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PIEKARY IIa PALAEOLITHIC INDUSTRIES : PRELIMINARY RESULTS OF A NEW MULTIDISCIPLINARY INVESTIGATIONS

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Introduction

The group of Palaeolithic sites in Piekary is situated on the left (north) edge of the Vistula River in the part of the valley called Tyniec Gate.

This complex was excavated in 1880-1881 by G. Ossowski (Ossowski 1880, 1881); 1927-1936 by S. Krukowski (Krukowski 1938/1948); 1954-1956 by L. Sawicki (Sawicki 1956, 1957, 1959) and 1967-1983 by W. Morawski (Morawski 1968a, 1968b, 1969, 1970a, 1970b, 1973, 1975, 1984, 1992).

In 1998 and 1999, excavations were continued by K. Sobczyk, W. Morawski and V. Sitlivy on the site Piekary IIa (sectors XX and XXI), in the western part of Okrążek Hill (fig. 1 and 2). Technological analyses were begun in 1997 in the framework of an international multidisciplinary research program (Jagiellonian University of Cracow, Polish Academy of Sciences, Institute of Geography and Spatial Organisation of Cracow, Royal Museums of Art and History of Brussels, University of Liège, Laboratoire des Faibles Radioactivités of Gif-sur-Yvette).

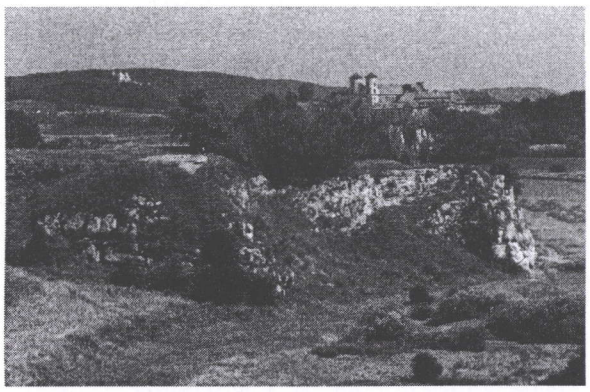

Figure1. General view of the Piekary IIa site and trench XX (1998): to the feft - Bielany Monastery and to the right - Tyniec Monastery.

This article presents the preliminary results of the 1998-99 excavations and of the technological analysis of the old assemblages (mostly Middle Palaeolithic layers 7a and 7b).

Geological analyses, chronostratigraphy and dating (W. Morawski excavations)

As a result of Morawski's investigations (1967-69, 1971-72 and 1983) in the western part of Okrążek Hill, a multi-level Upper and Middle Palaeolithic site was discovered.

Geological interpretation by T. Madeyska (Madeyska *et al.* 1994) was made in collaboration with J. Rutkowski, B. van Vliet and H.J. Müller-Beck. In the most complete profile - sector X (depth 7m) - four members (units) have been distinguished:

Member 1: sandy-gravel series, which lie on the Jurassic rock. In the upper part of this link partially loamy sand is present (layer 8a and 8b after Morawski).
Member 2: sandy dusts with the addition of colloidal clay (layer 7c after Morawski).
Member 3: overbank deposits - dusts with traces of cryoturbation and abundant charcoal (layers $7b^2$, $7b^1$, 7a and 6 after Morawski).
Member 4: loess, containing up to 8% carbonates, with 3-4 soil levels (layers 5b, 5a and 4, after Morawski).

Based on petrographical analyses and comparisons with gravels from the Crakow region (Kościuszko dam on the Vistula River near Crakow - the Holocene gravels, Kryspinów - early Vistulian), gravels from member 1 were attributed by J. Rutkowski to the Riss (Saalian) glaciation.

Van Vliet, after micromorphological analyses, confirms the presence of traces of soil processes in sands from the top of member 1. Similar processes

are observable in member 2. Madeyska defines these soil as probably of Nietulisko type. In consequence the sandy-loess deposits of units 1, 2 were formed during the cold-stage before Eemian.

In member 3, Van Vliet confirms the existence of soil processes and humus layers. Charcoal from this member have been dated by H.J. Müller-Beck (14C, B-2562 double) from 25,840 to 41,460 BP. Madeyska defines member 3 as similar to the Komorniki soils complex (isotopic stage 3; about 55.400 - 28.000 BP) (Kozłowski and Kozłowski 1996).

Madeyska correlates the initial soil levels from the youngest loess (member 4) with the Lascaux warm oscillation (Madeyska *et al.* 1994).

Lithic assemblages from Morawski excavations (after W. Morawski)

As a result of excavations from 1967 to 1983, four Middle and four Upper Palaeolithic cultural levels were discovered.

The first was identified in the upper part of 8 layer (member 1). There are Clactonian flakes, Levallois flakes and rare tools (mainly side-scrapers). This complex is present in all of the excavated area of the site.

The next, from layer 7c (member 2), is present on across the site as well but a homogeneous complex was discovered only in sector XIII (170 artefacts). Material was only slightly disturbed (refittings are present). Artefacts from this complex represent a combination of Middle Palaeolithic Levallois debitage methods with Upper Palaeolithic blade production, which was obtained by means of hard hammerstone percussion.

In layer 7b[1], abundant altered material (thermal, frozen and fire fractures) was discovered. However, it also was only slightly disturbed (thermal and technological refittings are present). Numerous artefacts were burnt. Cores are irregular, discoid and with multiple striking platforms (changing of orientation). General technological characteristic: IL- 19%, IFl- 48%, IFs- 36%. Some retouched tools are present. In general, there are traces of Middle Palaeolithic workshops.

Layer 7a contains remains of other Middle Palaeolithic workshops. Numerous artefacts with alterations (thermal fractures), charcoal and disturbance of material are similar to the 7b[1] layer. Cores and tools also suggest a workshop character for the assemblage. However, the statistical characteristic is completely different: IL- 3%, IFl- 21%, IFs- 8%.

The first Upper Palaeolithic level is represented by material from the 6 layer (discovered in all parts of the site). All artefacts have a white or blue-white patina. Blades are medium sized and were detached from volumetric uni-directional cores. Core striking platforms are not as big and have been prepared. Tools are absent. This industry can be attributed to the Aurignacian.

In the lower part of the 5b layer (last Würm loess) two concentrations of flints were discovered, probably representing different Upper Palaeolithic cultural traditions.

One lithic concentration came from sector XIII (Piekary IIa, excavated in 1971). Artefacts (light to dark grey flint) have numerous traces of freezing action and carbonate coating. The complex was slightly disturbed (numerous technological refittings were possible). Among cores, only reduced or fragmented pieces are present. Blades (Ilam- 40%) are big, long and massive, and were flaked from bi-directional cores with facetted and abraded (to eliminate the overhang) striking platforms. Tools are absent.

Another Upper Palaeolithic concentration was found in sector XVIII (Piekary IIa, excavations 1972). Material (black flint) has been also slightly moved and has carbonate coating. Cores are small, volumetric with prepared striking platforms and with traces of elimination of the overhang (faceting and abrasion). Final blank products are small. Tools are again absent.

The third Upper Palaeolithic cultural level (LG-workshop) was discovered in the highest level of the initial soil (correlated with a short, warm period of the Second Pleniglacial - Laugerie-Lascaux). This is the top of the 5b layer. Material was found *in situ* (sectors XI-XII/72, XIX/83 Piekary IIa). Artefacts (about 6000 pieces) were made from local Jurassic flint (99.5%) and imported chalky and chocolate flint. 50% of the material is represented by small fragments, chips (<2x2cm.) and small flakes. Technological and statistical analyses were performed on the rest of the assemblage. Of these analysed flints, 44% were refitted. The industry is represented by cores (2-3%), hammerstones (0.15-0.60%), non-cortical blades (5-6%), tools (9-12%), burin spalls (8-22%). The remainder includes products of a cortex removal stage, preparation and re-preparation of cores. Among the tools, burins dominate (75-78%). This geological layer has a close analogy with

layer 5a (initial loess soil) at the Crakow Spadzista C site.

The youngest Upper Palaeolithic workshop (LP) was found in the initial soil level - 4 layer (sector IX/69, XII-XIII/71 Piekary IIa). Material was discovered *in situ* (refittings are present, with the largest set containing 60 debitage pieces). Cores are bi-directional with prepared debitage. Numerous re-preparations of striking platforms and working surfaces as well as changing of debitage orientation are indicated. Tools are absent.

1998 Excavations (sector XX)

Sector XX is situated south of sector XIII (excavated in 1971). Over a period of one year, an area of 18m² was excavated. The maximum depth is 4.48m, and six archaeological levels were discovered (fig. 2:4). Jurassic limestone is the bedrock of the Quaternary sediments.

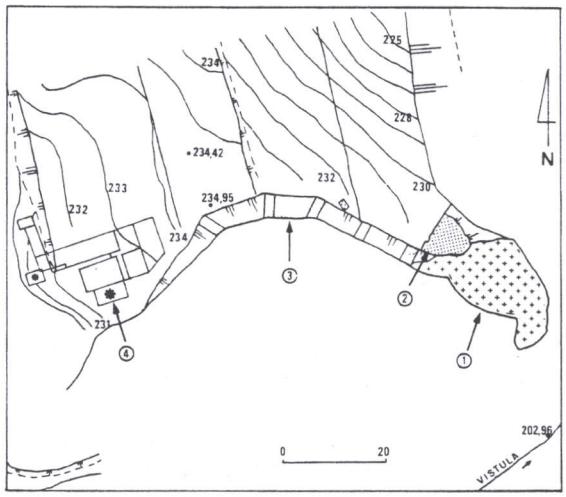

Figure 2. Piekary's sites. Plan: 1. S. Krukowski excavations; 2. L. Sawicki excavations; 3. W. Morawski excavations; 4. excavations 1998-1999.

