MIDDLE AND EARLY UPPER PALAEOLITHIC OF THE KRAKOW REGION
PIEKARY IIa

Edited by
Valéry Sitlivy  Aleksandra Zięba & Krzysztof Sobczyk

ROYAL MUSEUMS OF ART AND HISTORY
BRUSSELS 2008
Dedicated to Zygmunt Holcer
8. COMPARATIVE ANALYSES

8.1. Inter-assemblage Comparisons

Detailed comparative analyses are presented here for three newly discovered Late Middle Palaeolithic assemblages and one Early Upper Palaeolithic assemblage. These have been placed within Oxygen Isotope Stage 3 and date between 61-31/26 ka BP (Valladas et al. 2003; Chapter 5). Micoquian finds from layer 7c² are limited, but these, as well as the majority of abundant, but often mixed, old collections, have been added to this study. Moreover, such old collections usually lack small debitage products, such as small debris chips, which makes it difficult to carry out detailed comparative analyses (e.g., assemblage structure). It was, however, possible to use certain data from the old collection of layer 7c (1969-1983 excavations) to complete the less abundant lithic industry for some inter-assemblage comparisons.

In all of the assemblages, one type of local Jurassic flint was principally exploited. This is a fine-grained, rather homogeneous flint, varying from very good to mediocre quality. Other types of flint are rare and exogenous raw materials are absent. Thus, transport of non-local materials to the site is virtually absent and human mobility will not influence comparisons. Properties of the flint (shape, texture, inclusions, etc) do not affect artefact morphology. The Late Middle Palaeolithic assemblages show the use of blade technology, different degrees of use of Levallois methods and a total absence of bifacial tools.

General artefact composition

The general structure of the Middle Palaeolithic assemblages shows the dominance of flakes, blades and chips (<2cm) (table 8.1.1). Chips, however, were less frequent in layer 7b (less than 20%) and especially in layer 7c, which could be explained by a stronger effect of post-depositional processes in this part of the excavated trench. In addition, chips were not recorded in the old Morawski collections. Chips generally increased in frequency and proportions throughout the sequence to the debitage products and are more common than flakes in the EUP assemblage. Large debitage products, first of all flakes, are dominant in the Middle Palaeolithic assemblages, showing a general decreasing trend from layer 7b to layer 6 as blades/bladelets increase in frequency. The only exception is layer 7a, where on-site blade production resulted in a surprisingly low blade component in comparison with the nearly exclusive presence of blade cores. This may reflect exportation of blades from the site.

While the flint sources were probably nearby and there were no constraints imposed on technological activity by lack of abundance or accessibility, it is unusual that raw or tested blocks of flint were absent. A single unmodified cobble was recovered in layer 7a. Primary unmodified nodules, which were reduced as cores in all layers, are absent as well. Gelifracted fragments usually are fairly small and would not represent a raw material reserve. Debris, comprising small flint fragments, resulted from core reduction. Tested blocks include only two large items in layers 7b and 6. These observations contrast with other contemporaneous and more recent assemblages in this region. Pre-forms are absent in all assemblages, except single pieces in layers 7c and 7a. Cores are more representative, but typically account for only about 1%-1.6% in the uppermost layers with a maximum of 4.3% in the lowermost assemblage in layer 7c. Retouched tools are more proportionally common and range between 0.3% and 2%. Hammerstones are very rare (only two items in layer 7b) or absent.
Use of soft hammers (mostly in the uppermost layers) may only partially explain their absence.

The tool to core ratio is low: a minimum of 0.4 to 1 in lowermost layer 7c and a maximum of 2 to 1 in uppermost layer 6. The general increase in this ratio shows some deviation in the middle part of Piekary sequence with a low index in layer 7a (1.4 to 1). The blank to core ratio progressively increases from the bottom to top with rather low productivity in layer 7c (11 to 1) and high ratios of 46 to 1 (layer 7b), 42.7 to 1 (layer 7a) and a maximum of 55.5 to 1 in layer 6. Burnt artefacts are present in all layers in small quantities.

Thus, lithic artefact composition for all assemblages suggests increasingly intensive on-site core reduction, with some blanks selected for modification into tools, and tool use.

<table>
<thead>
<tr>
<th>Table 8.1.1.</th>
<th>P IIa 7c</th>
<th>P IIa 7b</th>
<th>P IIa 7a</th>
<th>P IIa 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td><strong>%</strong></td>
<td><strong>n</strong></td>
<td><strong>%</strong></td>
<td><strong>n</strong></td>
</tr>
<tr>
<td>Unmodified cobble</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Gelifracts</td>
<td></td>
<td></td>
<td>18</td>
<td>11.2</td>
</tr>
<tr>
<td>Debris, small fragments</td>
<td>47</td>
<td>29.2</td>
<td>12</td>
<td>2.1</td>
</tr>
<tr>
<td>Burnt fragments</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tested blocks</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Pre-forms of tool/core</td>
<td>1</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cores</td>
<td></td>
<td>7</td>
<td>4.3</td>
<td>9</td>
</tr>
<tr>
<td>Chips (&lt; 2cm)</td>
<td></td>
<td></td>
<td>5</td>
<td>107</td>
</tr>
<tr>
<td>Flakes</td>
<td></td>
<td></td>
<td>60</td>
<td>37.3</td>
</tr>
<tr>
<td>Blades</td>
<td></td>
<td></td>
<td>15</td>
<td>9.3</td>
</tr>
<tr>
<td>Bladelets</td>
<td></td>
<td></td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Blank fragments</td>
<td>-</td>
<td></td>
<td>-</td>
<td>11</td>
</tr>
<tr>
<td>Burin spalls</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hammerstones</td>
<td>-</td>
<td>-</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Retouched tools</td>
<td></td>
<td></td>
<td>3</td>
<td>1.9</td>
</tr>
<tr>
<td>Total</td>
<td>161</td>
<td>100</td>
<td>567</td>
<td>99.9</td>
</tr>
</tbody>
</table>

Cores

Cores are scarce and account for 4.3-1% of the total assemblages (table 8.1.1). Most cores were made on flint nodules and all blade cores were on nodules in all layers. Cores-on-flakes in layer 7b are represented by non-Levallois types, namely Kombewa and discoidal; in layer 7c, Levallois lineal and centripetal cores were also made on cortical flakes. There is no evidence for blade production from cores-on-flakes. Cores vary in dimensions, but are often fairly large (even exhausted ones) in all layers. The smallest are found in layer 7b, both exhausted cores and those on tiny primary nodules or flakes. Initial cores and core pre-forms are usually much larger in volume and size and were destined for blade production. In most assemblages, cores reflect different reduction stages: initial (except in layers 6 and 7b), full debitage and exhaustion. The initial stages of core preparation and exploitation are more easily observed on blade pre-cores, bifacial pre-forms and some non-Levallois flake cores. The general result of core exploitation is decrease in the thickness of primary blanks. Thus, “micro-cores”, including heavily reduced polyhedral or discoidal cores, are absent. By contrast, core fragments are more numerous than intact cores in layer 6 where classifiable items (5 out of 6) show the reduction stage of full debitage to exhaustion. Pre-cores are absent in this industry (table 8.1.2). A similar pattern was documented in layer 7b. Blade pre-cores and pre-forms are, however, present in layers 7c and 7a. Cores from the initial reduction stage are also common and represented in similar proportions in these two assemblages.
Blade cores or their remnants (fragments, core flanks) were documented in all of the assemblages. Non-Levallois and Levallois flake cores are present in different proportions exclusively in Middle Palaeolithic assemblages, leaving no traces during the EUP (table 8.1.3). Levallois cores and corresponding debitage decreased considerably in final MP layer 7a and disappeared in EUP layer 6. By the end of Middle Palaeolithic (layer 7a), flake production was ensured mainly by discoidal core reduction. Curiously, numerous characteristic flakes in layer 7a contrast with a complete absence of corresponding cores in the newly excavated trenches, but are well-presented in Morawski’s mixed 7a/7b collections. Levallois flake cores are of lineal mode. Point cores occurred only in layer 7b (one item was recorded in layer 7c – Morawski’s excavations), while Levallois blade cores are absent. Prismatic blade cores are often bidirectional (narrow-faced or with a wide flaking surface), partially turned (some turned cores also appear in layer 6), with acute single-blow platforms or platforms prepared by several removals (facetted only in layer 7c) and can be prepared (by crests) or unprepared (direct debitage). Narrowing of cores by means of large removals and platform preparation by laminar removals was attested in all of the core samples. Blade cores in the oldest layer differ slightly from more recent pieces: the back remains cortical, while in layers 7a and 6, core backs may be thinned, prepared as a crest or used like extended working surface.

