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MAREK CHŁODNICKI AND JACEK KABACIŃSKI

MIRKOWICE – ANOTHER SETTLEMENT OF THE HAMBURGIAN CULTURE AT THE POLISH PLAIN

Paper dicuss a new-discovered Hamburgian site located in the northern part of the Polish Lowland. A detailed technological and typological analysis of flint materials as well as stratigraphic and palaoenvironmental context of the settlement are presented. Exceptional geomorphological and stratigraphic position of the site – location at a dune in the close vicinity of the glacial trough, filled with biogenic sediments of the Bølling times – creates a unique possibility of a relatively complete reconstruction of the Early Late Glacial environment during the times of human occupation and a real chance of recovering artefacts made wood, bone and antler. Location of the Mirkowice site far north of the maximal extent of the last glacier is another argument in the discussion on spatial distribution of the Hamburgian settlement and generally supports a thesis of fast expansion of the Hamburgian to the north.

KEY WORDS: Early Late Glacial, archeological finds, palaeoevironmental reconstruction

1. INTRODUCTION

In the early spring 1992, during regular field penetration in the area located ca 70 kilometres northeast of Poznań (Fig. 1), Marek Chłodnicki and Bogusław Okupny of the Poznań Archaeological Museum have found locally exploited sand quarry that served also as the dumping area. Within this area they recorded numerous pottery fragments of the neolithic Globular Amphorae Culture. This discovery resulted in the same year a regular rescue excavation around the devastated area, conducted by the explorers of the site. Following the name of the neighbouring village the site was called and registered as Mirkowice 33.

Within four following seasons the area of over 600 square metres was excavated (Fig. 2), and settlements of a few different archeological units have been found: early Funnel Beaker Culture (Early Wiórek phase), Globular Amphorae Culture (II/IIIa phase), Late Neolithic settlement of the so called Forest Cultures, Corded Ware Culture and single traces of Lusatian Culture. The archeological material was usually found not deeper than 50-60 cm below the present surface.

In the 1994 season in the north-western part of the excavated area and slightly below the maximal range of the neolithic materials, the concentration of flint material was recovered – later identified as belonged to the Hamburgian Culture. In the 1994 and 1995 seasons most of this concentration was excavated.

Next excavation season (1996) – already conducted by Jacek Kabaciński – was concentrated on the palaeolithic settlement exclusively. During this season four trenches were opened including two stratigraphical ones (Fig. 2) in order to: *(i)* recognize the geomorphology and stratigraphy of the site; *(ii)* record the exact location of Hamburgian materials within the litho-stratigraphic sequence and *(iii)* follow initially the relation between the sandy part of the site – where flint materials were excavated – and the organogenic sediments deposited in the vicinity.

Fig. 1. Location of the site at Mirkowice (empty circle). Dotted line marks the maximal extension of the Vistulian ice-sheet

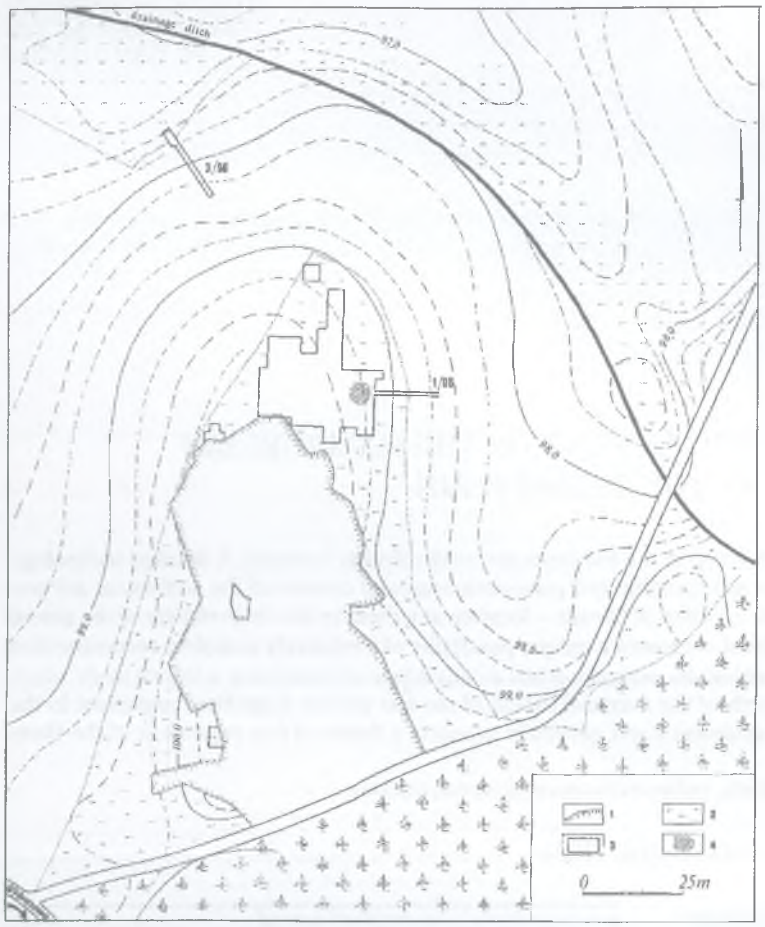

Fig 2. Topographic map of the site
(1 – limits of sand quarry; 2 – peatbog; 3 – archaeological trenches; 4 – concentration of the Hamburgian material)

2. GEOMORPHOLOGICAL SETTING OF THE SITE

The Mirkowice site is located in the northern part of the Great Poland Lowering that is the most western part of the Polish Lowland. According to generally accepted geomorphological setting of this area (Krygowski 1956) the site has been found within the Gniezno Plateau Region, and to be more specific, within the Żnin Plain Sub-region (Fig. 3).

The site occupy the very north-western end of the several hundred metres long dune ridge, heavily deflated in this part and modified by the modern human activity. The dune was formed on the south-eastern bank of the glacial trough filled with the biogenic materials (Fig. 4). The trough itself is one of several that were drained away melted glacier waters in the NE direction during Sypniewo-Sielec oscillation of the Chodzież readvance stage of the Vistulian, some 18 800 conv. years BP (Nowaczyk 1967; Kozarski 1995, Fig. 1).

In the 1996 season stratigraphy and geomorphology of the site was initially recognized[1] and it looks as follows: within the sandy part of the site (trench 1/96) on the basement of fluvioglacial deposits built of sands and gravels a sequence of two aeolian series was recorded. The lower one – most probably a dune – was formed during the early phase of the Late Glacial Period. On the surface of this dune a settlement of the Hamburgian Culture was located. Having in mind the chronology of the Hamburgian that postdate this dune (for C^{14} dates see Burdukiewicz 1987, Fig. 58), the lower aeolian serie was deposited during the Oldest Dryas or the very beginning of the Bölling. In the top part of the lower aeolian series a well developed palaeosoil was recovered comprising most of the Hamburgian flint materials. The palaeosoil is most probably of the

Fig. 3. Geomorphological setting of the Gniezno Plateau (acc. to Krygowski 1956, map 2; 1 – Środa Plain; 2 – Kostrzyn and Poznań Hillocks; 3 – Wągrowiec Plain; 4 – Czarnków Hillocks; 5 – Chodzież Hillocks; 6 – Żnin Plain; 7 – Janowiec Hillocks; 8 – Gniezno Plain; 9 – Gniezno, Mogilno and Skulsk Hillocks; 10 – Kleczew Plain; 11 –Września Plain). Black arrow indicates the approximate location of the Mirkowice site

[1] We would like to express here our thanks to Prof. Romuald Schild who is conducting geomorphological and stratigraphical studies of the site for initial information.