The stratigraphy is similar to previous profiles of the Morawski excavations (fig. 3). However, this sector was situated on the hillside of the Okrążek, so the stratigraphy is not yet complete:

Layer 1: modern humus level.
Layers 2 and 3: two levels of loess deluvia.
Layer 4: loess deluvia with initial soils level.
Layer 5: carbonate loess with calcium concentrations.
Layer 6: loess with solifluction deformations.
Layer 7a: loess? with traces of cryoturbation and soil formation (?), numerous charcoals.
Layer 7b: sandy loess? (or loess deluvia - after W.Morawski) with traces of cryoturbation and some charcoal.
Layer 7c: stratified sands.
Layers 8a and 8b: sandy-gravel formations with partially loamy-sands in their upper part (8a).

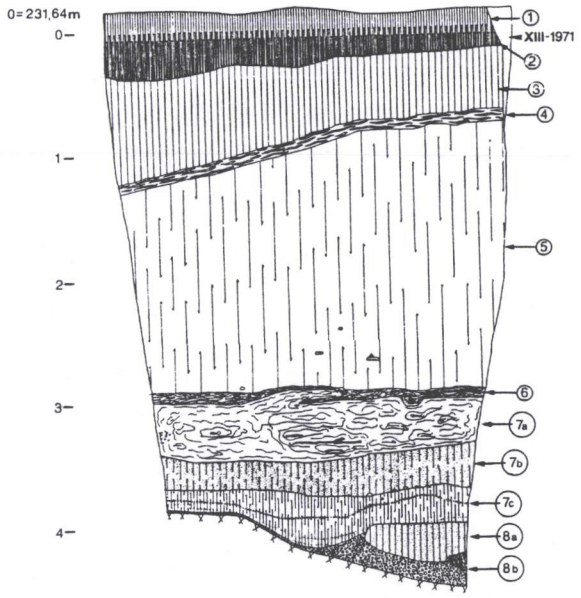

Figure 3. Piekary IIa, trench XX (1998), profile W.

First Upper Palaeolithic level (layer 4)

The first archaeological level was discovered in the 4 layer. It is represented by a small flint assemblage (28 pieces). The lithic assemblage includes 9 flakes (2 cortical, 3 semi-cortical, 3 backed cortical, 1 broken with some cortex), 1 blade (backed cortical), 14 chips and small flakes (< 20 mm) and 4 fragments of flint (table 1). Although this complex is not numerous, two refittings are present:

Block 1: massive (75 mm length, 51 mm width and 18 mm thickness) backed cortical orthogonal flake with one small flake (< 20 mm).
Block 2: two backed cortical flakes (43; 39; 12 and 57; 54; 9).

Debitage products (flakes and blade) are medium to large size (table 2). Cortical, semi-cortical and backed cortical flakes and blade represent the cortex removal stage.

The pointed platform of the sole backed cortical blade was created with a single blow. The blade

shape is oval (bi-convex sides), profile is straight and section is triangular. It was obtained by means of soft hammer percussion, confirmed by the small (pointed) platform, right internal flaking angle and diffuse bulb.

Flake platforms (8 unbroken) were created with a single blow (plain and pointed) and rare prepared and dihedral butts are also present (table 5). They have mainly developed bulbs (table 7), while only three have a lip. Internal flaking angle is obtuse and right (table 6). These features characterise hard hammer percussion.

Proximal parts of blanks (flakes and blade) have no traces of abrasion or facetting (elimination of overhang).

Such a small collection of 28 artefacts (only flakes and blade from cortex removal stage) without cores and tools is not sufficient for cultural attribution. However, this industry may be connected with the Upper Palaeolithic workshop found in the 4 layer of the Piekary IIa site (sectors IX/69 and XII-XIII/71) near sector XX.

Second Upper Palaeolithic level (layer 5)

Artefacts from the second cultural level were discovered in the lower part of the 5 layer. This complex is the most representative on the site; the assemblage consists of 764 artefacts (all of dark grey flint). Materials are mainly fresh (96.1%) with rare patina (3.3%) and gloss (0.6%).

The artefact composition evidences the reduction aspects of this complex (table 1). Natural nodules of flint and tested blocks are absent. Only one blade core was found. The most numerous are chips and small flakes, followed by debitage blanks (flakes and blades, fig. 4). In general, all technological categories are present.

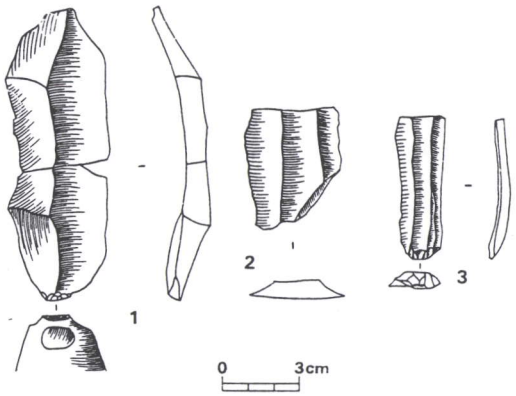

Figure 4. Upper Palaeolithic layer 5 (sector XX / 1998). Blade debitage.

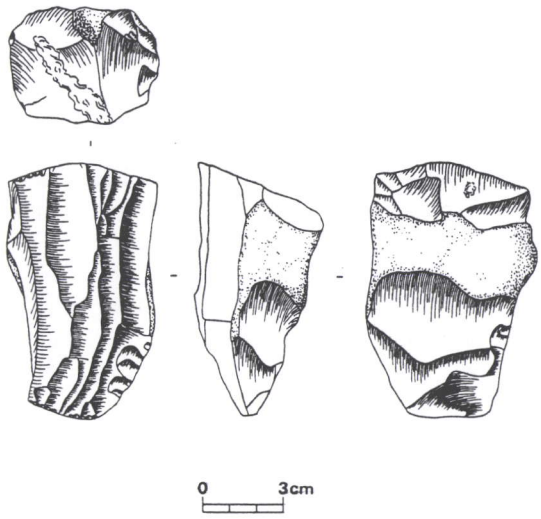

Figure 5. Upper Palaeolithic layer 5 (sector XX). Bi-directional prepared partially turned blade core.

N° 834, P IIa/XX/98/331: blade prepared bi-directional core (fig. 5).
Initial block: nodule.
Volume, shape: voluminous, trapezium.
Sizes according to working surface: 99 mm length; 60 mm width; 47 mm thickness.
Raw material: dark grey flint.
Quality: good.
Alteration: light blue-white patina.
Reduction stage: full debitage.
Shaping out: rest of transversal preparation, e.g. postero-lateral crest.
Striking platform(s): 1st and 2nd prepared.
Striking platform angle: 1st and 2nd acute.
Re-preparation of striking platform(s): 1st by tablet and facetting, second by tablet, abrasion and facetting.
Left side: rest of crest and flat nature area.
Right side: working surface, neo-crest and cortex.
Distal part: 2nd opposite striking platform.
Back: lateral crest and cortex.
Working surface(s): bi-directional for blades.
Localisation: on the wide part and right side
Shape and sizes of working surface: rectangular, (99 mm; 52 mm).
Convexity: a) longitudinal: convex,
b) transversal: convex,
c) accidents: hinge fractures.
Last visible products: blades
Maintenance / rearrangement: by means of bi-directional debitage, neo-crest.
Discard / termination of debitage: crystal inclusions and hinge fractures.

The core (fig. 5) was made on a flint nodule of good quality with few crystal inclusions. It is a voluminous bi-directional blade core in full debitage stage, with traces of postero-lateral crest (pre-forming stage). This core was rejuvenated by means of tablets and neo-crests.

Cortical, semi-cortical and backed cortical flakes are present. However, the most numerous are flakes with little or no cortex (table 3).

The most common flake dorsal pattern (table 4) is uni-directional, followed by centripetal and orthogonal. Bi-directional, transversal, convergent and multiconvergent patterns are rare. Crested flakes and tablets are present.

Flake platforms were very often created with singe blow (plain and pointed), but could also be dihedral, prepared, with rare cortical, linear or facetted (table 5) platforms. Internal flaking angle is mainly right or obtuse and, rarely, acute (table 6). Developed bulbs are most common, followed by diffuse or absent (table 7). Only 17.5% of flakes with present proximal part have a lip.

In sum, flake debitage is more characteristic of hard hammer percussion because of developed bulb domination. Flakes, very often cortical and semi-cortical, are products of the cortex removal stage; non-cortical, crests and tablets represent pre-forming, exploitation and rejuvenation of volumetric bi- or uni-directional blade cores.

Blades are mainly medium size but 87.1 % are broken (Elongation Index >255.9).

The most numerous non-cortical blades are products of the full debitage stage (table 3). Blades from cortex removal and shaping core stage (cortical, semi-cortical, backed cortical) are rare.

Dorsal pattern with traces of uni-directional debitage is the most frequent, followed by orthogonal, bi-directional, centripetal and convergent (table 4). Crested blades are well represented.

