques

| Arbres (A.P.) % | W2 | W5 | W7 |
|---|---|---|---|
| Alnus | 18,7 | 1,0 | 5,6 |
| Betula | 2,1 | - | 1,1 |
| Corylus | 13,2 | 3,7 | 5,0 |
| Ilex | - | - | 1,1 |
| Pinus | 2,8 | 1,0 | 1,1 |
| Quercus | 3,5 | - | 0,6 |
| Tilia | 26,4 | 92,7 | 5,6 |
| Total A.P. % | 66,7 | 98,4 | 20,1 |
| Non Arboréens (N.A.P.) % | | | |
| Graminées | 3,5 | 0,5 | 2,8 |
| Calluna | 29,9 | 1,0 | 56,3 |
| Céréales | - | - | 12,8 |
| Composées : Cirsium | - | - | 6,1 |
| Crepis | - | - | 1,1 |
| Renonculacée | - | - | 1,7 |
| Total N.A.P. % | 33,4 | 1,5 | 80,8 |
| Total pollens et spores | 144 | 191 | 179 |

3.3.2.4. Chronologie

Les spectres W2 et W5 caractérisés par l'abondance de *Tilia*, *Corylus* et *Alnus* ont un âge Atlantique ou Subboréal. Quoique l'absence de *Fagus* et de *Carpinus* ne permet pas d'attribuer un âge Subatlantique à W7, il faut cependant remarquer l'importance prise par les cultures, importance rarement atteinte avant le Subboréal. En outre, il faut noter l'importance que revêt la forêt dans le niveau W5. Si stratigraphiquement il est postérieur à W2, il faut admettre que durant la fin de l'Atlantique et durant le Subboréal, le tilleul possédait encore une vitalité suffisante pour reprendre possession d'un terrain partiellement déboisé.

3.3.2.5. Infiltration du pollen

Il est intéressant de remarquer l'absence totale de pollen directement sous les pierres et cailloux qui parsèment le profil, tandis que les pollens peuvent être abondants dans deux échantillons situés à un même niveau pédologique, mais sans protection. Ce fait semble bien confirmer l'hypothèse suivant laquelle les pollens présents dans les sols sableux, s'y sont infiltrés postérieurement au dépôt géologique que constituent les sables. Si le pollen était enfoui simultanément à cette déposition, il ne manquerait pas d'être présent sous les pierres aussi bien qu'à proximité. Le cas de W7 pourrait éventuellement s'expliquer par la dimension réduite des cailloux surmontant les échantillons et par une infiltration latérale.

3.3.2.6. Datation archéologique

Pour autant que les pierres situées dans le profil pédologique aient une origine anthropique, il faut conclure de ce travail qu'il n'est pas possible de les dater par la palynologie. Il est impossible, dans la fouille de Weelde de démontrer le synchronisme des spectres situés à proximité des pierres et le dépôt de ces pierres.

## 3.4. ANALYSIS OF BOTANIC MACROREMAINS (F. GULLENTOPS)

In the course of the excavation a considerable amount of broken and carbonized nutshell fragments was recovered. The latter were most numerous in sector 5, some originate from sector 1, but none from sector 4 (see furtheron 4.2.). Distinctive features are the rounding of these fragments, their fairly constant thickness (0.7-0.8 mm), the occurrence of large external longitudinal ribs at a 1.4-1.5 mm interval, the large two by two longitudinal vascular bundles close to the surface of the shell, as well as the very dense cellular structure of the latter. On the basis of these characteristics most fragments could be identified as *Corylus avellana L.* In view of their fragmentary condition (maximum 5 mm long), often due to recent crumbling, it was impossible to determine whether the nutshells had been fractured in a characteristic fashion either by man or by animal.

## 3.5. FAUNAL ANALYSIS (W. VAN NEER)

Due to the acidity of the soil, conditions for faunal preservation are not very favorable. Only small fragments of whitish burned bone could be recovered. The latter are numerous in sectors 4 and 5, but lack almost completely in sector 1 (see also 4.2.). Few specimens could be identified, the list of which is furnished below.

| Identification | Sector | Square | Soil horizon |
|---|---|---|---|
| Atlas (fox) | 4 | AD 077 | $B_2$ir or BC |
| Axis (fox) | 4 | AE 077 | BC |
| Proximal metatarsal (deer ?) | 4 | KO 077 | BC |

Two fragments could with certainty be identified as atlas and axis of fox. Taken into account the archaeological context, and in the supposition that no recent contamination has occurred, a proximal metatarsal fragment of a large ruminant has been identified as deer.

## 3.6. RADIOCARBON DATING OF ARCHAEOLOGICAL SAMPLES (in collaboration with E. GILOT)

Up till now the following three dates have been obtained :

| | | |
|---|---|---|
| Lv-854D | $< 430$ B.P. | KA-KB 050 |
| Lv-934 | 5710 $\pm$ 80 B.P. | Sector 5 |
| Lv-959 | 6990 $\pm$ 135 B.P. | Sector 5 |

The date Lv-854D was obtained on a sample of tiny charcoal fragments originating from a pit within squares KA-KB 050. The precise recovery circumstances of the sample have already been indicated previously (see 2.1.). The sample was treated with hydrochloric acid (HCl) for decomposition of carbonates. In view of the insufficiency of the material it has been diluted with inactive carbon.

The second date (Lv-934) was extracted from a sample of dispersed charcoal originating for the greater part from the leached horizon ($A_2$) within sector 5. The horizontal distribution of the charcoal fragments is indicated on plan 7. Their stratigraphic position may be inferred from the profile sketch of fig. 13. The sample was treated with cold solutions of HCl and NaOH for removal of respectively carbonates and possible humic contaminants.

The date Lv-959, which also concerns sector 5, was obtained on a considerable amount of broken and carbonized hazelnutshells (*Corylus avellana*). These nutshells, essentially occurring within two distinct concentrations (see plan 7), have for the greater part (85 %) been recovered from the $B_2$ir- and the BC-horizon. In the profile sketch of fig. 13 their stratigraphic position may be compared to that of the dated charcoal sample from the same sector (Lv-934). The shell sample was treated with a 1 % HCl solution and a diluted cold solution of NaOH. In view of its insufficiency it has moreover been diluted with inactive carbon.

A final sample, consisting of 600 mg broken and carbonized hazelnutshells, has been submitted at the Oxford Radiocarbon Accelerator Unit by the intermediary of J.A.J. Gowlett (results not yet available). The location of the sample within square AB 011 (sector 1) is indicated on plan 1. Its stratigraphic position within the C-horizon, i.e. at the base of the vertical artifact dispersion, may be inferred from the profile sketch of fig. 12.

# 4. DISTRIBUTION OF THE ARCHAEOLOGICAL MATERIAL

## 4.1. VERTICAL DISPERSION OF THE ARCHAEOLOGICAL MATERIAL

The vertical dispersion of the archaeological material recovered geologically *in situ* varies considerably all over the explored area. Its recording is hampered by the wholesale disturbance of the upper soil horizons, the degree of which may be subject to notable variations at small intervals. Consequently, a comprehensive general account of the vertical artifact dispersion may but difficultly be established.

As may be inferred from the data presented on the topographical sketch of the dune (fig. 2) most of the test-squares yielded less than 40 % of the archaeological material *in situ*. On the basis of the artifact densities recorded and with the intent to recover as much material as possible *in situ*, the sectors 1, 4 and 5 were selected for further excavation. The present considerations regarding the vertical artifact dispersion are confined to these three main sectors. Other potentially rewarding areas, however, remain to be explored, e.g. between sectors 1 and 5 (area tentatively designated as sector 2) and close to the fen. With the exception of square MY 075 (see above) the test-pits in the latter area yielded only a small amount of archaeological remains.

From the table featuring surface finds versus *in situ* finds (table V) it may be appreciated that 55.9 % of the artifactual assemblage from sector 1 was recovered within undisturbed soil. The furrowed layer (Ap-horizon) overburdening this soil averages approximately 30 cm in thickness. The subjacent $A_2$-horizon, ranging from 10 to 20 cm in thickness, is truncated by ploughing. The latter horizon together with the $B_2$-horizon yielded most of the *in situ* material. Within the C-horizon artifacts become increasingly rare. As such, the traceable, though truncated vertical artifact dispersion, is considerable and amounts to 30-40 cm. From fig. 12, resulting from a backplot of the artifacts recovered within squares AA-AC 010-011, it may be noted that even in neighbouring squares important variations occur as to the vertical density and dispersion of the finds. As a random test the frequencies of both lithic artifacts and sandstone and quartz fragments collected *in situ* within squares AB-AD 015 have been plotted according to 10 cm levels below the present surface (fig. 14). From this graph it appears that the highest frequencies recorded for both *in situ* lithic artifacts and sandstone and quartz fragments coincide for the 40-50 cm level. One should, however, take into account that the minor frequencies represented for the overlying level (30-40 cm) supposedly refer to an underestimation of the actual number of recoveries. In view of the irregular and undulating transition from the Ap-horizon to the intact soil (represented by the zigzag line on the graph) a certain amount of finds from this level will undoubtedly have ended up with the surface material. In sector 4 only 31.1 % of the lithic assemblage was collected *in situ*. This small percentage of *in situ* finds is due to the fact that the original podzolic profile was profoundly disturbed. The $A_2$-horizon is only preserved to a maximum thickness of 10 cm within the outermost western squares of the sector. The Ap-horizon, ranging from 10 to 30 cm in thickness and consequently generally less developed than in sector 1, mostly rests immediately on the $B_2$-horizon. In some squares the disturbance may even reach down to the C-horizon. As may be read from the graph representing the artifact frequencies according to depth within squares AD-AF 077 (fig. 14) more than 50 % of the *in situ* material was recovered immediately below the disturbed horizon (10-20 cm level). The subjacent levels are marked by a gradual decrease of the artifact frequencies. The remarkable coinci-

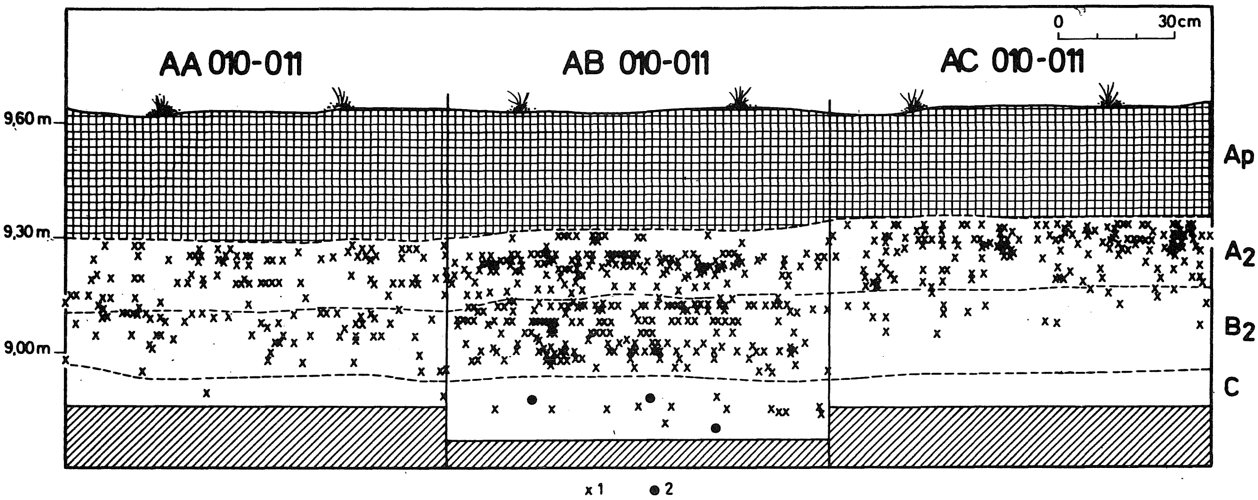



Fig. 12. Backplot of finds within squares AA-AC 010-011 (sector 1).
1: stone artifact; 2: hazelnutshell.

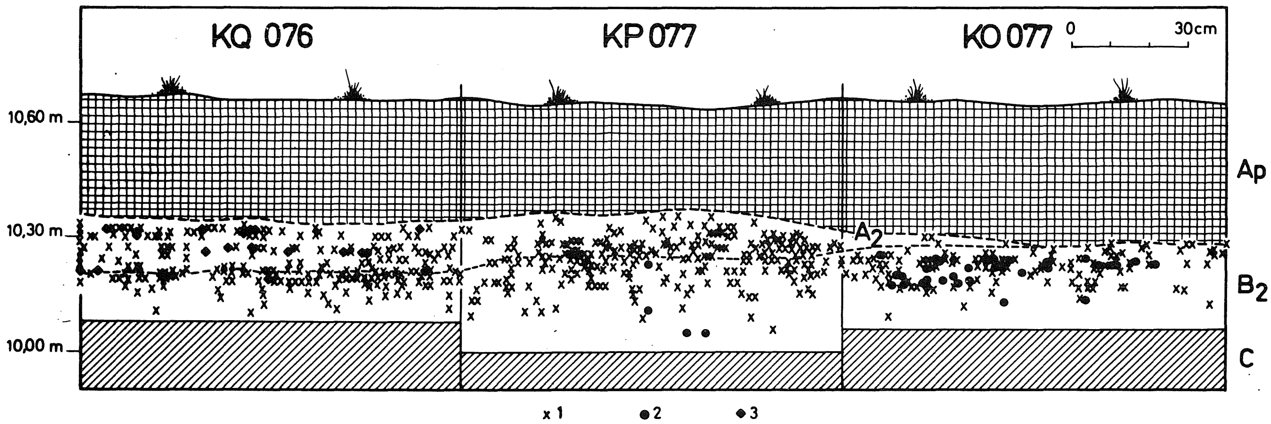



Fig. 13. Backplot of finds within squares KQ 076 and KP-KO 077 (sector 5).
1: stone artifact; 2: hazelnutshell; 3: charcoal.

dence of the lithic industry and pottery within this and other parts of the sector will be discussed with regard to the horizontal distribution of the archaeological material. In sector 5 no less than 67.4 % of the lithic industry was recovered *in situ*. Underneath the disturbed Ap-horizon, ranging from 20 to 30 cm in thickness, the truncated $A_2$-horizon is generally preserved to a thickness of 10-20 cm. From the profile showing the backplot of the artifacts recovered within squares KQ 076 and KP-KO 077 (fig. 13) it may be noted that the latter horizon is completely obliterated by ploughing within the extreme northern part of the artifact concentration. The possibility might be suggested that much of the surface material originated from this area. From the backplot and the frequencies recorded according to depth within squares KP 075-077 (fig. 14) it appears that the vertical artifact dispersion is well-defined and limited to approximately 20 cm. As such it encompasses the

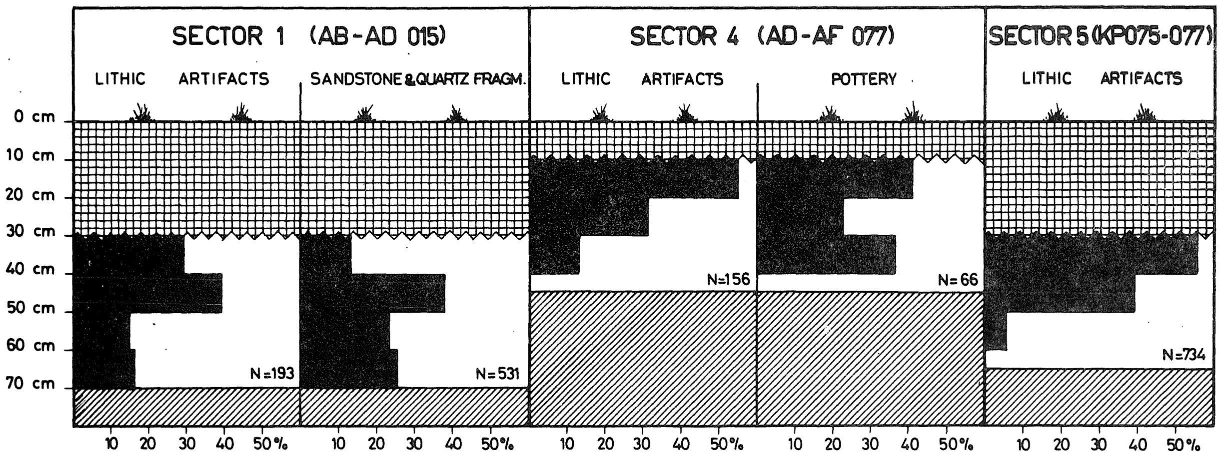



Fig. 14. Vertical dispersion of finds according to 10 cm levels below the present surface.

remainder of the $A_2$-horizon and the upper part of the $B_2$-horizon. From fig. 13 it is also worth noticing that the distinct species of organic waste encountered within the sector clearly coincide stratigraphically with the lithic industry.

In the above considerations no attempt has yet been made as to the determination of the original occupational surface. Unfortunately none of the sectors yielded preserved substantial features, such as constructed hearths, the stratigraphical position of which could be indicative of the level of occupation. Thus, the sole evidence at our disposal are the relative frequencies of finds recorded according to depth. This evidence is however incomplete, as for each of the sectors the true extent of the vertical dispersion is not known. The stratigraphical problems involved and the mechanisms behind the dispersion have already been discussed on several other occasions (VERMEERSCH et al., 1973; VERMEERSCH, 1976, 1977). It may be recalled here that the original level of occupation on most sites most likely corresponds with the upper part of the vertical artifact concentration. The actual dispersion of the material may then be attributed to biological activities in the subsoil and/or intense human traffic on the site causing a penetration of artifacts in the mobile, supposedly sparsely overgrown dune sands. The variations recorded as to the degree of the vertical dispersion obviously relate to the intensity of the mechanisms involved and the particular conditions of the subsoil (e.g. formation of a consolidated impenetrable $B_2$-horizon). In view of the intersector differences recorded, such a differential impact may be the case for the site of Weelde-Paardsdrank. The causes of this differential impact however elude objective observation. As in each of the sectors a considerable quantity of material was recovered from the disturbed horizon, the upper limits of the vertical artifact dispersion may not be settled with certainty. It may therefore be suggested that the original levels of occupation have been obliterated by ploughing. This seems particularly likely for the sector 4, which yielded but little more than 30 % of the lithic assemblage geologically *in situ*. As for the sectors 1 and 5, most of the material of which was recovered *in situ*, it might tentatively be suggested that the original occupational levels more or less correspond with, or slightly overtop, the lower limit of the disturbance.

Table V. Surface finds (A) versus *in situ* finds (B) according to main artifact classes.

| | Sector 1 | | | Sector 4 | | | Sector 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | Tot. | A | B | Tot. | A | B | Tot. |
| Cores | 50 | 57 | 107 | 41 | 32 | 73 | 35 | 51 | 86 |
| Core rejuvenation products | 55 | 85 | 140 | 39 | 27 | 66 | 34 | 49 | 83 |
| Flakes | 709 | 888 | 1597 | 1044 | 543 | 1587 | 405 | 839 | 1244 |
| Blades | 116 | 184 | 300 | 129 | 83 | 212 | 85 | 228 | 313 |
| Blade fragments | 848 | 869 | 1717 | 1021 | 379 | 1400 | 344 | 856 | 1200 |
| Debris | 1709 | 1888 | 3597 | 1772 | 728 | 2500 | 956 | 1787 | 2743 |
| Chips | 1404 | 2134 | 3538 | 1694 | 766 | 2460 | 996 | 2112 | 3108 |
| Tools and tool fragments | 295 | 453 | 748 | 410 | 219 | 629 | 146 | 280 | 426 |
| Microburins | 50 | 83 | 133 | 128 | 60 | 188 | 28 | 67 | 95 |
| Total | 5236 | 6641 | 11877 | 6278 | 2837 | 9115 | 3029 | 6269 | 9298 |
| % | 44.1 | 55.9 | 100.0 | 68.9 | 31.1 | 100.0 | 32.6 | 67.4 | 100.0 |

Table VI. Evaluation of detailed distribution plans. A : surface finds; Br : registrated *in situ* finds; Bnr : non registrated *in situ* finds.

| | Sector 1 | | | | Sector 4 | | | | Sector 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | Br | Bnr | Tot. | A | Br | Bnr | Tot. | A | Br | Bnr | Tot. |
| Cores | 50 | 56 | 1 | 107 | 41 | 30 | 2 | 73 | 35 | 51 | - | 86 |
| Core rej. products | 55 | 77 | 8 | 140 | 39 | 22 | 5 | 66 | 34 | 49 | - | 83 |
| End-scrapers | 17 | 34 | - | 51 | 29 | 14 | 4 | 47 | 10 | 23 | - | 33 |
| Retouched flakes | 42 | 51 | 5 | 98 | 45 | 30 | 10 | 85 | 17 | 47 | - | 64 |
| Retouched blades | 68 | 92 | 12 | 172 | 103 | 27 | 15 | 145 | 26 | 54 | 1 | 81 |
| Points | 7 | 22 | 6 | 35 | 18 | 4 | 5 | 27 | 4 | 7 | 1 | 12 |
| Backed bladelets | 8 | 20 | 11 | 39 | - | - | - | - | 7 | 7 | - | 14 |
| Triangles | 3 | 8 | 1 | 12 | 5 | 2 | - | 7 | - | 2 | - | 2 |
| Points surf. retouch | 7 | 13 | 4 | 24 | 3 | - | - | 3 | - | 4 | - | 4 |
| Trapezes | 49 | 44 | 3 | 96 | 56 | 21 | 7 | 84 | 28 | 37 | - | 65 |
| Montbani blades | 44 | 50 | 3 | 97 | 69 | 25 | 10 | 104 | 21 | 41 | - | 62 |
| Points danub. type | - | 3 | - | 3 | - | 2 | - | 2 | 1 | 3 | - | 4 |
| Microburins | 50 | 61 | 22 | 133 | 128 | 31 | 29 | 188 | 28 | 59 | 8 | 95 |
| Tools neol. affinity | 2 | - | - | 2 | - | 1 | - | 1 | - | - | - | - |
| Total | 402 | 531 | 76 | 1009 | 536 | 209 | 87 | 832 | 211 | 384 | 10 | 605 |
| % | 39.9 | 52.6 | 7.5 | 100.0 | 64.4 | 25.1 | 10.5 | 100.0 | 34.9 | 63.5 | 1.6 | 100.0 |

4.2. HORIZONTAL DISTRIBUTION OF THE ARCHAEOLOGICAL MATERIAL

In the course of the excavation three high artifact density areas (sectors 1,4 and 5) have been identified. The total counts of both the surface finds and the geologically *in situ* lithic artifacts are given in table V. Of the three sectors, sector 5 is obviously the less disturbed : 67.4 % of the recovered lithics have been collected *in situ*. In sectors 1 and 4 respectively, 55.9 % and 31.1 % of the industry could be recovered *in situ*. The *in situ* finds (including lithic artifacts and sandstone and quartz fragments) have been plotted on the general distribution plans (plans 1, 3 and 5). Some of these plans also render the distributions of nutshells, bone fragments, charcoal and pottery. One should take into account that an important amount of the *in situ* material was collected in the sieve and therefore bears no exact square number and/or co-ordinates. For that reason no less than 20-30 % of the finds recovered *in situ* do not figure on the general distribution plans. Refitted artifacts (mostly broken blades) have been linked up by dashed lines; a systematic refitting of the industry however was not at all attempted. The distributions of cores, core rejuvenation products, tools and microburins are represented on plans 2,4 and 6. Table VI offers an evaluation of these more detailed distribution plans. One may derive from it that in sectors 1, 4 and 5 respectively 52.6 %, 25.1 % and 63.5 % of the artifacts taken into consideration figure on the plans. For the sake of completeness those artifacts for which the exact co-ordinates lacked, but for which the square of provenance was known, have been added on the plans. They are indicated by means of closed symbols distributed arbitrarily throughout the square meter. It should be emphasized that the true artifact density is but imperfectly represented by all of the distribution plans.

From the general and the more detailed distribution plans of sector 1 (plans 1 and 2) a diffuse pattern of artifact dispersion may be noted. Some areas of light artifact density occur centering around squares AF 004 and AB 011. The area around the latter square principally corresponds with the distribution of homogeneous blondishly patinated flint artifacts, including cores and core rejuvenation products. The most eye-striking feature encountered is a circular structure of burned sandstone and quartz fragments located in squares AB-AD 015-017. Due to an error in recording about 55 % of the *in situ* finds in square AC 016 were not given exact co-ordinates. The gap has however been filled up and the missing pieces were added on the plan and distributed arbitrarily throughout the square. The feature thus completed most likely represents the circularly spread remnants of a constructed hearth. Charcoal however was not available. A number of pieces have been refitted (mostly broken blades but also some mistletoe points). As may be inferred from the refitting pattern, artifacts belonging undoubtedly to the same occupation (in fact fragments of a single piece) may be widely distributed (up to 25 m). The percentage of artifacts displaying traces of firing in sector 1 is more important than in the other sectors (30.0 % of the total), a fact which may well be related to the presence of the hearth. Preserved bone fragments and charcoal, both being extremely rare, do not figure on the general distribution plan. In square AB 011 some fragmentary hazelnutshells were recovered from the C-horizon (see also fig. 12). The latter sample has been submitted for radiocarbon dating (results not yet available). The distribution pattern of cores, core rejuvenation products, tools and microburins is roughly analogous with the general artifact distribution pattern. As far as may be read from the plan, few concentrations of individual artifact types occur. Some groupings of cores (square AE 013) and microburins (square AE 009 and around square AF 002) may be noted. Backed bladelets seem to be confined to the eastern half of the sector.

Even less instructive than the distribution plans of sector 1 are those of sector 4 (plans 3 and 4). One should take into account that only about 30 % of the recovered archaeological material is figured. Some areas of light artifact density occur centering around squares AF 065, AE 072 and AE 077. Sandstone and quartz debris are scarce. Of the total of lithic artifacts 22.7 % display traces of firing. Whereas bone fragments are absent within the western part of sector 4, they center in small amounts around squares AE 072 and AE 077. A considerable quantity of burned bone was recovered from the disturbed Ap-horizon. Charcoal was only present in very small amounts and does not figure on the distribution plan. Likewise some dispersed small lumps of ochre are not indicated. The most striking and problematical feature is the occurence of potsherds within the mesolithic level. These sherds, highly concentrated within the squares AE-AF 077, have for the most part (60 %) been recovered from the $B_2$ir-horizon. About 30 % of them were situated within the $B_2$h-horizon, whereas the remainder originates from the BC- and C-horizons. Within the surface layer (disturbed and mixed $A_1$, $A_2$ and AB) no potsherds were encountered. It might however not be excluded that these fragile and much worn relics did not survive within an aerated and ploughed soil. Another small series of sherds, of the same type of ware, was recovered from squares AD-AF 070. There were no field-indications of possible soil-disturbances which could be held responsible for the presence of these potsherds. Down to the C-horizon they occur in close correlation with the lithic industry. There is obviously no reason not to accept a contemporary burial of both sherds and lithics, which however does not necessitate their contemporary discard. Also for sector 4 the distribution pattern of cores, core rejuvenation products, tools and microburins is roughly analogous with the general distribution of the finds. One may note the importance of trapezes within the central area. The end-scrapers recovered are almost exclusively confined to the extreme eastern part (squares AF-AG 078-079). All other recorded artifacts seem equally distributed throughout the sector. Special mention should be made of the presence of a triangular arrowhead of evolved neolithic affinity (fig. 23, 25), which was recovered within the $B_2$h-horizon of square AD 067.

Due to its geographic isolation, outside the fire-alley on the top of the dune, the artifact distribution of sector 5 is not only the best preserved but also the most instructive. In fact, more than 60 % of the archaeological material has been recorded on the plans. As may be inferred from the general distribution plan (plan 5), the well-defined horizontal artifact concentration is clearly oval-shaped and measures c. 7 by 3 m along its axes. Except for its eastern part, where the diminution of finds is less pronounced, the artifact density quickly drops down beyond the concentration area. Some squares (KQ 074 and KP 078) have been inadequately excavated so that most of the finds were improperly registrated. They have, however, been filled up, taking into account the overall ratio of non-registrated versus registrated *in situ* finds. One should take note that within the northern part of sector 5 the $A_2$-horizon is for the most part disturbed and mixed with the overlying horizon, so that much of the surface material may originate from this area. However, as may be inferred from the section drawn (fig. 13), this erosion affects only the uppermost part of the vertical artifact dispersion preserved and is therefore not thought to distort the horizontal artifact distribution as reflected by the various plans. Within sector 5 sandstone and quartz debris are quite scarce. A sole potsherd of similar manufacture as those from the sector 4 was recovered from the $B_2$h-horizon of square KN 078, i.e. outside the main concentration area. In the vicinity (squares KM 078 and KN 079) some small ochre nodules and a sole substantial ochre cobble were collected. Few artifacts have been refitted. The influence of fire may be spotted on 21.2 % of the lithic industry. Because of their important amounts and noteworthy distributions, the organic remains of sector 5 are represented on an additional plan (plan 7). The approximate limit of the lithic artifact concentration is indicated by a dashed line. As may be read from the plan, a large amount of broken and carbonized hazelnutshells was recovered. The latter occur essentially within two distinct concentrations : squares KO 076-078 and KO 080-081. About 85 % of these shells were located within the $B_2$ir- and the BC-horizon. The remainder originates from the $A_2$-$B_2$h-succession. The complete sample has been subjected to radiocarbon dating (Lv-959). The distribution pattern of preserved burned bone fragments roughly coincides with the nutshell concentration within squares KO 076-078. Within the southwestern part of the concentration area a considerable amount of charcoal was recovered, nearly all of which was located within the $A_2$-horizon. This sample was also submitted for radiocarbon dating (Lv-934). As may be inferred from their distributions, the distinct species of organic waste are clearly confined to the general distribution pattern, within which they mark off fairly well-defined areas (obviously subject to functional interpretation). As may be read from the detailed distribution plan (plan 6) cores, core rejuvenation products, tools and microburins seem to be randomly distributed within the concentration area. Except for a concentration of microburins centering around square KQ 078 no apparent groupings of individual artifact types occur. It should however be noted that the most densely populated area of plan 6 corresponds with a vacuum of organic remains within the concentration limits.

# 5. THE ARCHAEOLOGICAL MATERIAL

## 5.1. RAW MATERIALS

As may be inferred from table VII, raw materials mainly consist of flint and wommersom-quartzite. The latter mostly bears a penetrating light greyish patina, whereas the former, multifarious but predominantly grey coloured, is found both patinated and unpatinated. Chert (phtanite) and micaceous sandstone are present only in very small quantities and have henceforth been incorporated into the flint total counts. The raw material distribution according to main artifact classes is given in table VIII.

Table VII. Representation of raw materials utilized.

| | Sector 1 | | Sector 4 | | Sector 5 | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Flint | 9704 | 81.70 | 6897 | 75.67 | 6716 | 72.23 |
| Wommersom-quartzite | 2142 | 18.03 | 2210 | 24.24 | 2579 | 27.74 |
| Chert (phtanite) | 16 | 0.13 | 8 | 0.09 | 3 | 0.03 |
| Micaceous sandstone | 15 | 0.13 | - | - | - | - |
| Total | 11877 | 99.99 | 9115 | 100.00 | 9298 | 100.00 |

The flint processed is often of inferior quality, displaying frost-cracks and heterogeneous in its colour and structure. As far as may be inferred from the cortical surfaces preserved, most of the flint material was obtained from rolled nodules. The average length of these nodules may be estimated through the dimensional characteristics of flaking products at 8-10 cm. Their exact provenance remaining unknown, they most likely originate from fluviatile gravel terraces in the immediate vicinity.

