THE MIDDLE PALAEOLITHIC FINDS FROM HOGERSMILDE

J. D. van der Waals & H. T. Waterbolk

with drawings by B. Kuitert

CONTENTS

I. INTRODUCTION

The finding of some 70 artefacts of Middle Palaeolithic date in January 1965, on the boulder-clay near Hogersmilde in Drenthe certainly was good luck, but by no means pure chance. Ever since the handaxe from Wynjeterp (Friesland; Bohmers & Wouters, 1954) was published, skipper Tjerk Vermaning of Hijkersmilde had realized its implications. This one handaxe, abandoned and later found on top of the Saale boulder-clay, underneath Weichsel coversand, implied that Middle Palaeolithic hunters had been present at that site, and that more finds of that period could be expected. Therefore, and mainly since 1960, Mr. Vermaning started to hunt systematically for Middle Palaeolithic artefacts in those areas where the boulder-clay is near the surface and not covered by coversand of more recent times. In so doing, he concentrated on those areas which, due to their impenetrable and badly drained character, have been avoided by practically all hunters and settlers of post-Weichsel date. Furthermore, in consequence of the great quantity of naturally broken flint littering the surface, these areas had so far disheartened amateur collectors.

In the autumn of 1964 Mr. Vermaning found a flake with a Levallois-like form, of which some of the retouch scars might be considered to be of human origin (Pl. I). This led him to revisit the findspot in January, 1965, when by chance this field had been worked by a deep-plough. In the resulting inverted soil, he found two concentrations with 30 to 40 artefacts each at a mutual distance of 65 m. A more detailed account of the events leading to Mr. Vermaning's Hogersmilde discovery has appeared in the annual of the province of Drenthe (Van der Waals & Waterbolk, 1967). As a curious detail it can now be observed that the Levallois-like flake that led to this discovery appears to be no artefact at all. It is in fact a pseudo-artefact which differs by its heavy patination and by the character of its "retouch" from all real artefacts subsequently found at the site.

Following the information of Mr. Vermaning, a preliminary investigation of the site was carried out by members of the Biologisch-Archaeologisch Instituut in the early days of February, 1965. However, waterlogged condition of the field precluded any serious work; which had to wait until the autumn of 1965, when a period of dry weather favoured our activities.

The present paper is the result of a joint study, for which both authors take full responsibility. It can be stated that sections (5) and (9) and appendix I have been the primary concern of H. T. Waterbolk, and sections (3-4) and (6-8) and appendix II of J. D. van der Waals.[1]

During the preparation of the present report, Mr. Vermaning discovered another Middle Palaeolithic site near Hijken, at a distance of 4 kilometers from Hogersmilde (fig. 2). We have been able to study this interesting complex in a

Fig. 1. The location of Hogersmilde.

very preliminary way and shall be referring to it at times. The Hijken complex is being studied by Mr. D. Stapert. He will pay particular attention to the geology of the area and to the fabrication processes of the handaxes. In that context he will also reconsider the Hogersmilde finds. Moreover, he will deal with a number of isolated Middle Palaeolithic finds, mostly of recent date.

The finds of Hogersmilde have been purchased by the province of Drenthe with the help of the State University at Groningen, to be registered as part of the collections of the Provinciaal Museum van Drenthe at Assen. Part of the finds (those of concentration A) have been given on loan to the Rijksmuseum van Oudheden at Leiden.

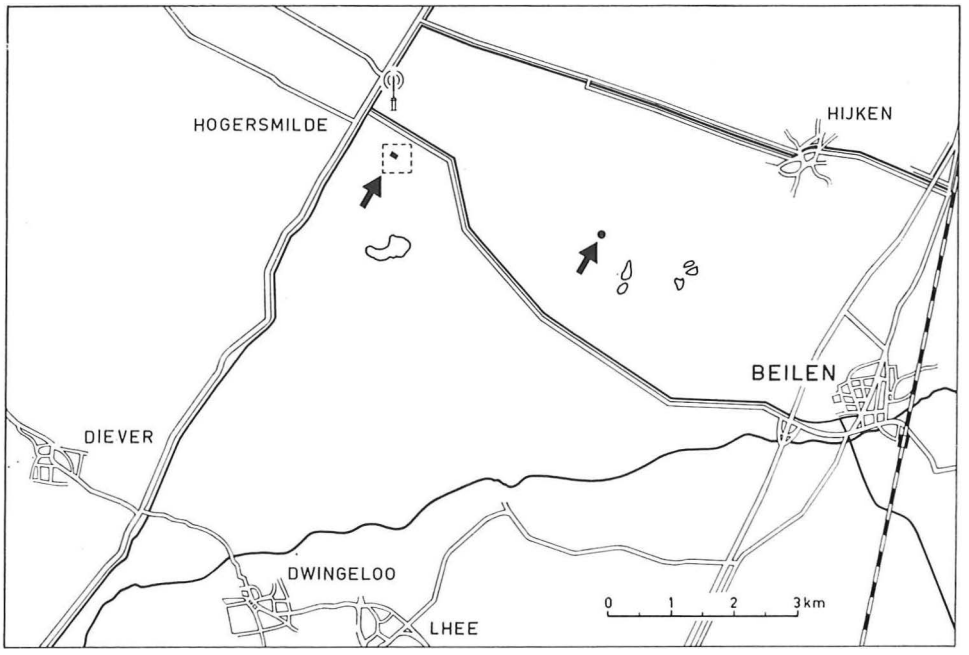
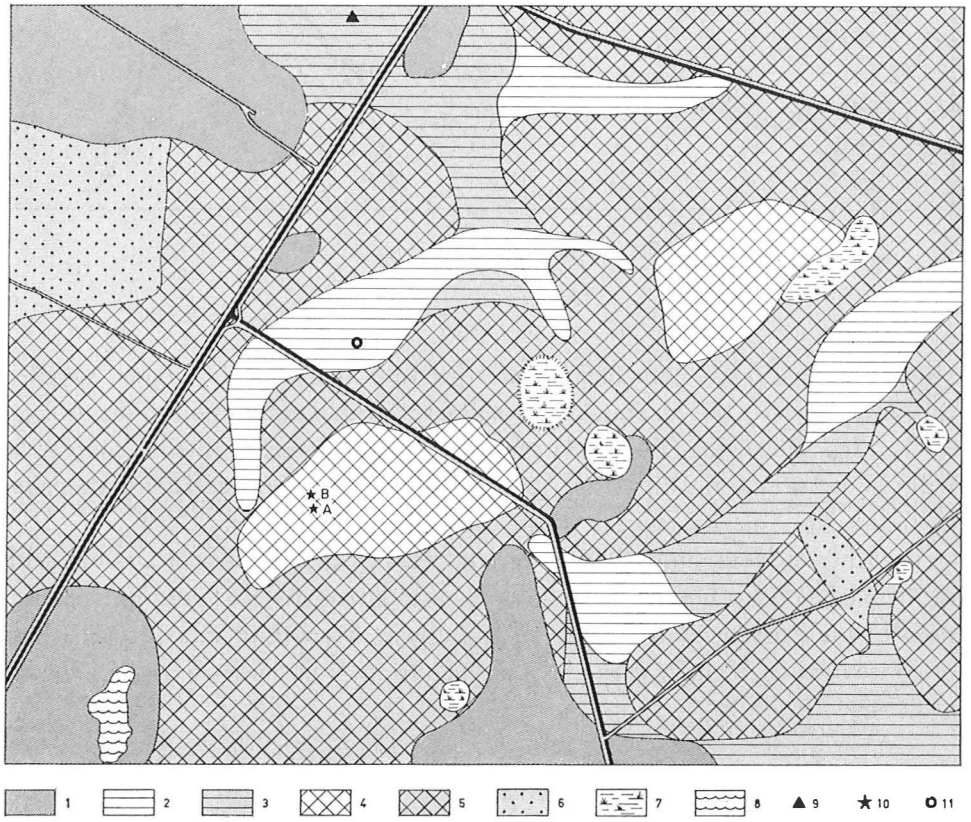


Fig. 2. Location of the Middle Palaeolithic sites of Hogersmilde and Hijken; the inset shows the location of the map, Fig. 6.



M. W. ter Wee

EXPLANATION TO FIG. 3

The findspot of the Palaeolithic artefacts near Hogersmilde is situated on a boulder-clay ridge, which forms the divide between the source areas of two valley systems.

The site is on the west side of the Drenthe glacial plateau where boulder-clay moraine material of the Saale glaciation mainly occurs at or near the surface. Locally, however, outcrops have been found of so-called pre-glacial sands without a boulder-clay cover. These are eolean sands formed under periglacial conditions in the first part of the Saalian, before the ice cap had developed.

During the Eemian, sands and clays were deposited in the glacial basins and the deep melt water valleys of Saalian ages. From the Drenthe glacial plateau, no informations are known from the warm Eem period. However, the climatic conditions were such that a soil must have developed and that locally peat could have formed in depressions in the badly drained boulder-clay surface. An example is the Brasenia-peat near de Voorst in the Northeast-Polder (Wiggers, 1955). One may assume that such formations on the Drenthe plateau have disappeared by erosion in the Pleniglacial period of the Last Glacial.

There are two valley systems, which have a part of their source area near the site of Hogersmilde. The valley system at the northern side of the ridge is that of the present Steenwijker Aa (Vledder Aa). The downward course of the Steenwijker Aa originated as the basin of a glacier lobe in the Saalian. Its upper course, however, is the result of recessing in the Pleniglacial of the Last Glacial. The valley system at the southeastern side of the ridge is part of the large valley system of the Beilerstroom. This valley system has its only origin in an erosion stage of the Pleniglacial period of the Last Glacial (Ter Wee, 1966).

Afterwards, during the Pleniglacial and the Late Glacial, these valley systems have been filled with brook sediments, mainly consisting of sands of local origin, in which lens-shaped, mostly thin inclusions of loam and gyttja occur.

Furthermore, numerous cryoturbatic formations originated under influence of the permafrost during the Last Glacial. In particular, mention should be made of the so-called pingos. These ground ice-filled mounds left numerous round or oval depressions after the disappearance of the permafrost on the Drenthe plateau.

In the Late Glacial, the last period of the Last Glaciation, coversands have been deposited under cold, but dry climatic conditions. These mostly occur as a thin eolian cover over the boulder-clay, the preglacial sands, and locally also over the valley sediments. In this same period, gyttja formed in the pingo remnants. On these gyttja occur peat layers of Holocene age. In the lowest parts of the valley peat likewise formed during the Holocene.

Fig. 3. Geological map of the surrounding of the Middle Palaeolithic site of Hogersmilde. 1. Coversand, thickness more than 2.0 m; 2. Valley sediments; 3. Valley sediments, overlain by coversand with thickness between 0.5 and 2.0 m; 4. Boulder-clay, overlain by less than 0.5 m. coversand; 5. Boulder-clay, overlain by coversand with thickness between 0.5 and 2.0 m; 6. Preglacial sands, overlain by coversand with thickness between 0.5 and 2.0 m; 7. Peat-filled depressions; 8. Open water; 9. Pollen profile; 10. Concentrations; 11. T.V. tower.

We would like to express our warmest thanks towards the authorities of the province of Drenthe and of Groningen University for their understanding and generosity when it came to acquiring this important find complex and for their realization of the possibilities for its scientific evaluation.

II. GENERAL SITUATION. GEOLOGICAL, PEDOLOGICAL AND PALYNOLOGICAL INVESTIGATIONS

The two concentrations lie at a distance of c. 700 m. E. of the Smilder Vaart and of c. 650 m. S.S.W. of the television tower near Hogersmilde, gem. Smilde, province of Drenthe (fig. 1-2), on an elevated point of the boulder-clay plateau.

Concurrent with the archaeological and pedological investigations, a geological survey of the surrounding area was carried out by R. Nolles and M. A. Smakman of the State Geological Survey, district North, from which resulted the geological map, Fig. 3. A geological description of this area is given as an explanation to this map by M. W. ter Wee (p. 39).

Together with the archaeological investigations in October, 1965, a detailed pedological survey of the immediate surroundings was completed by A. H. Booy and J. Wieringa of the Soil Survey, district North. For this purpose, a grid of borings every 10 meters were made to a depth of c. 1.20 m. As the pictures of the sections thus obtained were fairly consistent, only one of these sections is illustrated here (fig. 4), together with the explanation given by B. van Heuveln. For a detailed description of the local stratigraphy the reader is referred to this explanation (p. 41).

The organic deposits at the bottom of the fill of one of the river valleys, found by the geological surveyors, were analysed for their pollen content by W. A. Casparie (Biologisch-Archaeologisch Instituut). The results of this analysis are reproduced in fig. 5, with a comment by Mr. Casparie.

As indicated on the geological map (fig. 3), the findspot is situated between the tributaries of two extinct river systems. As is clear from the pollen analysis and from the C14 date (fig. 5), at least one valley was open at the time of the Middle Pleniglacial Hengelo interstadial. This fact confirms the suggestion of ter Wee (p. 39), that these valleys, formed by river erosion, probably date back to an early phase of the Last Glacial when the strong sea level recession, caused by the growing ice-cap, resulted in increased river erosion. Therefore it is not inconceivable that the two river systems were already in existence when the artefacts were abandoned. In that case, it can hardly have been accidental that the artefacts were left exactly on the divide between the two river systems. One could well imagine that such a site was of exploitative importance to the hunters, as this

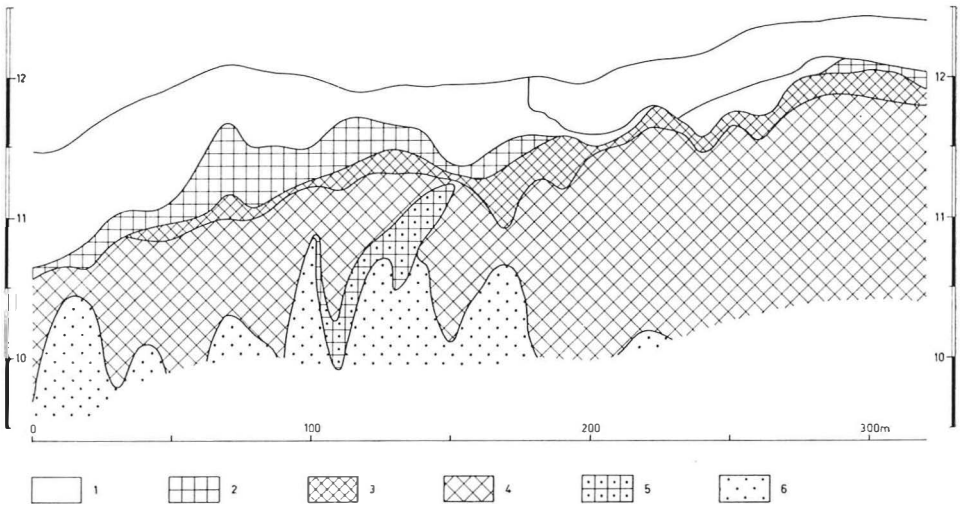


Fig. 4 Section through immediate surroundings of the Middle Palaeolithic site of Hogersmilde; heights are given in meters above ordnance datum (N.A.P.). 1. Coversand (partly disturbed by ploughing); 2. Coversand, mixed with *Geschiebesand material*; 3. Weathered (brown) boulder-clay; 4. Boulder-clay (decalcified); 5. Pre-morainal sand, mixed with *Geschiebesand* material; 6. Pre-morainal sand.

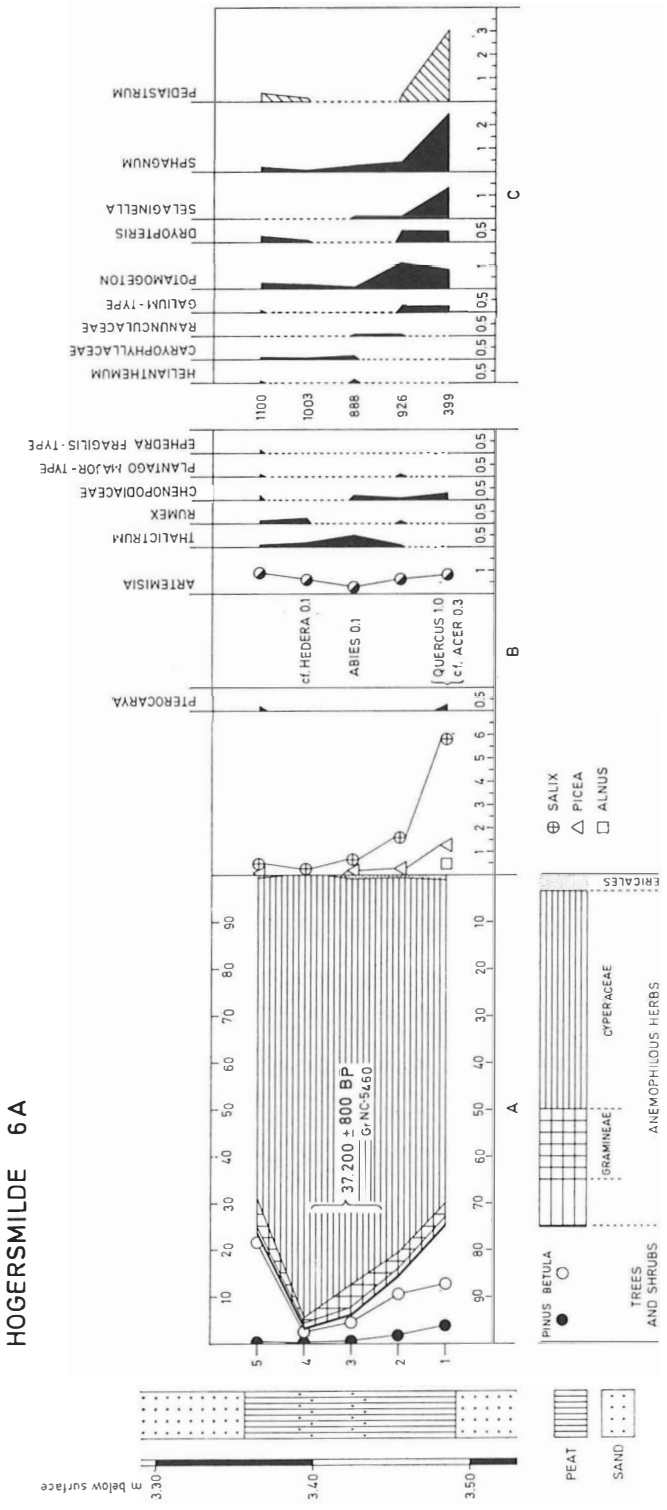
B. van Heuveln

EXPLANATION TO FIG. 4

a. *Coversand* is a wind-blown sand with a grain size between 140 and 160 microns.
b. "*Geschiebesand*" is what is left of boulder-clay after the clay fraction and, for the greater part also, the loam fraction have been washed out.
c. *Weathered boulder-clay* is the upper part of the boulder-clay deposit. Through the process of soil formation a relatively high percentage of brown loam and clay particles form coatings on the coarser elements of structure and texture.
d. *Boulder-clay* is a moraine deposit containing 25% lutum and rock fragments with a wide range of dimensions.
e. *Pre-morainal sand* is a term used for all sands that have been deposited before the land-ice cover.

The mixture of coversand and "*Geschiebesand*", with a thickness of 0.05-0.40 m. (see section) probably originated during the Last Glacial by cryoturbation of the uppermost washed-out layer of the boulder-clay with the coversand. Locally (not, however, in the published section) thin levels of pure "*Geschiebesand*" occurred. These may have formed part of the upper part (A2) of the Eemian soil profile. The top horizon of the boulder-clay is, to a depth of 0.05-0.40 m., brown and sticky. This is presumably the infiltration horizon of the Eemian soil profile (B2), which is enriched by clay and loam from the upper layers.

The boulder-clay has an undulating surface; its base is even more irregular.


HOGERSMILDE 6A
m below surface
3.30
3.40
3.50
PEAT
SAND
PINUS
BETULA
TREES AND SHRUBS
GRAMINEAE
CYPERACEAE
ERICALES
ANEMOPHILOUS HERBS
SALIX
PICEA
ALNUS
A
B
C
37.200 ± 800 BP
Gr.NC-5460
cf. HEDERA 0.1
ABIES 0.1
QUERCUS 1.0
cf. ACER 0.3
PTEROCARYA
ARTEMISIA
THALICTRUM
RUMEX
CHENOPODIACEAE
PLANTAGO MAJOR-TYPE
EPHEDRA FRAGILIS-TYPE
HELIANTHEMUM
CARYOPHYLLACEAE
RANUNCULACEAE
GALIUM-TYPE
POTAMOGETON
DRYOPTERIS
SELAGINELLA
SPHAGNUM
PEDIASTRUM
1100
1003
888
926
399

← Fig. 5. Pollen diagram Hogersmilde 6A.

W. A. Casparie

EXPLANATION TO FIG. 5

The pollen diagram is taken from a peat layer at the bottom of the northern valley system (Steenwijker A, Vledder A), mentioned in the explanation to fig. 3 (p. 39). The sampling site is indicated in fig. 3 (core 6a). According to Iversen's suggestion for Pleniglacial and Late-glacial diagrams (Faegri & Iversen, 1964, pp. 90-91), the pollen sum is composed of the sum of trees, shrubs, anemophilous herbs, and Ericales (Iversen diagram).

The following pollen-types are not recorded in the diagram:
spectrum 1: Cruciferae 0.5%, Tubuliflorae 0.5%;
spectrum 2: *Botrychium* 0.1%;
spectrum 3: *Mentha*-type 0.1%;
spectrum 4: *Filipendula* 0.1%;
spectrum 5: *Potentilla*-type 0.2%, *Pteridium* 0.1%.

The bracket in the A-diagram shows the exact thickness of peat included in the C14-dated sample: GrNC-5460: 37,200 ± 800 B.P.[1]

The diagram shows much resemblance to sections of diagrams of the Weichsel Pleniglacial which have been published by Zagwijn (1961), *e.g.* Vinkenhoef, Moershoofd (the sections I, II and III), and Lunteren. Zagwijn's as yet unpublished diagrams Hengelo IV (pit KNZ) – particularly its lowermost part – and Ruigekluft I and II rather strongly resemble the picture as present in Hogersmilde 6A.[2]

The pollen content of Hogersmilde indicates the presence of a treeless tundra in which *Betula* and *Salix* (*Betula nana* L. and *Salix herbacea* L.?) probably existed as shrubs.

The radiocarbon date proves the Pleniglacial age of the northern valley system as Ter Wee has already suggested (p. 39). The peat layer is clearly a formation of the Hengelo Interstadial (Van der Hammen, Maarleveld, Vogel, Zagwijn, 1967). The valley was already formed before the climate became milder. There are relatively few valley incisions known from the cold phase between the Moershoofd and the Hengelo Interstadial. It is therefore not unlikely that most of the Pleniglacial valleys can be dated before the Moershoofd Interstadial. This is also possible for this valley system. A thin gyttja-like brown loamy layer, present about 75 cm above the Hengelo layer is perhaps a formation of the Denekamp Interstadial.

Part of the pollen is derived from the boulder clay and/or older clay (tree pollen: *Pterocarya*, cf. *Acer*, *Quercus*, *Alnus*, cf. *Hedera*) or has been transported over a long distance (*Pinus*, *Abies* (?), *Picea* (?)). In spectrum 1, this part is 28% of the tree pollen, in spectra 2 to 4 this varies between 15% and 19%, and in spectrum 5 it is 3.5%. This points to decreasing erosion activity, possibly as the result of the closing of the vegetation cover. It is clear that such a development is more likely to take place when the climate becomes milder than when a deterioration of the climate sets in. For this reason, we think that the peat layer dates from the beginning of the Hengelo Interstadial, when the filling of the valley with mineral material strongly decreased as the vegetation cover closed.

In spectrum 1 there is a *Salix* maximum present (5.6%); spectrum 5 has the highest *Betula* value (21.7%). Both pollen types have obvious lower values in the spectra 2 to 4. The tree pollen precentages in these spectra are much lower than in spectra 1 and 5.

The lowermost part of Zagwijn's pollen diagram Hengelo IV (pit KNZ), giving the beginning of the Hengelo Interstadial, shows a corresponding picture (oral comm. Zagwijn). It can be dated to about 39.000 B.P. (Van der Hammen & Wijmstra, 1971; Van der Hammen *et al.*, 1967). The dating of the Hogersmilde peat layer is about 1500 years younger. The Holocene peat deposits, laying on the surface perhaps have caused infiltration of much younger material.

The diagram Hogersmilde 6A differs from the pollen diagram Mekkelhorst (Van der Hammen & Wijmstra, 1971), dated to 38,700 ± 1100 B.P., by much lower percentages of *Artemisia* (ca. 0.7%, resp. ca. 8.5%). In our opinion, this can better be ascribed to differences in soil conditions (richer soil in Twente) than to differences in climatological conditions.

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[1] In Groningen Radiocarbon Dates 10, p. 23 (*Radiocarbon* 14, 1972) erroneously published as GrN-5460: 18,610 ± 800 B.P.

[2] Our thanks go to Dr. W. H. Zagwijn, Geological Survey, Haarlem, for his permission to use the diagrams and for many fruitful discussions about Pleniglacial questions.

divide must have formed a passage for heavy animals in the summer time, when the valleys themselves may have been quite impassible because of their waterlogged condition.

We are much indebted to Messrs. van Heuveln, Ter Wee, and Casparie, and to their collaborators for their combined efforts and for permission to publish the results. We also are grateful to Mr. J. D. de Jong and Dr. W. H. Zagwijn (State Geological Survey, Haarlem), and to Prof. G. C. Maarleveld (Soil Survey, Bennekom), who visited the site on 7 October, 1965, and who discussed the stratigraphy of the sections at the findspots and their dating value for the artefacts.

III. ARCHAEOLOGICAL INVESTIGATION

Having collected six artefacts lying closely together on the surface of the deep-ploughed soil, Vermaning dug into the soil disturbed by the plough and collected 33 more artefacts, taking the trouble to indicate the exact horizontal provenance (but not their depth) of each of these with numbered sticks. Following Mr. Vermaning's notification to the B.A.I., the area investigated by Vermaning (an oval pit of 3 x 2 m.) and the location of the wooden sticks within this pit, which later became designated as concentration A, were recorded. The value of these locations is limited, since the artefacts concerned had already been displaced by the deep plough. Therefore, on our plan (fig. 7), these locations are indicated by a different symbol. On this occasion, two more artefacts were found in the soil dug out by Vermaning, bringing the total number of artefacts found to date up to 41.

A few days later, Mr. Vermaning notified the B.A.I. of the location of the second concentration in the same field 65 m. due north (fig. 6). Here too, he dug into the soil upturned by the plough, collecting 35 artefacts; this time without

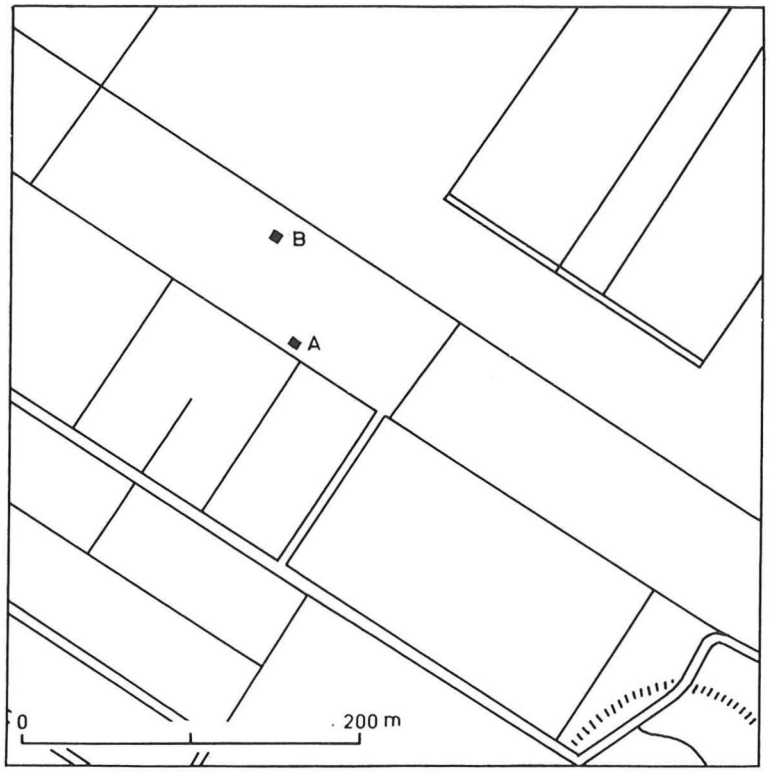


Fig. 6. Hogersmilde, location of the concentrations A and B.

keeping record of the exact location of each piece. However the extent of his digging activities (an oval pit of 2.15 x 1.20 m.) could be recorded. This site was henceforth indicated as concentration B. Due to the waterlogged condition of the ground, nothing more could be done at that time. Sheets of plastic were spread out on the bottom of Vermaning's pits, which then were filled-in again, in anticipation of a more complete investigation. This took place between 27 September and 15 October, 1965. It was carried out by volunteers, members of the "Society for the Advancement of Interest in Antiquities", and by Messrs. A. Meijer, K. Klaassens, and A. J. Cool of the B.A.I., under the direction of the first author. Its aims were fourfold: 1) to verify the alleged limited horizontal extension of the concentrations A and B; 2) to establish the stratigraphic position of the finds; 3) to check whether there were any débris at the sites, not collected by Vermaning; and 4) to increase the number of artefacts.

At the sites of concentrations A and B, the top soil was removed from rectangles

of 5 x 4 and 6 x 8 m. respectively, which enclosed the oval pits dug by Vermaning earlier that year. At site A (fig. 7), this rectangle was later enlarged to 6 x 4 m. Across each of the squares and each of Vermaning's pits, one section dam was saved. Vermaning's pits were cleared out first. Especially in concentration A, it appeared that the soil had been disturbed to a depth greater then that of the deep-plough action. This disturbance was apparently due to the trampling about in the waterlogged soil earlier that year. Next, the remainder of the squares and, eventually, the sections underneath these pits, were gradually deepened to well beyond the depth at which no more artefacts occurred. As the soil was extremely rich in stones and natural flakes, all stones were collected and inspected. Of those which were recognized as artefacts when found, the exact location and depth was recorded. Together with the pieces acquired from Mr. Vermaning, those found during the excavation were inventorized as nos. 1965/X. 1-133 in the Assen Museum. For the sake of convenience, they are referred to throughout this paper as nos. 1-133. Following subsequent analysis, many of these stones proved not to be artefacts, but rather naturally broken pieces of flint of the local moraine. Though

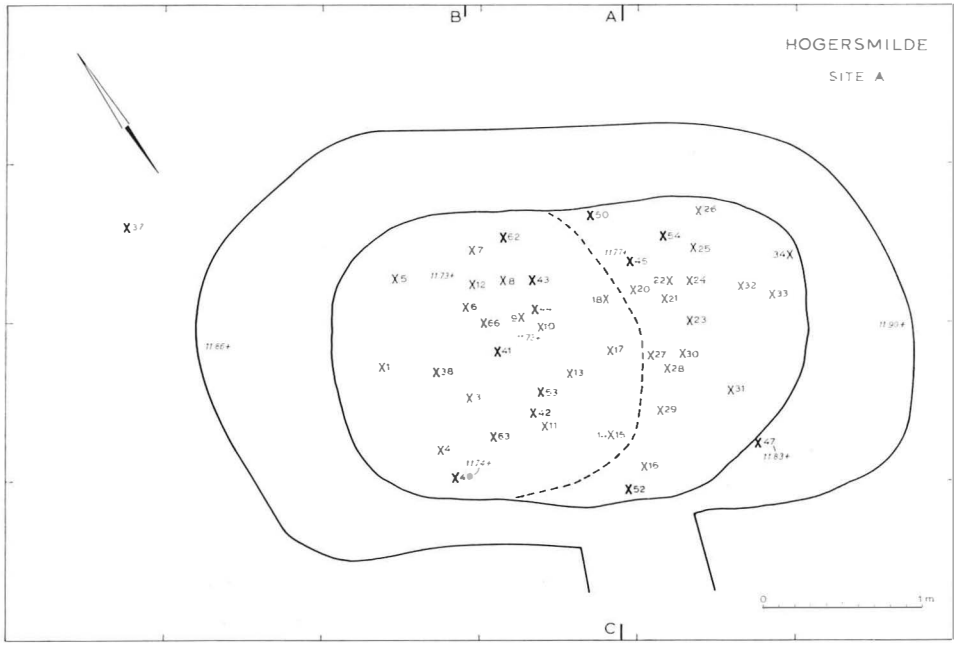


Fig. 7 Hogersmilde, concentration A, location of the finds. Thin crosses: finds collected by Tj. Vermaning, mainly in the soil disturbed by the plough. Heavy crosses: finds from the excavation. The oval lines indicate the confine of the digging activities by Mr. Vermaning at various depths.

Fig. 8 Hogersmilde, concentration A. Northwestern half of the rectangle at the end of the B.A.I. excavation, as seen from the SE. Photo B.A.I.

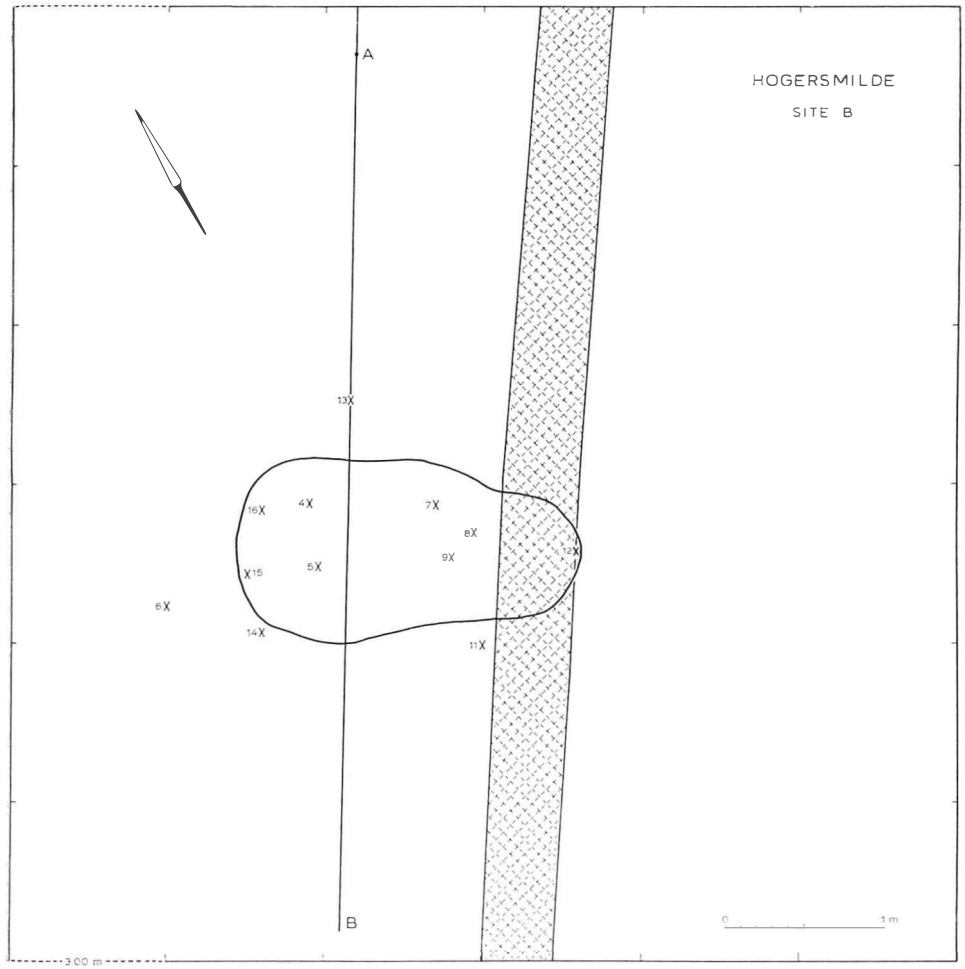


Fig. 9 Hogersmilde, concentration B, location of the finds from the B.A.I.-excavation. The oval line indicates the pit dug by Tj. Vermaning. Hatched area: disturbed by drain.

these have not been recorded in our catalogue, appendix II, they have been preserved and were inventorized with the artefacts in the Assen Museum.

As to the horizontal extension of both concentrations, one could wonder whether the reported concentrations really represented original concentrations, or, possibly, two elevated points in a continuous artefact-bearing stratum, which happened to have been brought to the surface only locally by the deep-plough. The investigations at the site clearly indicated that the concentrations were quite real.

At site A, Vermaning (and members of the B.A.I.) had found 41 artefacts within an oval pit of 3.00 x 2.00 m. In addition to these, 24 more pieces were

found during the excavation. Of these 24 artefacts only one turned up outside the oval pit already dug by Vermaning, all others occuring within this pit and underneath the level to which Vermaning had dug, so that at site A a total of 65 artefacts was found within a rectangle of 3.10 x 2.00 m.

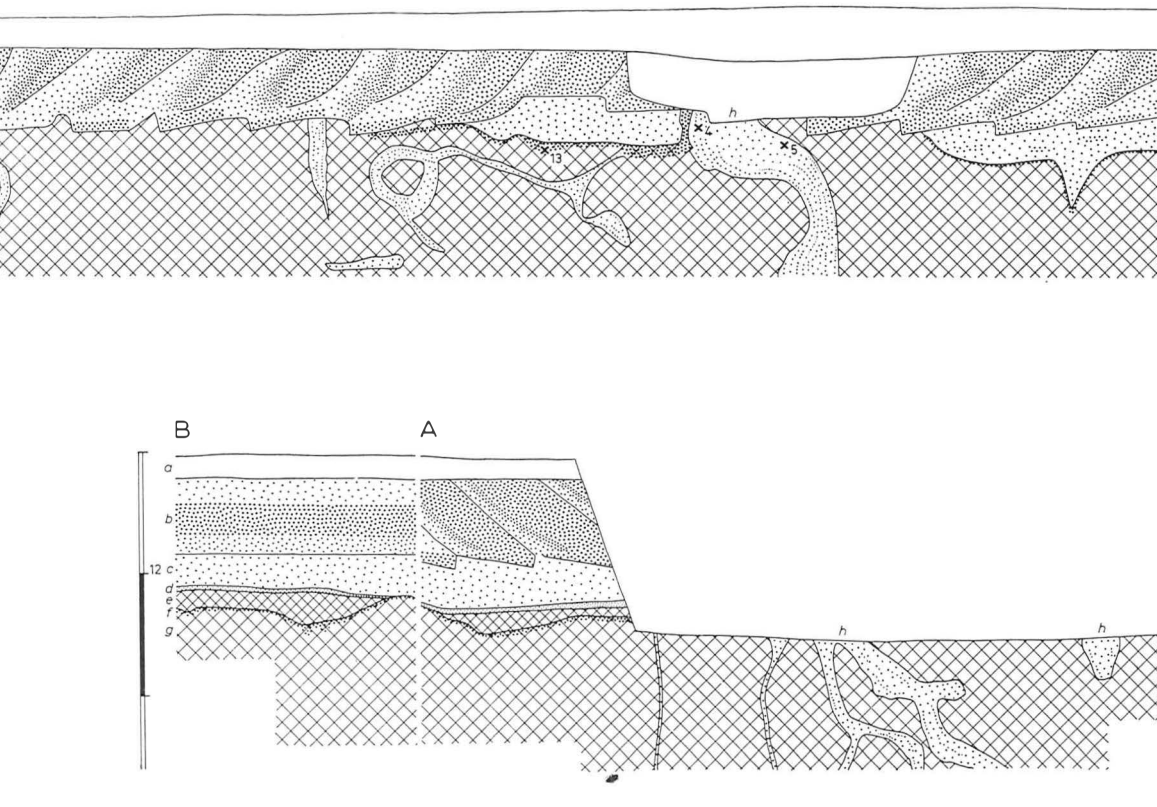
At site B (fig. 9), the oval pit dug by Vermaning, measured only 2.15 x 1.20 m. When re-excavating this site, we found 18 more artefacts and flakes, of which only two (B 11, B 14) were found outside Vermaning's pit, all others turning up within this pits at deeper levels. Therefore, all 51 finds at site B are enclosed within a rectangle of 2.15 x 1.20 m.

As we were curious whether any waste, representing an atelier, was overlooked by Vermaning, the soil in which Vermaning found his pieces was also inspected. However no real waste was found.

Even when a few pieces were found further afield, which nevertheless belong at least in part to one or the other of the concentrations, it is clear that the artefacts have been left relatively undisturbed since their deposition. On different visits in the winter and the spring of 1966, after the field had been ploughed again, Vermaning found 15 more artefacts, of which the exact location was not recorded. These pieces were inventorized as nos. 1966/VI. 2-20; there also being 4 naturally broken pseudo-artefacts. For sake of convenience they have been referred to as nos. II-XX throughout this paper.

The artefacts have been subjected to a certain amount of involution, which brought some of them into the frost cracks. But it seems highly improbable that the original surface on which they once lay should have been eroded away to any considerable depth. The hardly worn appearance of the artefacts and their mutual proximity strengthen this conclusion. Soon upon their abandonment they must have been covered by a thin layer of coversand (at present incorporated in the topsoil), or have sunken into the topsoil by involution. They can have been only slightly displaced.

This conclusion should be born in mind not only in connection with the geological argumentation as to the dating of the artefacts. It also suggests that we now possess the majority of the artefacts once left at the two places. They therefore can be held as fairly representative of that which was abandonded by the population(s) that once used them.



Fg. 10 Sections; heights are given in meters above ordnance datum (N.A.P.); for the significance of the letters a-h, see the description, p. 51. Drawing H. R. Roelink.

IV. STRATIGRAPHICAL OBSERVATIONS

In the section and walls of our excavation, site A, the following stratigraphy, from the top downward, could be observed (fig. 8, 10):

(a) the *topsoil*;

(b) *soil broken by the deep-plough.* In perpendicular section, the furrows of the plough were clearly visible. At their deepest points, these furrows reached to a depth of c. 0.45 m. below the surface, leaving parts of undisturbed soil between the furrows to a height of 0.40 m. As the floes of earth, turned on their side by the plough, were well preserved, the original stratification can be reconstructed as follows: underneath the former topsoil was a layer of dark brown sand, which gradually passed into yellow sand. The brown colour was apparently due the humic-acid infiltration in postglacial times;

(c) a *layer of yellow sand*, the continuation of the yellow sand described in (b) and representing the top of the undisturbed sequence (cf. explanation to the section (fig. 4), p. 41, sub (a);

(d) a *thin band of loess-like loam*;

(e) *Geschiebesand* (cf. p. 41 sub (b));

(f) a *thin sticky brown* (cf. p. 41 sub (c)), marking the top of:

(g) *the boulder-clay* (cf. p. 41 (sub d)), which was intersected by frost cracks, mainly filled by the same sand as mentioned under (b) and (c).

The stratigraphy observed can be matched by the stratigraphy described in the explanation to the geological/pedological section fig. 4, p. 41); only the thin band of loam (f) in between (e) and (g) is not recorded in the soil borings. In the southern half of the excavation pit at sites A and B, the stratigraphy was reduced in that the yellow sand rested immediately upon the boulder-clay (g), without the intercalation of the *Geschiebesand* (e).

When Vermaning dug his pits, he observed that most of the artefacts turned up in the brown sand. Although we could ourselves only repeat this observation twice, as all other artefacts located in the deep-ploughed soil had already been recovered by Vermaning, there is no reason to doubt its validity. As the action of the deep-plough did not reach beyond the brown and yellow sand, the artefacts can only have been embedded in this sand. All other artefacts found during the excavation occurred in places affected by involution in the contact horizon of sand and (*Geschiebesand* or) boulder-clay and in the fillings of the frost cracks (cf. table 1).

From the stratigraphy, two conclusions can be drawn with certainy. The artefacts must have been left *after* the deposition of the brown and yellow sand, but *before* the formation of the frost cracks. Thus, sand and cracks provide us with *termini post* and *ante quem* respectively.

Depths are given in meters below the surface. The surface of concentration A was fixed at a point 12.50 m above Ordnance Datum, that of concentration B at a point 12.10 m above Ordnance Datum.

	Find no. (cf. fig. 7, 9, 10)	Registration no. (cf. Appendix II)
Concentration A		
Collected by Vermaning on surface, Febr. 1965:	-	2-8
Collected by Vermaning, unstratified, Febr. 1965, in deep-plough floes, in yellow coversand and in *Geschiebesand*:	1-34	9-42
Collected in Sept.-Oct. 1965 (B.A.I. excavation):		
In fill pit Vermaning and in arable top soil:	36	101[a-f]
In brown coversand of deep-plough floes:	37	102
In remaining part of *Geschiebesand*, underneath pit Vermaning, and in frost cracks, in between 0.73-0.78 below surface:	38-45 50 52-54 62-63	103-110 115 117-119 127-128
Lowermost find, 0.80 below surface in frost crack:	66	131
Concentration B		
Collected by Vermaning, Febr. 1965, on the surface and in deep-plough floes, position not registered:	-	45-77
Collected in Sept.-Oct. 1965 (B.A.I. excavation)	3	
On the surface:	17	95
Immediately below arable top soil:		81[a-e]
In coversand of deep-plough floes, outside pit Vermaning	6	84
Below pit Vermaning, in frost crack (depth 0.52-0.56 below surface):	4-5	82-83
In contact horizon of coversand and boulder-clay and in frost cracks (depth 0.52-0.58 below surface):	7-9 11-12 14-16	85-87 89-90 92-94
Lowermost find, in loamy-brown infiltration band on top of boulder-clay (depth 0.61 below surface):	13	91

The dating value of fossil frost cracks is limited. The only condition required for their genesis is extremely cold winters with little or no snow, but contrary to frost wedges, they did not survive the summer season (Dylik and Maarleveld, 1967). Occasionally, even frost wedges did occur at late as Late Dryas times (last phase of the Weichsel glaciation, i.e. the period of the Ahrensburg Culture on the North-west European Plain). The frost cracks in question are accompanied by involution; both phenomena may have originated at the same period. Van der Hammen *et al.* (1967, fig. 3) indicates five main phases of the Weichsel glaciation from which involutions are known. They range from the early Lower to the early Upper Pleniglacial. When visiting the site, Zagwijn was inclined to assign frost cracks and involution to the Pleniglacial A.

As to the dating value of the sand, everything depends upon its character and the estimation of the age of its deposition. In his explanation to the soil section (fig. 4, p. 41), Van Heuveln considers this sand to be a coversand, which implies its deposition during the Weichsel glaciation. When visiting the site, Maarleveld and Zagwijn characterized this sand as being of the type "young coversand", i.e. of the morphological type of coarse coversand also typical for the last, Late Dryas period of the Weichsel glaciation. However, they stressed that coversand of this same type was deposited in an early phase of the Weichsel glaciation (cf. Van der Hammen *et al.*, 1967, fig. 3).

A Late Dryas date for the coversand at Hogersmilde can be ruled out, as it is simply impossible to date the artefacts (which, as we have seen, postdate the coversand) as late as the Late Dryas period (the period of the Ahrensburg Culture). However, an early Weichsel date for the coversand would leave one of the two early Weichsel interstadials (Brørup and Amersfoort) or the Moershoofd phase of the Pleniglacial (Van der Hammen *et al.*, 1967, 87; fig. 19) as the period in which the artefacts could have been left. After that event, involution and frost cracks at the end of the Middle Pleniglacial could have caused their sinking into the soil. Such a sequence would account for the slightly worn character of the artefacts.

Much depends upon the question of the extent to which the Eemian soil had been denuded in the strongly erosive, earlier phases of the last glaciation. Ter Wee is inclined to believe that the Eemian soil is not preserved (cf. p. 39). Van Heuveln, on the other hand (cf. p. 41), considers the locally preserved layer of *Geschiebesand* and the underlying, brown top layer of the boulder-clay as possibly representing the A2 and B2 layers of the Eemian soil profile. This would imply that no very deep erosion of the Eemian soil has taken place at the locality of the finds. The mutual proximity of the pieces within the sites of concentrations A and B, and their well-preserved character exclude the possibility of considerable erosion of these sites after their abandonment. If a major degree of erosion of the Eemian soil took place in early Weichsel times, the implication would be that

the artefacts must have been abandoned after this erosion took place. A pedological investigation of the relationship of *Geschiebesand* and brown boulder-clay to the Eemian soil will take place in the context of the study of the Hijken finds. In the meantime the situation of the Hogersmilde site on a watershed between two river valley systems that most probably date back to the early Weichsel erosive phase, and that of the site of Hijken at the very edge of an entirely comparable valley (oral information D. Stapert), strengthen the idea that the occupation of the sites by Middle Palaeolithic man took place after the early Weichsel erosive phase.