### Table 8.1.2.
**Piekary IIa. CORES**

<table>
<thead>
<tr>
<th>Core Type</th>
<th>7c Morawski</th>
<th>7c</th>
<th>7b</th>
<th>7a</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Pre-cores</td>
<td>1</td>
<td>4.8</td>
<td>1</td>
<td>14.1</td>
<td>-</td>
</tr>
<tr>
<td>Pre-forms of blade cores</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>14.1</td>
<td>-</td>
</tr>
<tr>
<td>Volumetric blade cores</td>
<td>12</td>
<td>57.1</td>
<td>2</td>
<td>29.5</td>
<td>-</td>
</tr>
<tr>
<td>Flake unidirectional</td>
<td>2</td>
<td>9.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Orthogonal</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>14.1</td>
<td>-</td>
</tr>
<tr>
<td>Fan-like</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Centripetal</td>
<td>1</td>
<td>4.8</td>
<td>1</td>
<td>14.1</td>
<td>-</td>
</tr>
<tr>
<td>Discoidal</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Levallois</td>
<td>3</td>
<td>14.3</td>
<td>1</td>
<td>14.1</td>
<td>2</td>
</tr>
<tr>
<td>Semi-polyhedral</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kombewa</td>
<td>1</td>
<td>4.8</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Unidentifiable fragments</td>
<td>1</td>
<td>4.8</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>21</td>
<td>100</td>
<td>7</td>
<td>100</td>
<td>9</td>
</tr>
</tbody>
</table>

### Flakes and blades

Blades occurred in high frequencies in most MP layers and reach their maximum (Ilam = 49.5) in EUP layer 6 (table 8.1.4.). The lowest blade index is 14 (layer 7a) and, since cores are almost exclusively blade cores, could be explained by selection and transport of blades from the debitage area. A considerable increase in the blade/bladelet component was documented in layer 6, while blade indexes in MP layers are still similar and rather high. The percentages of Levallois blanks decreased, showing a similar moderate rate in
the two lowermost layers, a decrease in IL in the highest MP layer 7a and a total absence in EUP layer 6. Thus, the dual technological structure (UP blades + Levallois flakes in the lowermost layers 7c and 7b) lost the Levallois component in favour of non-Levallois flakes (layer 7a) and then became an exclusive blade system (layer 6). Levallois debitage in MP industries lacks preferential blades (except for a few unintentional by-products, such as laminar technical preparation removals), but includes preferential and recurrent flakes and sometime short broad-based points, except in layer 7b where they are more common.

Table 8.1.5.
Piekary IIa. UNIDIRECTIONAL SCARS

Table 8.1.6.
Piekary IIa. BIDIRECTIONAL SCARS

Dorsal scar pattern

Dorsal scars display some patterns in knapping methods and reduction processes.

Unidirectional scars. Blanks with unidirectional scars are the most representative. Blades with such scars dominate in all assemblages, reflecting a gradual rise from >50% to >60% throughout the sequence (table 8.1.5). Unidirectional flakes dominate only in EUP layer 6, while they display various patterns in the MP layers: dominating over centripetal scars (layer 7c), present in similar proportions to centripetal and convergent scars (layer 7b), and in second place after centripetal flakes (layer 7a). Unidirectional flake scars vary between 25-37%, mostly depending on the proportions of centripetal and convergent scars. In sum, this dorsal scar pattern confirms the importance of blade debitage in all layers, as well as use of other debitage models during the Middle Palaeolithic.

Bidirectional scars. These often occurred on blades in layer 7c and are less common in the other layers, reflecting the role of bidirectionality during blade debitage and core maintenance. However, the dominance of unidirectional blades could also indicate a lower frequency in the use of alternate bidirectional reduction for successive exploitation of double-platform cores. Flakes with bidirectional scars are rare (table 8.1.6).

Convergent scars. The great majority of these were recorded in layer 7b, for both flakes and blades, confirming systematic Levallois point production in this assemblage (table 8.1.7). The presence of convergent blanks, especially flakes, in layer 7a, fits well with centripetal reduction of mostly discoidal cores, which often produced “pseudo-Levallois points” (oblique scars are also the most frequent in this layer).

Centripetal scars. Centripetal flake scars are equally well represented in all MP layers (table 8.1.8), varying in relation with unidirectional scars,
and reflect the use of different Levallois and non-Levallois flake methods. In the EUP layer, the decrease in this dorsal pattern indicates a change in reduction strategy from centripetal to parallel core exploitation. Flakes with centripetal scars (without corresponding cores) in layer 6 were removed during the shaping of blade cores. Blades with centripetal scars are poorly represented or absent (layers 7c and 6) and, together with other indications, confirm the absence of Levallois blade debitage at Piekary IIa.

_Crested dorsal pattern._ The rise in crested dorsal pattern in layers 7c and 6 corresponds to use of the Upper Palaeolithic prepared blade method (table 8.1.9). Crested blades are less frequent in layers 7a and 7b. This observation fits well with the presence of direct reduction of blade cores in layer 7a.

_Tablets._ These occurred in layer 7a and are numerous in layer 6 (table 8.1.9).

Flakes and blades with different scar patterns retain lateral (_débordant_) and distal (plunging) portions of the core from which they were produced. _Débordant_ flakes are abundant in MP layers, showing a gradual increase from the bottom to the top of the sequence (table 8.1.10). They usually resulted from Levallois flake (layer 7c), point (layer 7b) and discoidal (layer 7a) methods. _Débordant_ blades are equally present in low proportions in all MP layers and absent in the EUP layer. They represent both desired blanks and unintentional by-products.

_Cortex._

Flakes with different proportions of cortex always dominate over blades (table 8.1.11). Blanks in layer 6 are generally the least cortical, especially blades. In MP assemblages, cortical blades are represented in similar proportions of about 30%, while cortical flakes are more numerous with maximum of 64% in layer 7c.
Primary flakes progressively increase in frequency to the EUP with a maximum in layer 7a (n=52, 24%), showing a slight decrease in layer 6 (table 8.1.12). Cortically backed flakes display an opposite trend. By contrast, semi-cortical flakes are the most numerous and stable category during the MP and comprise about 30%, with a maximum of 35% in layer 7b. Blades (table 8.1.13) show significant difference with flakes by the scarcity of primary or fully cortical blades and the dominance of cortically backed items. Both cortically backed flakes and blades, together with blades with lateral cortex, play a significant role in the creation and maintenance of flaking surfaces on prismatic and Levallois point cores.

Non-cortical flakes and especially blades
(i.e., from the full debitage phase) are dominant over cortical removals. However, the ratio of cortical removals (100% cortex + semi-cortical) to cores is high in layers 7a and 7b (6.2 and 7.7) and could evidence on-site preparation of at least some cores. In layer 6, only 3.6 cortical removals per core seems show limited support of in situ cortex removal from cores (table 8.1.14).

**Platform preparation**

The highest degree of facetting (IFI, IFs, IFss) was recorded in the two lowermost assemblages with both blade and Levallois technologies (table 8.1.15). A significant difference is also clear in these assemblages: in layer 7b facetting was much higher for blades (IFI = 57.1; IFs = 47.6 and IFss = 42.8) than for flakes (IFI = 43.1; IFs = 34.3 and IFss = 18.7). These indices all clearly and gradually decreased to the Early Upper Palaeolithic technological complex.

*Cortical butts.* These are absent (blades of layer 7c) or poorly represented in all other assemblages, both for flakes and blades (4-10%) and reflect initial core reduction (table 8.1.16 and 8.1.17).

**Plain, linear and punctiform butts.** The great majority of flake and blade butts are plain, showing a gradual increase in the sequence, reaching 40-52% in the two uppermost layers. Linear and punctiform butts increase considerably in frequency in layer 6, the result of an elaborated technique of blade detachment (table 8.1.16 and 8.1.17).

*Dihedral butts.* These are rather scarce and stable for flakes (9-12%). Blades with dihedral buts clearly decreased to EUP layer 6 (table 8.1.17).

*Polyhedral butts.* These are common in all MP layers up to 20%, more so for flakes, but also for blades, especially in layer 7c (table 8.1.16 and 8.1.17).

**Facetted butts.** These are common in the two lowermost layers and then dramatically decrease in the two most recent assemblages. Curiously, non-Levallois blades are more facetted than Levallois flakes and points in layers 7c and 7b. This disproportion disappears in layers 7a and
6, together, in fact, with fine facetting (table 8.1.16 and 8.1.17).

Platform angles. Obtuse interior flaking angles dominate, both for flakes and blades (except one case for flakes in layer 6 when a sudden increase in right angles was recorded) (table 8.1.18). In the two lowermost layers, obtuse angles are more frequent for flakes than for blades, which is reversed in the two uppermost layers. The highest frequency of obtuse angles for all blanks was documented in layer 7a. Right angles were more common in both the oldest Mousterian and youngest EUP assemblages. In fact, right angles on blades are proportionally similar throughout the sequence, except for layer 7a (which has a minimum frequency for both flakes and blades). Acute angles are rare.

Bulb patterns and butt lipping. Developed bulbs dominate in all assemblages, except for blades in layer 6, where diffused bulbs account for more than half (table 8.1.19). Pronounced bulbs are present in the same proportions on both flakes and blades in the two lowermost layers, while developed bulbs on blades progressively declined in the two youngest assemblages. A high frequency of diffused bulbs was documented in EUP layer 6, on flakes and on more than half of the blades. Interestingly, bulb absence (flat bulb zone) occurred on blades in layer 7c, then after a decline in 7b, remarkably increased in layer 7a and was substituted in the EUP layer by diffused bulbs. When analysing this attribute, it is important to draw attention to lipping patterns which occurred both with and without weak bulbs. Thus, lipped butts are extremely abundant in layer 6 (43% of blades). Blade butt lipping was already
attested in both of the lowermost layers (>10%). The frequency was doubled in layer 7a and then again in layer 6 (table 8.1.20). In sum, hard hammer technique was dominant in the two oldest Mousterian layers for both flake and blade detachment. Soft hammers were used to produce some blades. The contrast between the two groups of assemblages (lowermost and uppermost) is shown by patterns of blade lipping and weak/absent bulbs, marking a change in knapping technique prior to the first Upper Palaeolithic complex in Piekary. The soft hammer technique was also used in tandem with hard stone in layer 7a for blade production. Later, in layer 6, many more flakes, involved in blade manufacture, were obtained by soft hammer.