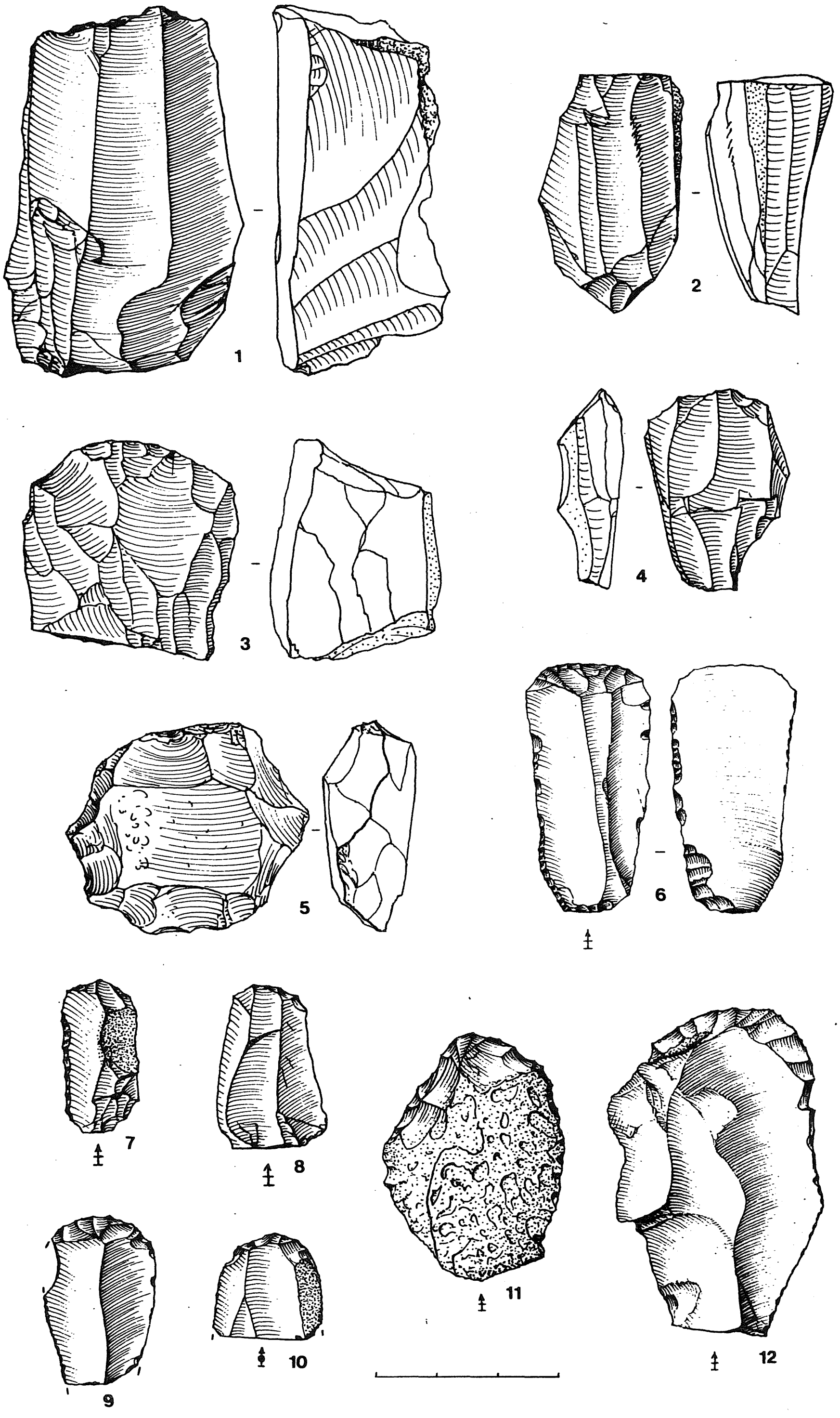

1
2
3
4
5
6
7
8
9
10
11
12

Table VIII. General composition of the sectors 1, 4 and 5 according to main artifact classes. F : flint; W : wommersom-quartzite.

| | Sector 1 | | | | Sector 4 | | | | Sector 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | W | Tot. | % | F | W | Tot. | % | F | W | Tot. | % |
| Cores | 85 | 22 | 107 | 0.9 | 61 | 12 | 73 | 0.8 | 78 | 8 | 86 | 0.9 |
| Core rej. prod. | 98 | 42 | 140 | 1.2 | 40 | 26 | 66 | 0.7 | 46 | 37 | 83 | 0.9 |
| Flakes | 1268 | 329 | 1597 | 13.4 | 1167 | 420 | 1587 | 17.4 | 938 | 306 | 1244 | 13.4 |
| Blades | 205 | 95 | 300 | 2.5 | 133 | 79 | 212 | 2.3 | 225 | 88 | 313 | 3.4 |
| Blade fragm. | 1073 | 644 | 1717 | 14.5 | 731 | 669 | 1400 | 15.4 | 637 | 563 | 1200 | 12.9 |
| Debris | 3117 | 480 | 3597 | 30.3 | 2093 | 407 | 2500 | 27.4 | 2054 | 689 | 2743 | 29.5 |
| Chips | 3192 | 346 | 3538 | 29.8 | 2073 | 387 | 2460 | 27.0 | 2349 | 759 | 3108 | 33.4 |
| Tools | 578 | 170 | 748 | 6.3 | 429 | 200 | 629 | 6.9 | 316 | 110 | 426 | 4.6 |
| Microburins | 119 | 14 | 133 | 1.1 | 178 | 10 | 188 | 2,1 | 76 | 19 | 95 | 1.0 |
| Total | 9735 | 2142 | 11877 | 100.0 | 6905 | 2210 | 9115 | 100.0 | 6719 | 2579 | 9298 | 100.0 |
| % | 82.0 | 18.0 | 100.0 | - | 75.8 | 24.2 | 100.0 | - | 72.3 | 27.7 | 100.0 | - |

wommersom-quartzite raw material unities were obviously acquired from their outcrop at Wommersom near Tienen (Brabant), about 65 km to the south. The strikingly small proportion of wommersom-quartzite cores (especially in sectors 4 and 5; see table IX) in addition to the high frequency of wommersom-quartzite core rejuvenation products (see table X) may point at their relative voluminosity. Micaceous sandstone may also have been derived from outcrops near Wommersom. However this raw material is less distinctive and determination of its provenance is difficult. The same applies to chert (phtanite) which may possibly originate from the Cambrium outcrops near Ottignies (Brabant), some 140 km to the south. It might however not be excluded that both micaceous sandstone and chert (phtanite) were extracted from fluviatile gravels either close or distant to the site.

## 5.2. CORES AND CORE REJUVENATION PRODUCTS

The particularities of these artifacts point at the economical processing of the raw material resources. Cores occur with similar frequencies in each sector (see table VIII). Their typological classification is presented in table IX.

Cores with one striking platform (fig. 15, 1-2; 20, 1; 24, 1-4), often showing cortex on the back, are the most frequent. Amongst these, circumferentially flaked pyramidal cores (fig. 24, 4) are scarce. In sector 1 cores with opposed striking platforms (fig. 15, 3-4; 20, 2-3) are slightly more numerous than cores with crossed striking platforms (fig. 20, 4-5); the latter are however more frequent in sectors 4 and 5. Amongst these two core types, distinct by the mutual relationship between the striking platforms, further subdivision may be made depending on the pattern of flake removal: same side, adjacent sides or opposite sides (HASSAN, 1974:22).

Fig. 15. Sector 1. 1-2 : cores with one striking platform; 3-4 : cores with opposed striking platforms; 5 : discoidal core; 6 : long end-scraper on a blade; 7-8 : short end-scrapers on a blade; 9-10 : broken end-scrapers on a blade; 11-12 : single end-scrapers on a flake.

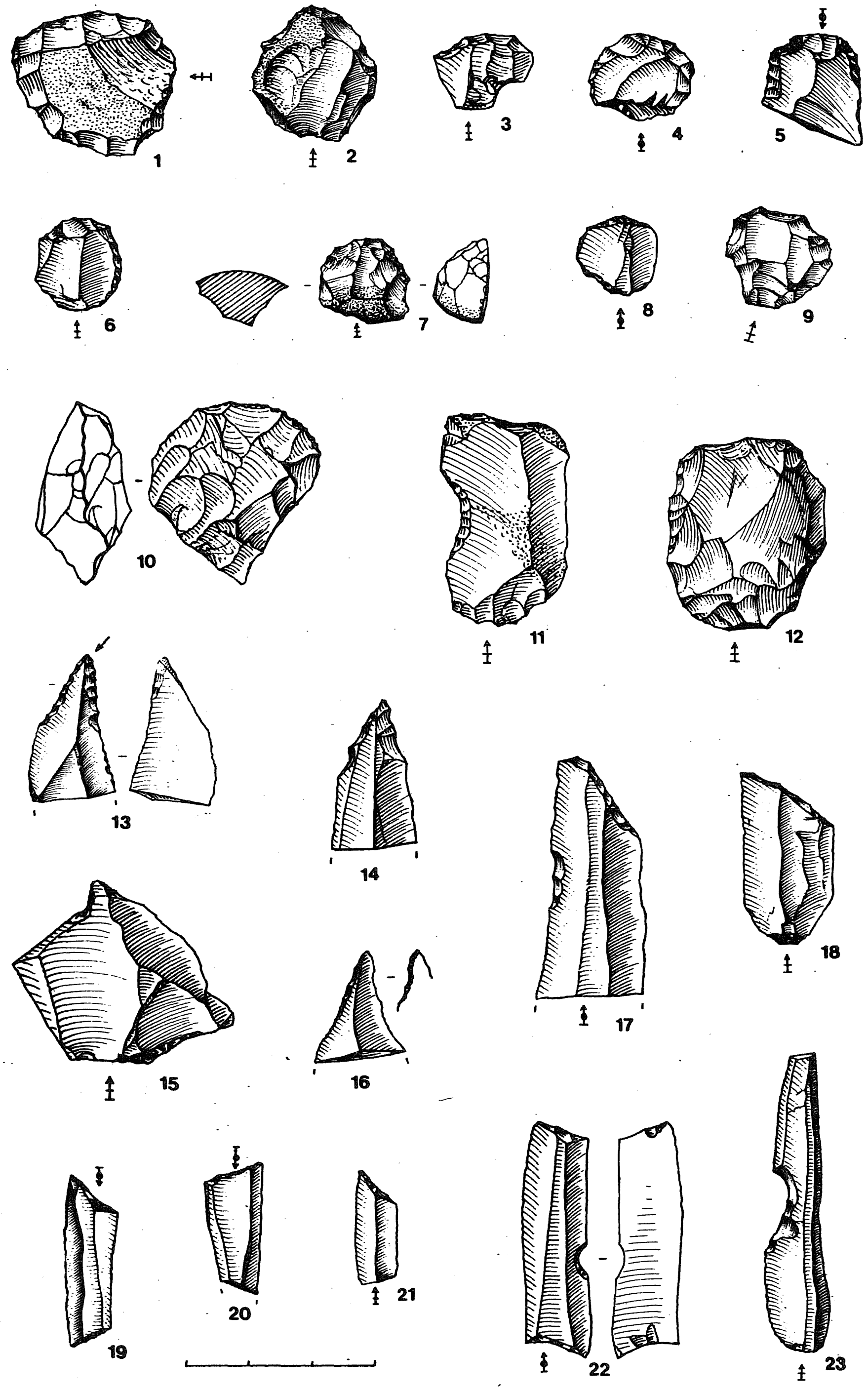


Table IX. Classification of cores. F : flint; W : wommersom-quartzite.

| | Sector 1 | | | | Sector 4 | | | | Sector 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | W | Tot. | % | F | W | Tot. | % | F | W | Tot. | % |
| One platform | 27 | 7 | 34 | 31.8 | 27 | 7 | 34 | 46.5 | 32 | 3 | 35 | 40.8 |
| Opposed platforms | 18 | 1 | 19 | 17.7 | 7 | 1 | 8 | 11.0 | 10 | - | 10 | 11.6 |
| Crossed platforms | 7 | 5 | 12 | 11.2 | 11 | 3 | 14 | 19.2 | 10 | 2 | 12 | 13.9 |
| Discoidal | 4 | 2 | 6 | 5.6 | 5 | 1 | 6 | 8.2 | 1 | - | 1 | 1.2 |
| Globular | 2 | - | 2 | 1.9 | 1 | - | 1 | 1.4 | 1 | - | 1 | 1.2 |
| Irregular | 17 | 3 | 20 | 18.7 | 9 | - | 9 | 12.3 | 13 | 2 | 15 | 17.4 |
| Indeterminable fragm. | 10 | 4 | 14 | 13.1 | 1 | - | 1 | 1.4 | 11 | 1 | 12 | 13.9 |
| Total | 85 | 22 | 107 | 100.0 | 61 | 12 | 73 | 100.0 | 78 | 8 | 86 | 100.0 |
| % | 79.4 | 20.6 | 100.0 | - | 83.6 | 16.4 | 100.0 | - | 90.7 | 9.3 | 100.0 | - |

Discoidal (fig. 15, 5) and globular cores are of little importance. Irregularly shaped cores, including cores presenting only one or two negatives of removal as well as flake cores, are not uncommon. The amount of indeterminable core fragments, mostly fire-cracked, is quite important in sectors 1 and 5.

Most of the cores are in an apparently exhausted state. They most frequently attain a largest dimension of 3 to 4 cm. Larger cores are generally of wommersom-quartzite (e.g. fig. 24, 1). The few tiny cores for the production of narrow microblades (e.g. fig. 20, 5) indicate a refined flaking-technology. The edges of the striking platforms are frequently denticulated. In fact, once exhausted, cores were left about without edge regularisation. The latter can however be observed on the bulbar ends of flaking products (especially blades) in the form of dorsal retouch originating from the butt-edge.

It is not always easy to determine the exact sort of flaking products that have been detached. Single platform cores as well as cores with opposed and crossed striking platforms will initially have served for blade production, whereas - judging by the shape of removal negatives - ultimately elongated flakes and flakes were obtained. Discoidal, globular and irregular cores were of course only suitable for flake production.

Amongst the core rejuvenation products core sides ("flancs de nucléus"), tabular flakes ("tablettes de nucléus") and single crested blades ("lames à crête simple") have been discerned (table X). Taking into account the high frequency of the last, re-orientation of the flaking direction is to be considered as the most widely applied rejuvenation technique. Removal of the striking platform or the core side, thus deliberately reducing the workable volume, was far more exceptionally applied. Some core rejuvenation products have been reshaped into tools, in which case they have been catalogued with the toolkit (e.g. the Montbani blades of fig. 29, 6, 11).

Fig. 16. Sector 1. 1-2: thumbnail scrapers; 3-8: mini scrapers; 9: denticulated end-scraper; 10: atypical carinated end-scraper; 11: single notched flake; 12: single convex side-scraper; 13-14: borers; 15: bec; 16: "alésoir"; 17-22: blades with an oblique truncation; 23: single notched blade.

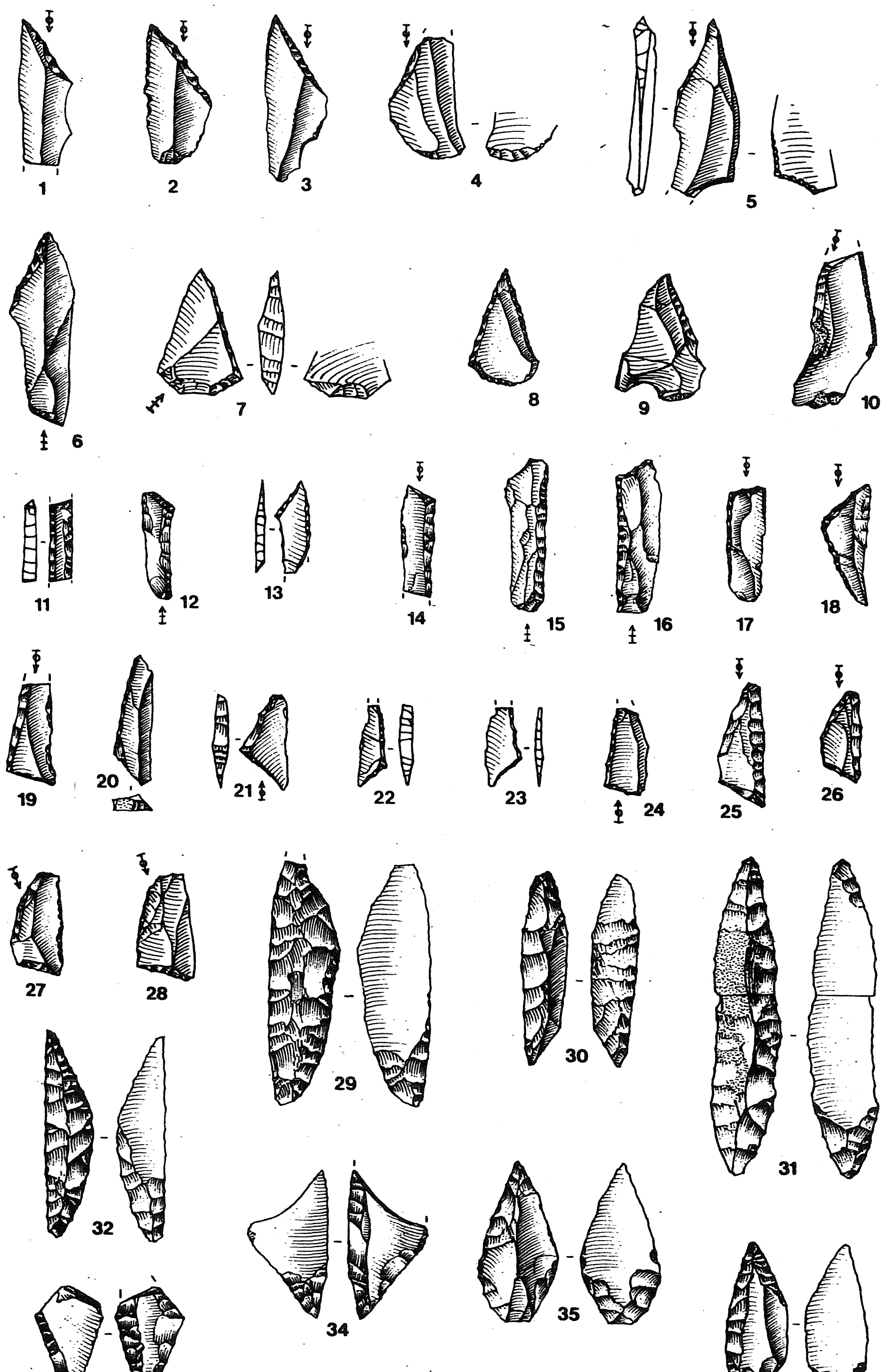

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

Table X. Classification of core rejuvenation products. F : flint; W : wommersom-quartzite.

| | Sector 1 | | | | Sector 4 | | | | Sector 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | W | Tot. | % | F | W | Tot. | % | F | W | Tot. | % |
| Core side | 3 | 1 | 4 | 2.8 | 3 | 1 | 4 | 6.1 | 4 | 4 | 8 | 9.6 |
| Tabular flake | 21 | 5 | 26 | 18.6 | 12 | 3 | 15 | 22.7 | 13 | 5 | 18 | 21.7 |
| Crested blade | 74 | 36 | 110 | 78.6 | 25 | 22 | 47 | 71.2 | 29 | 28 | 57 | 68.7 |
| Total | 98 | 42 | 140 | 100.0 | 40 | 26 | 66 | 100.0 | 46 | 37 | 83 | 100.0 |
| % | 70.0 | 30.0 | 100.0 | - | 60.6 | 39.4 | 100.0 | - | 55.4 | 44.6 | 100.0 | - |

## 5.3. THE DEBITAGE

Flaking aims essentially at the production of blades on which, in fact, more than 70 % of the toolkit was manufactured. Consequently, it did not seem very appropriate to undertake a detailed classification of flakes and debris. The latter comprises all unretouched broken flakes of which the largest dimension exceeds or equals 1 cm. All flakes and debris smaller than 1 cm have been considered as chips and were counted separately. Flakes, debris and chips prove to occur with equal frequencies in each sector (see table VIII). The following three flake classes have been discerned according to size :

Class 1 : largest dimension $\geq$ 4 cm
Class 2 : 4 cm $<$ largest dimension $\geq$ 2 cm
Class 3 : 2 cm $<$ largest dimension $\geq$ 1 cm

The results of this classification are listed below (table XI). Large flakes prove to be extremely scarce whereas small flakes abound. Total

Table XI. Classification of flakes. F : flint; W : wommersom-quartzite.

| | Sector 1 | | | | Sector 4 | | | | Sector 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | W | Tot. | % | F | W | Tot. | % | F | W | Tot. | % |
| Class 1 | 19 | 6 | 25 | 1.6 | 13 | 4 | 17 | 1.1 | 24 | 7 | 31 | 2.5 |
| Class 2 | 331 | 82 | 413 | 25.8 | 299 | 73 | 372 | 23.4 | 236 | 90 | 326 | 26.2 |
| Class 3 | 918 | 241 | 1159 | 72.6 | 855 | 343 | 1198 | 75.5 | 678 | 209 | 887 | 71.3 |
| Total | 1268 | 329 | 1597 | 100.0 | 1167 | 420 | 1587 | 100.0 | 938 | 306 | 1244 | 100.0 |
| % | 79.4 | 20.6 | 100.0 | - | 73.5 | 26.5 | 100.0 | - | 75.4 | 24.6 | 100.0 | - |

Fig. 17. Sector 1. 1-6: obliquely truncated points; 7-9: short points; 10: unilaterally backed point; 11: fragment of a small backed bladelet; 12-14: truncated small backed bladelets; 15: backed bladelet; 16-17: truncated backed bladelets; 18: scalene backed bladelet; 19-24: scalene triangles; 25-28: truncated scalene triangles; 29-32: mistletoe points; 33: triangle with surface retouch; 34: fragment of a point with oblique base (?); 35: point with rounded base; 36: point with oblique base.

counts comprise cortical (primary) flakes. Only flint flakes with at least one third of the dorsal side covered with cortex have been considered as such. Their percentage attains 13.1 of all flakes in sector 1, 12.4 in sector 4 and 15.0 in sector 5. Most of these also belong to class 3. Wommersom-quartzite flakes with cortex (or wind polish) are extremely scarce. Hardly 5 to 10 % of the complete flakes show traces of firing, whereas the number of fire-cracked debris and chips amounts up to 30 to 40 %. Complete blades represent only a small fraction of the total industry (see table VIII). Blade fragments are numerous, but one should of course take into account their overrepresentation of the true artifact number. Judging by the combined amount of proximal blade fragments (see table XII) and proximal microburins (see table XVIII) one could estimate 60-70 % of the original stock of blades to be fractured either voluntarily or accidentaly.

Among the different classes of the debitage there exists a marked discrepancy in the use of raw materials. In sectors 1, 4 and 5 respectively 36.6 %, 46.4 % and 43.0 % of the amount of blades and blade fragments were obtained from wommersom-quartzite. Among flakes and debris, however, strikingly different frequencies of wommersom-quartzite were noted : respectively 15.6 %, 20.2 % and 25.0 %. From this discrepancy the preferential use of wommersom-quartzite for blade production may be inferred. This preference may be explained by both wommersom-quartzite's natural occurence in tabular form and its structural qualities, which lend it more readily for blade production, rather than do the rolled flint nodules.

As may be concluded from the table below (table XII) proximal

Table XII. Classification of blade fragments. F : flint; W : wommersom-quartzite.

| | Sector 1 | | | | Sector 4 | | | | Sector 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | W | Tot. | % | F | W | Tot. | % | F | W | Tot. | % |
| Proximal | 435 | 238 | 673 | 39.2 | 291 | 218 | 509 | 36.4 | 274 | 198 | 472 | 39.3 |
| Distal | 212 | 142 | 354 | 20.6 | 165 | 143 | 308 | 22.0 | 157 | 118 | 275 | 22.9 |
| Medial | 221 | 176 | 397 | 23.1 | 125 | 89 | 214 | 15.3 | 110 | 132 | 242 | 20.2 |
| Accidental | 205 | 88 | 293 | 17.1 | 150 | 219 | 369 | 26.3 | 96 | 115 | 211 | 17.6 |
| Total | 1073 | 644 | 1717 | 100.0 | 731 | 669 | 1400 | 100.0 | 637 | 563 | 1200 | 100.0 |
| % | 62.5 | 37.5 | 100.0 | - | 52.2 | 47.8 | 100.0 | - | 53.1 | 46.9 | 100.0 | - |

blade fragments outnumber by far distal and medial ones. Their preponderance may primarily be explained by the important preservation of distal ends in the toolkit, especially the armatures, which are moreover likely to have been discarded outside the excavated accumulation zone. Amongst the clearly accidentally broken blades the amount of fire-cracked pieces is considerable.

For the complete blades both mean and standard deviation of the three dimensions have been calculated. The results according to sectors are presented in table XIII. Length, width and thickness prove to be quite similar. Only of sector 5 proximal and distal blade fragments have been examined according to size. As may be judged from the means and standard deviations presented in table XIV, length and thickness are in perfect accordance. Distal fragments, consisting of the slightly converging part of the blade, are on the whole somewhat narrower than proximal ones. Both proximal and distal fragments prove to be less thick than the

Table XIII. Means ($\bar{X}$) and standard deviations ($\sigma$) of the dimensions of complete blades (expressed in mm).

| | Length | | Width | | Thickness | |
|---|---|---|---|---|---|---|
| | $\bar{X}$ | $\sigma$ | $\bar{X}$ | $\sigma$ | $\bar{X}$ | $\sigma$ |
| Sector 1 | 31.3 | 10.1 | 10.3 | 3.5 | 3.2 | 1.5 |
| Sector 4 | 30.7 | 11.0 | 9.9 | 3.3 | 3.3 | 1.5 |
| Sector 5 | 28.7 | 9.6 | 9.8 | 3.4 | 3.0 | 1.4 |

Table XIV. Means ($\bar{X}$) and standard deviations ($\sigma$) of the dimensions of proximal and distal blade fragments from sector 5 (expressed in mm).

| | Length | | Width | | Thickness | |
|---|---|---|---|---|---|---|
| | $\bar{X}$ | $\sigma$ | $\bar{X}$ | $\sigma$ | $\bar{X}$ | $\sigma$ |
| Proximal fragments | 18.5 | 7.6 | 9.5 | 3.2 | 2.0 | 0.8 |
| Distal fragments | 18.3 | 7.9 | 8.5 | 2.6 | 2.0 | 0.8 |

complete blades, which is merely due to the fact that the maximum thickness of the blades coincides with their medial part (compare to the metric evaluation of the trapezes furtheron).

From a morphological point of view blades have usually a small, slightly oblique and often beetling butt. The bulb of percussion is mostly weakly profiled. Consequently, negative bulbs on the cores are seldomly pronounced. The cone of percussion and the point of impact are mostly absent. These particularities indicate according to F. BORDES (1947) the use of a soft (wooden or bone) hammer. Hammerstones are indeed very scarce. Only few quartz-pebbles with abrasion traces are present (see furtheron). Obviously these were applied for cortex removal and rough preparation of the core.

The above morphological characteristics also point at a refined flaking-technology. Blades are moreover regular and mostly display parallel edges and ridges. They often present three facets on the dorsal side. Wommersom-quartzite blades more often than flint blades accord to these characteristics. In general, however, the "style de débitage" may be referred to as being Montbani-like (ROZOY, 1968 : 370).

## 5.4. TOOLS

With regard to the total artifact counts, retouched pieces occur in similar quantities in sectors 1 and 4 (respectively 6.3 % and 6.9 %). In sector 5 they are somewhat less represented (4.6 %). Frequencies of wommersom-quartzite within the tool class amount to 22.7 % in sector 1, 31.8 % in sector 4 and 25.8 % in sector 5.

Microliths occur in similar quantities : 33.3 % of the toolkit in sector 1, 24.5 % in sector 4 and 29.9 % in sector 5. As is the case for the total retouched tools, frequencies of wommersom-quartzite accord well with frequencies in regard to the total artifact counts : 18.7 % of all microliths have been obtained from wommersom-quartzite in sector 1, 31.2 % in sector 4 and 22.3 % in sector 5. However, a strong preferential use of wommersom-quartzite is to be noted amongst particular types of mi-

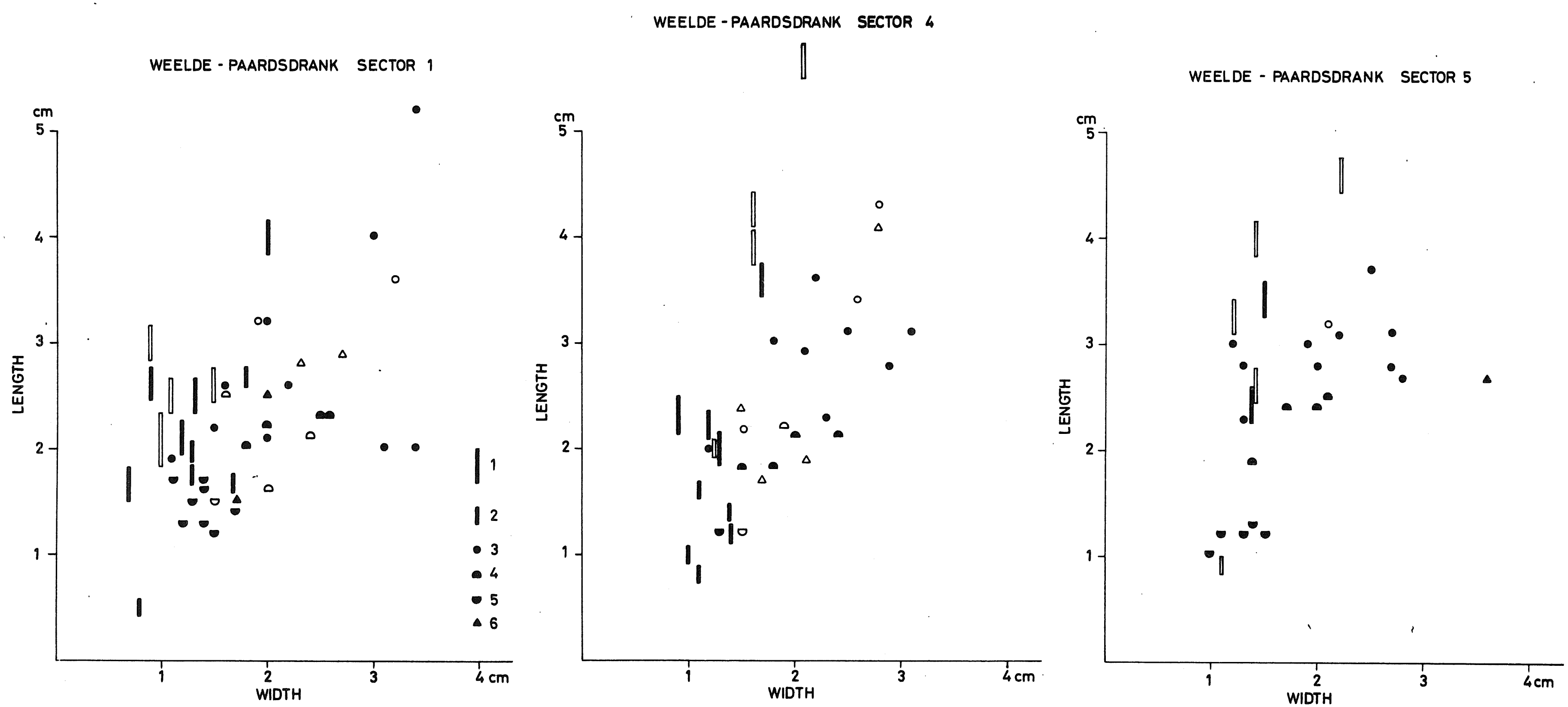



Fig. 18. Length-width correlation of end-scrapers. 1: end-scraper on a blade; 2: broken end-scraper on a blade; 3: end-scraper on a flake; 4: thumbnail scraper; 5: mini scraper; 6: other end-scraper. Open symbols indicate artifacts from wommersom-quartzite.

croliths (see furtheron).

Analysis and classification of tools essentially rests on the typology of J.G. ROZOY (1968). For the geometric microlithic armatures the guidelines of the G.E.E.M. (1969) have been applied. The general typological composition of the Weelde microliths is presented in a comparative table (table XX). For more detailed information we refer to the tool inventory list (table XIX) and the cumulative graphs (fig. 32).

As far as possible also fragmentary tools were catalogued. The percentages indicated with regard to the total tool counts relate, if not stated otherwise, to the totality of retouched artifacts minus unclassified indeterminable tool fragments (see table XIX).