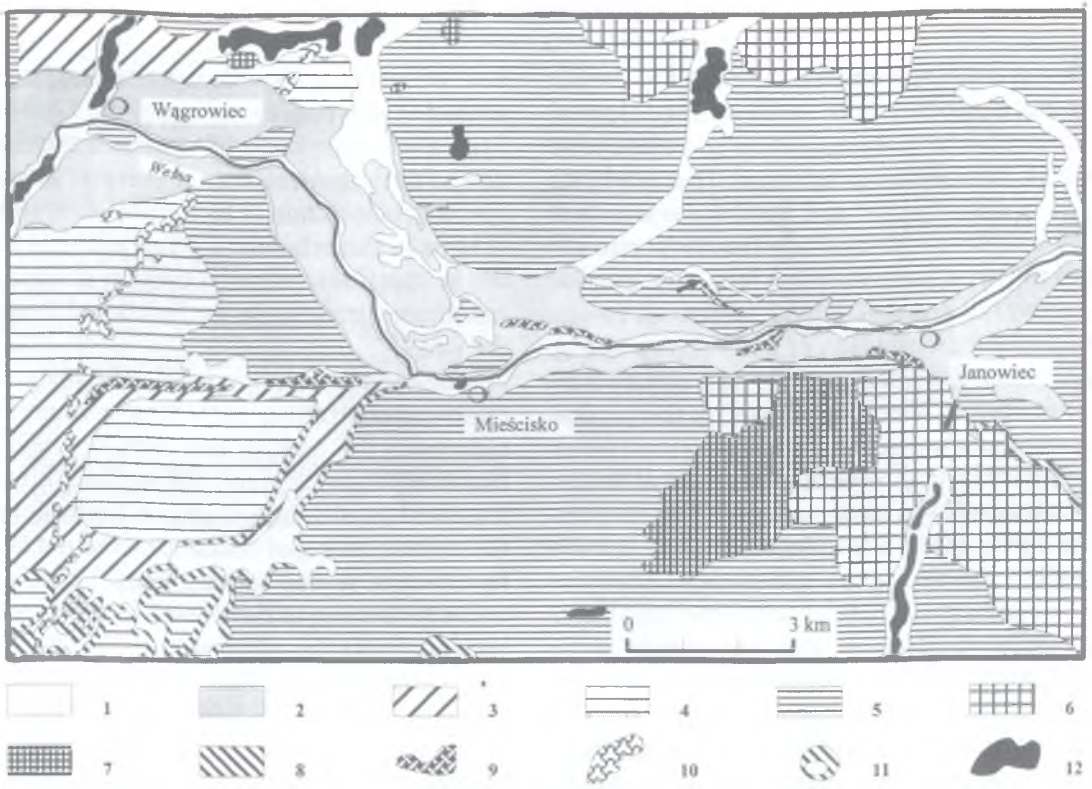

Fig. 4. Geomorphological map of the Mirkowice region (acc. to Bartkowski and Krygowski 1964, with supplements of S. Kozarski and J. Kabaciński; 1 – glacial trough bottom; 2 – higher terraces; 3 – outwash plain; 4 – flat moraine; 5 – undulating moraine; 6 – hillock moraine; 7 – terminal moraine; 8 – edges and slopes of the valleys; 9 – dune ridges; 10 – esker ridges; 11 – monadnocks; 12 – water basins). Black arrow indicate the location of the Mirkowice site

Late Glacial age, however its exact age as well as the relation to the Hamburgian settlement is not clear yet. The lower dune is covered by the younger one that within the site area is heavily deflated and its thickness do not exceed 40-50 cm. The age of the upper dune is unknown but very possibly it was also formed during the Late Glacial[2]. In this dune – mostly in the deeper part – palaeolithic flint materials were also recorded together with limited traces of the Neolithic and Early Bronze Age settlement.

In a distance of ca.70 m off the Hamburgian concentration another trench (3/96) was opened, partially within the glacial trough filled with biogenic sediments. Here a sequence of several calcareous and detrytus gytia layers was recorded, covered by thin peat layer. The very bottom part of the basin is filled with the thick-detrytus gytia. Up to now two radiocarbon dates of single branch fragments were made and these are as follows: 12870±190 conv. BP (Gd-10544) and 12160±80 conv. BP (Gd-7851). Both dates demonstrate the presence of a shallow water reservoir during the Bölling, and when we accept the approximate date of the Hamburgian settlement on the Lowland within 13 and 12 thousands conv. years BP, than this water basin existed during the occupation. Another two C^{14} dates (8020±150 conv. BP – Gd-9652 and 3310±140 conv. BP – Gd-9666) made of a set of small wood fragments excracted from the upper gytia layers are much younger and they do not confirm the initial palynological dating of these gytia layers[3].

In the southern part of the peatbog trench at least two dune phases were observed interfingering the gytia layers in the beach zone of the basin. However, because the relation between aeolian series traced in the sandy part of the site and those found in the glacial trough are not cleared up definitely, the exact relation between dunes is not established yet.

All the gytia layers delivered the paleofaunal remains and the reachest is the thick-detrytus gytia of the Bölling times where many fish, birds, amphibia and small mammal remnants were recorded. These are submitted to the future studies of the local environmental conditions around the site.

[2] During the 1997 it was proved this aeolian serie is older than Alleröd.

[3] Palynological studies are conducted by Prof. Kazimierz Tobolski and Mrs. Lucyna Kubiak-Martens.

3. DESCRIPTION OF MATERIALS

The flint assemblage was mostly explored during the rescue excavations where some methodological standards obvious for the excavation of Palaeolithic and Mesolithic sites were not followed. That is why its composition is very specific and need some words of comment. First, we must mention that in horizontal plan all the material was recorded in a very general manner, i.e. within squares 2 by 2 meters. It means that the horizontal distribution of finds shown at Fig. 5 reflects oryginal distribution as far as a square 2 by 2 meters it concerns. Much more exactly the vertical distribution of finds was recorded – within the 10 centimeters arbitrary layers. Nevertheless, most of the excavated flint artefacts were encountered in the concentration ca. 6 by 6 meters. Some finds occurred outside these limits but still they show a tendency to concentrate in the neighborhood. Perhaps another small concentration exists in the very northern corner of the trench but that will be check during future excavation.

In the first seasons of excavation – from 1992 to 1995 – the site was excavated by shoveling, without screening. It caused that the assemblage is dominated by larger pieces with almost complete lack of small flakes, chunks and chips. Assuming that chips usually cover 70 to 80 percent of the well explored concentration, we can roughly estimate the complete number of artifact in the concentration at ca. 1200-1500 pieces. Such a selective material creates a number of limitation in the interpretation of the site. Nevertheless, a specific composition of tool group, over-representation of tools in the relation to other artifacts and unbalanced proportions between certain groups of artifacts constitute a good basis for functional interpretation of the site.

Below we describe whole the material from the main concentration, including some characteristic tools from the outside that certainly belonged to the Hamburgian settlement. We exclude however a limited number of debitage pieces from the area around the concentration of which we were not sure they can be included to the Hamburgian. These doubts from one side are due to the presence of the Neolithic settlement. From the other side, single finds might suggest a younger Late Glacial settlement connected with the so called Arch Backed Point Technocomplex. Certainly, a future studies on the articulating pieces let us include at least part of that debitage to the Hamburgian assemblage.

Artifacts were studied following the rules of the dynamic technology analysis of stone assemblages

Fig. 5. Mirkowice 33. Concentration of the Hamburgian Culture artifacts: horizontal distribution of tools (1 – end-scrapers; 2 – burins; 3 – perforators and groovers; 4 – Zinken; 5 – truncations; 6 – backed points; 7 – notches; 8 – shoulder points; 9 – tanged point; 10 – combined tools; 11 – retouched flakes; 12 – retouched blades)

Table 1. Mirkowice 33. General structure of the assemblage
(* – percent counted without unidentified and fragments)

DEBIGATE TYPE	n.	% (*)	%
GROUP I – PREPARATION OF CORES AND INITIAL PHASE OF CORE EXPLOITATION			
1. Initial cores	1	0.40	0.35
2. Cortex flakes	4	1.59	1.38
3. Cortex blades	4	1.59	1.38
4. Primary *lames à crete*	10	3.98	3.46
5. Core trimming flakes	9	3.59	3.11
GROUP II – PRODUCTION OF FLAKES			
6. Flakes from single platform cores	28	11.15	9.69
7. Flakes from opposed platform cores	4	1.59	11.38
GROUP III – PRODUCTION OF BLADES			
8. Blades from single platform cores	32	11.95	10.38
9. Opposed platform cores for blades	2	0.80	0.69
10. Blades from opposed platform cores	14	5.58	4.84
11. Cores for blades with changed orientation	2	0.80	0.69
12. Blades from cores with changed orientation	1	0.40	0.35
GROUP IV – REPAIRS			
13. Core tablets	2	0.80	0.69
14. Secondary *lames à crete*	7	2.79	2.42
GROUP V – TOOLS AND TOOL PRODUCTION WASTES			
15. Tools	126	50.20	43.60
16. Burin spalls	6	2.39	2.08
17. Microburins	1	0.40	0.35
GROUP VI – UNIDENTIFIED AND CORE REDUCTION WASTES			
18. Core fragments	2	–	0.69
19. Chips	29	–	10.04
20. Chunks	7	–	2.42
SUBTOTAL (WITHOUT GROUP VI)	251	100.00	–
TOTAL	289	–	99.99

proposed already in the 70-ties (Schild et al.1975; Schild 1980). When making typological characteristic of tool group we applied general typological list created by R. Schild for all the Late Glacial materials of the European Lowland (Schild 1975) as well as more detail list of J. Burdukiewicz (1987) formed to describe the Creswellian and Hamburgian assemblages, with some modifications only.

All the material is shown in two general tables (Table 1 and 2) accompanied by the individual description of the artifacts or groups of artifacts, where references to the drawings are also present.

GROUP I – PREPARATION OF CORES AND INITIAL PHASE OF CORE EXPLOITATION

1. Initial cores – one specimen only. That is a part of a larger core broken during the exploitation along the raw material cracking. Few fine flakes were removed and core was abandoned. As a striking platform a surface formed by thermal cracking was taken. Except the striking platform it is completely covered by cortex, not showing any traces of core preparation.