**Exterior platform margin preparation.** Elimination of the overhang on cores is visible on the proximal/dorsal parts of blanks and was achieved by means of trimming/facetting and by abrasion/grinding. In layer 7c, few cases of this technique were documented, while both techniques, especially abrasion, later appeared more often and became a common practice. In layer 7b, Levallois products were twice as often abraded as blades (9.8% versus 4.7%) while in layer 7a, already 12.2% of blades and only 0.8% of Levallois flakes exhibit such traces. A sudden rise of use of abrasion is observed in layer 6: 13.6% of flakes, 39.1% of blades and 21.7% of bladelets.

**Shapes**

*Flakes.* These show a gradual increase in rectangular and oval shapes (table 8.1.21), which are usually dominant; the increasing is due to the oval shapes. Triangular and scalene shapes decline. In layer 7b, these shapes characterise point production. Trapezoidal (often non-axial and asymmetrical) flakes are present in nearly the same proportions in all of the MP layers. Together with irregular shapes (with a maximum in 7a), they illustrate characteristic products of the discoidal method.

*Blades.* Rectangular and oval shapes clearly dominate (table 8.1.22). Blades with bi-convex
edges are more numerous in layer 7a, while in other layers blades with more parallel sides are more common. Irregular shapes also occurred more often in layers 7c and 7a.

**Blade profiles and cross-sections**

Straight profiles for blade are dominant only in layer 7b, probably due to numerous laminar by-products of Levallois point production, and identical in frequency to the convex profiles in layer 7a (table 8.1.23). Convex profiles show a gradual increase to EUP layer 6 where they become dominant. Twisted and irregular profiles are less representative, seemingly more frequent in layer 7c (but biased by the small sample size). Trapezoidal and polyhedral cross-sections dominate in layers
Blades, based on mean sizes, are bigger than lakes, although maximal sizes have an opposite trend, and retain stable dimensions in layers 7b and 7a. Blades became longer and narrower in layer 6. According to maximum sizes, the longest, widest and thickest blade was found in layer 7b. Mean sizes of bladelets decrease throughout the sequence: 26.6, 8.6, 2.9 mm in layer 7b and 18.4, 8.1, 2.2 mm in layer 6.

The maximum lake Mass Index (Th/L\% ratio) was documented in layer 7a, in trench XX (resulting from the discoidal method) (table 8.1.26). In general, a Mass Index >30 is typical for non-Levallois and/or “archaic” complexes. The lowest ratio was recorded in the Levallois-based assemblage of layer 7b. The blade Mass Index displays a clear decrease to the EUP. The maximum was recorded in layer 7b (due to thick laminar by-products of point production). Differences in indices exist among blades of the same layer (7a and 6) recovered in different trenches rather than between layers. Judging from the Elongation Index (L/W\% ratio), lakes are astonishingly non-variable, i.e., short (L=slightly >W) (table 8.1.27). Only lakes from layer 7c are slightly more elongated. On the contrary, blades show a very gradual trend for elongation (without any spatial variation across the site). Finally, blades from layer 6 are the most

7c and 6 (table 8.1.24), confirming the intensity of blade reduction. The frequency of triangular sections may also be explained by the common exploitation of narrow-faced cores to obtain narrow blades instead of bigger blanks. Scalene sections are more numerous in layers 7b and 7a, corresponding to the use of lateral crests for preparation and maintenance/extension of flaking surfaces of both blade and Levallois point cores (one example in layer 7b).

**Metrical data and indices**

Cores, including pre-forms, are rather large on the basis of maximum dimensions; the smallest was found in layer 7b (where there is an absence of blade cores) and in layer 6 (resulting from intensive reduction). The largest cores were always used for blade production (layer 7c and especially in 7a). Minimal sizes are far too large to consider them as heavily reduced “micro-cores” (table 8.1.25). Core discard was usually determined by other factors.

Flakes in average are medium-sized in the two lowermost layers; their dimensions then decline to rather small sizes. The largest flake (as well as the largest core) was found in layer 7a, but large flakes also occurred in other layers. This is also valid for maximum thickness.

Blades, based on mean sizes, are bigger than flakes, although maximal sizes have an opposite trend, and retain stable dimensions in layers 7b and 7a. Blades became longer and narrower in layer 6. According to maximum sizes, the longest, widest and thickest blade was found in layer 7b. Mean sizes of bladelets decrease throughout the sequence: 26.6, 8.6, 2.9 mm in layer 7b and 18.4, 8.1, 2.2 mm in layer 6.

The maximum flake Mass Index (Th/L\% ratio) was documented in layer 7a, in trench XX (resulting from the discoidal method) (table 8.1.26). In general, a Mass Index >30 is typical for non-Levallois and/or “archaic” complexes. The lowest ratio was recorded in the Levallois-based assemblage of layer 7b. The blade Mass Index displays a clear decrease to the EUP. The maximum was recorded in layer 7b (due to thick laminar by-products of point production). Differences in indices exist among blades of the same layer (7a and 6) recovered in different trenches rather than between layers. Judging from the Elongation Index (L/W\% ratio), flakes are astonishingly non-variable, i.e., short (L=slightly >W) (table 8.1.27). Only flakes from layer 7c are slightly more elongated. On the contrary, blades show a very gradual trend for elongation (without any spatial variation across the site). Finally, blades from layer 6 are the most
Table 8.1.25.
**Piekary IIa. Metrical data and indices**

<table>
<thead>
<tr>
<th></th>
<th>layer 6</th>
<th>layer 7a</th>
<th>layer 7b</th>
<th>layer 7c</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cores</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>max.</td>
<td>&gt;97, 38, 20</td>
<td>170, 146, 60</td>
<td>92, 75, 32</td>
<td>139, 107, 65</td>
</tr>
<tr>
<td>min.</td>
<td>&gt;53, 70, 42</td>
<td>43, 56, 28</td>
<td>41, 29, 10</td>
<td>67, 35, 43</td>
</tr>
<tr>
<td><strong>Flakes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>max.</td>
<td>126, 110, 29</td>
<td>142, 99, 58</td>
<td>110, 60, 26</td>
<td>89, 60, 17</td>
</tr>
<tr>
<td>max.width</td>
<td>110</td>
<td>110</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>max.thickness</td>
<td>36</td>
<td>58</td>
<td>32</td>
<td>24</td>
</tr>
<tr>
<td>average</td>
<td>35.7, 31.9, 8.4</td>
<td>37, 33.7, 9.8</td>
<td>43.3, 37.4, 8.8</td>
<td>50.1, 41.3, 14.5</td>
</tr>
<tr>
<td>Elongation Index</td>
<td>111.9</td>
<td>109.9</td>
<td>109.7</td>
<td>121.3</td>
</tr>
<tr>
<td>Mass Index</td>
<td>23.5</td>
<td>30.7/XX 26.4/XXII</td>
<td>22.7</td>
<td>28.9</td>
</tr>
<tr>
<td><strong>Blades</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>max.</td>
<td>88, 31, 17</td>
<td>&gt;90, 36, 16</td>
<td>107, 45, 34</td>
<td>86, 39, 13</td>
</tr>
<tr>
<td>max.width</td>
<td>44</td>
<td>48</td>
<td>45</td>
<td>39</td>
</tr>
<tr>
<td>max.thickness</td>
<td>18</td>
<td>27</td>
<td>34</td>
<td>17</td>
</tr>
<tr>
<td>average</td>
<td>57.8, 21.2, 9.3</td>
<td>51.8, 21.3, 7.1</td>
<td>52.5, 24.5, 10.6</td>
<td>-</td>
</tr>
<tr>
<td>Elongation Index</td>
<td>272.6/XXII 239/XX</td>
<td>243/XXII 229.6/XX</td>
<td>214.2</td>
<td>-</td>
</tr>
<tr>
<td>Mass Index</td>
<td>16/XXII 13.4/XX</td>
<td>13.7/XXII 17.5/XX</td>
<td>20.1</td>
<td>-</td>
</tr>
<tr>
<td><strong>Tools</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>max.</td>
<td>67, 48, 22</td>
<td>95, &gt;80, 12</td>
<td>100, 47, 13</td>
<td>113, 93, 25</td>
</tr>
<tr>
<td>min.</td>
<td>32, 15, 4</td>
<td>&gt;31, 32, 9</td>
<td>&gt;21, 11, 5</td>
<td>54, 83, 18</td>
</tr>
<tr>
<td>average</td>
<td>58.1, 37.8, 14.2</td>
<td>61.6, 52.1, 16.8</td>
<td>60.7, 44.3, 15.6</td>
<td>-</td>
</tr>
<tr>
<td>Elongation Index</td>
<td>153.7</td>
<td>118.2</td>
<td>137</td>
<td>-</td>
</tr>
<tr>
<td>Mass Index</td>
<td>24.4</td>
<td>27.2</td>
<td>25.7</td>
<td>-</td>
</tr>
</tbody>
</table>

elongated and at the same time less massive. This elegance resulted, however, in a very high fragmentation rate.

Tools are larger than unmodified blanks in mean counts and are rather stable in size. Maximum sizes decrease from the bottom to the top of the sequence. Tools on tiny blanks are also present. The Mass Index of tools on blanks is less variable than for unmodified flakes and blades throughout the MP (25.7 mm and max. of 27.2 in layer 7a) and decreases only in layer 6 (24.4). The highest tool elongation index was recorded for layer 6, while preceding layer 7a reflects the lowest rate.