More than 50% of proximal parts of blades have flat platforms. Other types are rare and occur nearly in the same proportions (table 5). Most of the interior platform angles are obtuse, less right and, rarely, acute (table 6). Developed and diffuse bulbs were present in the same frequency. Well-developed and absent bulbs are rare. From all proximal parts of blades, more than 45% have a lip. Thus, use of soft hammer percussion was more common for blade production.

The most numerous blade shapes are rectangular, then convex-concave and trapezium, others (irregular and oval) are rare (table 10). Profiles are mainly straight, but also often convex, with twisted profiles rare (table 11). Almost 50% of blade sections are triangular and more than 30% trapezium, other types are rare (table 12).

Blades in this cultural level are products of volumetric prepared blade cores reduction, which came from different stages (e.g. cortex removal, pre-forming, exploitation and re-preparation). Non-cortical blades are mostly final desired products of a volumetric prepared type of debitage.

Bladelets are not very numerous in this level and characterise shaping (backed cortical bladelets) and full debitage (non-cortical) stages (table 3). They are mainly uni-directional, rarely bi-directional and orthogonal (table 4). All platforms were created with a single blow (plain and pointed); angles are right or acute; bulbs are developed or rarely diffuse (tables 5-7). Oval, trapezium and convex-concave shape (table 10) are present in the same proportions. Profiles are straight, convex and twisted (table 11). Sections are triangular or scalene (table 12).

Proximal parts of blanks (flakes, blades and bladelets) have traces of elimination of overhang (abrasion and facetting) (table 9).

Tools are modest, not very numerous and include a broken side-scraper on massive flake, a core-tool with retouch, a broken blade with direct retouch, two retouched blank fragments, a dihedral burin on massive semi-cortical flake and two burin spalls.

In sum, this complex can be classified like other Upper Palaeolithic workshops, based on general artefact classes and the rarity of tools. Debitage products confirm volumetric core exploitation and prepared blade production with crested installation.

Third Upper Palaeolithic level (layer 6)

In the solifluction level, the next, also abundant (640 pieces), Upper Palaeolithic complex was discovered. The industry is dominated by chips and small flakes, but also contains blanks (blades, flakes and bladelets), 1 tested block, 5 cores (complete and two fragments), 16 tools, blank fragments and small angular debris (table 1).

Artefacts are very often altered, i.e. with blue or blue-white patina (47.3 %) and rarely with gloss (0.5 %).

One tested block, which was found in this level, has medium size (100 mm; 73 mm; 54 mm) and was made on a natural fragment of flint of poor quality (it was broken during the testing stage).

One core fragment still has part of a working surface (although it is impossible to tell for which kind of blanks this flaking surface was intended) and a portion of striking platform (probably created with a single blow). The second is represented by a big fragment (> 53; 70; 42) of a partially turned blade core with changing orientation (4 striking platforms).

Three cores were found unbroken. Two cores display a full debitage stage and the third one is exhausted.

The first (fig. 6) is a voluminous blade bi-directional core of medium size (93; 64; 50). It was made on medium quality flint (crystal inclusions) with light altered surface (blue patina). Two alternate surfaces of debitage are present That core was prepared by crest installation.

The next core is in full debitage stage, uni-directional with crest preparation and made on medium quality flint (crystals) and has also medium size (76; 58; 66). The working surface is located on the narrow part of the nodule. This core does not have maintenance traces and was abandoned because of the poor quality of the raw material and hinge fractures.

The third core is at a stage very close to exhaustion. It was prepared by crest installation (on the right side) and, during the initial stage, had bi-directional working surfaces (on the left side). At the last visible stage, the working surface is uni-directional; the core has several striking platforms (prepared with facetting) due to changes in orientation. The working surface was extended from the narrow part to the left side. This prepared partially turning blade core was abandoned because of flat working surfaces (after changing of orientation), crystal inclusions and hinge fractures.

In this level, is possible to distinguish three modes of blade core exploitation:

1) Prepared uni-directional (after initial bi-directional exploitation); debitage orientation : from narrow working surface to left large side,
2) Prepared uni-directional exploitation from right large side to narrow working surface,
3) Prepared bi-directional exploitation with two opposite working surfaces located on the large part of the core.

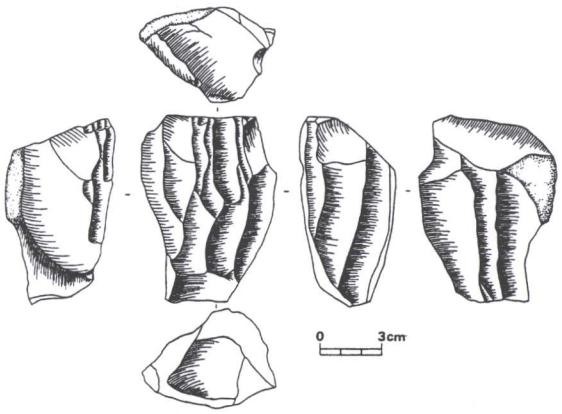

Figure 6. Upper Palaeolithic layer 6 (sector XX / 1998). Bi-directional prepared blade core.

N° 826, PIIa/XX/98/256: blade prepared bi-directional alternate core (fig. 6).
Initial block: nodule.
Volume, shape: voluminous, trapezium.
Sizes according to working surface: 93; 64; 50.
Raw material: dark grey flint.
Quality: medium (crystals).
Alteration: light blue patina.
Reduction stage: full debitage.
Shaping out: small traces of crest on the distal part.
Striking platform(s): 1st and 2nd flat.
Striking platform angle: 1st and 2nd acute.
Re-preparation of striking platform(s): on the 1st abrasion (elimination of overhang and on the 2nd tablet and abrasion.
Left side: working surface and cortex.
Right side: working surface and negative of re-preparation.
Distal part: second striking platform.
Back: opposite working surface
Working surface(s): two alternate working surfaces for blades (bi-directional).
Localisation: on the wide sides.
Shape and sizes of working surface: two trapezium, 1st 84; 64 and 2nd 70; 55.
Convexity: a) longitudinal: 1st and 2nd convex;
b) transversal: 1st and 2nd convex;
c) accidents: hinged fractures and crystals.
Last visible products: blades.
Maintenance / rearrangement: tablet (2nd striking platform) and re-preparation of right side.
Discard / termination of debitage: quality of flint (crystals).

Flakes in this level are, in contrast to the assemblage from the 5 layer, less numerous than blades. They have nearly the same average size as flakes from the last complex (table 2). However, they are less massive: Massivity index = 22.9 (for flakes from the 5 layer, it was 28.7).

As in the 5 layer, many flakes represent the cortex removal stage. The majority of non-cortical flakes were made during full debitage or re-preparation stages (table 3).

The most numerous flakes dorsal pattern are uni-directional, then centripetal, orthogonal and rarely bi-directional, transversal and multi-convergent (table 4). Flakes from preparation and re-preparation of core (crests and tablets) are in similar proportions as in the 5 layer.

Proximal parts of flakes also have many similarities with the 5 layer. Flat platforms are the most numerous, others (linear, cortical, pointed, dihedral and crudely prepared) are found in the same proportions. Facetted platforms are rare (table 5). Interior flaking angles are right or obtuse and seldom acute (table 6). Developed and diffuse bulbs are more representative than well-developed or absent (table 7). 23 % of flakes with unbroken proximal part have a lip (table 8).

Blades are the most plentiful among debitage products. They are smaller than blades from the second cultural level (table 2) and less elongated (Elongation Index > 215.3), but 55.4 % of them are broken (the proportion between unbroken and broken blades is different from that observed in the 5 layer).

As in the 5 layer, non-cortical blades are the most numerous, followed by blades with a minimum of cortex. Cortical, semi-cortical and backed cortical blades are also present (table 3).

In this cultural level, crested blades are well represented. Proportions between different kinds of blade dorsal patterns are similar - the most plentiful are uni-directional, then bi-directional and orthogonal. The less numerous are transversal, convergent and multi-convergent (nearly in the same proportions) (table 4).

Most blade platforms were created with a single blow (the most numerous are flat, linear, and pointed); others are dihedral, crudely prepared and rarely facetted (table 5). Right and obtuse interior platform angles are nearly in the same proportions and only acute occurs rarely (table 6). Diffuse bulbs dominate (table 7). 45.3 % of proximal parts of blades have a lip (table 8).

Rectangular blade shape is the most common; trapezium, oval, convex-concave and irregular are also present (table 10).

Straight, convex and twisted profiles of blades are nearly in the same proportions (table 11).

The most numerous blades sections are triangular and trapezium. Scalene, triangular-trapezium and irregular sections are also present (table 12).

Bladelets are more plentiful than in the 5 layer (table 1). One of them is semi-cortical but the majority are non-cortical (table 3). They have a uni-directional dorsal pattern, rarely bi-directional and transversal. One of them is a crested bladelet (table 4). Bladelet platforms were created with a single blow - plain, linear and pointed (table 5); flaking angle is always obtuse (table 6), bulbs are diffuse and rarely developed (table 7); four bladelets have a lip (table 8). They have straight, convex and twisted profiles (table 11); rectangular, trapezium, oval and irregular shape (table 10) occur nearly in the same proportions. Triangular section dominates; scalene, trapezium, triangular-trapezium and irregular are rare (table 12).

Proximal parts of blanks (flakes, blades and bladelets) were abraded and facetted (for the elimination of the overhang) (table 9).

In sum, this complex reflects exclusive blade/bladelet production based on volumetric core exploitation with crest(s) formation during all reduction and partly turning debitage extention. Use of soft hammer percussion is well attested, especially during full debitage stage of blade production.