5.4.1. End-scrapers

In sectors 1, 4 and 5 end-scrapers account for respectively 8.0 %, 9.2 % and 9.6 % of the toolkit. Frequencies of wommersom-quartzite in sectors 1 and 4 accord well with frequencies in regard to the total tool counts; in sector 5 the amount of wommersom-quartzite end-scrapers is rather small (18.2 %). Nearly 25 % of all end-scrapers in sectors 1 and 4 have been obtained from cortical flakes; in sector 5 up to 50 % display patches of cortex. Most of these tools have a carefully prepared scraper front. The table below (table XV) indicates its orientation. More than 50 % in each sector have the scraper front opposite to

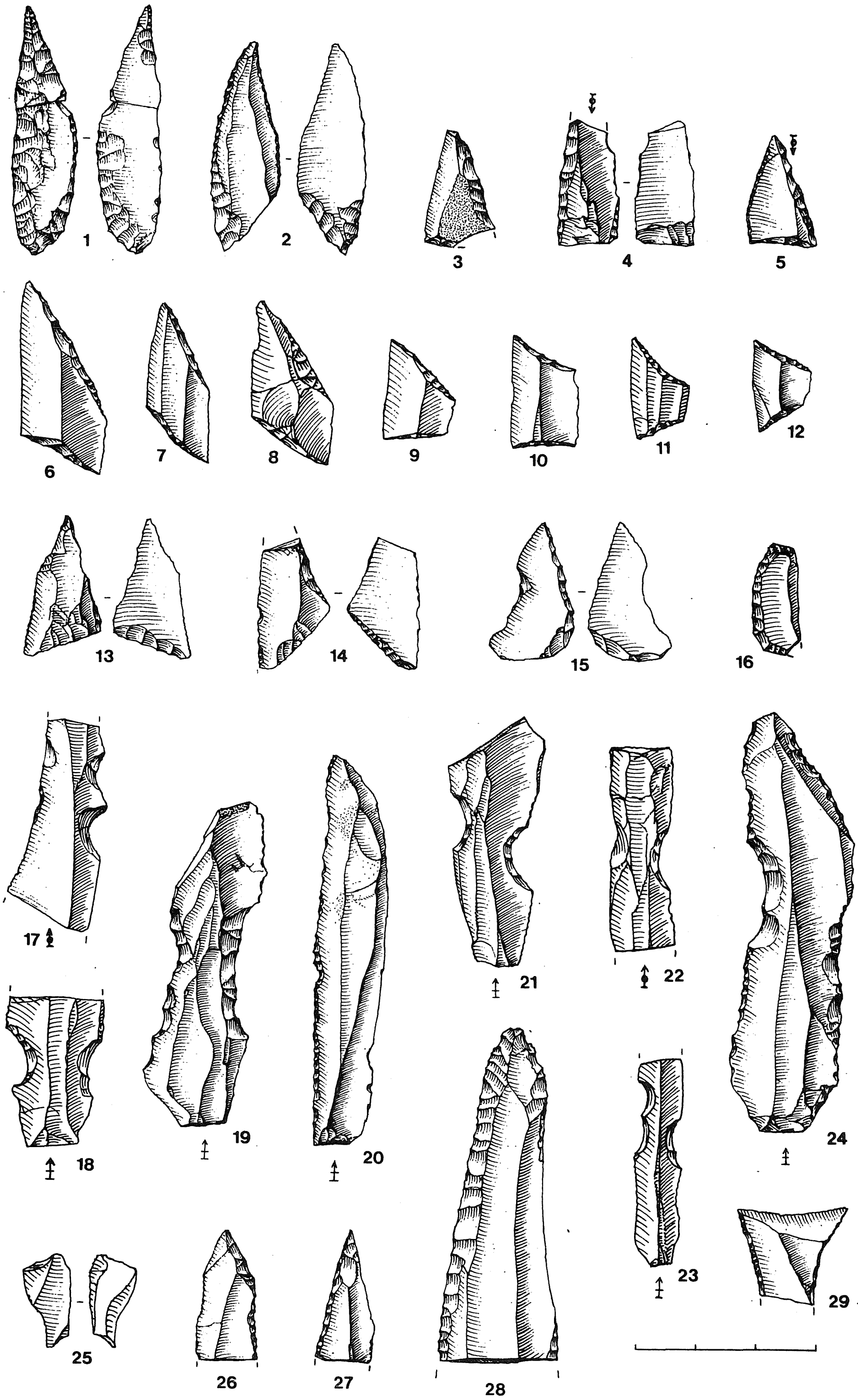
Table XV. Orientation of the scraper front.

| | Sector 1 | | Sector 4 | | Sector 5 | |
|---|---|---|---|---|---|---|
| | Tot. | % | Tot. | % | Tot. | % |
| Distal | 32 | 63 | 25 | 53 | 20 | 61 |
| Proximal | 6 | 12 | 6 | 13 | 2 | 6 |
| Lateral | 6 | 12 | 2 | 4 | 3 | 9 |
| Indeterminable | 7 | 13 | 14 | 30 | 8 | 24 |
| Total | 51 | 100 | 47 | 100 | 33 | 100 |

the proximal end of the blank. Proximal and lateral scraper fronts, however, are common. In many instances - due to the fragmentary condition of the piece - the exact orientation of the scraper front has not been determined. Its working edge may often be renewed (or merely highly worn ?).

In the three sectors end-scrapers on a flake occur more frequently than end-scrapers on a blade. The latter occur in sectors 1, 4 and 5 for respectively 29 %, 28 % and 21 %. Almost half of all end-scrapers on a blade are long end-scrapers (fig. 15, 6; 20, 6-8; 24, 5-6). Some specimens display a slightly convex scraper front (e.g. fig. 15, 6; 20, 7). A strongly marked angular transition between the scraper front and the edges of the blank is rather uncommon (e.g. fig. 20, 8). Short end-scrapers on a blade (fig. 15, 7-8; 20, 9-10; 24, 7) are rare. The percentage of broken specimens (fig. 15, 9-10; 20, 11-12) is however not negligible. The end-scrapers on a blade only exceptionally bear a retouch of the blank-edges (e.g. fig. 15, 6-7). In sectors 1 and 4 nearly 1/3 of all specimens have been obtained from wommersom-quartzite. In sector 5, five out of seven were made on wommersom-quartzite blades. As may be judged from fig. 18, showing the length-width correlation of all end-scrapers except for non-measurable fragments, no marked standardization is to be noted.

Amongst the end-scrapers on a flake single end-scrapers and thumb-


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

nail scrapers/mini scrapers prevail. The former (fig. 15, 11-12; 20, 13-14; 21, 1-5; 24, 8-12) display a great morphological variety and do not show any degree of standardization, as may be noted from fig. 18. Some of them (e.g. fig. 21, 6) might be classified as end-scrapers on a retouched flake. As opposed to end-scrapers on a blade only a few have been obtained from Wommersom-quartzite. Both thumbnail scrapers (fig. 16, 1-2; 21, 7-9; 24, 13-14) and mini scrapers (fig. 16, 3-8; 21, 10; 24, 15-16) may be defined on the basis of their clustering on the graphs (fig. 18). From a morphological point of view, however, their separation is less apparent. In sectors 1 and 5 mini scrapers predominate over thumbnail scrapers; in sector 4 the latter are slightly more numerous. The actual scraper front of the thumbnail scraper of fig. 16, 1 has been shaped on the right edge of a flint cortical flake and is marked by abrupt retouch and intense use wear. Oblique left edge retouch however does not display visible traces of wear and could possibly be related to a hafting of the implement. The mini scraper of fig. 16, 8 has two opposite scraper fronts and is to be considered as a double end-scraper. Only few thumbnail scrapers and mini scrapers have been obtained from Wommersom-quartzite. The mini scraper of fig. 16, 5 is a unique specimen from chert (phtanite).

An important amount of indeterminable end-scraper fragments have been catalogued as other end-scrapers on a flake. The few double end-scrapers (fig. 21, 11-12) occur within the size-range of the thumbnail scrapers. The one of fig. 21, 12 displays two lateral scraper fronts. The end-scraper of fig. 16, 10 presents a scraper front adjusting a wommersom-quartzite core fragment and could be referred to as an atypical carinated end-scraper. The carinated end-scraper of fig. 21, 14 was obtained on a tabular flake from wommersom-quartzite. The flint artifact of fig. 24, 17 has been catalogued as a core-like end-scraper but might also be a core with regularised striking-edge. Denticulated end-scrapers are rare. The shown specimen (fig. 16, 9) accords well with the mini scrapers.

### 5.4.2. Retouched flakes

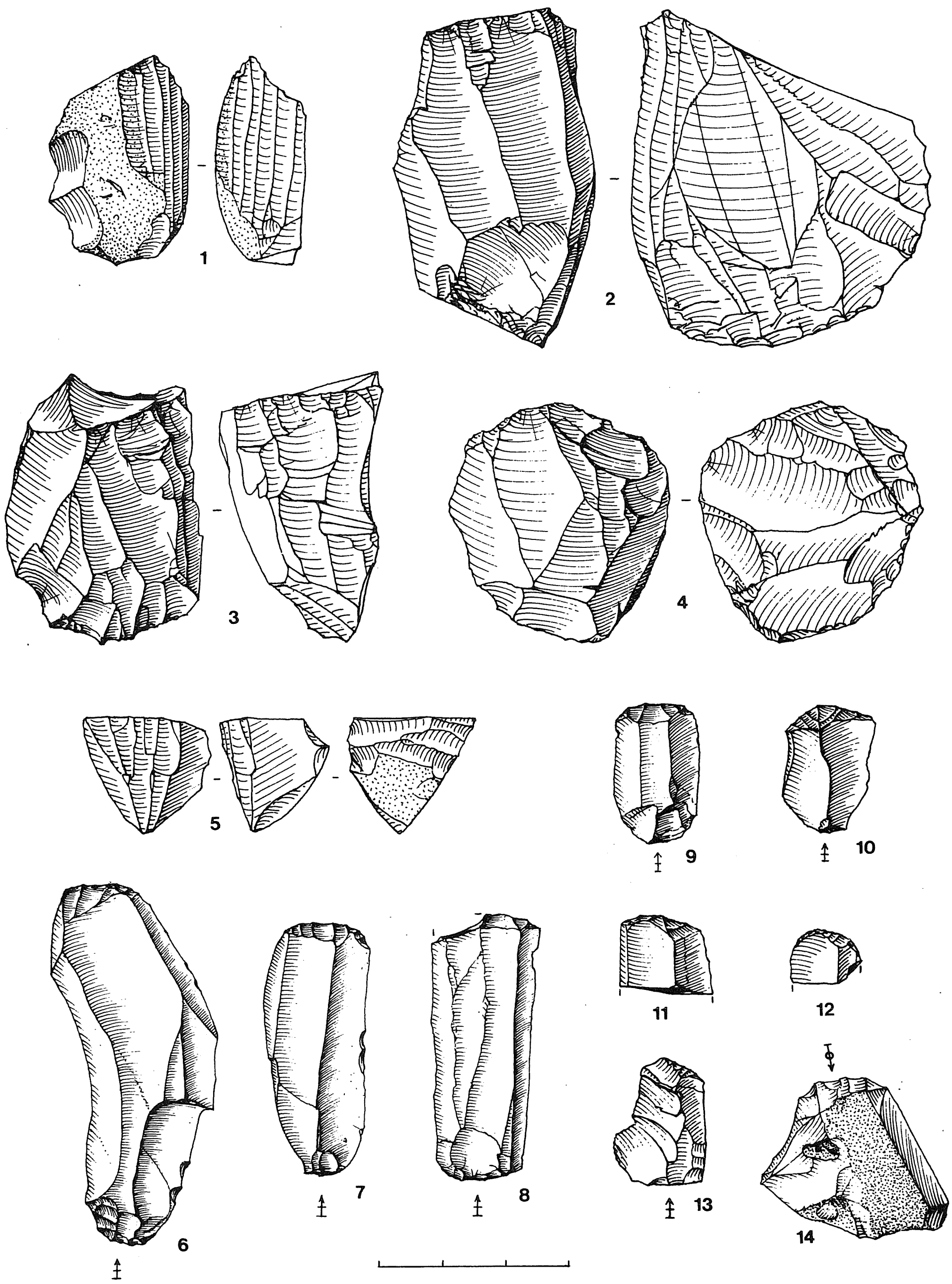
Retouched flakes occur with similar frequencies in the three sectors : 15.3 % of the toolkit in sector 1, 16.6 % in sector 4 and 18.6 % in sector 5. In each sector about 70 % of them bear a regular partial retouch along one of the flake-edges. Continuous retouch occurs only exceptionally. The frequency of truncated flakes, mostly slightly obliquely truncated, is about 15 %. Denticulated flakes are somewhat less common. Almost half of the latter are single notched (fig. 16, 11).

Some rare side-scrapers occur in sectors 1 and 5. A single convex specimen from sector 1 was obtained from chert (phtanite). Another one (fig. 16, 12), from the same sector, was shaped on a flint flake. A unique double convex side-scraper on a thick flint flake from sector 5 (fig. 25, 1) bears alternate retouch.

### 5.4.3. Borers and burins

Borers and burins are rare and account for less than 1 % of the toolkits. The two small borers of fig. 16, 13-14 have been obtained from

Fig. 19. Sector 1. 1-2: points with oblique base; 3: short triangular point; 4: long triangular point; 5: ogival point with concave base; 6-8: long rhombic trapezes; 9-10: short rectangular trapezes; 11: long asymmetric trapeze; 12: symmetric trapeze with very oblique truncations; 13-15: points of danubian type; 16: indeterminate microlith; 17: unilateral multiply notched blade; 18: blade with opposing notches; 19: blade with opposing retouch; 20: unilateral irregularly retouched blade; 21-23: blades with off-set notches; 24: blade with off-set retouch; 25: double microburin; 26-27: broken armatures; 28: robust pointed blade; 29: transverse arrowhead.


1
2
3
4
5
9
10
6
7
8
11
12
13
14

blades. The one of wommersom-quartzite (fig. 16, 13) shows a minuscule burin facet (impact fracture ?) on its ventral side. The borers of fig. 16, 15 and fig. 21, 15 display a solid thorn and may be referred to as becs. Those of fig. 16, 16 and fig. 21, 16 have been shaped by alternate retouch ("alésoirs").

Only one flint artifact (fig. 21, 13), from sector 4, has been catalogued as a burin. A burin blow was executed perpendicular to the scraper front of a single end-scraper, whereas several burin blows in the opposite direction constitute a dihedral angle with the base of the artifact, which is a fracture facet.

5.4.4. Diverse

A thick flint flake with curved backed end (fig. 25, 2) displays intense use wear on both the right edge and the retouch and may therefore be catalogued as a blunted piece ("pièce émoussée").

A unique typical splintered piece ("pièce esquillée") (fig. 21, 17) was obtained from a highly weathered flint fragment. Its working edge displays bifacial splintering, most apparent on its "ventral" side, whereas the butt is formed by an intensely abraded ridge. This particular type of artifact should therefore not necessarily be considered as a core with worn striking edges, as has been claimed (ESCALON DE FONTON, 1969), but may indeed have served as a chisel for an hitherto unknow purpose (ROZOY, 1978 : 62).

5.4.5. Retouched blades

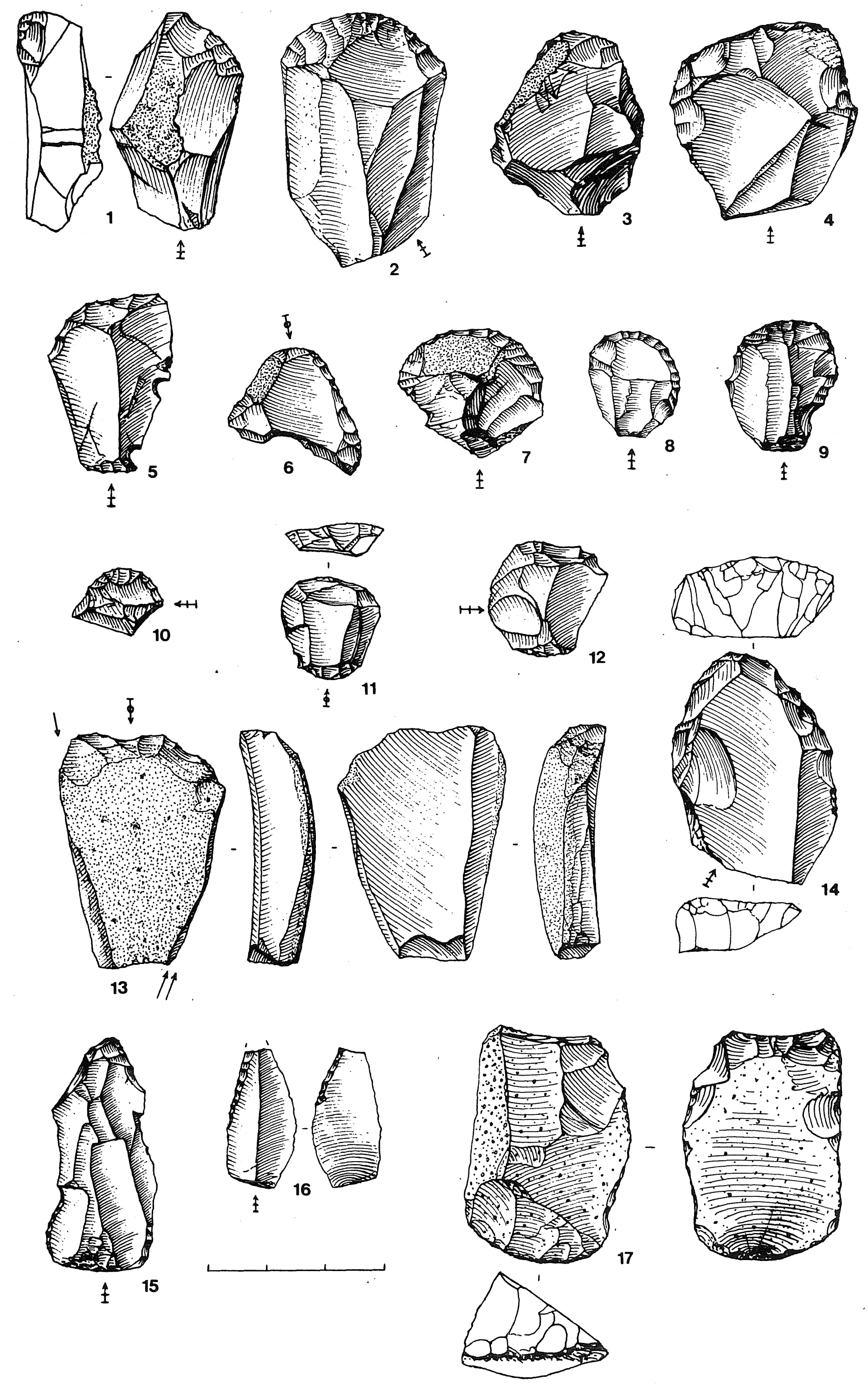
In the present analysis blades and bladelets are considered together. In fact, their separation on the basis of traditional criteria (TIXIER, 1963 : 38; ROZOY, 1968 : 212) would be arbitrary. Indeed, metrical analysis seems to indicate that for the manufacturing of standardized tool types, such as the trapezes (see below; fig. 26) a selection of unmodified flaking products has been made irregardless of the traditional distinction between blades and bladelets. With regard of the retouched blades and Montbani blades, the arbitrary distinction has been maintained in the tool inventory list (table XIX) and the cumulative graphs (fig. 32), where it accounts for the identification of distinct tool types and their sequence in the type-list. The criteria in use are those of J. TIXIER. It was, however, necessary to insert a number of retouched blades in the category of retouched bladelets, e.g. the single notched blades for which no distinct type is provided in the type-list.

Retouched blades, including single notched and truncated blades, are present in sectors 1, 4 and 5 for respectively 26.9 %, 28.4 % and 23.5 % of the toolkit. Frequencies of wommersom-quartzite accord well with frequencies in regard to the total counts.

Atypically and partially backed blades occur in small quantities. Gibbously and curved backed blades are lacking. Typical backed bladelets are to be considered as microlithic tools and are described below. A few blades with an arched end have been recovered from sectors 1 and 4.

Approximately 1/5 of the retouched blades of sectors 1 and 4 display a regular retouch along one or both edges or bear a retouch of the distal end; in sector 5 these tools amount to 1/4 of the total count. The retouch may be partial or continuous although the latter seldomly occurs. The partially retouched blades *sensu stricto* have been grouped with the

Fig. 20. Sector 4. 1: core with one striking platform; 2-3: cores with opposed striking platforms; 4-5: cores with crossed striking platforms; 6-8: long end-scrapers on a blade; 9-10: short end-scrapers on a blade; 11-12: broken end-scrapers on a blade; 13-14: single end-scrapers on a flake.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

continuously retouched blades. Distally retouched blades and blades with Ouchtata Type retouch are of little importance.

Most frequent are single notched and truncated blades. The former occur in sectors 1, 4 and 5 for respectively 30.9 %, 37.2 % and 33.3 % of the total count of retouched blades. Approximately half of these have the notch entirely preserved (fig. 16, 23; 22, 5; 25, 3). Few have been broken just above it. The remainder are fractured in the notch. It is impossible to attribute the latter a lateralisation in relation to the microburins. A connection between blades broken in a notch and microburins thus remains speculative, although it might well be that the former often resulted from a failed microburin-technique.

Truncated blades are present in sectors 1, 4 and 5 for respectively 38.9 %, 33.8 % and 32.1 % of the total counts. Over 3/4 of these artifacts are either obliquely truncated (fig. 16, 17-22; 22, 1-4) or broken under a truncation. Amongst the latter, oblique truncations predominate, straight and concave truncations being on the whole much less common. A few truncated blades bear retouch along the blank-edges (e.g. fig. 16, 17; 22, 1). Some double truncated blades (e.g. fig. 16, 19) are too long to be classified with the trapezes. The wommersom-quartzite blade of fig. 16, 22 has two oblique truncations, one of them slightly concave, which bear flat ventral retouch. Although the function of this artifact remains enigmatic, it might be suggested that it represents a stage in the manufacturing of a trapeze with microburin-technique.

5.4.6. Points with unretouched base

Points with unretouched base constitute a substantial part of the microlithic component (see table XX). Most frequent are obliquely truncated points and short points.

Obliquely truncated points are present in variable amounts. They are most numerous in sector 1 where they account for 37 % of the points with unretouched base. Nearly all obliquely truncated points are proximally oriented and display a base constituted by the distal end of the blades from which they were obtained (fig. 17, 1-5; 25, 4); only three specimens are distally oriented (e.g. fig. 17, 6; 22, 6). In sectors 4 and 5 all obliquely truncated points are lateralized to the right. Of the 12 obliquely truncated points from sector 1 five bear the truncation on the left side (e.g. fig. 17, 4-6). The trihedral point or "piquant-trièdre" has often been partly preserved. Basal thinning or slight basal modification present on some points (fig. 17, 4-5) was obtained by oblique or flat ventral retouch. This retouch is in no way related to the straight, concave or convex truncations which define points with retouched base. Some points, as e.g. those of fig. 17, 2-3, display a fine regular dorsal retouch of the blade-edge near to the actual point. Almost all obliquely truncated points have been obtained from flint.

Short points with unretouched base (fig. 17, 7-9; 22, 7-11; 25, 5-6) are by far the most frequent type. They constitute in each sector over 60 % of the points with unretouched base. The dominance of proximally oriented points is less pronounced than for obliquely truncated points : 4 out of 19 short points are distally oriented in sector 1, 7 out of 17 in sector 4 and 4 out of 7 in sector 5. In sector 1 the lateralisations are again well-balanced. In sectors 4 and 5 lateralisations to the right prevail : less than 1/3 of the short points bear the retouch on the left side. The truncations are mostly straight; occasionally slightly concave (e.g.

Fig. 21. Sector 4. 1-5: single end-scrapers on a flake; 6: end-scraper on a retouched flake; 7-9: thumbnail scrapers; 10: mini scraper; 11-12: double end-scrapers; 13: end-scraper - double burin; 14: carinated end-scraper; 15: bec; 16: "alésoir"; 17: splintered piece.

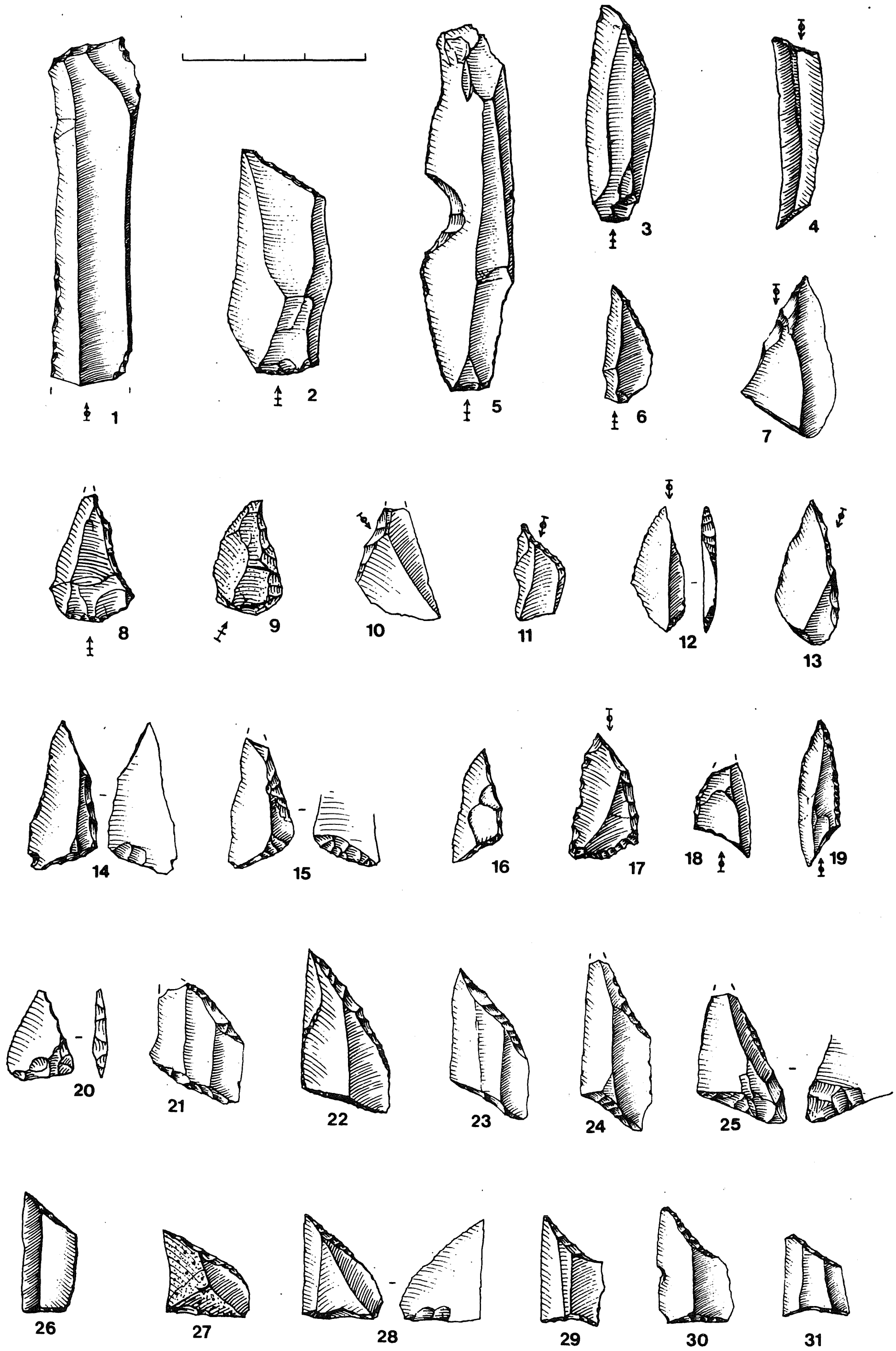

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31

fig. 22, 8) and sometimes even convex (e.g. fig. 25, 5). Several short points have been obtained from flakes (e.g. fig. 17, 9; 22, 9). A retouch along the edges, as is the case for the point of fig. 17, 8, is not very common. The base of the above-mentioned point was slightly modified by oblique dorsal retouch. The distally oriented short point of fig. 17, 7 displays oblique ventral retouch of the base in order to eliminate the strongly profiled bulb of percussion. Some short points partly preserve the trihedral point. Most of these microlithic armatures however seem to have been obtained by oblique backing of a flexion fracture. The point angle of short points is between 45 and 60° in more than 50 % of the cases. Only two specimens were obtained from wommersom-quartzite.

Not more than five unilaterally backed points have been recovered. Three of these originate from sector 4 and display a lateralisation to the right. Both specimens from sectors 1 and 5 bear the backing on the left side. Only the one from sector 5 (fig. 25, 7) is distally oriented. The one from sector 1 (fig. 17, 10) displays a regular continuous retouch along its right edge. Of the two figured points from sector 4, the one of fig. 22, 12 has the base modified by oblique dorsal retouch; the one of fig. 22, 13 has the trihedral point partly preserved. Two unilaterally backed points, both from sector 4, have been obtained from wommersom-quartzite.

An atypical double backed point from sector 4 was obtained on a flake. A double backed point fragment, from the same sector, is broken in the retouch and has consequently been classified with the tool fragments.

### 5.4.7. Crescents

These microlithic armatures are absent in the toolkits apart from a unique specimen with retouched chord from sector 1.

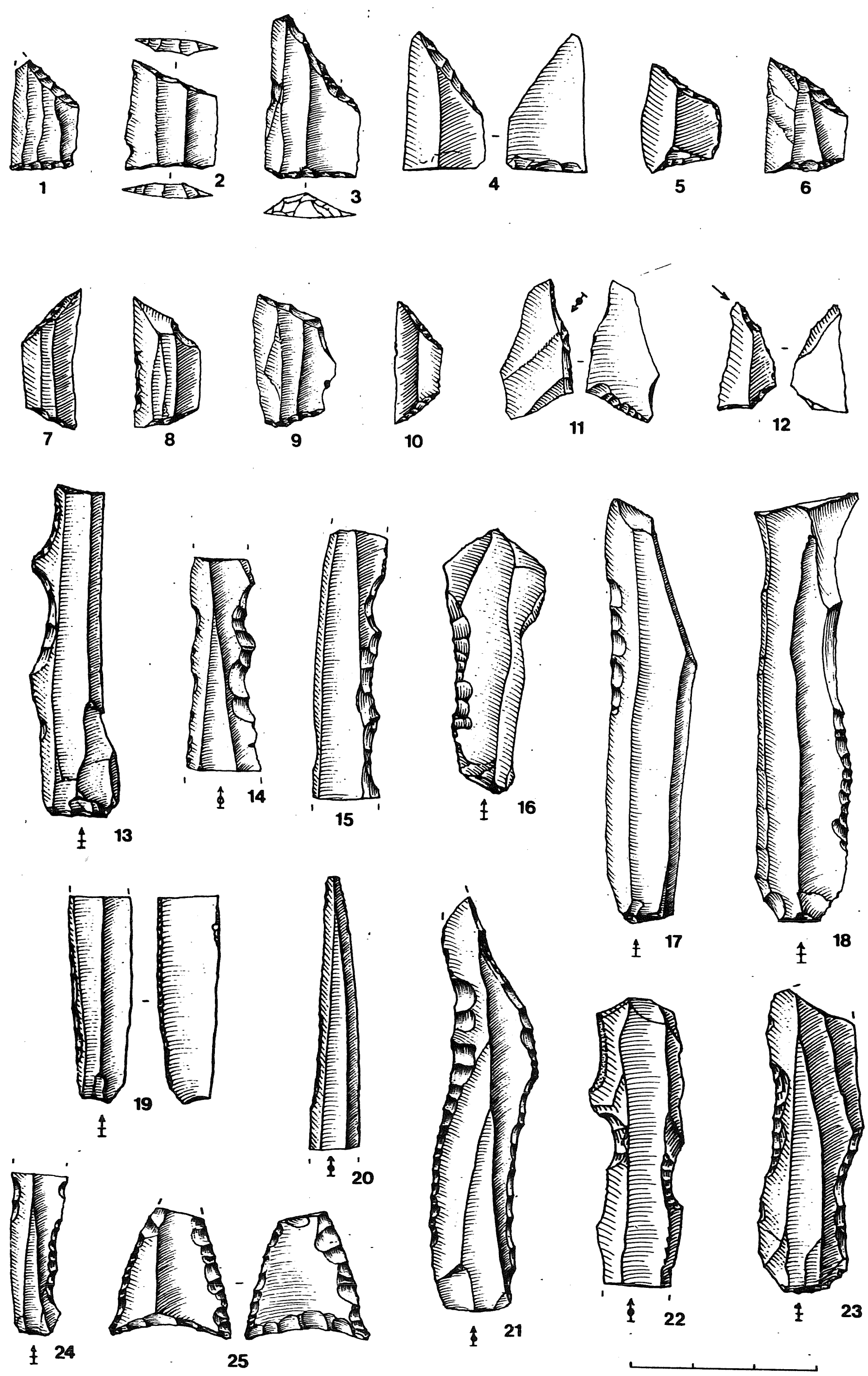
### 5.4.8. Backed bladelets

In sectors 1 and 5 backed bladelets account for respectively 18.3 % and 13.6 % of the microlithic component. In sector 4 they are conspiciously absent.

More than 60 % of these microliths from sector 1 fall within the size-range of small backed bladelets; in sector 5 all except one accord to this size-class. Complete small backed bladelets, preserving both distal and proximal end, are absent. Broken and truncated specimens occur in approximately the same frequencies. The figured fragment of a small backed bladelet from sector 1 (fig. 17, 11) bears flat dorsal retouch on the edge opposite to the backing. Fragments of double backed bladelets occur only in sector 5 (3 specimens). One of these displays alternate backing. Truncated small backed bladelets (fig. 17, 12-14; 25, 9-12) mostly show oblique truncations. Additional retouch along the preserved edge of the bladelet, as is the case for the artifacts of fig. 17, 12-14, occurs only seldomly. Only few small backed bladelets have been obtained from wommersom-quartzite; the one of fig. 25, 8 is a unique specimen of chert (phtanite).