2. Cortex flakes – four specimens with two complete and two broken ones were found. Off three with

Table 2. Mirkowice 33. Structure of the tool group

TOOL TYPE	n.	%
1. End-scrapers on flakes	1	0.79
2. End-scrapers on blades	4	3.17
3. Dihedral burins	1	0.79
4. Burins on truncation	11	8.73
5. Multiple burins on truncation	2	1.59
6. Burins on a snap	3	2.38
7. Mixed burins	1	0.79
8. Perforators	23	18.25
9. Double perforators	2	1.59
10. Zinken	7	5.56
11. Groovers	4	3.17
12. Truncations	14	11.11
13. Double truncations	2	1.59
14. Backed points	2	1.59
15. Notches	4	3.17
16. Shoulder points	11	8.73
17. Tanged points	1	0.79
18. Combined tools	6	4.76
19. Retouched flakes	11	8.73
20. Retouched blades	16	12.70
TOTAL	126	100.00

preserved butts two flakes have cortex butts and one undetermined. All were removed with hard hammer.

3. Cortex blades – four specimens, all are broken. Only one piece has a *lisse* butt.

4. Primary lames à crete – ten specimens of which seven are untouched and three are broken. Four blades have a crest made from two sides and another six from one side only. Off seven blades with preserved butts two have *lisse,* one pointed and three faceted butts. The biggest blade measures 89 x 20 x 7 mm and shows intensive traces of use. The dimensions of the smallest one are 29 x 12 x 5 mm. Except of one all *lames à crete* are very slim specimens (Fig. 6:1,4).

5. Core trimming flakes – nine specimens. There are usually small, oval flakes that have multi-directional scares on the dorsal surface. Most of them were knocked off during the core preparation process or during the early phase of core exploitation. Eight are complete and one broken. Five butts are faceted and three are unidentified. The biggest one measures 15 x 20 x 4 mm, the smallest 30 x 29 x 3 mm. They were removed mostly with the help of soft hammer.

GROUP II – PRODUCTION OF FLAKES

6. Flakes from single platform cores – twenty-eight specimens including nineteen complete and nine broken. Within the broken flakes five are proximal, one central and three distal fragments. Twenty-four flakes have preserved butts. Nine of them are *lisse*, four pointed, six facetted and five unidentified. The biggest one measures 69 x 71 x 19 mm and the smallest 17 x 20 x 3 mm. Most of flakes were removed with hard hammer. Some specimens wear traces of striking platform edge smoothing.

7. Flakes from opposite platform cores – four flakes (three complete and one distal fragment). Two butts are pointed and one is unidentified. The biggest measures 34 x 18 x 3 mm and the smallest 27 x 14 x 2 mm. All flakes are very slim, close to blade proportions. Some were removed of the core with the punch.

GROUP III – PRODUCTION OF BLADES

8. Blades from single platform cores – thirty specimens including seven complete and twenty-three broken pieces. Within these last ones eight are proximal, two central and therteen distal parts. Most of them seem to be broken accidentally – during the removal or later. However, at least two blades were certainly broken intentionally. For breaking a technic of direct percussion at the dorsal surface of blade was applied. Within specimens with preserved butts five have *lisse,* seven pointed, one faceted and two unidentified butts. For blade removal a soft hammer or punch was used. The largest blade measures 75 x 14 x 4 mm and the smallest 22 x 7 x 2 mm.

9. Opposed platform cores for blades – two specimens. First – 48 x 20 x 22 mm – has both platforms placed under an acute angle formed with single blows, and common striking surface. Platform edges were trimmed during the exploitation. Both sides and back of the core were prepared (Fig. 6:5). Second specimen – 53 x 29 x 52 mm – belongs to category *opposite platforms and opposite sides.* Both platforms were carefully faceted and the platform edges were trimmed during exploitation of the core. It also shows the traces of side preparation to narrow the striking surface (Fig. 6:2).

10. Blades from opposite platform cores – fourteen blades with seven complete and seven fragments. Within fragments three are proximal, one central and three distal parts. Some blades were intentionally broken with the same technic as the blades from single platform cores (see above). Ten blades have preserved butts including three *lisse,* four pointed, one faceted and two unidentified. Blades were removed by the direct percussion with soft hammer or punch. The biggest unbroken blade measures 65 x 23 x 5 mm and the smallest one 32 x 12 x 3 mm.

11. Cores for blades with changed orientation – two specimens. First core – 71 x 39 x 29 mm – has a cortex striking platform oriented under acute angle to the striking surface. The platform edge was trimmed. Sides of the core were prepared by the removal of several flakes that narrowed the striking surface. When this part of the core was overexploited, the orientation of the core was slightly changed. The upper part of former striking surface was adopted as a striking platform and several blades were removed from the side of the core (Fig. 6:6). When internal cracks of the nodule have been appeared the core was abandoned. Second core – 53 x 30 x 25 mm – was made of the fragment of the larger core that broke during the exploitation (Fig. 6:7). Main striking platform of the core is faceted and the platform edge is partially trimmed. This platform was used to remove 2-3 blades and few flakes. Than the orientation of the core was changed and the second platform was located at the distal part of the primary striking surface. Of this platform several fine blades were removed, perpendicularly to the main core orientation and the core was abandoned. The core is burnt and therefore difficult to study.

12. Blades from cores with changed orientation – only one distal fragment was recorded. The blade was intentionally broken.

GROUP IV – REPAIRS

13. Core tablets – two fine specimens removed from the striking surface side.

14. Secondary lames à crete – seven blades. They bear traces of secondary correction of the striking surface. With no exception there are slim blade speci-

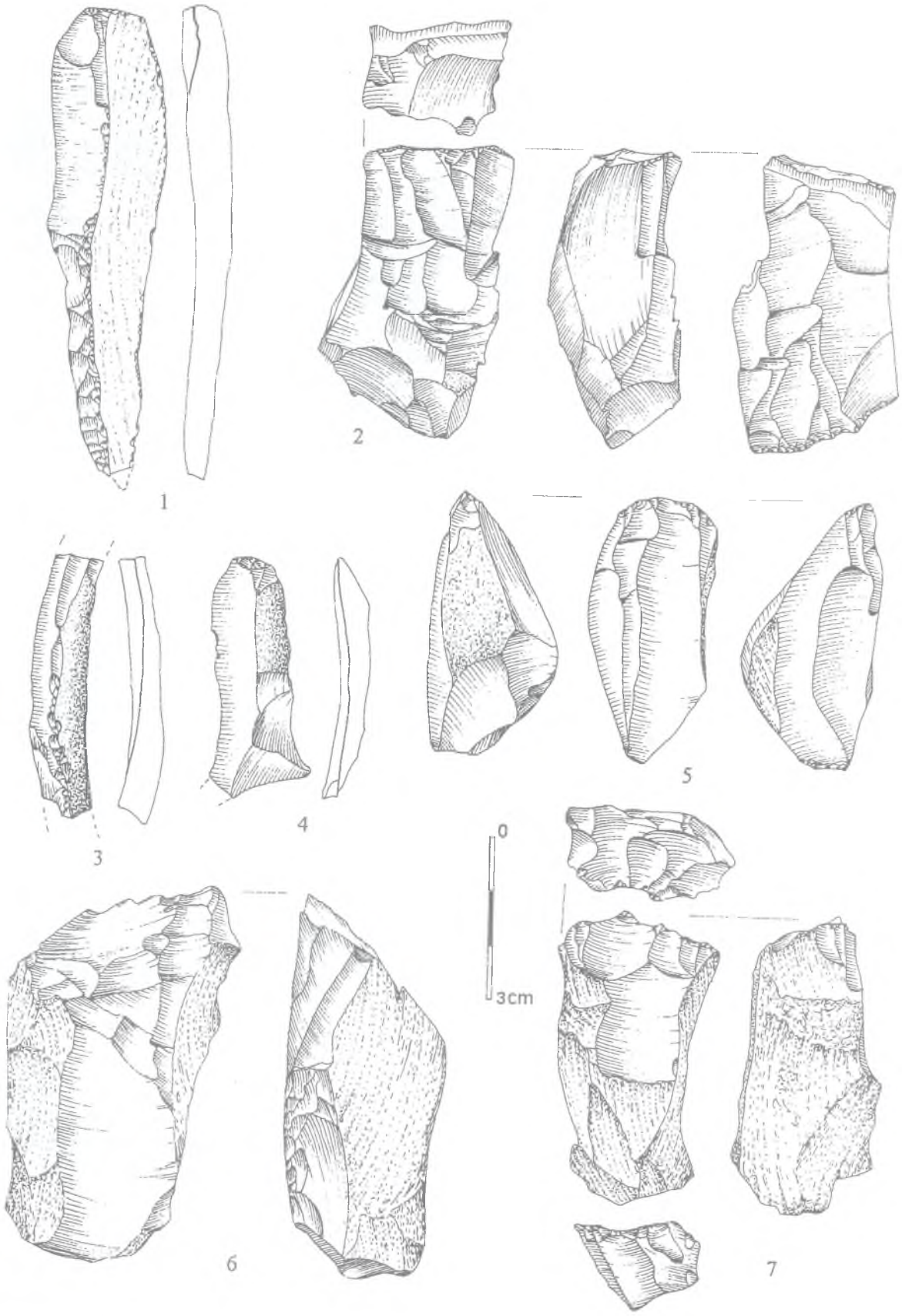

Fig. 6. Mirkowice 33.
1, 4 – primary *lames à crete*; 2, 5 – opposed platform cores for blades; 3 – secondary *lame à crete*; 6-7 – cores for blades with changed orientation

mens mostly removed with the help of soft hammer or punch. Within three *lames à crete* with preserved butts one has dihedral butt, one pointed and one unidentified. The biggest blade measures 75 x 17 x 6 mm, the smallest 38 x 13 x 4 mm (Fig. 6:3).