Tools are more numerous than in the 5 layer (table 1) and are represented by a denticulate tool, two side-scrapers, two backed knives, a notch tool, a combined tool (knife + notch), two retouched flakes, four retouched blades, a broken burin and two burin spalls.

The denticulate tool was made on a broken massive flake by means of alternating retouch on the broken platform.

One side-scraper has a straight working surface and was made on a massive (78; 46; 23) semi-cortical flake with thinned base. The other is convex and was made on a broken medium size (42; 20; 11) flake.

Backed knives are massive and thick (84; 45; 24 and >62; 42; 12); one was made on a bi-directional backed cortical flake and the other on a broken non-cortical flake.

The notch tool was made on a broken centripetal flake (>47; 73; 17).

The knife was created on a transversal, backed cortical massive flake (77; 70; 18) and was combined with a notch tool.

Retouched flakes were made on broken uni-directional medium size flakes.

Retouched blades were made on medium size blades but all are broken (e.g. >22; 15; 5 and >26; 14; 6.5). Two of them were directly retouched; one has retouch on its distal end and one was modified with abrupt and denticulate retouch.

The burin is broken and it is impossible to define its type. It was made on a bipolar medium size blade (>52; 16; 6).

First Middle Palaeolithic level (layer 7a)

This cultural level was discovered in the 7a layer. Artefacts altered by white patina are numerous (30.8 %) and rare with gloss (8.2 %). The industry (222 pieces) is represented by cores (one of them is a fragment), the most abundant are flakes, with rare blades and bladelets, chips and small flakes, blank fragments, fragments of flint and tools (table 1).

The core fragment has part of working surface broken because of frost action (fig. 7:2).

The first voluminous pre-core (fig. 7:1) is in the cortex removal stage. This is a large nodule (133; 83; 104) with only two flake and blade negatives.

The second is an unprepared voluminous core (92; 72; 90), made on poor quality flint (with crystal inclusions). This pre-core displays the cortex removal stage, has two flat striking platforms and two working surfaces (changing orientation). The first working surface with blade negative is located on the narrow part of the core and the second, with flake negative, on the large right side. The blade negative on the first working surfaces was exploited as a second striking platform. The core was abandoned in this early stage because of numerous crystal inclusions and hinge fractures.

The most numerous artefact class is flakes (table 1), which are of medium size (table 2).

More than 50 % of flakes are non-cortical. Semi-cortical flakes and flakes with a minimum of cortex are also present; cortical and backed cortical are rare (table 3).

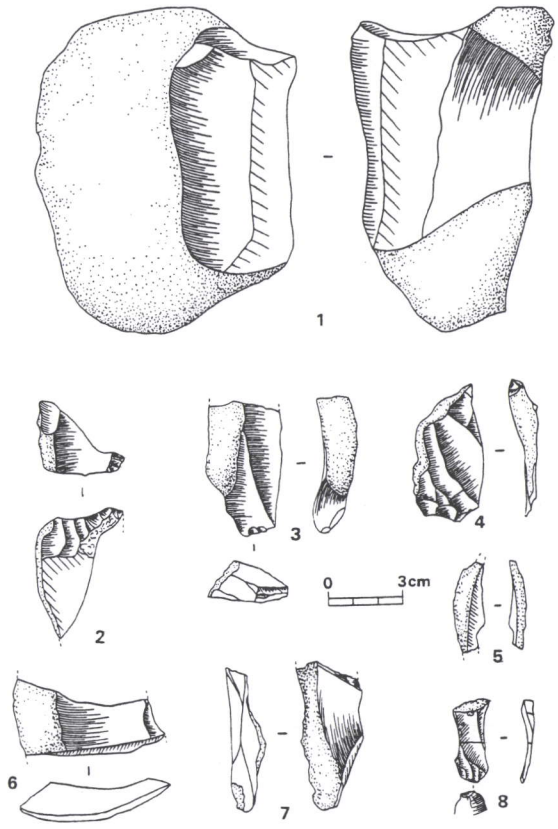

Figure 7. Layer 7a (trench XX / 1998). Blade debitage: 1. uni-directional pre-core with frost fractures; 2. core fragment; 3-8. decorticated blade fragments.

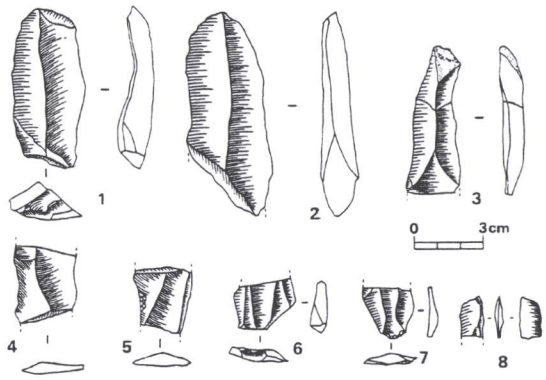

Figure 8. Layers 7a (1-7) and 7b (trench XX / 1998). Blade and blade fragments of full debitage stage.

They are mostly centripetal (fig 12:6, 8, 10-13, 15-16) or uni-directional; other kinds of dorsal patterns are rare (orthogonal, transversal, convergent and multi-convergent) and nearly in the same proportion (fig. 12:4-5, 7, 9). *Débordant*, often small, flakes are very common (fig. 12:7-8).

Platforms are flat (fig. 12:4, 6) or crudely prepared (fig. 12:7-8, 10-11). Facetted (fig. 12:12-15) and *chapeau de gendarme* (fig. 12:9, 16) are present

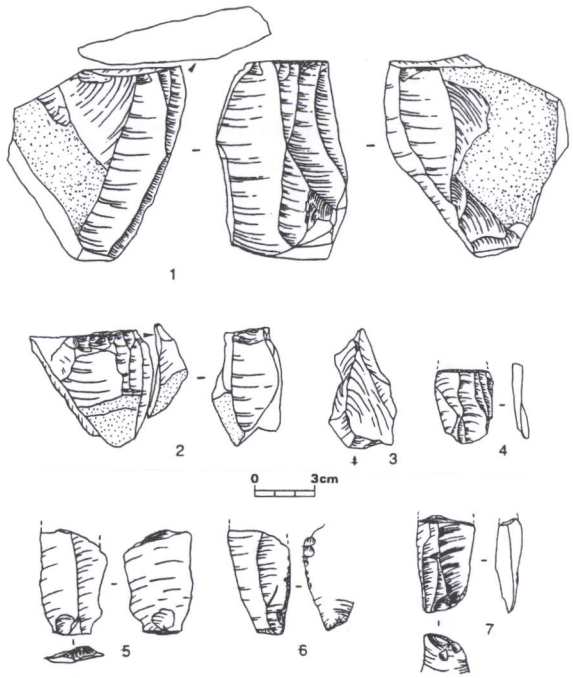

Figure 9. Upper Middle Palaeolithic layers, 7a and 7b (Morawski excavation). Blade debitage: 1. narrow uni-directional core with refitted tablet; 2. narrow uni-directional core with refitted partial crested blade; 3. crested piece / tablet ?; 4, 6-7. proximal blade fragments with flat butts; 5. proximal blade fragment with facetted butt.

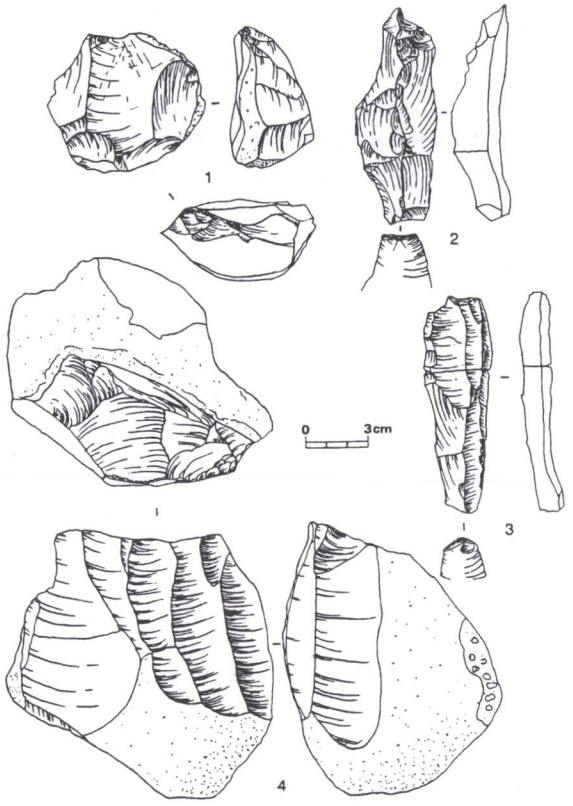

Figure 10. Middle Palaeolithic layer 7c (Morawski excavation): 1. Levallois linear flake core; 2. crested blade; 3. secondary crested bi-directional blade; 4. partially turning uni-directional pre-core.

too (table 5). The interior flaking angle is obtuse and, rarely, right and acute (table 6); bulbs are mostly developed, rarely diffuse, very rarely another type occurred (well-developed or absent) (table 7). Proximal parts of flakes were rarely abraded (5.7 %) or facetted (3.8 %).

Rectangular, round or triangular flake shapes are present in nearly in the same proportions (table 10).

Blades (fig. 8:1-7) are rare but they are the most common in all Middle Palaeolithic layers of the XX sector (table 1); medium to large size (table 2) with big differences in length and width (probably because of high fragmentation - only two blades was found unbroken).