**Fragmentation mode**

Fragmentation of blades and bladelets was considerable in all layers (>80%). Complete
blades are more representative in layer 7a and less numerous (only about 5%) in layer 6 (table 8.1.28). This observation reflects the effect of increased elongation and decreased thickness of blades (curve profile), which made them more fragile during production, modification and use in general, and particularly in this layer. To varying degrees, other factors (selection of intact blades, post-depositional processes) may also have influenced the relative frequencies of complete blades and bladelets in each assemblage. Mesial fragments (except in layer 7c) are usually numerous (indicating that blades were fragile enough to be broken into a minimum of three parts) and peaked in layer 6. Proximal fragments (including proximal + mesial) are more common in layer 7b, while distal fragments dominate in layer 7c.

**Tools**

Tools are clearly rare and account for only about 0.3-2% of the total assemblages. Tool types are often represented only by a few pieces each (table 8.1.29).

**Sidescrapers.** These are numerically significant in the first (7c) and last (7a) MP layers. The lowest frequency was recorded in overlying EUP layer 6. The most common scraper types are simple, mainly single lateral with convex or straight edges. Lateral scrapers are present in all truncated-facetted scraper was recorded in layer 7c (trench XIII, Morawski’s excavations) and one truncated-facetted piece in layer 7b in trench XXII (2000 excavations). Thinning of scrapers occurred rarely (e.g., proximal/ventral and back/proximal). Most scrapers were made on flakes and rarely on blades (layer 7a).

**Retouched flakes.** These occur in the scraper-dominated layers 7c, 7a and in EUP layer 6, where they occupy second place after retouched blades. They are lateral, distal and a single piece has lateral-distal retouch. They sometimes differ only slightly from simple scrapers due to generally light retouch. Retouch is marginal, abrupt, characteristically short, discontinuous or irregular, usually obverse.

**Retouched blades.** Modifications are similar to retouched flakes. Retouched blades occurred in layer 7b and dominate the tool-kit of layer 6.
Table 8.1.29.
Piekary IIa. TOOLS

<table>
<thead>
<tr>
<th>Tool Type</th>
<th>7c Morawski</th>
<th>7c</th>
<th>7b</th>
<th>7a</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side-scrapers</td>
<td>7</td>
<td>67</td>
<td>3</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>Retouched flakes</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Retouched blades</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Backed blades/bladelets</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Raclettes</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Backed knives</td>
<td>-</td>
<td>-</td>
<td>13</td>
<td>33</td>
<td>3</td>
</tr>
<tr>
<td>Naturally backed knives</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Denticulates</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Notches</td>
<td>8</td>
<td>-</td>
<td>5</td>
<td>29</td>
<td>4</td>
</tr>
<tr>
<td>Endscrapers</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Burins</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Truncated-facetted pieces</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Splintered pieces</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Retouched and notched blades</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Backed knife and notch</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Unidentifiable</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td><strong>3</strong></td>
<td><strong>100</strong></td>
<td><strong>17</strong></td>
<td><strong>28</strong></td>
</tr>
</tbody>
</table>

Raclettes. These occur in small quantity in the two uppermost layers and are represented by typical pieces on small flakes.

Backed knives. Both classes (naturally backed and backed) were documented in all layers and were made on flakes with cortical or débordant backs. Backed blades, as a variant of knifes sensu lato, appeared in two chronologically opposing assemblages, namely 7c and 6.

Notches and denticulates. Both types occurred together, except in layers 7c and 7a. Notched pieces are well represented or dominant in all MP layers. Like the scrapers, both tool classes are made mostly on flakes and sometimes on blades (layer 7b).

Endscrapers and burins. These appeared only in EUP layer 6. One burin was found in the old collection for layer 7c.

Except in layers 7c (old collections) and 7a, dominance of sidescrapers was not documented since the new sample from layer 7c is too small. A certain balance between several types is common: scrapers-notches – denticulates.

Retouch position. In general, tools were clearly modified by obverse retouch, the percentage peaking in layer 7b and declining in overlying layer 7a due to the relative frequencies of inverse and alternating retouch (table 8.1.30).

Retouch types. Generally retouched tools from analysed Mousterian and Upper Palaeolithic assemblages display (as scrapers) non-invasive light modifications. Quina retouch are absent. Three types of retouch dominate: scalar, marginal and combination of scalar + abrupt. Marginal abrupt with nibbling, sub-parallel, flat and lamellar are less common or scarce (table 8.1.31).

Tool blanks. Retouched tools in MP
assemblages were made mostly on flakes (table 8.1.32). Change in blank choice was documented only in EUP layer 6. Even intensive systematic blade production did not result in the dominance of tools on blades. These are less representative in the last MP layer 7a. The trend is similar across the sequence: the proportion of flake blanks is very close to the proportion of tools on flakes. This is also true for blades (table 8.1.32). Levallois blanks were used more often in layer 7b (mostly retouched and directly used flakes). Kombewa and débordant flakes were selected more often in layer 7a. Cortical and semi-cortical flakes (sidescrapers, backed knives) as well as ordinary flakes (full debitage blanks) were frequently used. Some cases of core transformation or use as tools were documented. Flint fragments, including gelifracted pieces, were rarely used.
8.2. Inter-site Comparisons

The “non-Micoquian” Middle Palaeolithic industries in this region document chronological discontinuity. They appear during the Saalian as represented at Bińnik Cave, layers A6, A5, A4, A3 (Cyrek 2002, 2003) with a probable existence at the end of OIS 6 - beginning of OIS 5e and following various episodes of the early Vistulian/Weischelian (?), represented by a small undated collection from Krakow-Zwierzyniec I, layer 2 (Chmielewski et al. 1977) and other old assemblages from different trenches at this site or from Piekary I, II, III and IV (Sachse-Kozłowska, Kozłowski 2004). However, they are mostly found at the end of the Middle Palaeolithic and during the transitional period (OIS 3), at the sites of Piekary IIa, layers 7c, 7b, 7a and 6, and Księcia Józefa, layers III, II and I (Valladas et al. 2003; Mercier et al. 2003; Kalicki and Budek 2004; Sitlivy et al. 2004).

The Piekary complex of Palaeolithic sites has yielded Micoquian and Mousterian industries. The Piekary IIa sequence is the most complete in this area (Morawski’s excavations) and, after new investigations, documents the Micoquian at the bottom (redeposited position of rare artefacts) and a sequence of three overlying Mousterian industries (Sitlivy et al. 2004). Unfortunately, other sites (fig. 2.6) at Piekary I (cave), II, III and IV show complicated and reduced stratigraphy to less than 2 m, lack absolute dates and often have contaminated or mixed collections. Inter-site correlation is thus extremely difficult. As a result, several chronological scenarios have been recently proposed (Sachse-Kozłowska, Kozłowski 2004, Fig. 30) using new absolute dates (direct dating of burnt flints) obtained from another part of this area: Piekary IIa site (Valladas et al. 2003). Based on available stratigraphic data, the state of artefact preservation (patina, gloss), and technological and typological features, different assemblages have been distinguished from the huge legacy left by G. Ossowski, S. Krukowski and L. Sawicki (Sachse-Kozłowska, Kozłowski 2004). Taking into consideration the generalised characteristics of these collections, typological sorting of material and their imprecise chronological position, comparative analyses will be limited (see also Sitlivy and Zięba 2006).

Piekary I

Three collections have been distinguished at this cave site, resulting from excavations by G. Ossowski, S. Krukowski and L. Sawicki: Micoquian, Levalloisian and Aurignacian (Sachse-Kozłowska, Kozłowski 2004). Judging mostly from illustrations, the Levallois-Mousterian of this cave site is characterised by Levallois recurrent flake (abundant flakes débordant) and Levallois convergent point methods. Levallois blades are also present. The presence of large Levallois flake and blade cores (including double-platform) as well as numerous massive blades and Levallois points were noted (Sachse-Kozłowska, Kozłowski 2004). Centripetal and discoidal debitage are common. The tool kit is modest: mostly retouched Levallois products, simple sidescrapers and denticulates. The lowermost Micoquian collection differs by the absence of Levallois debitage, exploitation of small discoidal and large sub-conical cores, massive flakes of various sizes for a small tool-kit and abundant asymmetrical knives and scrapers prepared mainly in a plano-convex manner by invasive bifacial retouch (Quina retouch is common). While characteristic Micoquian implements are easy to separate, debitage products and discoidal cores were present in both Levallois-Mousterian and Micoquian assemblages at different sites at Piekary. The Aurignacian collection, in addition to tools, unidirectional crested core and debitage, yielded worked bones (e.g. a sagaie with a round cross-section, similar to the Gravettian of Central Europe), bone fragment with circular engraved lines and red colorant traces, and a longitudinally perforated reindeer antler fragment.

Piekary II

Trench I also yielded three similar collections as well as another Aurignacian workshop. The Levalloisian is separated from the Micoquian horizontally, but not stratigraphically. Levallois elements are well represented: Levallois convergent unidirectional point cores, also with opposed auxiliary platforms, flakes, elongated blanks with
faceted butts and points). Additionally, Levallois linear cores and large final flakes were recovered. Some cores show unidirectional preparation and are transversal (L<W) or non-systematic preliminary shaping. Kombewa cores with semi-discoidal reduction and large discoidal cores were found. Lateral, transversal and *déjéte* sidescrapers and retouched Levallois blanks are present among the tools. Two flakes were truncated, one of which has obverse retouch. Traces of UP blade reduction are absent, which were observed in all MP layers of the nearby site of Piekary IIa.