V. FLINT VARIETIES AND GROUPING OF ARTEFACTS

All the artefacts are made from nodules and naturally fractured pieces of flint derived from the moraine. No selection seems to have taken place, for the flint used varies strongly as to fossiliferous content, granulation, transparancy, iron oxide impregnation, and colour.

These variations are such, that groups of artefacts present themselves as obviously having been made from one nodule. In fact, in as many as 18 instances two to four artefacts were found to fit together.

Since one of our problems was whether the two concentrations, found at a short distance of each other, could in fact be the result of one sojourn, we treated all the artefacts from both concentrations as one complex and tried to bring as many artefacts as possible into groups of possible common origin. The way in which the artefacts of these groups should be distributed over the two concentrations would help us to solve this problem.

Due to natural transitions in colour and structure within the nodules and to the fact that some nodules were, of course, quite like each other, the grouping of artefacts was not always equally simple. We grouped them into three categories, viz. (1) fitting together, (2) most probably derived from the same nodule, (3) possibly belonging to the same nodule. We used only a magnifying glass. Results are given in table 2.

Nos. 1965/X. 1-44 and 101-131 have been found in concentration A, nos. 1965/X. 45-100 in concentration B. Nos. 1966/VI. 2-20 – here referred to as II-XX – have been found in the field after the excavation. They cannot with certainty be attributed to one of the concentrations. The same applies to nos. 1965/X. 132-133.

In the majority of the 21 groups which we have distinguished, all artefacts appear to belong to either concentration A or concentration B. To concentration A belong groups (1), (4), (6), (10), (13), (15), (16), (21); to concentration B groups

Fitting together	*Probably made from same nodule*	*Possibly made from same nodule*
(1) 17, 27,119	20, 115	117
(2) 48, 65, 66	64	32, 85, 89, 132, XII
(3) 9, 16, 30, 74 26, 128		
(4)	3, 7, 22, 38, 101[c], 127	
(5) 50, 75, 95 11, 33	77	
(6) 4, 14	15, 18, 21, 23, 40, 41, 43 101[d], 106, 118[b], VIII, XI	
(7) 49, 68, 69 70, 71	67	
(8)	46, 62, 86	92, 93
(9) XVI, XVIII	96, XV	
(10) 109[a], 118[a]	109[b], 110, 101[e]	
(11) 12, 29		39, 54, 101[a]
(12)		45, 51, 52, 56, 57 63, 81[e]
(13)	31, 37	
(14)	47, 53	
(15) 25, 43		
(16) 44, 105		
(17) 84, 81[a]		
(18) 91, 81[b]		
(19)	2, 76	
(20) 55, 90 101[b], 103[a]	72, 73, 100	
(21)		19, 34

(7), (8), (9), (12), (14), (17), (18). In groups (2), (3), (5), (11), (19), (20) there are one or two artefacts, which do not belong to the same concentration as the majority of the artefacts. After reinspection, we found that for no. 31 in group (2), nos. 11 + 33 in group (5) and 54 in group (11), our designation was after all, debatable. In the remaining three cases, however, there was no reason for doubt. In fact, in group (3) no. 74 of conc. B was found to fit together with three artefacts of concentration A. Group (20) contains four artefacts of group B and two of group A.

Fig. 11 Concentration B, flint group Ba. Handaxe 48. Photo C.F.D., Groningen.

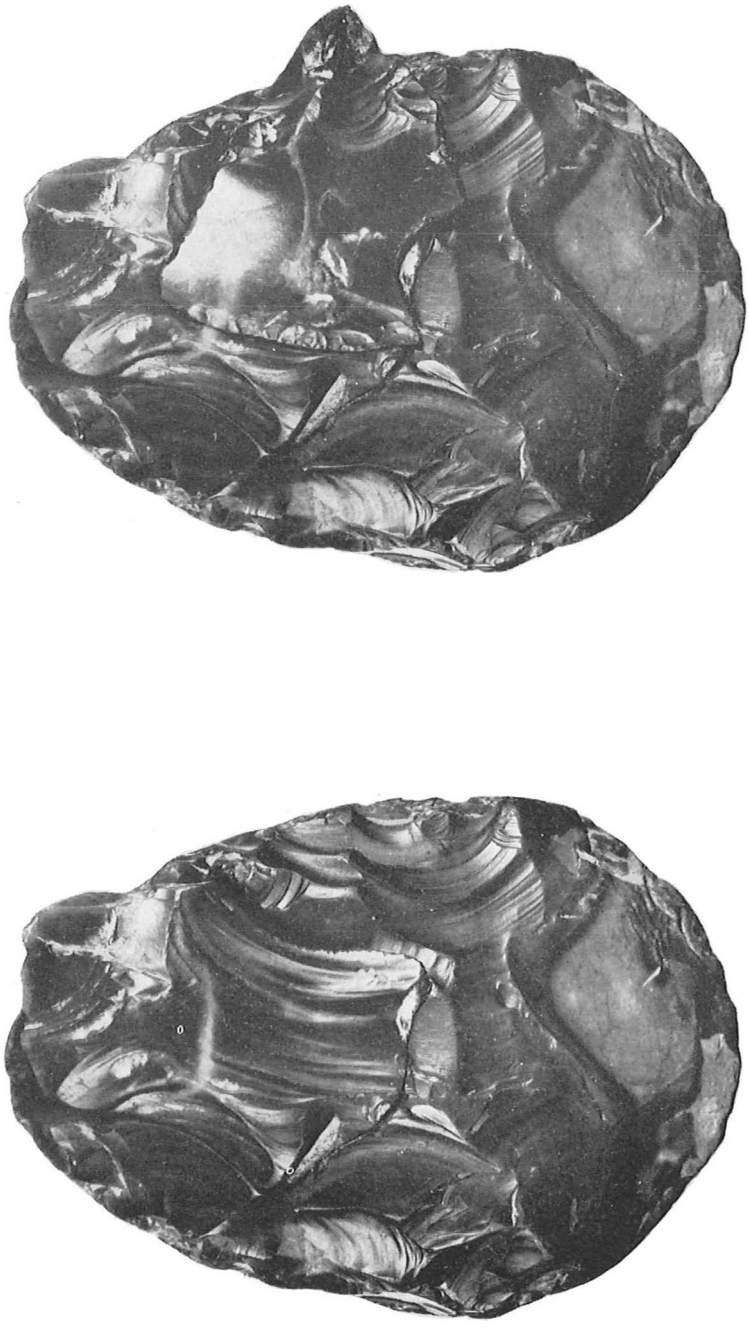


Fig. 12 Concentration B, flint group Ba. Handaxe 48 with flake 65 (bottom) and with flake 65 and scraper 66 (top). Photo C.F.D., Groningen.

Fig. 13 Concentration A, flint group Ab. Handaxe 9. Photo C.F.D., Groningen.

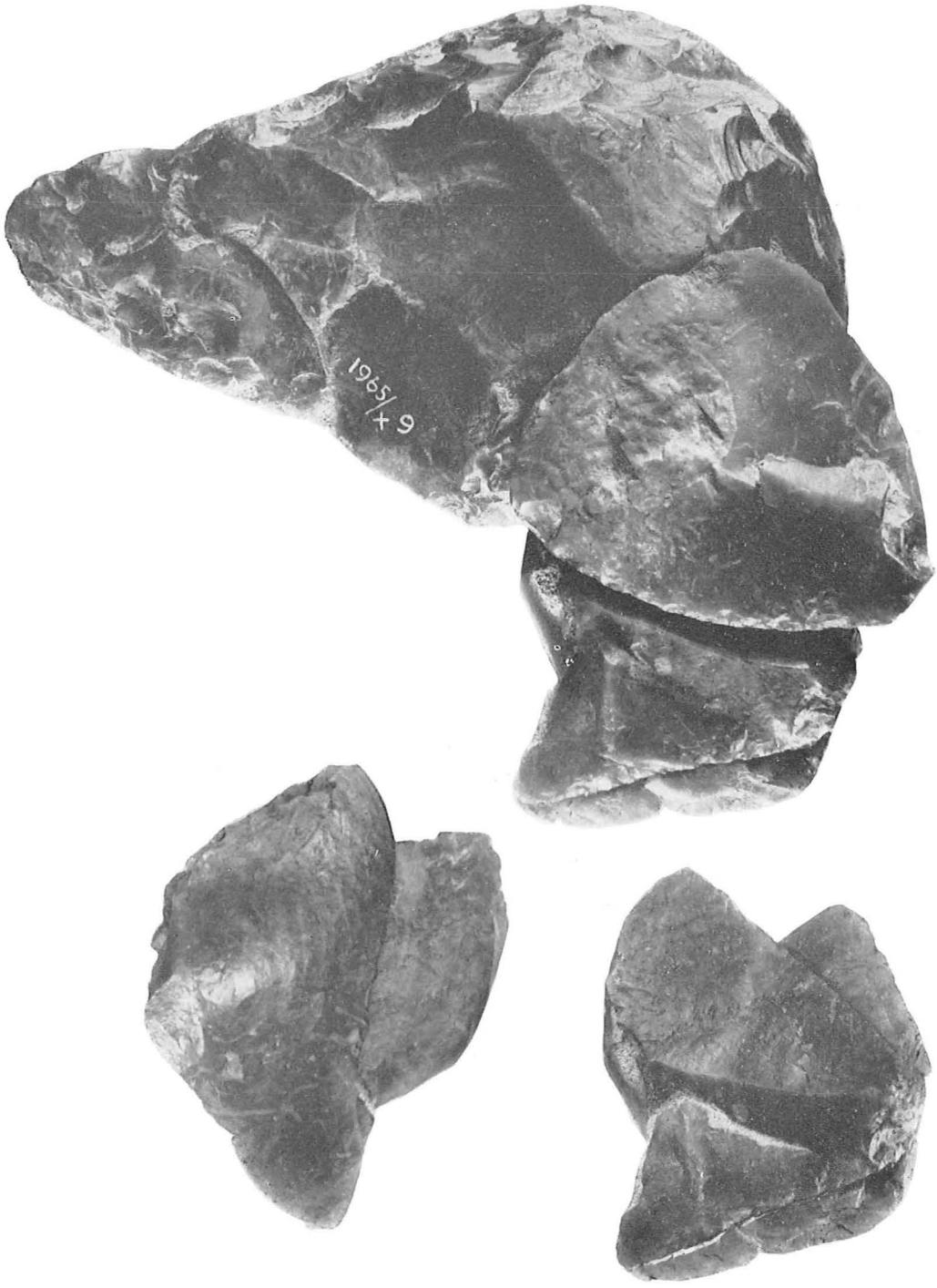


Fig. 14 Concentration A, flint group Ab. Flakes 74 and 16 (bottom); handaxe 9 with scraper 30 and flakes 74 and 16 (top). Photo C.F.D., Groningen.

Fig. 15 Concentration B, flint group Bc. Handaxe 49. Photo C.F.D., Groningen.

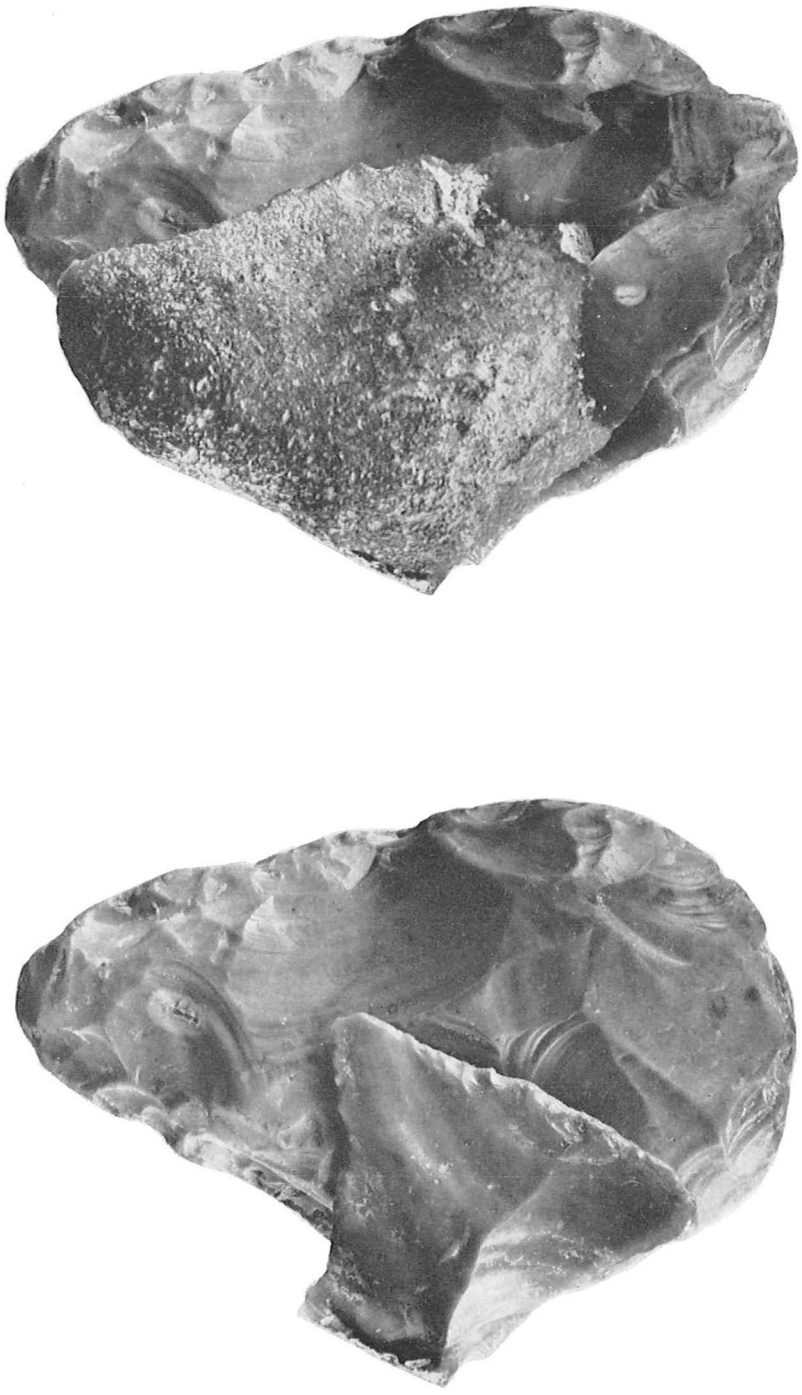


Fig. 16 Concentration B, flint group Bc. Handaxe 49 with scraper 69 (bottom) and with flake 68 (covering scraper 69) (top). Photo C.F.D., Groningen.

These latter artefacts (101[b], 103[a]) have been found during our excavation and an interchange is highly improbable. Nor have we reason to doubt the information of Mr. Vermaning who found nos. 74 and 76 in concentration B, some days after he had found concentration A[2].

We thus have a few significant exceptions on the general rule that the groups are neatly restricted to the concentrations. Our preliminary conclusion must be that the two concentrations represent two different assemblages of artefacts, which were either fabricated or used contemporaneously. We are dealing with two sites of the same age and we shall have to treat them accordingly. Later (p. 65) we shall come back to the possible cause of this situation.

It can be noted that some of the artefacts of the series 1966/VI. 2-20, insofar as they appear to belong with one of the flint groups, can now with some probability also be attributed to concentration A or B.

Although we realize that our designation is likely to be wrong in a few more, unknown, instances, we feel justified in arranging the artefacts in groups of probable derivation of one nodule or naturally fractured piece of flint. After applying the necessary corrections for groups (2), (5) and (11) as indicated above and having redesignated the groups according to the concentration to which they (chiefly) belong, these groups present themselves as listed in table 3[a] (separated by comma only: pieces actually fitting together; separated by point-comma: pieces not fitting but from the same nodule).

TABLE 3. DEFINITIVE FLINT GROUPS

Concentration A:	
Aa : 17, 20, 27, 119; 115; 117	6
Ab : 9, 16, 30, 74; 26, 128	6
Ac : 3; 7; 22; 38; 101[c]; 127	6
Ad : 11, 33	2
Ae : 4, 14; 15; 18; 21; 23; 40; 41; 42; 101[d]; 106; 118[b]; VIII; XI	14
Af : 109[a], 118[a]; 109[b], 110; 101[e]	5
Ag : 12, 29; 39; 101[a]	4
Ah : 31; 37	2
Ai : 2; 76	2
Aj : 19; 34	2
	total 49

Concentration B:

Ba : 48, 65, 66; 64; 85; 89; 132; XII	8
Bb : 50, 75, 95; 77	4
Bc : 49, 68, 69; 70, 71; 67	6
Bd : 46; 62; 86; 92; 93	5
Be : 45; 51; 52; 56; 57; 63; 81[c];	7
Bf : 47; 53	2
Bg : 81[a], 84	2
Bh : 81[b], 91	2
Bi : 55, 90; 101[b], 103[a]; 72; 73; 100	7
Bj : XVI, XVIII; 96; XV	4
total	47

The groups Aa-Aj, Ba-Bj are not all of the same character. The most conspicuous are groups in which one handaxe or other bifacial tool is represented together with a number of flakes, some of which have been worked to scrapers of various kind (in particular *racloirs déjetés*). Often there is cortex or heavy patina on the dorsal side. There can be no doubt that these flakes were by-products of the fabrication of handaxes (groups Ab, Ac, Ae, Ag, Ai, Ba, Bb, Bc, Bd, Bg). Group Be contains 3 bifacial tools together with a number of flakes.

In three cases, the groups consist of two bifacial tools only: groups Ah, Aj and Bf. In these groups, one of the tools is small in size and has the shape of a disc (a *biface discoide* in two instances and a *disque* in one).

Groups Ad en Bj do not contain a handaxe, but in view of the character of the flakes, there can be little doubt that they did result from the production of handaxes which are not present among our finds.

Of the remaining groups, Aa is characterized by the lack of any traces of percussion on the flakes. In this case, a piece of flint seems to have been crushed and suitable pieces have been made into tools. Another possibility would be that the nodule was picked up in a broken condition (see below, p. 68). There are four convergent scrapers in this group. Group Af probably resulted from the fabrication of an endscraper from a natural flake at the site. Group Bh contains a scraper, made from a very flat flint core, togeether with a *raclette*.

Finally, group Bi consists of a double scraper, a triangular pointed tool and a number of blades and blade-like flakes, which cannot be products of the fabrication of a handaxe. They might have resulted from core preparation (see below, p. 69).

Summarizing this comparison, we see that of the 20 groups, certainly 14 and

probably two more resulted from the fabrication of handaxes and other bifacially worked large tools from large pieces of flint. In one case (Aa), a large piece of flint has simply been broken and the fragments worked into artefacts. In only two cases are we dealing with the fabrication of rather small scrapers.

The remaining 27% of the artefacts (35 pieces) can be divided into three categories. The largest category (henceforth referred to as p) consists of 15 artefacts (mainly convex scrapers) made from naturally fractured pieces of flint of various shapes. The second category (q, 12 pieces) consists of artefacts made from isolated flakes of human origin, mostly with percussion bulbs. The last category (r, 8 pieces) consists of bifacially worked tools.

These categories are distributed over the concentrations A and B as listed in table 4.

TABLE 4. CATEGORIES OF ISOLATED ARTEFACTS

Concentration A:	
Ap : 6; 24; 36; 25 + 43; 102; 108; 112; 131	8
Ar : 5; 28; 32; 35; 101[f]; 107	6
Aq : 13; 44 + 105	2
	total 16
Concentration B:	
Bp : 58; 59; 60; 61; 94	
Bq : 83; 87	2
Br : 54; 82	2
	total 9
Concentration unknown:	
Cp : V; XIX	2
Cq : IV; XX	4
Cr : II; III; XVII; 133	4
	total 10

We shall deal with the groups distinguished thus far in some more detail in Appendix I. For the present we shall have to make a few more remarks on the general character of the two concentrations.

In both concentrations, the quantity of unworked flakes and blades is small (total 22, or 17%: 11 in conc. A, 8 in conc. B; 3 in conc. unknown). There is little indication of tool fabrication at the site itself. The only evidence might be group Af: a scraper with four small blades and flakes, three of which are unworked.

From the description of the find circumstances, it is clear that it is quite out of question that we should have found only a small percentage of all the artefacts originally present at the sites.

On the other hand, the fact that so many tools still fit together, indicates that they have not had a long history since they were fabricated.

The best explanation is that the tools from Hogersmilde have been made at some small distance from the find spot, not long before they were selected for a special purpose, *e.g.* the slaughtering and further treatment of a hunted animal. This conclusion holds good for both concentrations independently.

At least three possibilities present themselves for explaining the contemporaneity of the two concentrations, which we already concluded.

Firstly we could assume that one or more hunters first fabricated one of the assemblages and later the other one at about the same working floor. In this way some pieces left over by accident from a previous occasion could be picked up. However this is not very probable, since the admixing occurs in both directions, and one would have to assume another accident to explain a successive use at two sites located at such a short distance from one another. There is also reason to believe that some of the isolated handaxes were fabricated before those from which flakes are present. Such axes occur in both assemblages.

The second possibility is that two hunters (or groups of hunters) each fabricated their own tools at apparently the same time at a short distance from each other, so that some interchange of the flakes could take place, before each hunter or hunter party went out with a selection of them for the slaughtering activity, for which the tools were probably used.

The third possibility is that the interchange of the artefacts did not take place until their use at the sites where they have been found. In that case one would have to assume that both activities were contemporaneous and that the interchange was the result of some form of mutual assistance at the slaughtering activities. In this case, too, it would be strange that the admixture should be both ways and of the same limited amount. We therefore prefer the second explanation.

The fields in the surrounding area certainly have been examined most carefully by Mr. Vermaning, but not all of them have undergone deep-ploughing. Furthermore, Late Glacial coversand sheets, that would seal off the find layer and Late Glacial pingo's that would have pulled apart any concentration occur at short distances from the concentrations (fig. 3).

In the new concentration of Middle Palaeolithic artefacts, which has been discovered near Hijken, 4 kilometers from Hogersmilde, the number of unworked flakes is about half the total number of objects (c. 400), while unfinished and broken tools are frequent. Even if the tools in part appear to be typologically different from the ones from Hogersmilde, this new site seems to have just the

character we must postulate for the (two) yet unknown place(s) where the tools of Hogersmilde have been fabricated.

Bordes estimates the number of flakes resulting from the production of one handaxe at approximately 50. In our case we have one instance of 13 flakes from one – or two nearly identical – nodule(s), but in all other groups the number is 5 or less: 5 (5x), 4 (1x), 3 (2x), 1 (1x). There are 3 groups which only consist of two bifacial tools. Together with 8 isolated bifacial tools, they account for 11 instances where accompanying flakes are missing, as against 10 instances where three or more of them are present. This distribution can hardly be accidental. It rather suggests that handaxes could be used much longer than the flake tools and that at our sites only those flake tools are present which had been made together with the most recently fabricated handaxes. Some of the isolated handaxes accordingly present a definitely worn appearance (*e.g.* no. 13).

In a much more pronounced form, the same situation is present in the Hijken assemblage. There the nodule groups are much larger – in one case comprising as many as 70 artefacts! –, but still half of the handaxes occur as single pieces. These are all finished tools with signs of wear, while many handaxes in the groups were unfinished or broken. Among the isolated artefacts, no other tool types than handaxes occur in Hijken. Apparently, people had brought quite a few handaxes with them to the place where they were going to fabricate new ones.

The Hogersmilde material shows more regularities, which can best be explained in terms of the habits of the makers. Firstly, we see that there is never more than one convergent scraper per group. Two convergent scrapers occur isolated (28, 87). This suggests, that they had been in use for a longer period. The only other flake tools occurring in isolation are a *racloir double* (no. 35) which is very much like a *racloir déjeté*, a *racloir sur face plane transversal*, and two endscrapers (5, 107). It is quite possible that the latter two have been made from flakes of natural origin.

The second regularity is the strong preference of the convex scrapers for being made on blanks of naturally fractured pieces of flint. Of a total of 18, only two occur in groups together with handaxes (101[a] in group Ag and 93 in group Bd).

In general, we may not expect to be able to decide whether the tools on naturally fractured pieces of flint were made at the site or brought to it. In one case, we suggested the possibility that a scraper (no. 110) was made at the site, because it was found together with four small flakes and blades (group Af). But if alle scrapers of this type had been made at the site, we would expect more of such small flakes among our finds and this is not the case.

The preference of Hogersmilde man for naturally fractured pieces of flint for the fabrication of this scraper type is probably to be sought in the steep scraper

angle which would be easier to obtain from these natural pieces (see also below, p. 68, 76).

The main conclusions of this chapter on the source material are the following.

a. The source material of the tools is unselected flint derived from the local moraine. Larger pieces were made into handaxes. The flakes formed during the manufacturing of these axes were used for making various other tools. Small naturally fractured pieces of flint were directly used as blanks for the production of various types of scrapers.
b. None of the tools are more than slightly patinated. Heavy patina only occurs on older natural fractures. High gloss due to windpolish occurs on a few artefacts, but again, only on older fractures of natural origin.
c. In 13 flint groups, 39 artefacts can be fitted together, thus resulting in 16 combinations. The fabrication of these artefacts must have taken place shortly before they were used at the present sites at as yet unknown spots in the vicinity. The incomplete character of the groups precludes their being fabricated at the find spots themselves.
d. Of at least four handaxes which are not accompanied by flakes, the fabrication had probably taken place at an earlier date. We can thus distinguish two "generations" of artefacts in the assemblages.
e. The two concentrations have to be considered as representing two separate sites, where two small groups of people were engaged in performing, independently but contemporaneously, pursuits of comparable character. The notion of two butchering sites and of people from a common base camp presents itself.

VI. ASPECTS OF PRESERVATION AND TECHNOLOGY

We have referred to the fresh character of the Hogersmilde artefacts. As to colour and character of the fractures, there is, on macroscopic inspection, no essential difference between recent fractures and those due to palaeolithic man (but the older fractures due to the moraine are easily recognizable by patina and windgloss; cf. preceding section). Yet, when studying the artefacts under the binocular microscope, the difference is clear. It appears that all ridges in between intersecting fracture and flaking negatives, especially at prominent points, are rounded, showing a combination of gloss and miniature scratches. On first sight, this may give the impression that the artefacts have been worked with a sand-blast, and in fact this effect has been responsible for a certain mistrust of the authenticity of the artefacts[4]. However, the same phenomenon is also present with the artefacts

which we ourselves dug up from positively undisturbed position, and there can be little doubt that the effect is due to the cryoturbation in a sandy milieu to which the artefacts have been subjected. Accordingly, the edges of thin flakes are not as sharp as would be expected. If not showing irregular and often alternate, shallow, marginal "retouch" or steep "retouch" (*retouche alterne mince*, *retouche abrupte mince*) they are at least slightly blunted. These phenomena apparently are also largely due to cryoturbation. For this reason, we have strong reservations about some miniature flakes with sharp edges from concentration A, which may have been the result of trampling about in the waterlogged soil in January, 1965. The pains taken to register the location of the artefacts in the concentration with sticks and the subsequent recording of these locations certainly caused a good deal more trampling on this concentration than on concentration B.

The character of the raw material (moraine flint) will have influenced, to a large degree, the *débitage* and the shape and workmanship of the artefacts. To some extent this will be true for the bifacial artefacts (hidden fractures in the flint nodules), but chiefly concerns the unifacial artefacts.

The handaxes are generally crudely shaped. Apparently, a stone served the flaking at least initially, as can be seen from flakes like no. 12 (Pl. XXVIII) which belongs to flint group Ag together with handaxe 39 (Pl. X). See also no. 74 (Pl. XLV) which is included in flint group Ab, together with handaxe 9 (Pl. IV). But most of the flakes included in the flint groups with handaxes or fitting onto handaxes are thin and lack the characteristics of hard-percussion flakes. They apparently represent soft-percussion flakes, even though the plains of percussion and the dorsal face near the striking point often were badly damaged by the striking blow, and definitive characteristics of soft percussion flakes are lacking (cf. e.g. Pl. XXVI: 33, XXVII: 66, XLI: 65 and 85, XLII: 32). That soft percussion was practised is shown beyond doubt by the flakes 81[b] and 96 (Pl. XLI), which, however, do not belong to flint groups that also include a handaxe.

A striking feature of the Hogersmilde industry is the extensive use which has been made of naturally broken blanks from the moraine, picked-up from the surface. These can easily be indentified by their patinated or wind-polished fractures, by the many potlid-fractures, and by the lack of any indications of percussion. Of the total number of 79 unifacial, worked artefacts, 16, that is 20%, have been made from these naturally broken pieces. If we leave out questionable *raclettes* and the flakes with thin marginal steep or alternate "retouch", which may have resulted largely from cryoturbation, this percentage even amounts to 27%.

Numerically less important, but also characteristic, are implements made on blanks which lack all characteristics of human-made flakes, but which neither show patination, wind-gloss or potlid-fractures. Of these, it is not clear whether they have been broken by man or by nature. One cannot rule out the possibility

that such pieces of flint resulted from the smashing of larger lumps of flint on boulders by Hogersmilde men. But often such pieces occur embedded in the boulder clay, naturally fractured but still holding together. As the natural fractures in these cases are as little patinated as those fractured or flaked by Hogersmilde men, the distinction is difficult to make. Perfect examples of artefacts made on such pieces of flint can be found in flint group Aa (nos. 20, 27, 115, 119; Pl. XXIV-XXV; these can still be fitted together).

As to the regular flake industry, a first characteristic is that preparation of striking platforms for the flaking was hardly, if at all, practised. The striking platforms and flakes sufficiently preserved never show traces of preparation.

Nor are there very clear traces of core-preparation in the Levallois-technique. There are 8 flakes and blades which could point to core-preparation, and these appear to belong to only three of the flint groups (nos. 7 and 127 of flint group Ac, 14 and 23 of flint group Ae, and 72, 90, 100 and 101[b] of flint group Bi). It is noteworthy that four of these belong to the one flint group Bi, and that among these specimens are to be found three of the total of six blades (*i.e.* flakes in which the length is more than twice the breadth) represented among the finds. Even if all eight flakes and blades are accepted as representing the Levallois-techniques, their percentage (10%) among the total number of blades and flakes (IL according to Bordes) would be quite low.

Many of the flake implements have been made on handaxe flakes; with a total number of at least 15 out of the 100 unifacial implements these represent 15%.

VII. TYPOLOGY

In classifying the artefacts of Hogersmilde, we tried to follow as closely as possible the typology set out by Bordes (1961a), supplemented by types defined by Bosinski (1967), in order to facilitate comparison with the material from other sites. For the handaxes, Bordes' typology proved useful, even though a consistent characteristic of the Hogersmilde handaxes, namely the continuous working edge around the base, is not accounted for in this typology. Also the artefacts from flakes could be easily accounted for with this typology. But difficulties arose when it came to classify the implements made on naturally fractured blanks, provided by the local moraine. In Bordes' classificatory system, the position of the working edges in relation to the striking axis of the flakes from which the artefacts have been made (especially the *racloirs*) plays a predominant role. But as soon as one is faced with artefacts made from natural blanks (e.g. resulting from pressures in the moraine or from frost), such criteria are futile. We therefore had to introduce a new type (named *convex scraper*).

We were thus, *in extremis*, confronted with a problem inherent to all typological classification: either one imposes a preconceived typology on a given set of artefacts in order to facilitate comparison with other groups of artefacts, classified according to the same criteria (the system followed by the Bordes school a.o.), or one prefers to set out what can best be termed the "inherent" typology, but this will inevitably lead to definitions of types that vary with each group, and which certainly hamper comparison of find complexes in the traditional way. The first procedure, however suggests differences and similarities which do but part justice to reality – part of that reality will remain concealed.

We do not pretend that we could produce the inherent typology of Hogersmilde. In fact, as often has been stated, there is not just one such typology, but several, conditioned for instance by functional or by traditional factors. As long as we do not know to what extent our variables are determined by either tradition, function or the raw material available to palaeolithic man, the character and the meaning of our typologies will not become clear to us. We are well aware that the main lines of division of the classification as followed here may eventually prove not to have been the essential ones.

Table 5 presents the types of artefacts and the unworked flakes and blades (chiefly according to the typology set out by Bordes, 1961a, but in a few cases according to Bosinski, 1967). Added are references to the plates, to the flint-groups and to the types of blanks used. For details concerning each of the artefacts, the reader is referred to the catalogue, Appendix II. It is not necessary to deal in detail with each of the types figuring in the table. But a few comments concerning some of the groups of artefacts or individual types must be made.

The total number of artefacts (*raclettes* and flakes with thin marginal steep or alternate retouch included) amounts to 127. Of these, 27 are bifacial, and 78 unifacial tools. The number of unworked flakes and blades is 22.

Of the 27 bifacial artefacts, 19 can be classed as handaxes. They have been made as core-instruments and have more or less symmetrical cross-sections. Some have one flattish and one strongly convex face (Pl. II: 37, III 46, V: 49, XI: 54). The working edges of the handaxes have been hammered to form an unbroken line, but several show an S-twisted working edge (*arète torse*; nos. 37, 45, 48, 54, 31, III). A highly characteristic feature of the majority of the handaxes is the continuous working edge around the base. The outlines of the bases are markedly convex, and in consequence the level of the greatest width of the handaxes is at a relatively high point above the base (high values for "a" according to Bordes, 1961a, p. 51). Two handaxes and one leafshaped handaxe have pointed distal ends (Pl. VI: 13; XV: 133, 82).

Of the 19 handaxes, 15 represent in a convincing manner types defined by Bordes (1961a); cf. table 3 and the description in the catalogue, Appendix II. Of the remaning 4, one is a fragment of which too little is preserved to permit definite classification (Pl. VI: 19), two are rather a-typical (Pl. II: 37; XVII: 45); the fourth being a partially worked thick triangular handaxe (Pl. XIV: VIII) that compares with the *breitdreieckige Faustkeile* from Central Europe (Bosinski 1967, p. 28).

The remaining 8 bifacial tools again comprise four types which find their counterparts rather with the Central European group of *blattförmige* artefacts than with the French types; one being a good representative of Bosinski's *kleines breitdreieckiges Faustkeilblatt* (Pl. XV: 82), the second a less typical example of a *kleines Faustkeilblatt* (Pl. XV: 52), and the other two *blattförmige Schaber* (Pl. XVI: 3; XIX: 84); of these no. 3 has a hammered working edge around the base and the lower part of one of the sides. The third bifacial scraper represents a Quina-type specimen (Pl. XVII: II), even though it is rather thin and lacks real scalariform flaking. The last bifacial "chopping tool" looks like an unfinished handaxe (Pl. XVIII: 2); it has a hammered working edge round the base, but otherwise is covered with cortex and only shows some flaking where it had been damaged previously by natural action.

As to the types of unifacial artefacts, two have been classed as Mousterian points, two as borers, five as *raclettes*, and 18 as flakes with thin marginal steep or alternate retouch. One tool cannot be classed, and the remaining 54 all belong to the most important of the Hogersmilde type groups, the scraper group.

Of the two Mousterian points, one (Pl. XXI: 56) is a borderline case. Had we applied the criterion used by Bosinski (1967), we would have had to group it with the convergent scrapers. The second is an elongated, slightly asymmetrical point with flattening retouch on the ventral face (Pl. XX: 17). Of the two borers, one (Pl. XXXVIII: 23) especially is a questionable specimen, the second (Pl. XXXIX: IX) being but slightly more convincing.

Of the flakes and blades with thin, marginal, steep or alternate "retouch" one may well ask whether this retouch does not represent retouch caused by the cryoturbation of the sand in which the artefacts were embedded. The retouch occurs chiefly along the thinnest edges of the flakes, and especially the hollow retouch in pseudo- *encoches* of *e.g.* nos. 67, 70 and 74 (Pl. XLIII) is suggestive of a non-human cause (cf. Bordes et Bourgon, 1951, pp. 16-17). Also the *raclettes* are likely to be due to this natural cryoturbation retouch (Pl. XLI: XVI).

By far the most numerous among the unifacial artefacts are the scrapers. In accordance with their general character, these can easily be divided in two main groups. To the first group belong mostly thin, flat scrapers, usually with little

e court	1	VI		13		
vrai	1	VIII-IX	50			
loïde	1	II	37			
	3	X, XI, XII	39 48	44/105		
	4	XIV, X, XI, XIII	31 34		54	
épais	1	XIV	**VIII**			
leterminable	1	XII	51			
total	18					
acloir à	1	XVII	45			
att (fragment)	1	XV	52			
kiges Faustkeilblatt	1	XV			82	
ber (27)	2	XVI, XIX	3 84			
iface type						
	1	XVII				
	2	XIX, XVIII	53			
	1	XVIII				
total	9					
efacts	27					

able 5, Typology, flint groups and types of blades and flakes

Cf. pp. 69-77; names in French refer to the typology of Bordes (1961), numbers ackets behind these names refer to the type numbers according to Bordes (1954b). erman refer to the typology of Bosinski (1967).

. *Cf.* pp. 54-67; the numbers indicated are the abbreviated inventory numbers: 1-133

The abbreviated inventory numbers just mentioned in heavy pri made on naturally fractured, wind polished or patinated blanks, pi the total number of these for each type is indicated in the last sect Underlined numbers refer to thick flakes with plane striking plat their total for each type of artefact is indicated in column II.

racloirs simples droits (9)	4	XXI		{64 / 89} 81[a]		94
racloirs simples convexes (10)	4	XX, XXXV	30 22	62	6	
racloir simple concave (11)	1	XXII		103[a]		
racloir double droit-convexe	1	XXII			35	
racloir double biconvexe	1	XXIV	27			
racloir convergent double-droit	1	XXVII				
racloirs convergents convexes (19)	2	XXV, XXVI	119 33			87
racloirs convergents concaves (20)	4	XX, XXV, XXIII	20 115 14	63		
racloirs déjetés (21)	7	XXVI, XXVII, XXIX	42	66 95 69 86 57	28	
racloirs transversaux droits (22)	2	XXVIII	{15 / 106}			
racloir transversal convexe (23)	1	XXVIII	118[b]			
racloirs sur face plane (25)	4	XXVIII, XXIX	{4 / 21} 12			
convex scrapers	10	XXXII, XXXIII, XXXI, XXX	101[a]	93 91	{24 / 36 / 102 / 131}	{58 / 60} 83
double convex scrapers	1	XXXV				
convex scrapers (pseudo- *grattoirs*)	7	XXXVI, XXXIV, XXXVII	117 110		{25/43 / 108} 5	{59 / 61}
grattoirs (30)	4	XXXVIII, XXXIX, XXXIV	11 29	92	107	
total	54					
miscellaneous						
perçoirs atypiques (35)	2	XXXVIII, XXXIX	(23)			
raclettes (questionable specimens) (39)	3	XLI		XII 81[h] XVI		
éclats à retouche abrupte mince (48)	13	XL-XLV	(127) {18 / 101[d]}	65 75 {68 / 70 / 71} 81[c] {72* / 100*} XVIII	32	
éclats à retouche alterne mince (49)	4	XLII-XLIV	{16 / 26} 7*	67		
triangular tool with surface retouch	1	XXXIX		55		
total						
unworked flakes and blades						
blades	3	XL, XLIII, XLV	109[a] 76	90		
flakes	18	XL-XLV	{74 38 / 128 101[c]} {40 101[c] / 41 109[b] / XI 118[a]}	{85 / 132} 77 {73 96 / 101[b] XV}	101[f]	

retouched, flat, shallow working edges. The angle between the ventral plane of those scrapers and the tangent of the working edge averages about 50°. Most of these have been made on regular flakes, many of them handaxe flakes. Flat, naturally fractured pieces of flint were used only twice in this group. Within this group we find the single side scrapers, the single transverse scrapers, the single scrapers with ventral retouch, and most of the convergent scrapers, among which are the *racloirs déjetés*. Special mention must be made of a particularly fine *racloir déjeté double* (Pl. XXIX: 57), of a convergent scraper *à retouche alternante*, in shape resembling a *racloir déjeté* (Pl. XXIV: 20); and of a *racloir déjeté alterne* (Pl. XXVII: 69).

The second and most conspicuous group consists of generally heavy, thick scrapers with broad, often steep and deeply retouched working edges. With these scrapers, the angle mentioned before averages about 80°. To this group belong the closely related convex and endscrapers (Pl. XXIX-XXXVIII). Of the total number of 22 of these scrapers, 12, that is 55%, are made on blanks consisting of naturally broken pieces of flint, picked up from the surface. Taking into account that the total number of unifacial artefacts made on such blanks is 16, this implies that it was especially for this group of scrapers that the blanks provided by nature were selected. Apparently, many of the larger naturally broken pieces of flint were well suited to be made into the heavy scrapers, but the preference may also have been aimed at the large, even, patinated or wind-polished natural fractures, which were chosen to serve as the ventral faces of the scrapers: even when these scrapers were not made on ready-found naturally broken pieces of flint, a natural fracture was sometimes chosen to serve as the ventral face of the scraper (Pl. XXXII: 101a; XXXIII: 83). Otherwise, chiefly heavy flakes or otherwise broken pieces of flint were selected for scrapers of this group; quite characteristically, handaxe flakes are lacking in this group. Apart from their strongly convex working edges, many of these scrapers are also characterized by broad, high, and often steep working edges, which mostly show deep parallel flaking rather than scalariform flaking.

Within this group of scrapers, the distinction of a subgroup of pseudo-endscrapers would offer no difficulty, the position of the working edge, perpendicular to the longitudinal axis of the artefact being clear, even when the artefacts have been made on natural blanks (Pl. XXXVI). But as to the others, it is impossible to classify them either with the sidescrapers (*racloirs simples convexes*) or with the transversal scrapers (*racloirs transversaux convexes*), as the criterion for such a distinction, the direction of the percussion of the flake and the position of the plane of percussion, is lacking, none of these scrapers having been made on regular flakes. Therefore, even though some of them give the impression of being endscrapers and transversal scrapers from the fact that the axis of symmetry is

perpendicular to the working edge, we have classified this entire scraper group as a separate group, the *convex scrapers*. These convex scrapers also differ from most side and transversal scrapers in that the working edges continue the unbroken outline of the artefact (*e.g.* Pl. XXX: 24, 36; Pl. XXXI: 58; Pl. XXXIII: 83). The discoïd scraper no. 102 (Pl. XXXII), made on a potlid piece of flint, shows the characteristics of the convex scrapers carried in to the extreme. The close inter-relationship of convex scrapers and endscrapers is clearly illustrated by the double scraper no. V (Pl. XXXV), of which the two working edges are practically identical; nevertheless the one represents the convex scraper, the other could be classed as an endscraper. There are more artefacts combining a pseudo-endscraper with a convex scraper (Pl. XXXVII: 59, 61); of one of these, the hollow ventral face is shaped by a natural, heavily patinated frost fracture.

As may be clear from the above description, many of the convex scrapers could be ranged with the *Steilschaber* as defined by Bosinski (1967, p. 31).

VIII. CHARACTERIZATION AND AFFINITIES OF THE HOGERSMILDE FLINT INDUSTRY

In the introductory paragraph to the section on the typology of the Hogersmilde artefacts, we have expressed our reservations as to the meaning of the resultant classification. We are only partly in a position to take a stand as to the three extreme notions on the meaning of the differences between industries defined on a comparable basis as our find group, i.e. the position of Bordes c.s. (Bordes, 1950, 1961a, 1961b), the position of the Binfords (Binford & Binford, 1966; S. L. Binford, 1972) and that of Mellars (1969). Nor are we sufficiently familiar with Middle Palaeolithic materials to attempt a full typological comparative study. In the following, we shall content ourselves with giving a short characterization of the Hogersmilde industry, and trying to indicate elements which may help in defining its position as compared with other find groups, which appear to be significant in relation to dating on geological and C14-grounds.

General character

Technologically, the Hogersmilde industry is characterized by the very limited application of core preparation in the Levallois-technique, by the absence of striking platform preparation, and by the extensive use made of blanks provided by the local moraine.

Typologically, the characteristics are the importance of the handaxes and the predominance of the scrapers, among which the "Charentian" group (scrapers

with convex working edges, transverse scrapers), and convergent scrapers (including *racloirs déjetés*), are the most important constituents. In a negative sense, the absence of backed knives, Levallois-type implements and denticulates, and the rarity of points and blades must be mentioned.

More precisely, it is the combination of high values for the handaxe index (IB = 17) on one hand, with high values for the scraper index (IR = 57) (except endscraper) and for the Charentian index (IC = 21) on the other, which defines the special character of this industry. In this case, one could add an index for the double scrapers (chiefly convergent and *déjeté* scrapers) (IRD = 29) as another major constituent. It must be realized, that these indices are counterbalanced by a relatively great number of flakes with thin, marginal, steep or alternate retouch. If our presumption is correct that the "retouch" of these flakes is largely due to cryoturbatic action of the soil in which the finds were embedded, the real values for the indices cited would even be higher.

The Hogersmilde handaxes are of an Acheulean character. It would be misleading to emphasize their coarseness and the occurrence of S-twisted working edges, which were possibly conditioned by the poor quality of the available flint. Only the *disques* nos. XVIII and 53 (Pl. XVIII and XIX) show the Mousterian technique with one strongly convex and one flat, summarily worked face (Bordes, 1954a, pp. 205, 493).

The types represented indicate a similar trend. In comparing the handaxes which occur predominantly in Acheulean contexts with those chiefly characteristic of the Mousterian of Acheulean tradition, and excluding those which are less specific, the following picture emerges:

Acheulean types		Mousterian types	
bifaces micoquiens:	2	*biface cordiforme vrai*:	1
bifaces amygdaloïdes:	4	*biface amygdaloïde court*:	1
	total 6		total 2

The predominance of the Acheulean element, combined with the absence of the handaxe type which is most characteristic of the Mousterian of Acheulean tradition (the flat triangular handaxe) is typical of the Hogersmilde handaxe component.

That the notion of an early Mousterian complex with handaxes that are of an archaic looking Acheulean character is quite possible, is proven by the second find of Middle Palaeolithic date, from Hijken, Gem. Beilen, referred to already. The Hijken industry includes a.o. 13 handaxes (Fig. 17-18). The balance of "Acheulean" versus "Mousterian" handaxes in the Hijken find is as follows:

Acheulean types		Mousterian types	
biface lancéolé à arète torse:	1	*biface cordiforme vrai:*	1
bifaces amygdaloïdes:	3	*bifaces triangulaires plats:*	2
limande:	1	*biface subtriangulaire plat:*	1
		biface amygdaloïde court:	1
	total 5		total 5

Among the Acheulean handaxes from Hijken, the lanceolate and one almond-shaped handaxe are conspicuous by their large size (Fig. 17; they measure 19 and 17 cm in length respectively). On the other hand, the triangular handaxes (Fig. 18) are perfect examples of their type, with plano-convex cross-sections, carefully flaked dorsal faces (soft-percussion technique) and partially flaked ventral faces. Clearly, Mousterian handaxes are of more importance in Hijken than in Hogersmilde, but it is difficult to decide whether to account for this difference by assuming a younger date for the Hijken industry, or by pointing to the entirely different character of the two sites.

To summarise, the Hogersmilde industry combines an important handaxe component, in which an Acheulean element predominates, with a flake industry which, both technologically and by its composition, is reminiscent of the Quina-type Charentian Mousterian group, but also comprises an important group of double scrapers.

The relation to the Balve succession

In searching for affinities to the Hogersmilde industry, it is worth while to compare it with the Micoquian *Inventartypen* in Germany as defined by Bosinski (1967). He defines four *Inventartypen*, of which the oldest, the *Inventartyp* Bockstein, is believed to be closely related to the industry of level 6 at La Micoque. The specific characteristic of all these groups is the *wechselseitig-gleichgerichtete Kantenbearbeitung*. In the *Inventartyp* Bockstein, large and small Micoquian handaxe blades (*Faustkeilblätter*), and a specific type of backed knife, the *Bocksteinmesser*, are characteristic types. In the later *Inventartypen* the handaxes disappear, but the *Faustkeilblätter* and a different type of backed knife (*Pradnikmesser*) persist. It must be clear that many Upper Acheulean complexes in France, often referred to as Micoquian, do not really belong to that industry according to this definition.