They are non-cortical, with minimum of cortex or backed cortical (table 3), mainly with uni-directional dorsal pattern and some centripetal, transversal and bi-directional negatives (table 4) (fig. 7:3-8).

Platforms are plain (fig. 8:6-7), crudely prepared, less commonly dihedral (fig. 8:1) or facetted; interior platform angle is right or obtuse; bulbs are mostly developed. (table 5-7). Two blades have a lip (table 8).

Oval, triangular, trapezium or convex-concave blade shapes are present in the same proportions (table 10).

They have convex, straight or twisted profile (table 11).

The most numerous blade sections are triangular or trapezium, others (scalene, triangular-trapezium, convex and irregular) are present in the same proportions (table 12).

In this collection *débordant* flakes (15) and also blade (1) are very common.

Some debitage elements confirm the presence of several production systems:

1) Levallois for single (lineal method?) or several small, short, massive flakes (recurrent centripetal method);
2) Non-Levallois centripetal recurrent method for massive (big and small) non-elongated flake production based

on flat core exploitation or, probably more often, on reduction of conical/biconical centripetal cores ("discoid");

3) Blade production based on mostly direct reduction of voluminous flint nodule.

Normally decorticated and *débordant* flakes were modified or used like tools. Tool categories are modest and clearly trivial for a Middle Palaeolithic complex with significant core reduction activity. Blades are still nearly unretouched.

Tools include four side-scrapers, two fragments of side-scrapers (fig. 15:3-4), a knife and a scaled piece.

Side-scrapers are the most common class of tool. One is convex (fig. 15:5) and made on a medium size flake (31; 46; 8). The second, concave, was made on a broken semi-cortical medium size flake (42; 30; 9) (fig. 15:8). The third, transversal straight, was created on a massive (46; 75; 21) flake with thinned base (fig. 15:2). The fourth, transversal convex, was made on a large (82; 97; 17) semi-cortical flake (fig. 15:1).

The knife is represented by a *débordant* orthogonal massive (72; 71; 23) flake by means of direct discontinued retouch or traces of using (fig. 15:6).

The scaled piece was made on a small (>13; 11; 2) proximal part of a broken uni-directional blade (fig. 15:7).

Second Middle Palaeolithic level (layer 7b)

A small collection of artefacts (28 pieces) in layer 7b was discovered. The industry is represented by one core fragment, debitage blanks (8 flakes and 1 blade-small distal fragment), more numerous blank fragments, some chips and small flakes and rare fragments of flint (table 1).

Alterations are similar to the 7a layer (white patina and rare gloss); however, patina occurred more often (75 % of artefacts). Very often artefacts have traces of freeze action: of 28 pieces, only 8 (chips and 4 flakes) were unbroken.

The fragment of the centripetal flake core is small. The striking platform and a small part of the working surface with small flakes negatives is still visible. The fragment was broken because of freeze action.

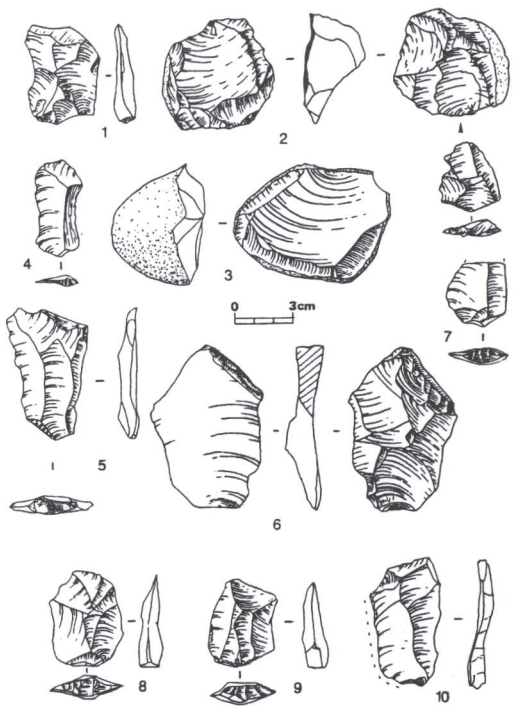

Figure 11. Upper Middle Palaeolithic layers, 7a and 7b (Morawski excavation). Levallois debitage: 1, 8-9. small massive flakes; 4, 7. preparational / recurrent flakes; 5, 10. elongated recurrent flakes (10-*débordant*); 6. preferential overpass flake; 2. linear core with refitted flake on its back; 3. linear core with summary preparation.

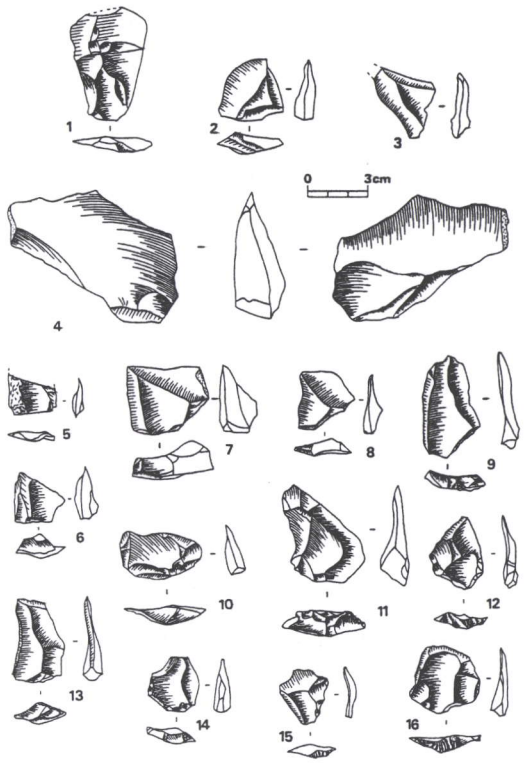

Figure 12. Upper Middle Palaeolithic layers 7a and 7b (trench XX / 1998). Centripetal Levallois and non-Levallois flake debitage: 1-3. 7b layer and 4-16. 7a layer.

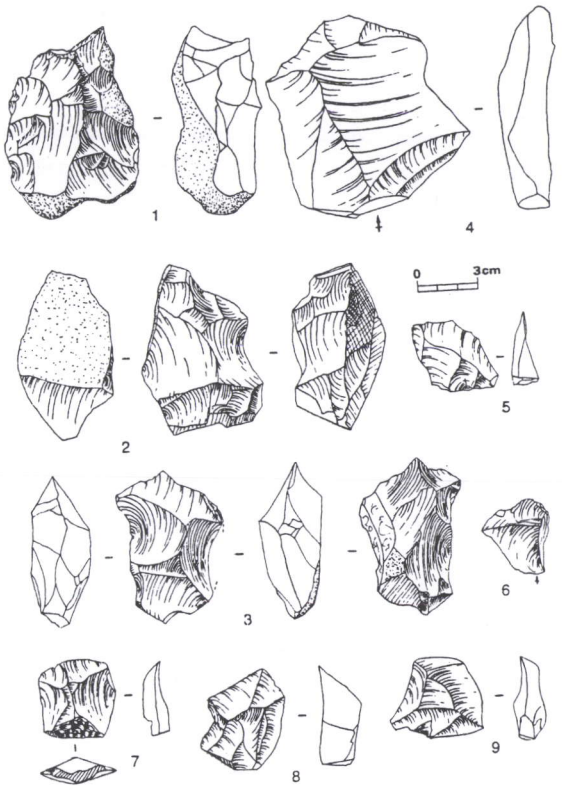

Figure 13. Upper Middle Palaeolithic layers 7a - 7b (Morawski excavation). Centripetal non-Levallois debitage: 1-3. centripetal conical / bi-conical cores on different reduction stages; 4. big, massive centripetal flake; 5-6. triangular débordant flakes; 7-9. small massive centripetal flakes.

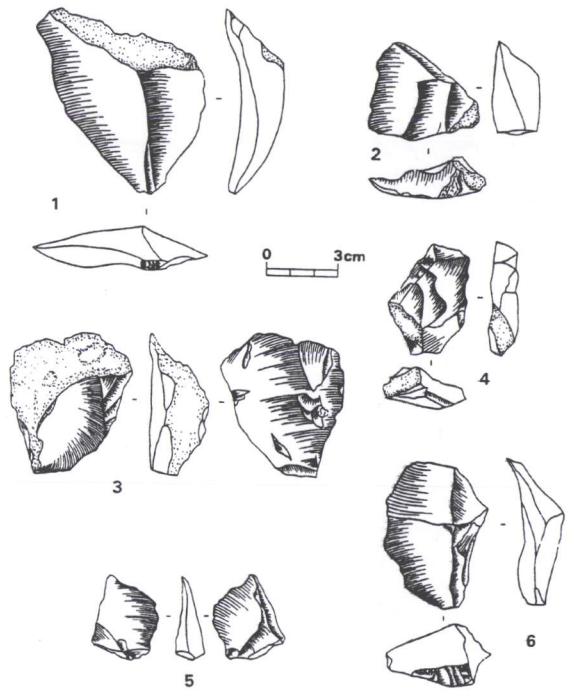

Figure 14. Layer 7c (trench XX / 1998). Flakes: 1. uni-directional flake with facetted platform; 2. uni-directional flake with flat butt; 3. semi-cortical flake with positive area on the dorsal pattern; 4. centripetal débordant flake; 5. convergent flake with crudely prepared butt; 6. centripetal flake with facetted platform.