GROUP V – TOOLS AND AND TOOL PRODUCTION WASTES

15. Tools – One hundred and twenty six retouched or formed tools were recorded within several subcategories (Tab. 2).

(1) End-scrapers on flakes – only one slim specimen (46 x 26 x 6 mm). It was made of a distal part of a secondary *lame à crete.* Flat scraping edge is regularly rounded and located at a proximal part of the blade (Fig. 7:1).

(2) End-scrapers on blades – four specimens including two broken ones. Two complete end-scrapers are very slim. First – 83 x 20 x 6 mm – is made of a primary *lame à crete* (Fig. 7:3). Slightly rounded and low scraping edge is located at a proximal part of the blade. An intensive traces of use are readable on the scraping edge and on sides of the tool. Location of edge retouch at a distal part of the tool suggests that this end was used as a drill. Another end-scraper – 85 x 32 x 8 mm – was made again of primary *lame à crete.* Scraping edge is carefully elaborated and shape remains so-called *grattoir à l'épaulement* (acc. to de Sonneville-Bordes, Perrot 1956) – Fig. 7:2. It is located at a distal part of the blade. Fine lateral retouch is most probably a result of work. Third end-scraper is broken and made of a blade removed from a single platform core, and it is half-covered by cortex. Scraping-edge is flat and slightly fan-like in shape (Fig. 7:4). It measures 47 x 19 x 7 mm. Last specimen (30 x 15 x 6 mm) was made either on intentionally broken blade or was intentionally broken after the scraping edge has been formed (Fig. 7:5). The edge of breakage was later blunted. Scraping edge is regularly rounded and located at a distal end of the blade removed of opposite platform core.

(3) Dihedral burins – one specimen (Fig. 7:6). That is a core-like burin made of a large fragment of a broken core. That is an angle burin with multiple burin blows.

(4) Burins on truncation – eleven specimens (Fig. 7:7-9; 8:1-3), all are made of blades. Three burins were made of *lames à crete,* five of blades removed of single platform cores and three of opposite platform cores. Five burins are central ones (Fig.2:7-9), five of a *'déjeté'* kind (Fig. 8:2-3) and one is the angle burin (Fig. 8:1). Truncated edges are mostly oblique, often also concave, but sometimes also straight. Within eleven broken burins five were intentionally broken. In the case of nine tools burin tip was located at a proximal end of a blank against only two located at opposite end. The largest intact burin measures 63 x 24 x 7 mm and the smallest 40 x 17 x 6 mm. Around half of the tools were additionally retouched on lateral sides.

(5) Multiple burins on truncation – two specimens made of blades removed from single platform cores. The first (Fig. 8:5) is a combination of an angle burin and burin with oblique truncation. The second (Fig. 8:4) has two burin tips located on the same distal end of the blade.

(6) Burins on a break – three specimens. The first – 32 x 24 x 10 mm – is made of a secondary l*ame à crete* and most probably is the only intentionally made burin of this type. A fragment of its left edge is retouched (Fig. 8:6). A burin tip is located at a proximal end of the blank. Two other specimens from typological point of view are burins on a break. However, single burin blows are very fine and easy can be accidental ones. Both are made of blades removed from opposite platform cores (Fig. 8:7-8) and have burin tips located at proximal parts of the blades. Perhaps future microwear studies let us determine if they are real burins or just accidental forms.

(7) Mixed burins – one specimen (47 x 26 x 10 mm). That is a combination of dihedral central burin and angle burin on truncation (Fig. 8:9), and is made of a primary *lame à crete.*

(8) Perforators – twenty-three specimens. That is the most numerous, and very differentiated category of all the retouched tools. It can be divided into two main groups, i.e., *short perforators with well-distinguished tips* and the same *with undistinguished tips.* Within the group with well-distinguished tips (nine perforators alltogether) two subgroups are well visible. In the first subgroup – four tools – perforators have their tips made with a very fine edge retouch and tips itself are delicate (Fig. 8:10-13). Tips within the second subgroup (five specimens) are much more solid and made with abrupt or semi-abrupt retouch (Fig. 8:14-15; 9:1-3).

For the group of perforators with undistinguished tips the same kind of grouping can be made. Six were made with fine edge retouch (Fig. 9:4-6) while the rest (eight tools) with more abrupt retouch (Fig. 9:7-8). Within this last sub-group two perforators show a very distinct traces of use. Very wide tips – extremely rounded by an intensive use – suggest that both tools performed the same and very specific role at the site (Fig. 9:13; 10:1). Future microwear investigations also in this case will allow us to say something more about their function.

Altogether the perforators are almost exclusively a blade specimens. In eleven cases they were made of blanks removed of single platform cores, in five of opposite platform cores and six were made of primary or secondary *lames à crete.* One tool was made of a burin spall (Fig. 9:9).

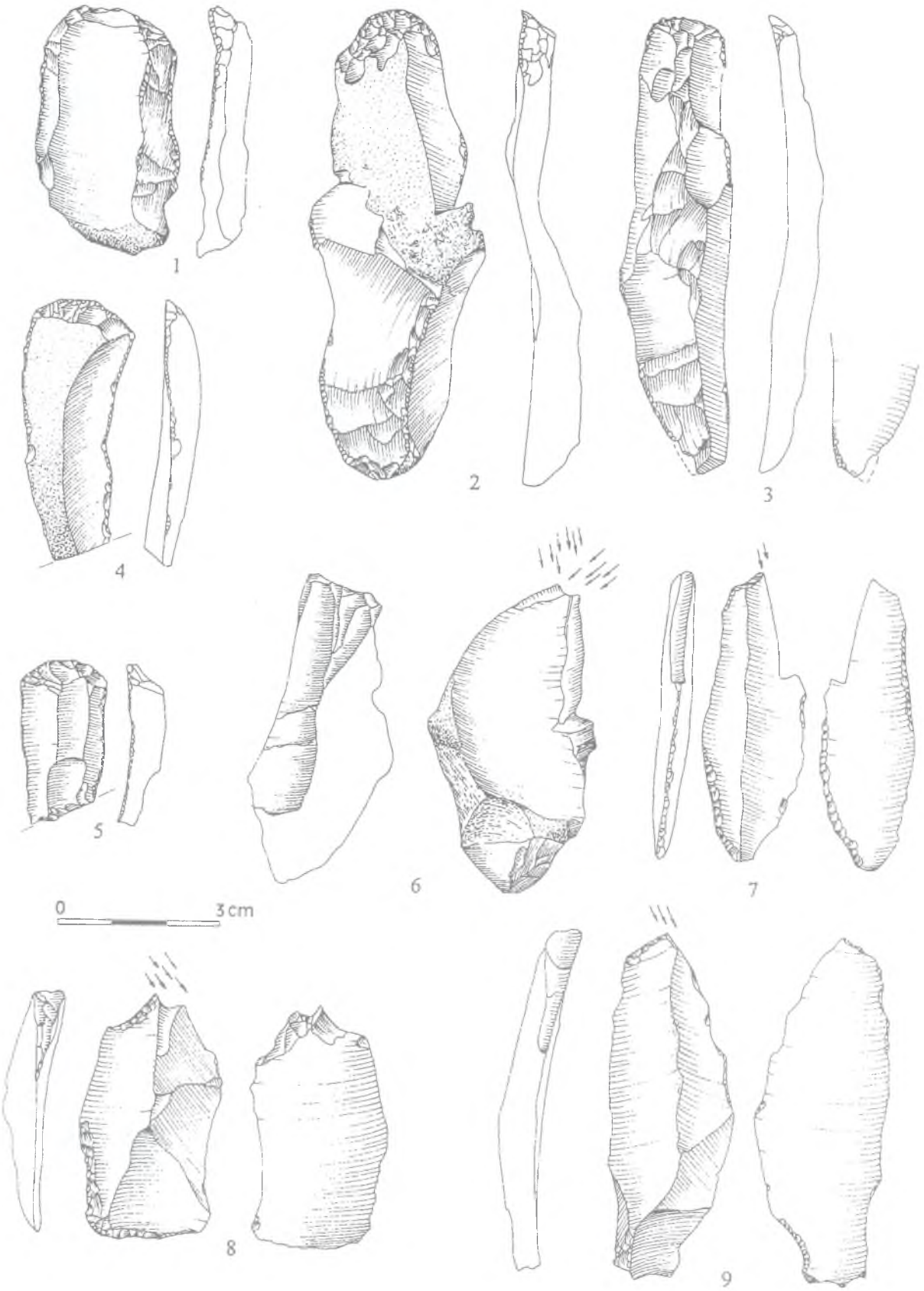

Fig. 7. Mirkowice 33.
1-5 – end-scrapers; 6 – dihedral burin; 7-9 – burins on truncation