The Hogersmilde industry is certainly not a Micoquian complex according to this definition. There are no examples of the *wechselseitig-gleichgerichtete Kantenbearbeitung*, and secondly, backed knives are altogether absent at Hogersmilde. Nevertheless, the points in common are noteworthy. As types, the large Micoquian

Fig. 17 Hijken. *Biface amygdaloïde* (left) and *biface lancéolé* (top). Photo C.F.D., Gronin
Scale ca. 2/3

Fig. 18 Hijken. Two flat triangular handaxes (left and middle); *limande* (right). Photo C.F.D., Groningen. Scale ca. 2/3.

handaxe (Pl. III: 46) and the small one (Pl. XV: 133; *Fäustel mit ausgezogener Spitze und verdicktem Ende* in the words of Bosinski) of Hogersmilde are characteristic of the *Inventartyp* Bockstein, even though the two Hogersmilde specimens differ from those of the *Inventartyp* Bockstein in having the continuous working edge around the base. As stated already, these types disappear with the later Micoquian *Inventartypen* in Germany. Furthermore, the two types of *Faustkeilblätter* from Hogersmilde are also typical of the Micoquian complex (cf. Pl. XVII: 52 with *e.g.* Bosinski, 1967, Taf. 70: 5, and Pl. XV: 82 with his Taf. 70: 2 and 80: 2), though not of the *Inventartyp* Bockstein in particular. Within his working area, Bosinski considers these four types of artefacts as exclusively characteristic for his Micoquian complex. A comparison between the Hogersmilde flake industry and the *Inventartyp* Bockstein is also rewarding. According to Bosinski (1967, pp. 31, 44, 49, 52) convergent scrapers are well represented in the *Inventartyp* Bockstein. He (o.c., p. 48) also points to the smallish character and irregular retouch of the simple unifacial scrapers, if compared with those of his Upper Acheulean Lebenstedt group; both characteristics also apply to many of the Hogersmilde unifacial scrapers. He furthermore distinguishes a special group of *Steilschaber*, which is not represented in the typology of Bordes and in our type list, and which he considers as quite characteristic of his *Inventartyp* Bockstein (Bosinski, 1967, pp. 49, 52). We have seen already that many of our convex scrapers meet the requirements of a *Steilschaber*.

The above observations indicate that apart from obvious differences (absence of *wechselseitig-gleichgerichtete Kantenbearbeitung* and of backed knives, notched implements and denticulates at Hogersmilde), there also exist clear points of similarity between the Hogersmilde finds and the Micoquian complex, more specifically the *Inventartyp* Bockstein, and, to a lesser degree, the *Inventartyp* Klausennische.

The evident affinities of the Hogersmilde industry with the *Inventartyp* Bockstein are of interest in connection with the important Balve stratigraphy (cf. pp. 87-90). At Balve, the industry of layer II is attributed by Bosinski (1967, p. 44) to this *Inventartyp* on the basis of one Micoquian handaxe, of *Faustkeilblätter*, *Bocksteinmesser* and *Steilschaber*. Even when on direct comparison the similarities between Balve II and Hogersmilde are not conspicuous, the indirect connection by way of the *Inventartyp* Bockstein in general seems convincing. The overlying layer Balve III (containing the industry IIIa of Günther, 1964) represents the younger *Inventartyp* Klausennische, in which the elements in common with Hogersmilde are less prominent. The underlying layer I contains an entirely different find complex, which is included by Bosinski (o.c. p. 37) in his Upper Acheulean Lebenstedt group.

Relations with Lebenstedt

Apart from Micoquian and discoid handaxes, and from the oval handaxes, which according to Bosinski (1967, p. 28) hardly occur at all in his working area, Bosinski would range the Hogersmilde handaxes with his lanceolate handaxes and, especially, with his *massive Faustkeile* (this group encompasses all handaxes which are more than 10 cm in length, in as far as they do not represent lanceolate or Micoquian handaxes). Both lanceolate and massive handaxes are considered by Bosinski as typical for his Lebenstedt group, which does not comprise any of the Micoquian elements just dealt with. Apart from the finds from Salzgitter-Lebenstedt itself (which have only partly been published; Tode, 1953; Bosinski, 1967, Taf. 1-8), a rather considerable number of mostly smaller find complexes (among which the well-known sites of Hannover-Döhren, Rethen, and Herne), and stray finds of handaxes and other implements have been ranged by Bosinski with this Lebenstedt group, which he states to be the oldest of the Middle Palaeolithic groups in his working area. This hypothesis is corroborated by the Balve stratigraphy.

The Lebenstedt group appears to be the only one of the Middle Palaeolithic groups of Bosinski to which are attributed finds from the Northwest-German lowland, of which the Hogersmilde area is nothing but the adjacent western extension; in fact the handaxe from Wijnjeterp in the province of Friesland, at only 4 km from Hogersmilde, figures among these finds (*o.c.* pp. 35, 98; Taf. 36: 2; Karte 1 : 1, 3 : 1). This, combined with the fact that several of the Hogersmilde handaxes are of a type considered by Bosinski as characteristic for this group, would point to a relation between the Hogersmilde finds and the Lebenstedt group. In view of the similarities observed with the Micoquian complex on the one hand, and of the occurrence of massive handaxes on the other, one could therefore feel tempted to assign to the Hogersmilde industry a position somewhere in between the Lebenstedt group and the earliest German Micoquian; that is, in terms of the Balve stratigraphy somewhere in between Balve I and Balve II. Whether this would be sensible depends largely on the homogeneity – culturally, geographically and chronologically – of the Lebenstedt group as defined by Bosinski. In these respects, we have strong reasons for doubt.

Firstly, most of the finds from the Saale moraine of the Northwest German lowland are stray finds. Among these are six handaxes which have been classed with the Lebenstedt group since they represent the lanceolate or the massive type, so for instance the handaxe from Wijnjeterp, already referred to. But if one of our massive handaxes from Hogersmilde and from Hijken, or the large lanceolate handaxe from the latter site, had been found previously as a stray find, it should also have figured as a Lebenstedt group representative. Yet, the Hogersmilde find comprises Micoquian elements not present within the Lebenstedt group, and con-

sidered by Bosinski as essentially later. The Hijken find even includes flat triangular handaxes, which should be contemporary with the earliest Mousterian of Acheulean tradition. The twofold inference from this situation is that, at least in the North-German lowland, neither the lanceolate nor the massive handaxe can be considered as exclusively typical for the Lebenstedt group culturally, and that many of them can hardly be contemporary with the name-giving site of Salzgitter-Lebenstedt itself[5].

One of the main reasons for this confusion appears to be the definition of the massive handaxe, a type which appears (as in the case of the Selm-Ternsche handaxe[5]) to comprise quite heterogeneous elements. Among the handaxes considered by Bosinski as such, we find on the one hand thick and heavy handaxes with symmetrical cross-sections and unretouched basal parts with cortex, like the Salzgitter-Lebenstedt specimens, but also handaxes like that from Woltersdorf near Hamburg (Bosinski, *o.c.*, p. 104, Taf. 34 : 1), which is quite a good example of a *biface cordiforme vrai*, comparable to our no. 50 (Pl. VIII-IX).

In fact, there may be found among the massive handaxes published by Bosinski more specimens which have, like the one from Woltersdorf, and like most of the Hogersmilde examples, carefully worked continuous working edges round the base (*cf.* Bosinski, *o.c.*, Bergen-Enkheim, Taf. 57 : 1; Oberisling-Unterisling, Taf. 61 : 1; Ungedanken, Taf. 53 : 2; Geilenkirchen, Taf. 46 : 1-2).

When comparing the Hogersmilde industry with the Lebenstedt group *sensu stricto* as represented by the finds from the eponymous site, there appear to be no real similarities. The handaxes are different in appearance as well as in type. The flake industry, of typical Levallois character, is different in composition. The style of the scraper retouch is also different. And all Hogersmilde elements cited as reminiscent of the *Inventartypen* Bockstein and Klausennische are lacking at Lebenstedt. If these differences are to be explained in a chronological sense (as is a.o. suggested by the Balve stratigraphy), their meaning can only be that Lebenstedt is the older site of the two.

It would follow then that the best equation for the Hogersmilde industry is with the industries contained in the layers Balve II and III, with a preference for layer II in view of the *Steilschaber* found in the Bockstein *Inventartyp* and their resemblance to our group of convex scrapers.

Affinities with French industries

We have pointed to the elements in the Hogersmilde industry that are reminiscent of the La Quina Mousterian group. These similarities concern chiefly the absence of Levallois *débitage* and of platform preparation, the absence viz. scarcity of

denticulates, the high Charentian scraper index, and morphological aspects of the scrapers. Differences also exist. There is only one bifacial Quina type scraper at Hogersmilde, which is not even a very characteristic one. There is no real scalariform retouch at Hogersmilde. There are no *limaces* in Hogersmilde, nor are there *tranchoirs*.

The other way round, handaxes are not represented in the French La Quina groups, and convergent scrapers, especially *racloirs déjetés*, are far from common with these groups.

It might seem dangerous to attach too much value to scraper forms and types for purposes of cross-dating or the establishing of traditional affiliations. Common elements in the subsistance basis of the manufacturers might also account for similarities in the scraper technology and typology between groups that otherwise are quite different in their composition. But even then, the value of these similarities would not have to be *a priori* excluded for purposes of cross-dating. The postulated common elements in the economy might themselves be determined by time-bound ecological factors or by tradition. If Mellars (1969) is right in assigning a certain period (Middle part of Würm II in the Dordogne sequence) to the La Quina type Mousterian in that area, this could possibly provide us with yet another cross-dating possibility.

Affinities with the *Moustérien de tradition Acheuléenne* (MTA), type A, might be expected in a find complex that encompasses not only an important handaxe component but also a conspicuous scraper group. Yet, the affinities are by no means impressive. Common elements are the cordate handaxe from Hogersmilde (the most common type of handaxe in MTA, which, however, does occur as early as in the atelier Commont), the ovate handaxes (also present before MTA times) and the group of single side scrapers (with significantly higher percentages at MTA sites than at Hogersmilde). At the other hand, backed knives and denticulates, well represented at MTA sites, are conspicuously lacking at Hogersmilde, and the La Quina elements referred to above do not normally occur in MTA contexts.

A type which seems to be exclusively characteristic for, but by no means abundant in, MTA find complexes is the flat, triangular handaxe. As mentioned before, triangular handaxes of perfect MTA type are present at Hijken (Fig. 18), but not at Hogersmilde. Whether this is due to chance, or due to the difference in character of the sites, or due to a difference in age between the two complexes, we do not yet know. But the presence of this type of handaxe in Hijken, together with handaxe types that are more like those from Hogersmilde, must be taken to imply that Hijken is contemporaneous with, and Hogersmilde hardly can be much older than, (an early phase of) the MTA group.

So far, it is only in the Paris Basin that we meet with MTA find complexes in which older, Micoquian handaxes survive (Bordes 1954a, pp. 439-440). The best example is the third series at Bihorel (Bordes 1945a, pp. 202-208). At Houppeville (*o.c.* pp. 222-264, resp. 253-257), the *série rousse* represents a MTA flake industry which is combined with a Micoquian handaxe component. The agreement of these series with the Hogersmilde and Hijken find is only true in the very broad sense indicated; in detail the differences are considerable. Notably the Charentian scraper element is entirely lacking at these sites.

An element that might prove to be of typological value is the continuous working edge around the basal part of the Hogersmilde handaxes and of some of the handaxes found on the North European plain. In the MTA complexes, this element is commonly associated with the finely worked cordate handaxes, and it should be realized that also the flat triangular handaxes are similar in having a basal working edge. In the Paris Basin, also the older, Micoquian handaxes often are of corresponding type, notably in the third series of Bihorel. But the dating value of the phenomenon may be limited. Among the handaxes from the *briqueterie d'Allonne* (Bordes & Fitte 1949) which also in technological respect are very much reminiscent of the Hogersmilde handaxe industry, many have the continuous round working edge at the base. Yet, the finds from Allonne are throughout of Upper Acheulean character.

Conclusion

Summarizing, the following can be said.

The Hogersmilde flint industry represents a combination of elements hitherto unknown: a handaxe group of Micoquian affinities with a scraper group of Charentian type.

Among the Micoquian elements, several are found in the *Inventartypen* Bockstein and Klausennische, which are represented by layers II and III at Balve respectively. The Lebenstedt group, as present at Lebenstedt itself and at Balve I, appears to be older.

As to the similarities with the La Quina type Mousterian, residing primarily in the Charentian scraper group and the absence of Levallois-flaking, we do not yet know whether the similarities are due to socio-cultural contacts, identical age, or comparable economic demands.

The fact that flat, triangular handaxes occur at Hijken seems to imply a broad contemporaneity of at least the Hijken industry with an early phase of MTA. The reason for the absence of this handaxe type from Hogersmilde we do not know. It can in principle be due to a chronological difference, a difference as to the character of the sites, or to chance.

The rounded edges along the handaxe bases, which are so much typical for the Hogersmilde handaxe component, are (a.o.) also met on a number of handaxes scattered over the North European plain, on handaxes of the MTA complex, and on Micoquian handaxes in early MTA contexts, especially in the Paris Basin. When occurring as a group-characteristic it may prove to be of diagnostic value. At least one complex displaying this feature (Allonne) is of Late Acheulean character.

IX. GEOLOGICAL AND RADIOCARBON DATING

In this chapter we shall try to obtain a more precise date for the Hogersmilde assemblages. Our frame of reference will be the detailed climatic curve of the Netherlands (Vogel & Zagwijn, 1967; Van der Hammen *et al.*, 1967). We shall try to fit in this curve geological sequences in N.W. Europe which contain Middle Palaeolithic industries. Through archaeological comparison of these industries with the Hogersmilde finds we may expect to find a geological date for these finds, which may then be compared with the geological evidence obtained at the site itself. Since the greater part of the curve is radiocarbon dated, we may also hope for a rough absolute date.

In a separate paper, one of us (Waterbolk, 1972) has directly compared radiocarbon dates from palaeolithic sites in Western Europe with the climatic curve. The climatic contexts of the culture deposits which had provided the samples, were used as a means for judging the reliability of the dates. It was argued that the main expansion of Middle Palaeolithic cultures over the plains of Western and Northwestern Europe did not take place until the beginning of the Lower Pleniglacial. Since *a priori* arguments were against a date of the Dutch finds in the coldest periods, it was suggested that the Hogersmilde finds dated either from the beginning of the Lower Pleniglacial or from the Moershoofd interstadial.

Some of these views have been critized by Bordes (Waterbolk, 1972: discussion) and by McBurney (in litt.). In the present paper we shall avoid some controversial points, such as the equation by Bosinski of the industry of La Micoque 6 with his Bockstein inventory type and the date of La Cotte de St. Brelade, which according to McBurney is probably contaminated. The line of our argument will be less direct and our conclusions will be slightly different.

The Balve cave

Because of its situation in the Ruhr valley system, close to the edge of the Lower Rhine Basin, the cave site of Balve with its rich cultural remains is of particular

importance. Günther (1964) has assembled all the archaeological, palaeontological and sedimentological evidence from the many early excavations in the cave (since 1843) and from his own control excavation in 1959. The early operations had destroyed practically all evidence for Upper Palaeolithic habitation (Late Magdalenian, Gravettian, Aurignacian), but the older layers were still intact, and it was still possible to reconstruct the complete sequence. Here, we reproduce the summary table by the author.

The correlation with the climatic curve of the Netherlands does not, in our opinion, present great difficulties. The *ozean. Mittelwürm-Interstadial* with a few Aurignacian finds and forest elements in the fauna must on the basis of the absolute dates obtained from the Aurignacian in France at least in part correspond to the Denekamp interstadial, whilst the sterile layer with coarse chalk debris, the *kalt-arides Altwürm* best fits in the cold stage between the Moershoofd and Hengelo interstadials. The intermediate layer with a late Mousterian flint industry (Balve IV) would then represent the Hengelo interstadial, including possibly a part of the cold stage between the Hengelo and the Denekamp interstadials, which in France is the last period in which the Mousterian occurs. Günther distinguishes two different flint inventories within the horizon Balve IV, and there is some evidence for a stratigraphic succession. Industry IVa still contains a few bifacial tools and would be comparable with the Preszeletian of Hungary. Industry IVb, on the other hand, would be more like late Mousterian industries of France. It contains a few Upper Palaeolithic elements, and would therefore be quite late. Independently, both industries suggest a very late stage within the Middle Palaeolithic.

The *ozean. Altwürm* layers with the industries Balve II, IIIa and IIIb, which formed under cool humid conditions, find their general counterpart in the Dutch sequence in the tundra layers below the Hengelo interstadial, which have formed under like conditions. The Balve fauna with cave bear, cave lion, horse, woolly rhinoceros, giant deer, mammouth, reindeer (only in the later part of the sequence) and wolf (only in the earlier part) points definitely to an open vegetation. There can, therefore, be no reason at all for an equation with the Early Glacial Amersfoort and Brørup interstadials which at our latitude are characterized by a forest vegetation.

In detail the attribution of the Balve layers is more difficult. Much depends on the interpretation of the underlying 'final Eem interglacial' loam layers 5 and 6, which contain the industry Balve I. These layers are weathered and must have originated under interglacial or fully interstadial conditions. Yet they contain many remnants of cave bear, which suggest cold winters. The top layer (5) contains more coarse chalk debris; bones of the woolly rhinoceros were identified in

Sedimente	Faunen	alte Schicht-bezeichnungen	Zeitstellung	Fundverbände
im 19. Jahrhundert zerstört		·	jüngeres Holozän	·
		Sinterschicht	Atlantikum	
		Rentierschicht	(älteres Holozän) Jungwürm - kalt-arides Mittelwürm	·
hellgelber, einarmer Lehm	u.a. Hirsch, Wildschwein	Rollschicht oder Bärenschicht	ozean. Mittelwürm-Interstadial	·
braungelber, mittelsteiniger Lehm	(Eis-?) Fuchs, wollhaariges Nashorn, Ren, Hirsch, Mammut	Mammutschicht	Interstadial Ende Altwürm	Balve IVa-b
mittelgrober bis grobstückiger Kalkschutt	·		kalt-arides Altwürm	·
nsteinige Lehme	Höhlenbär, -Löwe, Wildpferd, woll-haariges Nashorn, Ren, Riesenhirsch, Mammut		ozean. Altwürm	Balve IIIa-b
graugelber mittelsteiniger Lehm	Höhlenbär, Wolf, Wildpferd, Riesen-hirsch, Mammut		ozean. Altwürm	Balve II
braune, einarme Lehme	(wollhaariges Nashorn) Höhlenbär	·	Ende Eem-Interglazial	Balve I
Erosion			Eem-Interglazial	·
mittelgrober bis grobstückiger Kalkschutt in 4 Schichten	Höhlenbär, Wolf, Hirsch, Elephas sp.	·	Riß-Glazial	·
vischenschichten	Höhlenbär	·	nicht datierbar	·
Basistone	·	·	nicht datierbar	·
Felsboden				

TABLE 6. Summary table of the succession of layers and industries in the Balve cave (from Günther, 1964)

it. The best correlation for these layers would be found in the Early Glacial Amersfoort/Brørup interstadials and the following Lower Pleniglacial. The Balve II horizon with its coarser stones could fall in the Lower Pleniglacial cold stage between the Brørup and Moershoofd interstadials. Balve III would fall in the Moershoofd interstadial. Günther distinguishes two industries Balve IIIa and IIIb, which on typological grounds would succeed each other. They were collected in different parts of the cave. The long duration of the Moershoofd interstadial would easily provide room for two successive stages.

By and large, the correspondence of the Balve sequence with the climatic curve of the Netherlands is quite satisfactory, so that comparison of the Hogersmilde material with the Balve assemblages should be promising.

Lebenstedt

Lebenstedt (Tode *et al.* 1953) is an open air station, found at a depth of 7 meters. It is situated at the same latitude as the Netherlands, on the edge of the North-German plain. On the basis of geological, palaeobotanical and palaeontological evidence the culture layer belongs to an early stage of the last glaciation, before its cold maximum. It consists of river sand with small depressions filled with humus or thin peat layers with a tundra flora. The identified bones belong mainly to reindeer (72%), mammouth (14%), bison (5.4%), horse (4.6%) and rhinoceros (2%). The culture deposit is heavily cryoturbated and covered by sand deposits containing plant remains.

There is no possibility for direct correlation of the geological sequence with the standard profile from the Netherlands, but a radiocarbon date was obtained from peat material which generally is reliable (after isotopic enrichment: GrN-2083: 55600 ± 900). In comparision with the dates obtained from the Brørup interstadial, this suggests an age at the beginning of the Lower Pleniglacial.

The affinity of the Balve I and the Lebenstedt industries, on which both Günther and Bosinski agree, confirms the suggested equation of the Balve sequence with the climatic curve. The further importance of the Lebenstedt site is, of course, the richness in ecological data, which for open air sites of this age, is very rare. It is to be regretted that the flint industry (c. 2000 pieces of which 200 are tools) has never been completely published.

The loess sequence in the Paris basin

For our purpose it would be important to know the position of the loess sequence in the Paris basin (Bordes, 1954a) with regard to the climatic curve of the Netherlands. There are three ways of doing this. One means is by studying the transition

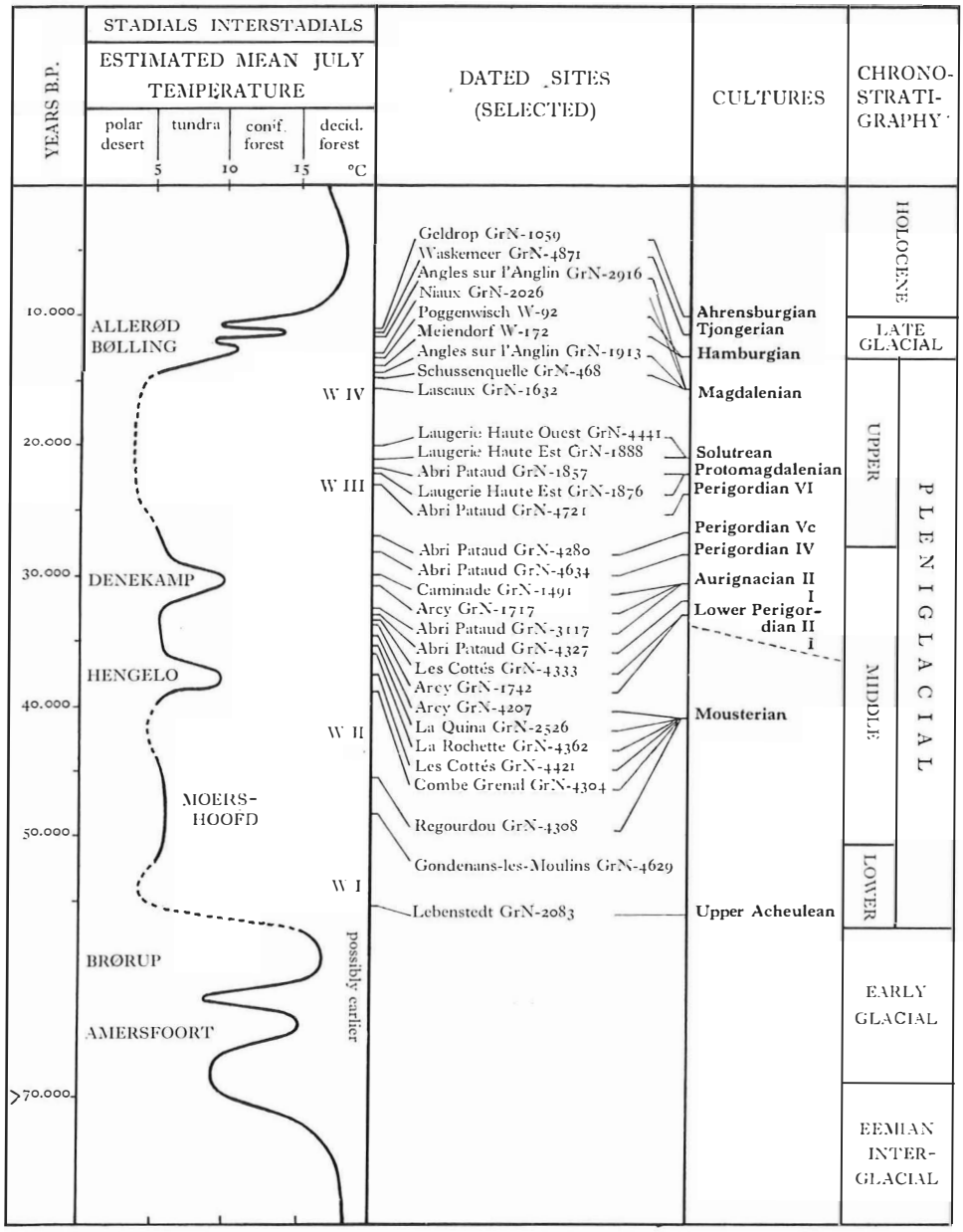


Fig. 19 Climatic curve of the Netherlands (after Van der Hammen *et al.* revised), with C14-dated Middle and Upper Palaeolithic sites in Western Europe.

of the lithostratigraphy of the coversand zone into that of the loess zone. This has been done by Zagwijn and Paepe (1968) for Belgium. Comparison of the Belgian and French loess stratigraphies would then give the wanted correlation.

The second means is by using the absolute dates for cultural remains embedded in the loess. In absence of good dates from sites in the loess area itself, one might use radiocarbon dates for comparable industries obtained in other areas, e.g. the Dordogne. In that case one would use established archaeological sequences as frame of reference.

A third possibility is the morphological comparison of loess stratigraphies in central European areas with that of the Paris basin, using the absolute dates obtained on humic materials from soil profiles in those areas. In this case the basic assumption would be that the main development of loess deposition would be broadly synchronous in both areas.

For various reasons, however, none of the three procedures gives quite satisfactory results and they are often seemingly contradictory.

1. Zagwijn and Paepe base their correlation mainly on two soil profiles that can equally well be distinguished in the loess zone, in the transition zone, and in the coversand zone. At the base of the late pleistocene sequence it is the Eem interglacial Rocourt soil, and in the middle of the sequence it is the Kesselt/Zelzate soil, which on the basis of radiocarbon dates would have formed in the Denekamp interstadial. In between, the authors distinguish two main stratigraphical bodies which are separated by a zone of small frost wedges or a desert pavement; which they place in the Lower Pleniglacial on the basis of pollen and C14 dates from underlying and overlying soils and peats. In the upper body (*torfige Lehmschichten*) two coversand layers, seperated by the Hoboken soil of Hengelo interstadial age, are correlated with two loess deposits. A soil profile, the Poperinge soil, forms the basis of the sequence in the transitional zone, but has so far not been found in the Belgian loess area. It belongs to the Moershoofd interstadial.

In the lower body (*Lehme und Grobsande*), a soil profile, the Warneton soil, has been identified as being of Amersfoort interstadial age. It occurs in the transitional zone; the stratigraphic equivalent of the Early Glacial in the loess area is a sequence consisting of sand and gravel, followed by a grey loam deposit with a steppe soil on top.

The evident correlation with the Paris basin standard sequence would be as follows:

W II/III	: Kesselt/Zelzate soil	: Denekamp interstadial
W II	: loess	

W I/II	: Hoboken soil	: Hengelo interstadial
W Ib	: loess	
W Ia (*paléosol*)	: Poperinge soil	: Moershoofd interstadial
*caillouti*s	: desert pavement and frost wedges	: Lower Pleniglacial
fendillé remanié	: loam	
*caillouti*s	: sand and gravel	: Early glacial
fendillé	: Rocourt soil	: Eem interglacial

We shall have to come back to this correlation, in view of some resulting archaeological difficulties. Weak points are the correlation of the *Paléosol* for which both the Warneton and the Poperinge soils might be equivalents and the W II/III interstadial, for which a correlation with the Denekamp and the Hengelo interstadials together has been suggested as a possibility (Vogel & Van der Hammen, 1967).

2. The correlation of the loess sequence in the Paris basin with the climatic curve of the Netherlands through the intermediate of the embedded cultural remains and their absolute dates has been discussed separately (Waterbolk, 1972). A major problem is caused by some uncertainties in the position of the industries with regard to the standard sequence.

A final Mousterian occurs together with a Perigordian I in the W II/III interstadial (Goderville), at the base of the W II loess an upper Mousterian occurs with few handaxes comparable to that of layer J of Le Moustier. At the base of the W I loess and in the *paléosol* at least four different industries have been found. Most frequent is the Mousterian of Acheulean Tradition with many handaxes, but at this level also a late Micoquian, which typologically would be earlier, a *Mousterien typique* (type le Moustier J) and a *Mousterien denticulé* (ttype Belcayre) occur. The *fendillé remanié* and its basal gravel only contain Micoquian industries.

Radiocarbon dates from the Dordogne (Arcy, La Quina, La Rochette) suggest that the final Mousterian is to be placed in the cold period between Hengelo and Denekamp. At Combe Grenal, a date of 39000 ± 1500 for a *Mousterien denticulé* was obtained from a level (no. 12) just before a period with a somewhat milder fauna, which apparently corresponds to the Hengelo interstadial (GrN-4304).

In view of the typologically advanced character of the Goderville industries, there can be no objection against correlating the W II/III soil in the Paris Basin with its final Mousterian, with the Denekamp interstadial nor against a correlation of the W I/II soil with the Hengelo interstadial. But one could also advocate a correlation of the W II/III interstadial with both Denekamp and Hengelo. In that case the W I/II loess soil would correspond to Moershoofd.

Deeper in the Mousterian sequence at Combe Grenal a soil profile is present which on the base of a date obtained from a sample just below this soil in a parallel sequence at Regourdou (Bonifay, 1964) (GrN-4308: 45500 ± 1800) is probably the equivalent of the Moershoofd interstadial (see below). In any case, it is older than Hengelo. No direct dates are as yet available for the Mousterian of Acheulean Tradition (type A, with many handaxes), but assemblages of this type are reported by Bordes (1954b) to occur both directly above the interstadial (Pech de l'Azé) and just below it (Combe Capelle Bas and possibly Combe Capelle Haut and Le Moustier layer G).

Since in the Paris Basin the Mousterian of Acheulean tradition (with many handaxes) occurs always below the younger loess, the deposition of the latter can only have started after the Moershoofd interstadial. Thus the first of the two alternatives discussed above, would appear to be preferable, as long as the Mousterian of Acheulean Tradition remains absent from deeper levels in the Dordogne caves.

Even if we cannot exclude the possibility of earlier occurrence of this Mousterian variety we prefer the first alternative, because a late start of the younger loess deposition would give us a long period for the formation of the *Paléosol* and thus a simple explanation for the great variety of industries encountered in it.

3. Vogel and Van der Hammen (1967) have convincingly argued that the end of the Paudorf soil profile in the Central European loess corresponds to the end of the Denekamp interstadial. Its beginning cannot be determined; it might fall in the Hengelo interstadial. Locally, two weak soils are present in Germany. In such cases loess deposition might have taken place in between both interstadials.

The beginning of the younger loess formation in Central Europe depends on the date of the underlying soil profiles. At Dolni Vestonice humus from the upper part of the Stillfried A complex has a date of more than 51800 years (GrN-2599). This is, of course, only a *terminus post quem* for the formation of the overlying loess. Comparable dates are obtained from soil profiles at other sites in Austria and Czechoslovakia (Vogel & Zagwijn 1967). A charcoal cluster within the younger loess, just above the soil horizon at Krems gave a date of 46800 ± 1800 (GrN-3261), which, though probably still somewhat too young, would suggest a late start of the younger loess formation.

The overall agreement with the loess sequence in Western Europe is great. The suggestion presents itself that the *Paléosol* sould be comparable to the Stillfried A complex, and therefore be of at least partly Early Glacial age, and the W II/III soil should be attributed to the Denekamp interstadial. A second weak soil profile in the loess could either be of Hengelo or of Moershoofd age.

If we try to harmonize the three arguments, we find that the correlation based on lithostratigraphical studies of Paepe and Zagwijn (see above, p. 92) is quite satisfactory. It leads to the conclusion that the formation of loess in the Paris Basin did not start until after the Moershoofd interstadial. A consequence is that the W I/II interstadial in the Dordogne caves must be equated with Moershoofd, whilst the W I/II interstadial in the Paris Basin loess corresponds to Hengelo.

In our earlier paper (Waterbolk, 1972) we tried to solve the contradictory evidence from the Dordogne and the Paris Basin as to the position of the Mousterian of Acheulean tradition (type A) by disputing Bordes' attribution of some MTA culture horizons, and placing them higher in the standard sequence. In view of his critical remarks, we have changed our opinion and left his geological correlations intact. We maintain, however, our view that the Early Glacial cold periods had no appreciable effects on the stratigraphy of the caves in the Dordogne (see also next paragraph).

The Dordogne caves

In the preceding paragraph we mentioned some radio-carbon dates from Mousterian levels in the Dordogne caves. Now we shall briefly discuss the geological evidence for correlating the cave and rock shelter sequences with the climatic curve. For a much more detailed discussion we refer to Mellars (1969).

A key position is occupied by the Combe Grenal section with its 55 distinct stratigraphic levels and rich faunal remains. Following the interglacial soil two main phases are distinguished; a lower called Würm I and an upper called Würm II. Throughout Würm I reindeer is very rare. In Würm II it is dominant; only for a short phase towards the top of the section red deer, bovids and horse are more frequent.

Sedimentological and palynological data confirm the greater severity of the climate of the upper phase. In other French areas too, there is marked contrast between the lower and upper parts of Mousterian sequences. Everywhere reindeer dominance characterizes the upper (Würm II) levels.

Within the Würm I deposits at Combe Grenal palynological and granulometric data point to two periods of milder conditions. Minor oscillations also occur in the Würm II deposits.

The equation of this sequence with the climatic curve presents difficulties. Most French authors (and also Mellars) agree on the Würm I/II equation with the Brørup interstadial. We would, however, advocate a parallel with the Moershoofd interstadial, and, correspondingly, no start of cave habitation until the Early Pleniglacial. Our main arguments are the following:

1. The radiocarbon date of 39000 ± 1500 for charred bone material from Combe Grenal layer 12 is in the zone of low reindeer percentages, just before the increase of red deer near the top of the Würm II sequence. If not contaminated, this date would prove the contemporaneity of this increase with the Hengelo interstadial. The radiocarbon date of 45500 ± 1800 for charred wood from Regourdou, layer 4, is in the upper part of the Würm I sequence before the appearance of reindeer. The date suggests a contemporaneity of the Würm I/II interstadial with a late stage of the Moershoofd interstadial. The two dates confirm each other. For both of them the faunal context is compatible with the climatic curve.

2. In the Balve cave (see above, p. 88-89) reindeer appears relatively late in the sequence, in a layer with the industry Balve III, which we correlated with the Moershoofd interstadial. Above this layer there is a sterile layer with course chalk debris, pointing to cold-arid conditions, which we equated with the cold period between the Moershoofd and Hengelo interstadials. The underlying layers were deposited under more humid conditions.

There is thus a broad faunal and sedimentological agreement with the Dordogne sequence, suggesting a parallel development.

3. The arboreal/non-arboreal pollen ratio in the pollen diagram of Mlle. Packereau from Combe Grenal bears a striking resemblance to the climatic curve of the Netherlands. The two milder intervals within the Würm I sequence are indeed strongly suggestive of the Amersfoort and Brørup interstadials. Yet it is our opinion that this resemblance is deceptive. In the time of these interstadials one would of course expect milder climatic conditions in the Dordogne than in the Netherlands. This means closed deciduous woods in the warm periods and no more tundra-like conditions in the cold periods.

Neither expectations are, however, confirmed by the pollen evidence. In the cold periods we find much more pronounced tundra or steppe conditions than in the Netherlands and in the warm periods the forests are still very open, as is shown by a non-arboreal pollen percentage of 40.

Of course, the interpretation of pollen data from cave sediments is difficult because of the possible admixture with rebedded pollen from older deposits. It is, however, hardly conceivable that an admixing agent should mainly have brought "cold" pollen into the sediments; normally the effective contaminant derives from warmer deposits, which are more frequent and which contain much more pollen. Differences in degree of contamination cannot explain the anomalies either, for they are confirmed by sedimentological data.

The easiest way out of the difficulties is to consider the fluctuations to be minor ones within a generally cold period. They might even fall within the Moershoofd period, which has a considerable length and may well encompass a number of

small oscillations. After all, the Regourdou date finds its place late in this interstadial.

4. Even though we do not want to enter into the discussion of the interpretation of the various Middle Palaeolithic industries, we find it difficult to conceive of the Acheulean industry from Lebenstedt as being a contemporary of the various Mousterian inventory types occurring in the early Würm II deposits in the Dordogne. Such a proposition would be the consequence of the equation Würm I/II with the Brørup interstadial. Our correlation, however gives the industry of Lebenstedt the expected chronological priority.

Mellars discusses the position of the various Mousterian industries in the standard sequence of the Dordogne. He is inclined to give them greater chronological value than Bordes and Binford. As to the Mousterian of Acheulean tradition, he is struck by the fact that in the Combe Grenal section this inventory type only occurs near the end of Würm II. Bordes maintains that he has also found this type earlier in Würm II deposits and near the end of Würm I. The deeper occurrences all refer to the MTA type A (with many handaxes). In the Combe Grenal section only type B is present.

Among the animal bones associated with MTA industries in the Dordogne reindeer is always scarce. According to Mellars this independently points to a late date, but in view of possible earlier occurrences one should be cautious.

In any case, there is a big contrast with the faunal assemblages, that are associated with the Quina type industries. These are all very rich in reindeer remains. Industries of this type occur in Combe Grenal only in the middle part of the Würm II sequence.

Mellars also discusses the age of the MTA industries in the Paris Basin in comparison to those in the Dordogne. He finds that there is a considerable chronological gap, which he partly explains by pointing to a different character of the handaxes. Those in the Paris Basin should be relatively thin, large, and of angular forms and they should often have finely-worked butts. Such features should be rare in the Dordogne. In our view, the MTA industries in the Paris Basin might go on into the time of the Moershoofd interstadial, so that there need not be a gap of any importance (which of course does not mean that all MTA industries in that area should be of that age). In any case, there would in our opinion be no reason for speculations about remote areas where the handaxe tradition could have survived.

Conclusion

In our characterization of the flint industry of Hogersmilde we have seen, that there are no directly comparable finds in dated contexts in western and north-

western Europe. Yet various elements present in Hogersmilde are found again in other industries. They make a rough age estimate possible. Our main conclusions were that (1) there are various indications for a broad contemporaneity with the Bockstein inventory type (as present e.g. in Balve II), and to a lesser degree with the Klausennische inventory type (Balve III); (2) handaxes with continuous working edges on their butts only occur in quantity in northern France; in the upper Acheulean find complex of Allonne and in the industries representing the Mousterian of Acheulean tradition; (3) the character of the important Hogersmilde scraper group is strongly reminiscent of the La Quina-type Mousterian.

The only place in the climatic curve where according to our geological correlations these affinities could meet, is the Moershoofd interstadial.

At the same time, this is a period of tundra conditions, in which human habitation is *a priori* more probable than in the periods of polar desert which at our latitude occurred both before and after this interstadial.

The attribution of the Hogersmilde finds to the Moershoofd interstadial is corroborated by the geological evidence at the site itself, which led us to the conclusion that the habitation probably dated from an advanced period of the Last Glaciation.

Finally, our equation would confirm that the striking situation of the Hogersmilde site between two valley systems, which formed in early Last Glacial times, is by no means accidental.

In terms of absolute age, the Hogersmilde finds should date from ca. 50.000 to 45.000 years ago.

X. FINAL CONSIDERATIONS

The spectacular discoveries at Lehringen (1948-'50) (Jacob-Friesen 1956), and particularly those at Lebenstedt (1952) (Tode a.o. 1953) have played the same role in prehistoric research as the Meiendorf excavations of Alfred Rust did in the early thirties of this century. These cases proved the presence of Palaeolithic cultures in the lowlands north of the *Mittelgebirge* which up to the time of their discovery were, but for a few isolated finds, only known from more southerly regions. Due to the special geological conditions, favouring the preservation of plant and animal remains, these finds provided an even more convincing picture of the mode of life and environment of the Palaeolithic hunters than had been the case in the southern caves. At the same time both amateur and professional archaeologists in these northern areas were stimulated to pay more attention to possible finds of the same kind in their region.

The number of Middle Palaeolithic finds has indeed increased considerably

in the last two decades. Bohmers and Wouters summarized the Dutch finds, including the handaxe from Wijnjeterp in Friesland, in 1954. Artefacts from the Bremen area were described by Schwabedissen in 1956. Bosinski (1967) and Schwabedissen (1970) have treated all the West-German finds in recent studies.

Thus Vermaning's finds did not come unexpected. But unlike most other amateurs, he deliberately included in his field reconnaissances the boulder-clay sub-soil of former raised bogs. Not without some luck, he found the greater part of the present collection of artefacts, when he revisited a field that had been subject to deep ploughing, where he had formerly found an artefact-like object on the surface. As a systematic collector he proved the efficacy of his ideas, when he found a second site in 1967 at Hijken under nearly identical circumstances.

That a deeply ploughed ground moraine should provide a probable location for Middle Palaeolithic finds is a result of geological and pedological considerations. The find-spot of Hogersmilde is situated on a boulder-clay plateau of Saale age, between two valley systems, formed during an early stage of the Weichsel glaciation. These valleys have partly been filled up with coversands, which also cover large parts of the plateau itself. These coversands date from the Upper Pleniglacial and are thus younger than the Middle Palaeolithic. A thin layer of coarse sand is present on top of the boulder-clay; this may represent an early Weichsel deposit. The artefacts are younger than this layer. Involutions and frost cracks have caused a deplacement of the greater part of the artefacts to depths below the normal level of ploughing. These involutions probably date from an early part of the Upper Pleniglacial. That the valley systems were in existence when Palaeolithic man had his camp sites here, is quite possible. If so, we might come to a still narrower definition of the geographical circumstances, under which Middle Palaeolithic finds can be expected in our area.

One important result of Vermaning's discovery is, that the study of the Middle Palaeolithic need no longer depend on purely accidental finds, but is open for a more systematic approach. This also holds good for the adjacent parts of the *Altmorainelandschaft* in North Germany and Denmark. Of course, this does not mean that finds cannot come to light in other geological conditions, such as in valley bottoms, etc. But such situations are yet to be demonstrated, and are hardly open for systematic investigation.

The determination of the geological age of the Hogersmilde finds does not only depend on the geological observations at the site and its surroundings – and in particular on the interpretation of the thin sand layer covering the boulder-clay. It can also be arrived at independently by determining the typological affinity of the Hogersmilde assemblages with the cultural stages, whose representative sites have been dated by radiocarbon, and by comparing these radiocarbon dates with

the climatic curve of Van der Hammen *et al.* Via elaborate reasoning, we arrived at the conclusion that the Lower Pleniglacial tundra phase of ca. 50.000-45.000 B.P. (Moershoofd interstadial) was the most probable place in this sequence for the Hogersmilde finds. We assumed that the coldest periods, during which a polar desert was dominant, were unsuitable for human habitation.

If our interpretation of the geological age is right and our assumption is valid, then there is no reason why we could not expect finds in our area from other suitable periods, such as the Denekamp and Hengelo interstadials, which in France have yielded Upper Mousterian/Lower Perigordian and Aurignacian II industries respectively. This is another important result of the Hogersmilde discovery: we must be aware of the possible occurrence of still other Palaeolithic cultures.

From an analysis of the composition of the two concentrations A and B we concluded that we have to deal with two different, but contemporary assemblages of identical character. In both, unworked flakes are small in number, and in each assemblage there are many groups of artefacts that have been made from one nodule. The greater part of the artefacts must therefore have been made at only a short distance from the site, and our assemblages doubtless represent a selection of tools used for a restricted number of purposes. Quite a few handaxes, however, occur isolated; they were probably produced on an earlier occasion.

Our typological comparison with Middle Palaeolithic finds from France and Germany has led us to the conclusion that the Hogersmilde assemblages cannot be matched with any of the known Mousterian, Micoquian or Acheulean inventory types. The combination of a good number of – relatively early – handaxes with an important scraper group, comprising a strong Charentian element, seems to be quite new. There is much discussion on the meaning of the various Mousterian industry types that have been recognized by Bordes and others. Are they indicative of cultural traditions or of various functions exerted within one – or more – population groups? As long as there is so little agreement in these matters, the cultural position of Hogersmilde will be difficult to identify. But in view of the fact that on first inspection the finds from Hijken, which possibly represent a later stage of development, appear in a comparable way to combine a Charentian scraper group with an important handaxe component, we could imagine that the Hogersmilde and Hijken finds represent a specific Middle-Palaeolithic adaptation to the Nordwest-European lowland. It is clear that any future discussion of the Mousterian problem has to take into consideration the Hogersmilde and Hijken assemblages, which are more homogeneous and complete than many assemblages from the classical areas in the south.

The Hijken complex will be treated in a study by D. Stapert, in which will also be dealt with the other Middle Palaeolithic artefacts that have been found or recognized at various places in the northern part of the Netherlands since the discovery at Hogersmilde. It then will probably be easier to account for a certain number of isolated finds in Northwest-Germany, that have been incorporated by Bosinski in his Late Acheulean Lebenstedt group. It might prove possible to dissociate a number of these from the Lebenstedt group and range them with the postulated Hogersmilde and Hijken Northwest European Plain tradition.

In contrast to current opinion we definitely advocate a "short chronology" for the Middle Palaeolithic industries under discussion. We realize that many colleagues will find it difficult to accept our views, which are the consequence of giving great weight to the detailed climatic and chronological evidence obtained from the research on the Last Glacial in the Low Countries.

Proof of our correlations can only be obtained by radiocarbon dating of suitable organic materials from cultural deposits whose position in regional standard sequences is beyond doubt. This is certainly a major object for future research, particularly in the Dordogne.

If the Northwest European Plain really had a tradition or at least a type of industry of its own, represented a.o. by the Hogersmilde and Hijken find groups, then the questions as to the dating of these sites – in the Moershoofd interstadial? – and the character of the cold interval preceding this interstadial retain an extra interest. If in fact these industries are to be dated in the Moershoofd interstadial, and if this interstadial was really preceded by a cold inhospitable interval with average July temperatures below 5° centigrade, then one would have to look for the roots of such a lowland tradition in the south. But if in fact this cold interval did have a less severe character than the stage following Moershoofd, then one could not preclude the possibility that still older stages belonging to the same tradition will eventually turn up in the same area.

As to the later stages of such a tradition there can be no doubt. With the cold interval succeeding the Moershoofd interstadial, the possibilities for human sojourn at our latitude must, at least for a series of thousands of years, have come to an end. Therefore, the subsequent stages of the lowland tradition, if there really are any, can only be expected farther to the south.

NOTES

[1] We feel indebted to many of our colleagues, in the Netherlands and abroad, for help and advice. We specially remember lively discussions during the Paris Unesco Homo Sapiens conference in 1969, with the drawings of the artefacts on hand. We would like to thank in particular Prof. and Mrs. Fr. Bordes, Prof. H.-J. Müller-Beck, Dr. R. R. Newell, Prof. H. Schwabedissen, Mr. D. Stapert, Mr. P. Vermeersch.
Our gratitude is also due to the technical and administrative staff of the B.A.I. Miss M. Bierma and Miss J. C. van Dijk, Msrs. B. Kuitert, J. Klein, and H. R. Roelink helped in preparing several intermediate stages of this paper, which preceded the final version here presented.

[2] There has, however, been an occasion – a press conference – where the artefacts of both concentrations have been demonstrated before they were numbered, and where afterwards some confusion existed as to the designation of one of the objects.

[3] The combinations 25, 43, and 44, 105 have apparently resulted from the fracture of one original artefact into two pieces, and have therefore been left out of this list, which includes 96 artefacts or 73% of a total of 131.

[4] Prof. Fr. Bordes, when studying a small number of the artefacts in his laboratory at Bordeaux August 1969, was struck by the unusual aspect of the artefacts.

[5] Indications of the same character can also be found in material published by Bosinski himself, which he ranges with the Lebenstedt group. At Selm-Ternsche for instance (Bosinski, *o.c.*, pp. 37, 118; Taf. 30-31) a *biface ovalaire* (after Bordes) of thin section, and a *biface subtriangulaire plat*, both registered as *massive Faustkeil*, were allegedly found with a.o. a backed knife which, as Bosinski points out, would be typical rather of a Mousterian of Acheulean tradition. Both in type and appearance (handaxes of this flat type are not published from Lebenstedt itself) the handaxes from Selm, in our opinion, should rather be attributed to a Mousterian of Acheulean tradition than grouped with the Lebenstedt group (an alternative possibility suggested by Bosinski himself).