Amongst the (large) backed bladelets from sector 1 truncated pieces prevail. The sole specimen from sector 5 is also truncated. Only one backed bladelet is complete (fig. 17, 15). Double backed specimens do not occur. As for the small backed bladelets truncations are mostly

Fig. 22. Sector 4. 1-4: blades with an oblique truncation; 5: single notched blade; 6: obliquely truncated point; 7-11: short points; 12-13: unilaterally backed points; 14-17: scalene triangles; 18-19: scalene triangles with a concave small truncation; 20: short triangular point; 21: short rhombic trapeze; 22-25: long rhombic trapezes; 26-31: short rectangular trapezes.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

oblique (e.g. fig. 17, 16-17). All pieces have been obtained from flint.

A unique scalene backed bladelet from sector 1 (fig. 17, 18), preserving the distal end of the blank, is closely associated with the scalene triangles of that sector.

The degree of fragmentation is considerable in both sectors : in sector 1, 27 out of 39 specimens (i.e. 70 %) display one or two fracture facets; in sector 5, 8 out of 14. In almost all these cases a posteriority of the fragmentation to the backing may be suggested. In addition, the variable length of the fragments would indicate that the fractures were accidental. Due to the fragmentary condition of the pieces the lateralisations are difficult to establish. Insofar observable no true preference is attested.

5.4.9. Triangles

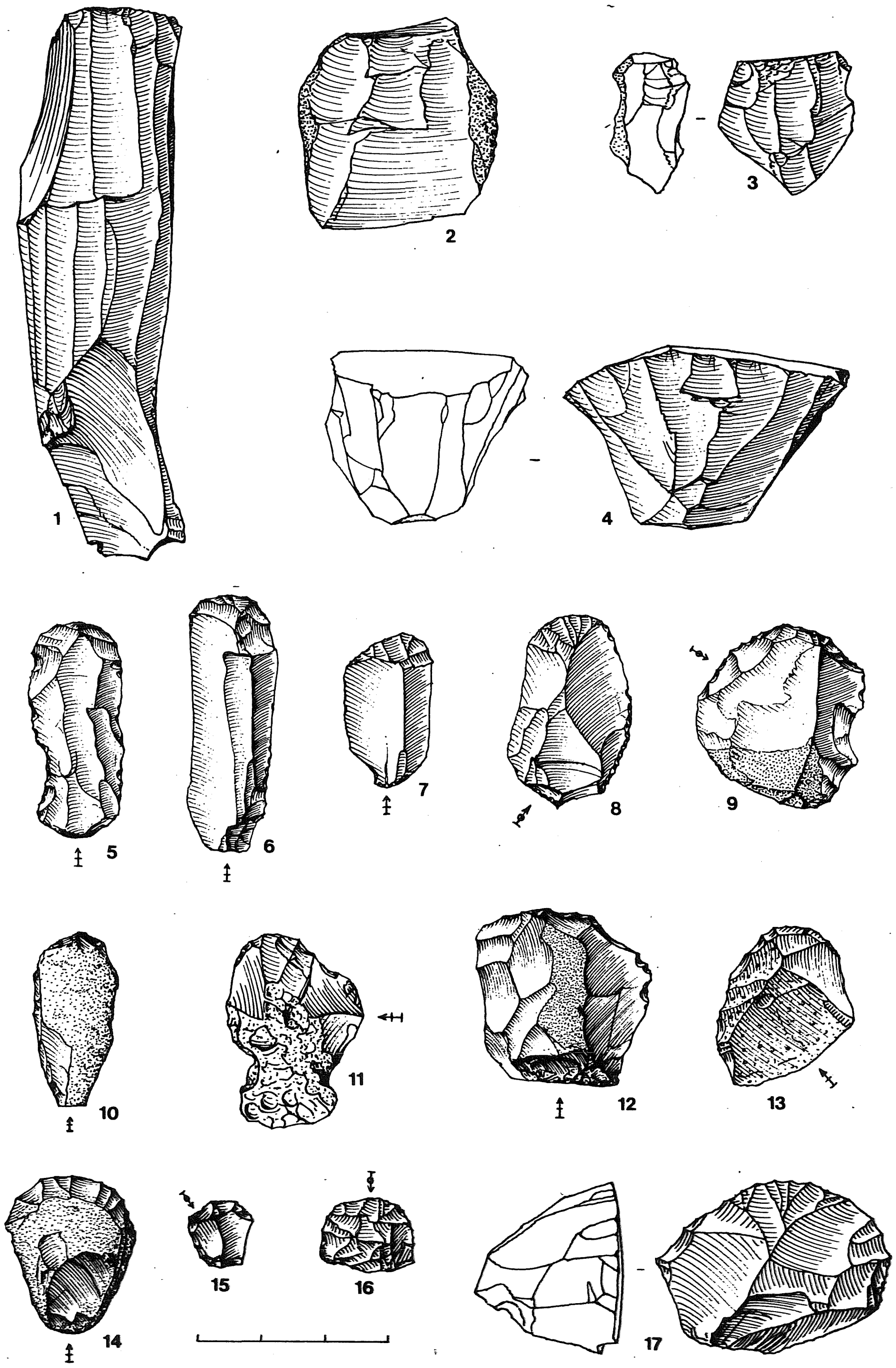
Triangles occur with equal frequencies in sectors 1 and 4 : 5.6 % of the microlithic component. In sector 5 they account for only 1.9 %.

Most frequent are scalene triangles. The series of eight from sector 1 (fig. 17, 19-24) displays marked metric homogeneity, the mean values of length, width and thickness being 13.6 mm, 6.5 mm and 1.9 mm respectively. Lateralisations are well-balanced. All specimens have been obtained from flint. The scalene triangles from sector 4 (fig. 22, 14-19) differ largely from those of sector 1. The mean dimensions of this series of seven are 20.6 mm, 9.5 mm and 2.9 mm respectively. The specimens of fig. 22, 14-15 display flat ventral retouch of the small truncation. Two other triangles (e.g. fig. 22, 17) show clear convex truncations and may be referred to as atypical scalene triangles. Those of fig. 22, 18-19 display a concavity of the small truncation. All specimens, except one (fig. 22, 18), bear the truncations on the right side. All have been obtained from flint, as was the sole scalene triangle from sector 5 (fig. 25, 13).

Four scalene triangular armatures from sector 1 (fig. 17, 25-28) constitute a microlithic type which has thusfar only been illustrated for some sites in the Dutch sandy area (see furtheron). The position attributed to it in the typelist (nr. 69 instead of "atypical scalene triangle") may be justified by the remarkable morphological and metric continuity with the scalene triangles from sector 1. With regard to the slight truncation of the angle formed by the longest side and the large truncation, we may refer to them as truncated scalene triangles. All specimens bear the truncations to the left. For each specimen the large truncation is convex and does not really intersect with the small truncation. The mean dimensions are the following : length 15.6 mm, width 7.6 mm, thickness 2.0 mm. Only the truncated scalene triangle of fig.17, 28 was obtained from wommersom-quartzite.

A unique atypical isosceles triangle (fig. 25, 14) was recovered from sector 5. Its base displays flat ventral retouch, whereas its actual point was sharpened bilaterally by oblique ventral retouch.

Fig. 23. Sector 4. 1-2: short rectangular trapezes; 3-4: Vielle trapezes; 5-6: short asymmetric trapezes; 7: long asymmetric trapeze; 8-9: long symmetric trapezes; 10: symmetric trapeze with very oblique truncations; 11: point of danubian type; 12: indeterminate microlith; 13-15: unilateral multiply notched blades; 16-20: unilateral irregularly retouched blades; 21: blade with opposing retouch; 22: blade with off-set notches; 23-24: blades with off-set retouch; 25: triangular arrowhead.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

5.4.10. Points with surface retouch

Points with surface retouch are strikingly important in sector 1 : 11.3 % of the microlithic component. In sectors 4 and 5 they are only present for 2.4 % and 3.9 % respectively.

Mistletoe points, including fragmentary pieces, are the most frequent (fig. 17, 29-32). The surface retouch, mostly completely covering on the dorsal side, is primarily restricted to the basal end on the ventral side. Only exceptionally has the slender point been sharpened by ventral retouch (e.g. fig. 17, 31). All complete mistletoe points display the same lateralisation; the most convex edge is always oriented to the right. Three out of nine mistletoe points from sector 1 have been obtained from wommersom-quartzite. In sector 4 two fragmentary mistletoe points have been recovered. A sole fragmentary specimen originates from sector 5.

Triangles with surface retouch are only present in sector 1 (3 specimens). All are in fragmentary condition. Judging by the presence of ventral retouch, the figured piece (fig. 17, 33) is probably a basal fragment. All three triangles with surface retouch have been obtained from flint.

Several indeterminable fragments have been catalogued with the other microliths with surface retouch. The one of fig. 17, 34 from flint might well be a basal fragment of a point with oblique base. Another microlith with surface retouch from wommersom-quartzite (fig. 25, 15) may be associated with the surface retouched triangles.

Only few points with rounded base occur (fig. 17, 35; 25, 16). On these specimens, dorsal surface retouch is mostly restricted to the actual point and the basal end, whereas ventral retouch affects the base only.

Points with oblique base are the next most frequent. Most of them are in fragmentary condition. In sector 1, seven specimens occur (fig. 17, 36; 19, 1-2). Dorsal retouch is seldomly completely covering, whereas ventral retouch is again mostly restricted to the basal end. Two of these points have been obtained from wommersom-quartzite. Both sectors 4 and 5 yielded only one point with oblique base; both specimens are from flint.

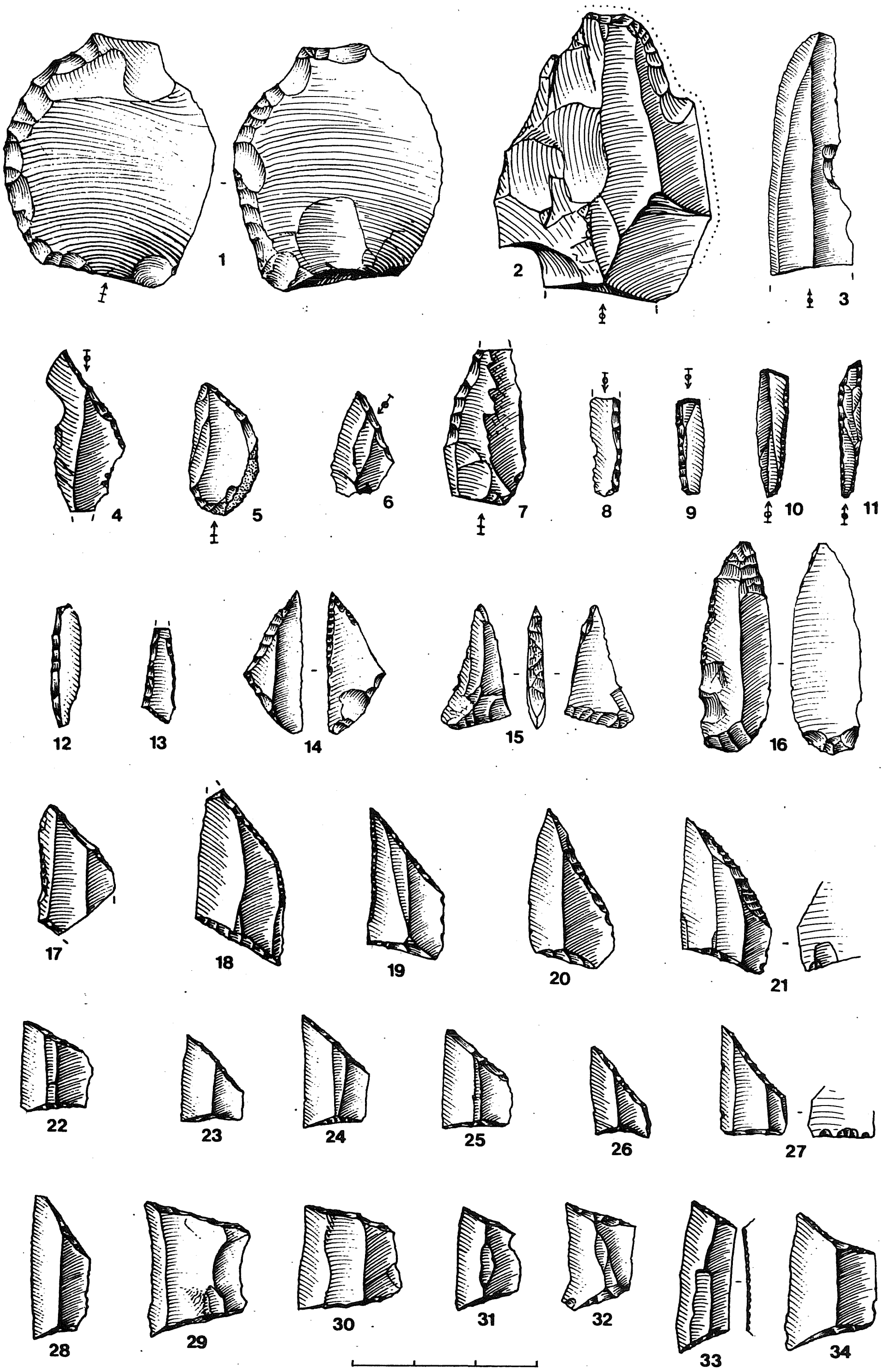
5.4.11. Points with retouched base

Only few points with retouched base have been recovered. The three short triangular points originate from sectors 1 and 4. The base of the figured specimen from sector 4 (fig. 22, 20) was obtained by oblique ventral retouch. The one from sector 1 (fig. 19, 3) has the trihedral point partly preserved. A unique long triangular point (fig. 19, 4) was recovered from the same sector; its base is constituted by oblique ventral truncation. The sole Tardenois point, from sector 5, is atypical. An ogival point with concave base from sector 1 (fig. 19, 5) still has the trihedral point partly preserved. All points with retouched base have been obtained from flint.

5.4.12. Trapezes

The trapezes constitute by far the main microlithic tooltypes.

Fig. 24. Sector 5. 1-4: cores with one striking platform; 5-6: long end-scrapers on a blade; 7: short end-scraper on a blade; 8-12: single end-scrapers on a flake; 13-14: thumbnail scrapers; 15-16: mini scrapers; 17: core-like end-scraper (?).


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34

In sectors 1, 4 and 5 they account for respectively 45.1 %; 67.2 % and 63.1 % of the microlithic component. Their detailed typological classification is listed in table XVI. The frequencies of wommersom-quartzite with regard to trapezes exhibit marked differences from the frequencies for the previously described microlithic armatures where wommersom-quartzite accounts for only a restricted percentage. Trapezes from wommersom-quartzite occur in sectors 1 and 5 for approximately 29 %; in sector 4 for over 40 %.

Table XVI. Typological classification of trapezes. F : flint; W : wommersom-quartzite.

| | Sector 1 | | | | Sector 4 | | | | Sector 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | W | Tot. | % | F | W | Tot. | % | F | W | Tot. | % |
| Short rhombic | 9 | 1 | 10 | 10 | 8 | - | 8 | 9 | 5 | - | 5 | 8 |
| Long rhombic | 11 | 2 | 13 | 14 | 16 | - | 16 | 19 | 12 | - | 12 | 18 |
| Short rectangular | 23 | 21 | 44 | 46 | 9 | 26 | 35 | 42 | 6 | 8 | 14 | 21 |
| Vielle | 9 | 2 | 11 | 12 | 2 | 2 | 4 | 5 | 7 | 1 | 8 | 12 |
| Short asymmetric | 7 | 1 | 8 | 8 | 6 | 3 | 9 | 11 | 3 | 5 | 8 | 12 |
| Long asymmetric | 2 | - | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 5 | 8 | 12 |
| Short symmetric | 2 | - | 2 | 2 | 2 | 2 | 4 | 5 | 3 | - | 3 | 5 |
| Long symmetric | 3 | 1 | 4 | 4 | 5 | - | 5 | 6 | 5 | - | 5 | 8 |
| Symm. oblique trunc. | 2 | - | 2 | 2 | 1 | - | 1 | 1 | 1 | - | 1 | 2 |
| Symm. concave trunc. | - | - | - | - | - | - | - | - | 1 | - | 1 | 2 |
| Total | 68 | 28 | 96 | 100 | 50 | 34 | 84 | 100 | 46 | 19 | 65 | 100 |
| % | 71 | 29 | 100 | - | 60 | 40 | 100 | - | 71 | 29 | 100 | - |

About 1/4 of all trapezes in each sector are rhombic trapezes. Long rhombic trapezes (fig. 19, 6-8; 22, 22-25; 25, 19-21) are in each case more numerous than short rhombic trapezes (fig. 22, 21; 25, 17-18). The truncations are mostly straight. A slight convexity of the long truncation may often be associated with a slight concavity of the short truncation (e.g. fig. 22, 22-23; 25, 21). All rhombic trapezes bear the truncations to the right. Some specimens display traces of a trihedral point on the long truncation (e.g. fig. 22, 24-25; 25, 20-21). There is however no reason to assume that short truncations were also obtained by microburin-technique; traces of a trihedral point are nowhere apparent. Flat ventral retouch of the short truncation occurs only seldomly : four specimens in sector 4 and six in sector 5. Except for one short trapeze only long rhombic trapezes are involved. On most specimens the flat ventral retouch is restricted to the angle constituted by the large base and the short truncation. It is however seldomly as elaborated as is the case for the

Fig. 25. Sector 5. 1: double convex side-scraper; 2: blunted piece; 3: single notched blade; 4: obliquely truncated point; 5-6: short points; 7: unilaterally backed point; 8: fragment of a small backed bladelet; 9-12: truncated small backed bladelets; 13: scalene triangle; 14: isosceles triangle; 15: microlith with surface retouch; 16: point with rounded base; 17-18: short rhombic trapezes; 19-21: long rhombic trapezes; 22-25: short rectangular trapezes; 26-27: Vielle trapezes; 28: long asymmetric trapeze; 29-30: short symmetric trapezes; 31-33: long symmetric trapezes; 34: symmetric trapeze with concave truncations.

trapeze of fig. 22, 25. The maximum thickness of these ventrally retouched trapezes is generally less than the mean thickness of the other rhombic trapezes. A retouch of Fère (G.E.E.M., 1969) or Ouchtata Type retouch along one or both bases is not uncommon. When present, it mostly affects the large base and is dorsal and continuous (e.g. fig. 25, 19). The short rhombic trapeze of fig. 25, 17 bears irregular retouch of the large base and might well have been obtained from a Montbani blade. Nearly all rhombic trapezes have been obtained from flint; the sole three specimens from wommersom-quartzite occur in sector 1.

Rectangular trapezes are by far the most common type, especially in sectors 1 and 4. Most frequent are short rectangular trapezes (fig. 19, 9-10; 22, 26-31; 23, 1-2; 25, 22-25). In sectors 1 and 4 the latter account for respectively 80 % and 90 % of all rectangular trapezes. In sector 5 they are "only" represented for 64 %. Long rectangular trapezes, commonly called Vielle trapezes (fig. 23, 3-4; 25, 26-27), are consequently rather scarce. The truncations are mostly straight or slightly concave. A marked concavity of the long truncation, as is the case for the trapeze of fig. 22, 29, is most uncommon. Far more frequent is a slight concavity of the short truncation (e.g. fig. 22, 29, 31; 25, 26). Only four rectangular trapezes display a deviating lateralisation and bear the long truncation to the left. Few short rectangular trapezes seem to have been obtained by microburin-technique. It may be assumed that most truncations resulted from the oblique or straight backing of a simple flexion fracture. Microburins of wommersom-quartzite - a raw material preferentially used for the manufacturing of short rectangular trapezes - are indeed quite uncommon (see furtheron). Vielle trapezes however display more indications as to the application of microburin-technique. As for the previously described rhombic trapezes,flat ventral retouch of the short (straight) truncation is rather uncommon : one specimen in sector 1 and four in both sectors 4 and 5 (fig. 22, 28; 23, 4; 25, 27). Five of these ventrally retouched trapezes are of the Vielle type. Their maximum thickness mostly exceeds the mean thickness of the other rectangular trapezes. In the case of the short rectangular trapeze of fig. 22, 28 the flat ventral retouch eliminates the strongly profiled bulb of percussion which had already partly been removed by the short truncation. The short truncation of the Vielle trapeze of fig. 23, 4 is in fact constituted by a fracture facet bearing flat ventral retouch. A retouch of Fère occurs on few rectangular trapezes (e.g. fig. 22, 26). Here too, this retouch is mostly dorsal and continuous but however affects in the same degree the large and the small base. Frequencies of wommersom-quartzite differ from those of the rhombic trapezes: in sectors 1 and 5 more than 40 % of all rectangular trapezes have been obtained from it; in sector 4 wommersom-quartzite rectangular trapezes account for no less than 72 %.

Asymmetric trapezes occur in sectors 1 and 4 for respectively 10 % and 13 % of the total count of trapezes. They are quite numerous in sector 5 (24 %). In sectors 1 and 4 short asymmetrical trapezes (fig. 23, 5-6) prevail upon long ones (fig. 19, 11; 23, 7) whereas in sector 5 both short and long asymmetrical trapezes (fig. 25, 28) appear with equal frequencies. Long truncations are mostly straight, sometimes slightly concave (fig. 23, 5) or even slightly convex (fig. 23, 6). A marked concavity of the long truncation occurs only once (fig. 19, 11) whereas a marked concavity of the short truncation may be noted on some specimens from sector 5 (e.g. fig. 25, 28). Some rare asymmetrical trapezes bear the truncations to the left (e.g. fig. 23, 7). Those of fig. 23, 6-7 have the trihedral point partly preserved. Flat ventral retouch of the short truncation occurs only once in the case of a long asymmetrical trapeze from sector 1. Four short asymmetrical trapezes from sector 4 bear a retouch of Fère affecting the small base only. In sectors 1 and 4 flint asymmetric trapezes prevail; in sector 5 specimens made from wommersom-quartzite are more numerous.

Symmetric trapezes are the least frequent in each of the three sectors. They are most common in sector 5 where they account for 17 % of all trapezes. In each sector, long symmetric trapezes (fig. 23, 8-9; 25, 31-33) prevail upon short ones (fig. 25, 29-30). Only few bear very oblique truncations (fig. 19, 12; 23, 10). A unique specimen has been catalogued as a symmetric trapeze with concave truncations (fig. 25, 34). The one of fig. 23, 8 has the trihedral point completely preserved and may supposedly be considered as an unfinished long symmetric trapeze. On a few specimens a ventral retouch of Fère may be noted (e.g. fig. 25, 33). Almost all symmetric trapezes have been obtained from flint.

In order to obtain a more comprehensible and quantitative appreciation of the variation between rhombic and rectangular trapezes, the widths and thicknesses have been systematically recorded. Means and standard deviations have been calculated (table XVII) and plotted on a graph (fig. 26). The latter are represented by means of rectangles, their long axes representing a single standard deviation of the width, their short axes representing one standard deviation of the thickness. Thus, from a statistical point of view, 68 % of the widths fall within such a rectangular area as well as 68 % of the thickness, but not necessarily the same percentage of the combination of both dimensions for each individual piece. A direct plot of the widths and thickness for all pieces, however, shows no marked correlation nor anomolous spreads, and therefore the standard deviationareas may be thought to reflect properly width-thickness combi-

Table XVII. Means ($\bar{X}$) and standard deviations ($\sigma$) of the width and thickness of rhombic and rectangular trapezes of sectors 1, 4 and 5 and Opglabbeek-Ruiterskuil (expressed in mm).

| | Rhombic trapezes | | | | Rectangular trapezes | | | |
|---|---|---|---|---|---|---|---|---|
| | Width | | Thickness | | Width | | Thickness | |
| | $\bar{X}$ | $\sigma$ | $\bar{X}$ | $\sigma$ | $\bar{X}$ | $\sigma$ | $\bar{X}$ | $\sigma$ |
| Weelde sector 1 | 12.3 | 2.1 | 2.8 | 0.6 | 11.4 | 1.6 | 2.5 | 0.5 |
| Weelde sector 4 | 13.7 | 1.8 | 3.5 | 0.5 | 11.5 | 1.9 | 2.5 | 0.5 |
| Weelde sector 5 | 12.9 | 1.0 | 3.0 | 0.6 | 10.7 | 1.1 | 2.4 | 0.4 |
| Opglabbeek-Ruiterskuil | 15.2 | 2.3 | 3.6 | 0.8 | - | - | - | - |

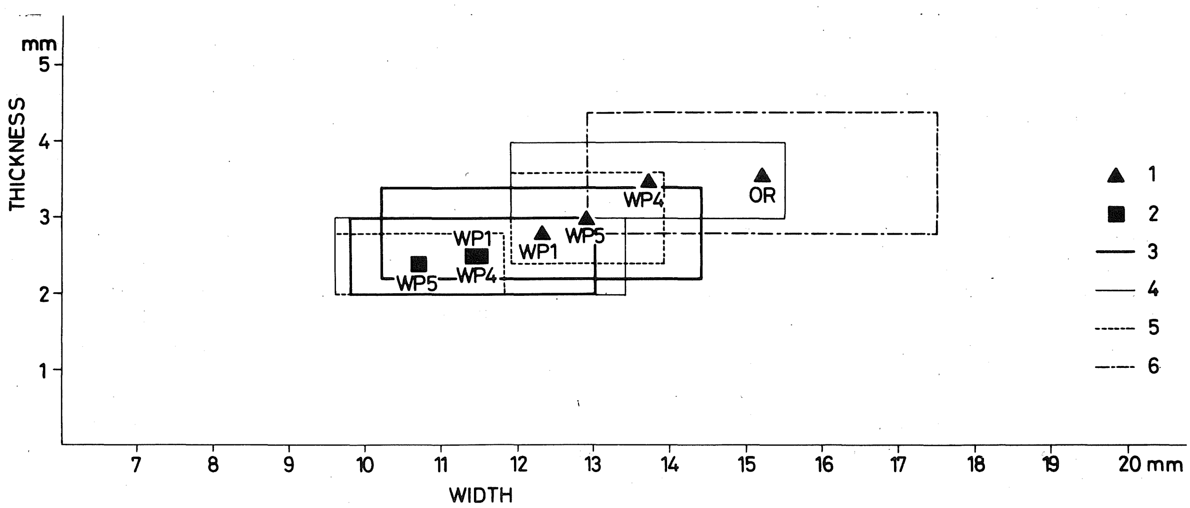



Fig. 26. Means and single standard deviations of the thickness and width of the trapezes from Weelde-Paardsdrank (WP1/WP4/WP5) and Opglabbeek-Ruiterskuil (OR). 1: rhombic trapezes; 2: rectangular trapezes; 3: sector 1; 4: sector 4; 5: sector 5; 6: Opglabbeek-Ruiterskuil.

nations clustering around a mean combination. As a datum for comparison the means and standard deviations of the width and thickness of the rhombic trapezes of Opglabbeek-Ruiterskuil are given in table XVII and have been added on the graph (fig. 26); the rectangular trapezes of the site being too scarcely represented to be of value in the present scope. The intertype differences thus standing out, although metrically small, prove to be of statistical significance but will not be studied in detail presently. Likewise, intersector and intersite differences do occur, the significance of which will be object of further research. From a quick glance at the evidence (tables XIII and XVII) it will however be clear that blades employed for trapeze-manufacturing are on an average larger and thinner than unmodified blades, a quasi-consistency which pleads for a deliberate selection and metric evaluation in the course of the manufacturing process. Similarly, a glance at the graphical representation of the trapezes (fig. 26) suggests that rectangular trapezes are on the whole somewhat less wide and less thick than their rhombic counterparts, a fact probably resulting from a secondary blade-selection to which a preferential treatment of the different raw materials might not at all be innocent.

5.4.13. Points of danubian type

Another distinct type of flint armatures may only with difficulty be identified with one of the previously treated microlithic types. Three of the armatures concerned originate from sector 1 (fig. 19, 13-15), 2 from sector 4 (fig. 23, 11 and a not-figured specimen) and 4 from sector 5 (fig. 29, 1-4). All except one from sector 5 (fig. 29, 3) have been recovered in situ within the mesolithic level. Their representations have been rearranged in fig. 27, where they stand according to an hypothetical filiation based on the transformation of specific attributes. The direction and consequences of this filiation will be considered furtheron; a typological justification is furnished below.

All these armatures share in common a scalene triangular shape as well as the occurence of ventral retouch. According to the shape of the base (or the small truncation according to the triangles' terminology), the lateralization and the appearance of the ventral retouch, these armatures may be subdivided into two distinct types, A and B. Type A is characterized by the concavity of the base (or small truncation), the consistent lateralization to the left and the partial aspect of the oblique to flat ventral basal retouch. Points a to c of fig. 27 accord to these characteristics. All three specimens originate from sector 5. Points d to h, displaying a straight base, have been classified amongst type B. Except for the not-figured specimen from sector 4 all these bear the truncations to the right. A rather oblique ventral retouch occupies the whole length of the base. In the case of points g and h the base is even exclusively constituted by ventral retouch.

The above morphological and technological characteristics in themselves do of course not justify the typological individualization of these armatures. Taken into consideration the sheer disposition of the attributes they could without great difficulty be catalogued amongst the scalene triangles. However, it might be clear that these armatures are much more related among themselves than they are individually to the triangles of the sector from which they originate, and thus constitute overall types. For instance, the armatures e to g from sector 1 can only with difficulty be treated as the standardized series of triangles from the sector; the morphological and above all technological particularities being too aberrant. As for sector 5, where only two completely distinct triangles occur, the armatures a to c and d are unmistakingly to be considered as autonomous types.

It will have dawned upon the reader that the closest parallels to the thus individualized pointtypes are to be found amongst armatures of early neolithic (danubian) manufacture and therefore have been designa-

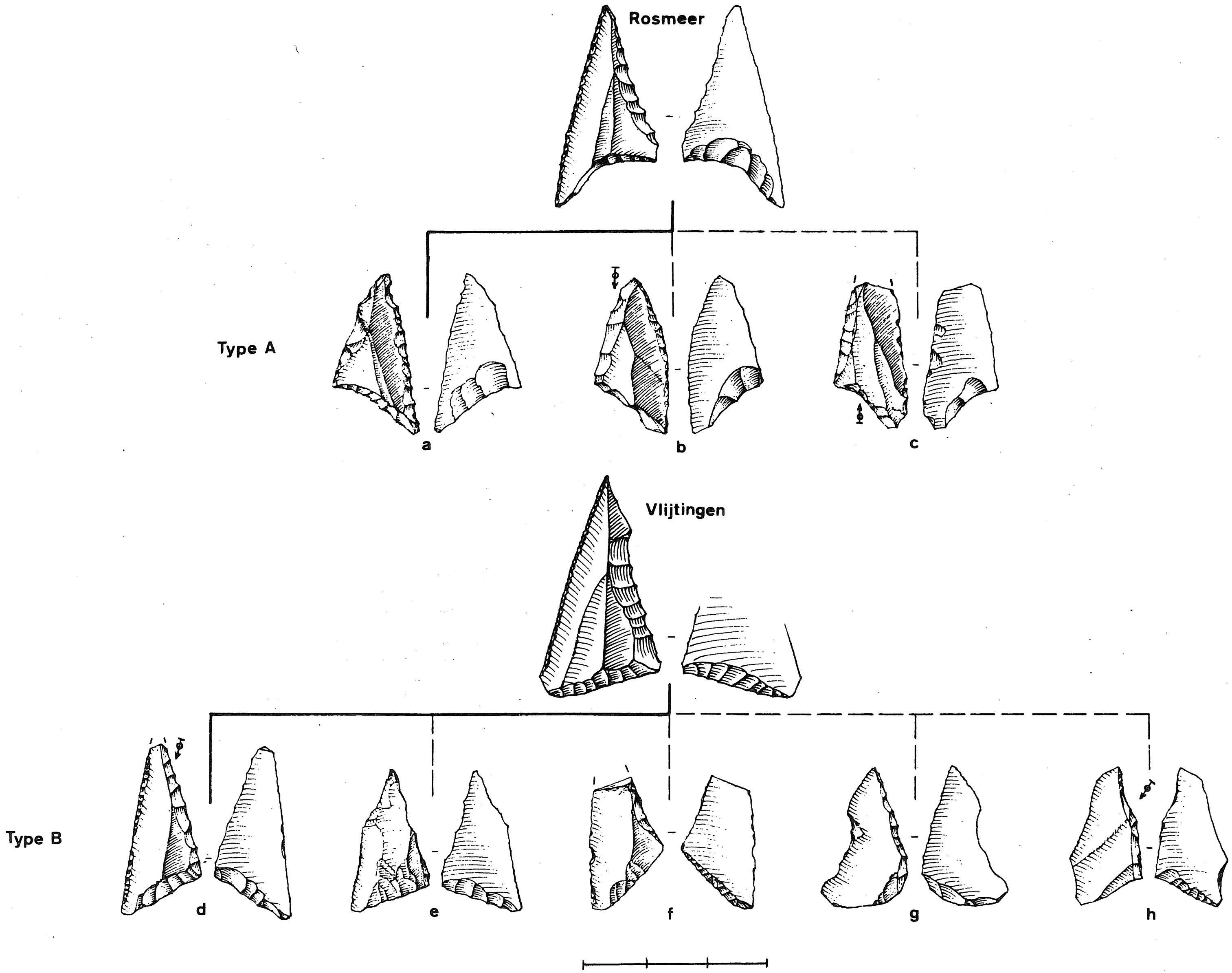



Fig. 27. Hypothetical filiation of danubian points and points of danubian type.

ted "points of danubian type". In fig. 27 they have been drawn interrelated to two points of true danubian origin. The one with concave base originates from the danubian settlement of Rosmeer (SCHEYS, 1972-73: fig. XI, 42); the one with straight base is from Vlijtingen (MARICHAL, 1981 : fig. 61, 9). On one hand the overall morphological and technological resemblances between these points and the pointtypes A and B are striking, on the other important points of difference remain, such as the quasi-absence of typical danubian denticulated retouch on the points of danubian type. Moreover, the regular continuous dorsal retouch of the preserved blank-edge, frequently applied on danubian points, is but present on the points of danubian type A a and b in the shape of irregular retouch. The points of type A bear a lateralization opposite to the average lateralization of true danubian points (and opposite to the average lateralization of the microlithic armatures). Amongst the specimens of type B, only d bears a regular dorsal retouch of the preserved blank-edge. As is the case for the danubian point from Vlijtingen the bases of points d to f and the not-figured specimen are constituted by oblique to flat dorsal retouch. Their reverse or ventral face bears posterior oblique ventral retouch. It should be noted that in opposition to the true danubian point, the dorsal basal retouch is but partial, though almost continuous on specimen d. Thus the straight truncation is essentially constituted by ventral retouch. In the case of points g and h dorsal retouch of the base is even non-existant.