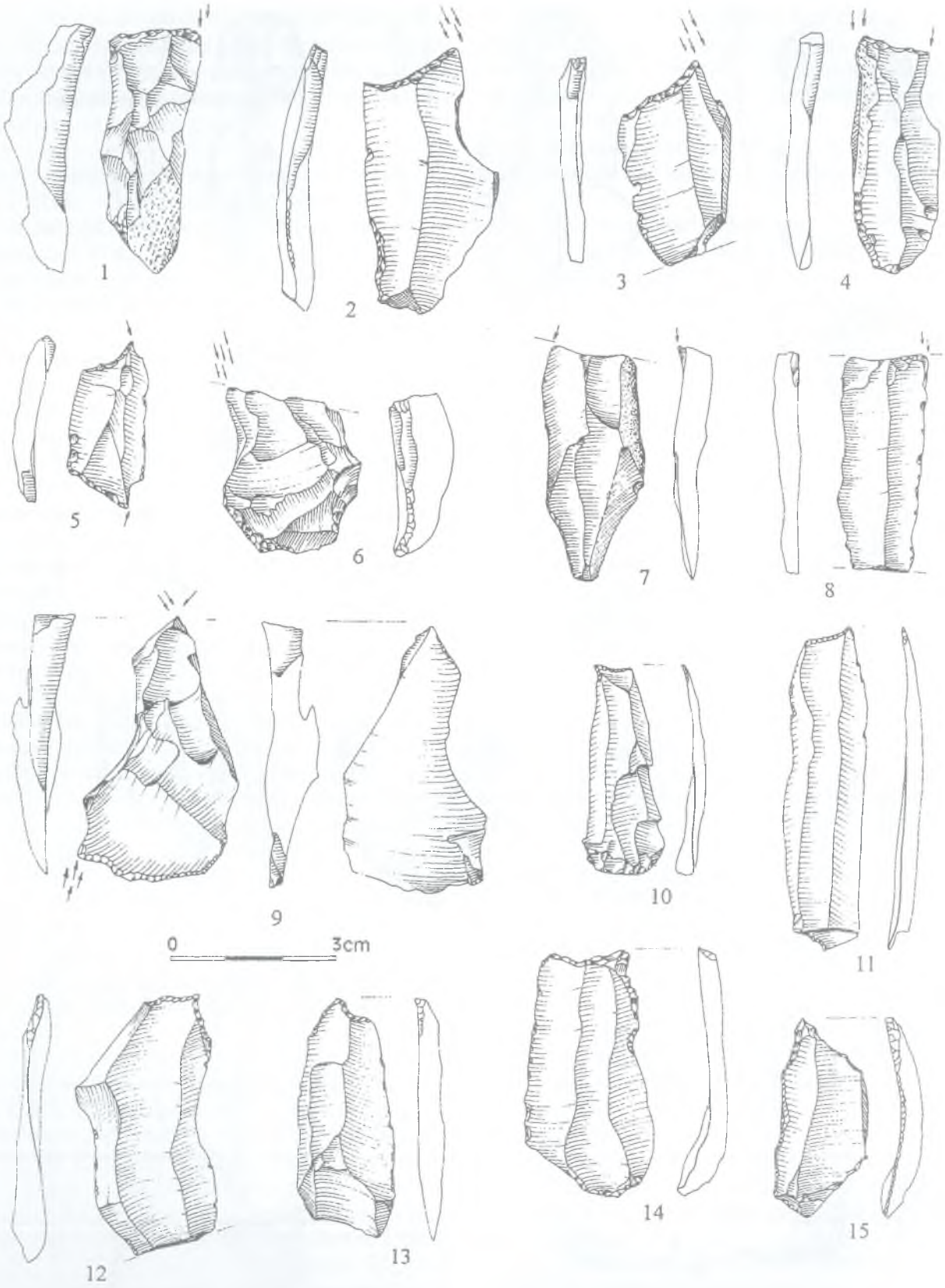

Fig. 8. Mirkowice 33.
1-5 – burins on truncation; 6-8 – burins on a break; 9 – mixed burin; 10-15 – perforators

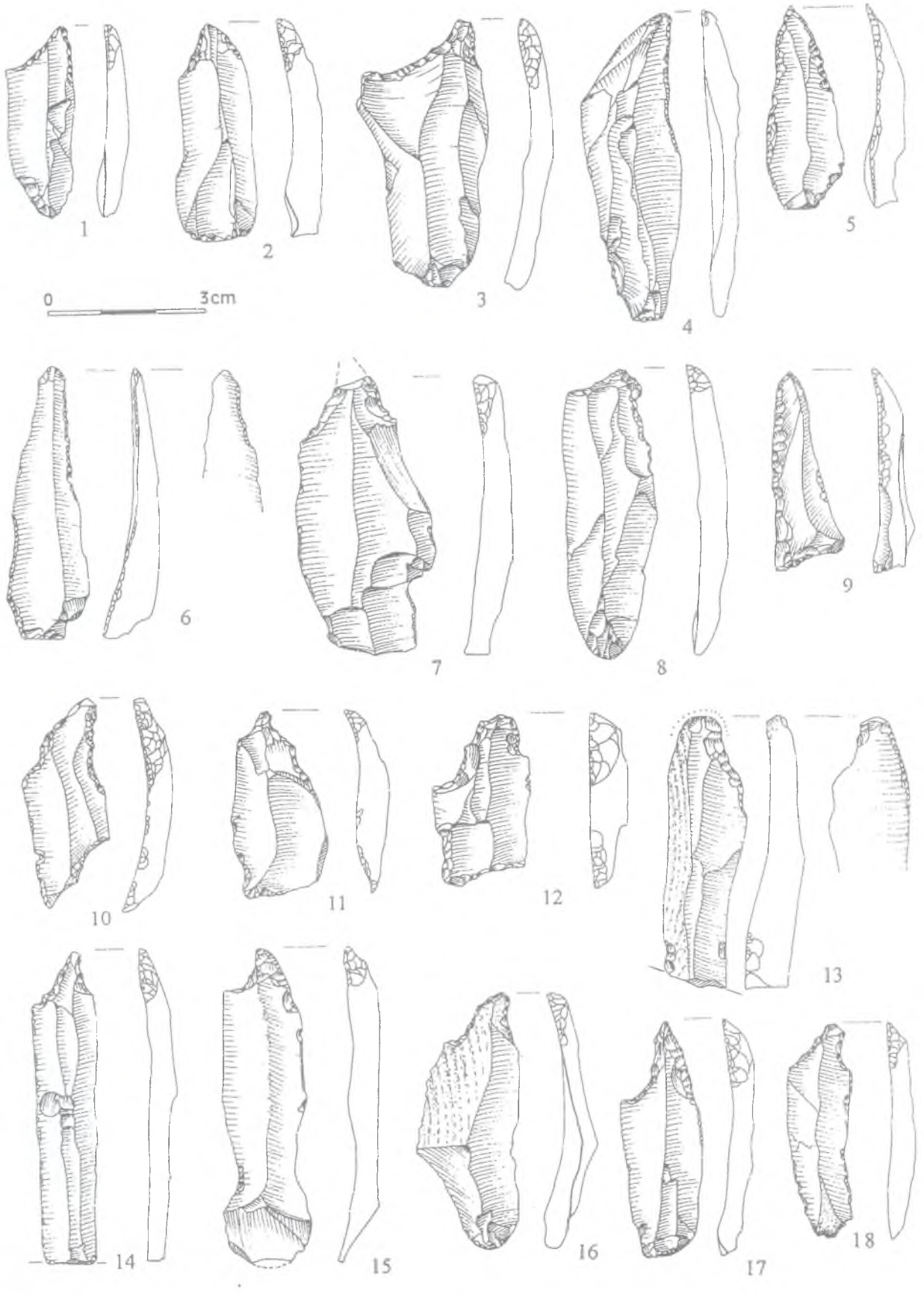

Fig. 9. Mirkowice 33.
1-9, 12-13 – perforators; 10-11, 14-18 – Zinken

For seventeen perforators their tips were located at a distal part of a blank and some have additional edge retouch on the lateral sides. The longest perforator measures 61 x 23 x 13 mm and the smallest one 35 x 12 x 3 mm.

(9) Double perforators – two short specimens (Fig. 9:12; 10:3). In both cases tips were made mostly with abrupt retouch.

(10) Zinken – seven specimens. To those group a specific kind of perforators with well distinguished and bent tips were encountered (Fig. 9:10-11; 14-18). Within seven Zinken one specimen is doubled (Fig. 9:10) and another is a combination of Zinken and regular perforator (Fig. 9:11). They are exclusively a blade specimens and only one, extremely slim specimen is broken (Fig. 9:14). One was made of a primary *lame à crete* and three of blades that were removed of single and opposite platform cores respectively. Of five Zinken three have tips located at a distal part of a blank while two at proximal one. The dimensions of the longest Zinken are 60 x 16 x 5 mm and for the smallest are 40 x 12 x 5 mm.