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APPENDIX I: FLINT GROUPS

In this appendix we shall give a description of the groups which have on p. 58-9 been distinguished within each of the concentrations. We shall restrict ourselves to some remarks on the character of the flint. Details of the technique of making artefacts and the typology have been given in the chapter on the technology-typology (p. 67-9). Further particulars are given in appendix II, where the tools will be described typologically.

Group Ae (nos. 17, 27, 119; 20; 115; 117). Grey-brown flint, non-transparant, extremely rich in fossils; structure fibrous. No cortex present. Patina heavy, ca. 2 mm thick, consisting of clearly separated white to milky brown outer layer and brown inner horizon. All objects are carefully retouched into tools: convex scraper (117), elongated point (17), convergent scrapers (20, 115, 119) and double scraper (27). None show indications of percussion, nor true negatives but for the retouches; they probably originated by simple crushing of a flint nodule. Another possibility is that the nodule occurred in the moraine in broken condition. There is no bifacially worked tool in this group. The production of convergent scrapers seems to have been the main purpose.

Group Ab, Fig. 13-14 (nos. 9, 16, 30, 74; 26, 128). Dark grey-brown to grey flint, slightly transparent, rich in small, long fossils. Surface of planes slightly irregular. Cortex white, without subcortical zonation. Patina brownish. One handaxe (9) and five thin flakes with some retouch. Only one of them (30) is classified as a scraper (*racloir simple convexe*).

Group Ac (nos. 3; 7; 22; 38; 101c; 127). Dark grey, granular, non-transparent flint with broad brown bands of iron oxide. Cortex light grey. Patination on natural planes slight and only recognizable by sheen. Edges of tools 3, 7, 22, 38 are rounded, those of 101c and 127 are not (the differences may be caused by the greater depth of occurrence: both latter artefacts have been found below the deepest level of ploughing). One bifacially worked tool (3, *blattförmiger Schaber*), five course flakes (*éclats de débitage*), one of which (22) is classified as a *racloir simple convexe*. Flakes 7 and 127 could point to core preparation.

Group Ad (nos. 11, 33). Grey-brown flint, slightly transparent in the center but becoming darker and more transparent in the zone ca. 0.1 m below the cortex. Rich in fossils. Patina orange, with slight milky sheen on the surface. *Grattoir* and *racloir convergent* on flakes. Originally these two artefacts were grouped

together with the artefacts of group Bb: inclusion in this group is not completely excluded.

Group Ae (nos. 4, 14; 15; 18; 21; 23; 40; 41; 42; 101d; 106; 118b; VIII; XI). Dark brown, transparent flint, becoming grey towards the center, poor in fossils. Cortex very thin, grey in various shades, fine grained. Planes very smooth. No patinated natural fractures present. The two largest pieces (14 and VIII) are somewhat different towards the center of the nodule. This may be due to irregularities within the nodule, but the possibility cannot completely be ruled out, that this large group does in fact comprise flakes of two closely resembling, but different nodules. There is one small, thick, triangular handaxe (VIII) with a large cortical face and a large convergent scraper (14) on a large flake. All other artefacts are small and mostly thin flakes, mostly with scraper or *raclette* retouch. Nos. 14 and 23 could point to core preparation. No. 23 is an atypical borer.

Group Af (nos. 109a, 118a; 101e; 109b; 110). Brown, transparent flint with few fossils. No cortex present. Patination on dorsal side heavy, with light brown inner and whitish outer horizon; on ventral side patina is less heavy and grey. Naturally fractured piece of flint, made into convex scraper (110), two blades, one of which has *raclette* retouch (118a), and two flakes. The small size of the flakes and blades, which were all found during our excavation, might indicate that this scraper had been made at the find spot. But the possibility of more recent, accidental origin cannot be excluded (see p. 68). A bifacially worked tool would not be found in this group.

Group Ag (nos. 12, 29; 39, 101a). Grey-brown, transparent but somewhat milky flint with few fairly large-size fossil inclusions. Planes fairly uneven. Cortex dark-grey. Patina on some planes reddish-orange, orange brown or of same colour as flint (in this case wind-polish?). One handaxe, one side scraper, one convex scraper and one endscraper.

Group Ah (nos. 31; 37). Grey, coarse flint, rich in fossils, with dark brown veins of iron oxide impregnation and broad, light brown zones adjacent to these veins. Naturally fractured planes are glossy, but not visibly patinated. Only two handaxes (but in group Aq two scrapers (nos. 28, 35) occur of a similar flint quality).

Group Ai (nos. 2; 76). Brown, transparent flint of irregular texture with few small white inclusions. Planes very irregular. Cortex thin, coarse. Natural planes unpatinated, glossy. One large piece with heavy frost weathering, worked into

a "chopping tool" (2); one thin blade. The latter was found in concentration B. Because of the size and importance of no. 2, we have included this group in the A series.

Group Aj (nos. 19; 34). Grey to grey-brown flint, fairly rich in thin, elongated fossils; a few larger white inclusions. Transparent only in the darker parts. Natural planes glossy. Cortex granular with fossils. One small handaxe, one broken-off handaxe top.

Group Ba, fig. 11-12 (nos. 48, 65, 66; 65; 85; 89; 132; XII). Dark grey to black flint with lighter large-size inclusions and few iron impregnations near the patinated surfaces. Few fossils, highly transparent, planes very smooth. Cortex white, finely granular. Patina variable, light brown with milky surface or very thin and greenish with wind polish. One handaxe (48) and 7 thin flakes, 3 of which made into scrapers (64, 66, 89); one *raclette (XII).*

Group Bb (nos. 50, 75, 95; 77). Light grey flint with coarsely granulated central part. Rich in small isodiametric fossils, transparent. Cortex fine granular, pitted. Patina greenish. Locally a bright brown iron impregnation. One handaxe (50) and three coarse flakes, one of which (95, broken) worked into a *racloir déjeté.*

Group Bc, fig. 15-16 (nos. 49, 68, 69; 70, 71; 67). Light brown to grey flint with a highly characteristic dark brown zone below the cortex. Transparency slight. Cortex granular, pitted, dark brown. No patinated planes. One handaxe (49) and five thin flakes, one of which (69) has been made to a *racloir déjeté alterne.*

Group Bd (nos. 46; 62 86; 92; 93). Light brown to grey flint with irregular impregnations of brown iron oxide, non-transparent. Patina white, locally dark grey at the surface; few fossils. One handaxe (46) and four scrapers of various types. No thin flakes present.

Group Be (nos. 45; 51; 52; 56; 57; 63; 81c). Light grey to dark grey flint with gradual or sudden transitions, bands etc. Few white inclusions. Transparency variable. Cortex white. Patina white. Tree bifacially worked tools (45, 51, 52), one point, two scrapers and one small flake.

Group Bf (nos. 47; 53). Light to dark grey flint with large light to dark brown impregnations, rich in fossils of elongated shape. One handaxe and a *disque.*

Group Bg (nos. 81a, 84). Grey brown flint, extremely rich in fossils of elongated shape. Fossiliferous cortex. One *blattförmiger Schaber* and one scraper.

Group Bh (nos. 81b, 91). Grey, non-transparent, slightly granular flint with few white inclusions. One scraper, made of a tabular piece of flint with dorsal and ventral plane showing no signs of percussion. Flake with *raclette* retouch.

Group Bi (nos. 55, 90; 101b, 103a; 72; 73; 100). Reddish dark brown to brown flint, with large, irregular blue-grey patches, which are often surrounded by orange brown iron oxide impregnations. Fairly numerous large, white inclusions. Many small fossils. Patina thin, brownish to grey, glossy. Cortex coarse, irregular One large scraper (103a), one triangular tool with surface retouch (55), three blades and two flakes. Both blades and flakes tend to have parallel sides and to be symmetrical. They may have resulted from the preparation of a core, which is absent among our finds.

Group Bj (nos. XVI, XVIII; 96; XV). Brown, very transparent flint, without fossils. Cortex very thin, dark brown, finely granular. Planes very smooth. Four flakes, of which two have some retouch.

Group Ap (nos. 6; 24; 36; 25/43; 102; 108, 112, 131). With one exception (25/43) this group consists of fairly small, naturally fractured, flat pieces of flint, resembling intentional flakes. On the dorsal side the cortex is mostly present, the patinated ventral side is flat. Four pieces (24, 36, 102, 108) have been carefully retouched to *convex scrapers*. Of these, nos. 24 and 108 have a high gloss on the ventral side, due to wind polish. No. 6 is a blade-like flake with denticulated scraper retouch. No. 25/43 is an exceptional piece, with steep scraper retouch and some secondary retouch on the breaking planes of both parts. A third part may be missing; the original piece may have been a knife.

Group Aq (nos. 5; 28; 32; 35; 101f; 107). Six flakes, two of which (28, 35) are of a flint quality much like that of group Ah. No. 32, with some retouch, is of a grey to brown flint with iron oxide veins and few fossils. No. 5 is a *convex scraper* of a blackish flint with few white inclusions. No. 101f is a very small light brown flake. No. 107 is a *grattoir* of milky grey flint without fossils.

Group Ar (nos. 13; 44/105). This group comprises the bifacially worked tools of concentration A, of which no corresponding flakes have been found. No. 13 is a beautiful handaxe of a light to dark grey flint, of which the edges are heavily worn. Handaxe 44/105 is of a dark grey transparent flint, rich in fossils, with

broad brown iron oxide impregnation veins. After breaking, the larger part has been retouched so as to remove the sharpest edges.

Group Bp (nos. 58; 59; 60; 61; 94). This group consists of naturally fractured pieces of flint of variable colour and structure. They are flake-like with cortex often being present on the dorsal side, and a patinated flat ventral plane. All the artefacts are scrapers, four of which have round working edges. No. 94 has a high wind polish gloss on all unworked planes.

Group Bq (nos. 83; 87). This group comprises two flakes, one of which (87) has no clear bulb of percussion left. No. 73 has *raclette* retouch.

Group Br (nos. 54; 82). Two small bifacially worked tools. No. 54 is a *disque* of milky grey slightly transparent flint, with reddish and brown patches and many small white inclusions, red-brown patinated planes and white cortex. No. 82 is a small *Faustkeilblatt* of grey to yellow-white non-transparent flint with many white inclusions and many small patches of iron oxide; patinated planes with irregular surface and white, glossy patina.

Group Cp (nos. V; XIX). Natural pieces of flint, worked into a *convex scraper* (V) and a borer (XIX).

Group Cq (nos. IV and XX). Two artefacts made from flakes. No. IV is a beautiful transverse scraper with retouch mainly on the ventral side, from a dark grey-brown transparent flint. No. XX is a questionable fragment.

Group Cr (nos. II; III; XVII; 133). Four small, bifacially worked tools. No. II is a beautiful Quina-type scraper of yellow-grey flint with light brown bands. No. III is a small handaxe of dark-grey, granular flint; no. XVII is a small *disque* of dark-grey flint; no. 133 is a small handaxe from a grey-brown flint with heavily patinated planes.

APPENDIX II: CATALOGUE OF FINDS

Somewhere about concentration A. Surface find by Tj. Vermaning, autumn 1964, prior to the deep-ploughing of the field.

1965/X.1. Pl. I. Pseudo-flake of Levallois-appearance. With patina and wind-polish on all fractures. No indications of human workmanship.

Concentration A, nos. 1965/X.2-8. Surface finds by Tj. Vermaning, Januar 1965, after the field had been subjected to deep-ploughing. The exact findspot of these finds within the concentration has not been recorded.

2. Flint group Ai, Pl. XVIII.
   "*Chopping tool*", only the base is shaped into a working edge, resembling that of the handaxes. Otherwise largely covered with cortex.
3. Flint group Ac, Pl. XVI.
   Bifacial scraper; basal end with round working edge resembling that of the thin handaxes. Distal end hardly worked (*blattförmiger Schaber*).
4. Flint group Ae, fitting onto 14, Pl. XXVIII.
   Pointed convergent scraper on ventral face of flake, detached from 14 (*racloir sur face plane convergent convexe-droit*).
5. Flint category Aq, Pl. XXXVI.
   Convex scraper resembling endscraper; character of fracture unclear (*pseudo-grattoir*).
6. Flint category Ap, Pl. XX.
   Scraper on natural pseudo-flake; patina on fractures (*racloir simple convexe*).
7. Flint group Ac, Pl. XLIV.
   Hard-percussion blade with marginal retouch apparently due to involution (*lame à retouche alterne mince*).
8. No artefact.

Concentration A, nos. 1965/X.9-42. Dug up by Tj. Vermaning (Jan. 1965) in the soil dislocated by the deep-plough, and that immediately below. The location of the finds has been recorded, but not their depth (find nos. A 1-34).

9. Find no. 1. Flint group Ab, fitting onto it 16, 30, 74. Pl. IV, fig. 13-14.
   Handaxe with continuous working edge in one plane, the only irregularity due to accidental extra deep flaking. Cortex on one face *(biface amygdaloïde*).
10. Find no. 2. No artefact.
11. Find no. 3. Flint group Ad, fitting onto 33. Pl. XXXVIII.
    Endscraper on hard-percussion flake, one of the sides (= no. 33) broken off,

apparently in primary working (*grattoir*).

12. Find no. 4. Flint group Ag, fitting with 29. Pl. XXVIII.
Side scraper on ventral face of hard-percussion flake (*racloir sur face plane simple convex*).

13. Find no. 5. Flint category Ar. Pl. VI.
Pointed handaxe with continuous working edge, blunt at the base. Patinated natural fractures on both faces (*biface amygdaloïde court*).

14. Find no. 6. Flint group Ae; no. 4 struck off from ventral face of this piece. Pl. XXV.
Convergent scraper, working edge continuous. Basal part ventral face flattened. Basal fracture dorsal potlid fracture. Cortex on dorsal face (*racloir convergent concave-droit*).

15. Find no. 7. Flint group Ae. Pl. XXVIII.
Transversal scraper on handaxe-type, probably soft-percussion flake. Thin, marginal retouch (*racloir transversal droit*).

16. Find no. 8. Flint group Ab, fitting with 30 and 74 onto 9. Pl. XLII, fig. 14.
Soft-percussion handaxe-flake with thin alternating retouch, probably due to involution (*èclat à retouche alterne mince*).

17. Find no. 9. Flint group Aa, 27 and 119 fitting onto this piece. Pl. XX.
Slightly asymmetric, atypical, elongated mousterian point with flattened "ventral" face, made on indeterminate blank (*pointe moustérienne allongée*).

18. Find no. 10. Flint group Ae. Pl. XL.
Soft-percussion handaxe-type flake with ripples on ventral face and thin steep retouch in notch, and, irregularly, along the edges, apparently due to involution (*éclat à retouche abrupte mince*).

19. Find no. 11. Flint group Aj. Pl. VI.
Top fragment of handaxe, fracture not worked after the break (*biface amygdaloïde ou cordiforme allongé*).

20. Find no. 12. Flint group Aa. Pl. XXIV.
Pointed convergent scraper on indeterminate blank (*racloir convergent concave-convexe*).

21. Find no. 13. Flint group Ae. Pl. XXVIII.
Transverse hollow scraper on ventral side of flake (possibly pseudo-scraper due to involution); one dorsal face fracture is part of same potlid fracture as no. 14 (*racloir sur face plane transversal concave*).

22. Find no. 14. Flint group Ac. Pl. XX.
Side scraper on piece of flint with exceedingly heavy ripples on ventral face (*racloir simple convexe*).

23. Find no. 15. Flint group Ae. Pl. XXXVIII.
A-typical borer on elongated flake from Levallois(?) core (*perçoir atypique*).

24. Find no. 16. Flint category Ap. Pl. XXX.
Thin *convex scraper* on naturally fractured blank with cortex on dorsal and strong patina on ventral face.

25. + 43. Find nos. 17 and 35. Flint category Ap. Pl. XXXIV.
Double scraper: convex scraper (pseudo end-scraper) and hollow scraper on thick elongated blank of patinated coarse-grained moraine flint (*pseudo-grattoir* and *racloir concave*).

26. Find no. 18. Flint group Ab, fitting with 128. Pl. XLII.
Blank of indeterminate origin with some alternate thin retouch, apparently due to involution (*débris*).

27. Find no. 19. Flint group Aa, fitting onto 119. Pl. XXIV.
Double scraper with one elaborate and one rudimentary working edge. Working edge not contiguous, no real point of convergence. On indeterminate piece of flint (*racloir double biconvexe*).

28. Find no. 20. Flint category Aq. Pl. XXVI.
Convergent scraper on thin flake. Contiguous thin working edges, point of convergance broken off (*racloir déjeté biconvexe*).

29. Find no. 21. Flint category Ag, fitting onto 12. Pl. XXXVIII.
Endscraper on elongated hard-percussion(?) flake. Fractures on dorsal face patinated (*grattoir*).

30. Find no. 22. Flint group Ab, fitting onto 9 with 16 and 74. Pl. XX, fig. 14.
Side scraper on dorsal face (not ventral as suggested by drawing) of flake with hinge fracture (*racloir simple convexe*).

31. Find no. 23. Flint group Ah. Pl. XIV.
Disc-shaped handaxe with continuous, twisted working edge (*biface discoïde*).

32. Find no. 24. Flint group Aq. Pl. XLII.
Soft-percussion(?) flake with steep, thin retouch, a.o. in notch, apparently due to involution. Strong ripples on ventral face (*éclat à retouche abrupte mince*).

33. Find no. 25. Flint group Ad, fitting onto 11. Pl. XXVI.
Convergent scraper on part of flake that broke in primary working (*racloir convergent convexe-droit*).

34. Find no. 26. Flint group Aj. Pl. X.
Disc-shaped handaxe with continuous working edge (*biface discoïde*).

35. Find no. 27. Flint category Aq. Pl. XXII.
Double scraper on thin, trapezoïdal flake (*racloir double droit-convexe*).

36. Find no. 28. Flint category Ap. Pl. XXX.
Convex scraper on naturally fractured blank, dorsal face with patina and cortex, ventral face entirely patinated.

37. Find no. 29. Flint group Ah. Pl. II.
Irregular asymmetric handaxe with obtuse point. Working edge continuous, in bent plane. Rudimentary third ridge from point to centre on one face (*biface sub-amygdaloïde).*
38. Find no. 30. Flint group Ac. Pl. XLIV.
Small hard-percussion flake (*éclat*).
39. Find no. 31. Flint group Ag; 101a fits on this piece. Pl. X.
Ovate handaxe with continuous working edge (*biface ovalaire*).
40. Find no. 32. Flint group Ae. Pl. XL.
Soft-percussion(?) cortical flake (*éclat*).
41. Find no. 33. Flint group Ae Pl. XL.
Probably soft-percussion flake with hinge fracture.
42. Find no. 34. Flint group Ae. Pl. XXVI.
Pointed convergent scraper, on soft-percussion flake. Striking plane crushed by the striking (*racloir déjeté double-droit*).

Concentration B, nos. 1965/X.45-77. Found by Tj. Vermaning (29 Jan. 1965) on van der Waals (27-28 January, 1965) in the loose soil, dug out by Tj. Vermaning.
43. Cf. no. 25. Pl. XXXIV.
44. Cf. no. 105. Pl. XII.

Concentration B, nos. 1965/X.45-77. Found by Tj. Vermaning (29 Jan. 1965) on top of and in the ground dislocated by the deep plough. The exact location of the finds has not been recorded.
45. Flint group Be. Pl. XVII.
Leaf-shaped handaxe – bifacial scraper (*biface passant au racloir à retouche biface*). The working edge is not carried around the distal and thickest end of the tool, which is its most carelessly worked part.
46. Flint group Bd. Pl. III.
Elongated pointed asymmetric handaxe with one flattish and one domed face, the latter with an extra hammered ridge from the point to the thickest part (*biface lancéolé ou micoquien à dos*). Top-part triangular in cross-section.
47. Flint group Bf. Pl. V.
Almond-shaped handaxe with continuous working edge in a curved plane, not twisted (*biface amygdaloïde*).
48. Flint group Ba, fitting on it 65 and 66. Pl. XI, fig. 11-12.
Ovate handaxe with continuous, twisted working edge (*biface ovalaire*).
49. Flint group Bc, fitting on it 69 and 68. Pl. VII, fig. 15-16.
Almond-shaped handaxe with one strongly curved face with cortex and one

flattish face. Continuous working edge in one plane (*biface amygdaloïde*).

50. Flint group Bb, fitting with 75 and 95. Pl. VIII-IX.
Heart-shaped handaxe. Cortex on one face (Pl. VIII), tiny patinated patch on coarse grained part of other face (Pl. IX). Continuous working edge in one plane (*biface cordiforme vrai*).

51. Flint group Be. Pl. VII.
Top-fragment of elongated handaxe; probably *biface lancéolé*, but the possibility of a *biface triangulaire* or *cordiforme allongé* cannot be excluded. Possibly broken in manufacturing process; slight retouches after the fracture.

52. Flint group Be. Pl. XV.
Leaf-shaped handaxe (*kleines Faustkeilblatt*). Top-fragment, broken in antiquity after the retouch.

53. Flint group Bf. Pl. XIX.
Disc-shaped handaxe on flake fragment; "mousterian" technique with one flat, superficially worked face and one curved, more fully worked face. Trace of ancient patina on dorsal face (*disque*).

54. Flint category Br. Pl. XI.
Disc-shaped handaxe with one strongly curved and one flattish face. Possibly made in the Levallois-technique. Continuous twisted working edge (*biface discoïde*).

55. Flint group Bi. Pl. XXXIX.
Triangular pointed indeterminate tool with unifacial surface retouch; (part of) large (natural?) flake with hinge fracture.

56. Flint group Be. Pl. XXI.
Mousterian point or pointed convergent scraper on flake fragment. Cortex on basal edge (striking platform?) (*pointe moustérienne à la limite du racloir convergent double droit*).

57. Flint group Be. Pl. XXXIX.
Pointed convergent triple scraper on hard percussion flake (*racloir déjeté double triconvex*).

58. Flint category Bp. Pl. XXXI.
Convex scraper on naturally broken piece of flint. Cortex on "dorsal" face, "ventral" face slightly hollow (potlid fracture).

59. Flint category Bp. Pl. XXXVII.
Convex scraper with almost continuous working edge. Cortex on "dorsal" face; "ventral" face hollow (potlid fracture), part of edge flattened.

60. Flint category Bp. Pl. XXXI.
Convex scraper on large, naturally broken piece of flint. Cortex on "dorsal" face; ventral face convex (potlid fracture).

61. Flint category Bp. Pl. XXXVII.
Convex scraper on naturally broken piece of flint. Cortex on "dorsal" face; "ventral" face flat and patinated.
62. Flint group Bd. Pl. XXXV.
Side scraper on heavy, hard-percussion flake (*racloir simple convex*, resembling convex scraper).
63. Flint group Be. Pl. XXIIII.
Pointed convergent scraper, possibly on fragment of very large (human-made?) flake (*racloir convergent convexe-concave*).
64. Flint group Ba. Pl. XXI.
Side scraper on thin, probably soft-percussion, handaxe flake. Patina on dorsal face (*racloir simple droit*).
65. Flint group Ba, fitting in between 48 and 66. Pl. XLI and fig.12.
Thin, probably soft-percussion, handaxe flake. Steep, thin retouch, especially along concave edges, apparently due to involution (*éclat à retouche abrupte mince*).
66. Flint group Ba, fitting on 65 and 48. Pl. XXVII and fig. 12.
Convergent craper. Working edges not contiguous, point of convergence not worked. Thin, probably soft-percussion, handaxe flake; striking point crushed (*racloir déjeté droit-convexe*).
67. Flint group Bc. Pl. XLIII.
Probably soft-percussion handaxe-flake with cortex on dorsal face and discontinuous shallow, marginal, alternate retouch, apparently due to involution (*éclat à retouche alterne mince*).
68. Flint group Bc, fitting on 69 and 49. Pl. XLIII and fig. 16.
Large, probably soft-percussion, handaxe flake, striking point crushed. Dorsal face largely covered with cortex. Irregular steep thin marginal retouch, probably due to involution (*éclat à retouche abrupte mince*).
69. Flint group Bc, fitting in between 49 and 68. Pl. XXVII and fig. 16.
Convergent scraper on thin, soft-percussion handaxe flake with ripples. Cortex on striking platform. Point of convergence not worked into a point. Third edge hollow with *retouches abruptes minces*, apparently due to cryoturbation (*racloir déjeté alterne droit-concave*).
70. Flint group Bc, fitting with 71. Pl. XLIII.
Thin, soft-percussion handaxe flake. Cortex on part of dorsal face. Concave edge with steep, thin retouch, apparently due to involution (*éclat à retouche abrupte mince*).
71. Flint group Bc, fitting with 70. Pl. XLIII.
Thin, soft-percussion handaxe flake. Cortex on part of dorsal face and on striking platform. Concave edge with steep, thin retouch, apparently due

to cryoturbation (*éclat à retouche abrupte mince*).

72. Flint group Bi. Pl. XLV.
Soft-percussion blade with steep, thin, marginal retouch on concave edge, apparently due to involution (*lame à retouche abrupte mince*).

73. Flint group Bi. Pl. XLV.
Soft-percussion flake with steep, thin, marginal retouch on concave edge, apparently due to involution (*éclat à retouche abrupte mince*).

74. Flint group Ab, fitting with 9, 16 and 30 of concentration A. Pl. XLIII, fig. 14.
Hard-percussion flake with some irregular marginal retouch, partly due to cryoturbation (*éclat de débitage*).

75. Flint group Bb, fitting with 50 and 95. Pl. XLV.
Flake with irregular marginal retouch, possibly due to cryoturbation (*éclat à retouche abrupte mince*).

76. Flint group Ai. Pl. XLIII.
Irregular soft-percussion blade (*lame*).

77. Flint group Bb. Pl. XLV.
Hard-percussion flake (*éclat de débitage*).

Concentration B, nos. 1965/X.78-79. Found by Tj. Vermaning during the investigation of the findspot by the B.A.I. on the surface of the field, in the immediate vicinity of the findspot.

78. Fragment of flint nodule with frost fractures (one patinated) and cortex. No traces of human workmanship. Burnt flint. Age of burning unknown.

79. Small fragment like no. 78.

Concentration B, nos. 1965/X.80-100. Finds recovered in the course of the investigation of the findspot by the B.A.I., from 20. Sept. to 15. Oct., 1965. Some finds have subsequently been identified as not being artefacts. Find numbers refer to the numbers given during the excavation, cf. the plan, fig. 9.

80. Find no. 2. Non-artefact.

81a. Find no. 3. Flint group Bg, fitting with 84. Pl. XXI.
Side-scraper on flake from which basal part with striking platform has been broken off (*racloir simple droit*).

81b. Find no. 3. Flint group Bh, fits with 91. Pl. XLI.
Typical soft-percussion flake with "raclette"-retouch along one of the concave edges, possibly due to cryoturbation (*raclette?*).

81c. Find no. 3. Flint group Be. Pl. XLIII.
Fragment of thin flake. Incidental steep marginal retouch possibly due to cryoturbation (*éclat à retouche abrupte mince*).

82. Find no. 4 Flint category Br. Pl. XV.
Pointed, asymmetric, triangular, leafshaped handaxe (*kleines breitdreieckiges Faustkeilblatt*).
83. Find no. 5. Flint category Bq. Pl. XXXIII.
Convex scraper on naturally broken piece of flint. "Dorsal" face frost fracture, "ventral" face, slightly convex, wind polished with patina.
84. Find no. 6. Flint group Bg, fitting with 81a. Pl. XIX.
Bifacial scraper, edge intermittently and summarily worked from either or both faces (*blattförmiger Schaber*).
85. Find no. 7. Flint group Ba (probably). Pl. XLI.
Flake with thin, crushed striking platform and strong bulbar scar; soft-percussion handaxe flake? Hinge fracture (*éclat*).
86. Find no. 8. Flint group Bd. Pl. XXVII.
Convergent scraper on flake, basal part with striking point missing. Working edge not contiguous, no worked point of convergence (*racloir déjeté droit-convex*).
87. Find no. 9. Flint category Bq. Pl. XXVII.
Pointed convergent scraper on indeterminate fragment of flint with patinated "dorsal" face (*racloir convergent double droit*).
88. Find no. 10. Non-artefact.
89. Find no. 11. Flint group Ba (probably). Pl. XXI.
Side-scraper on hard-percussion flake. Working edge intermittently and summarily retouched (*racloir simple droit*).
90. Find no. 12. Flint group Bi, fitting with 55. Pl. XLV.
Fragment of blade (*éclat*).
91. Find no. 13. Flint group Bh, fitting to 81b. Pl. XXXI.
Convex scraper on tabular piece of flint of indeterminate character. Irregular working edge, "ventral" face hollow.
92. Find no. 14. Flint group Bd. Pl. XXXIX.
Endscraper, concave scraper and point on heavy, hard-percussion flake (*grattoir-racloir simple concave*).
93. Find no. 15. Flint group Bd. Pl. XXXIII.
Convex scraper on large indeterminate piece of flint.
94. Find no. 16. Flint category Bp. Pl. XXI.
Scraper with two straight contiguous working edges converging under obtuse angle; worked point at end of one scraper edge. Naturally broken piece of flint with glossy patinated faces (*racloir simple droit passant au racloir convergent*).
95. Find no. 17. Flint group Bb, fitting to 50 and 95. Pl. XXIX.
Heavy double scraper with continuous working edge and rounded point of

convergence. Broken into two pieces prior to excavation (*racloir déjeté double droit*).

96. Find no. 18. Flint group Bj. Pl. XLI.
Thin soft-percussion flake with some steep, thin, marginal retouch, apparently due to cryoturbation (*éclat à retouche abrupte mince*).

97.-99. Find nos. 19-21a Non-artefacts.

100. Find no. 22. Flint group Bi. Pl. XLV.
Irregular blade with steep, thin, marginal retouch, apparently due to cryoturbation/involution (*lame à retouche abrupte mince*).

Concentration A, nos. 1965/X.101-131. Finds recovered in the course of the investigation of the site by the B.A.I., from 20. Sept. to 15. October, 1965. Some finds have subsequently been identified as not being artefacts. Find numbers refer to the number given during the excavation, cf. the plan, fig. 7.

101a-f. Find no. 36.
a. Flint group A, fitting on to 39. Pl. XXXII.
Convex scraper; ventral face of scraper is patinated, dorsal face fitting onto handaxe 39.
b. Flint group Bi, fitting onto 103a. Pl. XLIV.
Fragment (ca. half) of flake, broken lengthwise over the point of percussion (*éclat*).
c. Flint group Ac. Pl. XLIV.
Cortical flake (*éclat*).
d. Flint group Ae. Pl. XL.
Thin, soft-percussion handaxe flake with thin, steep retouch along hollow part edge, probably due to involution (*éclat à retouche abrupte mince*).
e. Flint group Af. Pl. XL.
Small flake (*éclat*).
f. Flint category Aq. Pl. XLII.
Very small and thin flake with sharp, irregular edges; possibly recent (result from trampling in soaked pit, Jan. 1965?).

102. Find no. 37. Flint category Ap. Pl. XXXII.
Discoïd *convex scraper* on potlid.

103(a?). Find no. 38. Flint group Bi, fitting with 101b. Pl. XXII.
Sidescraper on heavy hard-percussion flake (*racloir simple concave-convexe*).

104. Find no. 39. Non-artefact.

105. Find no. 40. Cf. also no. 44. Flint category Ar. Pl. XII.
Ovate handaxe, which was completed before it broke into the two pieces

44 and 105. Continuous, slightly twisted working edge. Edge of fracture of 105 worked after the break (*biface ovalaire*).

106. Find no. 41. Flint group Ae. Pl. XXVIII.
Transversal scraper with very thin working edge on cortical flake (*racloir transversal droit*).

107. Find no. 42. Flint category Aq. Pl. XXXIV.
Endscraper on basal part of ventral face of hinge-fracture flake (*grattoir sur face plane*).

108. Find no. 43. Flint category Ap. Pl. XXXVI.
Convex scraper shaped as endscraper on naturally fractured piece of moraine flint, with cortex on "dorsal" face and patina on "ventral" face (*pseudo-grattoir*).

109a-b. Find no. 44. Flint group Af, 109a fitting onto 118a Pl. XL.
Two small mini-blades with sharp edges, possibly recent (due to trampling in soaked pit, Jan. 1965?).

110. Find no. 45. Flint group Af. Pl. XXXVI.
Convex scraper shaped as endscraper, "ventral" face patinated (*pseudo-grattoir*).

111.-114. Find no. 46-49. Non-artefacts.

115. Find no. 50. Flint group Aa. Pl. XXV.
Pointed convergent scraper on indeterminate piece of flint (*racloir convergent concave-droit sur débris*).

116. Find no. 51. Non-artefact.

117. Find no. 52. Flint group Aa. Pl. XXXVI.
Convex scraper. Character of fractures on ventral face not clear. Fractures of dorsal face with patina.

118a. Find no. 53. Flint group Af. Pl. XL.
Mini-flake with very sharp edge, possibly recent (due to trampling in soaked pit, Jan. 1965?).

118b. Find no. 53. Flint group Ae. Pl. XXVIII.
Transverse scraper on small (hard-percussion?) cortical flake (*racloir transversal convexe*).

119. Find no. 54. Flint group Aa, fitting onto 17 and underneath 27. Pl. XXV.
Pointed convergent scraper on indeterminate piece of flint (*racloir convergent biconvexe sur débris*).

120.-126. Find nos. 55-61. Non-artefacts.

127. Find no. 62. Flint group Ac. Pl. XLIV.
(Levallois-core preparation?) flake with steep retouch along the edge, possibly due to involution (*éclat à retouche abrupte mince*).

128. Find no. 63. Flint group Ab, fitting onto 26. Pl. XLII. Flake (*éclat*).

129.-130. Find no. 64-65. Non-artefacts.

131. Find no. 66. Flint category Ap. Pl. XXX.
Convex scraper on naturally fractured piece of moraine-flint; "dorsal" face patinated, "ventral" face with cortex. Side opposite working edge backed.

Concentration unknown, 1965/X.132-133. Selected after the excavation from a large amount of naturally broken pieces of moraine-flint, collected at both sites during the excavation.

132. Flint category Ba. Pl. XLII.
Small flake; possibly soft-percussion handaxe flake (*éclat*).

133. Flint category Cr. Pl. XI.
Small, irregularly shaped pointed handaxe with lozenge-shaped cross-section. One hollow edge. Working edge not continuous (*biface micoquien*; *Fäustel mit ausgezogener Spitze*).

Concentration unknown, 1966/VI.1-20. Collected by Tj. Vermaning on various occassions as surface finds on the field of concentrations A and B in the winter of 1965-1966, subsequent to the excavation, and after the field had been subjected to ploughing at normal depth. Locations were not recorded, but some of the finds could be allotted to one of the concentration A or B on the basis of the flint groups to which they belong. Of the total number of these finds, 20 have been purchased by the Assen Museum as at all probability representing artefacts. After closer inspection seven pieces were discarded as not being artefacts after all. For the sake of convenience, the finds of this series are referred to throughout this study as nos. I-XX.

I. Non-artefacts.

II. Flint category Cr. Pl. XVII.
Bifacial scraper. Probably made on naturally fractured piece of moraine-flint (patinated fractures on both faces and on flat side opposite working edge). Finer, marginal retouch only on one face. Flint fine grained, not translucent, yellowish with lighter and darker bands (*racloir à retouche biface type Quina*).

III. Flint category Cr. Pl. XIII.
Disc-shaped handaxe. Twisted edge damaged during fabrication, when apparently too large a piece of flint sprang off; otherwise the now slightly pointed handaxe would have been of more regular, rounded shape. Made on naturally broken piece of moraine-flint: cortex and patinated patches preserved on both faces. Grey granular flint, not translucent (*biface discoïde*).

IV. Flint category Cq. Pl. XXIX.
Pointed transverse scraper on ventral face of (thin, probably hard-percussion) flake, with very shallow alternate retouch along second edge. Grey glassy flint, translucent, without inclusions (*racloir sur face plane transversal convexe*).

V. Flint category Cp. Pl. XXXV.
Double *convex scraper* on naturally broken piece of moraine-flint with cortex on "dorsal" and patina on irregular "ventral" face. Ridge on "ventral" face flattened. Slightly granular, not translucent, grey flint.

VI-VII. Non-artefacts.

VIII. Flint group Ae (and, therefore, with XI apparently originating from concentration A). Pl. XIV.
Thick, triangular handaxe of unfinished appearance. One face with cortex, summarily worked, strongly curved; the second face more level, totally worked. Only the basal edge worked from both faces (*biface triangulaire*).

IX-X. Non-artefacts.

XI. Flint group Ae (cf. VIII). Pl. XL.
Very thin soft-percussion flake (*éclat*).

XII. Flint group Ba (and therefore, probably, found near concentration B). Pl. XLI.
Flake with ripples near distal end of ventral face. Very shallow retouch along the edge, possibly due to involution (*pseudo-raclette*).

XIII-XIV. Non-artefacts

XV. Flint group Bj. Pl. XLI. Small flake, striking ridge damaged (*éclat*).

XVI. Flint group Bj, fitting onto XVIII (apparently found near concentration B). Pl. XLI.
Irregular, thin cortical flake. Very shallow, irregular retouch along concave edge, probably due to involution (*pseudo-raclette*).

XVII. Flint category Cr. Pl. XVIII.
Disc-shaped bifacial scraper. Cortex on curved, "dorsal", face; patinated older fracture patches on "ventral" face (potlid?) (*disque*).

XVIII. Flint group Bj, fitting onto XVI (apparently found near concentration B). Pl. XLI.
Small flake with steep retouch along one edge, possibly due to involution (*éclat à retouche abrupte mince*).

XIX. Flint category Cp. Pl. XXXIX.
Borer on either human-made or unpatinated, natural piece of flint (*perçoir atypique sur débris*).

XX. Flint category Cq. Pl. XL. Questionable fragment (*débris*).

Introduction to the Plates

All drawings are in the scale 1 : 1.

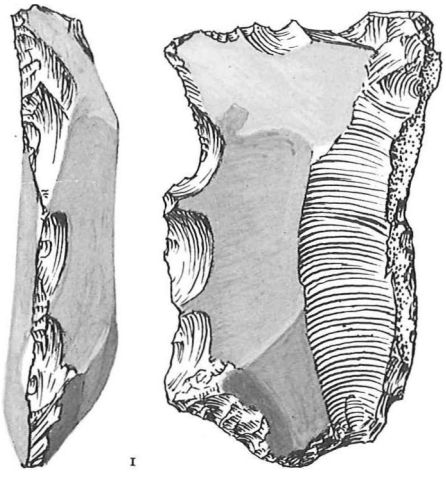
The artefacts found at concentration A are presented on the even-numbered, left-side plates (with the exception of Pl. VIII), and on Pl. XXV.

The artefacts found at concentration B are presented on the uneven-numbered, right-side plates (with the exception of Pl. I and XXV), and on Pl. VIII.

The artefacts of group C (concentration unknown) may be found on both left-side and right-side plates. Those which appeared to belong to concentration A flint groups are presented on left-side even-numbered plates; those of concentration B flint groups on the uneven-numbered right-side plates.

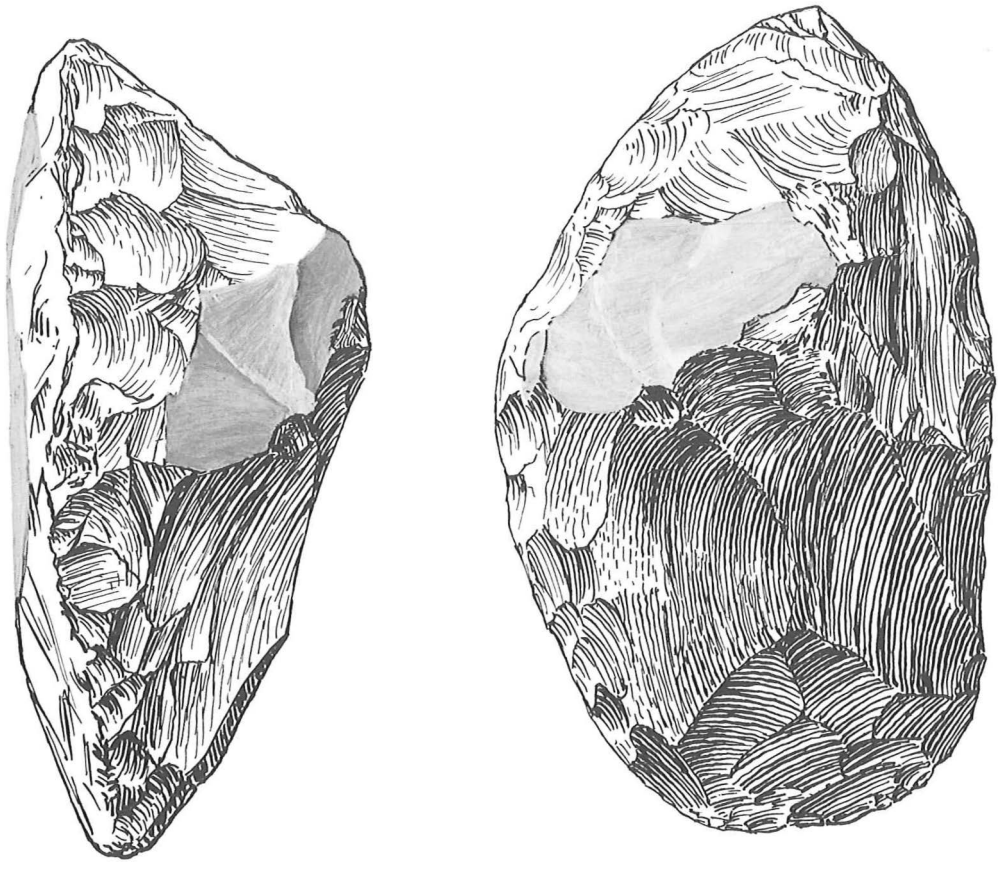
In the drawings, the following symbols have been used:
hatched fractures indicate flaking fractures;
pointillé surfaces indicate cortex;
shaded fractures indicate old natural fractures (either patinated or wind polished, or identifiable as potlid-fractures).

Cross-sections of flakes are, when possible, taken over the point of percussion in the striking direction, so that the short lines indicating the position of the sections also indicate the striking direction. Dots indicate the striking point; when the dot is placed in between the short line just mentioned and the artefact, this point is still present; when the dot is placed behind this short line, the striking point is either broken off or has been removed by subsequent working, in these cases the dot is only indicative of the direction from which the blow came.

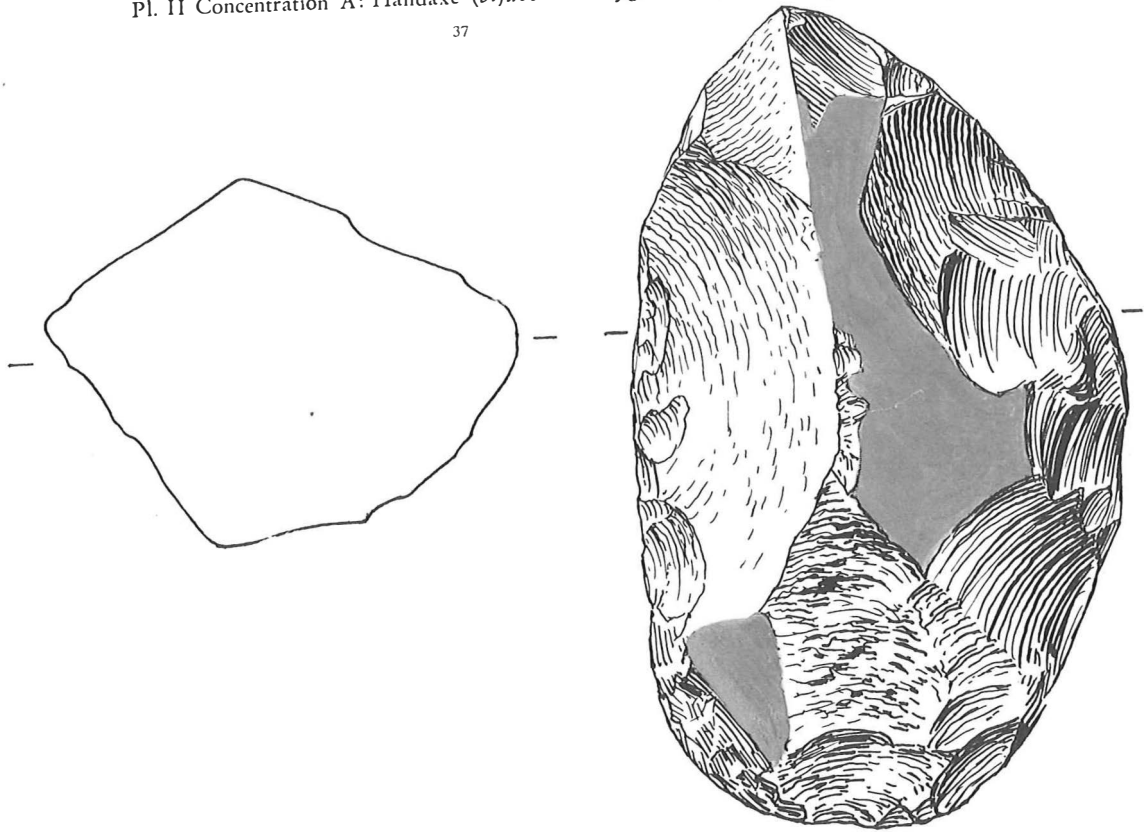


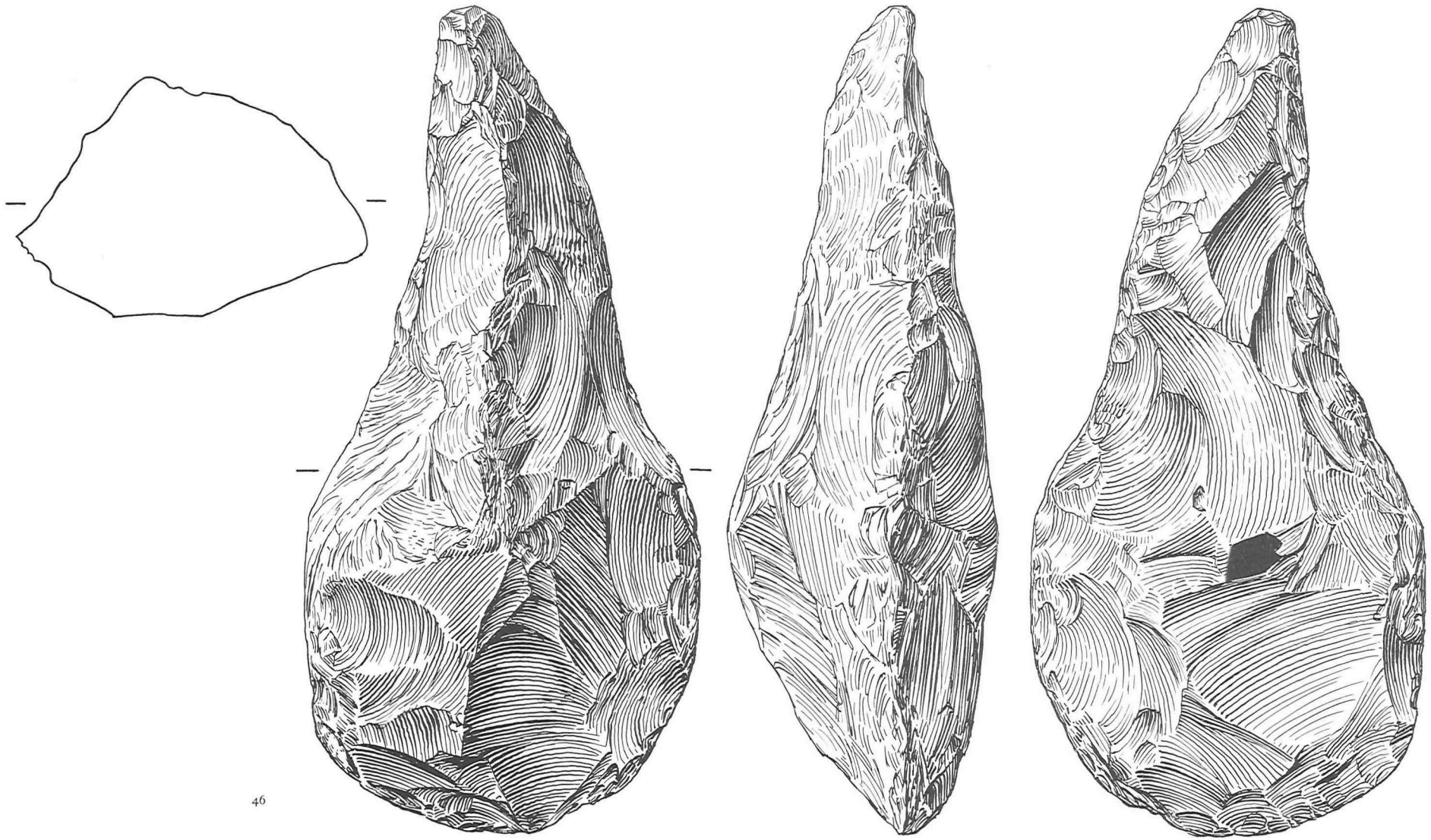
Pl. I Pseudo Levallois-flake.