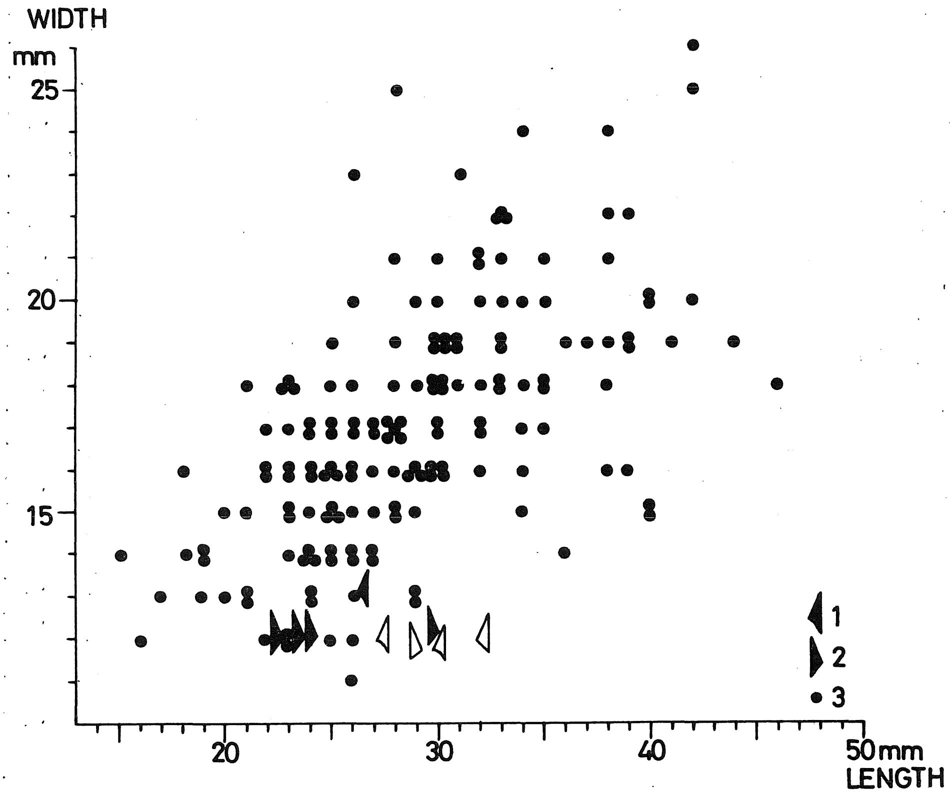



Fig. 28. Width-length correlation of the points of danubian type from Weelde-Paardsdrank and the danubian points from the Aldenhovener Platte, Western Germany (after ZIMMERMAN, 1977: 375). 1: point of danubian type A; 2: point of danubian type B; 3: danubian point. Open symbols indicate broken points for which the length is estimated.

These points of danubian type may also be differentiated from true danubian points on metric evidence. By lack of regional data, length-width combinations of points of danubian type have been compared to length-width combinations of danubian points from the Aldenhovener Platte, Western Germany (ZIMMERMAN, 1977 : 375) (see fig. 28). It is clear that the points of danubian type, as far as their widths are concerned, deviate notably from the average danubian point.

In conclusion, the affinities of points of danubian type with true danubian points may unambigiously be established for one, at best two, of the type A and B points. The remaining specimens, deviating to a higher degree, preserve nevertheless sufficiently characteristic attributes to justify their insertion in the suggested filiation.

5.4.14. Indeterminate microliths

Only few artifacts have been classified as such. They all bear a seeming resemblance with one of the previously descibed microlithic types but may not satisfactorily be classified within the existing typological framework.

From that point of view the flint armature of fig. 19, 16 might be associated with the crescents or even with the truncated scalene triangles. The one of fig. 23, 12, also from flint, could be considered an atypical asymmetric trapeze with kinked short truncation. Its ventral side displays a small burin facet (impact fracture ?), which has partly removed the long truncation. Another figured specimen from flint (fig. 29, 5) might be associated with the rectangular trapezes. The long truncation of this solid artifact was obtained by both dorsal and ventral retouch whereas the semi-abruptly retouched dorsal short truncation partly bears flat ventral retouch. Its small base is constituted by very steep backing.

5.4.15. Montbani blades

Multiply notched and irregularly retouched blades (Montbani blades) are numerous. In sectors 1, 4 and 5 they account for respectively 15.2 %, 20.4 % and 18.0 % of the total amount of tools. Frequencies of wommersom-quartzite are notable and may well be correlated with frequencies for the debitage (unretouched blades and bladefragments) : in sector 1 38 % of all Montbani blades have been obtained from wommersom-quartzite; in sectors 4 and 5 respectively 44 % and 45 %. As for the retouched blades the traditional distinction between blades and bladelets has not been maintained in the descriptive part.

Unilateral multiply notched blades are rather uncommon (fig. 19, 17; 23, 13-15; 29, 6). They are best represented in sector 4 where they account for 6 % of the total amount of Montbani blades. Irregular partial retouch of the blank-edge opposite the notches occurs only exceptionally (e.g. fig. 23, 14). The specimen of fig. 29, 6 was obtained on a crested blade. Nearly all unilateral multiply notched blades are from wommersom-quartzite.

Far more numerous are unilateral irregularly retouched blades (fig. 19, 20; 23, 16-20; 29, 7-11); in sectors 1, 4 and 5 they account for respectively 49 %, 52 % and 45 % of the total amount of Montbani blades. According to M. ESCALON DE FONTON (1979) the irregularly retouched blades might result from a morphological transformation of multiply notched blades through continuous utilization. On that account the large numbers of irregularly retouched blades and the scarcity of multiply notched blades might but tentatively be explained. From the figured specimens it will indeed be clear that this transformational theory is far from applicable to all artifacts concerned, the precise delineation of each distinct type and consequently the function of Montbani blades thus having to be reconsidered seriously. The retouch of the irregularly re-

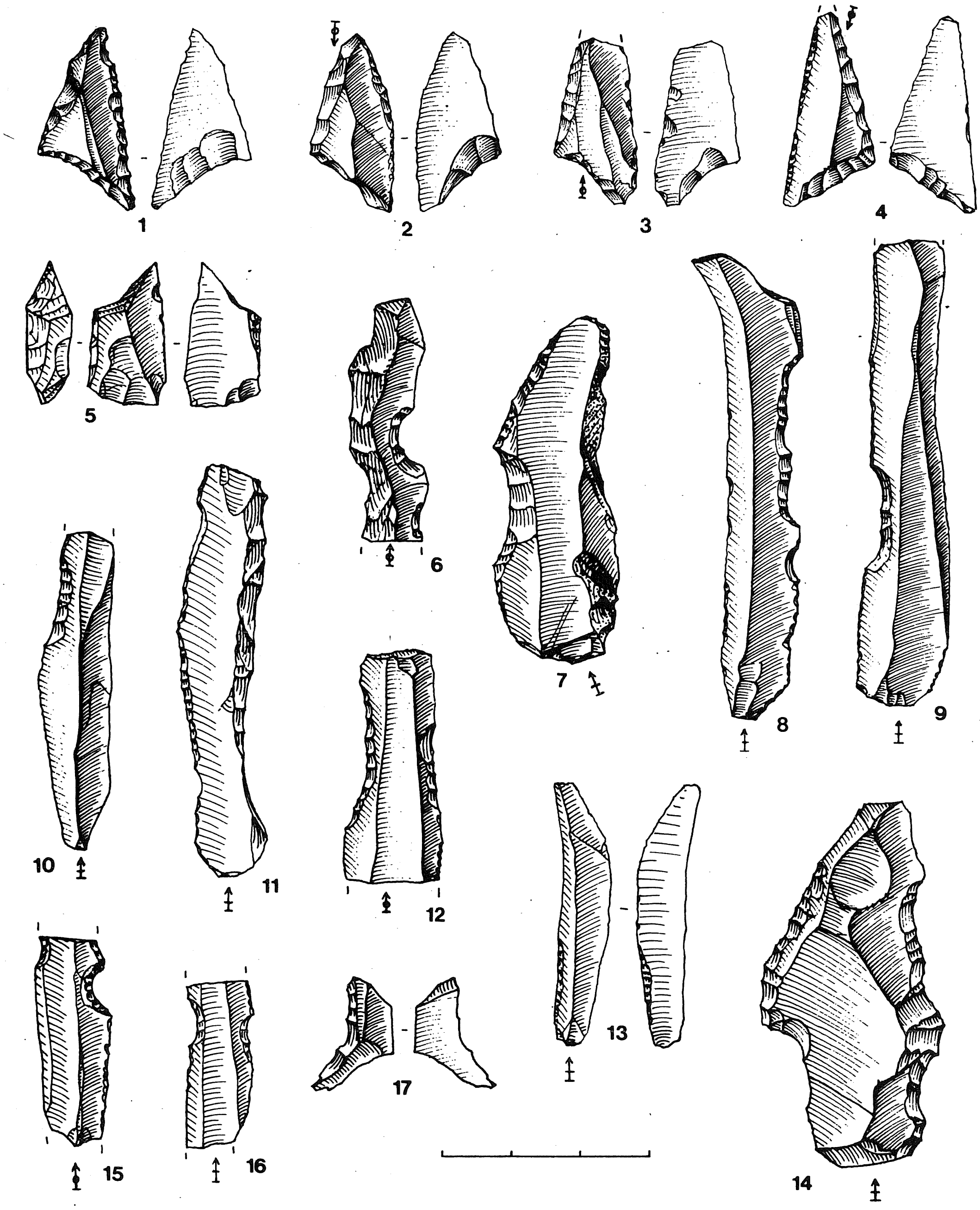



Fig. 29. Sector 5. 1-4: points of danubian type; 5: indeterminate microlith; 6: unilateral multiply notched blade; 7-11: unilateral irregularly retouched blades; 12-14: blades with opposing retouch; 15-16: blades with off-set notches; 17: accidental "microburin".

touched blades may indeed assume various shapes. Most often however it affects but a moderate part of the blank-edge and is oblique and often scalariform. In the case of the Montbani blade of fig. 23, 19 the irregular left-edge retouch occurs simultaneously with regular continuous right-edge retouch. The one of fig. 29, 11 was obtained on a crested blade. Approximately 18 % of these Montbani blades in each sector have been obtained from wommersom-quartzite. One specimen, from sector 1, is from micaceous sandstone; another unique Montbani blade, from sector 4, is from chert (phtanite).

Blades with opposing notches occur in each of the three sectors for approximately 15 % of the total amount of Montbani blades (e.g. fig. 19, 18). More than half of them have been obtained from wommersom-quartzite.

Blades with opposing retouch are somewhat less represented (fig. 19, 19; 23, 21; 29, 12-14). Here too, the retouch generally affects only a moderate part of the blank-edge. Its position may as well be proximal (e.g. fig. 29, 13), medial (e.g. fig. 19, 19) and distal (e.g. fig. 29, 12). As is the case for the blade of fig. 29, 13 it may moreover be alternately applied. Approximately 1/3 of the blades with opposing retouch have been obtained from wommersom-quartzite.

Still less represented are blades with off-set notches (fig. 19, 21-23; 23, 22; 29, 15-16). In sector 1, nine out of 11 artifacts bear the left notch at the top; in sector 4, five out of 6 bear the right notch above; and in sector 5, with seven specimens, the positions are more or less in equilibrium. Thus, the significance of the mutual position of the notches is difficult to evaluate. In sectors 1 and 5 approximately half of these blades have been obtained from wommersom-quartzite; in sector 4 all but one.

Blades with off-set retouch (fig. 19, 24; 23, 23-24) are represented in each sector for about 8 % of all Montbaniblades. As for the blades with off-set notches no true preference is attested with regard to the mutual position of the retouch. In sectors 1 and 5 nearly all these artifacts have been obtained from flint; in sector 4 more than half of them are from wommersom-quartzite.

Of the combined amount of Montbani blades from the three sectors only 18.3 % preserve both the distal and proximal end of the bank. Of the 81.7 % fragmentary artifacts only 15.6 % bear a clearly accidental fracture facet (patinated blades with unpatinated fracture facet and fire-fragmented artifacts). Most Montbani blades however are broken inside the retouch (40.1 %). Artifacts broken outside the retouch occur for 26.0 %. A rigourous exclusion of all clearly accidentally broken artifacts and all artifacts broken in a retouch (ROZOY, 1968 : 256) would halve the true amount of Montbani blades, which would indeed distort the tool inventory.

### 5.4.16. Tools of neolithic affinity

Few artifacts are on morphological and technological grounds of manifestly neolithic origin. The robust pointed blade (fig. 19, 28) of a flint variety uncommon to the site has been recovered from the disturbed surface layer of sector 1. The transverse flint arrowhead of fig. 19, 29, having the same provenance, has been shaped on a flake and displays marked concave truncations, contrary to the quasi-totality of trapezoidal armatures. Finally, a bifacially retouched triangular flint arrowhead with concave base (fig. 23, 25) was recovered *in situ* within the mesolithic level of sector 4.

It should moreover be noted that some of the previously described tools, such as the large end-scraper on a flake of fig. 15, 12 (horseshoe scraper ?) and some of the end-scrapers on blade with slightly convex scraper front (e.g. fig. 15, 6) would not at all be conspicious in any early or even middle neolithic assemblages.

5.4.17. Toolfragments

In sectors 1, 4 and 5 respectively 14.6 %, 18.8 % and 19.0 % of the absolute amount of tools (see table XIX) have not been included in the typological inventory because of their too fragmentary condition. More than half of these are unidentifiable microlithic armatures partly preserving a truncation or backed edge, such as is the case for the broken specimens of fig. 19, 26-27.

5.4.18. Tools beyond the list

Two fist-size spherical rolled quartz cobbles originating from sectors 1 and 4 display abrasion traces of the rounded angles and were assumably used as hammerstones.

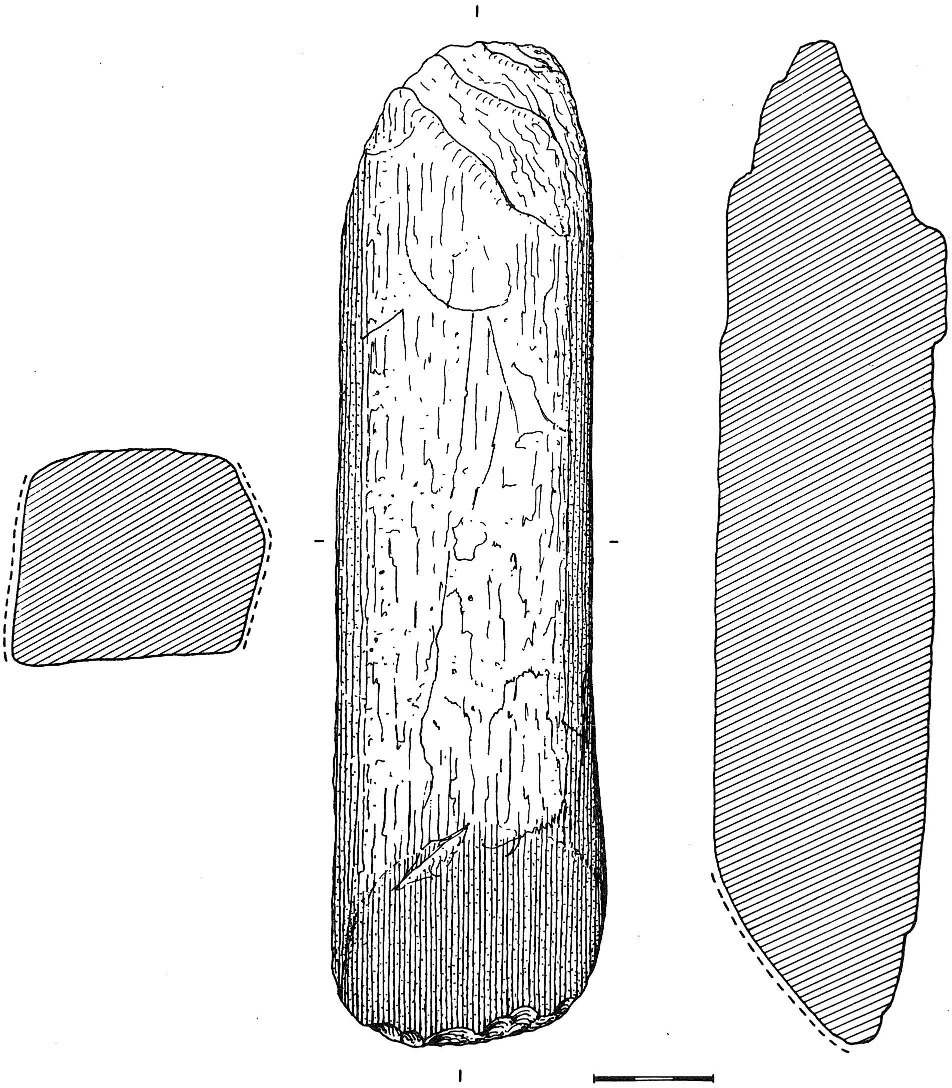


Fig. 30. Polished sandstone artifact from sector 1.

A lengthwise split, flat quartzite nodule (82 x 65 x 10 mm) from sector 1 bears polish on its upper part and along its edges. A fragmentary sandstone slab with quartz-veins (120 x 65 x 25 mm), also from sector 1, displays traces of polishing on its parallel upper- and underside. Finally, a long and narrow sandstone block with square section from sector 1 (fig. 30) has been polished on both sides; the polished oblique working(?) part shows an abraded edge (polished parts are indicated by a dashed line on the sections of the piece).

Ochre is only present in sectors 4 and 5 and appears in the form of tiny nodules; the sole substantial cobble, measuring 32 x 22 x 9 mm, was recovered from sector 5.

## 5.5. MICROBURINS

These typical waste products, whose classification is listed in table XVIII, are well represented in each of the three sectors, where they account for 1 to 2 % of the totality of recovered artifacts (see table VIII). Wommersom-quartzite microburins are strikingly rare in sectors 1 and 4 (respectively 10.5 % and 5.3 %). In sector 5, however, their frequency is less aberrant (20 %). These ratio's partly sustain our previously expressed hypothesis that wommersom-quartzite microlithic armatures (consequently especially rectangular trapezes) were but seldomly manufactured by means of microburin-technique. The two sole microburins of chert (phtanite) have been recovered from sector 4.

Table XVIII. Classification of microburins. L : notch to the left; R : notch to the right.

| | Sector 1 | | | | Sector 4 | | | | Sector 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | R | Tot. | % | L | R | Tot. | % | L | R | Tot. | % |
| Proximal | 52 | 9 | 61 | 45.9 | 76 | 26 | 102 | 54.3 | 26 | 8 | 34 | 35.8 |
| Distal | 42 | 3 | 45 | 33.8 | 38 | 14 | 52 | 27.7 | 27 | 6 | 33 | 34.7 |
| Double | 1 | - | 1 | 0.7 | - | - | - | - | 1 | - | 1 | 1.1 |
| Opposed to fracture | 6 | - | 6 | 4.5 | 15 | 2 | 17 | 9.0 | 5 | - | 5 | 5.3 |
| Krukowski | 4 | 1 | 5 | 3.8 | 5 | 1 | 6 | 3.2 | - | 2 | 2 | 2.1 |
| On tool | 2 | - | 2 | 1.5 | 4 | - | 4 | 2.1 | 2 | 2 | 4 | 4.2 |
| Fragmentary | 6 | 1 | 7 | 5.3 | 3 | - | 3 | 1.6 | 4 | - | 4 | 4.2 |
| "Ecaille" | 3 | 1 | 4 | 3.0 | 4 | - | 4 | 2.1 | 6 | - | 6 | 6.3 |
| Accidental | 2 | - | 2 | 1.5 | - | - | - | - | 5 | 1 | 6 | 6.3 |
| Total | 118 | 15 | 133 | 100.0 | 145 | 43 | 188 | 100.0 | 76 | 19 | 95 | 100.0 |
| % | 88.7 | 11.3 | 100.0 | - | 77.1 | 22.9 | 100.0 | - | 80.0 | 20.0 | 100.0 | - |

Most of the microburins have the notch oriented towards the left, which is of course closely correlated with the consistent lateralisation of the microlithic armatures. Their dimensions have not systematically been recorded : width and thickness however seem not susceptible to much variation; the length may vary between 5 and 40 mm.

In sector 1 and especially in sector 4 proximal microburins clearly outnumber distal ones. In sector 5 both occur with equal frequencies. Double microburins (e.g. fig. 19, 25) are scarce. A moderate amount are opposed to a flexion fracture. Krukowski-microburins (ROZOY, 1978 : 66) are mostly distal; one specimen is opposed to a flexion fracture. Some microburins were manufactured on tools or bear posterior retouch. Most of these display retouch along one of the blank-edges, which

Table XIX. Tool inventory list of sectors 1, 4 and 5. F : flint; W : wommersom-quartzite; C% : cumulative percentage.

| | SECTOR 1 | | | | | SECTOR 4 | | | | | SECTOR 5 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | W | Tot. | % | C% | F | W | Tot. | % | C% | F | W | Tot. | % | C% |
| 1. Long end-scraper on a blade | 3 | 4 | 7 | 1.09 | 1.09 | 2 | 3 | 5 | 0.98 | 0.98 | 1 | 3 | 4 | 1.16 | 1.16 |
| 2. Short end-scraper on a blade | 2 | 1 | 3 | 0.47 | 1.56 | 2 | - | 2 | 0.39 | 1.37 | 1 | - | 1 | 0.29 | 1.45 |
| 3. Broken end-scraper on a blade | 5 | - | 5 | 0.78 | 2.34 | 5 | 1 | 6 | 1.17 | 2.54 | - | 2 | 2 | 0.58 | 2.03 |
| 4. Single end-scraper on a flake | 10 | 2 | 12 | 1.88 | 4.22 | 10 | 2 | 12 | 2.35 | 4.89 | 9 | 1 | 10 | 2.90 | 4.93 |
| 5. End-scraper on a retouched flake | 2 | - | 2 | 0.31 | 4.53 | 2 | 1 | 3 | 0.59 | 5.48 | 2 | - | 2 | 0.58 | 5.51 |
| 7. Thumbnail scraper/mini scraper | 13 | 4 | 17 | 2.66 | 7.19 | 5 | 3 | 8 | 1.56 | 7.04 | 9 | - | 9 | 2.61 | 8.12 |
| 8. Other end-scraper on a flake | 2 | 2 | 4 | 0.63 | 7.82 | 5 | 3 | 8 | 1.56 | 8.60 | 3 | - | 3 | 0.87 | 8.99 |
| 9. Carinated/core-like end-scraper | - | - | - | - | 7.82 | - | 1 | 1 | 0.20 | 8.80 | 1 | - | 1 | 0.29 | 9.28 |
| 10. Denticulated end-scraper | 1 | - | 1 | 0.16 | 7.98 | 1 | 1 | 2 | 0.39 | 9.19 | 1 | - | 1 | 0.29 | 9.57 |
| 11. Thick denticulated flake | 3 | - | 3 | 0.47 | 8.45 | 2 | - | 2 | 0.39 | 9.58 | 1 | 1 | 2 | 0.58 | 10.15 |
| 12. Thin denticulated flake | 5 | 2 | 7 | 1.09 | 9.54 | 9 | 1 | 10 | 1.96 | 11.54 | 5 | 1 | 6 | 1.74 | 11.89 |
| 13. Thick truncated flake | - | - | - | - | 9.54 | - | - | - | - | 11.54 | 1 | - | 1 | 0.29 | 12.18 |
| 14. Thick retouched flake | 8 | 2 | 10 | 1.56 | 11.10 | 6 | 3 | 9 | 1.76 | 13.30 | 8 | 1 | 9 | 2.61 | 14.79 |
| 15. Thin truncated flake | 11 | 4 | 15 | 2.35 | 13.45 | 9 | 3 | 12 | 2.35 | 15.65 | 6 | 2 | 8 | 2.32 | 17.11 |
| 16. Thin retouched flake | 45 | 16 | 61 | 9.55 | 23.00 | 37 | 15 | 52 | 10.18 | 25.83 | 28 | 8 | 36 | 10.43 | 27.54 |
| 17. Side-scraper | 2 | - | 2 | 0.31 | 23.31 | - | - | - | - | 25.83 | 1 | 1 | 2 | 0.58 | 28.12 |
| 19. Borer | 4 | 2 | 6 | 0.94 | 24.25 | 1 | 1 | 2 | 0.39 | 26.22 | 1 | - | 1 | 0.29 | 28.41 |
| 22. Burin | - | - | - | - | 24.25 | 1 | - | 1 | 0.20 | 26.42 | - | - | - | - | 28.41 |
| 23. Blunted piece | - | - | - | - | 24.25 | - | - | - | - | 26.42 | 1 | - | 1 | 0.29 | 28.70 |
| 24. Splintered piece | - | - | - | - | 24.25 | 1 | - | 1 | 0.20 | 26.62 | - | - | - | - | 28.70 |
| 26. Blade with a cuncave truncation | 1 | - | 1 | 0.16 | 24.41 | 1 | - | 1 | 0.20 | 26.82 | - | - | - | - | 28.70 |
| 27. Blade with a straight truncation | 4 | - | 4 | 0.63 | 25.04 | 1 | 1 | 2 | 0.39 | 27.21 | 3 | - | 3 | 0.87 | 29.57 |
| 28. Blade with an oblique truncation | 10 | 1 | 11 | 1.72 | 26.76 | 8 | - | 8 | 1.56 | 28.77 | 2 | 2 | 4 | 1.16 | 30.73 |
| 29. Blade with distal retouch | 3 | 2 | 5 | 0.78 | 27.54 | 2 | 1 | 3 | 0.59 | 29.36 | - | 1 | 1 | 0.29 | 31.02 |
| 30. Blade with continuous retouch | 12 | 3 | 15 | 2.35 | 29.89 | 8 | 3 | 11 | 2.15 | 31.51 | 7 | 2 | 9 | 2.61 | 33.63 |
| 32. Atypically backed bladelet | 4 | 1 | 5 | 0.78 | 30.67 | 2 | 2 | 4 | 0.78 | 32.29 | 5 | 1 | 6 | 1.74 | 35.37 |
| 33. Partially backed bladelet | 7 | 1 | 8 | 1.25 | 31.92 | 3 | - | 3 | 0.59 | 32.88 | - | - | - | - | 35.37 |
| 36. Bladelet with an arched end | 1 | - | 1 | 0.16 | 32.08 | 2 | 2 | 4 | 0.78 | 33.66 | - | - | - | - | 35.37 |
| 37. Partially retouched bladelet | 7 | 2 | 9 | 1.41 | 33.49 | 6 | 3 | 9 | 1.76 | 35.42 | 4 | 1 | 5 | 1.45 | 36.82 |
| 38. Continuously retouched bladelet | 3 | - | 3 | 0.47 | 33.96 | 4 | - | 4 | 0.78 | 36.20 | 5 | 2 | 7 | 2.03 | 38.85 |
| 39. Bladelet with Ouchtata Type retouch | 1 | - | 1 | 0.16 | 34.12 | 2 | - | 2 | 0.39 | 36.59 | - | - | - | - | 38.85 |
| 40. Single notched bladelet | 9 | 6 | 15 | 2.35 | 36.47 | 2 | 8 | 10 | 1.96 | 38.55 | 6 | 5 | 11 | 3.18 | 42.03 |
| 41. Bladelet broken above a notch | 2 | - | 2 | 0.31 | 36.78 | 6 | 1 | 7 | 1.37 | 39.92 | 1 | 3 | 4 | 1.16 | 43.19 |
| 42. Bladelet broken in a notch | 29 | 7 | 36 | 5.63 | 42.41 | 26 | 11 | 37 | 7.42 | 47.16 | 12 | - | 12 | 3.47 | 46.66 |
| 43. Bladelet with a concave truncation | 1 | 2 | 3 | 0.47 | 42.88 | - | 2 | 2 | 0.39 | 47.55 | 1 | - | 1 | 0.29 | 46.95 |
| 44. Bladelet with a straight truncation | 6 | 3 | 9 | 1.41 | 44.29 | 3 | 2 | 5 | 0.98 | 48.53 | - | 2 | 2 | 0.58 | 47.53 |
| 45. Bladelet with distal retouch | 4 | 1 | 5 | 0.78 | 45.07 | - | 2 | 2 | 0.39 | 48.92 | - | - | - | - | 47.53 |
| 46. Bladelet with an oblique truncation | 17 | 7 | 24 | 3.76 | 48.83 | 5 | 4 | 9 | 1.76 | 50.68 | 3 | 2 | 5 | 1.45 | 48.98 |
| 47. Idem broken under an oblique trunc. | 11 | 4 | 15 | 2.35 | 51.18 | 15 | 7 | 22 | 4.30 | 54.98 | 8 | 3 | 11 | 3.18 | 52.16 |
| 48. Obliquely truncated point | 9 | 1 | 10 | 1.56 | 52.74 | 2 | 1 | 3 | 0.59 | 55.57 | 3 | - | 3 | 0.87 | 55.03 |
| 49. Idem (distal point) | 1 | 1 | 2 | 0.31 | 53.05 | 1 | - | 1 | 0.20 | 55.77 | - | - | - | - | 55.03 |
| 50. Short point | 18 | 1 | 19 | 2.97 | 56.02 | 16 | 1 | 17 | 3.33 | 59.10 | 7 | - | 7 | 2.03 | 55.06 |
| 51. Unilaterally backed point | 1 | - | 1 | 0.16 | 56.18 | 1 | 2 | 3 | 0.59 | 59.69 | - | - | - | - | 55.06 |
| 52. Idem (distal point) | - | - | - | - | 56.18 | - | - | - | - | 59.69 | 1 | - | 1 | 0.29 | 55.35 |
| 54. Double backed point | - | - | - | - | 56.18 | 1 | - | 1 | 0.20 | 59.89 | - | - | - | - | 55.35 |
| 57. Crescent with a retouched chord | 1 | - | 1 | 0.16 | 56.34 | - | - | - | - | 59.89 | - | - | - | - | 55.35 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62. Fragment of a small backed bladelet | 13 | 1 | 14 | 2.20 | 58.54 | - | - | - | - | 59.89 | 4 | 2 | 6 | 1.74 | 57.09 |
| 63. Truncated small backed bladelet | 9 | 1 | 10 | 1.56 | 60.10 | - | - | - | - | 59.89 | 7 | - | 7 | 2.03 | 59.12 |
| 64. Backed bladelet | 1 | - | 1 | 0.16 | 60.26 | - | - | - | - | 59.89 | - | - | - | - | 59.12 |
| 65. Fragment of a backed bladelet | 4 | - | 4 | 0.63 | 60.89 | - | - | - | - | 59.89 | - | - | - | - | 59.12 |
| 66. Truncated backed bladelet | 9 | - | 9 | 1.41 | 62.30 | - | - | - | - | 59.89 | 1 | - | 1 | 0.29 | 59.41 |
| 67. Scalene backed bladelet | 1 | - | 1 | 0.16 | 62.46 | - | - | - | - | 59.89 | - | - | - | - | 59.41 |
| 68. Scalene triangle | 8 | - | 8 | 1.25 | 63.71 | 5 | - | 5 | 0.98 | 60.87 | 1 | - | 1 | 0.29 | 59.70 |
| 69. Truncated scalene triangle | 3 | 1 | 4 | 0.63 | 64.34 | - | - | - | - | 60.87 | - | - | - | - | 59.70 |
| 73. Sc. triangle with conc. small trunc. | - | - | - | - | 64.34 | 2 | - | 2 | 0.39 | 61.26 | - | - | - | - | 59.70 |
| 77. Isosceles triangle | - | - | - | - | 64.34 | - | - | - | - | 61.26 | 1 | - | 1 | 0.29 | 59.99 |
| 78. Mistletoe point | 6 | 3 | 9 | 1.41 | 65.75 | 1 | 1 | 2 | 0.39 | 61.65 | 1 | - | 1 | 0.29 | 60.28 |
| 79. Triangle with surface retouch | 3 | - | 3 | 0.47 | 66.22 | - | - | - | - | 61.65 | - | - | - | - | 60.28 |
| 80. Other microlith with surf. retouch | 2 | 1 | 3 | 0.47 | 66.69 | - | - | - | - | 61.65 | - | 1 | 1 | 0.29 | 60.57 |
| 81. Point with rounded base | 2 | - | 2 | 0.31 | 67.00 | - | - | - | - | 61.65 | - | 1 | 1 | 0.29 | 60.86 |
| 82. Point with oblique base | 5 | 2 | 7 | 1.09 | 68.09 | 1 | - | 1 | 0.20 | 61.85 | 1 | - | 1 | 0.29 | 61.15 |
| 83. Short triangular point | 1 | - | 1 | 0.16 | 68.25 | 2 | - | 2 | 0.39 | 62.24 | - | - | - | - | 61.15 |
| 85. Long triangular point | 1 | - | 1 | 0.16 | 68.41 | - | - | - | - | 62.24 | - | - | - | - | 61.15 |
| 87. Tardenois point | - | - | - | - | 68.41 | - | - | - | - | 62.24 | 1 | - | 1 | 0.29 | 61.44 |
| 89. Ogival point with concave base | 1 | - | 1 | 0.16 | 68.57 | - | - | - | - | 62.24 | - | - | - | - | 61.44 |
| 92. Short rhombic trapeze | 9 | 1 | 10 | 1.56 | 70.13 | 8 | - | 8 | 1.56 | 63.80 | 5 | - | 5 | 1.45 | 62.89 |
| 93. Long rhombic trapeze | 11 | 2 | 13 | 2.03 | 72.16 | 16 | - | 16 | 3.13 | 66.93 | 12 | - | 12 | 3.47 | 66.36 |
| 94. Short rectangular trapeze | 23 | 21 | 44 | 6.89 | 79.05 | 9 | 26 | 35 | 6.85 | 73.78 | 6 | 8 | 14 | 4.06 | 70.42 |
| 95. Vielle trapeze | 9 | 2 | 11 | 1.72 | 80.77 | 2 | 2 | 4 | 0.78 | 74.56 | 7 | 1 | 8 | 2.32 | 72.74 |
| 96. Short asymmetric trapeze | 7 | 1 | 8 | 1.25 | 82.02 | 6 | 3 | 9 | 1.76 | 76.32 | 3 | 5 | 8 | 2.32 | 75.06 |
| 97. Long asymmetric trapeze | 2 | - | 2 | 0.31 | 82.33 | 1 | 1 | 2 | 0.39 | 76.71 | 3 | 5 | 8 | 2.32 | 77.38 |
| 98. Short symmetric trapeze | 2 | - | 2 | 0.31 | 82.64 | 2 | 2 | 4 | 0.78 | 77.49 | 3 | - | 3 | 0.87 | 78.25 |
| 99. Long symmetric trapeze | 3 | 1 | 4 | 0.63 | 83.27 | 5 | - | 5 | 0.98 | 78.47 | 5 | - | 5 | 1.45 | 79.70 |
| 100. Symm. trap. with very oblique trunc. | 2 | - | 2 | 0.31 | 83.58 | 1 | - | 1 | 0.20 | 78.67 | 1 | - | 1 | 0.29 | 79.99 |
| 101. Symm. trap. with concave truncations | - | - | - | - | 83.58 | - | - | - | - | 78.67 | 1 | - | 1 | 0.29 | 80.28 |
| 105. Point of danubian type | 3 | - | 3 | 0.47 | 84.05 | 2 | - | 2 | 0.39 | 79.06 | 4 | - | 4 | 1.16 | 81.44 |
| 106. Indeterminate microlith | 3 | - | 3 | 0.47 | 84.52 | 2 | - | 2 | 0.39 | 79.45 | 2 | - | 2 | 0.58 | 82.02 |
| 107. Unilateral multiply notched blade | - | 1 | 1 | 0.16 | 84.68 | - | - | - | - | 79.45 | - | - | - | - | 82.02 |
| 108. Idem (bladelet) | 1 | - | 1 | 0.16 | 84.84 | - | 6 | 6 | 1.17 | 80.62 | 1 | 1 | 2 | 0.58 | 82.60 |
| 109. Unilateral irregularly ret. blade | 19 | 4 | 23 | 3.60 | 88.44 | 24 | 5 | 29 | 5.67 | 86.29 | 9 | 5 | 14 | 4.06 | 86.66 |
| 110. Idem (bladelet) | 12 | 13 | 25 | 3.91 | 92.35 | 12 | 13 | 25 | 4.89 | 91.18 | 7 | 7 | 14 | 4.06 | 90.72 |
| 111. Blade with opposing notches | 5 | 3 | 8 | 1.25 | 93.60 | 5 | 5 | 10 | 1.96 | 93.14 | 2 | 2 | 4 | 1.16 | 91.88 |
| 112. Idem (bladelet) | 3 | 4 | 7 | 1.09 | 94.69 | 1 | 4 | 5 | 0.98 | 94.12 | 1 | 6 | 7 | 2.03 | 93.91 |
| 113. Blade with opposing retouch | 5 | 2 | 7 | 1.09 | 95.78 | 5 | - | 5 | 0.98 | 95.10 | 3 | - | 3 | 0.87 | 94.78 |
| 114. Idem (bladelet) | 3 | 3 | 6 | 0.94 | 96.72 | 6 | 3 | 9 | 1.76 | 96.86 | 2 | 4 | 6 | 1.74 | 96.52 |
| 115. Blade with off-set notches | 5 | 2 | 7 | 1.09 | 97.81 | 1 | 2 | 3 | 0.59 | 97.45 | 3 | 1 | 4 | 1.16 | 97.68 |
| 116. Idem (bladelet) | - | 4 | 4 | 0.63 | 98.44 | - | 3 | 3 | 0.59 | 98.04 | 1 | 2 | 3 | 0.87 | 98.55 |
| 117. Blade with off-set retouch | 5 | - | 5 | 0.78 | 99.22 | 3 | - | 3 | 0.59 | 98.63 | 4 | - | 4 | 1.16 | 99.71 |
| 118. Idem (bladelet) | 2 | 1 | 3 | 0.47 | 99.69 | 1 | 5 | 6 | 1.17 | 99.80 | 1 | - | 1 | 0.29 | 100.00 |
| 119. Tool of neolithic affinity | 2 | - | 2 | 0.31 | 100.00 | 1 | - | 1 | 0.20 | 100.00 | - | - | - | - | 100.00 |
| Total | 483 | 156 | 639 | 100.00 | | 339 | 172 | 511 | 100.00 | | 250 | 95 | 345 | 100.00 | |
| Tool fragments | 95 | 14 | 109 | | | 90 | 28 | 118 | | | 66 | 15 | 81 | | |
| TOTAL TOOLS | 578 | 170 | 748 | | | 429 | 200 | 629 | | | 316 | 110 | 426 | | |