Flakes are triangular or trapezoidal, medium size (table 1 and 10) and only one *débordant* flake is very big (66; 71; 16). They mainly represent the full debitage stage (non-cortical flakes). From the cortex removal stage, only two flakes are present (table 2). Centripetal flakes are the most numerous; uni-directional, orthogonal and convergent are also present (table 4). Platforms are mainly plain (table 5). Developed bulbs and obtuse flaking angles are dominant (tables 6-7). Abrasion sometimes occurred on proximal parts (table 9). Generally this collection of flakes is characterised by centripetal non-Levallois debitage (*débordant and* convergent asymmetrical massive flakes attest this method) with some Levallois flake production (fig. 12:1-3). Despite the scarcity of artefacts, the assemblage nevertheless shows the same technological pattern for flake production as in the 7a and 7c layers.

Third Middle Palaeolithic level(layer 7c)

In the 7c layer, a collection of 58 artefacts was found, including a core, flakes, blank fragments, abundant chips and small flakes and tools. Materials are very often altered by white patina (57.1 %) and gloss (52.3 %) and more than 77 % of artefacts were broken (freeze action).

The turned core (67; 35; 43) is not expressive (because of poor raw material quality) was probably used for blade debitage. However, numerous blades, which were found in the 7c layer during Morawski's excavations, were absent in this trench (XX).

Flakes are triangular, scalene or trapezium (table 10), medium and large size (Massivity index = 28.9), from the full debitage stage (most numerous non-cortical flakes) and also from the cortex removal stage (tables 2-3). They are mainly uni-directional (fig. 14:1-2) or centripetal (fig. 14:4, 6) and rarely convergent (fig. 14:5) (table 4). One of them has a positive on the dorsal side (fig. 14:3).

Platforms are very often facetted (fig. 14:1, 6), crudely prepared (fig. 14:4)or flat (fig. 14:2-3), also dihedral and rarely pointed (table 5). Interior platform angles are obtuse or right and bulbs are developed or diffused (tables 6-7). One flake has a lip (table 8). Only one *débordant* flake is present (fig. 14:4).

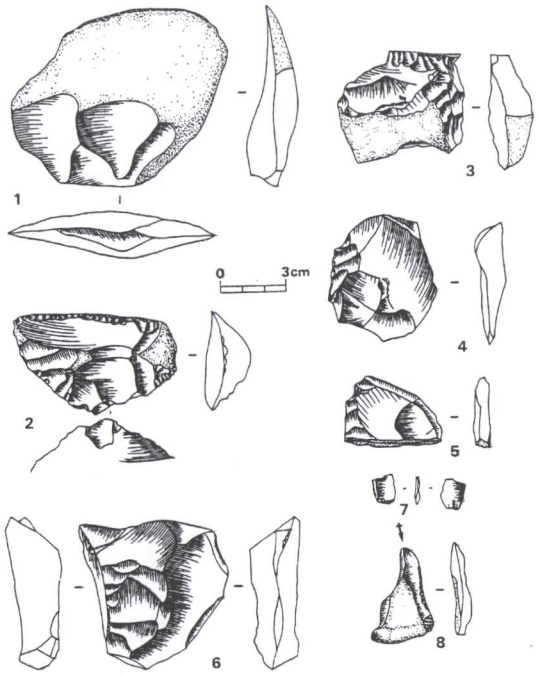

Figure 15. Upper Middle Palaeolithic layer 7a (trench XX / 1998). Tools: 1. transversal convex side-scraper on a semi-cortical flake; 2. transversal straight side-scraper with thinned base; 3-4. side scraper fragments; 5. convex side-scraper; 6. knife on the débordant orthogonal flake (retouch direct discontinued); 7. scaled piece; 8. concave side-scraper.

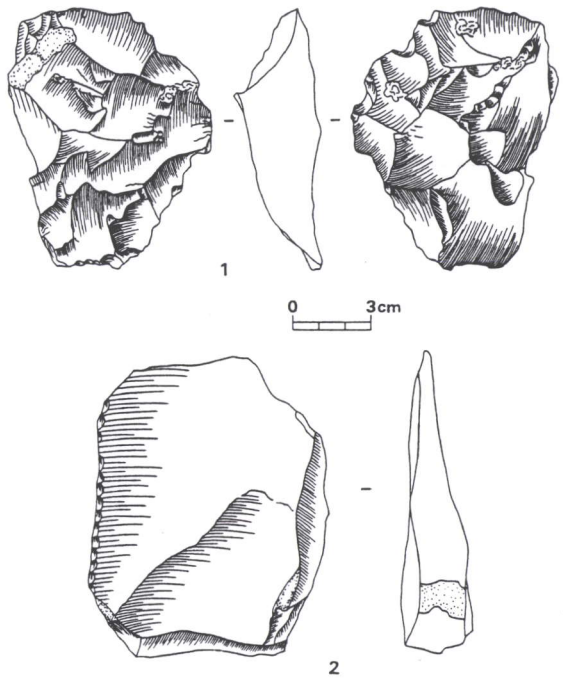

Figure 16. Layer 7c (trench XX / 1998). Tools: 1. preform of bifacial tool; 2. straight side-scraper with thinned base and inverse retouch.

Debitage products are too rare for technological conclusions; however, Levallois traces could be recognised in the high facetting level. The frequency of uni-directional blanks fits more with non-Levallois blade production, well-known from the Morawski 7c assemblage.

Only two tools in this layer are present. The first is a massive (100; 75; 24) pre-form of a bifacial tool on a big flake (fig. 16:1), and the second is a straight side-scraper with thinned base which was made on a massive (113; 93; 25) ordinary flake (fig. 16:2).

Artefacts from layer 8

The last geological layer yielded 22 lithic artefacts. The industry is not very characteristic and included one big natural flint nodule (130; 120; 95), 16 fragments of flint and 5 chips and small flakes.

1999 Excavations (sector XXI)

Trench XXI is located to the west of trench VII (1963 excavations) on Okrążek hill. Area about 6m² were excavated (maximum depth around 4m) for the purpose of collecting samples for the TL dating program (H. Valladas).

A small collection of lithic artefacts (26 pieces) was found between 2.60m and 3.12m. Because of the strong compression of the stratigraphy, these artefacts can be connected to the 7a or 7b layer.

Alterations of artefacts are very common : 57.7 % with patina and 23.1 % with gloss.

The industry includes a fragment of natural nodule with 2 intentional fractures, 5 flakes, 4 blades, 3 chips, 6 broken blanks, 5 natural flint fragments and 2 tools.

Flakes represent different stage of core exploitation. The first is a broken (>47; 45; 16) semi-cortical flake. The second is orthogonal with a crudely prepared platform and developed bulb (25; 24; 7). The third is multi-convergent with a linear butt and diffuse bulb (30; 32; 5). A single Levallois second order centripetal oblique flake with flat platform and well-developed bulb (37; 36; 10) and one *débordant* centripetal with pointed

butt and well-developed bulb (51; 39; 14) are also present.

All blades are broken (2 proximal and 2 mesial fragments). One mesial fragment is cortical (>29; 22; 6), another semi-cortical (>48; 24; 9). Proximal parts (>29; 21; 6 and >66; 41; 11) are uni-directional and one of them is backed cortical. Platforms are created by a single blow (flat and linear), bulb diffused. They have traces of elimination of the overhang by abrasion and one of them has a lip.

The convex side-scraper with denticulate retouch was made on a massive (57; 48; 15) semi-cortical centripetal flake with cortical butt and well-developed bulb.

The end-scraper was created on a massive (59; 51; 17) fragment of cortical blank by means of marginal abrupt retouch.

Conclusions

One of our main purposes was to establish and interpret a preliminary reconstruction of core reduction strategies used during the Middle Palaeolithic (especially the Later Middle Palaeolithic layers) in this huge complex of Piekary workshops. Reconstruction of the Upper Palaeolithic production system on the basis of both old and new excavations is the subject of a separate investigation. Only brief comparisons will proposed here in order to show similarities and differences in some *chaînes opératoires* throughout the Palaeolithic complexes.

Preliminary study of Morawski's assemblages and samples from the 1998-1999 excavations shows systematic blade production of Upper Palaeolithic type accompanied by (in various proportions) a series of Middle Palaeolithic flake methods. Blade manufacture during the Middle Palaeolithic in the Piekary sites was not linked to and differs significantly from Levallois technology which had a clear non elongated character. The volumetric concept of blade production occurred for the first time in Middle Palaeolithic layer 7c, coexisting with several flat core flake methods during the Later Middle Palaeolithic (layers 7b and 7a) and re-appeared (?) or developed into unique standardised blade production in the Upper Palaeolithic (layers 6, 5 and 4). Chrono-technological and spatial distribution of the Piekary IIa sites will be the subject of separate publications.

Several production systems can be proposed after this preliminary study:

1) Levallois lineal method for medium and small single preferential flakes. This method occurred in three Middle Palaeolithic layers (7c, 7b and 7a) and is attested by lineal cores (fig. 11:2-3; fig. 10:1) and preferential flakes (fig. 11:1, 6, 8-9; fig. 12:1; fig. 14:6). Cores are rather small - due to natural parameters or repetitive reduction in order to obtain several generations of end-flakes from a single prepared debitage surface (i.e. one technological cycle). Two main modes of core flaking surface preparation are visible:

   a) "simple" - summarily by means of a combination of a few centripetal or orthogonal removals with the natural convexity of the initial blank : nodule, half-nodule (deliberate breakage ?) or massive flake. Striking platform could be non-prepared, or even cortical (fig. 11:3);
   b) trivial - more regular centripetal or orthogonal preparation around the perimeter using auxiliary platforms with careful creation of the last, main, facetted platform.