**Piekary III**

The Levallois collection (layer 6 and mixed 5-6) comprises large preferential flakes with centripetal scars and blanks with uni-/ bidirectional and convergent patterns. The tool kit is similar with additional convergent symmetrical and asymmetrical sidescrapers and naturally backed knives. Level 7 yielded a Micoquian industry (Tomaszewski 2004).

**Piekary IV**

The small collection from this cave site contains a Levallois flake and blade, one point and a sidescraper on Levallois flakes.

In brief, the Levallois-Mousterian of Piekary I, II, III and IV differs from Piekary IIa by:

1. Absence of Upper Palaeolithic prismatic core reduction.
2. Presence of Levallois blades and elongated flakes obtained from prepared uni- or bidirectional cores (centripetal, sometimes with distal trimming).

Although the Levallois linear method observed at all sites, very large preferential flakes are still unknown in the MP of Piekary IIa.

Common features are represented by:

1. Use of Levallois linear and recurrent flake methods.
2. Additional production of broad-based Levallois points removed from single-platform convergent cores, sometimes with an opposed auxiliary platform for maintenance of the flaking surface (similar to layer 7b in Piekary IIa).
3. Generally low facetting rates for flakes and blades.
4. Non-Levallois flake methods (discoidal, sometimes on Kombewa flakes or short reduction sequences on the ventral face of a flake).
5. Tool kit structure and type of retouch.

The region of Zwierzyniec in Krakow represents another cluster of Palaeolithic sites. Collections from Zwierzyniec I comprising Middle Palaeolithic artefacts were recovered by amateur A. Jura since 1935 and have already been studied and published by several generations of scholars (Jura 1951a, b; Chmielewski 1975b; Kozłowski, Kozłowski 1996; Połtowicz 1996). Several sites have been recorded.

**Zwierzyniec I (A. Jura’s investigations)**

**Point P.**

This assemblage is the first Levallois-Mousterian industry discovered by A. Jura in this area. W. Chmielewski (1975b) identified 57 artefacts, which could be associated with a charcoal concentration. All were made on local Jurassic flint and, based on Jura’s notes, they came from sands covered by sandy loess and remnants of the fossil soil. The artefact-bearing horizon was attributed to a large time interval between the Eemian and first maximum of the Visla glacial (Chmielewski 1975a, b; Kozłowski 1969; Kozłowski, Kozłowski 1996). Our re-analysis of this collection in 1998 and 2000 again confirms its Levallois status, as previously recognised by other scholars. Judging from this material, it is possible to confirm that Levallois flakes and blades were obtained by means of the recurrent Biache method. Uni- and bidirectional scars with evidence of earlier centripetal preparation of the core flaking surface are common. Several points, including broad-based triangular blanks, and a convergent lineal single platform core may document use of the Levallois unidirectional
convergent method. A number of smaller flakes with centripetal scars from preparation of the working surface were also recorded. Facetted butts are the most common, including the *chapeau de gendarme* type (see also Połtowicz 1996). In addition to the dominant Levallois technology, non-Levalloisdebitage products (large massive flakes, often asymmetrical or pseudo-Levallois points) were also identified, confirming the use of discoidal and/or centripetal reduction. The tool kit is modest: some lateral scrapers, a denticulate and a burin. Retouch is light. The collection was attributed to the Levallois-Mousterian of Shaytan Koba type (Chmielewski et al. 1977). Comparisons can also be made with Molodova I and V (Chmielewski 1975b); however, Levallois tortoise lake cores and preferential flakes were not found in Jura’s collection.

**Trench J.**

Middle Palaeolithic artefacts mixed with material from different periods were recovered by A. Jura and later separated by W. Chmielewski (1975) from other cultural units (pre-Szeletian and Aurignacian as well as from possible contamination with Levallois artefacts similar to Point P). Morphological criteria of tools and raw material traits were used to sort this collection. The fossil soil, heavily modified by solifluxion, which contains these flints, was correlated with the period between the Visla I and II Glacial Maximum and labelled without certainty as a “supposed late Levalloisian assemblage” (Chmielewski 1975). Sorted Mousterian artefacts consist of 25 tools with delicate retouch and traces of edge use. Single sidescrapers with marginal retouch and naturally backed knives are the principal group and dominate over retouched lakes, notches and denticulates. Some tools identified as scrapers are in reality naturally backed knives, some with the back partially prepared by means of abrupt retouch or truncation (*idem.*, fig XXI, p. 39). Tool blanks are often cortical, naturally backed or massive *débordant* flakes. Some blanks may have resulted from Levallois reduction, based on their regular shape and faceted butts. Elongated blanks also have fine faceted butts, but mostly have plain, polyhedral or dihedral butts. The dorsal scar pattern and blank shape indicates use of Levallois recurrent unidirectional debitage, as well as the discoidal method. Similarities can be found in part with Point P and at the same time in the non-Levallois industry of the newly discovered site of Księcia Józefa, layer III, which might reflect mixing of different levels and an artificial origin for Jura’s collection.

**Zwierzyniec I (W. Chmielewski’s investigations)**

This site was excavated by W. Chmielewski from 1972-1974; limited information was published in a preliminary article (1977). In addition to the uppermost Aurignacian (layer 12) and Micoquian-Prondnician (layer 11), two older industries were discovered in the following geological layers: 1) the top of layer 3 (horizon A3 of the fossil soil) and 2) layer 2 (the bottom part of horizon B of the same soil). In the same article, it was pointed out that artefacts from layer 2 were found in the upper part of sands “forming the lowest part of the sediments and were formed during the Middle Polish Glaciation” (Saalian). According to T. Madeyska (1981), layers 2 and 3 constitute a complex of fossil soils and were attributed to the lower unit of Nietulisko soil type developing during the Eemian.

**Layer 2 (pre-Eemian?)**

A modest collection of 48 artefacts includes primarily debitage products: medium-sized flakes and blades. Plain and dihedral butts are common, while faceted platforms are rare. Only one flake/blade core with two opposed platforms was found. Tools are represented by a sidescraper with invasive retouch on nearly the entire perimeter, a bifacially thinned base and distal end, and a burin on a massive blade fragment (Chmielewski et al. 1977). The technique is characterised by use of hard hammerstone and rarely soft hammer. Some small flakes could have resulted from scraper retouching. A unique feature is the considerable number (20%) of regular blades of UP appearance. An interpretation of a general Levallois-Mousterian character of this industry with tools of UP type contradicts the description of artefacts presented in this article.

This industry was often compared to the
Blade Levallois-Mousterian of layer 7c at Piekary IIa (Chmielewski et al. 1977; Połtowicz 2005). However, new dates for Piekary IIa, 7c (Valladas et al. 2003), as well as significant technological differences, make such a comparison untenable. In addition, the collection from layer 2 is too small to provide statistically significant comparative analyses.

Layer 3 (Eemian/early Weischelian?)

This layer yielded two loci of artefacts (118 and 43 pieces) associated with a fireplace and smoke-oven (Chmielewski et al. 1977). The artefacts have a clear Levallois character. The first locus yielded one Levallois core and 21 tools. Levallois methods were applied to produce both flakes and blades. Lateral sidescrapers on blades are common. Knives on flakes and blades are present as well as elongated Mousterian points. Fine retouch was used for blank modification. The second locus represents a workshop or core reduction area with five Levallois cores for flakes and blades, debitage products and one sidescraper. These clusters, together with the “Point P industry” of A. Jura, were possibly contemporaneous, forming a single settlement complex (Chmielewski et al. 1977).

Zwierzyniec I, layers 12, 13, 14 (L. Sawicki’s investigations) Zwierzyniecian

Another area of the site was excavated by L. Sawicki where a majority of the Upper Palaeolithic artefacts were embedded in the upper part of the lower loess, which contained, without any stratigraphic differentiation, numerous Aurignacian and Szeletian pieces, as well as a backed point (Sachse-Kozlowska, Kozlowski 1975). Based on tool typology, spatial distribution of artefacts and comparisons, a separate culture with backed points was distinguished by these authors. Differences in preservation of Szeletian leaf points and Zwierzyniecian arched backed blades, based on microscopic analysis, became an additional argument (Kozlowski, Kozlowski 1996). However, Kostienki-Avdeeo elements in the overlying solifluction horizon caused the greatest difficulties in reconstruction of the backed point assemblage. This new entity contains 25 backed points of various types (crescents dominating) and other UP tools including truncated pieces, endscrapers, burins and retouched blades. Tools were made mostly on narrow blades. These tools came from the solifluction horizon, soil and lower loess (see also an attempt at reconstruction of the Szeletian, Aurignacian and Zwierzyniecian in section ¾: Sachse-Kozłowska, Kozłowski 1975, plates 22-24). This unique industry, unknown in Southern Poland, was compared with the Uluzzian and, based on stratigraphic position, was attributed to the early stage of the UP (idem, 1975; Kozłowski, Kozłowski 1996). Subsequent interpretations mostly attempt to clarify the chronological position of this collection. Layers 12 and 13 were thus attributed to the complex of Interplenioglacial soils (first phase of pedogenesis). The underlying loess (layer 11) belongs to the Lower Plenioglacial with TL dates between 67.6 and 71.7 ky calendric (Madeyska 1981; Kozłowski 2004). According to J. Kozłowski (2004), a slightly lehmified loess (layer 12) may be interpreted as the lower part of the Komorniki soil complex which developed from 37 to 41.2 ky, i.e., during the Moershoofd and Hengelo warm episodes. Thus, the primary deposit of this industry corresponds to this soil and artefacts can be placed between 37 and 40 ky. Similar artefacts in the overlying humic soil were displaced by solifluction (Kozłowski 2004). J. Kozłowski (2004) came to the conclusion that the association of blade endscrapers and dihedral burins with arched backed blades is less certain than was originally assumed. Also, it was pointed out that, technologically, all blades modified into arched backed pieces and other tools were obtained from volumetric single-platform cores. Examination of this material documents the presence of bidirectional dorsal scars on Zwierzyniecian tools. Unfortunately, no cores were associated with this unit. The rich debitage assemblage recovered cannot be securely separated or correlated with the three different UP cultural entities.