however is not adjacent to the notch as is the case for Krukowski-microburins. Few specimens are opposed to a truncation. Patinated microburins bearing an unpatinated fracture facet and fire-fragmented microburins have been listed with the fragmentary microburins in so far as their proximal or distal orientation was unclear. "Ecailles de microburin" are rather uncommon. Accidental "microburins" ("accidents de taille des lamelles à bord abattu") only occur in sectors 1 and 5. They lack conspiciously in sector 4, which indeed sustains their association with backed bladelets which likewise do not occur in this sector.

## 5.6. POTTERY (in collaboration with F. JANSSENS)

In the course of the excavation the considerable amount of approximately 130 potsherds was recovered from sector 4. As has previously been noted, these sherds originate for the greater part from the horizon of ferric accumulation ($B_2$ir). A sole sherd of similar manufacture was recovered from the $B_2$h-horizon of sector 5.

Most sherds are highly weathered and have deep cracks honeycombed all over their surface. Others are fairly well preserved and for the most part do not display cracking. The mean superficies of the sherds is approximately 1.5 $cm^2$.

The composition of the sherds is quite uniform. Both the highly weathered and the well preserved specimens display the same matrix and temper types. The former is fairly rich in quartz. The quartz grains are glossy and measure approximately 250 $\mu$m in diameter. According to the roundness scale of M.C. POWERS (1953) they have a sub-rounded to rounded shape. The ochreous and orange-brown colour which may be noted from the section of the sherds points at the presence of ferruginous components in the matrix. As temper types quartz fragments, vegetal material and chamotte (pounded potsherds) have been applied. The quartz fragments may often be spotted at the surface of the sherds. As opposed to the grains in the matrix they are very angular and frosted. Carbon, charcoal and cavities notable from the section of several sherds point at the processing of vegetal material. Within the highly weathered sherds numerous shrivelled vegetal fibres may be found. However, the latter are most likely intrusive since they may but seldomly be encountered on the fresh fracture facets of well preserved potsherds. Chamotte has only been applied to a very moderate degree.

The original colour of the sherds was grey or dark-brown. Many have obtained a rusty coloration due to their sojourn in the horizon of ferric accumulation ($B_2$ir). The iron present in suspension in the soil has consolidated around these sherds and acted as a cement with the surrounding soil particles. Hence results the multitude of quartz grains

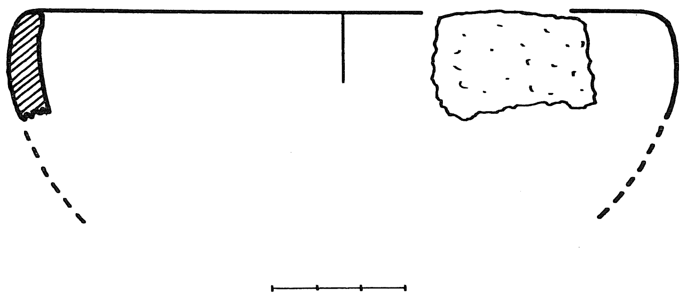


Fig. 31. Rim sherd from sector 4.

adhering to the surface of many sherds, giving them a sandy outlook. Taken into account the bad state of preservation of the majority of sherds no reference has been made to the hardness scale.

The sherds recovered do with certainty belong to hand-made vessels. Due to their fragmentary state no complete profile could be reconstructed. As far as may be judged from the few rim fragments present (fig. 31) and from traces on the surface the sherds originate from small bowls, which were manufactured by thumb pinching and measured approximately 15 cm in diameter.

In conclusion, the pottery present at Weelde-Paardsdrank may best be characterized on the basis of its components. Typological data are not very informative. Temper types in the matrix consist essentially of pounded quartz and vegetal material whereas chamotte is most scarcily represented.

The composition of the Weelde pottery has been compared microscopically with sherds belonging to the Danubian culture (Noville-en-Hesbaye and Vlijtingen), the final Rössen culture (Bosse del'Tombe), the Michelsberg culture (Kemmelberg, Thieusies, Neufvilles, Spiennes and Bosvoorde) and the Seine-Oise-Marne culture (Lesdain) (JANSSENS, 1981). According to the temper components, the Weelde sherds may best be associated with some sherds from the danubian settlement at Noville-en-Hesbaye. However, the mutual proportions of the temper types applied are strikingly different. Chamotte is used to a far higher degree than quartz in the danubian ware.

In view of the present typological and technological evidence an affiliation of the Weelde pottery with any of the known regional ceramic traditions can thus not be established with certainty.

# 6. DISCUSSION OF THE DATA

## 6.1 STRATIGRAPHY AND PHYSICAL DATA

From the stratigraphical and pedological analyses it may be inferred that the archaeological material of sector 5 is situated at the top of a tardiglacial dune relief. This relief was stabilized by the end of the Younger Dryas. Once the eolian accumulation came to an end, a mild brown forest soil developed. This soil formation lasted for many millenia during which mesolithic man settled down and left his archaeological material on top of the soil. Some penetration of artifacts into the upper soil horizon, due to human traffic on the site, is to be expected. The activity of plants and of burrowing animals caused a further vertical dispersion of the archaeological material. Maybe the burrowing by cockchafer grubs, found in this study, could have played also a role in this respect.

The pollen analysis in the ven (NC 051) indicates that the vegetation during (final?) Atlantic times consisted of (open?) lime woodlands with hazel and ivy. The presence of ivy could be related to human influence on the natural vegetation. This assumption cannot however be substantiated, as it is impossible to correlate any of the spectra with the mesolithic occupation. Since most of the mesolithic artifacts of this square occur below the lowest spectrum analysed, the spectrum contemporaneous with the mesolithic occupation does not appear to be represented in the pollen sequence of fig. 10. The natural vegetation at Weelde-Paardsdrank just prior to the arrival of mesolithic man therefore remains unknown.

New eolian accumulation took place, probably during the subatlantic period, covering the archaeological occupation surface with some tens of centimeters of sand. This sand sealed the archaeological material of sector 5. Although no sedimentological analysis has been performed in sectors 1 and 4, it is likely that here too the occupation surface was covered by some new eolian sand. We should not forget that this sand layer sealed not only the mesolithic archaeological material but also all other artifacts which were left on the site between the mesolithic occupation and the subatlantic eolian accumulation. This fact should be taken into consideration when evaluating the presence of some anachronistic artifacts (see below 6.4).

From Subboreal or Subatlantic onwards, the original mild brown forest soil was extremely leached due to deforestation and the installation of a very acid vegetation (heath). As a result of these changes the humic iron podzol developed. From all sectors it is clear that the horizons of this soil are independent of the vertical dispersion of the artifacts (fig. 12).

Some artifacts did occur in the fine loamy sand of upper weichselian age in square NC 051. Their presence in this sediment can be explained by a very thin tardiglacial accumulation, as was confirmed for the whole ven, followed by homogenisation due to the formation of the brown forest soil prior to about 4200 B.P. From 4200 B.P. on, the profile was indeed sealed by peat. In other squares in the ven some artifacts could be found in similar stratigraphic position. In the light of the fact that the later podzolisation did not affect the profile NC 051, it can be assumed that the vertical dispersion of the archaeological material was mainly due to the brown forest soil formation and not to the podzol formation. This view is consistent with the absence of nearly all biological activity not only in the B2 but also in the A2 horizon of a humic iron podzol.

The stratigraphical position of the artifacts in square MY 075, confined to a very thin layer, is uncertain. If the artifacts do belong to the same mesolithic occupation as those of the other sectors, we should expect them to have a similar vertical dispersion, which is not the case. Although technology and typology of the recovered archaeological material seems clearly to indicate late mesolithic affinities, the stratigraphic position suggests that this material was deposited in a very recent period, i.e. posterior to the formation of the brown forest soil and even to the humic iron podzol. Only new excavations can bring some light on this contradiction.

Considering its stratigraphic position the pit in squares KA-KB 050 is certainly not younger than the formation of the brown forest soil. The charcoal date of younger than 430 B.P. (Lv-854D) is probably due to the insufficiency of the material, which did not allow treatment with NaOH. The archaeological material recovered from this pit suggests its attribution to the mesolithic. As such,the stratigraphical position of the pit indicates that the formation of the brown forest soil was uncompleted at the time of the mesolithic occupation. Indeed the soil formation continued above the lower part of the pit, obliterating fully the upper part of it.

Taking in account all elements of stratigraphy and correlated analyses, one arrives at the conclusion that the mesolithic settlement is posterior to the end of the Younger Dryas but not later than the end of of the brown soil evolution. Unfortunately this is a very long period as probably the end of the brown soil evolution is to be situated at the end of the Subboreal.

Referring to the C14 dates of sector 5, we should take in account that the covering process of the archaeological occupation horizon does include the possibility of contamination by younger charcoal. With respect to contamination possibilities the hazel nutshell sample is the most reliable. However as there is not yet any coherent series of C14 dates for the regional mesolithic, one has to await confirmation of the date of 6990 ± 135 B.P. (Lv-959), especially as it seems to be contradicted by some of our considerations below (see 6.4.).

## 6.2. TYPOLOGICAL INTEGRITY OF THE SECTORS

The typological integrity taken into consideration here concerns only the component of the lithic industry attribuable on the basis of typology and technology to the mesolithic period. The minor seemingly anachronistic elements will be discussed furtheron (6.4.).

In fact, the possibility of non-homogeneity of mesolithic assemblages recovered from open air settlements on sandy soil needs serious consideration (ROZOY, 1978 : 80). One should take into account that the original occupation surface may have remained unchanged for several thousands of years. As the sedimentological and pedological analyses seem to indicate, this was the case at the site of Weelde-Paardsdrank. As a result all of the archaeological material left on the site within this time range, while subject to a certain vertical dispersion, would be confined to a single archaeological layer. So, from a stratigraphical point of view it would be out of the question to separate or even recognize distinct occupational phases. In view of the diffuse distribution patterns of sectors 1 and 4 such a mixture of chronologically and/or culturally distinct assemblages might not all be excluded. The artifact concentration of sector 5 is however well-defined and obviously corresponds with a single, though not necessarily continuous occupation of the site (see also 6.5.). In fact, it may be judged highly improbable that this concentration area would have resulted from the superimposition or juxtaposition of culturally distinct or chronologically distant occupations. Putting aside minor typological differences concerning almost exclusively the microlithic component (see furtheron) the overall typological composition of the three sectors is very much alike (compare table VIII and the cumulative graphs fig. 32). Thus, the three assemblages are tentatively thought to stand for *typologically comparable and equivalent entities*, which however does not imply that they are to be considered as the respective remainders of distinct, unique and brief frequentations of the site.

## 6.3. INTERSECTOR SIMILARITY AND DIFFERENTIATION

As may be inferred from the previous chapter and the tables and graphs presented , the overall typological and technological characteristics of the three assemblages may be closely paralleled. In the three sectors predominantly highly rolled and weathered flint, most likely of the same or similar provenance, was used in more or less the same frequencies. Wommersom-quartzite complementary occurs in slightly variable amounts. From the analogous general compositions of the artifactual assemblages it may be inferred that the modes of processing the raw material resources are very much the same. The assemblages are essentially characterized by the predominance of the debitage (approximately 90 %). Tools average 5 % whereas microburins account for 2 % or less. Cores as well as core rejuvenation products occur in similar frequencies (approximately 1 %). The apparently exhausted state of most of the cores points at the economical processing of the resources. Those with one striking platform are the most frequent. With the exception of

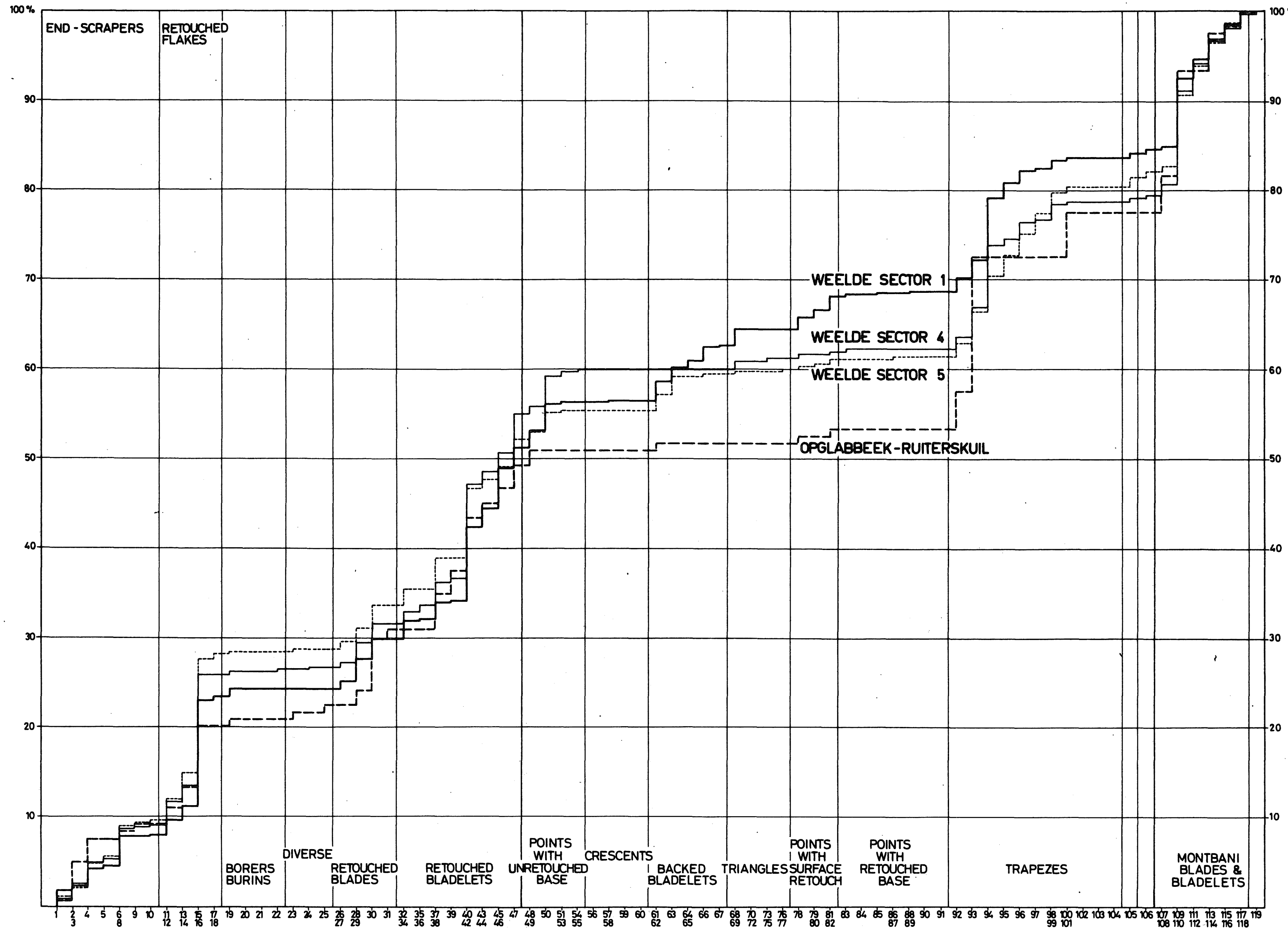



Fig. 32. Cumulative graphs of Weelde-Paardsdrank (sectors 1, 4 and 5) and Opglabbeek-Ruiterskuil (after ROZOY, 1978).

discoidal and globular cores the other core types are nevertheless well represented and occur in similar frequencies in the three sectors. As is suggested by the importance of single crested blades, a re-orientaion of the flaking direction is the most widely applied rejuvenation technique. The high frequencies of wommersom-quartzite core rejuvenation products (see the percentage frequency graphs fig. 33) in addition

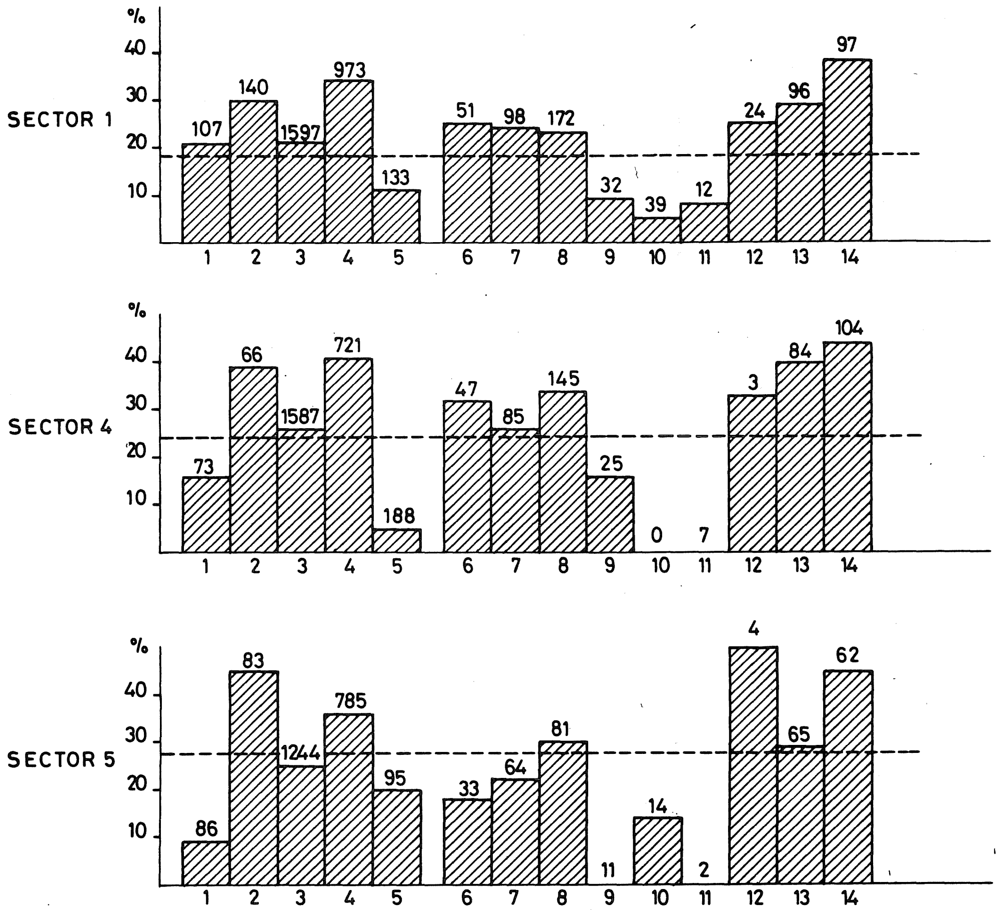



Fig. 33. Percentage frequencies of wommersom-quartzite for the debitage and the major tool classes. 1: cores; 2: core rejuvenation products; 3: flakes; 4: blades and proximal blade fragments; 5: microburins; 6: end-scrapers; 7: retouched flakes; 8: retouched blades; 9: points with unretouched base; 10: backed bladelets; 11: triangles; 12: points with surface retouch; 13: trapezes; 14: Montbani blades. Numbers above bars indicate total number of stone artifacts. The mean frequency of wommersom-quartzite for each sector is indicated by a dashed line.

to the strikingly small proportion of wommersom-quartzite cores may point at the relative voluminosity of the wommersom-quartzite raw material unities. Amongst the debitage flakes, blades, blade fragments, debris and chips occur in comparable amounts. Debris and chips are the main constituents of the lithic assemblages and account together for approximately 60 %. The formal characteristics of the flakes and blades are similar for the three sectors. In general the style of the blades (and especially the wommersom-quartzite specimens) is comparable to the "style de Montbani" as defined by J.G. ROZOY (1968 : 370). It may be inferred from the percentage frequency graphs (fig. 33) that wommersom-quartzite was preferentially used for their production. This preferential treatment of the latter raw material may be explained by both its natural occurrence in tabular form and its structural qualities, which lend it more readily for blade-production.

Amongst the non-microlithic tool components end-scrapers, retouched flakes and blades as well as Montbani blades are equally represented in the three sectors. A common feature of the three assemblages is the scarcity of borers and burins. End-scrapers account for approximately 9 % of the tool totals and vary a lot by type and size. In each sector end-crapers on a flake largely predominate end-scrapers on a blade. Amongst the former single end-scrapers and thumbnailscrapers/ miniscrapers prevail. Simple retouched flakes are numerous and account for approximately 17 %; amongst the latter, side-scrapers are very rare. Retouched blades consist for the most part of single notched and truncated blades and occur for approximately 26 %. Multiply notched and irregularly retouched blades (Montbani blades) occur in similar frequencies (approximately 18 %). They consist for the most part of unilateral irregularly retouched blades. The wommersom-quartzite percentage-frequencies, which may well be correlated with the frequencies noted for the debitage (unretouched blades and proximal blade fragments), indicate a preferential treatment of this raw material for the manufacturing of the Montbani blades.

Microliths occur in similar frequencies in each of the three sectors and account for approximately 25-30 % of the total counts of tools. Trapezes constitute by far the main types (see table XX). With regard to the manufacturing of these particular armatures, a marked preferential treatment of wommersom-quartzite may be inferred from the graphs. Rectangular trapezes are dominant and consist for the most part of short specimens (see table XVI). The latter are to a great extent obtained from wommersom-quartzite; hence the notable percentage frequencies of this raw material. Except for the asymmetric trapezes of sector 5, the other trapezoidal types, occurring in more or less the same frequencies, have preferably been obtained from flint. In the latter sector the relative importance of asymmetric and symmetric trapezes (at the expense of the rectangular ones) should not be left unnoted. The occurrence of flat ventral retouch of the short truncation is not a very common feature; at most it affects 15 % of the trapezes (sector 5). Amongst the non-trapezoidal armatures crescents and points with retouched base are equally unimportant. Points with unretouched base, for the most part from flint, are well-represented in somewhat variable amounts and consist chiefly of obliquely truncated points and short points. Next to the trapezes backed bladelets constitute the main microlithic types in sectors 1 and 5. In sector 4 they are however conspicuous by their complete absence. These microlithic tools, which have almost exclusively been obtained from flint, fall for the largest part within the size range of small backed bladelets. Triangles are but moderately represented in each of the three sectors. Only the series of scalene triangles from sector 1 (including the truncated specimens) displays marked morphological and metric continuity. Points with surface retouch, most frequently mistletoe points, are considerably numerous in sector 1. In sectors 4 and 5 they are but scantily extant. As is the case for the trapezes, a preferential treatment of wommersom-quartzite with regard to the manufacturing of these particular microliths might be inferred from the graphs. However, the small sample sizes, especially in sectors 4 and 5, do not quite justify such a deduction. Points of danubian type, all of which were obtained from flint, occur in small frequencies in each of the three sectors. It is however worth noticing that the specimens for which the suggested filiation with true danubian armatures holds best (fig. 29, 1-4) all originate from sector 5. These seemingly anachronistic elements, together with the tools of neolithic affinity and the pottery recovered, will be discussed in detail under a separate heading hereafter (6.4.).

Lastly it may be recalled that the microburin-technique was readily applied in the three sectors. However, as may be inferred from the percentage frequencies displayed, it was but infrequently performed on wommersom-quartzite blanks. This obvious limitation of the technique, well-marked in sectors 1 and 4, is of course related to the fact that short rectangular trapezes were preferably obtained by other means. The latter armatures indeed substantially contribute to the entirety of wommersom-quartzite microliths.

## 6.4. ANACHRONISTIC ELEMENTS

The occurrence of artifacts of manifestly neolithic origin in sectors 1 and 4 sets a problem. In fact, no decisive arguments may be put forward as to their association with the mesolithic industry. The triangular arrowhead with concave base from sector 4 (fig. 23, 25) is of evolved neolithic affinity as are the robust pointed blade (fig. 19, 28) and possibly the large end-scraper on a flake (horseshoe scraper?) (fig. 15, 12) from sector 1. The transverse arrowhead from sector 1 (fig. 19, 29) may well evoke the later Neolithic. In view of the present evidence these seemingly anachronistic elements are most likely to be considered intrusive and passing by neolithic groups may be held responsable for their presence. In fact, considering the scarcity of these remains, a neolithic reoccupation of the site may be judged highly improbable.

Attention has already been drawn to the presence of several end-scrapers on a blade displaying a slightly convex scraper front and a sometimes angular transition between the scarper front and the edges of the blank (e.g. fig. 20, 8). These end-scrapers bear striking morphological resemblances with end-scrapers of early neolithic (danubian) origin. However, similar artifacts do appear in the earlier mesolithic assemblages of the region and are, moreover not uncommon in epipaleolithic (Tjongerian) context so that it is unclear whether they reflect an early neolithic influence or an autochthonous epipaleolithic tradition.