II



Pl. II Concentration A: Handaxe (*biface sub-amygdaloïde*).

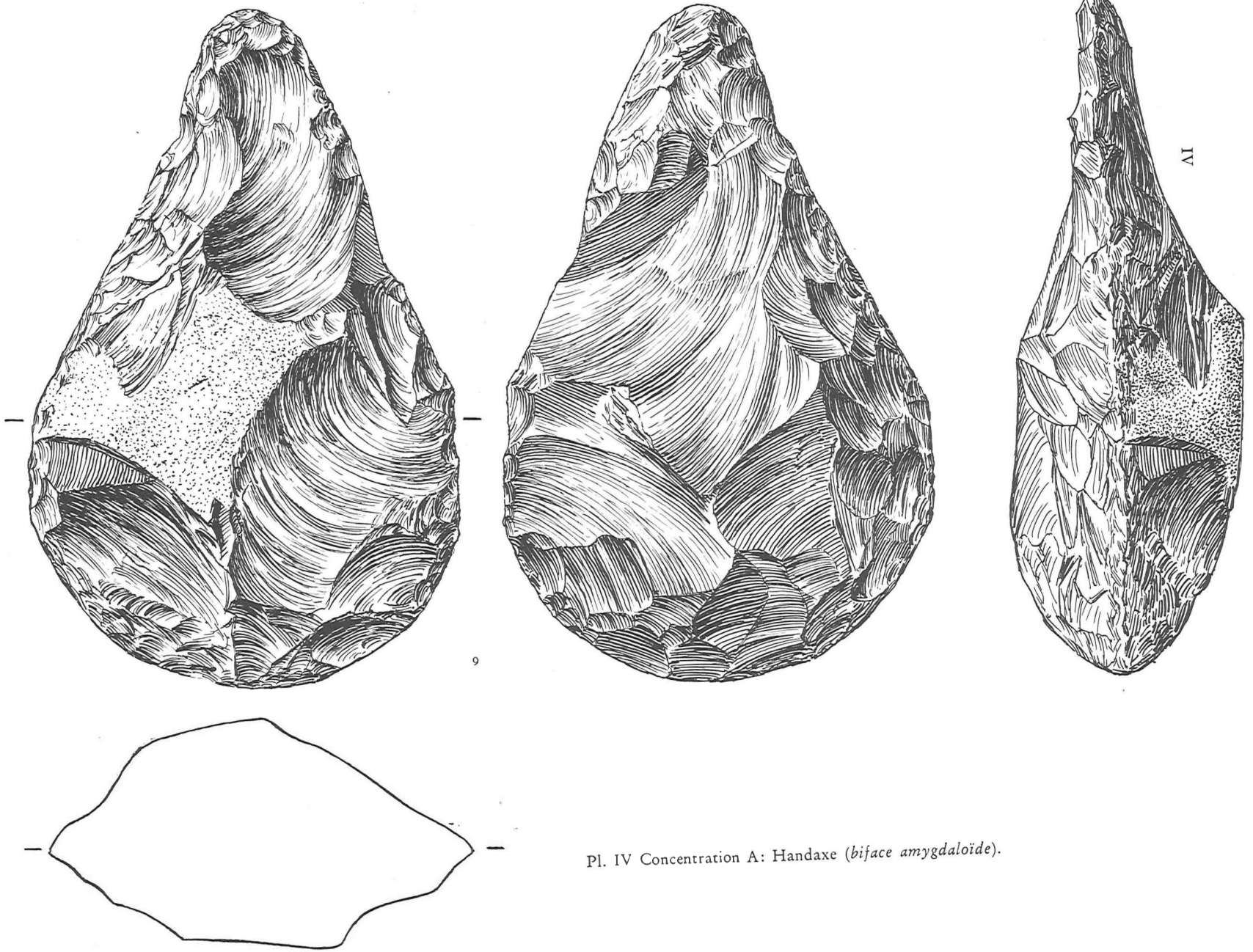




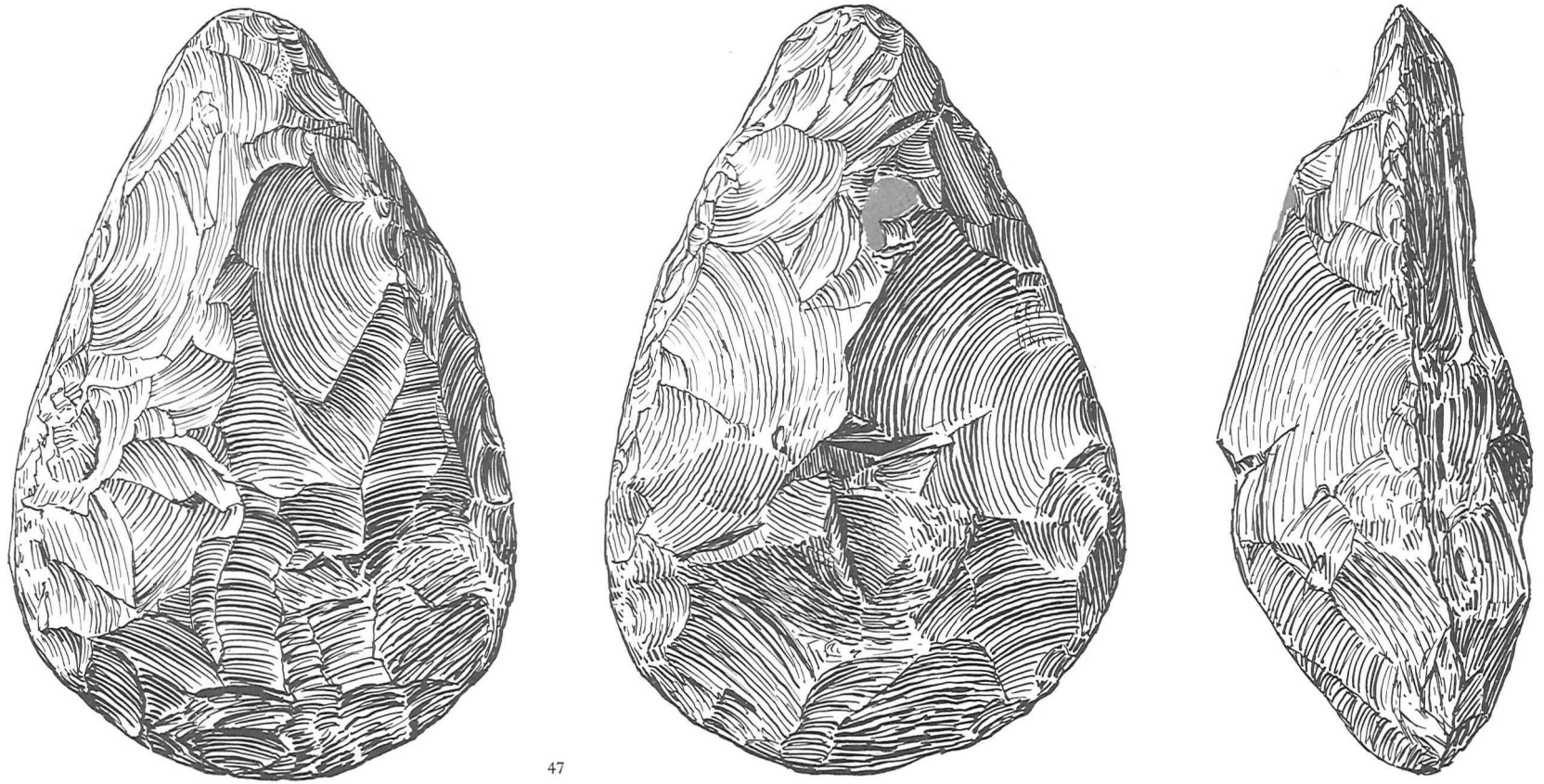
46

Pl. III Concentration B: Handaxe (*biface à dos micoquien*).

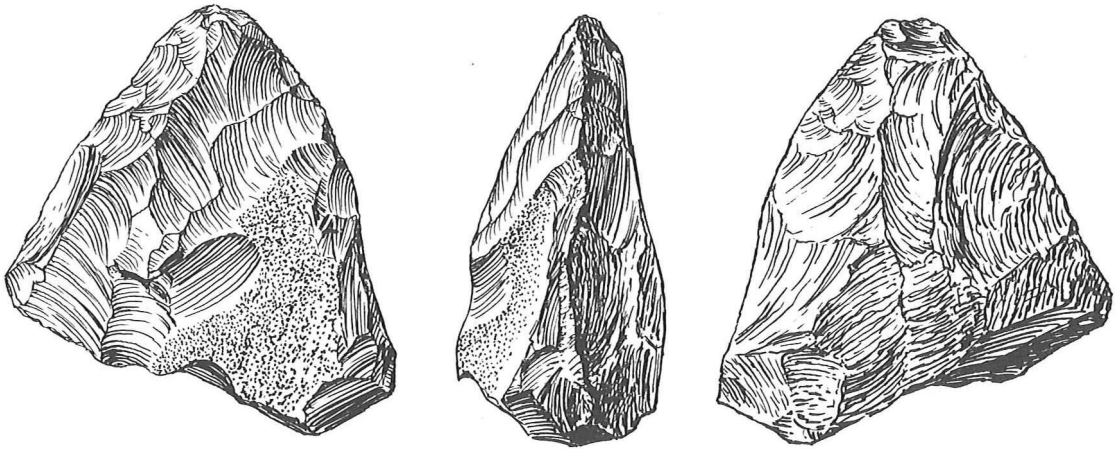
III



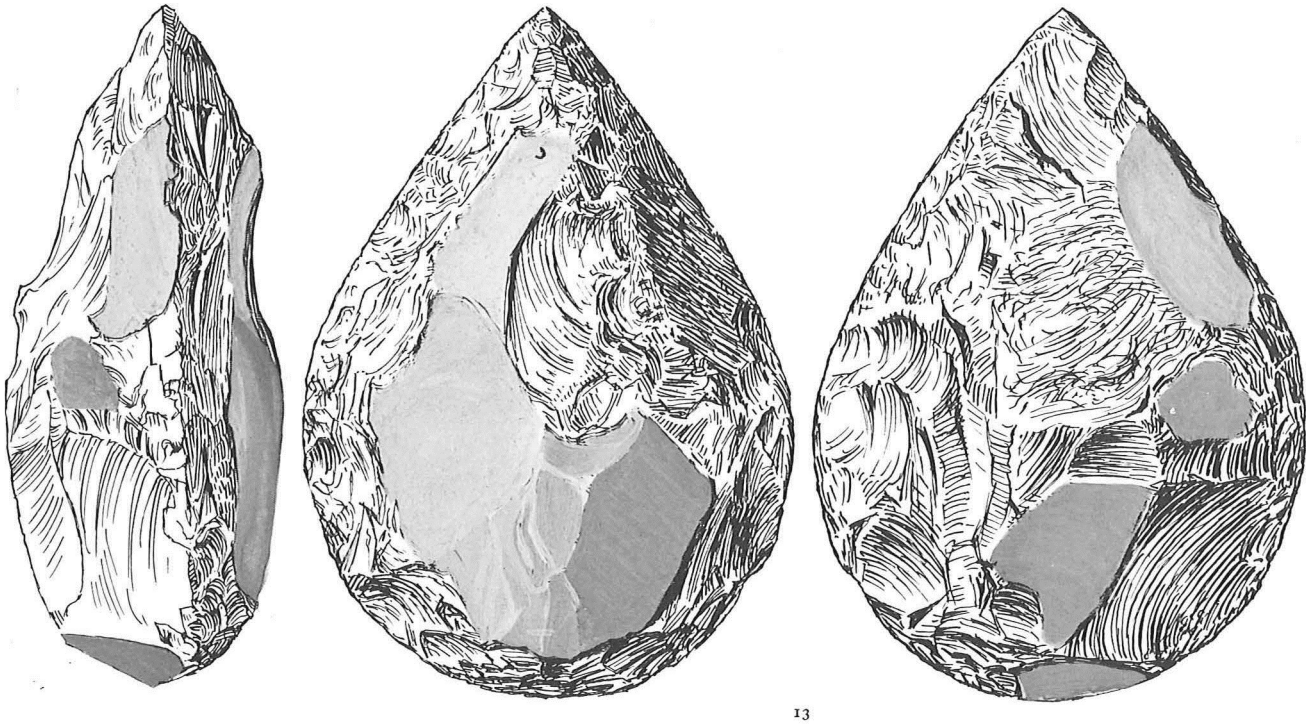
Pl. IV Concentration A: Handaxe (*biface amygdaloïde*).



Pl. V Concentration B: Handaxe (*biface amygdaloïde*).

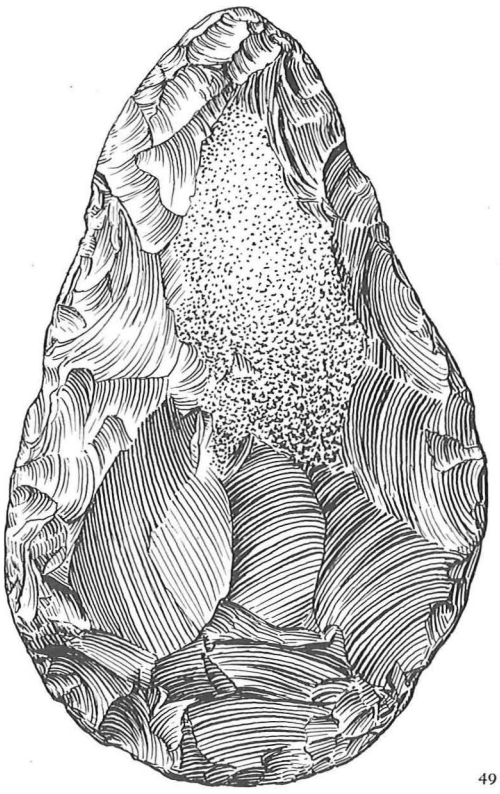


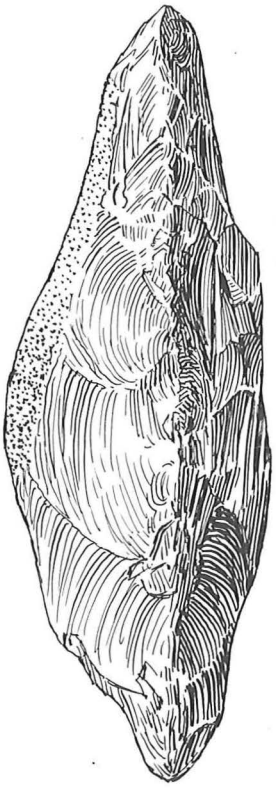
19

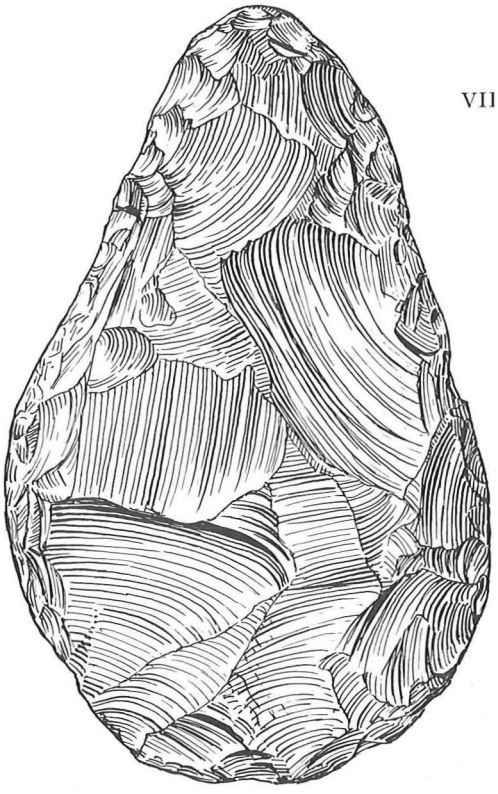


13

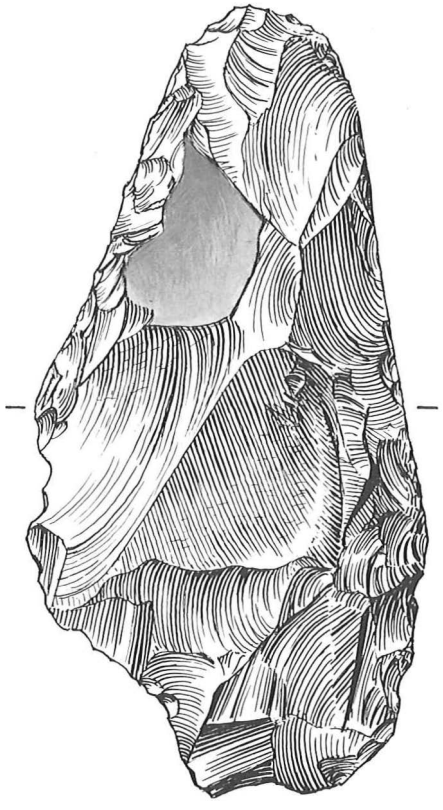
Pl. VI Concentration A: Topfragment of handaxe and handaxe (19: *biface amygdaloïde ou cordiforme allongé*; 13: *biface amygdaloïde court*)



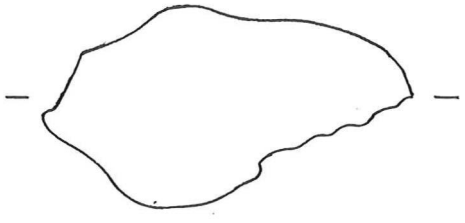




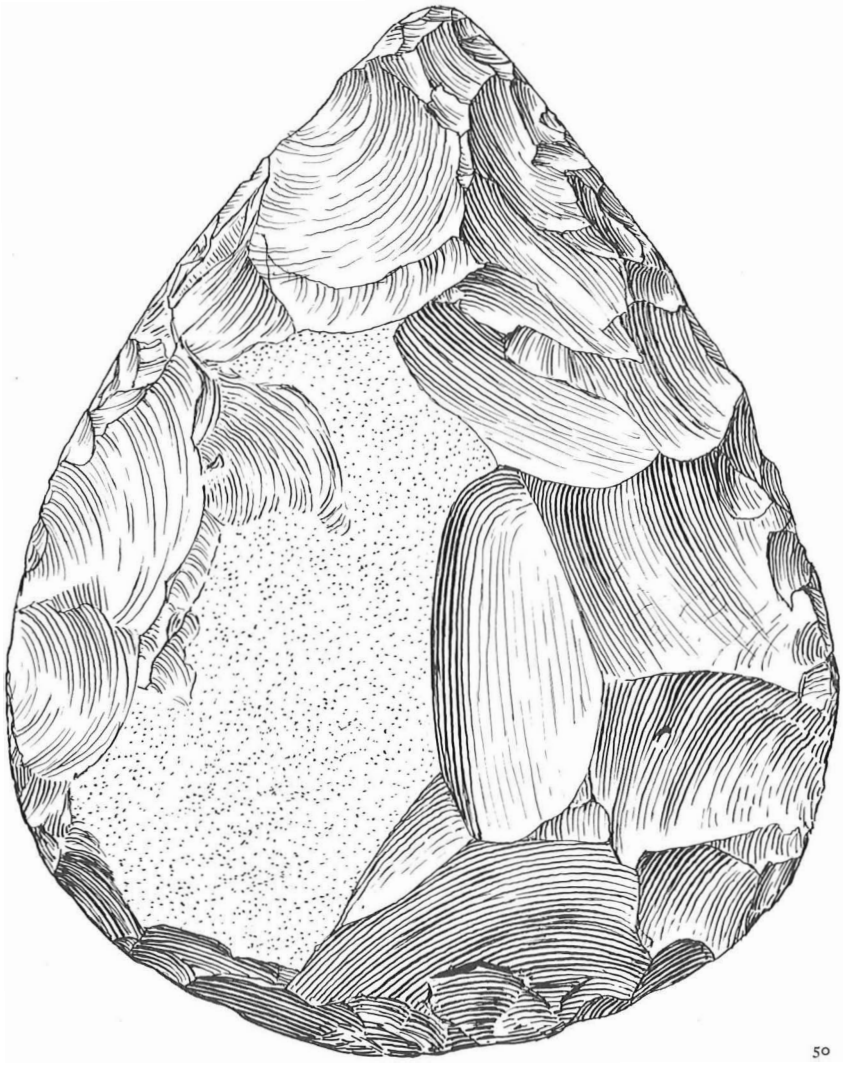
49



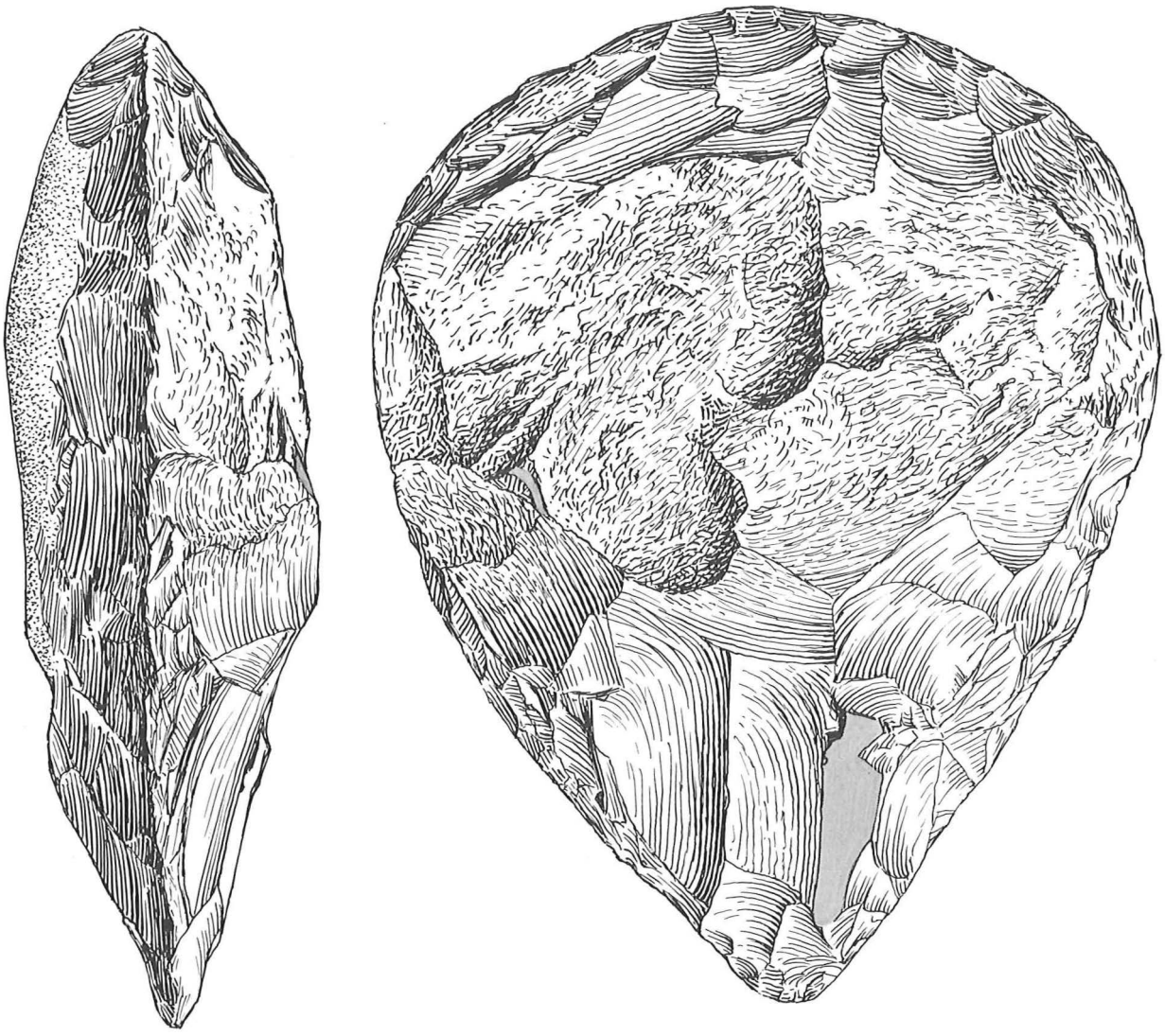
51



Pl. VII Concentration B: Handaxe and topfragment of handaxe (49: *biface amygdaloïde*; 51: *biface lancéolé, triangulaire ou cordiforme allongé*).

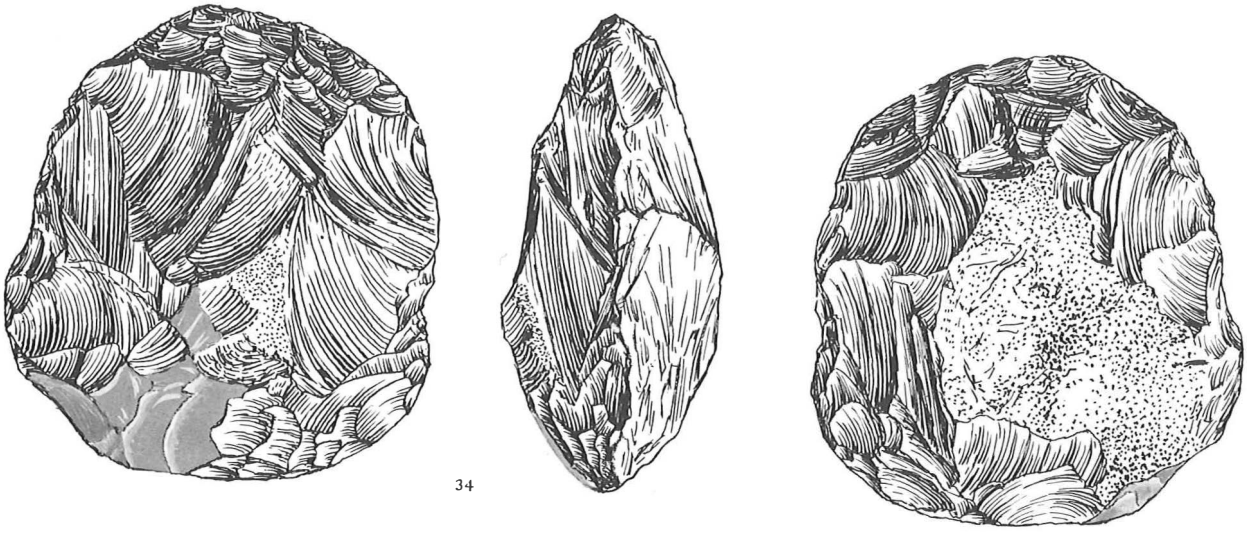


Pl. VII!-IX Concentration B: Handaxe (*biface cordiforme vrai*).

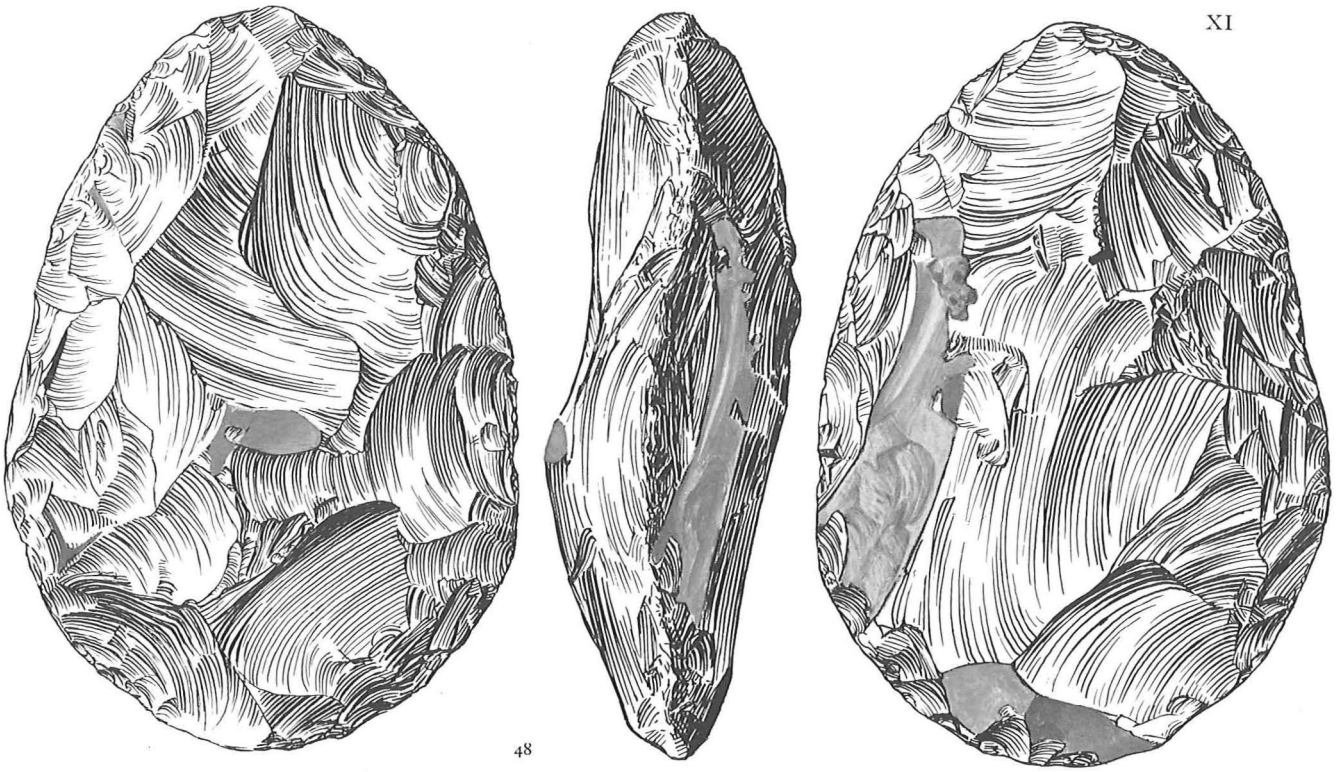


39

Pl. X Concentration A: Handaxes (39: *biface ovalaire*; 34: *biface discoïde*).

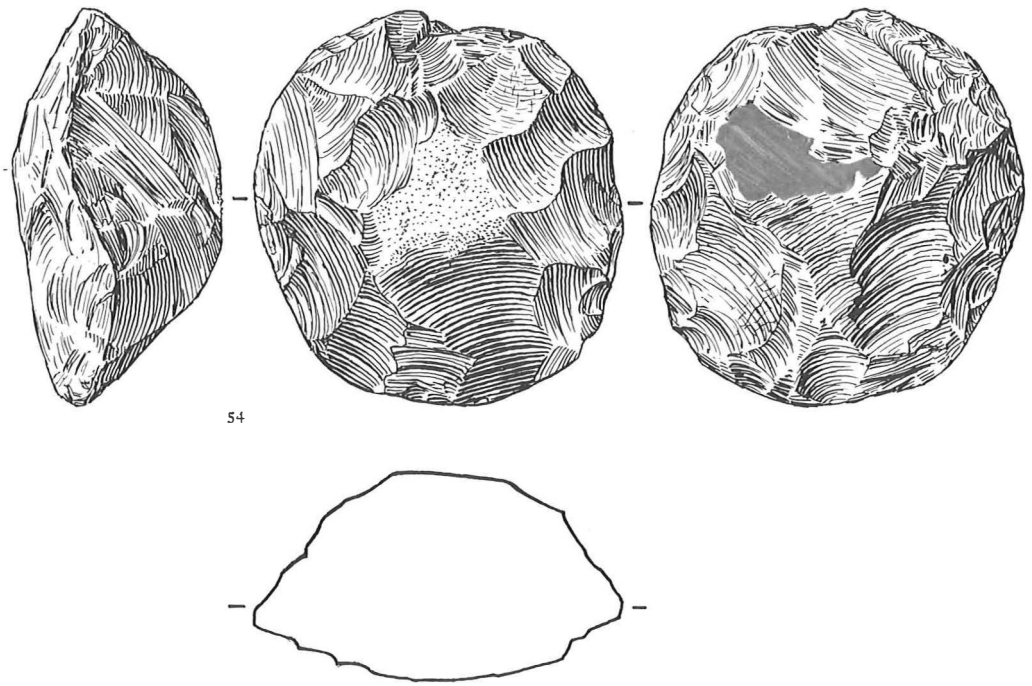


34

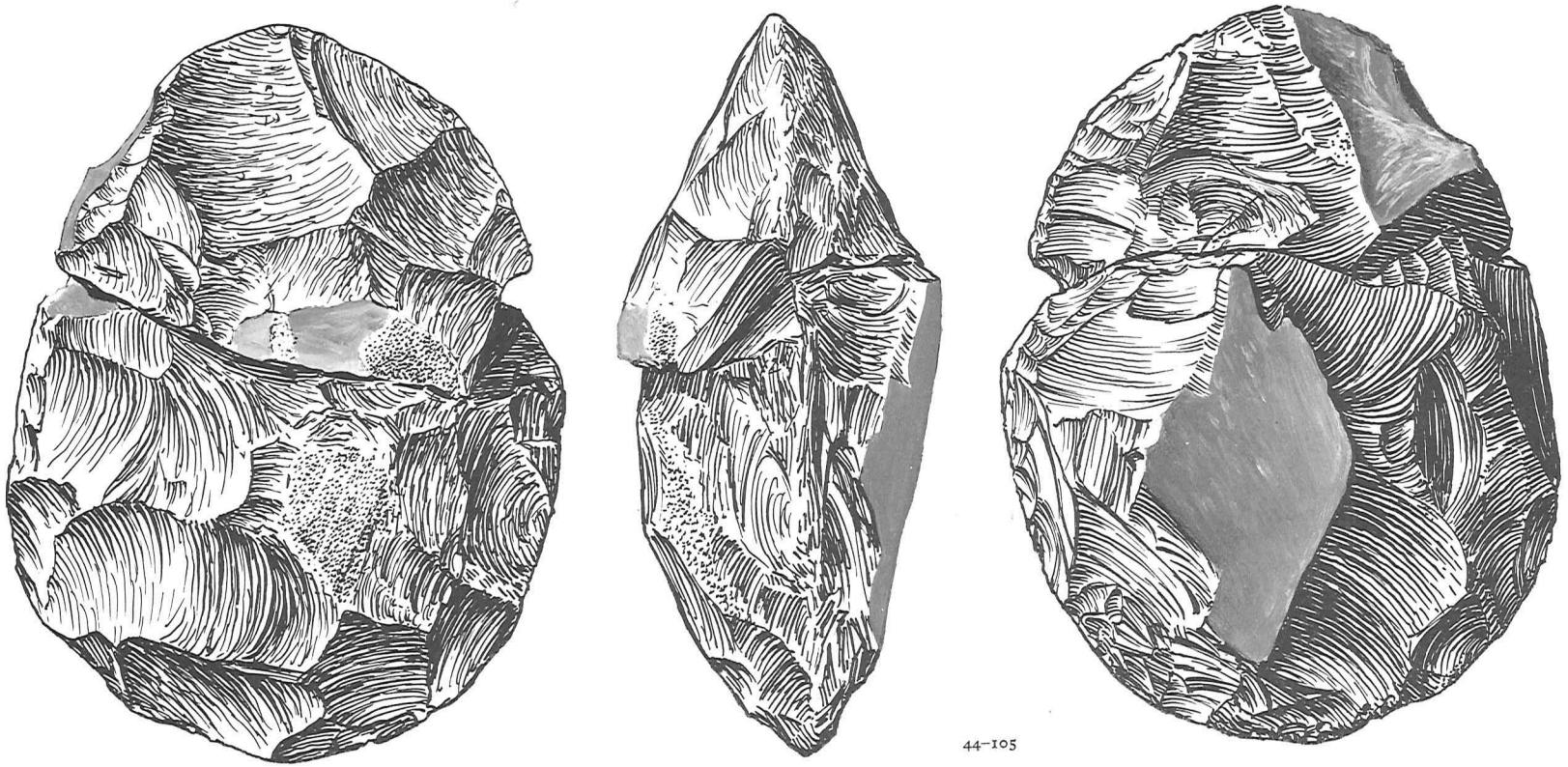


48

Pl. XI Concentration B: Handaxes (48: *biface ovalaire*; 54: *biface discoïde*).

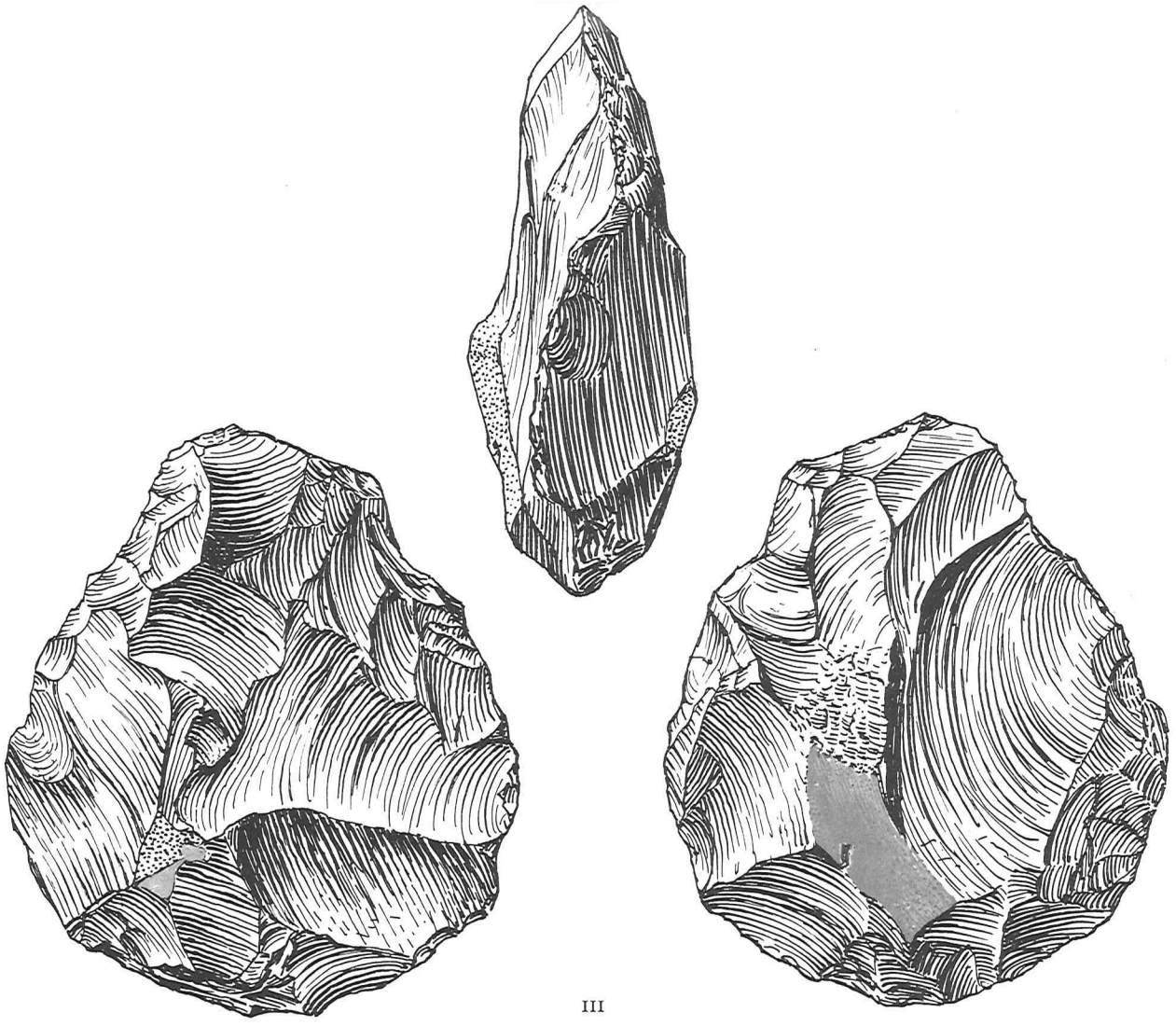


54



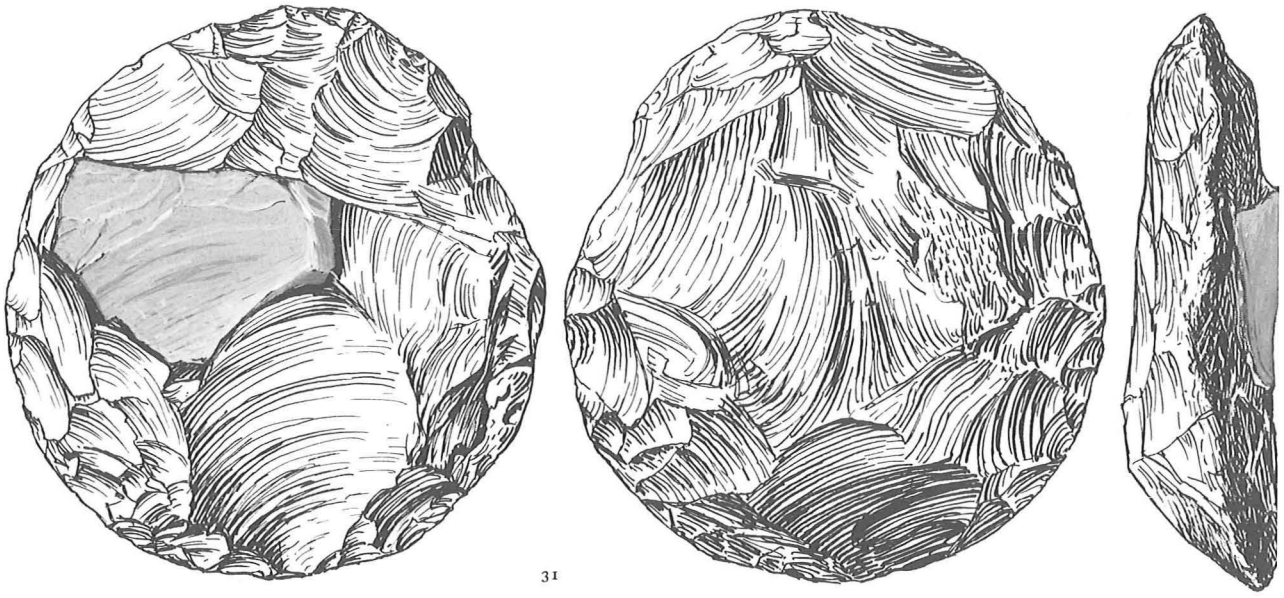
44–105

Pl. XII Concentration A: Handaxe (*biface ovalaire*).

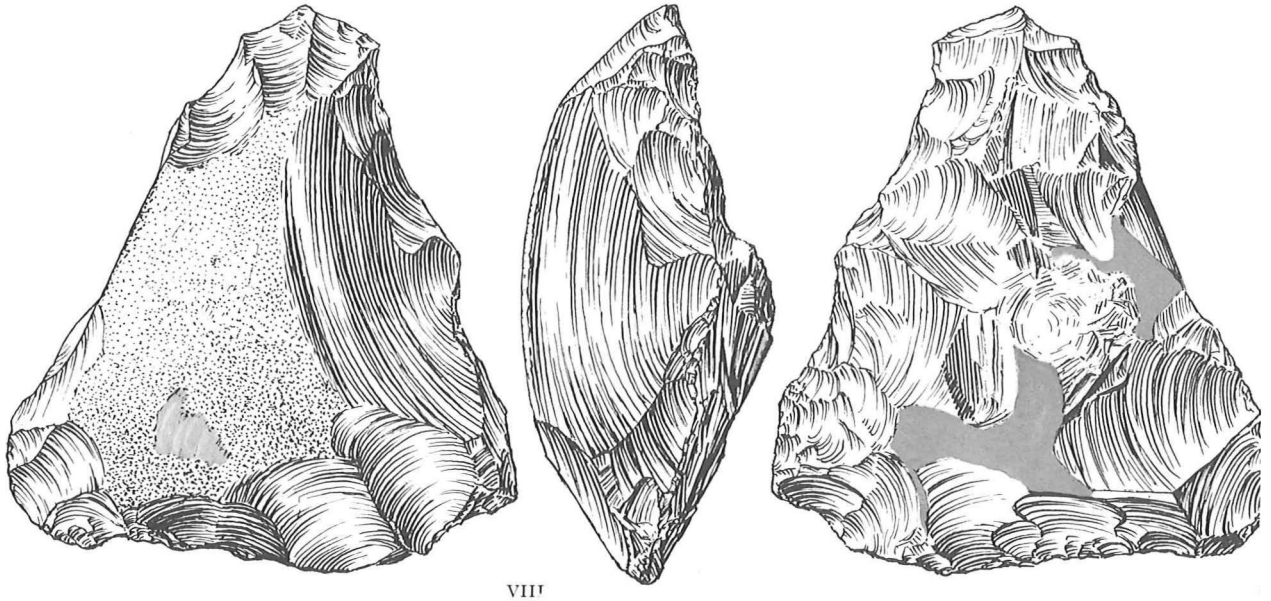


III

Pl. XIII Concentration unknown: Handaxe (*biface discoïde*).



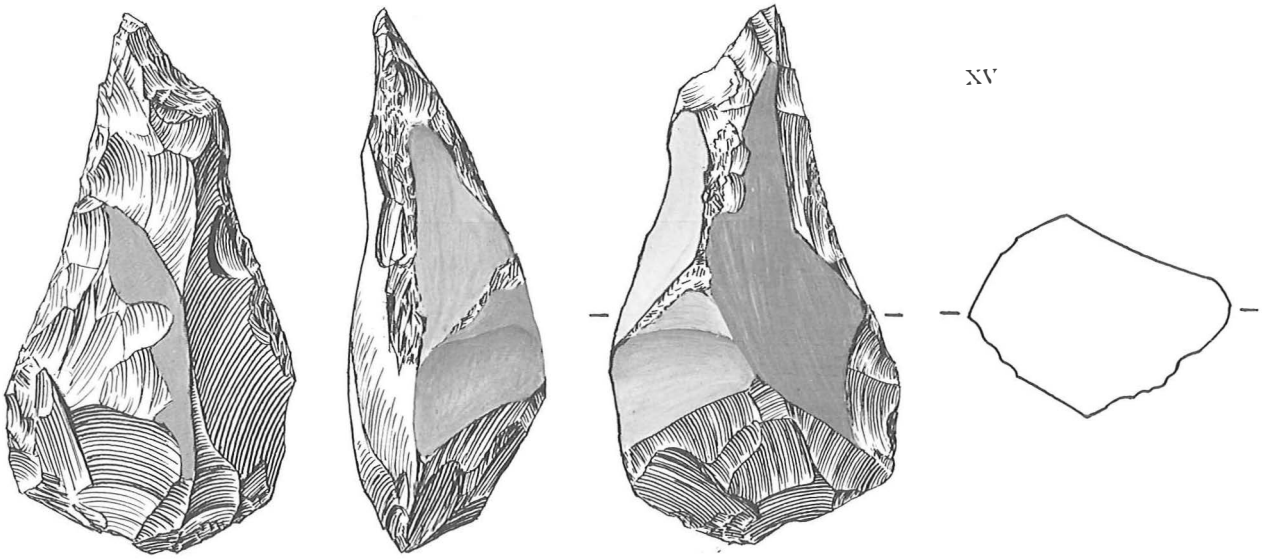
31



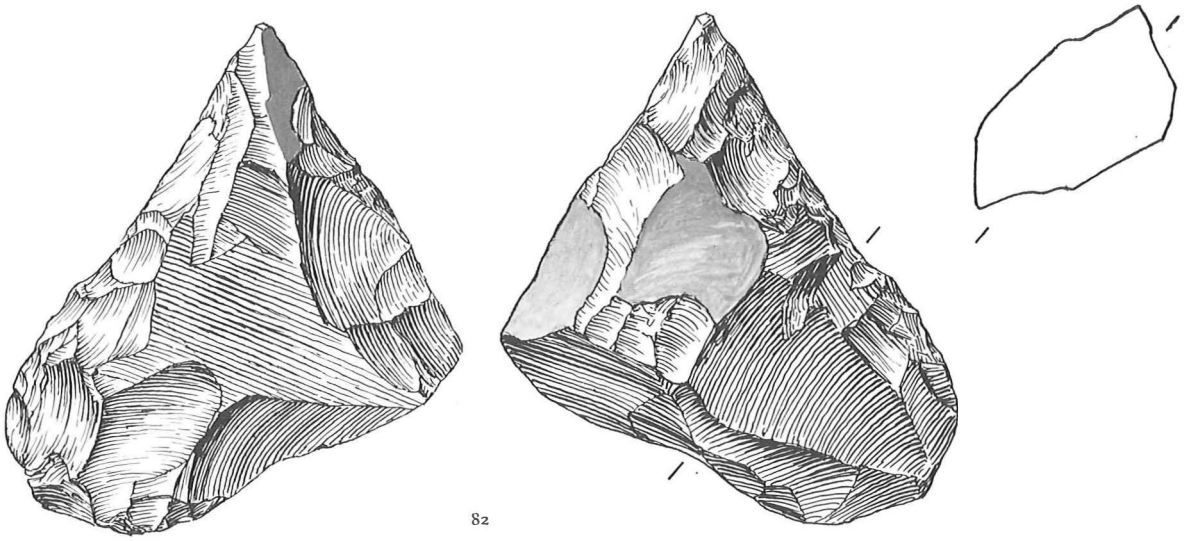
VIII

Pl. XIV Concentration A: Handaxes (31: *biface discoïde*; VIII: *biface triangulaire*).