(11) Groovers – four blade specimens (Fig. 10:2, 4-6). Three tools were made of primary *lames à crete* and the last one of a blade removed of single platform core. The only one intact groover measures 71 x 13 x 6 mm. Tips are located at distal ends of blanks exclusively and in every case they were elaborated with the help of fine edge retouch. Converging retouch on the ventral side of blades is often flat. What strikes is that groovers do not resemble at all the perforators, *i.e.*, they were elaborated in different way what suggest a specific task they were used for.

(12) Truncations – fourteen specimens. That is a very differentiated group of tools not only when we consider a kind of blank but a kind of retouch applied and orientation of truncated edges as well. Four truncations were made of flakes. Usually these are very massive forms made with abrupt retouch. Truncated edges are oblique and slightly concave (Fig. 10:10-11, 14). The biggest flake truncation measures 45 x 23 x 4 mm, and the smallest one 32 x 18 x 6 mm. In three cases truncated edges were located at a distal end of the flake and all tools were made of flakes removed of single platform cores.

Within nine blade forms three truncations were elaborated with abrupt retouch (Fig. 10:7-8) while the rest with a finer, steep or semi-steep edge retouch (Fig. 10:9, 12-13; 11:1-2). Truncated edges are mostly oblique, only sometimes straight. Seven blade truncations have truncated edges located at a distal end of the blank. Three were made of *lames à crete,* five blades were removed of single platform cores and two of opposite platform cores. The longest complete truncation measures 61 x 27 x 7 mm, the shortest 37 x 13 x 4 mm.

The last truncation is a very short flake specimen and can be attributed to so-called *mikroformen* (Fig. 11:5).

(13) Double truncations – two specimens. First with two parallel truncated edges (Fig. 11:3). Both lateral edges show an intensive traces of use. Second specimen is very close to *mikroformen* described in the above passus. It was made with the same technique except that its opposite edge is also truncated (Fig. 11:4).

(14) Backed points – two tools belong to this category, both with partially natural back edges. First specimen – 33 x 9 x 3 mm (Fig. 11:6) made of a secondary *lame à crete* has an asymmetric arched back. Its point was once convergently retouched and the tool possibly served later as a perforator. Second backed point (35 x 13 x 4 mm) has asymmetrical, triangle-like shape (Fig. 11:7). Its point is located at the proximal part of the blade removed from a single platform core. The point itself has not been finished and very possibly the tool was spoiled during its production and abandoned.

(15) Notches – four specimens. These are flakes or blades with single notches retouched. They are very differentiated from the point of view of location, depth and the kind of retouch applied to form a notch. Possibly they are accidental forms. (Fig. 11:8-9).

(16) Shoulder points – 11 tools of that kind have been encountered. Five are intact specimens (Fig. 11:10-14). Four other points are broken near the beginning of the shoulder (Fig. 11:15, 17-19). Last two have broken tips (Fig. 11:16, 20). Some specimens have tips formed with the microburin technique (Fig. 11:13) and at least one point was first intentionally broken in order to form a tip, and this oblique edge was later retouched (Fig. 11:17).

All shoulder points were made with the same manner. First series of larger chips were removed to form tips and tangs and than multiple series of fine retouch were applied to correct their shapes.

Within eleven tools six have their tips located at a distal and three at a proximal end of the blade. Four specimens have retouched tips, both sides and the base (Fig. 11:10, 12-13, 16) and other five points have at least the tang formed by a lateral retouch (Fig. 11:14-15, 17-20). Most of the points were made of blades removed of single platform core and one of secondary *lame à crete*. This last point – very narrow and atypical – is the largest intact tool – 47 x 11 x 4 mm. The smallest one measures 30 x 13 x 3 mm.

(17) Tanged points – a single example (Fig. 11:21) is present in the assemblage. That is slightly asymmetric point with the tang formed by the help of a steep, abrupt retouch. It has continuous retouch on the right side that form also a tip of the point. It is made with the same technique like the shoulder points. The very tip of the point is crushed.