The desired end-products consist of non-elongated medium or small sub-quadrangular, oval flakes, often short, transversal (L < W) and massive.

2) Levallois recurrent repetitive centripetal method for production of several generations of flakes (i.e. several flakes per working surface and several flake generations per core blank). Among cores, reduced flat centripetal pieces are observed, but they are not numerous. On the other hand, in all Middle Palaeolithic layers, centripetal convergent, multi-convergent, orthogonal removals (especially *débordant*) are extremely abundant. They can be rather big or medium sized, but more often small and very small (fig. 11:4-5, 7, 10; 12:5-16). This fact confirms not only the existence of the recurrent method(s), but their repetition in application to the initial core block. Massivity, non-elongation tendency of end-products and by-products (difference between them in recurrent system is, in fact, very flexible), "non-parallel" character and big variety of dorsal patterns (with very rare examples of typical Levallois points and Levallois blades), and numerous *débordant* pieces are clearly linked with the recurrent centripetal Levallois and non-Levallois

methods. It seems that these flake methods are dominant in all Middle Palaeolithic layers in Piekary IIa. All these debitage products theoretically could have resulted from three flake centripetal production modes : Levallois recurrent centripetal, non-Levallois centripetal (based on flat core exploitation) and centripetal conical / bi-conical (secant flaking reduction). The difference between the first two methods is very slight in Piekary IIa and could also have changed during the core reduction sequence. The difference in end-products could probably be seen only in platform preparation: careful facetting in the case of Levallois recurrent method (?) (fig. 11:4, 7; 12:12, 16).

3) Centripetal recurrent conical / bi-conical method with secant flake production occurred in all Middle Palaeolithic layers (fig. 12: 2-8; 13; 14:4-5). The method is represented by characteristic cores at different reduction stages with one or two large working surfaces, irregular shape and abundoned asymmetrical (*déjeté*) massive, broad (often *débordant*) flakes, and "pseudo-points" with non-facetted butts. The difference from the previous centripetal methods is linked to non-flat, secant, alternating (if bi-conical) core exploitation.

   Some artefacts could be typologically classified as Levallois points or blade debitage products. However, they normally resulted accidentally from other core reduction methods or occurred rarely in the framework of Levallois conception.

   Flake debitage of various methods was based on flint nodules, half-nodules and sometimes on massive flakes (e.g. cortical). Flake production demonstrates the variability of methods, on the one hand, and flexibility, non clear-cut debitage categories, on the other. Morphological differences between Levallois preferential flake struck from small lineal core and the first recurrent Levallois centripetal flake, or between secondary recurrent flakes of Levallois and non-Levallois centripetal methods is often very slight.

4) In contrast, blade debitage is rather unique and very well recognised during the Middle Palaeolithic in Piekary: long before in layer 7c, and more recently after our new excavations and analyses, less strikingly, in layers 7b and 7a. Systematic blade reduction in the Middle Palaeolithic layers has a volumetric concept of core reduction of Upper Palaeolithic type as opposed to flat Levallois blade production and it seem to have only quantitative difference with blade manufacturing in the Upper Palaeolithic workshops of Piekary. Two main methods occurred :

   a) direct non-Levallois blade method (fig. 10:4),
   b) prepared (with crest installation) non-Levallois blade method (fig. 10:2-3; 9:1-2; 5; 6).

   Voluminous flint nodules are the main source for blade production which was exploited without continuous reshaping, due to natural convexities and guide ridges of previous blade removals or with transversal pre-forming in order to create crest(s). Maintenance was achieved by neo-crest(s), changing of orientation and platform rejuvenation (tablets, grinding, trimming). All blade debitage elements and reduction stages are present in every layer. Initiation of debitage probably started from a single platform. However, bi-directional model is also well represented. Flaking surface(s) was located on large and narrow sides; and was expanded to the lateral edges resulting in partially turned and rare turned cores. At first glance, the principal difference between blade methods in the Middle and Upper Palaeolithic layers of Piekary IIa is in the technique of blank production: the use of soft hammer was regular during Upper Palaeolithic. However, detailed technological analyses of the rich Upper Palaeolithic assemblages of Piekary IIa must be undertaken in order to trace common features and differences in blade production during Palaeolithic periods at Piekary and surrounding sites.

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	layer 4	layer 5	layer 6	layer 7a	layer 7b	layer 7c	layer 8
Natural blocks							1 / 4.5%
Tested blocks			1 / 0.2%				
Cores		1 / 0.1%	5 / 0.8%	3 / 1.4%	1 / 3.6%	1 / 4.5%	
Flakes	9 / 32.1%	203 / 26.6%	157 / 24.5%	120 / 54.3%	8 / 28.6%	18 / 31%	
Blades	1 / 3.6%	109 / 14.3%	168 / 26.3%	13 / 5.9%	1 / 3.6%		
Bladelets		10 / 1.3%	24 / 3.8%	1 / 0.5%			
Blanks fragments		10 / 1.3%	18 / 2.8%	3 / 1.4%	11 / 39.2%		
Chips and small flakes*	14 / 50%	412 / 53.9%	241 / 37.6%	51 / 23%	4 / 14.3%	3 / 5.2%	5 / 22.7%
Fragments of flint	4 / 14.3%	9 / 1.2%	10 / 1.5%	22 / 9.9%	3 / 10.7%	34 / 58.6%	16 / 72.7%
Tools		8 / 1%	16 / 2.5%	8 / 3.6%		2 / 3.4%	
TOTAL	**28/100%**	**764/99.7%**	**640/100%**	**221/100%**	**28/100%**	**58/99.9%**	**22/99.9%**

* (< 20 mm)

Table 1. Lithic artefact Class.

		layer 4	layer 5	layer 6	layer 7a	layer 7b	layer 7c
Cores	max.		99-60-47	93-64-50	133-83-104		67-35-43
	max.thickness			80			
	min.			>53-70-42	92-72-90		
	min.width			58			
	average			>78-60.3-59.5	112.5-77.5-97		
Flakes	max.	75-51-18	108-57-30	126-110-29	65-84-23	66-71-16	89-60-16
	max.width	65	90				
	max.thickness		52,2		27		24
	average	49.5-40.8-10.7	44.2-42.5-12.7	45.4-41.6-10.4	35.5-32.5-10.9	47.5-43.3-10.8	50.1-41.3-14.5
	Elongation index	121.3	104	109.1	109.2	109.7	121.3
	Massivety index	21.6	28.7	22.9	30.7	22.7	28.9
Blades	max.	45-21-7	>111-39-9	>87-37-10	>90-36-16	>18-11-9	
	max.width			44			
	max.thickness		17	18			
	average		>58.1-22.7-8.4	>46.5-21.6-9.4	>64.3-28-11.3		
	Elongation index		255.9	215.3	229.6		
	Massivety index		14.4	20.2	17.5		

Table 2. Metrical data and Indexes.

	flakes 4	blades 4	flakes 5	blades 5	bladelets 5	flakes 6	blades 6	bladelets 6
Cortical	2 / 22.2%		14 / 6.9%	2 / 1.8%		11 / 7%	2 / 1.2%	
Semi-cortical	3 / 33.3%		33 / 16.3%	9 / 8.3%		11 / 7%	16 / 9.5%	1 / 4.2%
Backed cortical	3 / 33.3%	1	6 / 2.9%	10 / 9.2%	2 / 20%	5 / 3.2%	9 / 5.4%	
Min. cortex	1 / 11.1%		45 / 22.2%	14 / 12.8%		26 / 16.6%	14 / 8.3%	
Non cortical			105 / 51.7%	74 / 67.9%	8 / 80%	104 / 66.2%	127 / 75.6%	23 / 95.8%
TOTAL	**9/99.9%**	**1**	**203/100%**	**109/100%**	**10/100%**	**157/100%**	**168/100%**	**24/100%**

	flakes 7a	blades 7a	bladelets 7a	flakes 7b	blades 7b	flakes 7c
Cortical	7 / 5.8%			1 / 12.5%		
Semi-cortical	35 / 29.2%			1 / 12.5%		5 / 27.8%
Backed cortical	3 / 2.5%	3 / 23.1%				1 / 5.6%
Min. cortex	11 / 9.2%	3 / 23.1%				4 / 22.2%
Non cortical	64 / 53.3%	7 / 53.8%	1	6 / 75%	1	8 / 44.4%
TOTAL	**120/100%**	**13/100%**	**1**	**8/100%**	**1**	**18/100%**