Pl. XV Concentration unknown: Handaxe *(biface à dos micoquien*; *Fäustel mit ausgezogener Spitze*).
Concentration B: Leafshaped handaxes (52: *kleines Faustkeilblatt*; 82: *kleines breitdreieckiges Faustkeilblatt*).

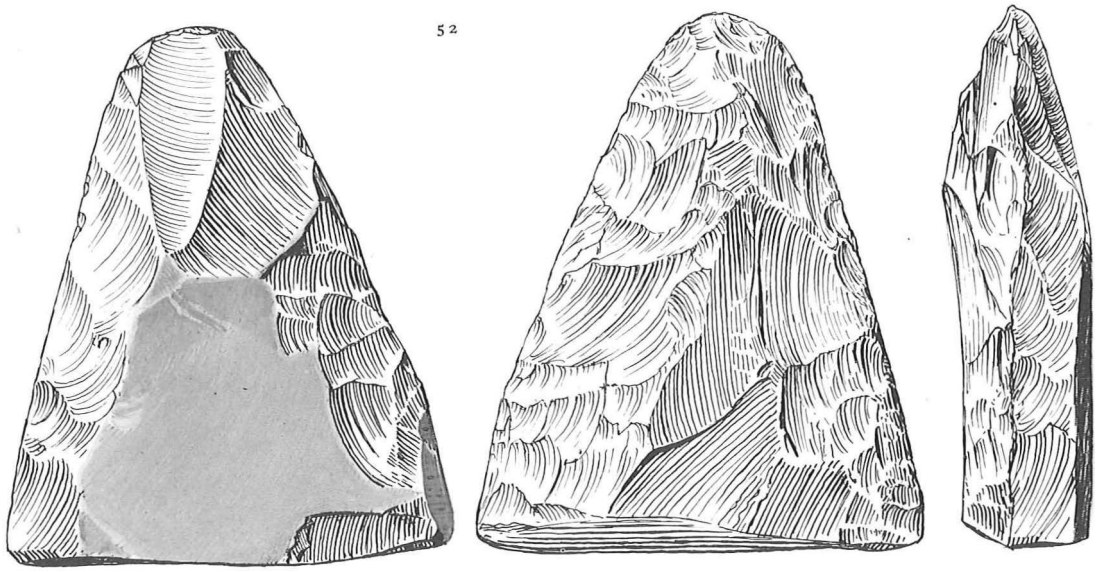


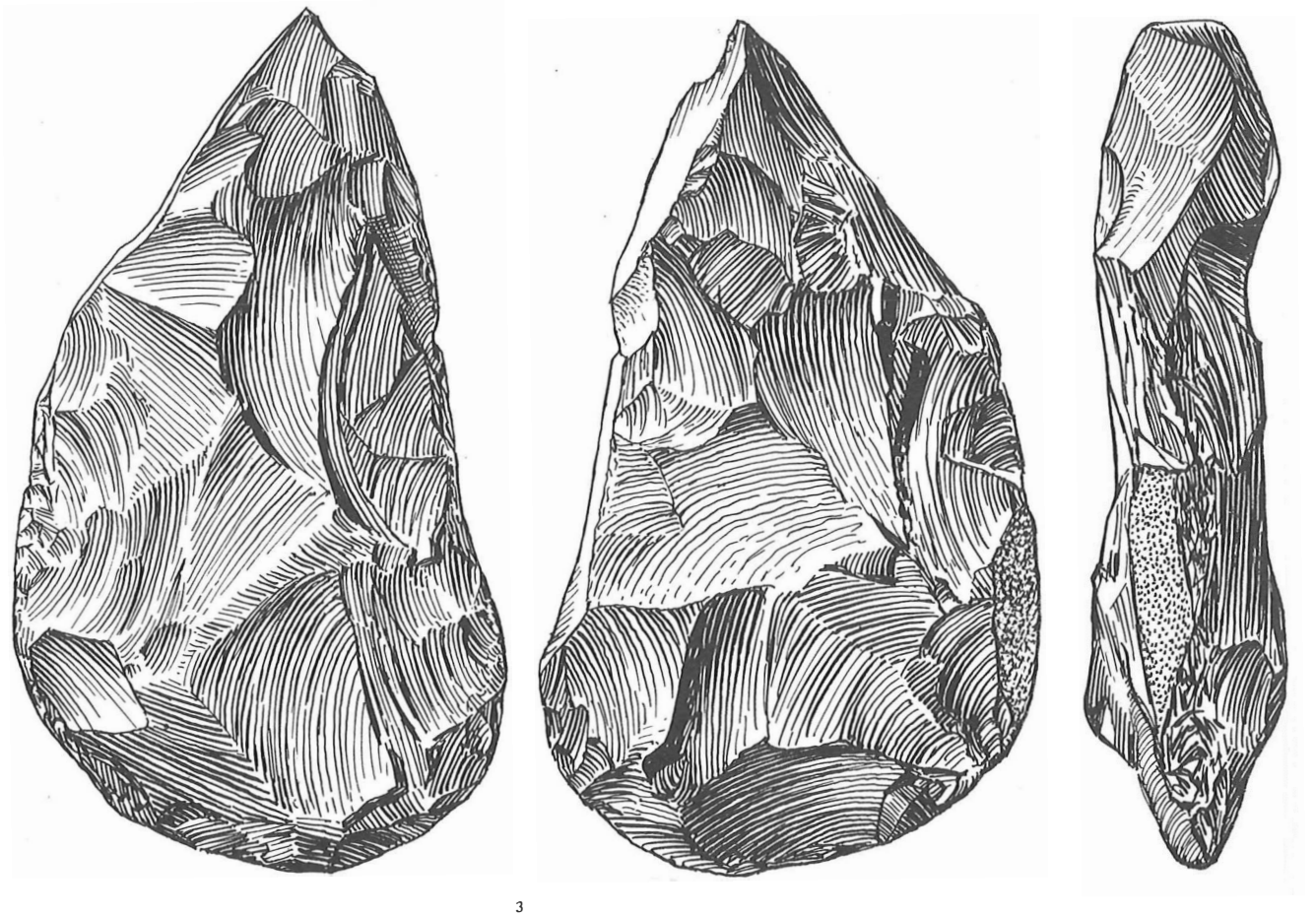
133



82

52

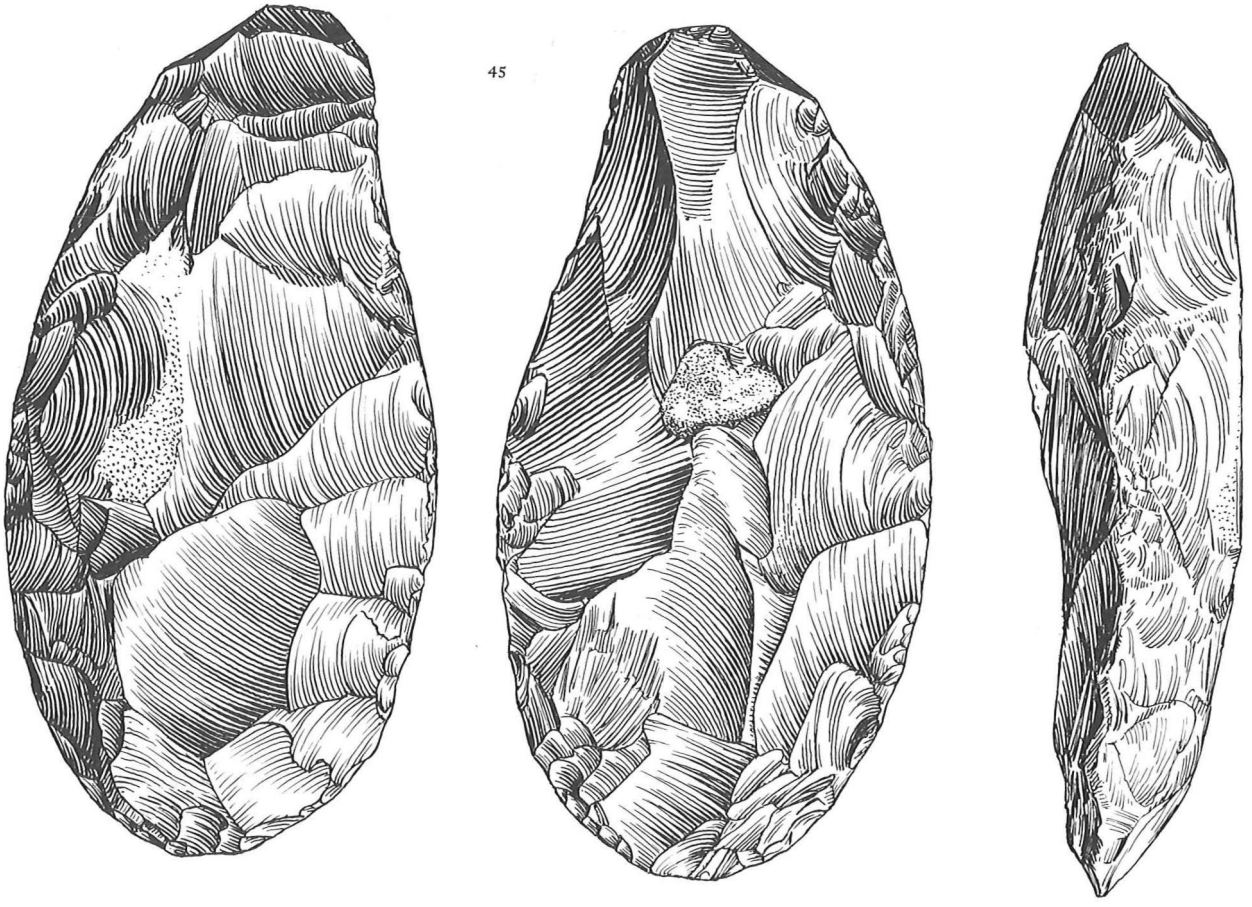




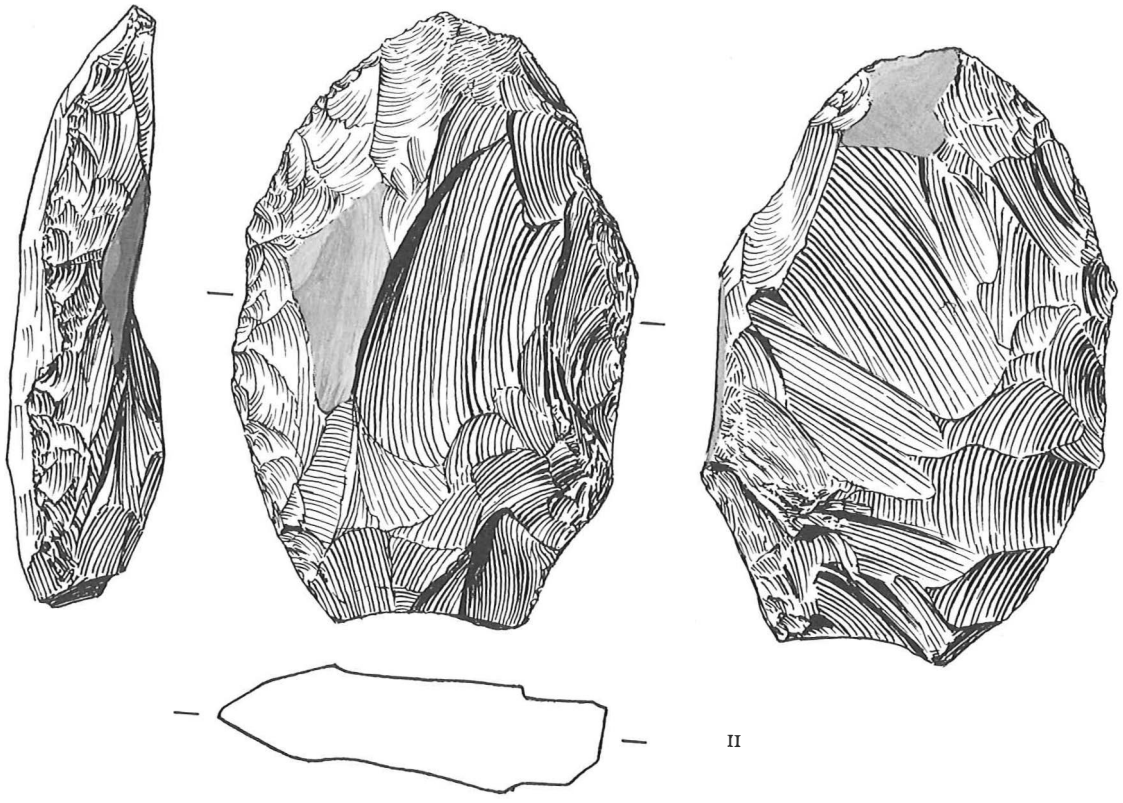
3

Pl. XVI Concentration A: Bifacial scraper (*blattförmiger Schaber*).

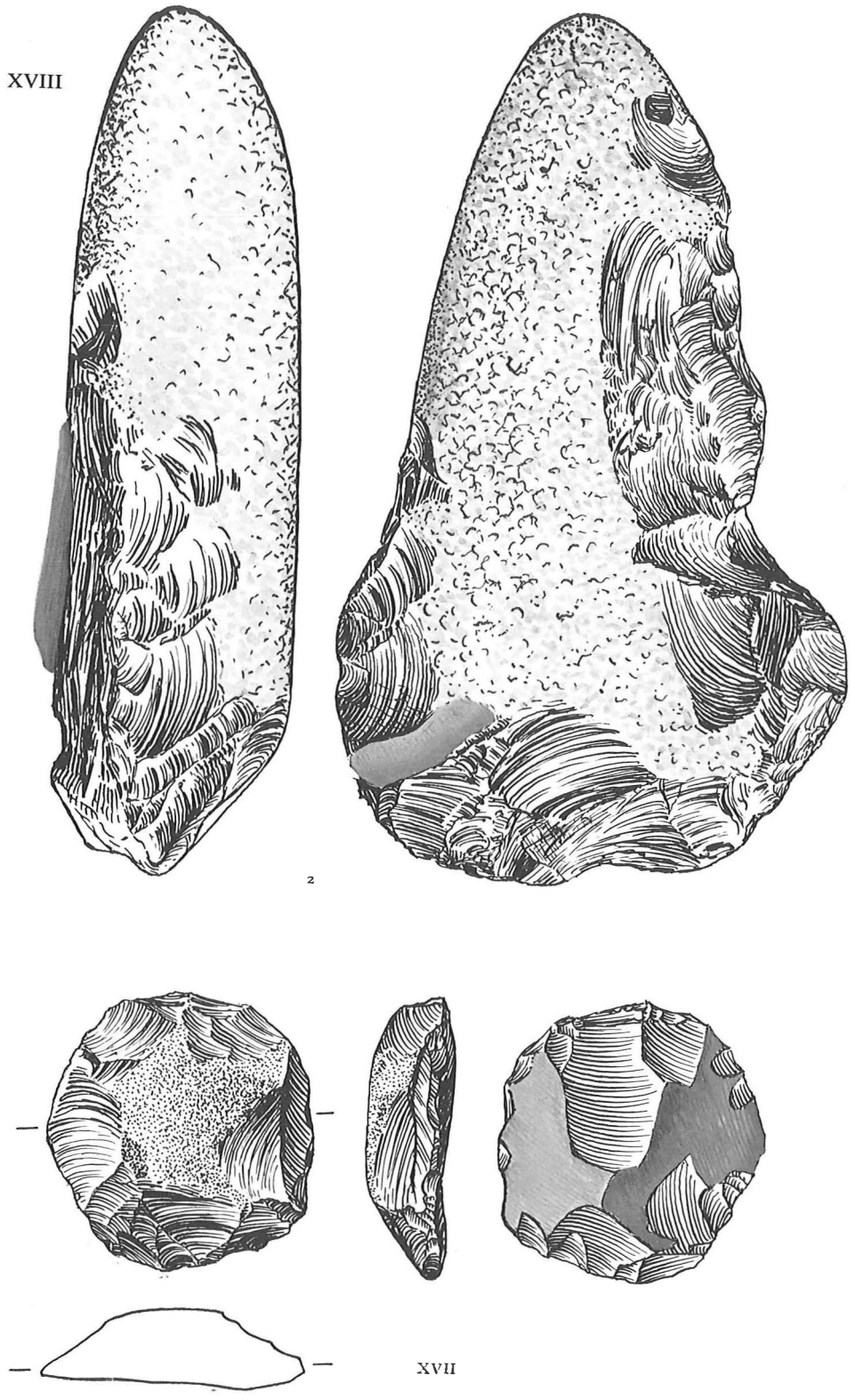
Pl. XVII Concentration B: Leafshaped handaxe or bifacial scraper (*biface passant au racloir biface*); Concentration unknown: Bifacial scraper (II: *racloir à retouche biface type Quina*).



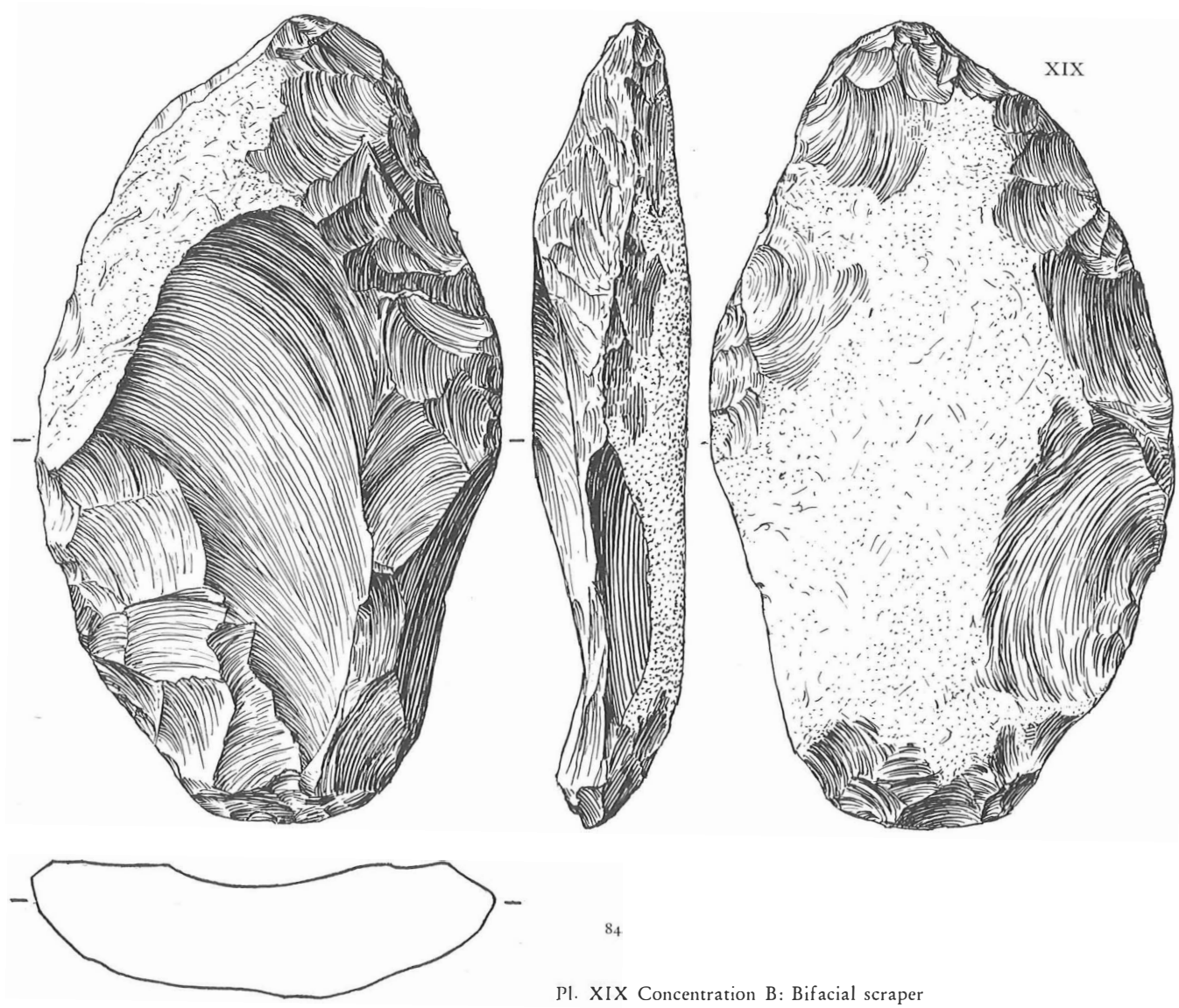
45



II

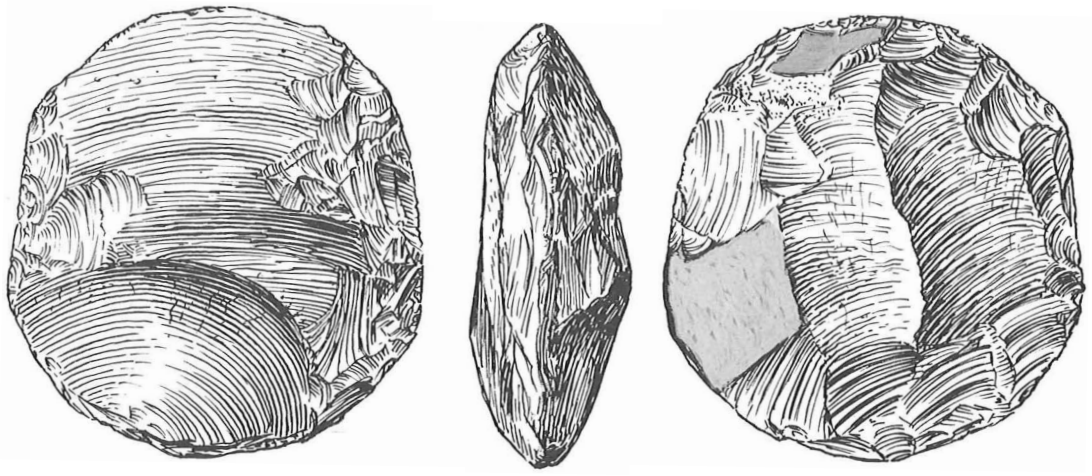


Pl. XVIII Concentration A: "Chopping tool". Concentration unknown: Disc (XVII: *disque*).

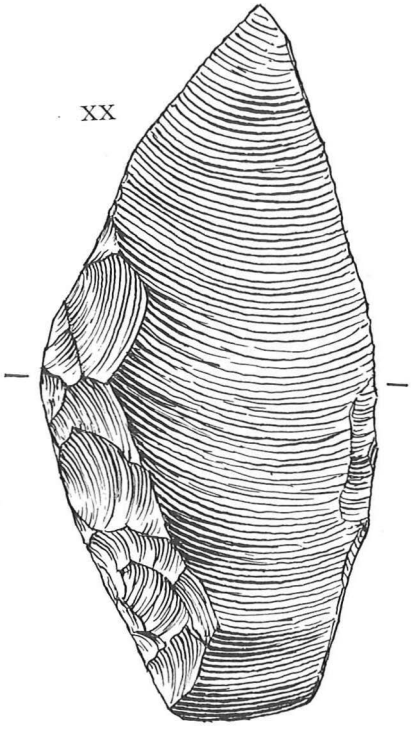


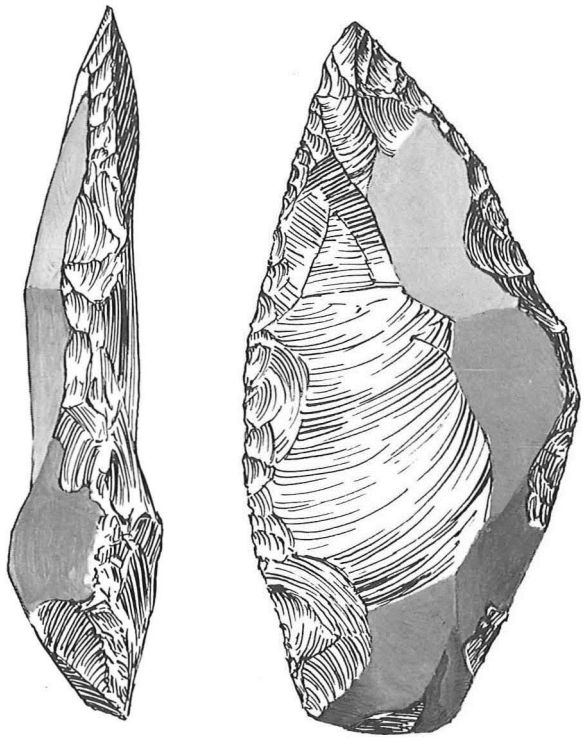
84

Pl. XIX Concentration B: Bifacial scraper (84: *blattförmiger Schaber*); disc (53: *disque*).

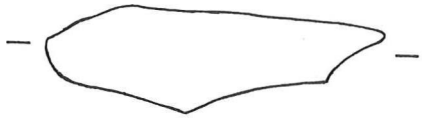


53

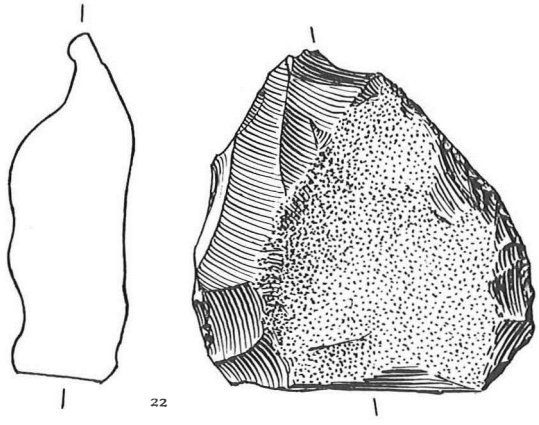




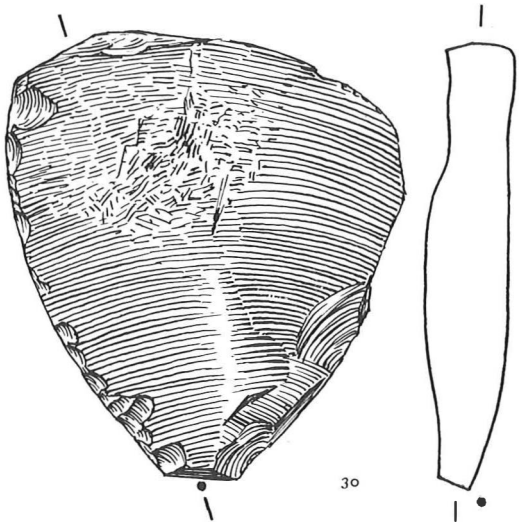
17



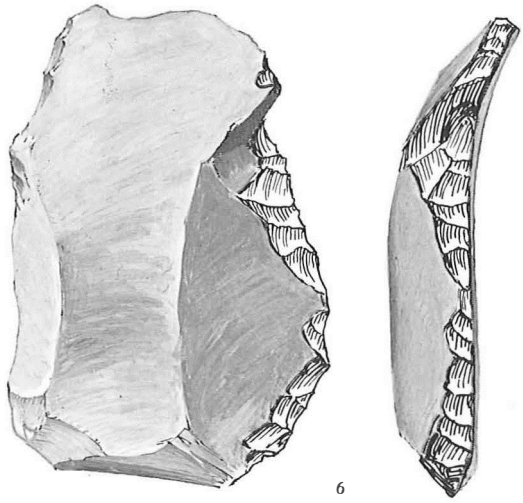
Pl. XX Concentration A: Point and sidescrapers (17: *pointe moustérienne allongée*; 6, 22, 30: *racloirs simples convexes*).



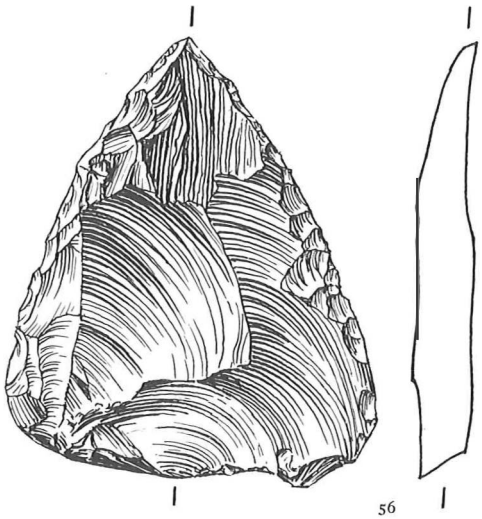
22



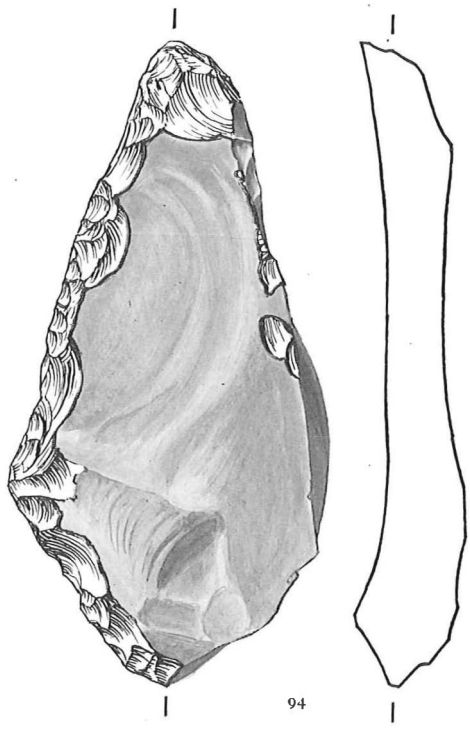
30



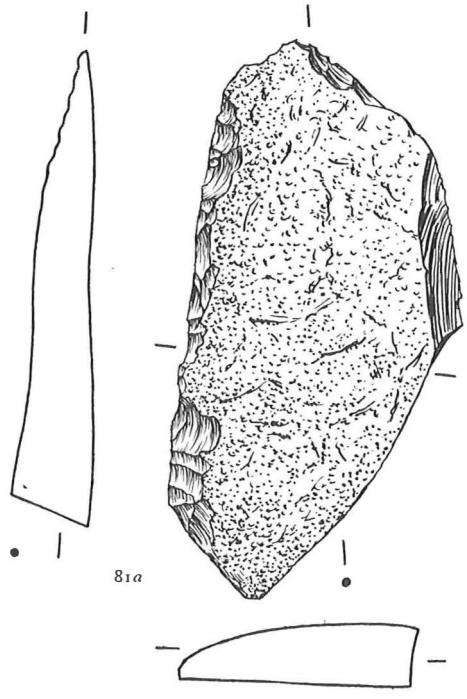
6



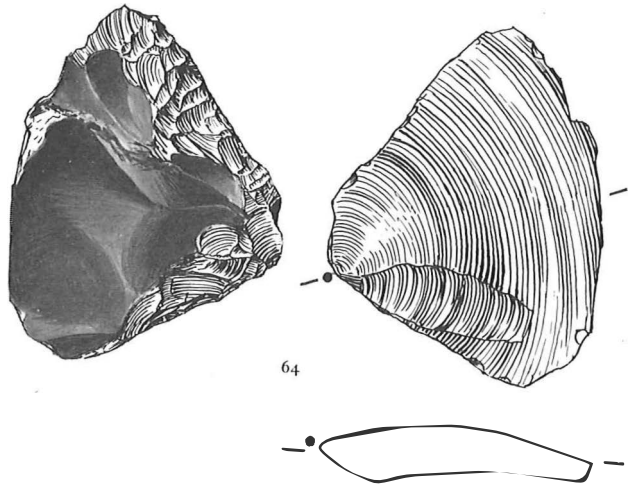
56



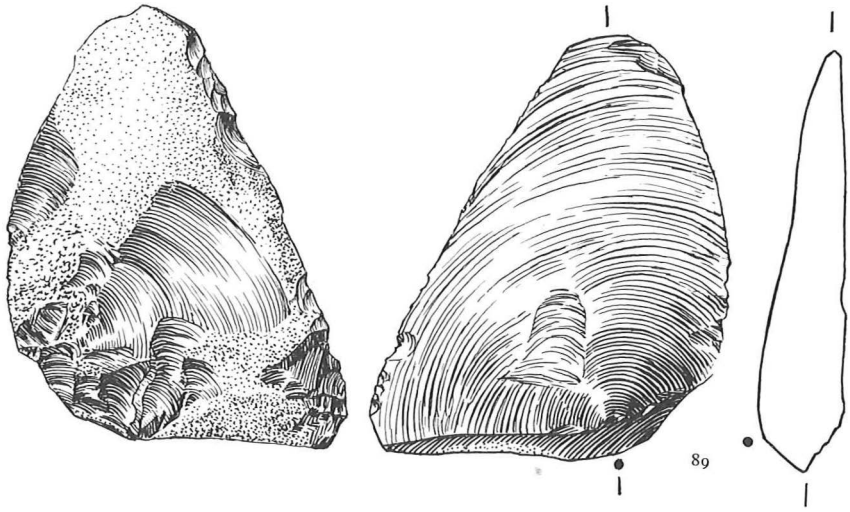
94



81*a*



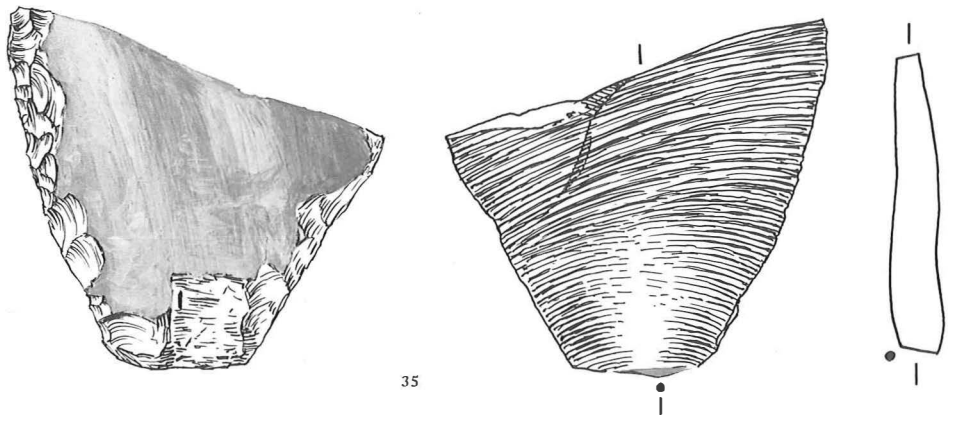
64



89

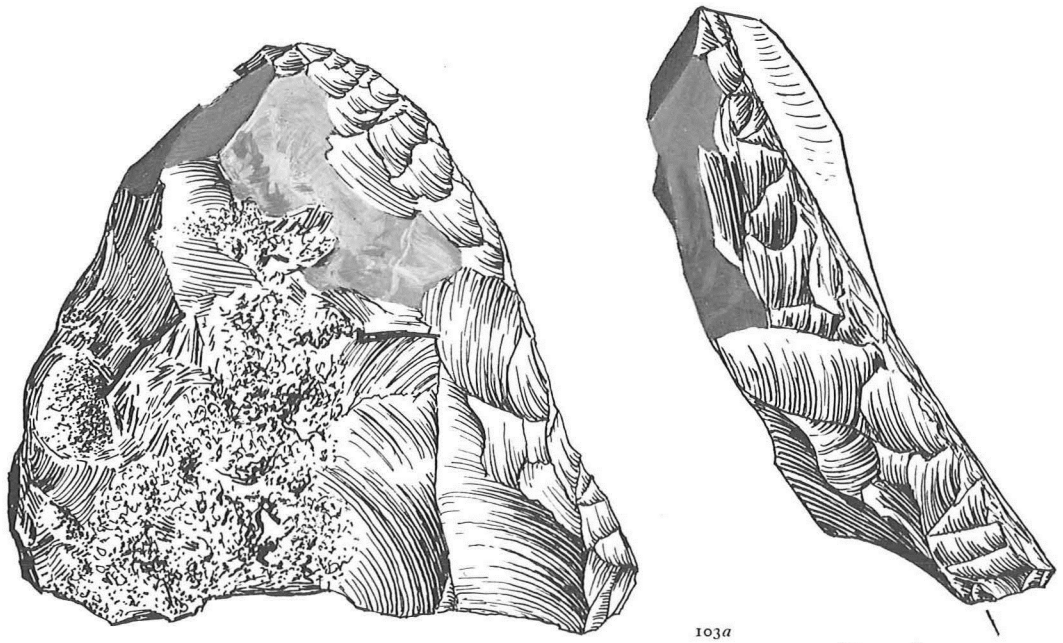
Pl. XXI Concentration B: Point and sidescrapers (56: *pointe moustérienne à la limite du racloir convergent*; 64, 81[a], 89: *racloirs simples droits*; 94: *racloir simple droit passant au racloir convergent*).

XXII

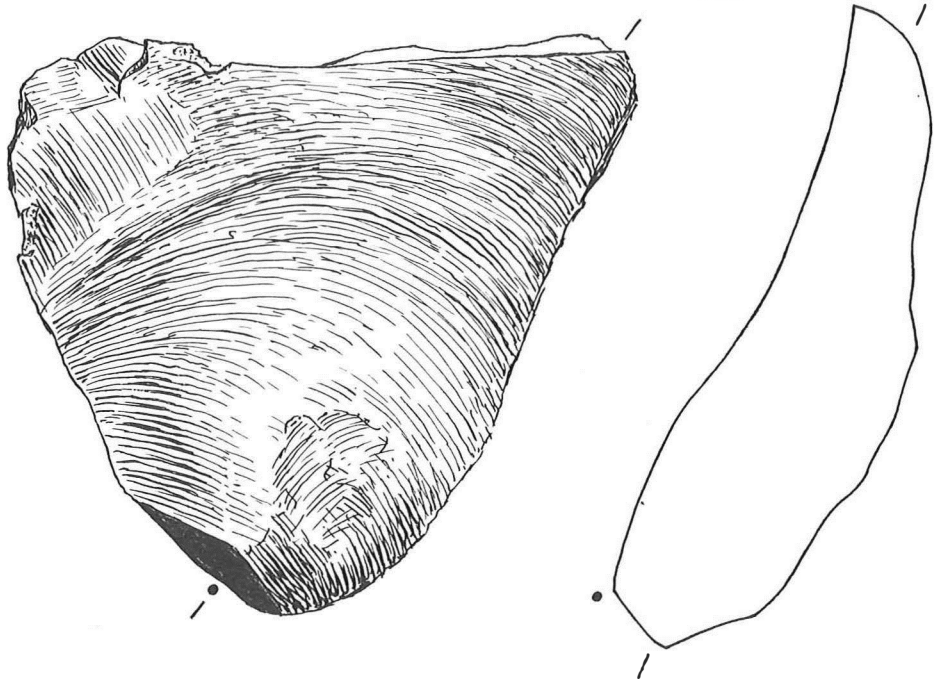


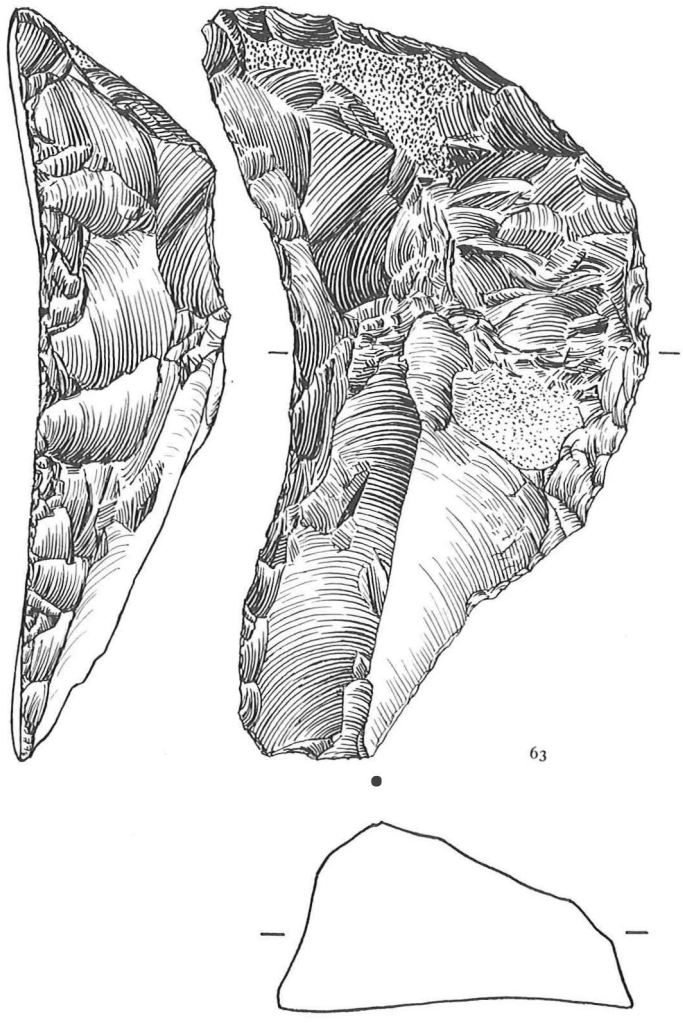
35

Pl. XXII Concentration A : Scrapers (35 : *racloir double*; 103ª : *racloir simple*).

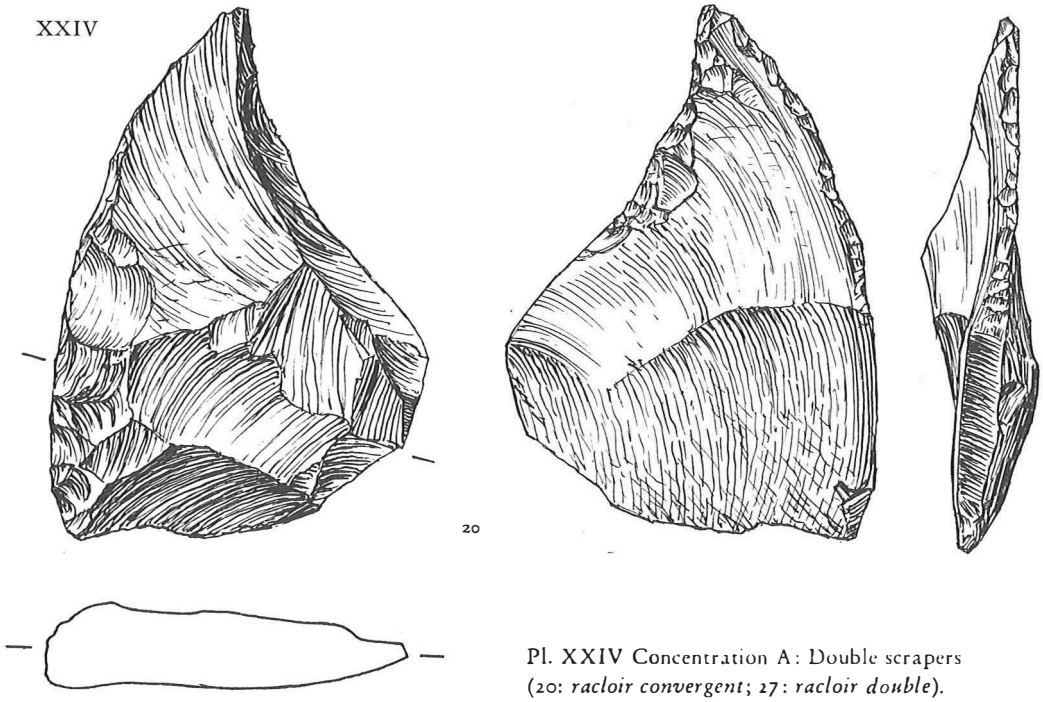


103*a*

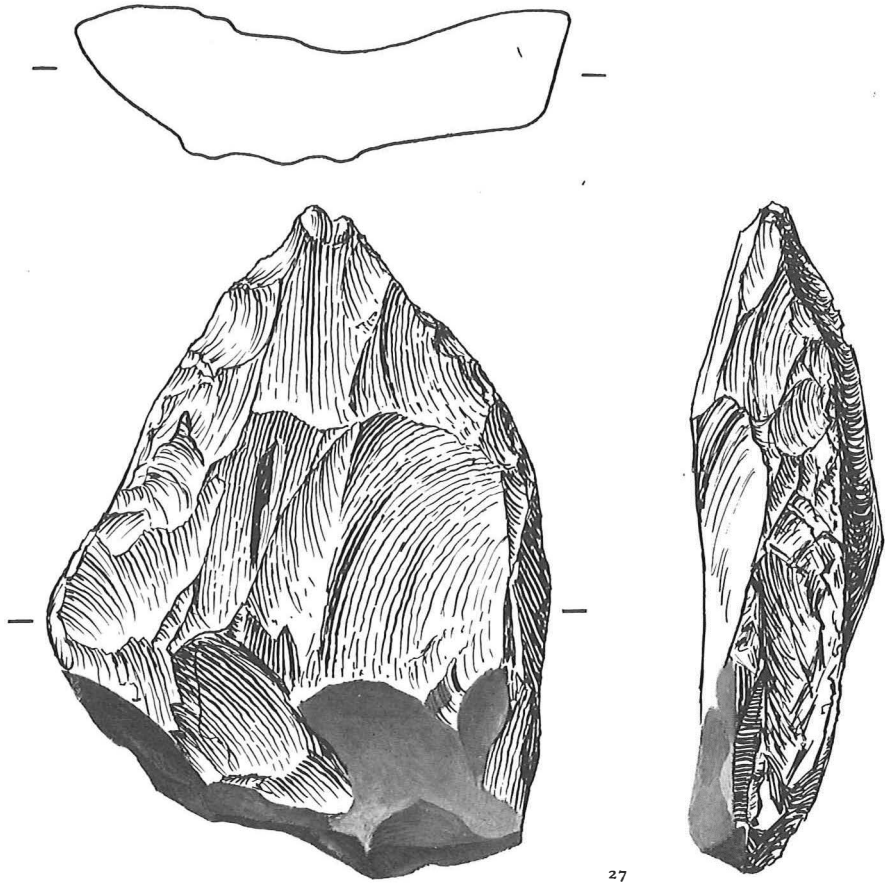


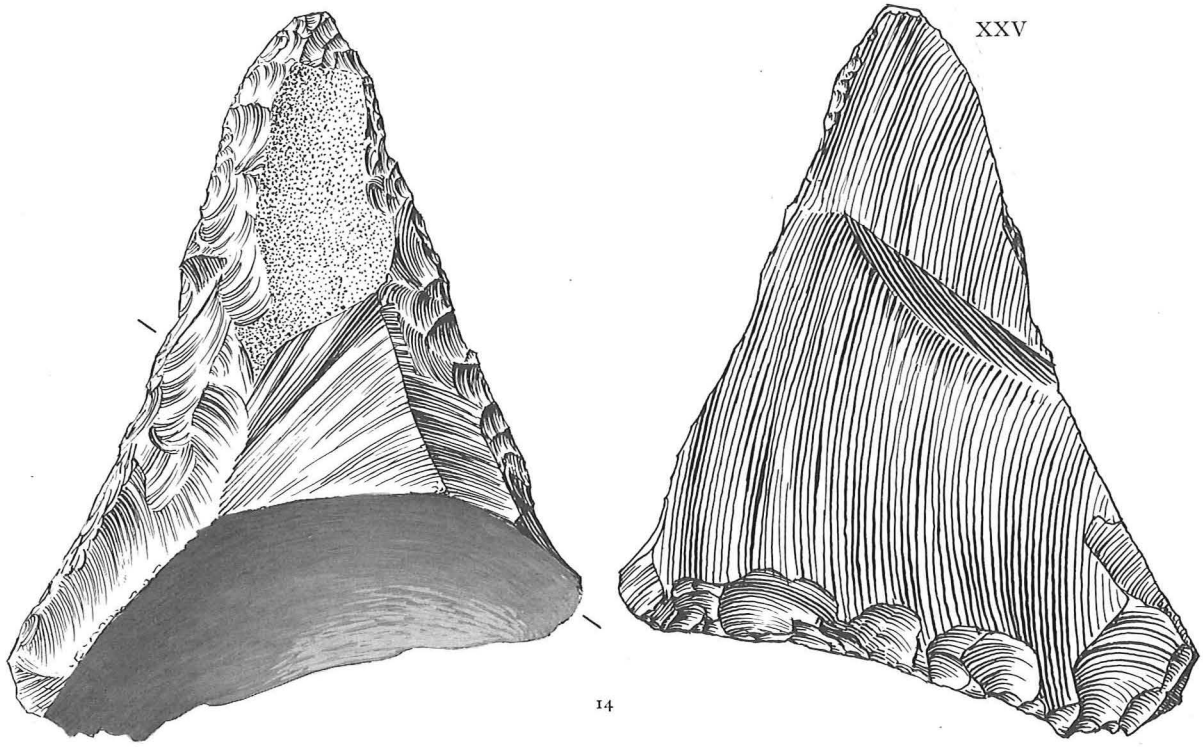


Pl. XXIII Concentration B: Convergent scraper (63: *racloir convergent concave-convexe*).