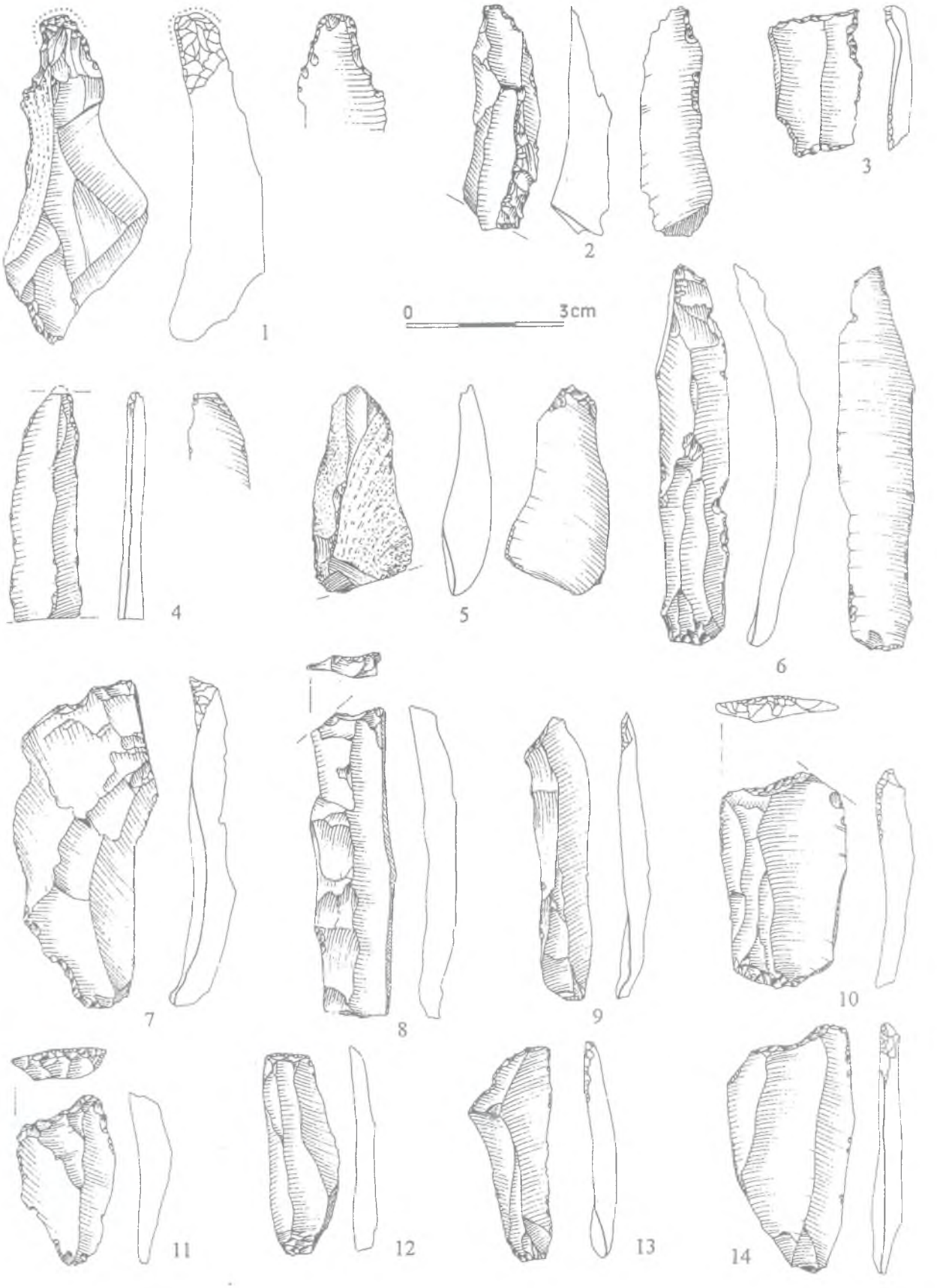

Fig. 10. Mirkowice 33.
1, 3 – perforators; 2, 4-6 – groovers; 7-14 – truncations

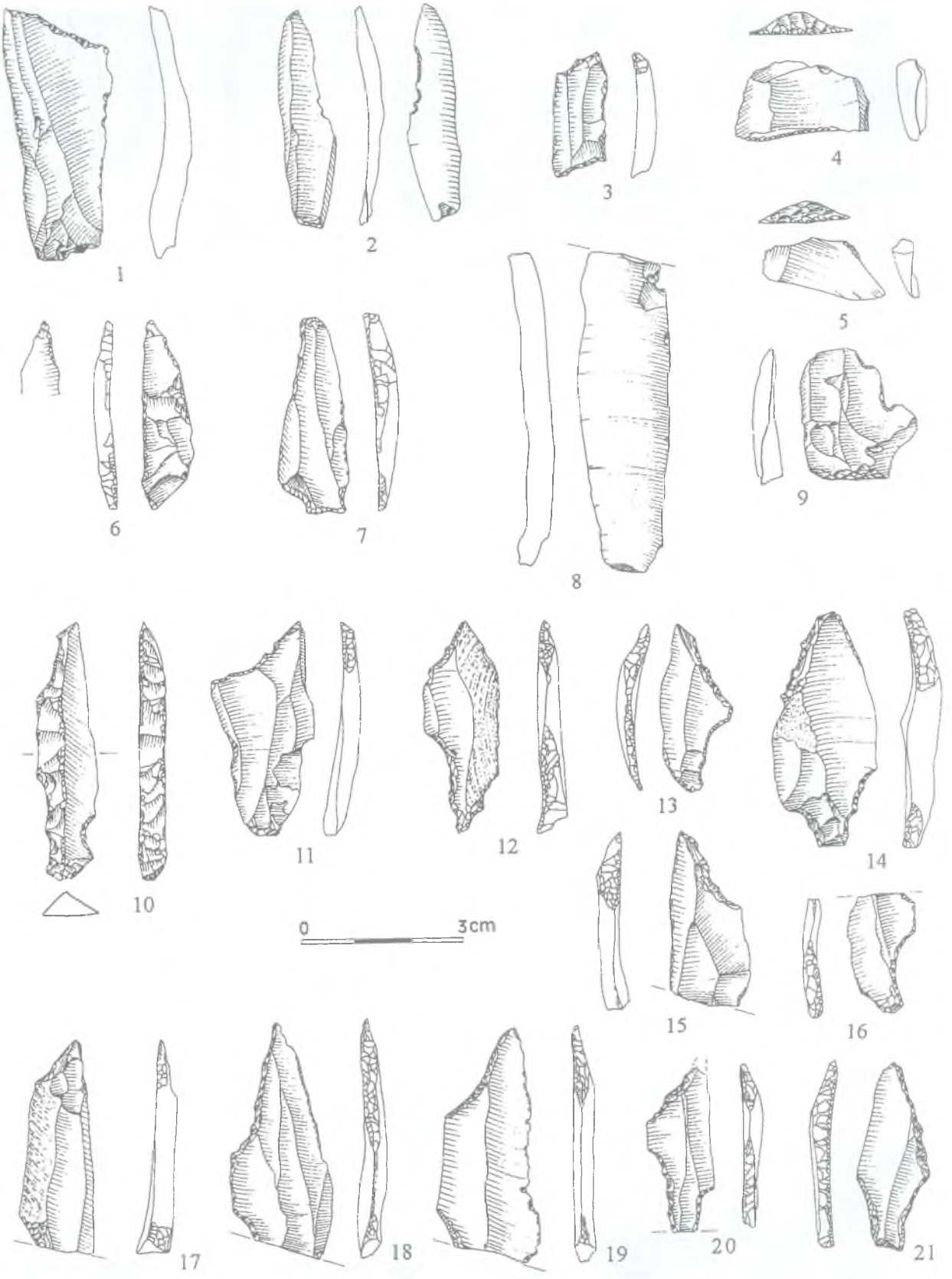

Fig. 11. Mirkowice 33.
1-2, 5 – truncations; 3-4 – double truncations; 6-7 – backed points; 8-9 – notches; 10-22 – shoulder points; 21 – tanged point

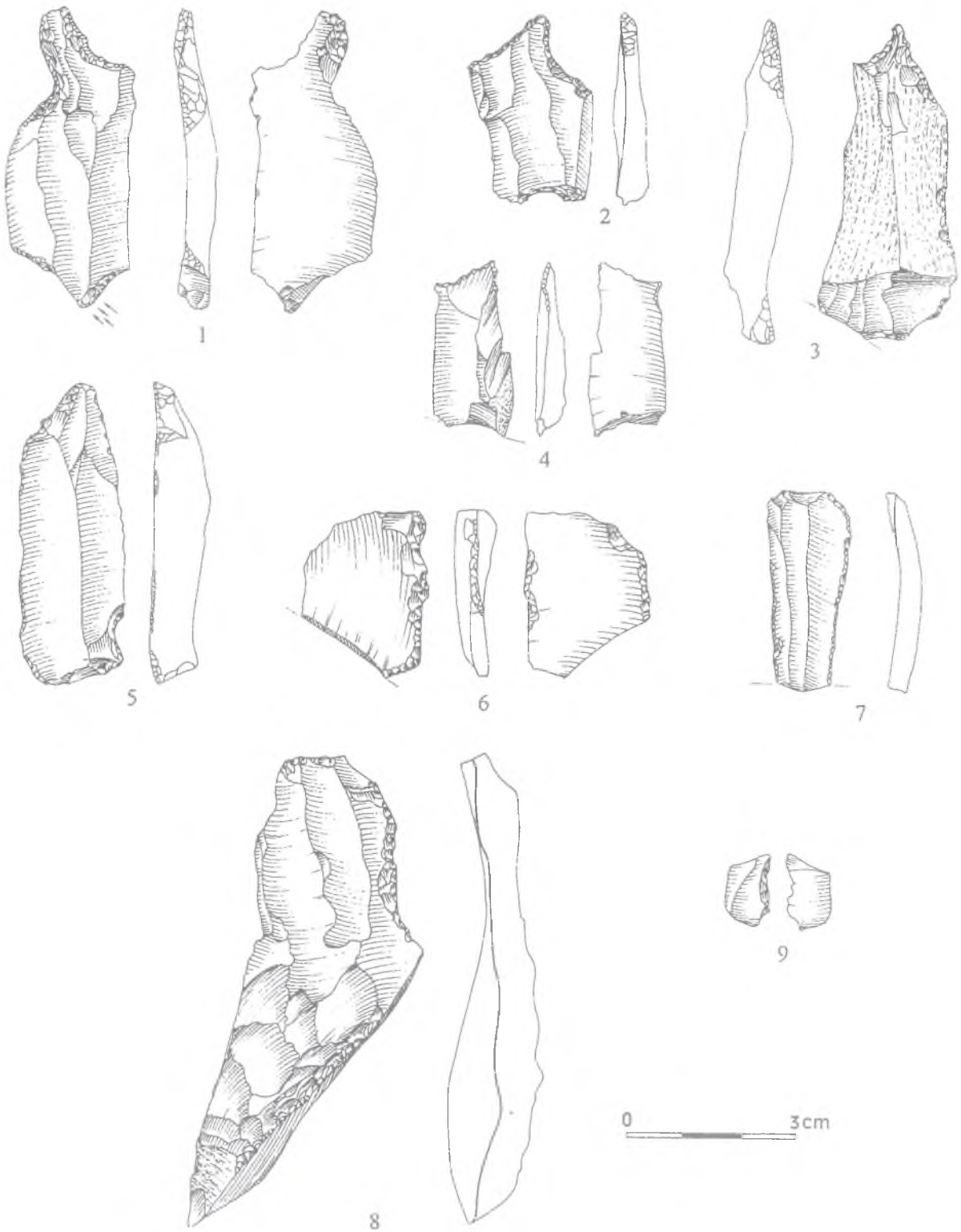

Fig. 12. Mirkowice 33.
1-5 – combined tools; 6 – retouched flake; 7-8 – retouched blades; 9 – microburin

(18) Combined tools – six specimens. In every case these are combinations of perforators with other tools, like: *Zinken* combined with *'déjeté'* burin on truncation (Fig. 12:1), perforator with concave truncation (Fig. 12:2), twice the perforator combined with end-scraper (Fig. 12:3,5) and twice the perforator with groover (Fig. 12:4). Altogether, combined tools were made of blanks removed of single platform cores and two of opposite platform cores.

(19) Retouched flakes – eleven specimens. These are flakes that have fragments of theirs edges covered by a simple, sometimes alternating retouch. One flake is a raclette-like form (Fig. 12:6). Six are complete forms while seven other are broken. Eight flakes were removed of single platform cores, two of opposite platform cores, two are completely cortex pieces and one is a retouched core-tablet.

The biggest intact flake measures 19 x 32 x 9 mm and the smallest 21 x 16 x 3 mm.

(20) Retouched blades – sixteen specimens. They have parts of the lateral edges covered by a simple, sometimes fine retouch (Fig. 12:7-8). Eight blades are intact and another eight are broken. Two specimens are retouched *lames à crete,* eight come from single platform cores, and five from opposite platform cores. Within the broken blades four are proximal, one central and three distal fragments. Eleven blades have preserved butts. *Lisse* (5) and facetted (4) butts dominate, while pointed ones were only two.

The dimensions of the longest intact blade are 86 x 22 x 11 mm, and the smallest are 41 x 12 x 4 mm.

16. Burin spalls – six specimens including two transversal forms. Only one articulates with a burin. Additionally, one burin spall was letter shaped into a perforator and this one is described in the tool group.

17. Microburins – a single example was found within the concentration (Fig. 12:9).

GROUP VI – UNIDENTIFIED AND CORE REDUCTION WASTES

18. Core fragments – two pieces were recorded in the concentration.

19. Chips – twenty-nine pieces. These are large specimens removed during the preparation and exploitation of cores.

20. Chunks – only seven pieces coming mostly from cracked nodules were recorded.

4. COMMENTS ON LITHIC TECHNOLOGY, TYPOLOGY AND FUNCTION OF THE SITE

First striking feature of the assamblage from Mirkowice is high amount of primary and secondary *lames à crete.* Including specimens reworked into tools fourty-two *lames à crete* were found. It points for application of a well developped core reduction technique. A contrastingly low number of core tablets indicates that flint knappers concentrated on striking surface curation mostly. However, considering debitage platforms, core striking platforms as a rule were prepared – formed with one blow or faceted. Usually platforms edges were trimmed during the core exploitation.