Table 3. Debitage Classes by type of reduction

	flakes 4	flakes 5	blades 5	bladelets 5	flakes 6	blades 6	bladeletes 6
Unidirectional		33 / 30.8%	31 / 47%	4 / 66.6%	27 / 33.3%	61 / 66.3%	8 / 66.7%
Bidirectional		2 / 1.8%	6 / 9.1%	1 / 16.7%	4 / 4.9%	9 / 9.8%	2 / 16.7%
Orthogenal	1	18 / 16.8%	7 / 10.6%	1 / 16 .7%	9 / 11.1%	6 / 6.5%	1 / 8.3%
Transversal		2 / 1.8%			6 / 7.4%	1 / 1.1%	
Convergent		5 / 4.7%	2 / 3%			1 / 1.1%	
Multiconvergent		1 / 0.9%			2 / 2.5%	2 / 2.2%	
Centripetal		25 / 23.4%	6 / 9.1%		17 / 21%		
Crested		8 / 7.5%	14 / 21.2%		4 / 4.9%	12 / 13%	1 / 8.3%
Tablet		8 / 7.5%			9 / 11.1%		
Debordan		5 / 4.7%			3 / 3.7%		
TOTAL	**1**	**107 / 99.9%**	**66 / 100%**	**6 / 100%**	**81 / 99.9%**	**92 / 100%**	**12 / 100%**

	flakes 7a	blades 7a	bladelets 7a	flakes 7b	flakes 7c
Unidirectional	9 / 20.5%	7 / 58.3%	1	1 / 16.6%	4 / 50%
Bidirectional		2 / 16.7%			
Orthogenal	3 / 6.8%			1 / 16.6%	
Transversal	3 / 6.8%	2 / 16.7%			
Convergent	3 / 6.8%			1 / 16.6%	1 / 12.5%
Multiconvergent	1 / 2.3%				
Centripetal	25 / 56.8%	1/ 8.3%		3 / 50%	3 / 37.5%
TOTAL	**44 / 100%**	**12 / 100%**	**1**	**6 / 99.8%**	**8 / 100%**

Table 4. Dorsal scar Patterns.

	flakes 4	blades 4	flakes 5	blades 5	bladelets 5	flakes 6	blades 6	bladelets 6
Cortical	2 / 25%		8 / 5.8%	1 / 1.8%		10 / 11.1%	4 / 6.3%	
Plain	2 / 25%		60 / 43.8%	30 / 54.5%	2 / 50%	37 / 41.1%	35 / 54.7%	3 / 33.3%
Linear	2 / 25%		4 / 2.9%	6 / 10.9%		13 / 14.4%	8 / 12.5%	4 / 44.4%
Punctiform		1	38 / 27.7%	4 / 7.3%	2 / 50%	10 / 11.1%	7 / 10.9%	2 / 22.2%
Dihedral	1 / 12.5%		12 / 8.8%	4 / 7.3%		10 / 11.1%	4 / 6.3%	
Prepared	1 / 12.5%		14 / 10.2%	4 / 7.3%		8 / 8.9%	5 / 7.8%	
Facetted			1 / 0.7%	6 / 10.9%		2 / 2.2%	1 / 1.5%	
TOTAL	**8/100%**	**1**	**137/99.9%**	**55/100%**	**4/100%**	**90/99.9%**	**64/100%**	**9/99.9%**

	flakes 7a	blades 7a	flakes 7b	flakes 7c
Cortical	3 / 5.5%		1 / 16.6%	
Plain	21 / 38.2%	2 / 40%	4 / 66.7%	3 / 23.1%
Punctiform	3 / 5.5%			1 / 7.7%
Dihedral	7 / 12.7%	1 / 20%		2 / 15.4%
Prepared	13 / 23.6%	1 / 20%	1 / 16.6%	3 / 23.1%
Facetted	6 / 10.9%	1 / 20%		4 / 30.7%
Chapeau de gendarme	2 / 3.6%			
TOTAL	**55/100%**	**5/100%**	**6/99.9%**	**13/100%**

Table 5. Platform Types.

	flakes 4	blades 4	flakes 5	blades 5	bladelets 5	flakes 6	blades 6	bladelets 6
Right	5 / 62.5%	1	50 / 46.3%	10 / 23.3%	1 / 50%	40 / 62.5%	20 / 40.8%	
Obtuse	3 / 37.5%		53 / 49.1%	31 / 72.1%		22 / 34.4%	28 / 57.1%	2
Acute			5 / 4.6%	2 / 4.6%	1 / 50%	2 / 3.1%	1 / 2%	
TOTAL	**8 / 100%**	**1**	**108 / 100%**	**43 / 100%**	**2 / 100%**	**64 / 100%**	**49 / 99.9%**	**2**

	flakes 7a	blades 7a	flakes 7b	flakes 7c
Right	9 / 19.6%	2 / 40%	2 / 33.3%	4 / 44.4%
Obtuse	35 / 76.1%	3 / 60%	4 / 66.7%	5 / 55.6%
Acute	2 / 4.3%			
TOTAL	**46 / 100%**	**5 / 100%**	**6 / 100%**	**9 / 100%**

Table 6. Interior Platform Angle.

	flakes 4	blades 4	flakes 5	blades 5	bladelets 5	flakes 6	blades 6	bladelets 6
Well-developed				1 / 1.8%		4 / 4.5%		
Developed	5 / 62.5%		94 / 69.1%	24 / 43.6%	3 / 75%	50 / 56.2%	13 / 20.3%	1 / 11.1%
Defuce	3 / 37.5%	1	30 / 22.1	26 / 47.3%	1 / 25%	34 / 38.2%	44 / 68.8%	8 / 88.9%
Absent			12 / 8.8%	4 / 7.3%		1 / 1.1	7 / 10.9%	
TOTAL	**8/100%**	**1**	**136/100%**	**55/100%**	**4/100%**	**89/100%**	**64/100%**	**9/100%**

	flakes 7a	blades 7a	flakes 7b	flakes 7c
Well-developed	4 / 7.3%			
Developed	35 / 63.6%	2 / 40%	4 / 66.7%	7 / 53.8%
Defuce	14 / 25.5%		1 / 16.6%	6 / 46.2%
Absent	2 / 3.6%	3 / 60%	1 / 16.6%	
TOTAL	**55/100%**	**5/100%**	**6/99.9%**	**13/100%**

Table 7. Bulb Patterns.

flakes 4	flakes 5	blades 5	bladelets 5	flakes 6	blades 6	bladelets 6	flakes 7a	blades 7a	flakes 7c
3 / 37.5%	24 / 17.5%	25 / 45.5%	1 / 25%	21 / 23.3%	29 / 45.3%	4 / 44.4%	5 / 10%	2 / 40%	1 / 7.7%
8/100%	**137/100%**	**55/100%**	**4/100%**	**90/100%**	**64/100%**	**9/100%**	**55/100%**	**5/100%**	**13/100%**

Table 8. Lip pressence.

	flakes 5	blades 5	bladelets 5	flakes 6	blades 6	bladelets 6	flakes 7a	flakes 7b
Facetting		1 / 1.8%	1 / 25%		1 / 1.6%		2 / 3.6%	
TOTAL		**55/100%**	**4/100%**		**64/100%**		**55/100%**	
Abrasion	18 / 13.1%	21 / 38.2%		18 / 20%	24 / 37.5%	5 / 55.6%	3 / 5.5%	5 / 83.3%
TOTAL	**137/100%**	**55/100%**		**90/100%**	**64/100%**	**9/100%**	**55/100%**	**6/100%**

Table 9. Exterior Platform margin Preparation.

	blades 4	blades 5	bladelets 5	blades 6	bladelets 6	flakes 7a	blades 7a	flakes 7b	flakes 7c
Rectangular		21 / 38.2%		17 / 37%	1 / 20%	13 / 30.2%			
Trapezium		10 / 18.2%	1 / 33.3%	10 / 21.7%	1 / 20%	2 / 4.7%	1 / 25%	1 / 33.3%	1 / 25%
Round						10 / 23.3%			
Oval	1	2 / 3.6%	1 / 33.3%	6 / 13%	2 / 40%		1 / 25%		
Triangular						14 / 32.5%	1 / 25%	2 / 66.7%	2 / 50%
Scalene									1 / 25%
Convex-concave		15 / 27.3%	1 / 33.3%	7 / 15.2%			1 / 25%		
Irregular		7 / 12.7%		6 / 13%	1 / 20%	4 / 9.3%			
TOTAL	**1**	**55/100%**	**3/99.9%**	**46/99.9%**	**5/100%**	**43/100%**	**4/100%**	**3/100%**	**4/100%**

Table 10. Blank Shape.

	blades 4	blades 5	bladelets 5	blades 6	bladelets 6	blades 7a
Straight	1	29 / 53.7%	2 / 33.3%	15 / 36.6%	6 / 37.5%	1 / 25%
Convex		16 / 29.6%	2 / 33.3%	15 / 36.6%	4 / 25%	2 / 50%
Wave				5 / 12.2%		
Twisted		9 / 16.7%	2 / 33.3%	6 / 14.6%	6 / 37.5%	1 / 25%
TOTAL	**1**	**54 / 100%**	**6 / 99.9%**	**41 / 100%**	**16 / 100%**	**4 / 100%**

Table 11. Blank Profile.

	blades 4	blades 5	bladelets 5	blades 6	bladelets 6	blades 7a	blades 7b
Triangular	1	45 / 45.4%	5 / 55.6%	76 / 47.5%	18 / 75%	5 / 45.4%	1
Scalene		7 / 7.1%	3 / 33.3%	10 / 6.3%	1 / 4.1%	1 / 9.1%	
Trapezium		32 / 32.3%		55 / 34.3%	3 / 12.5%	3 / 27.3%	
Triang.+ trapez.		5 / 5.1%	1 / 11.1%	10 / 6.3%	1 / 4.1%	1 / 9.1%	
Convex		1 / 1%		1 / 0.6%			
Irregular		9 / 9.1%		8 / 5%	1 / 4.1%	1 / 9.1%	
TOTAL	**1**	**99 / 100%**	**9 / 100%**	**160 / 100%**	**24 / 99.8%**	**11 / 100%**	**1**

Table 12. Blank Section.