Similar industries were found in Central and Eastern Europe: Vlckovec in Slovakia (however, without clear stratigraphic context), and more recent complexes at Ripiceni-Izvor, layer IIb and Korpatch I, layer 4, continuing this tradition until
about 28.4–25.5 ky (Kozłowski 2004). Interestingly, these latter assemblages contain leaf points.

* * *

The oldest Middle Palaeolithic record in the Krakow region (i.e., > OIS3), based only on geological interpretations, is represented mostly by Levallois-Mousterian with the following features:

- Levallois debitage originated from different methods (linear for single preferential flakes or rare points and recurrent centripetal and especially uni- or bidirectional of Biache type for elongated flakes/blades).
- Non-Levallois flake debitage: mostly recurrent with flat (centripetal) and secant (discoidal) exploitation of cores resulting in thick asymmetrical short flakes.
- Absence of UP blade production systems (except probably layer 2 in Krakow-Zwierzyniec I)
- Monotonous tool kit without clear dominance: simple sidescrapers, retouched flakes, raclettes, naturally backed knives, denticulates, notches, rarity or absence of UP tools; few convergent pieces, including Mousterian points.
- Light non-invasive retouch is common.

Typologically, the oldest Levallois-Mousterian is similar to Late Middle Palaeolithic industries, especially, taking into consideration the tool composition and their morphology. However, technologically they differ from the recent Middle Palaeolithic by the absence of fully Upper Palaeolithic prismatic core reduction and some differences in flake production (presence of Levallois blade strategy of Biache type) that demonstrate the presence of another technological group: flake group with Levallois debitage for preferential flakes or points and often recurrent for elongated blanks and Levallois blades (Point P; layer 3 of Krakow-Zwierzyniec I; Piekary I, II, III, IV). Krakow-Zwierzyniec, Trench J, seems to resemble Księcia Józefa, layer III (flake group with some blade and rare Levallois elements).

Only one small collection from Krakow-Zwierzyniec I, layer 2, could be the oldest candidate (final Saalien?) for a separate unit: blade/flake non-Levallois group with UP blade debitage based on bidirectional core reduction without platform faceting (mostly flat butts).

The Late Middle Palaeolithic is represented by Blade Levallois-Mousterian, Levallois-Mousterian, Mousterian and Blade Mousterian industries lacking bifacial tools; these industries display some new features and generally differ considerably from a technological point of view from their preceding industries:

- Co-existence of several independent parallel core reduction systems, i.e., blade strategy of Upper Palaeolithic type and Middle Palaeolithic flake technologies (Levallois and non-Levallois).
- Absence of Levallois flake.blade uni-bidirectional recurrent method of Biache type. Levallois methods used resulted in obviously non-elongated debitage products (short flakes or points).
- Larger variety of flake non-Levallois methods (polyhedral, discoidal, centripetal, uni-bidirectional, convergent, short reduction sequences of cores-on-flakes including the Kombewa technique, as well as varying exploitation of the dorsal face or thick narrow slice, etc.
- Systematic UP volumetric blade reduction strategies based on various modes (direct or prepared with different crest position, or bifacial pre-core shaping) from often opposed platforms (faceted or prepared by single or several large blows); maintenance by neo-crests, platform rejuvenation often by tablets and platform zone trimming, grinding.
- Appearance of soft hammer percussion technique.
- Tool kit does not show significant changes. Convergent pieces are rare or absent. However, the increase of abrupt light retouch and consequently of raclettes and backed knives in Księcia Józefa, layer III is striking.
TL, OSL and AMS dates for the Upper Palaeolithic volumetric concept of blade production, which was widely applied in the Levallois-Mousterien industry of Piekary IIa, layer 7c, show that it coexisted with several Middle Palaeolithic flake methods during Later MP (Piekary IIa, 7b, 7a and Księcia Józefa, III) and developed into a unique standardized blade production during the transition period and the EUP (Księcia Józefa II, I and Piekary IIa, 6).

Early Upper Palaeolithic industries of the Krakow region are characterized by:

- Absence of flake methods of core reduction, including Levallois. The Levallois heritage evidently was not strong and Bohunician influence is observed only by failed attempts for point removals and several refits in LMP and EUP industries of Księcia Józefa site (layers III and layer I, respectively).
- Fully UP prismatic blade reduction, as well as intentional bladelet debitage based on reduction of the narrow part of cores-on-flakes.
- Use of both hard and soft hammers.
- The tool kit is non-Aurignacian, non-specific and modest without persistence of MP types. Invasive retouch and bifacial pieces are absent.

The sites of Piekary IIa and of Księcia Józefa display various models of blade production development and significant technological variability during the Middle-to-Upper Palaeolithic transition. TL, OSL and AMS dating shows that the Upper Palaeolithic blade technologies occurred in parallel with Middle Palaeolithic flake production (Levallois and non-Levallois methods) in a time-span from 60 to 32,000 BP (Valladas et al. 2003). Lithic assemblages are abundant. Several individual reduction sequences (cores and tools) have been reconstructed, often able to entirely reconstruct the initial nodule or blank with few or no missing pieces, especially in layers III and II at the Księcia Józefa site. These show complex and unique tendencies in knapping activities and in human behaviour.

Inter-assemblage attributes, refitting and technological comparisons of these sites make it possible to distinguish several groups of industries (Zięba 2005; Sitlivy et al. 2006; Sitlivy and Zięba 2006).

1. Blade/flake group with Levallois features (Piekary IIa, layer 7c and 7b; Księcia Józefa, layer I?);
2. Flake group with some blade and rare Levallois elements (Księcia Józefa, layer III);
3. Blade/flake group with rare Levallois elements (Piekary IIa, layer 7a);
4. Blade group with exclusive blade/bladelet production (Księcia Józefa, layer II; Piekary IIa, layer 6);
8.3. Inter-regional Comparisons

The phenomenon of blade production before establishment of the Upper Palaeolithic occurred in different regions of Eurasia and Africa from as early as 300,000 BP. Early Middle Palaeolithic blade industries (OIS 8-6) are known mostly from North-western Europe, rare or subject to question in Central Europe (BiGińik Cave, layers A5, A6 and Zwierzyniec, layer 2) and abundant in the Near East. While the typological structure of early laminar assemblages is rather uniform, they display greater technologically variability (e.g., with and without Levallois strategy; with varying exploitation of Levallois methods; variation in blade production). A similar trend was observed among later Mousterian blade complexes in Eastern Europe (ZiCieba 2005; Sitlivy and ZiCieba 2006). The chronological impact on such technological variability was not documented. Throughout the entire Middle Palaeolithic, one can find similar technological patterns. Moreover, “advanced” or “developed” features appeared very early, while “archaic” traits could be present in the late stages or during the beginning of the Upper Palaeolithic. Site function and effects of raw materials were an influence in some cases when making inter-assemblage comparisons (often from a statistical viewpoint). The most serious problem concerning comparisons lies in the taphonomy of assemblages in the Krakow region. Some rich collections come from uncertain geological context or were mixed. In such situations, neither typological nor morphological comparisons can be used as chronological criteria.

In Western Europe during the Early Middle Palaeolithic, blades were produced using different knapping methods: Levallois recurrent uni- and bidirectional (e.g., Biache-Saint-Vaast – Boëda 1988), non-Levallois flat core exploitation (e.g., Crayford – Roe 1981; Révillion 1994), direct reduction of volumetric core (Saint-Valéry-sur-Somme – de Heinzelin and Haesaerts 1983) and prepared crested core flaking of Upper Palaeolithic type (Rissori – Adam 1991; Révillion 1994; Sainte-Walburge – Sitlivy 1996).

Upper Palaeolithic laminar production usually co-existed with different Levallois methods: flake, point, blade or a combination thereof (e.g., Markkleeberg – Baumann et al. 1983), rarely with non-Levallois flake debitage (Rheindahlen B1 – Bosinski 1966, 1986, Schirmer 2002; Schmitz and Thissen 1998) and, finally, appeared as an exclusive blade technology (Saint-Valéry-sur-Somme – de Heinzelin and Haesaerts 1983). However, the final case is represented by a small sample with several refitted blocks, while assemblages rich in debitage products show a combination of various methods. Continuity in blade manufacture based on prismatic core reduction in a single Middle Palaeolithic sequence is very rare (Hélin – Escutenaire 1996; Sitlivy 1996).