The internal structure of debitage group (Table 1) strongly suggests that on the site the core reduction sequence was limited mostly to exploitation of cores. That is proved by a small amount of cortex flakes and blades. The initial preparation of cores, including cortex removal, took place outside the concentration. That is an open question whether primary core preparation was done in the vicinity of the concentration or in the place where flint nodules were extracted from young moraine deposits. The second possibility suggests the existence of specialized workshops functionally different form hunting stations.

Speaking about the core reduction process, two-stage sequence can be observed. The cleaning of the nodule and rough preparation was done with the help of hard hammer. For advanced preparation and exploitation of cores a direct soft hammer percussion or sometimes punch were used. Considering the application of these last two techniques we didn't observe any particular patern except that soft hammer or punch served almost exclusively for removing blades and slim flakes.

Majority of flakes and blades were removed of single platform cores. That is against the kind of cores recorded in the concentration, where of four cores (excluding one initial core and two fragments) two are opposite platform cores and two with changed orientation. This relation suggest that cores were reduced following a single platform mode, i.e. a series of blanks were removed from the first platform and thereafter another platform was used.

As far as tool production it concerns some details of flint technology were recorded. Certainly a part of the blades were intentionally partitioned, suposedly to remove ends of the specimens. The technique of direct percussion at the dorsal surface of the blade was applied.

Shoulder points were retouched in a very specific way. First, the blank was reduced by the abrupt retouch and latter it was followed by multiple series of fine retouch in order to form a final shape of the point. Some shoulder points have ther tips modeled by a microburin technique.

Having in mind all the limitation caused by a specific method of excavation, the tool group seems to be

relatively representative for analysed concentration. Three elements characterised this group: *(i)* the extremaly low end-scraper index that do not exceed 4 percent (Table 2); *(ii)* very high index of boring tools (close to 30 percent) and *(iii)* a balanced index of burins, truncations and points – ca. 10-15 percent. Comparing the Mirkowice tool structure with other Hamburgian sites (Burdukiewicz 1987, Fig. 4) it is clear that analysed assamblage do not differs much of all the other except of low end-scraper index. That can be the result of functional specificity of the site.

Closer analysis of shoulder points clarify to some extent the site function as a hunting camp. Most of points are broken in a very specific and consistent manner, i.e. just below the shoulder (Fig. 11:15, 17-19). It is propable that the broken points were extracted of the animal body at the site. Similarity of this situation to that traced by Rust at Stellmor is stricking[4].

5. REMARKS ON ENVIRONMENTAL LIMITATION OF THE HAMBURGIAN SETTLEMENT

The rate of Hamburgian expansion on the European Lowland and its relation to the natural environment are key issues in the discussion of the Hamburgian Culture phenomena and the site at Mirkowice can deliver here another arguments. Reliable solution of those issues is of crucial importance for the reconstruction of economic and settlement strategies of the Late Glacial hunters and for the reconstruction of internal divisions of the Hamburgian Culture.

In the present-day debate two opposite views are clearly visible. First considers Hamburgian expansion as a slow, gradual movement to the north along the gradual climatic amelioration and improvement of environmental conditions of the Late Glacial period (Bratlund 1996, p.30). Some arguments support this thesis. First, we can observe a strong relation of the settlement network with the older moraine zone – outside the maximal extent of the Vistulian (Tromnau 1975; Burdukiewicz 1987). This zone – due to better developed soil cover – was during the Bölling covered by the park-tundra. Within the zone of young-glacial landscape directly formed by the last ice-sheet – north of its maximal extention – shrub-tundra dominated (Usinger 1978). Capacity of these two eco-zones, including a number and diversity of fauna available for hunting were different, and that is why their usefulness for the early settlement was different too.

Along with this picture Bodil Bratlund (1994) formed hipotesis on hunting strategy of the Hamburgian groups. Basing on genetic relation between the Hamburgian and the Late Magdalenian (Burdukiewicz 1987), on the analysis of Magdalenian hunting strategy and on detailed studies of the Hamburgian faunal materials, she reconstructed year-round hunting cycle. She convincingly showed that reindeer slaughters during the spring and autumn was able to cover only partially a year food demand for particular Hamburgian group. Looking for food they were forced to hunt also during the winter and summer, and than they were stalking mainly for horses and birds (Bratlund 1994). Elswhere she pointed out the presence of the Late Glacial fauna within the limits of the Vistulian, and she stated that „the recently deglaciated areas were thus not permanently void of potentially interesting game, but the question is whether it was the right combination of species" (Bratlund 1996, p. 29). In other words she doesn't see the faunal equivalent for horses in the early moraine zone.

Against a slow and gradual expansion of the Hamburgian settlement a contradictory hypotesis is lately formulated suggesting that the spread of the Hamburgian was relatively rapid (Holm 1996; Burdukiewicz 1997). The first argument supporting above thesis is of chronological nature: the earliest C^{14} dates for Hamburgian sites come from all the territory covered by the settlement, including the Southern Scandinavia, and these are as follows: three dates from Poggenwisch – 12570±115 BP (K-4332), 12440±115 BP (K-4331) and 12440±115 BP (K-4577) (Fischer and Tauber 1986), single date from Olbrachcice – 12685±235 BP(Lod-111) (Burdukiewicz 1987) and single date from Slotseng – 12520±125 BP (AAR-906) (Holm and Rieck 1992)[5]. This last, lately published date is especially intriguing. Even if it was made of reindeer antler not directly connected with the settlement, its stratigraphical context as well as the closest vicinity of the occupation (some 70 m) made this connection very possible. And the site itself shows strong typological relation to the so called Havelte group of the Hamburgian Culture (Tromanu 1975). The point is, however, that the Havelte group was not only limited to the Northern Netherlands, part of Schleswig-Holstein and Niedersachsen but it was considered as the youngest group within the Hamburgian Culture as well. Sites like Jells 1 and 2 or Slotseng let us extend radically the area where the Havelte-type sites are recorded to all the northern territory of the Hamburgian. From the other side, the early C^{14} date from Slotseng – assuming that is is connected to the neighbouring settlement – ruins the chronological division of Hamburgian Culture, forcing us to redefine the meaning of

[4] A. Rust recorded at Stellmor a similarly broken shoulder point embedded in the reindeer vertebra (Rust 1943).

[5] All those dates are uncalibrated.

Havelte points and consider them as, for instance, the functional or (and) territorial event rather than the chronological marker (see also Bratlund 1994, p. 86n.; Holm 1996, p. 56n.).

Another argument partially supporting thesis of rapid expansion of Hamburgian hunters to the north is increasing number of sites that are found in the areas within the maximal extent of the Vistulian. These are Scandinavian sites Jels 1 and 2, Slotseng, Sølbjerg, Mölleröd and possibly Øresund (Holm and Rieck 1992; Holm 1991; Larsson 1993; Petersen and Johansen 1991). Together with the older finds, including Bjerlev Hede, Liny and possibly also finds from Brandemburg and Meklemburg area (Becker 1970; Kobusiewicz 1975; Kobusiewicz et.al. 1987; Gramsch 1987) they demonstrate that the presence of the Hamburgian occupation on the lately deglaciated areas was not a single episode, but that these occurences reflect an existence of a permanent settlement system in this zone. Having in mind the C^{14} date from Slotseng it wouldn't be too risky to state that at least some of those sites are as old as Slotseng.

Accepting Bodil Bratlund hypotesis on the Hamburgian hunting strategy, sharing her oppinion about impossibility of its application to the younger moreaine zone (for the lack of horses), and considering significant number of new sites in the above zone, one can conclude that her ideas are valid as far as the old moraine areas they concern. In other words: if they couldn't hunt for horses because there were no horses, they must have found another game for hunting to survive.

Comming back to Mirkowice site, it constitutes another example of the occurence located far inside the young moraine zone – close to 80 km north of moraines of the Leszno-Brandenburg stage (Fig. 1). When taken together with other Polish sites located south or south-east of Mirkowice and mostly beyond the maximal extent of last glacial sheet, like Liny, Olbrachcice, Siedlnica, Rogów Opolski or Nowy Młyn (Kobusiewicz 1975; Burdukiewicz 1987; Rothert 1936; Kozłowski, Kozłowski 1977) it evidences that Hamburgian hunters without problems could existed in the differentiated eco-zones. Such a localisation of the Mirkowice site – far north of the other Hamburgian sites let us expect another Hamburgian occurences inbetween that will fulfill this gap. More precise dating of the site – what can be resonably expected in the nearest future due to the presence of organogenic sediments of the Bölling times close to the site – certainly will include the Mirkowice site into the discussion on chronology of expansion and subsistence of the Hamburgian Culture.

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Authors adress:

Dr Marek Chłodnicki
Muzeum Archeologiczne
ul. Wodna 27
61-781 Poznań
Poland

Dr Jacek Kabaciński
Instytut Archeologii i Etnologii PAN
ul. Zwierzyniecka 20
60-814 Poznań
Poland