The occurrence of points of danubian type poses a problem of greater complexity. Our present concept of these armatures is tentatively limited to the point types A and B identified in the previous chapter. However, points of diverging morphology and technology, originating from several mesolithic assemblages within the region, have been claimed to be of danubian affiliation. Unfortunately no conformity has yet been attained or even attempted as to the import of a typological designation for these armatures. Therefore, the construction of a comparative catalogue of true danubian points (i.e. points originating from a closed danubian context) and points of danubian type (which remain to be more accurately defined) would be a most valuable undertaking. The few examples listed below are by no means exhaustive but may serve to point the way for further research into the matter.

So, at the site of Maarheeze, dated by radiocarbon about 6200 B.P., R.R. NEWELL (1975) indicates the presence of two "bandkeramische spitsen" and considers their occurrence as additional evidence for a contemporaneity with the danubian occupation of the Maas valley. Unfortunately we do not dispose of a description or representation of these points. For the collection of Lommel-G.Q.W. J.G. ROZOY (1978 :

176-177) lists 27 "armatures à retouches inverses plates" or "armatures de type danubien", more than half of which (17) are trapezes bearing flat ventral retouch of the short truncation. The sheer presence of this retouch is considered anomalous, innovative and is thought to reflect possibly a foreign origin. The specimens figured by J.G. ROZOY (Pl. 23, 30-37) are however quite foreign to the Weelde points (except for nr 37 and maybe nr 31) and consist for the most part of typically microlithic armatures. As the author himself points out emphatically, the series of 27 "armatures à retouches inverses plates" is in close correlation with the rest of the microlithic component. The same applies to the trapezes of the site of Opglabbeek-Ruiterskuil (VERMEERSCH et al., 1974), many of which bear flat ventral retouch of the short truncation. In fact, it would seem highly artificial to separate and denominate distinctly armatures which constitute a continuous series from every point of view on the sole criterium of the presence or absence of ventral retouch. One wonders why this is agreed on by J.G. ROZOY (1978 : 186) in the case of Opglabbeek-Ruiterskuil but inconsequently contradicted for Lommel-G.Q.W. Thus, the sheer presence of flat ventral retouch, which may well be innovative from a technological point of view, is not thought to constitute substantial evidence for an affiliation with true danubian armatures. Besides, the overall morphological and technological characteristics of the latter are too aberrant from those of the microlithic component to support such an idea. Also at Lommel, Station 1 ("Blokwater"/Zinkfabriek) K.J. NARR (1968 : 81, Taf. 27, 86/99-100) indicates the occurrence of "asymmetrische Spitzen von Omalien-Art". According to this author (1968 : 105, Taf. 31, 77) such points are also present at the site of Budel III. For one of the points from Lommel (Taf. 27, 99) and for the figured specimen from Budel a morphological and technological association with the type A points from Weelde seems most plausible (despite the fact that their ventral surface is not shown). As for the Weelde points, the lateralisation of these armatures is opposed to the overall lateralisation of the microlithic component. On this basis and on the basis of their morphological and technological particularities treated in the previous chapter, the points of danubian type may but difficultly be related to the microlithic component. In fact, they are not thought to constitute microlithic armatures in the traditional typological sense, nor should they be considered as derivative forms of triangular or trapezoidal microlithic types. To the latter they may only be connected on the sheer account of rough morphological and technological convergences. Their microlithic originality thus put into doubt, they may well have been derived from early neolithic danubian prototypes but have been adjusted to microlithic standards both from a dimensional (closely related to the flaking mode) and a technological point of view (e.g. the quasi-absence of denticulated retouch).

Finally the occurrence of pottery in sector 4 (and a sole sherd in sector 5) should be taken into consideration. As has been said no traceable soil-disturbances could be held responsible for its presence. Moreover, from a stratigraphical point of view its association with the mesolithic industry might not adequately be investigated. This association indeed merely points at a contemporary *burial* of both potsherds and lithics but is not informative as to the contemporaneity of their *discard*. From the horizontal distribution plan (plan 3) it may however be noted that the concentrations of potsherds in sector 4 more or less coincide with (but partially represented) concentrations of mesolithic lithic material, which may indeed be an argument in favor of their belonging together. As it was moreover impossible to affiliate the pottery to any of the known regional ceramic traditions, the possibility might not at all be excluded that it indeed forms integrative part of the mesolithic material complex. The question whether this should imply a neolithic influence or reflect an autonomous innovation provides excellent food for thought but may not objectively be dealt with on the basis of the present evidence.

## 6.5. SPATIAL ORGANISATION AND GEOGRAPHIC IMPLANTATION OF THE SETTLEMENT

As may be inferred from the data presented on the topographical sketch of the site (fig. 2), lithic material was encountered all over the dune. On the basis of the test-pit results, the sectors dealt with in this report were selected for further excavation, not only because they were likely to yield high artifact densities but also because they offered the best chances for finding artifacts *in situ*. From the general distribution of the finds it is clear that next to these sectors other high artifact density areas do exist, the lithic material of which is very similar to that recovered from the sectors taken into consideration. These areas, however, prove to be for the most part profoundly disturbed. In the foregoing no attempt has been made as to a chronological seriation of the assemblages recovered from sectors 1, 4 and 5. On the basis of the data available such an attempt would seem unwarranted and for the present we rather envisage their quasi-contemporaneity. Hence the interpretation of the sectors as distinct living or working areas meets some difficulties. This is especially true for sectors 1 and 4, the rather diffuse, long-drawn horizontal distribution patterns of which are not very informative as to the settlement structure. This may partly be due to the incomplete recording of the horizontal artifact distributions for which the high degree of soil disturbance can be held responsible. However, from a closer look at the variations in soil disturbance within sectors 1 and 4 it appears that the distribution configurations recorded do not necessarily correspond with the least disturbed areas within these sectors, so that they may be thought to reflect fairly truthfully the original distribution patterns. For the moment it is however impossible to state whether these patterns correspond to single occupation units or resulted from the accumulation and/or juxtaposition of several subsequent frequentations to the site. The presence of a sole hearth in sector 1, the burned and broken remnants of which are circularly spread within an area of approximately 3 m diameter, as well as the broad refitting pattern indeed offer but little substantial evidence as to a uniqueness of the occupation.

Fortunately, the concentration of lithic material recovered within the sector 5 is more instructive as to the organization of the settlement. Within this sector the degree of disturbance is minimal, the archaeological material recovered from the surface layer (Ap) actually being limited to only a little more than 30 %. The artifact distribution pattern thus arising is clearly oval-shaped and measures approximately 7 by 3 m. Except for its eastern part, where the diminution of finds is less pronounced, the artifact density quickly drops down beyond the proper concentration area. Within the approximative limit of the lithic artifact concentration important amounts of organic waste were encountered. The distributions of these remains, consisting of charcoal, bone and hazelnutshells, line off fairly well defined areas, which may well correspond to specific activities carried out on the spot. It should moreover be noted that the area most densly populated with cores, core rejuvenation products, tools and microburins effectively corresponds with the vacuum of organic remains within the limits of the concentration. Whether this distribution area actually relates to a unique continuous occupation of the site may again not with certainty be stated. On one hand, the clear delimitation of the concentration makes a single occupation most likely and its apparent spatial organization incites us to consider it not merely as a dump, but as a structured living or working area. On the other hand, the substantial quantity of artifacts, though concentrated within a very restricted area, may also point at a human presence which has spanned over several frequentations to the site. In the latter case, the permanent existence of some kind of light shelter on top of the dune might well be held responsible for the delimitation of the artifact distribution.

Another important, but no less unaccounted for, aspect of the settlement is its geographic implantation in the landscape. As is the case for many mesolithic sites in sandy Northern Belgium and the Southern Netherlands the settlement is situated on top of a dune in the immediate vicinity of a ven. The motives behind this apparently deliberate choice of the habitat are little understood. Especially troubling is the fact that the ven probably didn't exist yet at the time of the mesolithic occupation. What were then the factors which attracted mesolithic man to these particular environments? Did the sandy islands actually correspond with clearings within a predominantly forested country, or was it rather the occasional presence of puddles within the dunes' deflation basins which attracted him to the site? In the latter case the occupation might have been seasonal and restricted to the moist period of the year (fall and winter), a possibility for which also the presence of numerous hazelnutshells might plead. Unfortunately all this remains very conjectural, which is largely due to the lack of profound and exhaustive regional geomorphological and paleobotanical investigations.

## 6.6. INTERSITE COMPARISONS

From a typological and technological point of view the lithic assemblages from Weelde-Paardsdrank may be related to the late mesolithic trapeze industries of Northern Belgium and the Southern Netherlands. It is most unfortunate that only very few settlements have so far been adequately excavated and/or reported. As such, for Northern Belgium only the sites of Opglabbeek-Ruiterskuil (VERMEERSCH et al., 1974; ROZOY, 1978) and Lommel (NARR, 1968; ROZOY, 1971, 1978) have been studied *in extenso*. From the latter site we retain only the small collection Destexhe, in which tools are but scantily extant (93 of which 77 are microliths) and which has been excavated over a fairly large area (200 m$^2$). In fact, the representativeness of the wommersom-quartzite series from Lommel (Lommel-G.Q.W.), claimed by J.G. ROZOY, may not at all be upheld. In the foregoing it has been demonstrated that wommersom-quartzite was preferentially used for the manufacturing of particular tool types. Consequently, it would be quite unjustified to equate the composition of an entire mesolithic toolkit with the sole composition of the wommersom-quartzite component. Next to the sites of Opglabbeek-Ruiterskuil and Lommel there exist several typologically related surface assemblages, e.g. Dilsen-Kruisven (MARDAGA, 1975) and Brecht-Overbroek (SCHELTENS, 1976), most of which are either insufficiently reported or yielded too little material to be of great comparative value. A number of trapeze industries from sites (listed below) in the Southern Netherlands, have been dated by radiocarbon (LANTING, MOOK, 1977 : 34-35) :

| | | |
|---|---|---|
| Tilburg-Pompstok | GrN-2443 | 3820 ± 75 B.P. |
| Tilburg 35 | GrN-4205 | 4070 ± 85 B.P. |
| Maarheeze | GrN-2446 | 6230 ± 115 B.P. |
| Tilburg-Labé | GrN-1597 | 6500 ± 120 B.P. |
| Best II | GrN-6085 | 6980 ± 105 B.P. |
| Oirschot VI | GrN-6475 | 7095 + 145 B.P. |

Unfortunately we do not dispose of any detailed information on the sites of Oirschot VI and Best II. As for the site of Maarheeze (BOHMERS, WOUTERS, 1956; NARR, 1968 : 107), only the composition of the microlithic component is known. The same goes for the undated settlement of Budel III (Dorplein) (BOHMERS, WOUTERS, 1956), the microlithic component of which is quite analogous to that of Maarheeze. Here too, the authors do not furnish the slightest indication as to the composition of the non-microlithic tool assemblage. According to J.G. ROZOY (1978 : 178) Montbani blades are absent from both sites. A. WOUTERS (1954), however, figures some fairly typical specimens for Budel III, but does not reveal details of their numeric importance. K.J. NARR (1968 : 105, Taf. 31) gives a brief account of the microlithic component from Budel III and indicates the occurrence of double and circular end-scrapers at that site. The report of R.M. PEETERS (1971) on the site of Tilburg only features the relatively small collection Hendriks/Peeters, consisting of 428 tools out of an assumed total of 3000). As far as may be inferred from the available literature, the three dates obtained for Tilburg relate to the same, but vast, site (approximately 10,000 $m^2$). R.M. PEETERS (1971 : 16) however emphasizes the homogeneous character of the entire lithic assemblage : "... de concentraties maken deel uit van een gesloten complex, want er is hier sprake van slechts één kultuur". The dates for Tilburg-Pompstok are considered aberrant by J.N. LANTING and W.G. MOOK (1977 : 35). Similarly, for unstated reasons, R.M. PEETERS (1971 : 19) rejects the date obtained for Tilburg-Labé.

From this brief account of the evidence available it is clear that an overall and coherent synopsis of the Late Mesolithic in the area is difficult to establish. As such, the vast and relatively well-documented settlement recovered at Weelde-Paardsdrank helps to fill a considerable void of basic information. The intersite comparisons, which we should like to make, are unfortunately much hampered by the lack of concrete data. From the sites listed above hardly any quantitative or qualitative information is available regarding the waste material (unretouched artifacts) and the non-microlithic tool components. Most often we simply and solely dispose of a concise and often incomplete account of the microlithic component. On this basis, the accomplishment of any possible affiliation between the sites may be attempted only very tentatively.

In table XX the general compositions of the microlithic components at the sites of Tilburg (coll. Hendriks/Peeters), Maarheeze, Budel III, Lommel (coll. Destexhe) and Opglabbeek-Ruiterskuil are compared to

Table XX. General composition of the microlithic components from sectors 1, 4 and 5 in comparison with some other microlithic assemblages from Northern Belgium and Southern Netherlands.

| | Tilburg coll. Hendriks/Peeters | | Maarheeze | | Budel III | | Lommel coll. Destexhe | | Weelde sector 1 | | Weelde sector 4 | | Weelde sector 5 | | Opglabbeek-Ruiterskuil | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tot. | % | Tot. | % | Tot. | % | Tot. | % | Tot. | % | Tot. | % | Tot. | % | Tot. | % |
| Point unret. base | 20 | 9.6 | 47 | 27.0 | 84 | 21.0 | 6 | 7.8 | 32 | 15.0 | 25 | 20.0 | 11 | 10.7 | 2 | 5.9 |
| Crescent | 1 | 0.5 | 5 | 3.0 | 8 | 2.0 | 1 | 1.3 | 1 | 0.5 | - | - | - | - | - | - |
| Backed bladelet | 68 | 32.5 | 21 | 12.0 | 64 | 16.0 | 12 | 15.6 | 39 | 18.3 | - | - | 14 | 13.6 | 1 | 2.9 |
| Triangle | 11 | 5.3 | 12 | 7.0 | 24 | 6.0 | 12 | 15.6 | 12 | 5.6 | 7 | 5.6 | 2 | 1.9 | - | - |
| Point surf. retouch | 36 | 17.2 | 22 | 13.0 | 48 | 12.0 | 10 | 13.0 | 24 | 11.3 | 3 | 2.4 | 4 | 3.9 | 2 | 5.9 |
| Point ret. base | 5 | 2.4 | 10 | 6.0 | 32 | 8.0 | 4 | 5.2 | 3 | 1.4 | 2 | 1.6 | 1 | 1.0 | - | - |
| Trapeze | 68 | 32.5 | 55 | 32.0 | 140 | 35.0 | 28 | 36.3 | 96 | 45.1 | 84 | 67.2 | 65 | 63.1 | 29 | 85.3 |
| Point dan. type | - | - | - | - | - | - | 2 | 2.6 | 3 | 1.4 | 2 | 1.6 | 4 | 3.9 | - | - |
| Indeterm. microlith | - | - | - | - | - | - | 2 | 2.6 | 3 | 1.4 | 2 | 1.6 | 2 | 1.9 | - | - |
| Total | 209 | 100.0 | 172 | 100.0 | 400 | 100.0 | 77 | 100.0 | 213 | 100.0 | 125 | 100.0 | 103 | 100.0 | 34 | 100.0 |

those of sectors 1, 4 and 5 from Weelde-Paardsdrank. From this table it may be inferred that in each of these assemblages trapezes contribute substantially to the entirety of the microlithic component. The latter armatures occur in similar frequencies at the sites of Tilburg, Maarheeze, Budel III and Lommel, where they account for 30-35 % of all microliths. At the site of Weelde-Paardsdrank they range from about 45 % in sector 1 to almost 70 % in the sector 4, whereas at Opglabbeek-Ruiterskuil they constitute the quasi-entirety (85 %) of the microlithic tool component. The frequencies of the main trapeze types at these sites are represented in the ternary diagram of fig. 34. From this diagram it appears that rhombic trapezes occur in the least variable frequencies

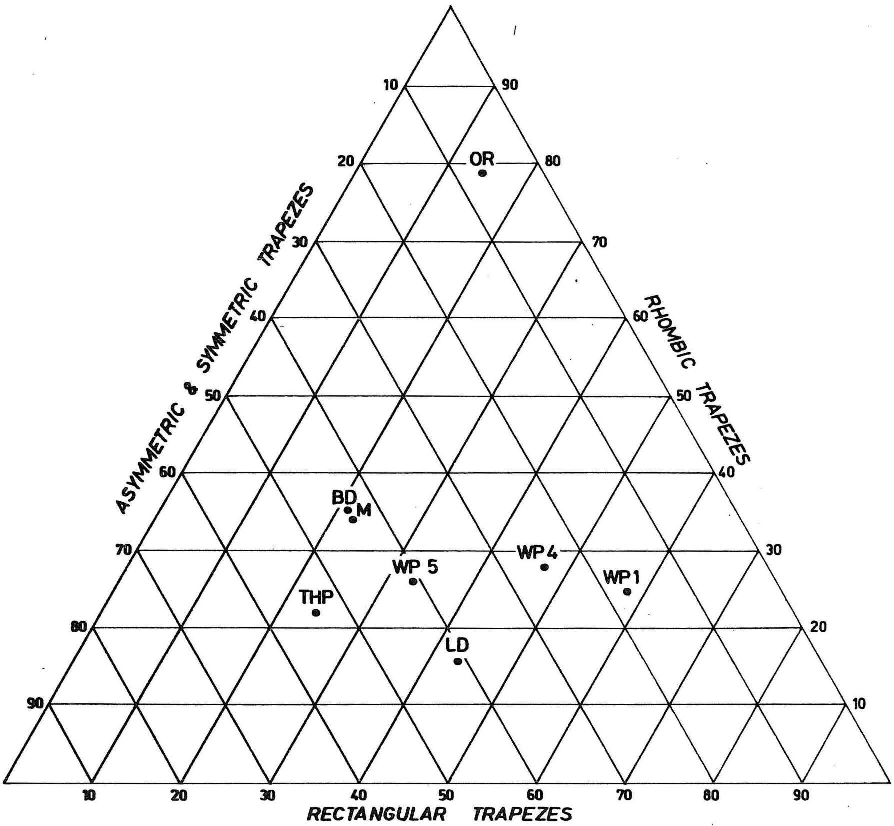



Fig. 34. Ternary diagram displaying the frequencies of the main types of trapezes at the sites of Tilburg coll. Hendriks/Peeters (THP), Maarheeze (M), Budel III (BD), Lommel coll. Destexhe (LD), Weelde-Paardsdrank (WP1/WP4/WP5) and Opglabbeek-Ruiterskuil (OR).

(15-35 %) for the whole of the sites, Opglabbeek-Ruiterskuil excepted. At this site, indeed, rhombic trapezes account for almost 80 % of all trapezes. Amongst the assemblages in which non-rhombic trapezes are dominant, those from the Southern Netherlands bear, next to the rhombic specimens, mainly asymmetric and symmetric trapezes (44 % at both Maarheeze and Budel III and 54 % at Tilburg). Rectangular trapezes are represented for little more than 20 %. The situation is reversed for sectors 1 and 4 from Weelde-Paardsdrank, where the rectangular specimens account for 58 % and 47 % respectively of the entirety of the trapezes. Sector 5 from Weelde-Paardsdrank and the site of Lommel occupy an intermediate position on the diagram. In these assemblages both main types of non-rhombic trapeze occur in more or less similar frequencies. Some of the trapezes display flat ventral retouch of the small truncation. Unfortunately the frequency of its occurrence is not known for all the assemblages. In the Lommel collection, this type of retouch does not seem to affect the trapezes. At Weelde-Paardsdrank its frequency ranges from 2 % in sector 1 to 15 % in sector 5, whereas at Tilburg 7 % of the trapezes display flat ventral retouch. At Opglabbeek-Ruiterskuil this fraction differs notably and amounts to 31 %. With regard to the assemblages from Weelde-Paardsdrank it has been demonstrated that wommersom-quartzite was preferentially used for the manufacture of trapezes and some other tool types. Next to Weelde-Paardsdrank the frequencies of the latter raw material are known only for the sites of Tilburg and Opglabbeek-Ruiterskuil. At the former site wommersom- quartzite is present for 23.1 % of the toolkit. It is worth noticing that 26 out of 68 trapezes (i.e. 38 %) have been obtained from wommersom-quartzite whereas the rest of the microlithic component displays only 13 % of this raw material. As for Opglabbeek- Ruiterskuil, which yielded only a small amount of retouched artifacts (116 of which 16.4 % are from wommersom-quartzite), it may be noted that 6 out of the 19 wommersom-quartzite tools are trapezes.

Amongst the remainder of the microlithic components, crescents and points with retouched base are but scantily represented at all sites. Both types of armature are absent or very scarce in those assemblages with over 60 % of trapezes. Nor are triangles a very common feature, except in the Lommel collection. Points with unretouched base, at all sites mostly obliquely truncated specimens, are present in quite variable though considerable frequencies. At the site of Maarheeze they account for up to 27 % of the microlithic component. Backed bladelets are of common abundance to most of the sites. They lack conspicuously in sector 4 from Weelde-Paardsdrank and are represented by a sole specimen at Opglabbeek-Ruiterskuil. Except in the assemblages with over 60 % of trapezes, points with surface retouch are well-represented and occur in quite similar frequencies. Special attention is drawn to the presence of truncated scalene triangles in the sector 1 from Weelde-Paardsdrank. To our knowledge typologically related armatures only occur in some lithic assemblages from the Southern Netherlands, e.g. Haagakkers (HEESTERS, 1971) and Nijnsel II (HEESTERS, 1967), both of which predate the Atlantic period on the basis of the radiocarbon dates available (LANTING, MOOK, 1977 : 33-34). On account of their typological composition (trapezes are absent or very scarce) the latter assemblages may however but difficulty be associated with those from Weelde-Paardsdrank.

Next to these observations regarding the microlithic component, some evidence exists concerning the variable abundance of Montbani blades on the sites concerned. Though not completely absent, these tools appear to be very scarce at the Maarheeze and Budel III sites. As for the Lommel collection, it appears that the excavation of Destexhe did not yield a single Montbani blade. According to J.G. ROZOY (1978 : 177) this absence should not be explained by a clustering of these artifacts beyond the excavated area, as the wommersom-quartzite series from Lommel (Lommel-GQW) holds only three, moreover, atypical specimens. In view of the fact that these blades were preferentially obtained, together with other tools, from wommersom-quartzite, J.G. Rozoy's argument may well be valid. In the Tilburg collection, Montbani blades account for 6.8 % of the toolkit, though from the report of R.M. PEETERS (1971) it appears that only the most typical specimens have been considered as such. In the sectors of Weelde-Paardsdrank the frequency of Montbani blades ranges from 15.2 % in the sector 1 to 20.4 % in the sector 4 whereas at Opglabbeek-Ruiterskuil they are slightly and insignificantly more numerous (22.8 %). With regard to the preferential use of wommersom-quartzite for the manufacture of these blades, it is worth noticing that 15 out of the 29 specimens from Tilburg (i.e. over 50 %) were obtained from this raw material, whereas for the rest of the non-microlithic tool component it only accounts for 21 %.

Another point of comparison, currently taken into consideration, is the degree to which microburin technique has been applied. Whereas no data on the frequencies of microburins at Maarheeze and Budel III are available, the Tilburg collection holds only 9 specimens for a total count of 141 determinate aramatures (backed bladelets excepted). As such the ratio armatures/microburins amounts to 15.6. This ratio may of course be affected by the defectiveness of the recovery techniques. In any case the collection Destexhe from Lommel does not hold microburins and there is no obvious reason to assume that these waste products were not collected or were grouped beyond the excavated area (ROZOY, 1978 : 179). Compared to the ratio for Tilburg those obtained for the sectors from Weelde-Paardsdrank are considerably smaller and range from 0.7 in sector 1 to 1.3 in sector 4. At Opglabbeek-Ruiterskuil the same ratio amounts to 0.4, which implies that the recovered microburins are actually more than twice as numerous as the recovered microlithic armatures.

From the above observations, whose value is hampered by the scarcity of concrete data, some consistent pattern seems to emerge, which is thought to have both cultural and chronological significance. On account of the typological and technological convergences, e.g. the ubiquitous abundance of typical trapezes, the overall scarcity of crescents and points with retouched base, the presence of surface retouches armatures and Montbani blades as well as the (apparently preferential) use of wommersom-quartzite, the sites concerned are believed to fit into the same cultural scheme. This actually implies that they are not only typologically interrelated but also interconnected (although we do not know in what way precisely). The quantitative differences mentioned here with regard to the composition of the microlithic components, the occurrance of Montbani blades and the application of microburin technique may have chronological significance, although other factors (e.g. functionality) may also be involved. From this point of view, these differences, recalled below, may to a certain degree function as chronological parameters. It is clear that, at present, they cannot be more than working hypotheses requiring further investigation.

1. If the *frequency of trapezes within the microlithic component* is chronologically significant, it most likely increases with time at the expense of the frequency of non-trapezoidal "archaic" microlithic types. As such, the assemblages from Weelde-Paardsdrank may occupy a chronologically intermediate position between the assemblages from the Southern Netherlands and Lommel on the one hand and that from Opglabbeek-Ruiterskuil on the other.

2. The *variability recorded with regard to the frequencies of the main trapeze types* may also be chronologically significant. In view of the sequence established above it is conspicuous that the assemblages from the Southern Netherlands bear, next to the rhombic trapezes, mainly asymmetric and symmetric trapezes, whereas in the sectors from Weelde-Paardsdrank mainly rectangular trapezes occur. Finally, at Opglabbeek-Ruiterskuil the quasi-entirety of these microlithic armatures is constituted by rhombic trapezes. The assemblages from Lommel and the sector 5 from Weelde-Paardsdrank occupy an intermediate position and do not quite fit the picture.

3. The *frequency of flat ventral retouch affecting the short truncation of the trapezes,* the appearance of which is considered innovative from a technological point of view, may have chronological significance as it is but small in the assemblages predating Opglabbeek-Ruiterskuil on the basis of the former parameters.

4. The *frequency of Montbani blades within the toolkit* is obviously chronologically relevant as these artifacts are very scarce or absent in the assemblages with the smaller frequencies of trapezes.

5. The *degree to which microburin technique has been applied* may furnish another chronological parameter as microburins are extremely scarce or absent in the assemblages with the smaller frequencies of trapezes, whereas at Opglabbeek-Ruiterskuil they are twice as numerous as the recovered armatures.

Taking into account the entirety of these parameters, the sectors from Weelde-Paardsdrank may thus be thought to occupy a chronologically intermediate position between the sites from the Southern Netherlands and Lommel on the one hand and that from Opglabbeek-Ruiterskuil on the other. Unfortunately the incoherent series of radiocarbon dates available does not allow us to "absolutize" this relative sequence. In so far as our suggested filiation of points of danubian type (see 6.4.) conforms to reality, the Late Mesolithic of the area is at least in part contemporary with the Earlier Neolithic.

As has been claimed repeatedly (ROZOY, 1978; GOB, 1981), the massive introduction of trapezes, initiating the Late Mesolithic, may have taken place well before the arrival of the first agriculturists. This statement, however, remains to be proven and the few typological data and radiocarbon dates on hand may but be abused in its favor. Similarly, the persistence of late mesolithic settlement until post-danubian times, however unlikely it may seem, cannot be refuted on the basis of the evidence available. It is clear that minute field research and conscientious site reports are required, rather than unverifiable speculation, to remedy the sterility of the present conceptions on the Late Mesolithic of the Belgian Lowland and its adjacent areas.

# BIBLIOGRAPHIE


BARBETTI, M., FLUDE, K.
1979 Geomagnetic Variation during the late Pleistocene Period and Changes in the Radiocarbon Time Scale, Nature, 279, 202-205.

BOHMERS, A., WOUTERS, A.
1956 Statistics and Graphs in the Study of Flint Assemblages III, Palaeohistoria, 5, 27-38.

BORDES, F.
1947 Etude comparative des différentes techniques de taille du silex et des roches dures, L'Anthropologie, 51, 1-29.

BUCHA, V.
1967 Intensity of the Earth's magnetic Field during Archaeological Times in Czechoslovakia, Archaeometry, 10, 12-22.

CLARK, J.G.D.
1971 Excavations at Star Carr, an early Mesolithic Site at Seamer Scarborough, Yorkshire, Cambridge.

DE BAKKER, H., EDELMAN-VLAM, A.W.
1976 De Nederlandse bodem in kleur, Stichting voor Bodemkartering, Wageningen.

DE PLOEY, J.
1961 Morfologie en Kwartair-stratigrafie van de Noorderkempen, Acta Geographica Lovaniensia, 1.

DIMBLEBY, G.W.
1962 Development of British Heathlands and their Soils, Oxford Forestry Memoirs, 23, 1-120.

ESCALON de FONTON, M.
1969 La pièce esquillée. Essai d'interprétation, Bull. Soc. Préhist. Franç., 66, 76.

ESCALON de FONTON, M.
1979 La retouche Montbani expérimentale, Bull. Soc. Préhist. Franç., 76, 217-220.

FLORSCHÜTZ, F.
1941 Resultaten van microbotanisch onderzoek van het complex loodzand-oerzand en van daaronder en daarboven gelegen afzettingen. "Besprekingen over het Heidepodzolprofiel", 10e wetensch. bijeenkomst Sectie Nederl. v.d. Internat. Bodemk. Ver. Groningen, 1-21.

G.E.E.M.
1969 Epipaléolithique-Mésolithique. Les microlithes géométriques, Bull. Soc. Préhist. Franç., 66, 355-366.

G.E.E.M.
1972 Epipaléolithique-Mésolithique. Les armatures non géométriques, Bull. Soc. Préhist. Franç., 69, 364-375

G.E.E.M.
1975 Epipaléolithique-Mésolithique. L'outillage du fonds commun - 1, Bull. Soc. Préhist. Franç., 72, 319-332.

GENDEL, P., PIRNAY, L.
n.d. A Microwear Analysis of experimental Stone Tools, manuscript in preparation.

GENDEL, P.
1982 The distribution and utilisation of wommersom-quartzite during the Mesolithic, Le Paléolithique Supérieur Final et le Mésolithique dans le Grand-Duché de Luxembourg et les régions voisines, Ardennes, Eifel et Lorraine, à paraître.

GILOT, E., MUNAUT, A.V., COUTEAUX, M., HEIM, J., CAPRON, P., MULLENDERS, W.
1969 Datations 14C et Palynologie en Belgique et dans les régions voisines, Bull. Soc. belge Géol. Paléont. Hydrol., 78, 21-29.

GOB, A.
1976 Le mésolithique du gisement inférieur de la Roche-aux-Faucons (Plainevaux), Bull. Soc. roy. belge Antrop. Préhist., 87, 45-76.

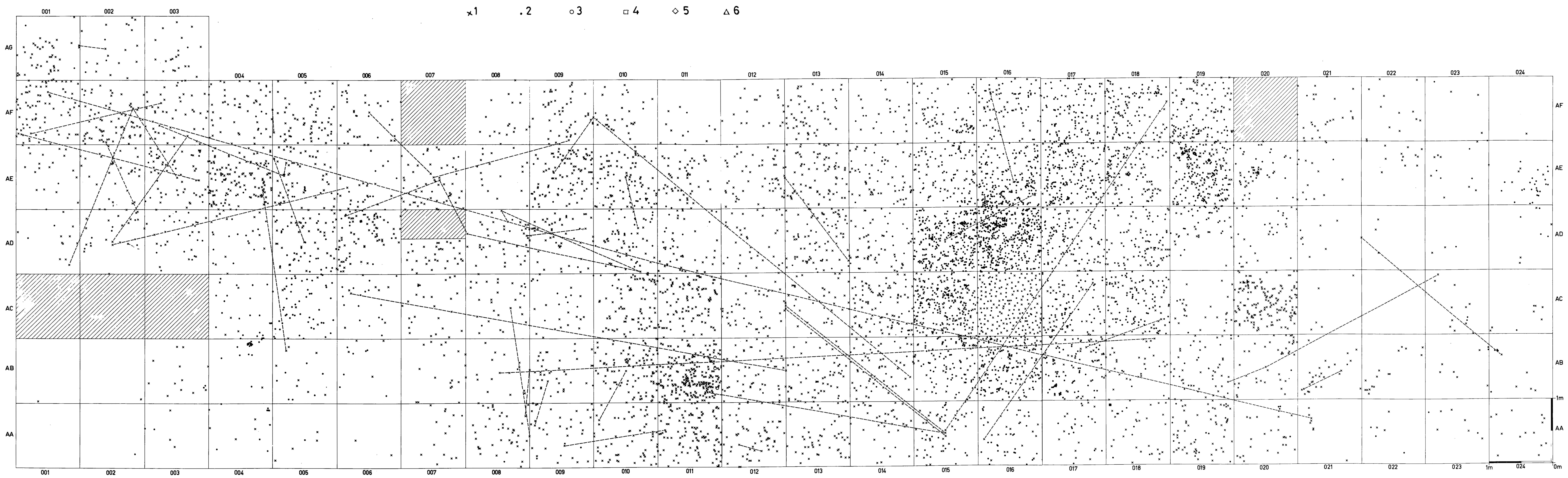
GOB, A.,
1979 Le mésolithique dans le bassin de l'Ourthe, Helinium, 19, 209-236.