Thus, prepared laminar production of Upper Palaeolithic type in Europe was invented at the very beginning of the Middle Palaeolithic, reappeared during the Last Interglacial (OIS 5d-5a), occurred rarely during OIS 4 and then again became a common practice prior to the establishment of the Upper Palaeolithic (OIS 3) (tables 8.3.1, 8.3.2 and 8.3.3).

Blade production was often based on the reduction of volumetric bidirectional partially turned cores. Two principal models were employed: extension of blade production from a wide flaking surface to the narrow faces (Seclin model) or from a narrow face onto a large surface (Rocourt model). By contrast, exploitation of fully turned blade cores is rather rare. Also, bi-polar narrow cores (with two opposed platforms) with a constant non-expanded working surface are common. Installation of a two-sloped crest on blade pre-cores became common as well. Nevertheless, bifacial preparation is rare, for example at Vinnef (early Weichselian), where Micoquian tools were produced (although it is difficult to separate bifacial pre-cores from tool pre-forms) (Gouédo 1994, Deloze et al. 1994). Blade cores on flakes were not documented during the EMP and appeared for the first time at the beginning of the Last Glacial. Direct reduction of partially turned cores for blades and elongated flakes is known during earlier “blade episodes” and is associated with prepared (crested) blade debitage. A common practice of preliminary core shaping prior to blade production was recorded for several industries, while other knappers preferred more unprepared core exploitation (usually unidirectional
cores) or used both systems (Saint-Germain-des-Vaux/Port-Racine, OIS 5c; Cliquet 1992). Although blade cores are numerous, laminar presence and productivity in some complexes was low, due to different factors: e.g., Tönchesberg and Wallertheim D (Conard 1992; Conard and Adler 1997). The use of hard hammerstone percussion is well-documented. The co-existence of prismatic blade debitage with a Levallois strategy continued to be a common system after the Saalian. A novelty is the association of blades with Micoquian tools. During stage OIS 5a, blade manufacture was sometimes accompanied by non-Levallois flake methods, including flat uni- and bidirectional reduction: e.g., Bettencourt-Saint-Ouen (Locht 2002). Such unprepared parallel debitage was common in Eastern Europe and Central Asia, and was early on described as the “proto-prismatic” technique by local scholars. The tool-kit of blade EMP assemblages is usually dominated by Mousterian implements with a characteristic decrease in sidescrapers. These are often in proportions similar to notches and denticulates. Upper Palaeolithic tools are also present, sometimes in high frequencies (Riencourt-les-Bapaume, layer CA-Ameloot – Van der Heijden 1993; 1994). Backed knives on both flakes and blades, were documented at Lailly “le domaine de Beauregard”, layer B (Locht and Depaepe 1994; Deloze et al. 1994), Bettencourt-Saint-Ouen (Locht 2002) and Rocourt (Otte et al. 1990; Otte 1994).

Blade complexes are rare during OIS 4 (e.g., Lailly/le Fond de la Tournerie – Depaepe et al. 1994) and re-appeared in OIS 3. Core reduction remains similar to the previously known methods of Seclin (exploitation of the large surface with extensions onto the narrow core sides) and Rocourt (exploitation of the narrow part with extension onto a large surface and back). A technological innovation is the Chatelperronian model of blade production (Roc-de-Combe type), which is based on the creation of a lateral crest and initial long reduction of the narrow core face with further extension onto large surfaces (Pelegrin 1990). The Rocourt model differs from this by immediate (after crest /débordant removal) reduction of the large surface and maintenance of debitage by means of débordant blades and flakes. In the Chatelperronian model, each blade cycle started with preparation of a neo-crest. Maintenance of blade debitage by neocrests, rejuvenation of platforms by tablets and use of soft hummer raised blade productivity per core and considerably increased the laminar index in the Chatelperronian technocomplex.

Another kind of elongated blank production during OIS 3 in MTA type A and B industries, according to C. Soressi (2002), is characterised by elongated flakes and blades, including cortical backed, obtained from unprepared partially turned cores. Exploitation began from the ridge between the narrow and wide surfaces and subsequently took place on the large core face. A crest was not prepared; hard hammerstone was used. Despite a low degree of blank elongation and lower productivity in comparison with the Chatelperronian, certain similarities in the technological order and cycles can be observed. This has also been used as an argument for a phylogenetic link between MTA Mousterian and Early Upper Palaeolithic units (Soressi 2002).

In North-western Europe, blade production was usually accompanied by Levallois technology. These parallel knapping methods were practiced during the entire Middle Palaeolithic. The tool-kit shows a lesser domination of sidescrapers and more parity in frequencies of denticulates, notches, retouched blades and flakes, naturally backed knives or raclettes. Upper Palaeolithic tools are common, including backed knives on blades. Bifaces have been recorded with blades at some sites (Lailly/le Fond de la Tournerie) after the penultimate Glaciation (Locht and Depaepe 1994; Deloze et al. 1994).

The Late Middle Palaeolithic of Piekary IIa and Księcia Józefa is represented by Blade Levallois-Mousterian, Levallois-Mousterian, Mousterian and Blade Mousterian industries lacking bifacial tools (table 8.3.2). All of the assemblages analysed reflect use, to different degrees, of blade manufacture, which is accompanied by different Levallois and non-Levallois flake and point production methods. Among the tools, typical Mousterian types are always present (lateral scrapers, less often double and other multiple categories), accompanied by notches, denticulates, retouched flakes and raclettes. These appeared in nearly the same proportions without a clear domination of a given
tool class. These types were sometimes made on blades. Backed knives are common: more often with a natural back (cortical or debitage back, i.e., débordant blanks), but also with prepared backs (“typical and atypical knives”). Upper Palaeolithic tools are rare (endscrapers and especially burins) or absent. Blade blanks are usually unretouched or retain visible traces of use. Many tools on blades are of Mousterian type. Among them are denticulates, notches, sidescrapers, naturally backed knives and raclettes, as well as a “neutral” group of retouched blades which could also be placed in the other tool categories. A common feature for all of the analysed assemblages is a lack of convergent retouched tools, both scrapers and Mousterian points as well as bifacial and Quina retouch. Types of retouch are very similar. These are generally short, non-invasive, scalar, steep, marginal, abrupt, or marginally-abrupt. An abundance of marginal retouch made it difficult to distinguish between some retouched flakes/blades and sidescrapers. Another common feature in blank modification is the rarity of tool thinning and truncation. Thus, these Late Middle Palaeolithic complexes present a number of unique technological and typological features and at the same time display a set of general common characteristics for the Mousterian and Levallois-Mousterian in the Krakow region (Zwierzyniec, sites P and J after A. Jura, and layers 2 and 3 after W. Chmielewski; Piekary I, II and III), Central Europe (Levallois-Mousterian of Ukrainian Transcarpacia, e.g., Korolevo I, complex IIb), North-western Europe (Mousterian with Levallois and blade technologies) and Eastern Europe (Levallois-Mousterian and Blade Mousterian).

Comparative inter-regional analyses on a European scale (see also Sitlivy and Zięba 2006) demonstrate the absence of direct and exact analogies with Piekary IIa and Księża Józefa assemblages and show both common features and differences. This is valid for Western, Central or Eastern Europe. For example, layer 7c of Piekary IIa exhibits similarities in its dual technological structure (Levallois + Upper Palaeolithic blade methods) with the majority of North-western blade Mousterian throughout the Middle Palaeolithic (e.g., Seclin facies) as well as with recent (OIS 3) blade industries of Eastern Europe (Western Crimean Mousterian - Chabai 1996, 1998a, b, 2004, 2006; Chabai et al. 2004), and clearly with the Near Eastern record where the laminar phenomenon is even more pronounced in Levallois contexts (Meignen 1994). On the other hand, Levallois technology in both west and east has a strong laminar character (recurrent uni- and bidirectional method) that is completely absent at Piekary, 7c. The tool-kit also shows some important differences: presence of convergent pieces, including Mousterian points (e.g., Seclin, Wallertheim D or Kabazi II of WCM) and abundant Upper Palaeolithic tools such as burins and endscrapers (e.g. Riencourt-les-Bapaume).

Comparative analyses also confirm that blade production throughout Europe and during the entire Middle Palaeolithic was represented by several systems which do not change significantly and can thus be a false indicator for chronological determinations (as well as flake MP technologies). Blade debitage was based on direct and/or prepared (central, lateral crests), partially turned (or rarely turned) core exploitation from the narrow part to the wide surface(s) and inversely. Reduction was often bidirectional from the narrow part to the wide surface(s) and inversely. Rare innovations sometimes appeared during the beginning of the Upper Palaeolithic. The Roc-de-Combe technique (long blade sequence on the narrow part of the core with repeated installation of neo-crests), blade/bladelet cores on flakes and bifacial pre-core shaping were carried out during the later Middle Palaeolithic and the Initial Upper Palaeolithic. In addition, blade/bladelet crested core-on-flake reduction of Roc-de-Combe type was recorded in Księża Józefa layers III and II. Earlier flakes were reduced exclusively without crest installation (Seclin), which was also practiced much later (OIS 3) in the Donbass-Azov region (Belokuzminovka). During the transitional period and the EUP, narrow slices of flat cores, especially Levallois, were regularly used for direct blade exploitation (Bohunician - Svoboda, Škrdla 1995 Meignen et al. 2004; Sitlivy and Zięba 2006). Hard hammerstone was sometimes accompanied by the soft hammer percussion technique. In these contexts, Piekary blade industries, including layer 7c (the oldest among the youngest in this sequence), have some rare features which are absent in Early
Middle Palaeolithic laminar complexes (bifacial shaping of blade cores, decrease in Levallois debitage), which is not in contradiction with their young absolute dates (OIS 3). A similar pattern (bifacial wedge-core pre-forms and absence of Levallois) was described in EUP complexes II of Korolevo II (Usik 1989).