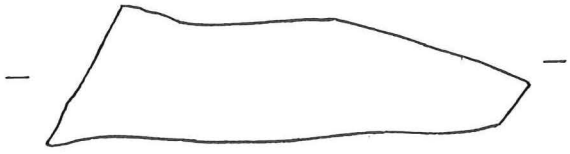


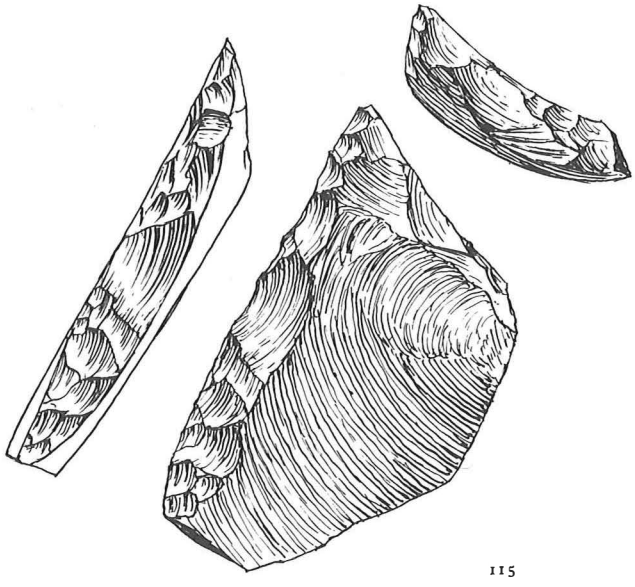
Pl. XXIV Concentration A: Double scrapers (20: *racloir convergent*; 27: *racloir double*).



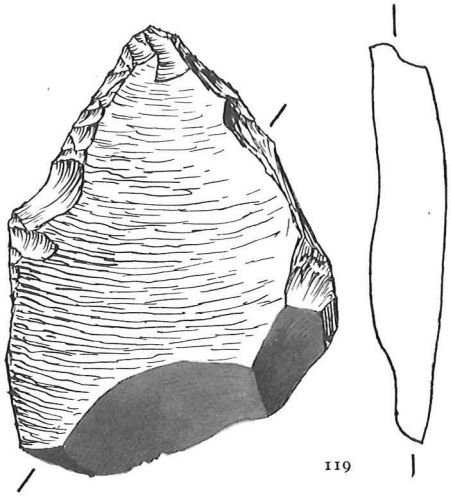


14



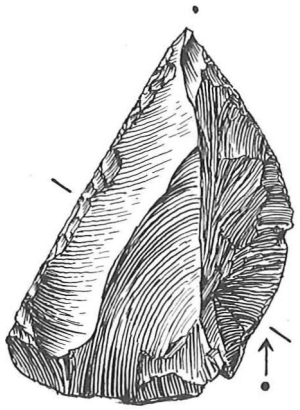


115

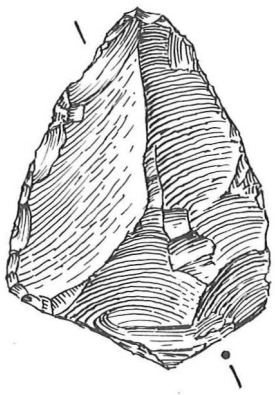


119

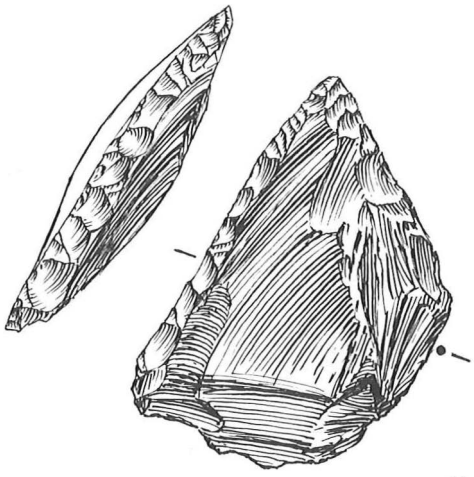
Pl. XXV Concentration A: Convergent scrapers (*racloirs convergents*).



33

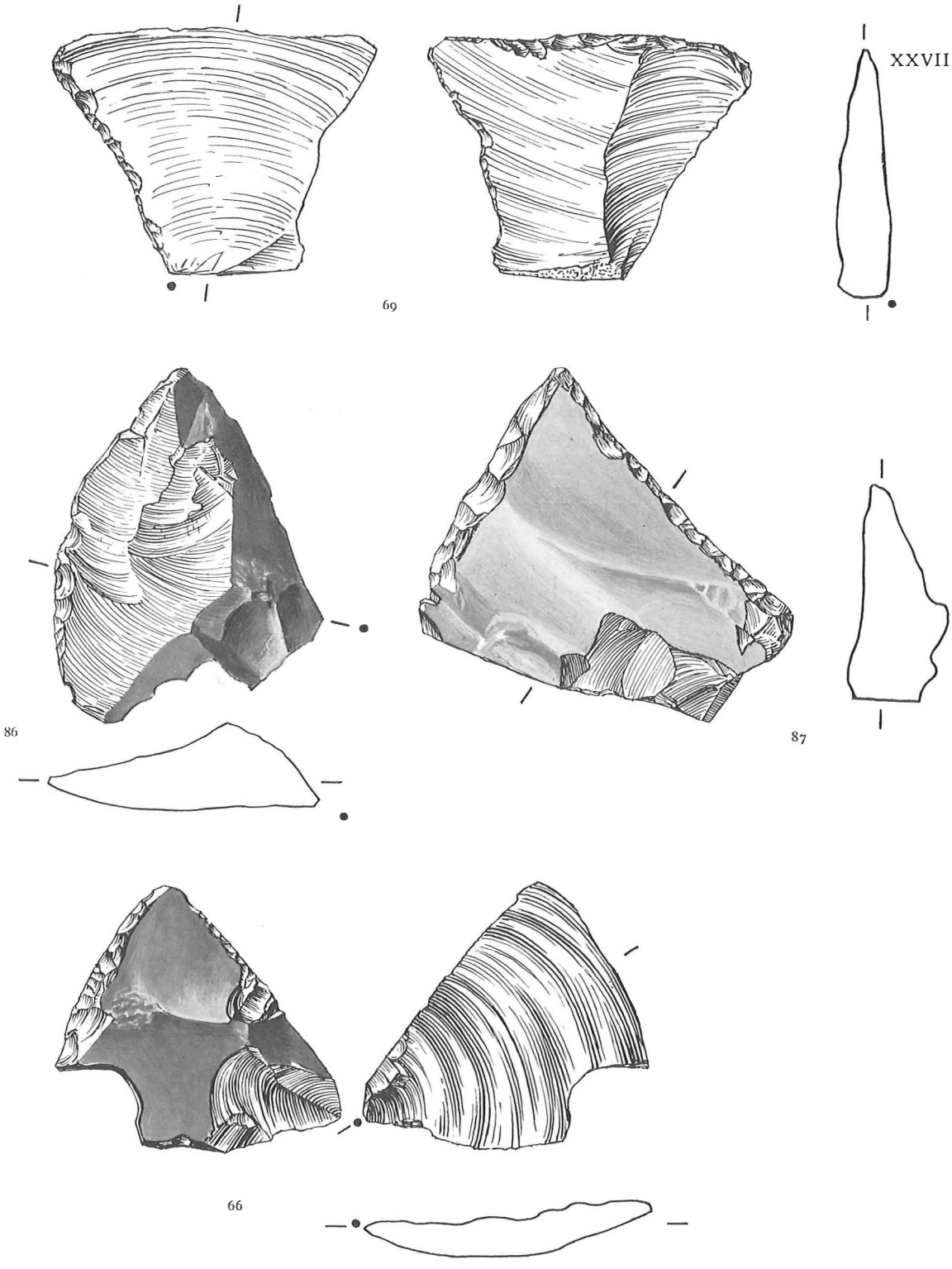


28

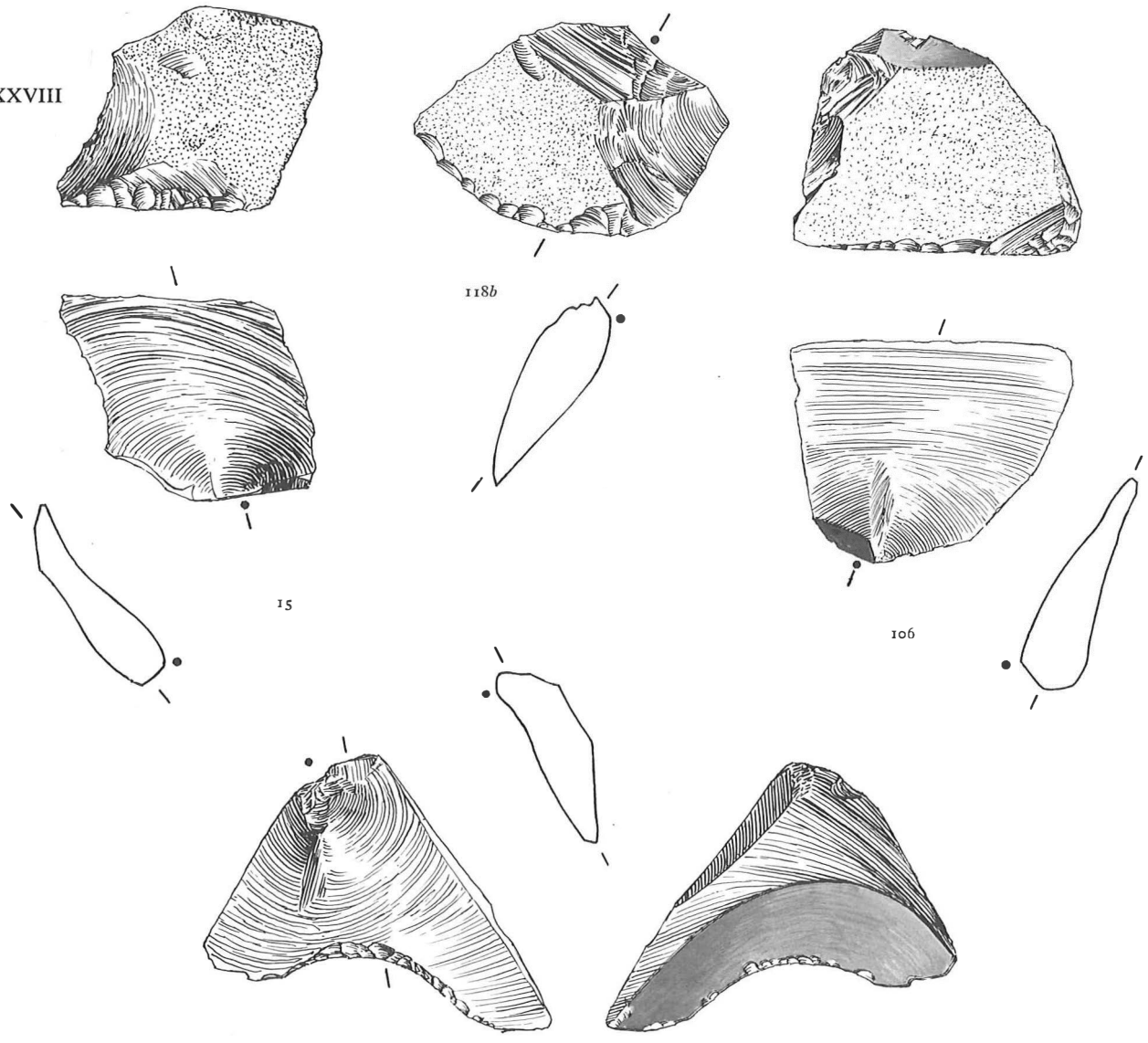


42

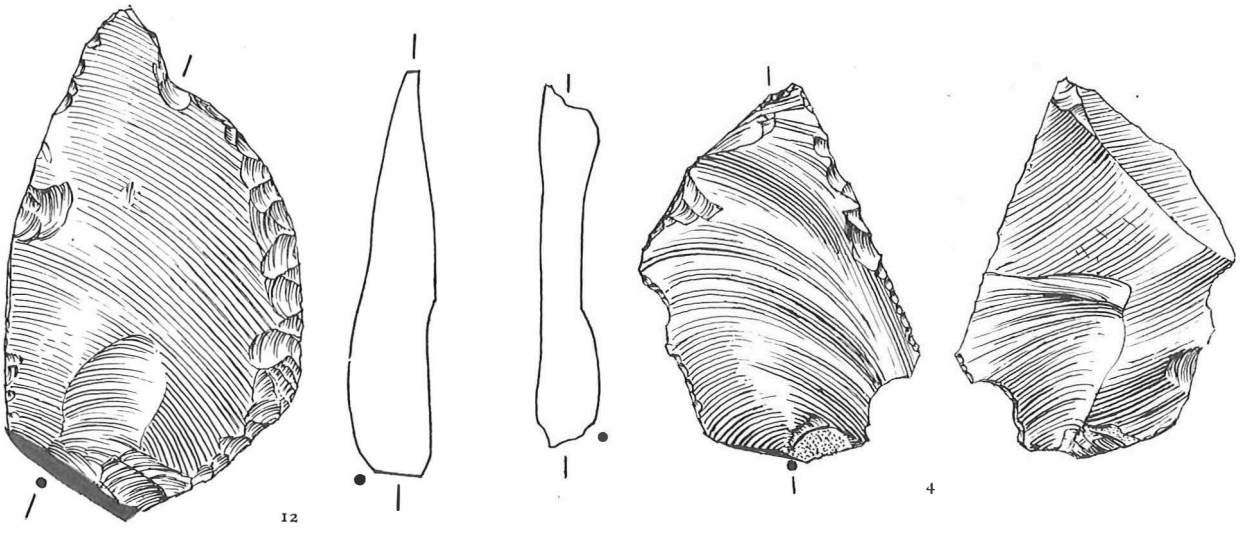
Pl. XXVI Concentration A: Convergent scrapers (33: *racloir convergent*; 28, 42: *racloirs déjetés*).

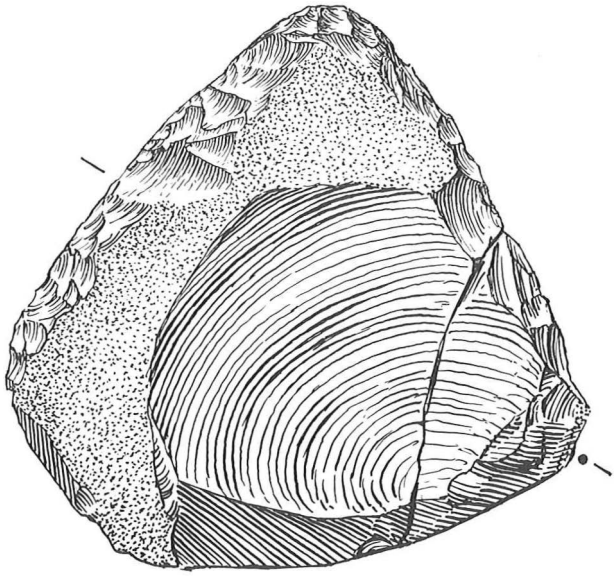


Pl. XXVII Concentration B: Convergent scrapers (87: *racloir convergent*; 66, 86: *raclons déjetés*; 69: *racloir déjeté alterne*).

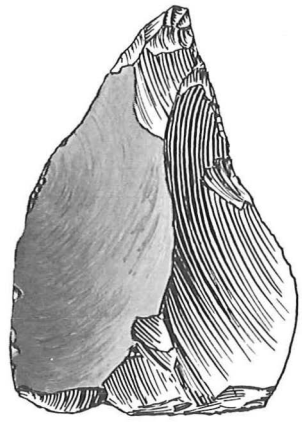


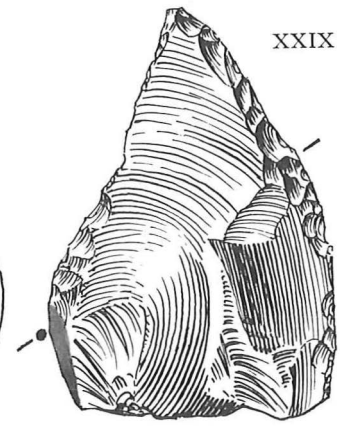
Pl. XXVIII Concentration A: Transverse scrapers (15, 106, 118^{b}: *racloirs transversaux*); ventral scrapers (4, 12, 21: *racloirs sur face plane*; 12, 21: *simples*; 4: *convergent*).





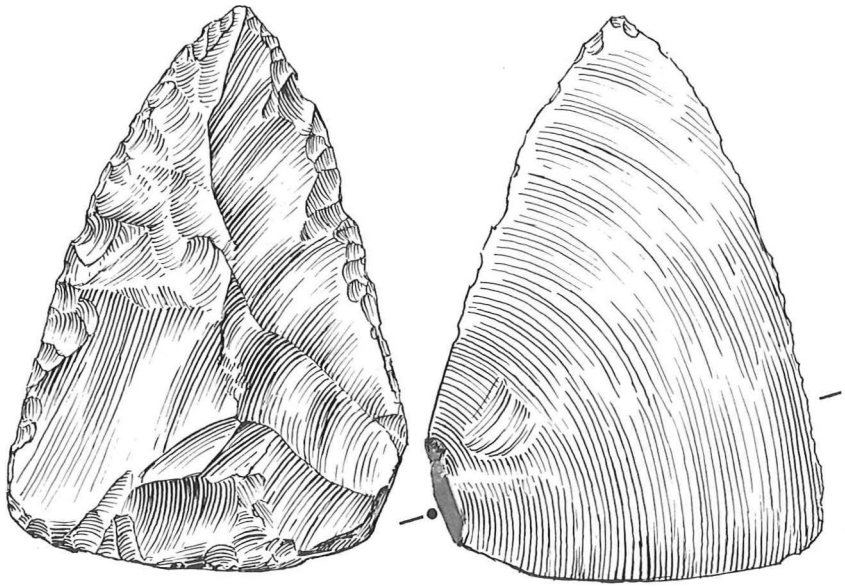
95



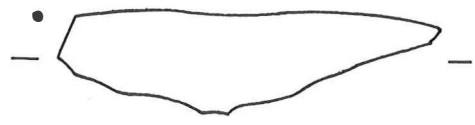


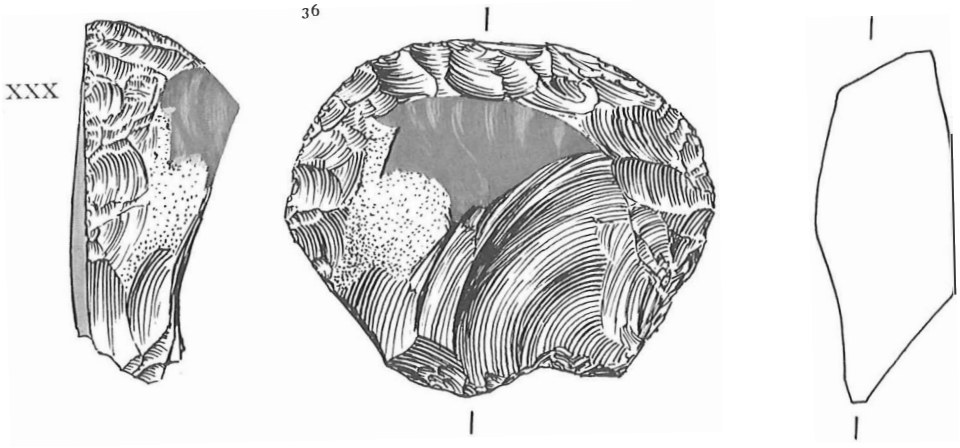
IV

Pl. XXIX Concentration B: Convergent scrapers (95: *racloir déjeté*; 57: *racloir déjeté double*). Concentration unknown: ventral scraper (IV: *racloir sur face plane transversal*).

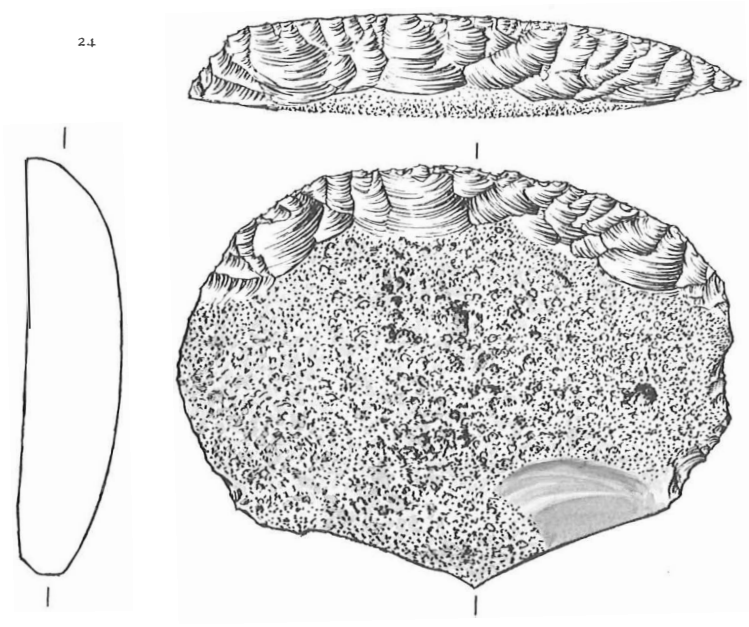


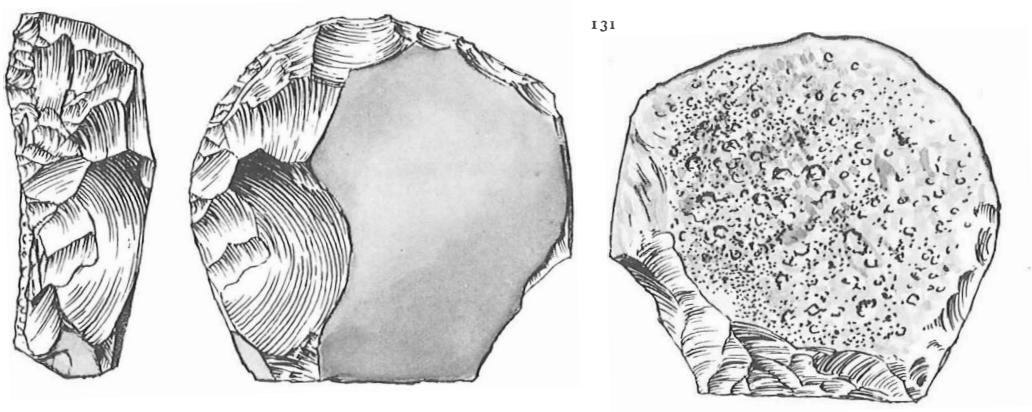
57

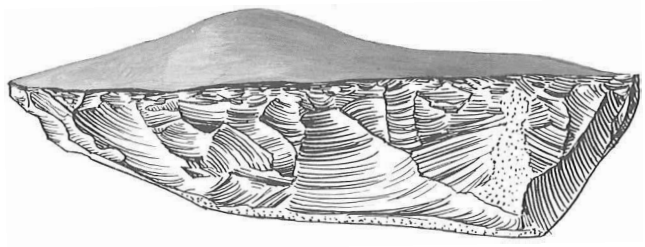


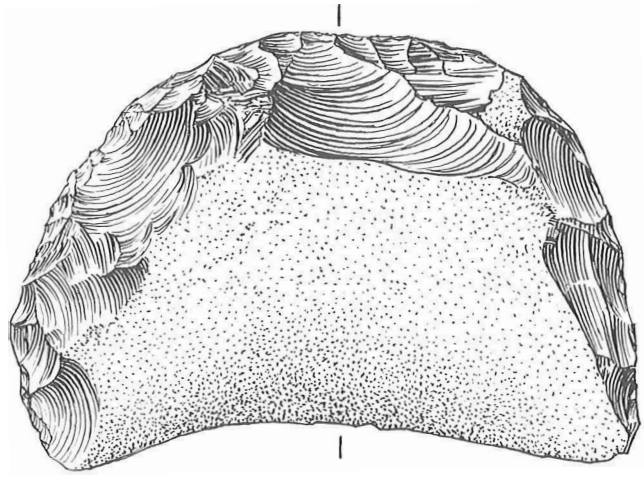


Pl. XXX Concentration A: *Convex scrapers.*

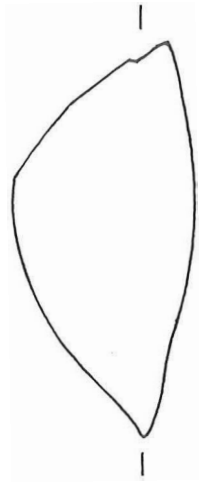




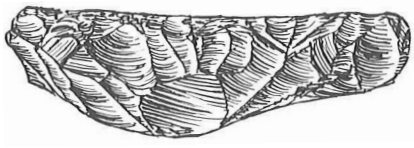




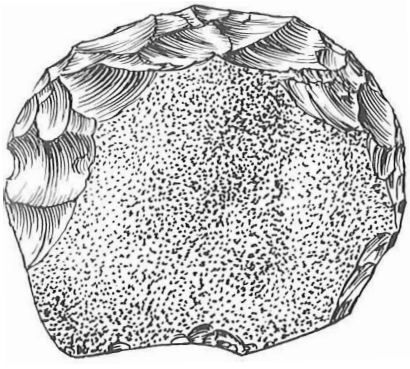
60



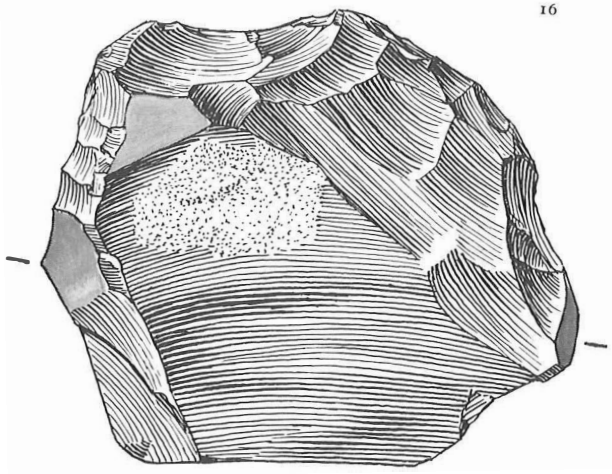
Pl. XXXI Concentration B: *Convex scrapers.*

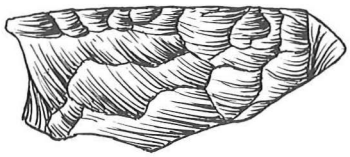


58

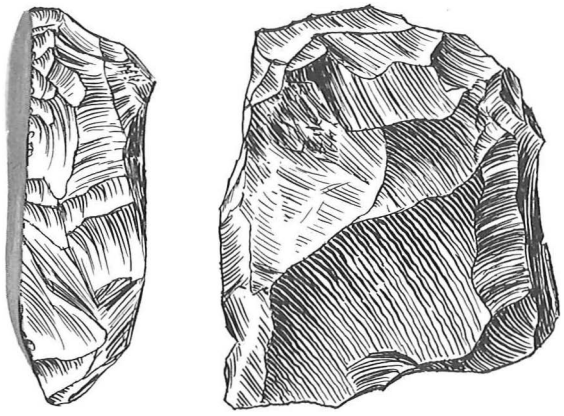


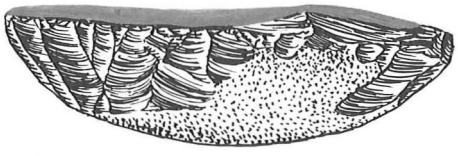
16



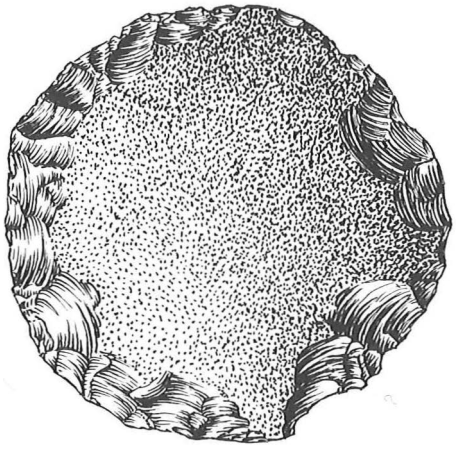


101*a*

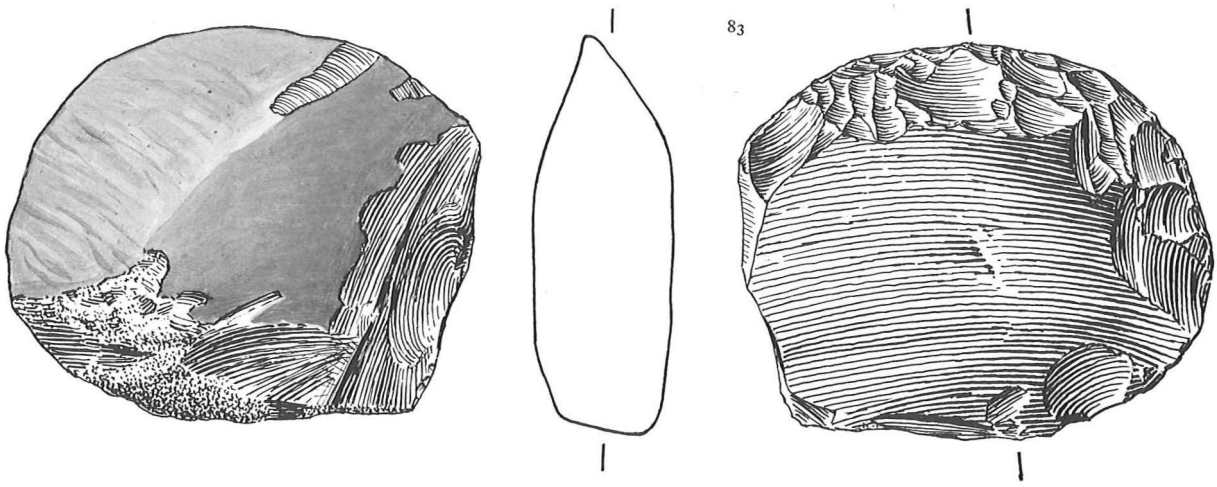


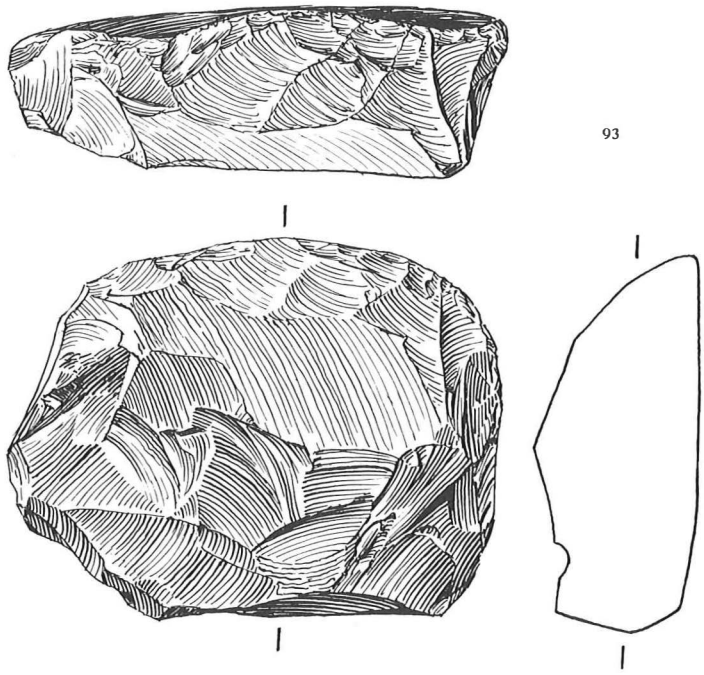


102

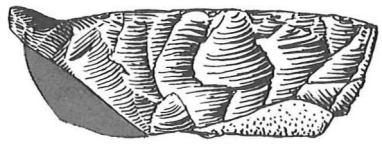


Pl. XXXII Concentration A: *Convex scrapers.*

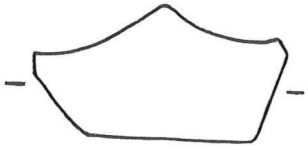


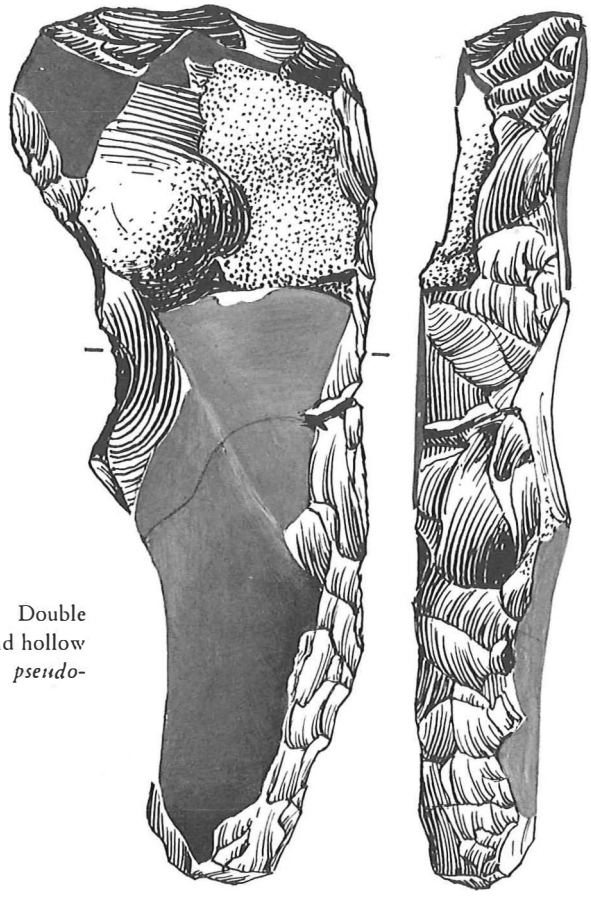


Pl. XXXIII Concentration B: *convex scrapers.*



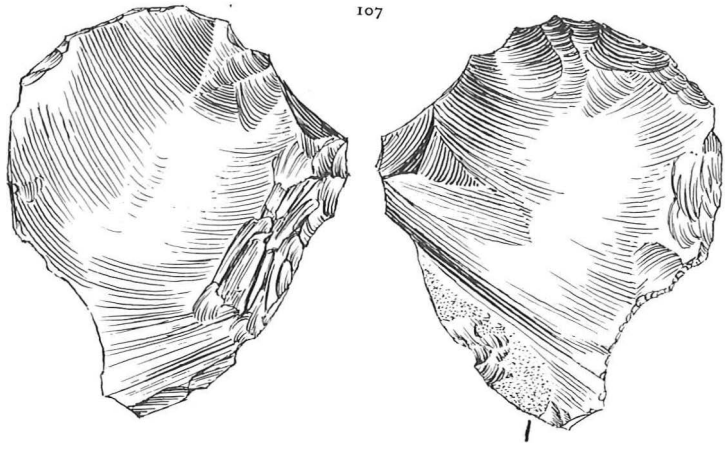
25+43

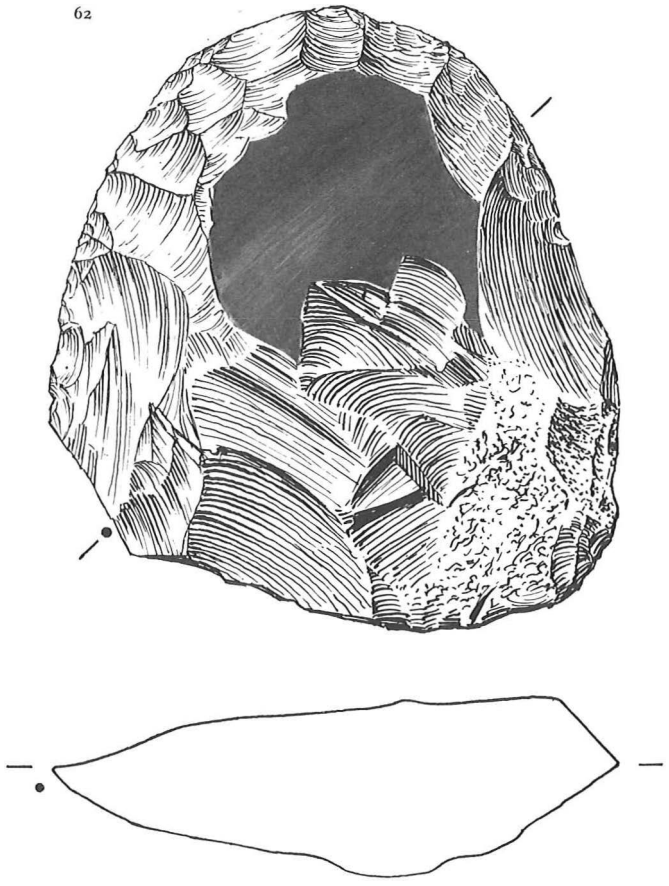




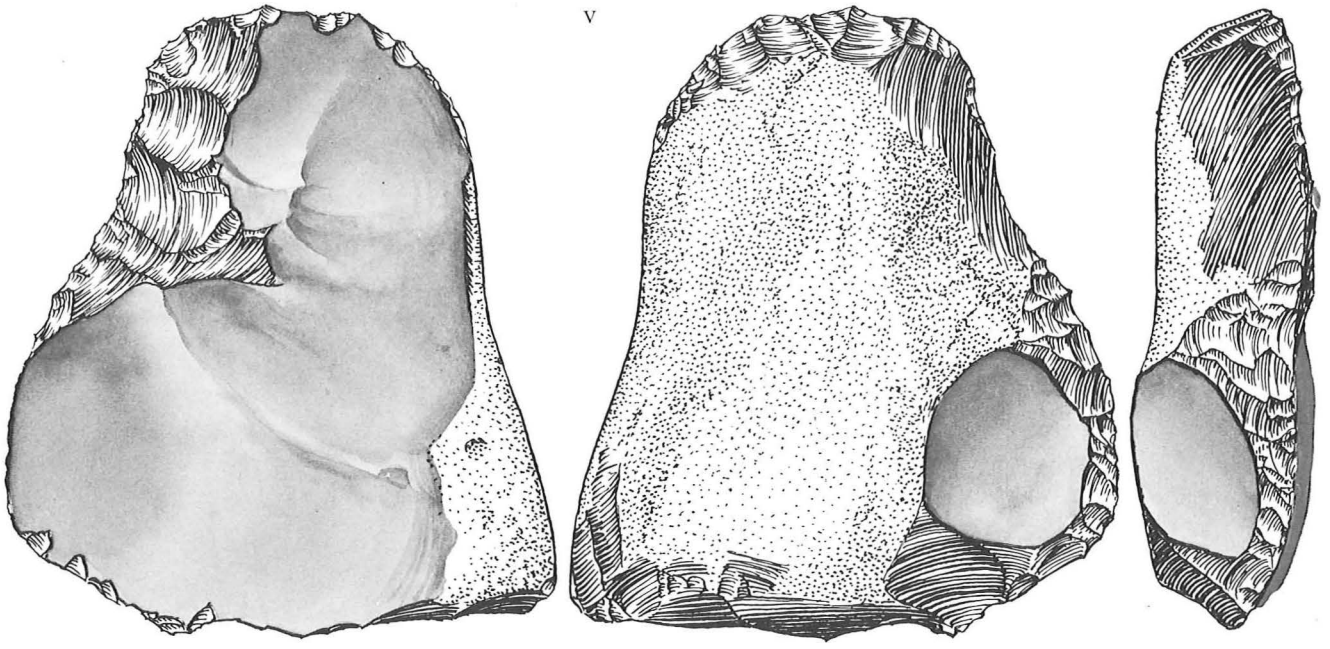
Pl. XXXIV Concentration A: Double scrapers (25/43: *convex scraper* and hollow scraper); *convex scraper* (107: *pseudo-grattoir*).

107

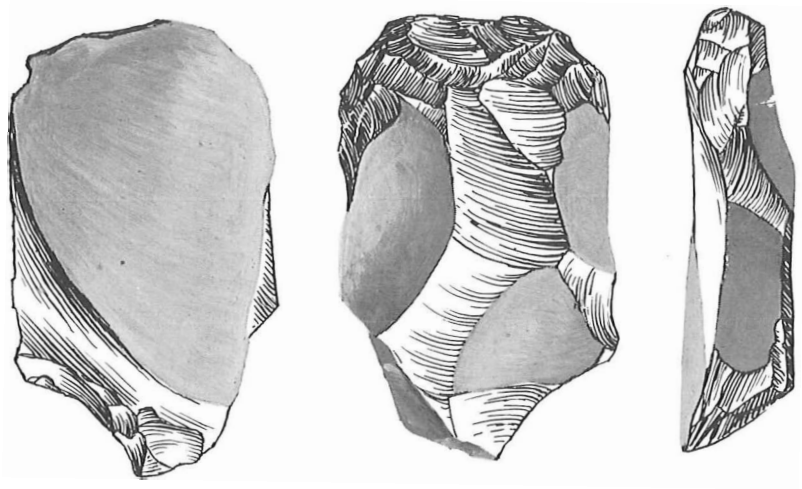




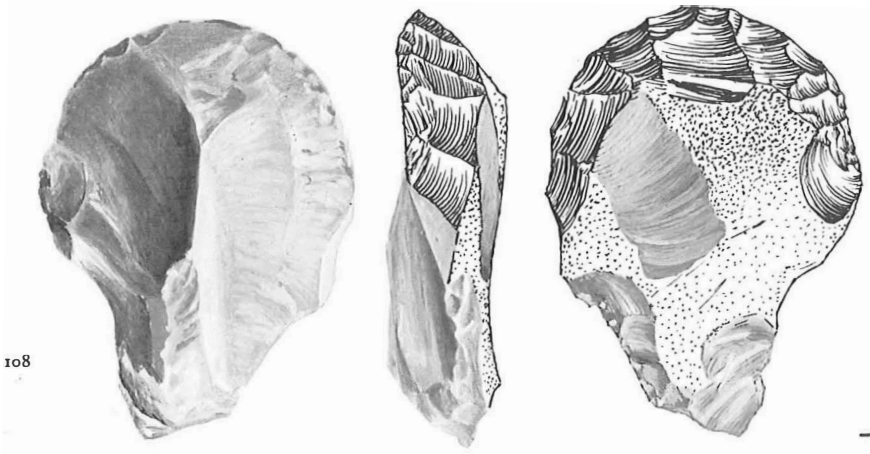
Pl. XXXV Concentration B: Double convex scraper (V) and side scraper (62: *racloir simple, rapprochant convex scraper*).



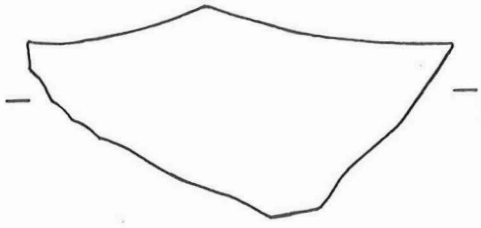
XXXVI



110

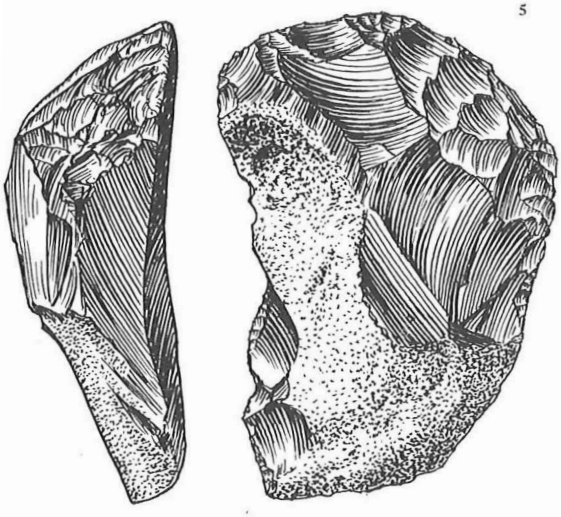


108

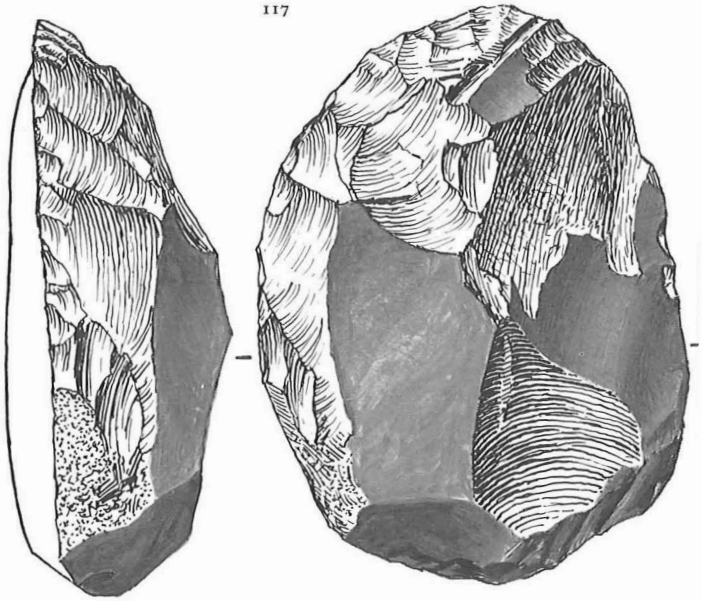


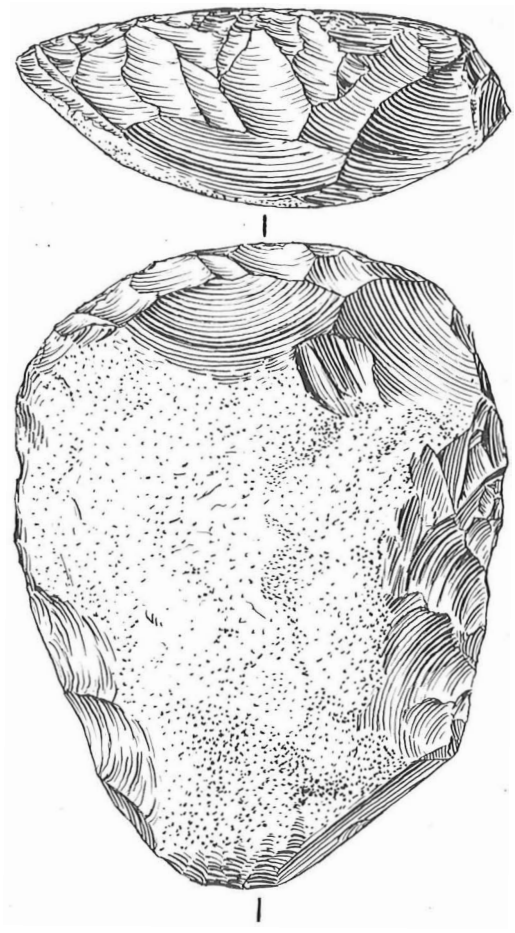
Pl. XXXVI Concentration A: *Convex scrapers* in the shape of endscrapers (*pseudo-grattoirs*).