GOB, A.
1981 Le mésolithique dans le bassin de l'Ourthe, Société wallone de palethnologie, Mémoire n° 3, Liège.
GUILLET, B.
1971 Etude palynologique des podzols : III. La podzolisation sur granite dans les Vosges hercyniennes de l'étage montagnard. Comparaison avec la podzolisation dans les Basses Vosges grèseuses et sur le plateau lorrain, Pollen et Spores, 13, 421-446.
GULLENTOPS, F.
1956 Etudes géologique, stratigraphique et pétrologique. IV. in : VERHEYLEWEGHEN, J., Le Paléolithique final de culture périgordienne du gisement préhistorique de Lommel, Bull. Soc. roy. belge Anthrop. Préhist., 67, 57-62.
GULLENTOPS, F.
1957 Quelques phénomènes géomorphologiques depuis le Pléni-Wurm, Bull. Soc. belge Géologie, 66, 86-95.
HASSAN, F.
1974 The Archaeology of the Dishna Plain, Egypt : a Study of a Late Palaeolithic Settlement, The Geological Survey of Egypt, paper n° 59, Cairo.
HAVINGA, A.J.
1962 Een palynologisch onderzoek van in dekzand ontwikkelde bodemprofielen, Doctoraatsproefschrift, Wageningen.
HEESTERS, W.
1967 Mesolithicum te Nijnsel, Brabants Heem, 19, 168-178.
HEESTERS, W.
1971 Een mesolithische nederzetting te Sint-Oedenrode, Brabants Heem, 23, 94-115.
HEESTERS, W., WOUTERS, A.M.
1968 Een vroeg-mesolithische kultuur te Nijnsel, Brabants Heem, 20, 98-108.
HEYSE, I.
1979 Bijdrage tot de geomorfologische kennis van het noordwesten van Oost-Vlaanderen (België), Verh. Kon. Acad. v. Wetenschappen, Letteren en Schone Kunsten van België, Kl. d. Wetenschappen, 41, nr 155.
HUYGE, D.
1981 Final Mesolithic Settlements at Weelde (Northern Belgium), Notae Praehistoricae, 1, 49-51.
JANSSENS, F.
1981 Een microscopische studie van Belgische neolithische en ijzertijd ceramiek, unpublished thesis, Katholieke Universiteit te Leuven.
KEELEY, L.H.
1980 Experimental Determination of Stone Tool Uses : a Microwear Analysis, Chicago.
KEELEY, L.H., NEWCOMER, M.H.
1977 Microwear Analysis of experimental Flint Tools : a Test-case, Journal of Archaeological Science, 4, 29-62.
KOVACHEVA, M., VELJOVICH, D.
1977 Geomagnetic Field Variations in Southeastern Europe between 6500 and 100 years BC, Earth and Planetary Science Letters, 37, 131-138.
KOZLOWSKI, S.K.
1980 Atlas of the Mesolithic in Europe, Warschau.
LANTING, J.N., MOOK, W.G.
1977 The Pre- and Protohistory of the Netherlands in Terms of Radiocarbon Dates, Groningen.
LAUSBERG-MINY, J. & P., PIRNAY, L.
1980 Le gisement mésolithique de l'Ourlaine à Theux, Archaeologia Belgica, 223, 25-29.
LAUWERS, R.
1981 Oud-Mesolithicum te Schulen, Notae Praehistoricae, 1, 18.
LAUWERS, R.
1981 Un site du mésolithique ancien à Neerharen (Limburg), Notae Praehistoricae, 1, 45.
LEROI-GOURHAN, A. et al.
1968 La préhistoire, Coll. La Nouvelle Clio, Paris.

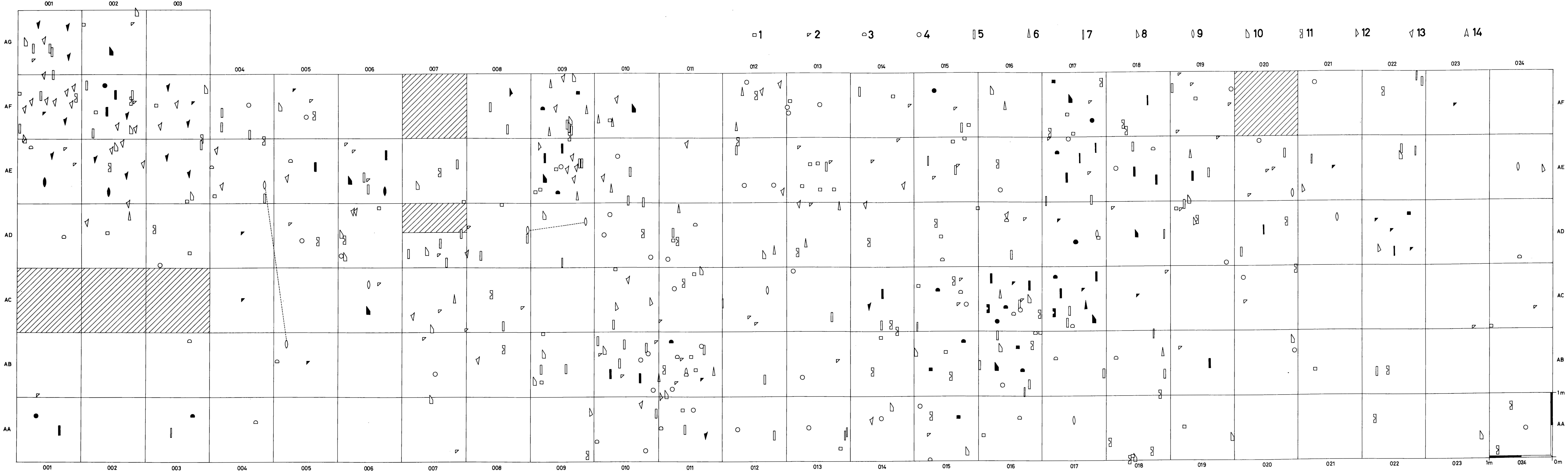
LORIE, J.
1916- De vennen van Oisterwijk in Noord-Brabant, Verh. Geol. Mijnbouwk. Gen. Geol.
1919 Serie, dl. 3, 123-132; dl. 2, 220-232; 281-292; dl. 4, 289-296.
MARDAGA, M.
1975 Dilsen (Kruisven), un site à débitage Montbani, Bull. Soc. roy. belge Anthrop. Préhist., 86, 93-111.
MARICHAL, H.
1981 Late Bandkeramiek te Vlijtingen-Kayberg, unpublished thesis, Katholieke Universiteit te Leuven.
McKERRELL, H.
1975 Correction Procedures for C-14 Dates, T. Watkins (ed.), Radiocarbon : Calibration and Prehistory, Edinburgh, 47-100.
MUNAUT, A.V.
1967 Recherches paléo-écologiques en Basse et Moyenne Belgique, Acta Geographica Lovaniensia, 6.
MUNAUT, A.V., GILOT, E.
1977 Recherches palynologiques et datations 14C dans les régions côtières du Nord de la France. I. Phases transgressives et stabilisations dunaires flandriennes dans l'estuaire de la Canche (Pas-de-Calais), Bulletin de l'Association Française pour l'Etude du Quaternaire, 3, 17-25.
NARR, K.J.
1968 Studien zur älteren und mittleren Steinzeit der niederen Lande, Bonn.
NEWELL, R.R.
1975 Mesolithicum, C.J. Verwers (ed.), Noord-Brabant in Pre- en Protohistorie, Oosterhout, 39-53.
NEWELL, R.R.
1980 Mesolithic Dwelling Structures. Fact and Fantasy, Mesolithikum in Europa, Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam, 14/15, 235-284.
NEWELL, R.R., VROOMANS, A.P.J.,
1972 Automatic Artifact Registration and Systems for archaeological Analysis with the Philips P1100 Computer : a mesolithic Test-case. Oosterhout.
PAULISSEN, E.
1973 De morfologie en Kwartairstratigrafie van de Maasvallei in Belgisch Limburg, Verh. Kon. Acad. v. Wetenschappen, Letteren en Schone Kunsten van België, Kl. d. Wetenschappen, 35, 127.
PAULISSEN, E., MUNAUT, A.V.
1969 Un horizon blanchâtre d'âge Bölling à Opgrimbie, Acta Geographica Lovaniensia, 17, 65-92.
PEETERS, R.M.
1971 De mesolithische kultuur te Tilburg, Historische Bijdragen, 4, Tilburg.
POWERS, M.C.
1953 A new Roundness Scale for Sedimentary Particles, Journal of Sedimentary Petrology, 23, 117-119.
ROZOY, J.G.
1968 Typologie de l'Epipaléolithique (Mésolithique) franco-belge, Issoudun.
ROZOY, J.G.
1971 La fin de l'Epipaléolithique (Mésolithique) dans le Nord de la France et la Belgique, Die Anfänge des Neolithikums vom Orient bis Nordeuropa, Fundamenta, A, Bd. 3, Teil 6, Köln, 1-78.
ROZOY, J.G.
1978 Les derniers chasseurs, Bull. Soc. Arch. Champenoise, numéro spécial.
SCHELTENS, E.
1976 Drie mesolithische sites te Brecht (Overbroek). Studie van het oppervlaktemateriaal uit de collectie R. Foblets, unpublished thesis, Katholieke Universiteit te Leuven.
SCHEYS, G., DUDAL, R., BAYENS, L.
1954 Une interprétation de la morphologie de podzols humo-ferriques, Trans. Fifth Intern. Congr. Soil Sci. Léopoldville, 4, 274-281.

SCHEYS, I.
1972- 1973 De opgraving op de Staberg te Rosmeer. Beschrijving en bespreking van het lithische materiaal uit drie opgravingscampagnes (1952-1954), unpublished thesis, Katholieke Universiteit te Leuven.
TAUTE, W.
1968 Die Stielspitzen-Gruppen in nördlichen Mitteleuropa, Fundamenta, A, Bd. 5, Köln.
THELLIER, E.
1981 Sur la direction du champ magnétique terrestre, en France, durant les deux derniers millénaires, Physics of the Earth and Planetary Interiors, 24, 89-132.
TIXIER, J.
1963 Typologie de l'Epipaléolithique du Maghreb, Mémoires du Centre de Recherches anthropologiques, préhistoriques et ethnographiques, 2, Alger, Paris.
VANDENBERGHE, J., VANDENBERGHE, N., GULLENTOPS, F.
1974 Late pleistocène and holocene Stratigraphy in the Neighbourhood of Brugge, Mededel. Kon. Acad. v. Wetenschappen, Letteren en Schone Kunsten van België, Kl. d. Wetenschappen, 36, nr 3.
VAN DIEPEN, D.
1968 De Bodem van Noordbrabant, Stichting voor Bodemkartering, Wageningen.
VAN NOTEN, F.
1978 Les chasseurs de Meer, Dissertationes archaeologicae gandenses, XVIII, Brugge.
VERMEERSCH, P.
1972 Twee mesolithische sites te Holsbeek, Archaeologica Belgica, 138.
VERMEERSCH, P.M.
1974 Epipaleolithicum en Mesolithicum te Helchteren, Sonisse Heide, Archaeologia Belgica, 169.
VERMEERSCH, P.M.
1976 La position lithostratigraphique et biostratigraphique des industries épipaléolithiques et mésolithiques en Basse Belgique, Congrès Préhistoriques de France, XXe sess. Martigues (1974), 616-621.
VERMEERSCH, P.M.
1976 Steentijdmateriaal uit het noordelijk Hageland, Oudheidkundige Repertoria, XI, 2 vol., Brussel.
VERMEERSCH, P.M.
1977 Die stratigraphische Probleme der Postglazialen Kulturen in Dünengebieten, Quartär, 27/28, 103-109.
VERMEERSCH, P.M.
1982 Quinze années de recherches sur le Mésolithique en Basse Belgique : état de question, Le Paléolithique Supérieur Final et le Mésolithique dans le Grand-Duché de Luxembourg et les régions voisines, Ardennes, Eifel et Lorraine, à paraître.
VERMEERSCH, P.M., CAROLUS, J.
1975 Un site mésolithique à Linkhout-Kampbergen (Limbourg belge), Bull. Soc. Préhist. franç., 72, 125-128.
VERMEERSCH, P.M., FOBLETS, R.
1976 Mesolithicum te Weelde, Archeologie, 62.
VERMEERSCH, P.M., HUYGE, D., FOBLETS, R.
1981 Weelde and the final Mesolithic of the Belgian Campine. A preliminary Report on the Excavations of a Mesolithic Site at Weelde (North Belgium), B. Gramsch (ed.), Mesolithikum in Europa, Veröffentlichungen des Museums für Ur- und Frühgeschichte Potsdam, 14/15, 323-328.
VERMEERSCH, P.M., MUNAUT, A.V., PAULISSEN, E.
1974 Fouilles d'un site du Tardenoisien final à Opglabbeek-Ruiterskuil (Limbourg belge), Quartär, 25, 85-104.
VERMEERSCH, P., PAULISSEN, E., MUNAUT, A.V.
1973 Fouilles d'un site mésolithique à Opgrimbie (Limbourg belge), Bull. Soc. roy. belge Anthrop. Préhist., 84, 97-152.
WATSON, G.S.
1956 A Test for Randomness of Directions, Monthly Notices of the Royal Astronomical Society, Geophysical Supplement, 7, 160-161.

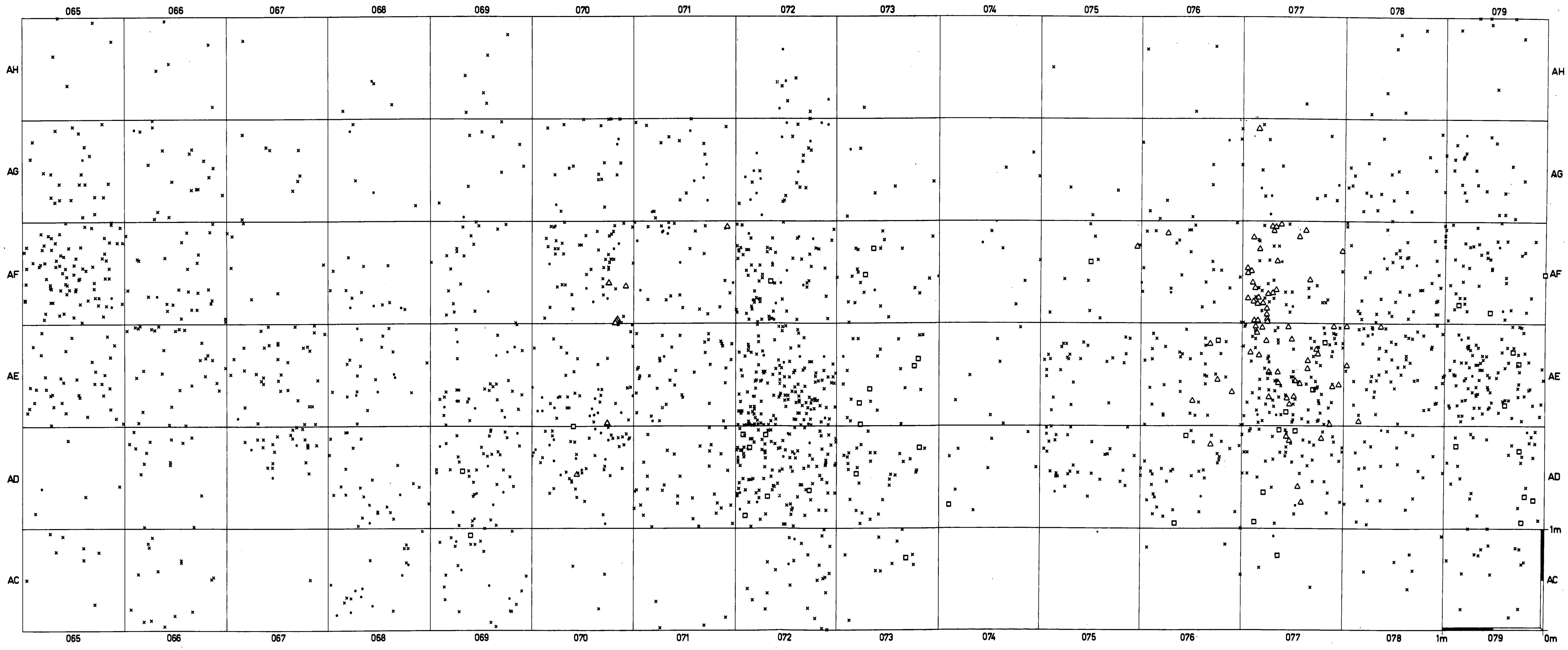
WOUTERS, A.
1954 De voorneolithische culturen in Noord-Brabant, Brabants Heem, 6, 122-148.
ZIMMERMAN, A.
1977 Die Bandkeramischen Pfeilspitzen aus den Grabungen in Merzbachtal, Rheinische Ausgrabungen, Band 18, Bonn, 349-432.
ZONNEVELD, I.S.
1965 Studies van landschap, bodem en vegetatie in het westelijk deel van de Kalmthoutse heide, Boor en spade, 14, 216-238.



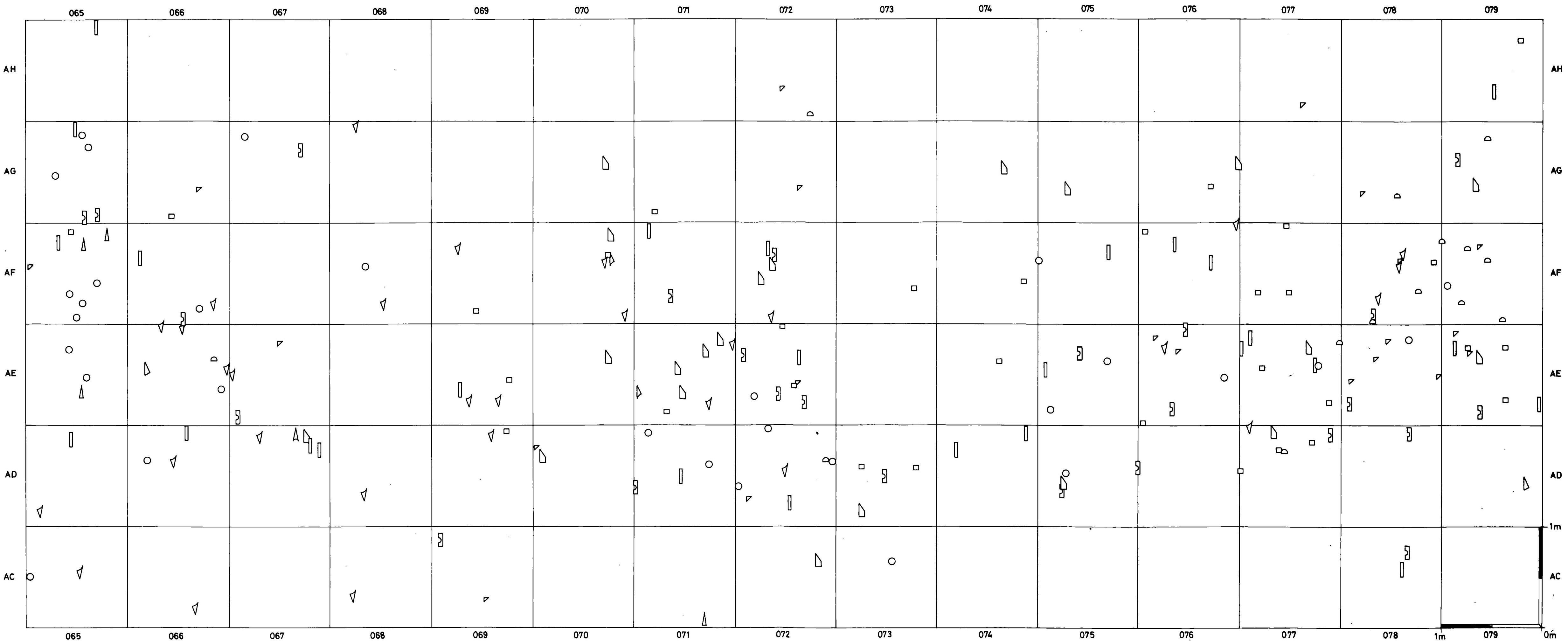

**Plan 1.** General distribution plan of sector 1. 1: stone artifact ; 2: sandstone or quartz fragment ; 3: hazelnutshell ; 4: charcoal ; 5: bone ; 6: potsherd . Refitted artifacts have been linked up by dashed lines. Shaded areas have been left unexcavated.



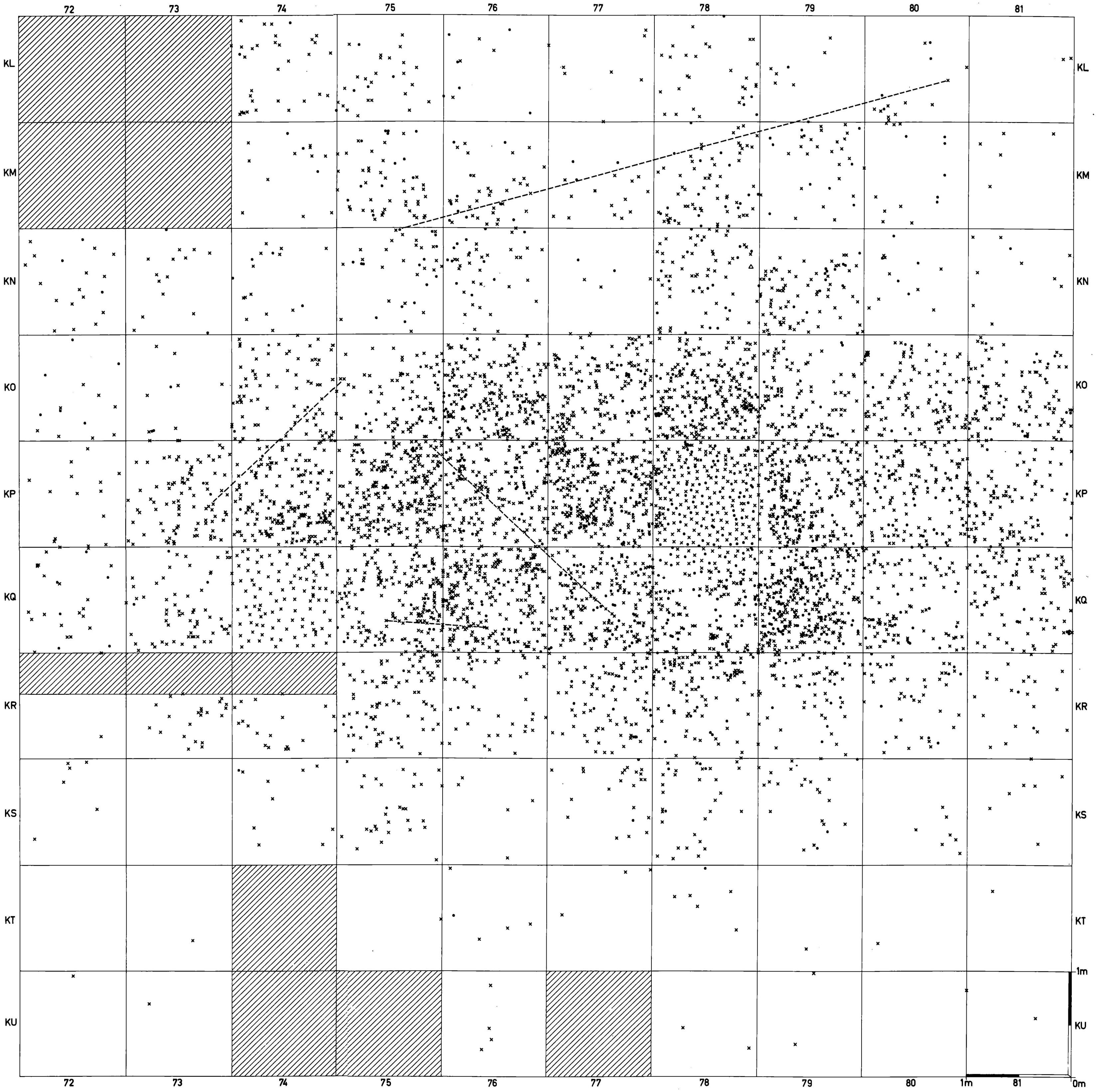

**Plan 2.** Detailed distribution plan of sector 1. 1: core; 2: core rejuvenation product; 3: end-scraper; 4: retouched flake; 5: retouched blade; 6: point; 7: backed bladelet; 8: triangle; 9: point with surface retouch; 10: trapeze; 11: Montbani blade; 12: point of danubian type; 13: microburin; 14: tool neol. affinity
Closed symbols indicate not precisely located artifacts for which only the square of provenance is known.



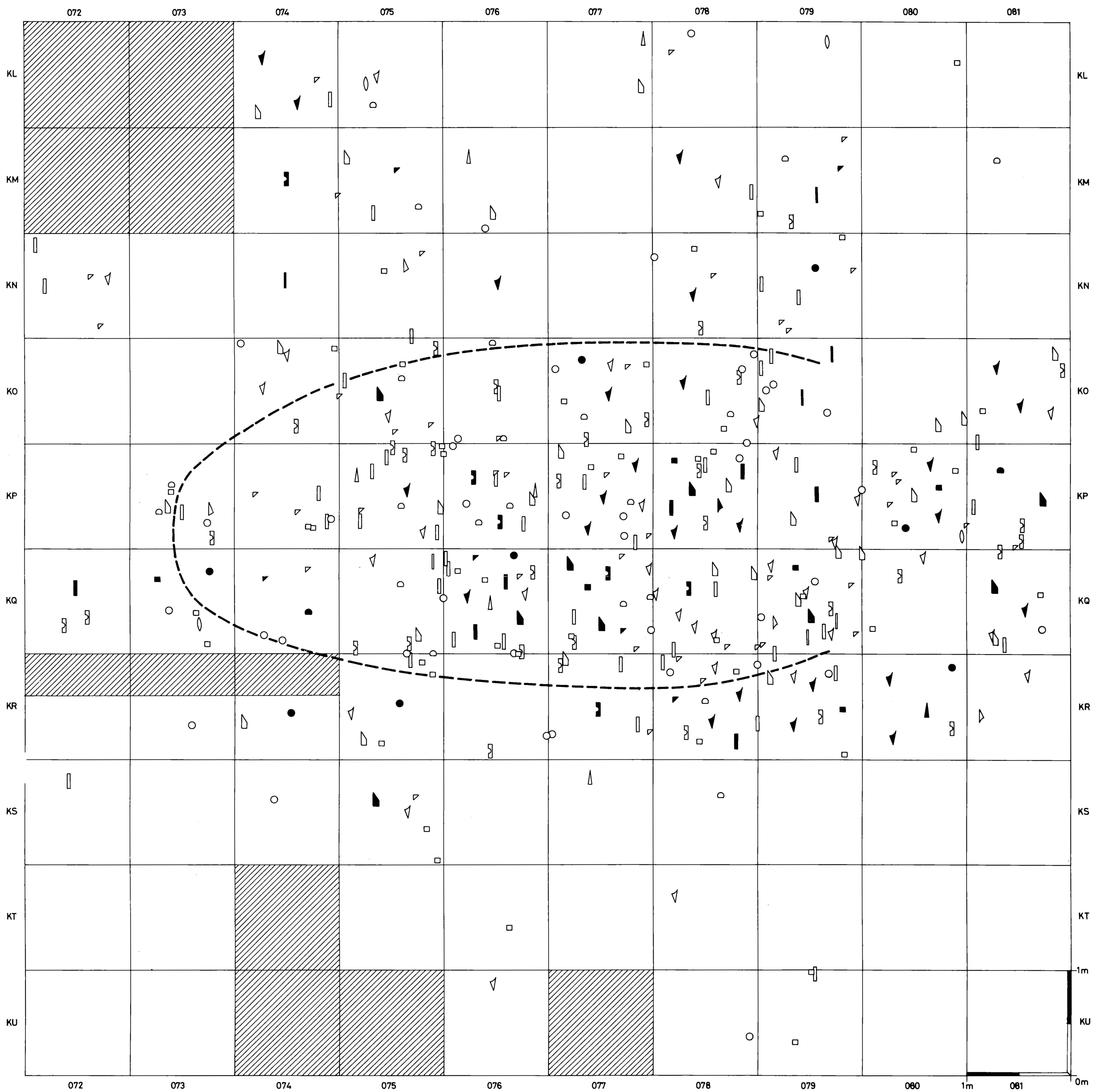

**Plan 3.** General distribution plan of sector 4. Legend as on plan 1.



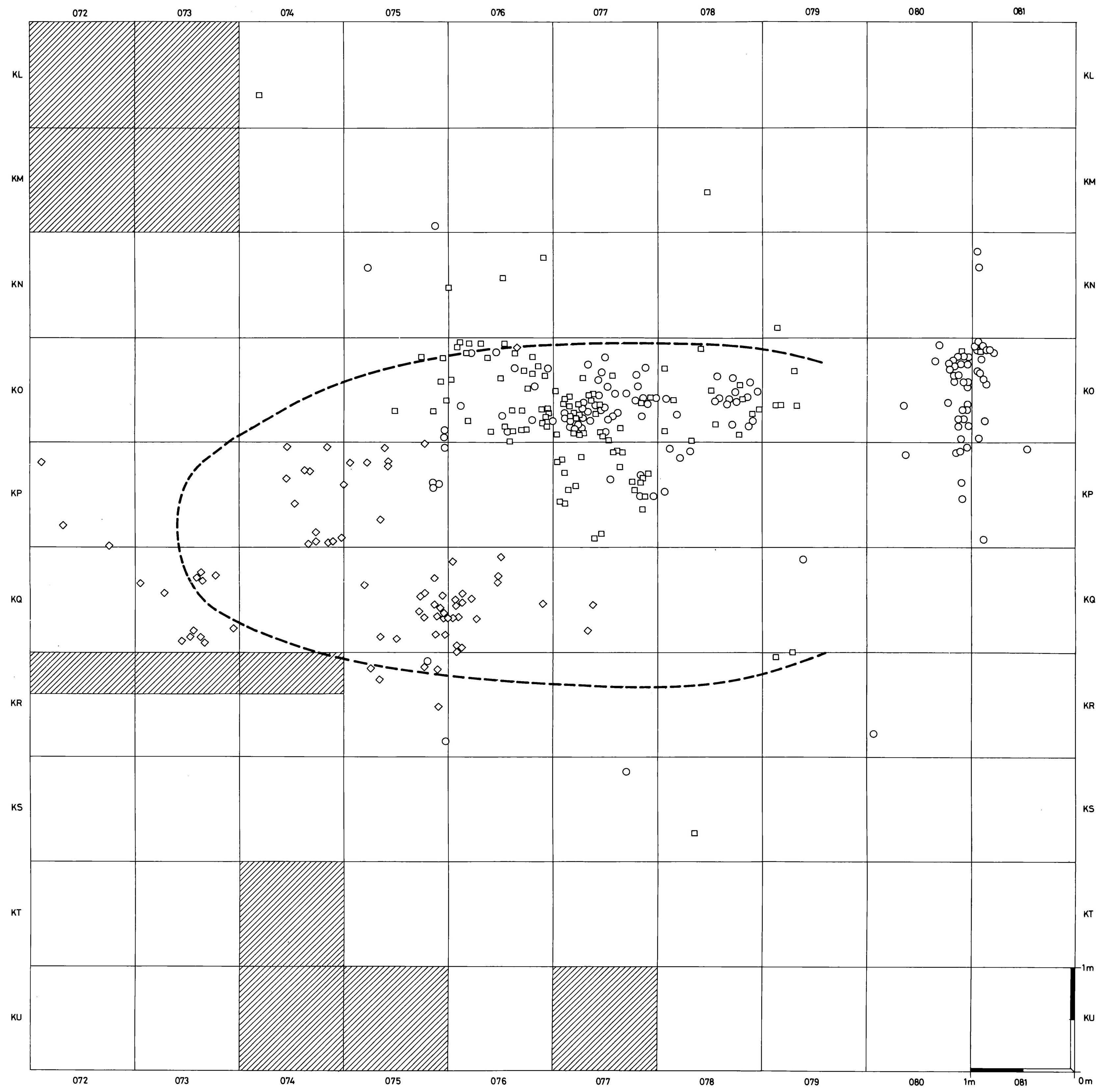

**Plan 4.** Detailed distribution plan of sector 4. Legend as on plan 2.




**Plan 5.** General distribution plan of sector 5. Legend as on plan 1.




**Plan 6.** Detailed distribution plan of sector 5. Legend as on plan 2. The approximate limit of the lithic artifact concentration is indicated by a dashed line.




**Plan 7.** Distribution plan of sector 5 showing the distinct species of organic material recovered. Legend as on plan 1.