5

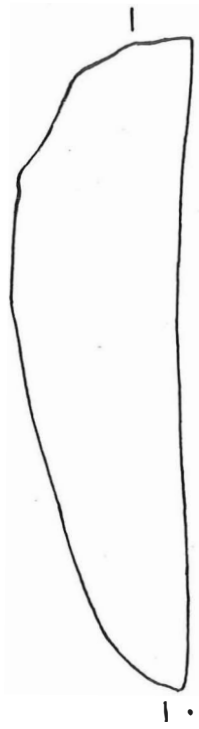


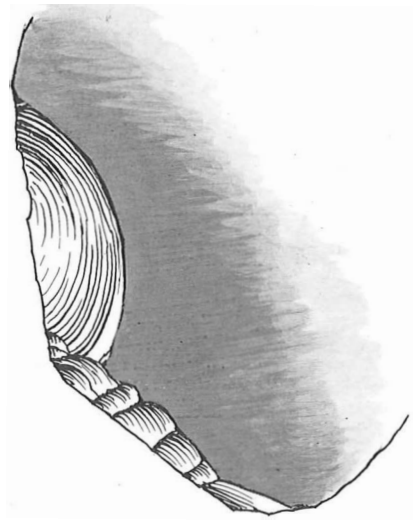
117



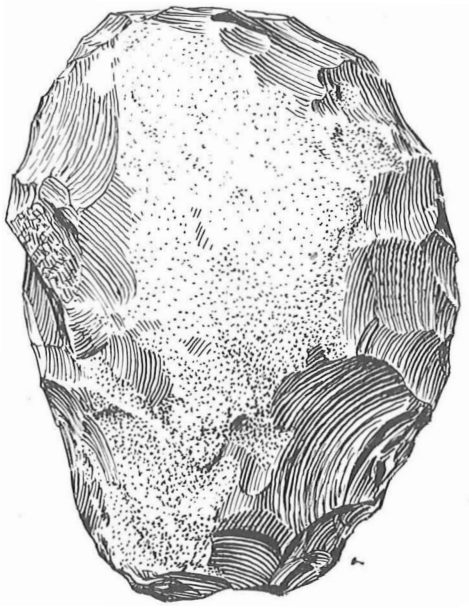


61

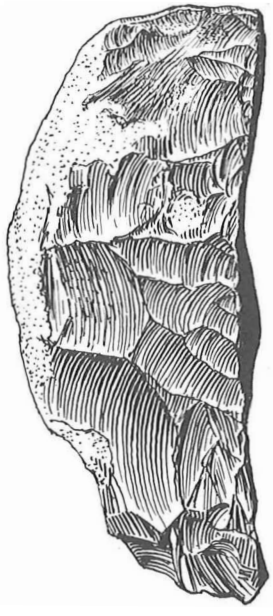


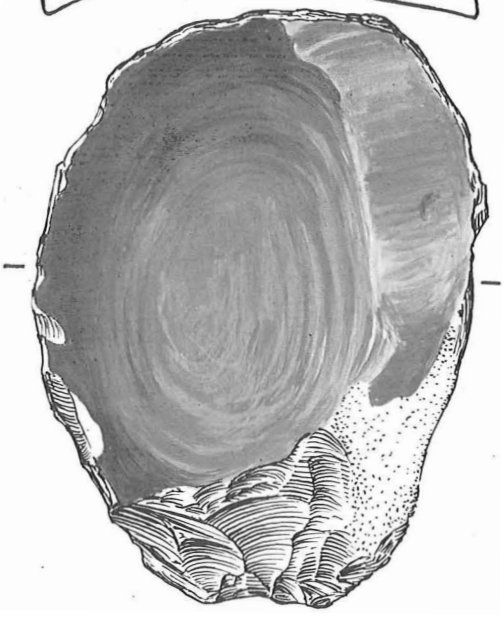


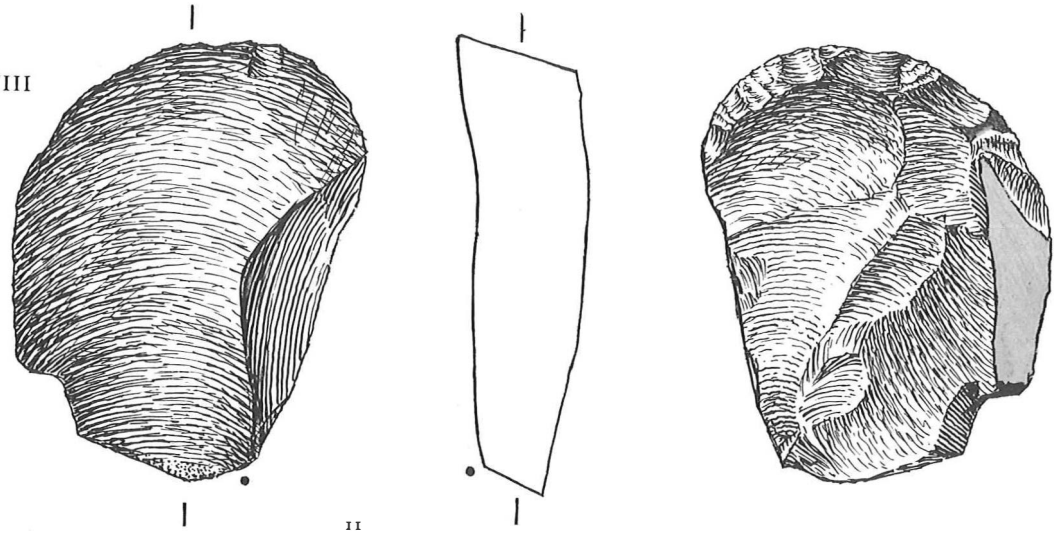
Pl. XXXVII Concentration B: *Convex scraper* (59); *convex scraper* in the shape of an endscraper (61: *pseudo-grattoir*).

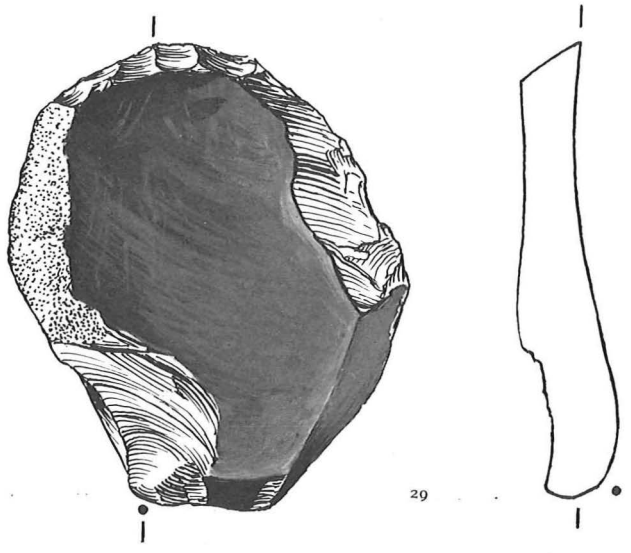


59

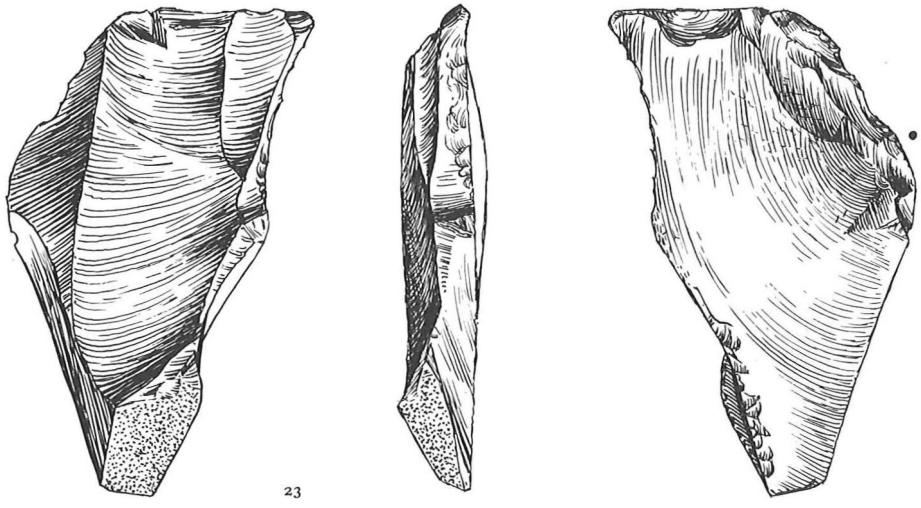


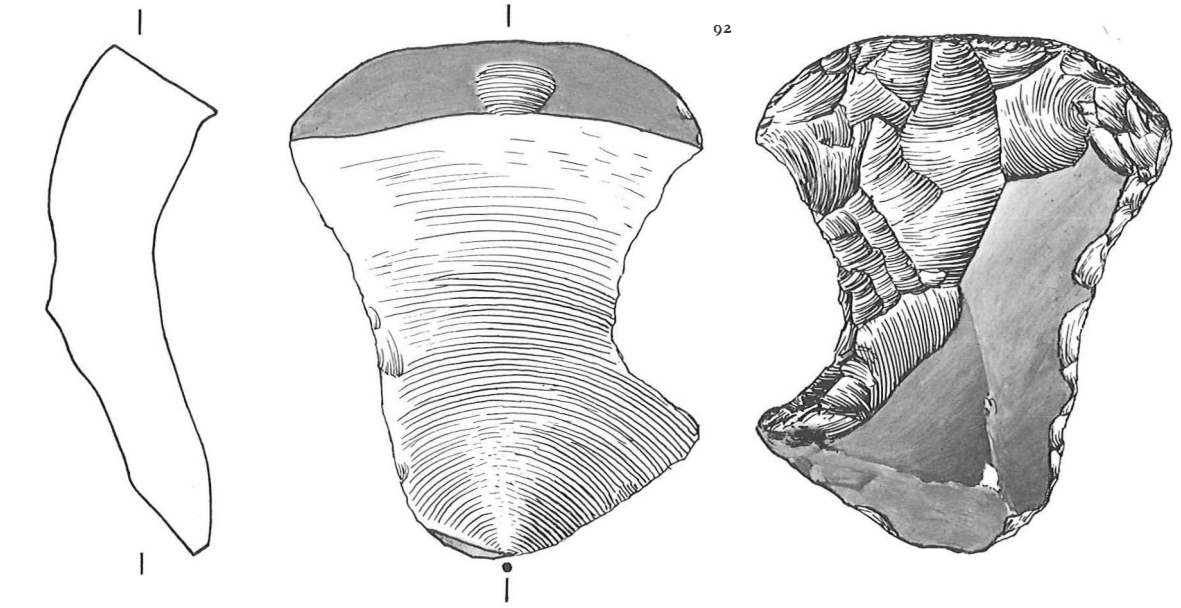


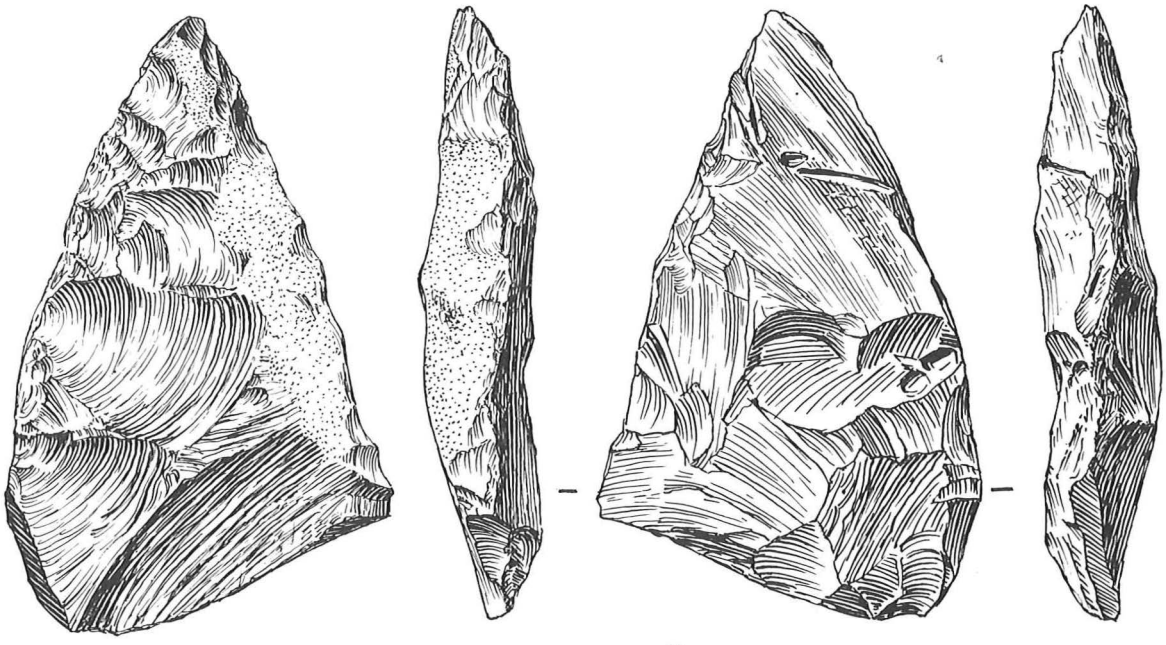


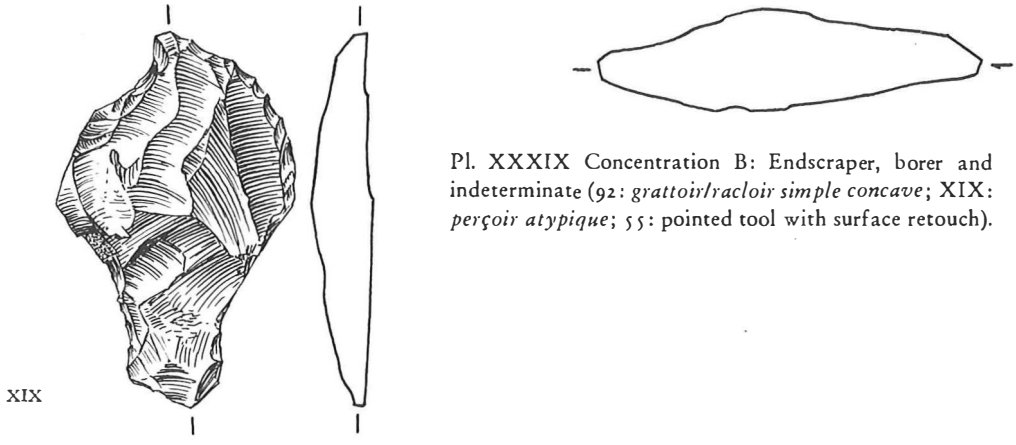


Pl. XXXVIII Concentration A: Endscrapers and borer (11, 29: *grattoirs*; 23: *perçoir atypique*).

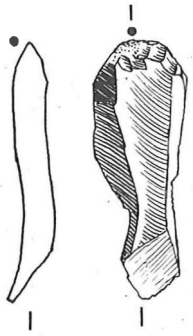




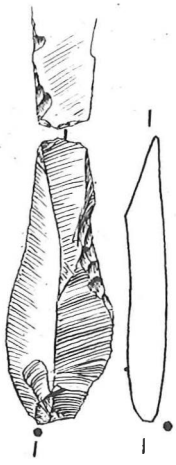




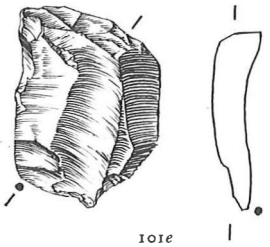
Pl. XXXIX Concentration B: Endscraper, borer and indeterminate (92: *grattoir/racloir simple concave*; XIX: *perçoir atypique*; 55: pointed tool with surface retouch).



109*a*

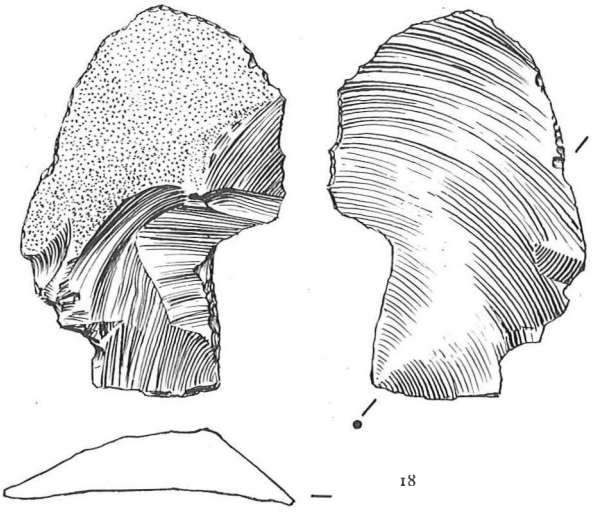


118*a*

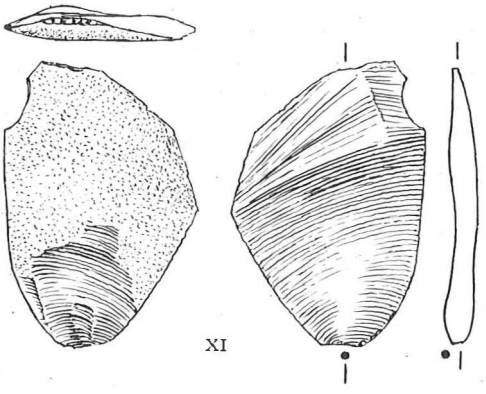


101*e*

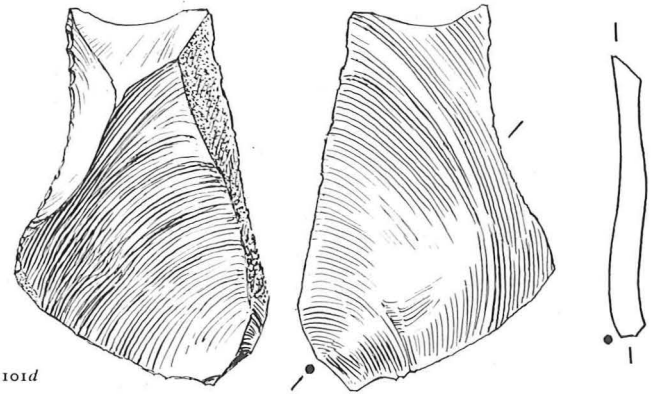
Pl. XL Concentration A: Worked and unworked flakes and blade (18, 101[d]: *éclats à retouches abruptes minces*; 101[e], XI, XX, 41, 40: flakes; 109[a], 118[a]: bladelets; 109[a], 118[a], 101[e]: flint group Af; 18, XI, 101[d], 40, 41: flint group Ae).



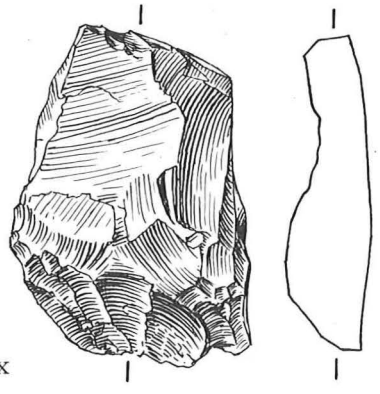
18



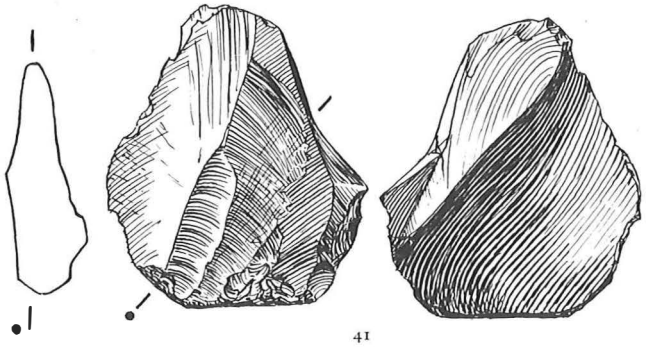
XI



101*d*



XX



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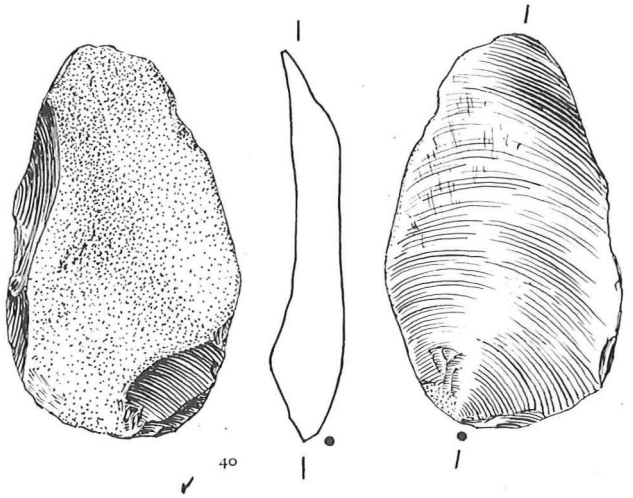

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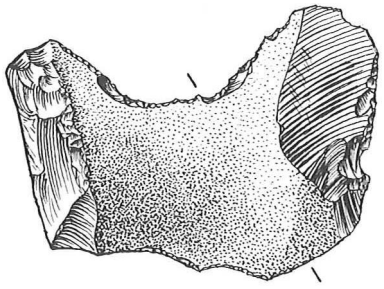
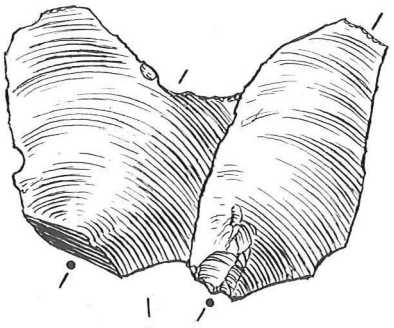
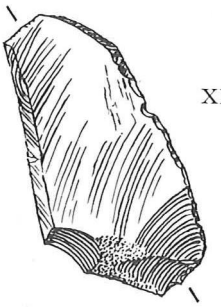
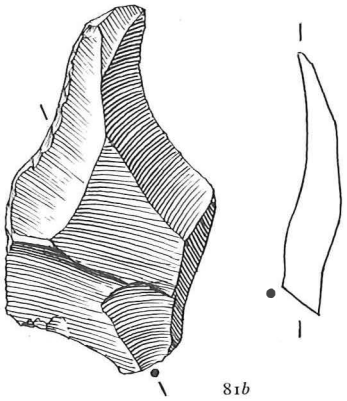


XVI

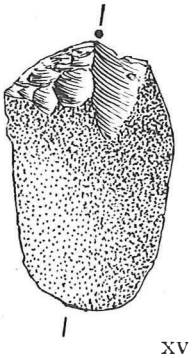




XVIII

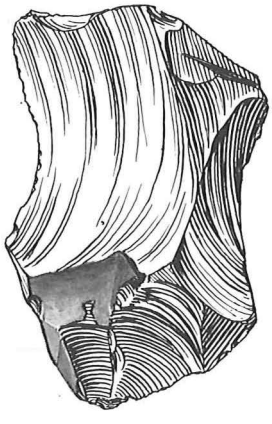


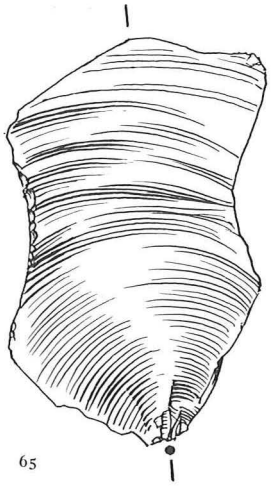
81*b*



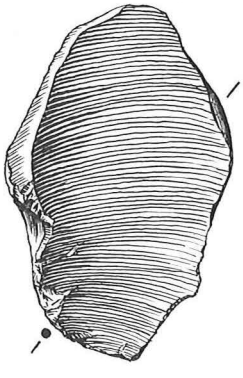
XV

Pl. XLI Concentration B: Worked and unworked flakes and blades (XVI, 81[b], XII: (pseudo-) *raclettes*; 65, XVIII: *éclats à retouches abruptes minces*; XV, 96, 85: flakes; XVI, XVIII, XV, 96: flint group Bj; 65, 85, XII: flint group Ba).

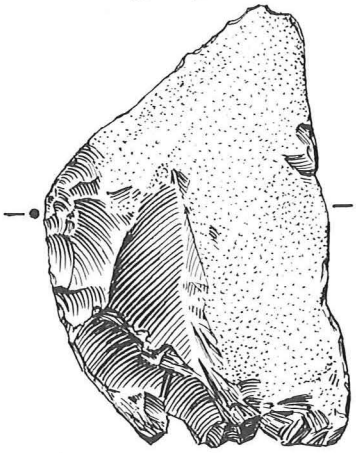




65



96



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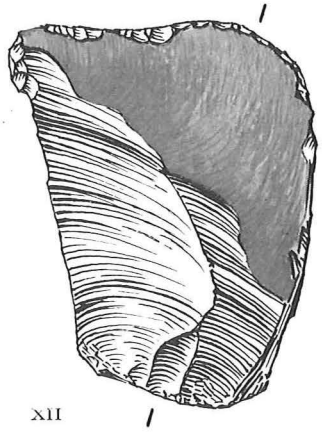
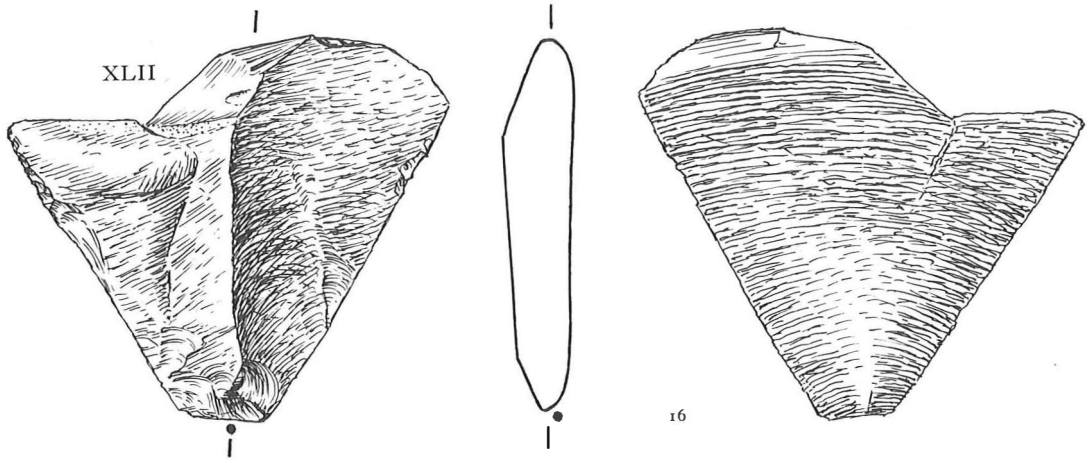
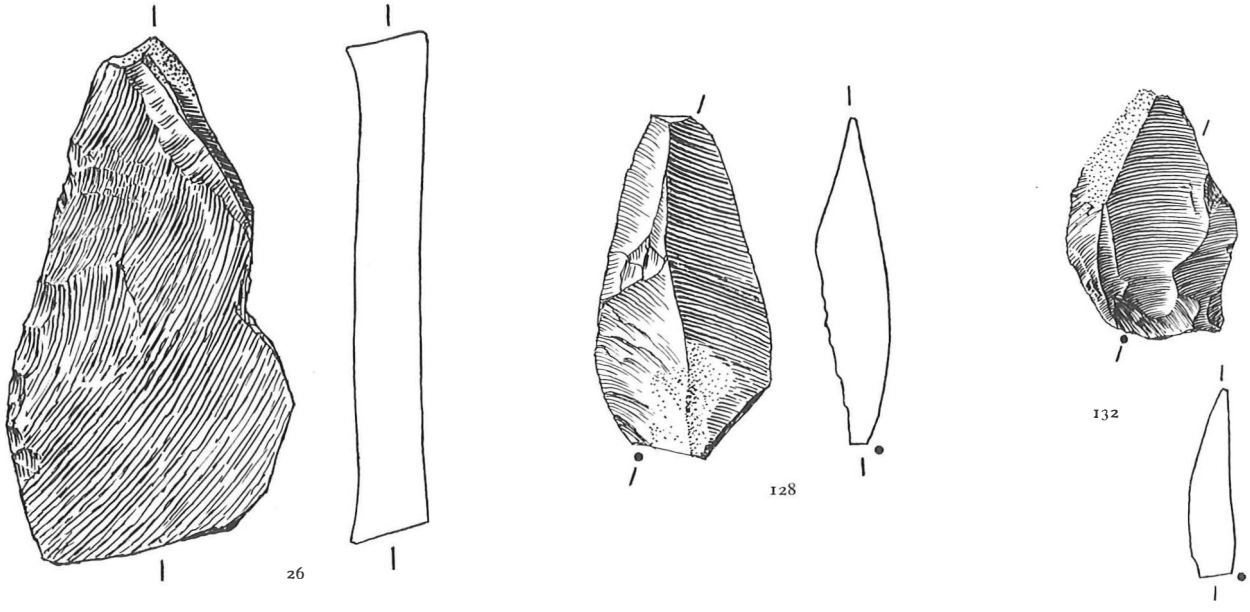
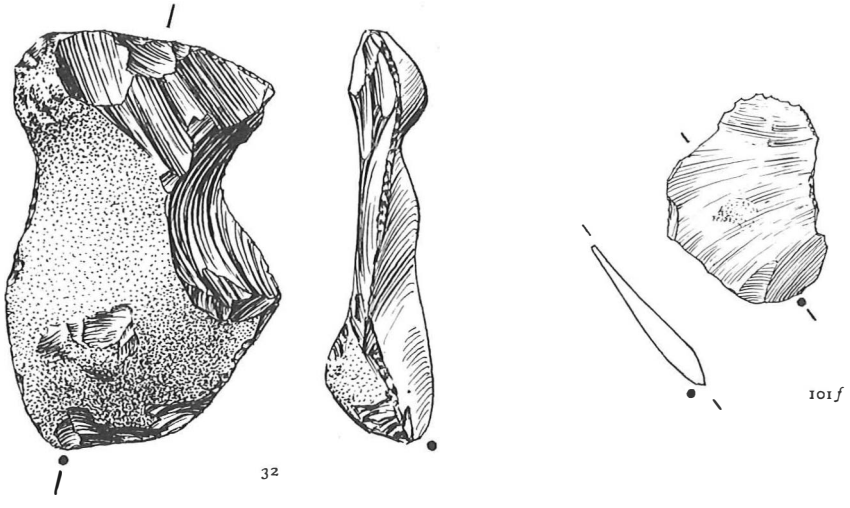


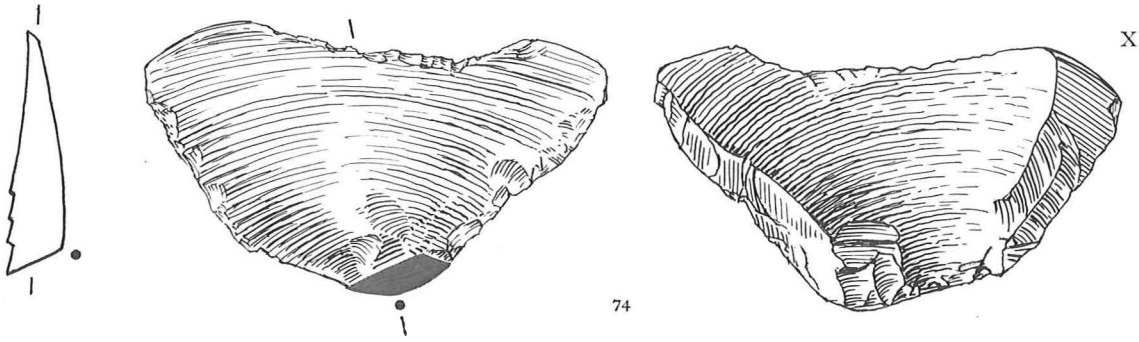
XII



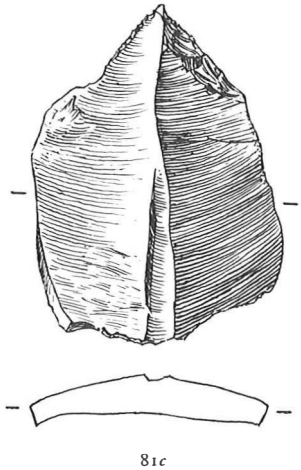


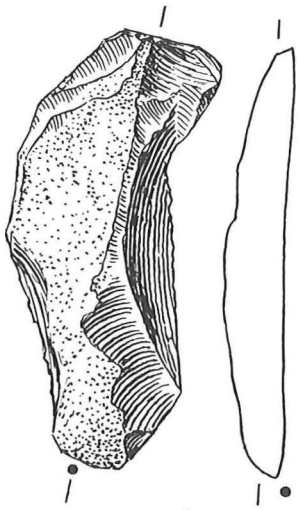
Pl. XLII Concentration A: Worked and unworked flakes (16, 26: *éclat et débris à retouche alterne mince*; 32: *éclat à retouche abrupte mince*; 16, 26, 128 and 74 of next plate: flint group Ab).

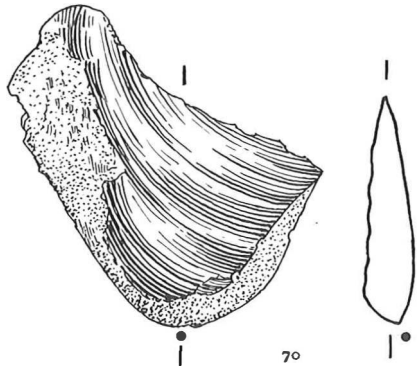


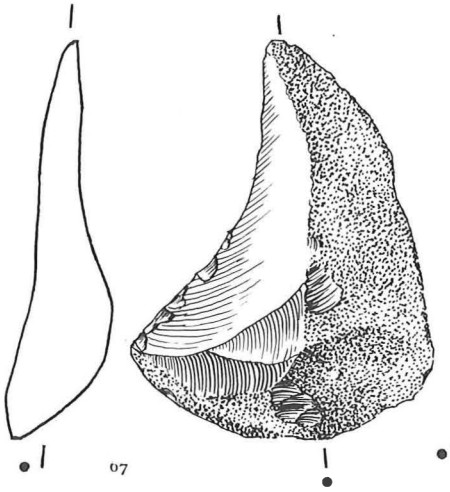


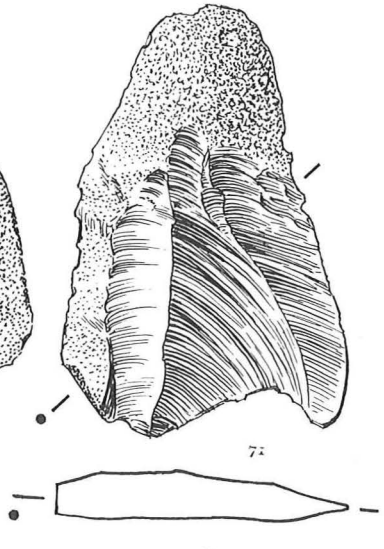
Pl. XLIII Concentration B: Worked and unworked flakes and blades (81c, 70, 71, 68: *éclats à retouches abruptes minces*; 67: *éclat à retouche alterne mince*, 74: flint group Ab, *cf.* preceding plate; 76: flint group Ai; 70, 67, 71, 68: flint group Bc).

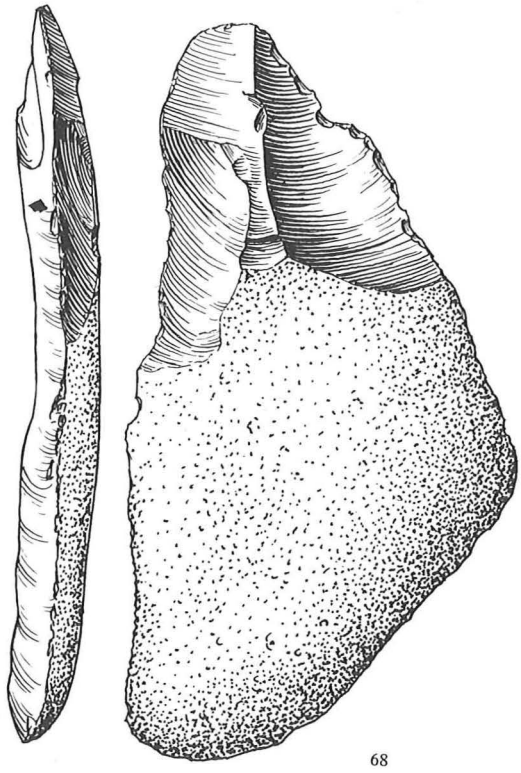


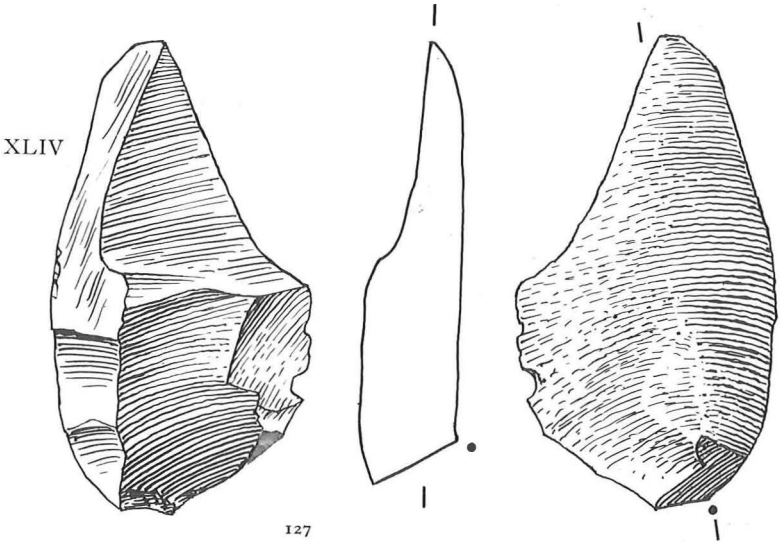


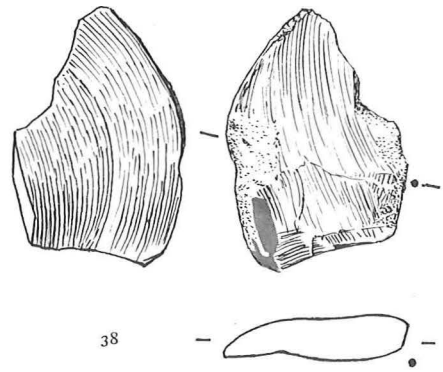




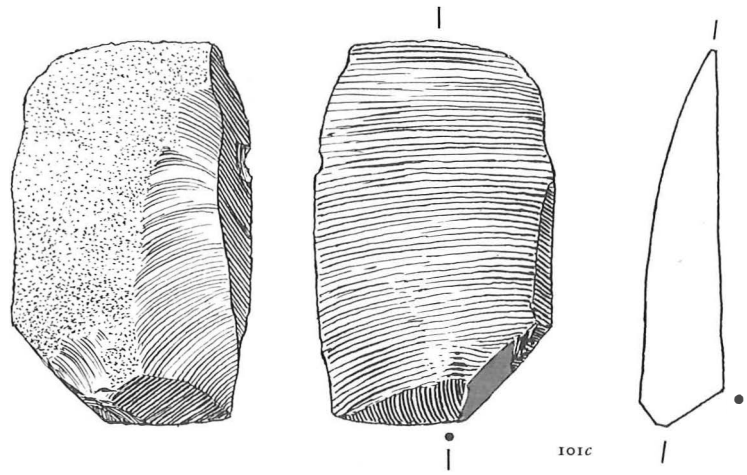


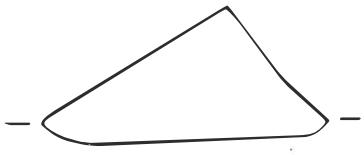


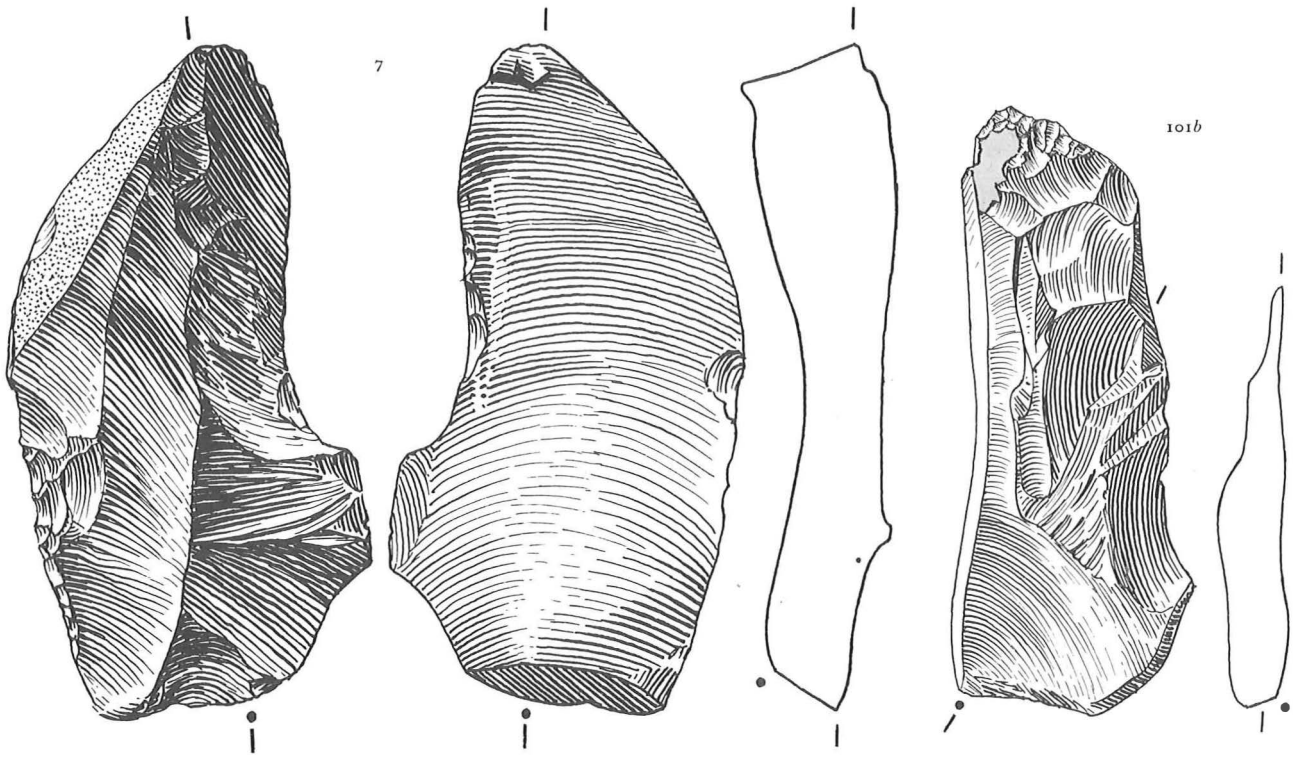


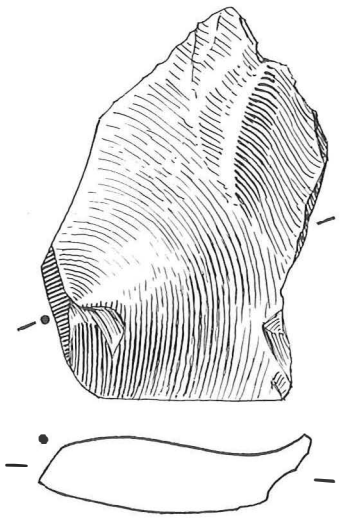


Pl. XLIV Concentration A: Worked and unworked flakes and blades (7: *lame à retouche alterne mince*; 127, 38, 101[e], 101[b]: flakes; 127, 38, 101[e], 7: flint group Ac; 101[b]: flint group Bi, *cf.* next plate).

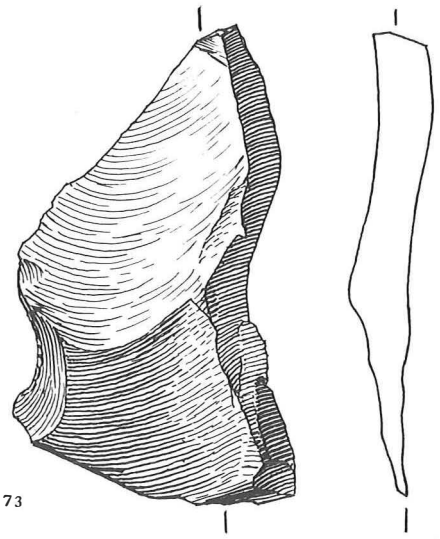






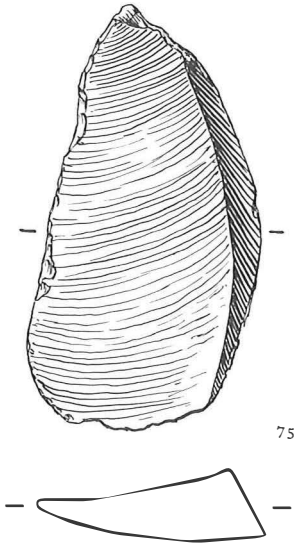


77



73

Pl. XLV Concentration B: Worked and unworked flakes and blades (75, 100, 72: *lames à retouches abruptes minces*; 77, 75: flint group Bb; 73, 100, 90, 72 and 101[b] of preceding plate: flint group Bi).



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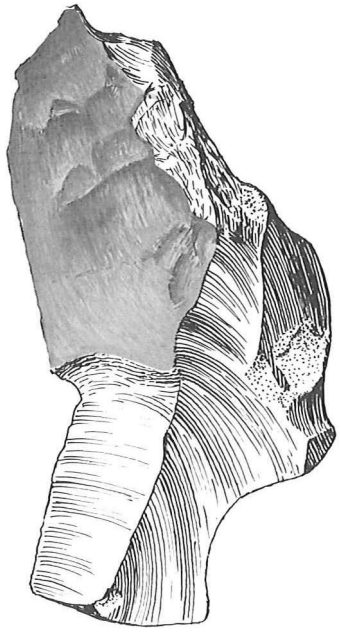

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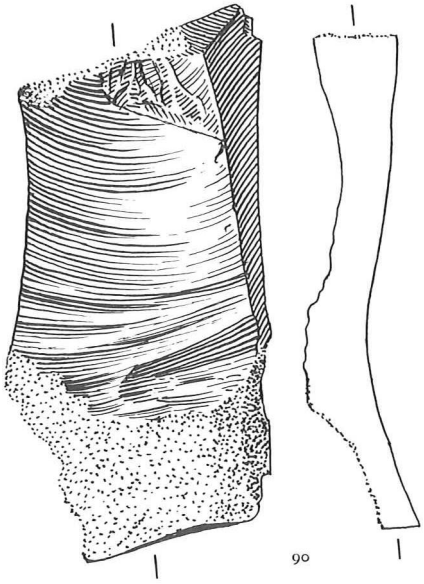

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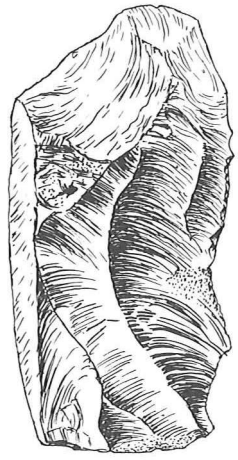

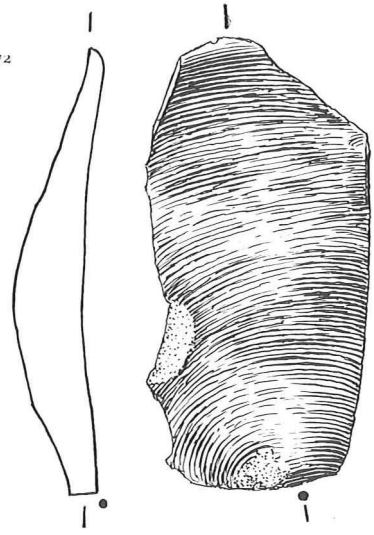

72