In sum, in Europe from OIS 8-6 to OIS 3, there is no specific spatial or chronological patterning for the use of blade production (except for the rare “recent” features mentioned above). Laminar production in the Krakow region was based on technological principles, which can be observed from the British Isles to the Volga Valley, and from the earliest appearance of volumetric prismatic reduction to the Upper Palaeolithic. The problem of origin of early blade technologies in Southern Poland is still open.

Another result of these comparisons is the common presence of Levallois and non-Levallois flake methods in blade MP assemblages. In fact, only a few sites display exclusively blade production (Saint-Valéry-sur-Somme and Rocourt), which are in addition limited to a small number of artefacts and several refitted blocks. More representative collections show variability in knapping methods. Exclusive blade production normally occurred during the transition period and later (Kościół Józefa, layer II; Piekary IIa, layer 6; Zwierzynieckian or Korolevo II, complex II).

The Western European pattern exhibits a typically dual technological structure for early laminar industries. The accompanying method is the Levallois strategy of core reduction, often by Levallois blade method of Biache type. Levallois point production is less common. In Eastern Europe, Levallois blade methods are also common: Yezupil, Dniester Valley (Sytnyk 2000) or Western Crimean Mousterian (Chabai 1996). In contrast, Levallois blade debitage is less known in the Middle Palaeolithic of Central Europe and entirely absent at Piekary IIa and Kościół Józefa. If this method occurred in other undated Krakow assemblages (Piekary I, II or Zwierzynieck, P), it is never associated with prismatic blade technology. On the other hand, the Levallois blade method was practiced later in some Early Upper Palaeolithic industries: Bohunician (Svoboda, Škrda 1995; Škrda 1996) or Temnata TD-II, layer VI (Ginter et al. 2000, Kozłowski 2000b).

The co-existence of blade prismatic and non-Levallois technologies is rather rare in the western part of the continent. At Reindahlen B1, (Bosinski 1966) for example, blades appeared with polyhedral cores (refitting is present). It appears that some, including crested removals, also were produced by the polyhedral method as at Kościół Józefa, layer III. Also in Germany, one blade core, a crested blade and blades of full debitage (refitting) were found together with bipolar fracturing of quartz cobbles at Tönchesberg 2B (Conard 2001). Piekary IIa and especially Kościół Józefa, layer III, display huge variability in non-Levallois methods (polyhedral, discoidal, centripetal, Kombewa, etc.). The persistence of flat core reduction was documented in nearby Early Upper Palaeolithic Bohunician assemblages - discoidal (Svoboda, Škrda 1995) and Korolevo I, layer Ia – cores on flakes (Usik 1989). Further to the east, polyhedral, Kombewa and discoidal reduction sequences (very similar to Kościół Józefa, III) were previously described for the Late Mousterian assemblage of Korman IV, layer 12 (Sitlivy, Sytnyk 2002). However, blades were rare as in other collections at Bugliv V, layers I and II (Sytnyk 2000) with the same flake debitage methods. The Blade Mousterian of Donbass (Bielokuzminovka, Kurovskijovka) was also represented by centripetal and discoidal core reduction (Kolesnik 2000, 2003). The Western Crimean Mousterian (Kabazi II) has independent centripetal reduction in addition to prismatic and Levallois technologies (Chabai 2004).

Thus, reduction of prismatic cores before Upper Palaeolithic was in parallel to the other Levallois and non-Levallois methods. In Central Europe and the Near East during the transition, a unique fusion technology was documented: a combination of prismatic (crested) blade and Levallois point/blade/lake methods in a single reduction sequence (Emiro-Bohunician after Svoboda 2004a, b). This technological influence was confirmed in Kościół Józefa, III and I, by refitting. In Piekary IIa, layer 7b, Levallois point production seems to be an independent method where some of the blades represent by-products of point core preparation. A similar pattern was
described at Korolevo II and IIb (Demidenko, Usik 1995).

From a typological viewpoint, comparisons of Piekary IIa and Księża Józefa show general uniformity and many common features in the context of the Mousterian, Levallois-Mousterian and Blade Mousterian of Europe. The majority of industries are represented by sites-workshops with relatively low proportions of retouched tools and rich debitage composition. Levallois debitage has fewer retouched pieces in comparison with industries based on non-Levallois strategies. This is also true for laminar complexes, in which tools on blades are rather scarce. In contrast, in Crimea and the Donbass-Azov regions, tools on blades are common; however, they are mostly of Middle Palaeolithic type. Retouch usually is light, non-invasive, scalar, and mostly direct. Another common feature is reflected in tool composition, in which domination of a single type, usually scrapers, is not characteristic. A certain balance between scrapers, notches, denticulates, retouched flakes and naturally backed knives is much more commonly observed. On the other hand, new data from the Krakow region demonstrate a complete absence of symmetrical convergent tools, including Mousterian points. In this case, one can find such tools in the West (e.g., Riencourt-les-Bapaume) or in the East (e.g., Kabazi II or Belokuzminovka). The absence or rarity of endscrapers and burins at Polish sites and in Eastern European assemblages contrasts with the representative Upper Palaeolithic component in North-western Europe (e.g., Seclin facies, especially Riencourt-les-Bapaume). Truncated-faceted pieces are found in the Krakow region as well as in other parts of Europe (e.g., a spectacular collection of these in Reindahlen B1; Schmitz, Thissen 1998) or in layer 4 of Temnata – TD-I and the Donbass-Azov Blade Mousterian, e.g., Shlyakh, layer 8c (Nehoroshev 2004). Thus, the Late Middle Palaeolithic of Krakow, also shares many similar typological features both with the East and the West and throughout the different chronological phases. Differences also do not display any specific geographical or chronological patterning. Finally, no technological or typological criteria can be used as a chronological marker for these kinds of industries. Large-scale analogies reflect mostly very general characteristics, “international” variability and, in our case, do not support a migration scenario.
Table 8.3.1. North-western Europe. Middle and Early Upper Palaeolithic blade production.

<table>
<thead>
<tr>
<th>Site</th>
<th>Blade core reduction</th>
<th>Working surface(s), localisation</th>
<th>Direction of debitage</th>
<th>Platform(s)</th>
<th>Technique</th>
<th>Other methods</th>
<th>Tool-kit</th>
<th>Cultural and chronological attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rissori</strong></td>
<td>+ +</td>
<td>Partially turned: large and narrow sides</td>
<td>Bidirectional</td>
<td>Prepared by large and small scars</td>
<td>Hard hammer percussion</td>
<td>Levallois: uni / bidirectional for blades, linear for flakes, for points</td>
<td>Middle Palaeolithic: sidescrapers + denticulates</td>
<td>Mousterian, Levallois OIS 7</td>
</tr>
<tr>
<td>Adam 1991; Révillion 1994; Sitlivy 1996.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Crayford</strong></td>
<td>+ -</td>
<td>Wide flat; Partially turned</td>
<td>Unidirectional</td>
<td>Plain, dihedral; some faceted</td>
<td>Hard hammer percussion</td>
<td>Unidirectional; convergent non-Levallois</td>
<td>EMP blade industry</td>
<td></td>
</tr>
<tr>
<td><strong>Rheindahlen B1</strong></td>
<td>- + partial crests</td>
<td>On the narrow sides, partially turned; extension to the wide side?</td>
<td>Unidirectional; Bidirectional; changes in orientation?; similar to Rocourt (Révillion 1994)</td>
<td>Prepared; dihedral</td>
<td>Hard hammerstone</td>
<td>Flake non-Levallois (polyhedral)</td>
<td>Rare MP tools: scrapers, retouched flakes and blades. Truncated-faceted pieces (Schmitz, Thiesen 1998)</td>
<td>MP blade industry of Rheindahlen B1 type Saalian or beginning of the Last Glaciation</td>
</tr>
<tr>
<td><strong>Saint-Valéry-sur-Somme</strong></td>
<td>+ - cortical backed blades</td>
<td>Partially turned to turned (based on cylindrical nodule)</td>
<td>Bidirectional</td>
<td>Prepared by several scars. Partial tablets</td>
<td>Hard hammerstone</td>
<td>-</td>
<td>Rare retouched blades and bladelets</td>
<td>Blade industry, First half of Saalian, Bantéga Interstadial</td>
</tr>
<tr>
<td>De Heinzelin, Haesaerts 1983.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Helin, Low layer</strong></td>
<td>+ mostly wide flat; partially turned; narrow</td>
<td>Bidirectional</td>
<td>Prepared by several scars and single-blow</td>
<td>Hard hammerstone</td>
<td>Levallois linear and recurrent for flakes; Levallois for points</td>
<td>Rare tools</td>
<td>MP work-shop; Saalian</td>
<td></td>
</tr>
<tr>
<td>Escutenaire 1996; Sitlivy 1996.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rocourt</strong></td>
<td>+ on block; lateral crest</td>
<td>From narrow to wide side</td>
<td>Bidirectional</td>
<td>Facetted</td>
<td>Hard hammerstone</td>
<td>-</td>
<td>21 tools: burin, backed blades, truncated bladelet</td>
<td>Blade industry OIS 5c</td>
</tr>
<tr>
<td>Otte et al. 1990; Otte 1994; Chabai and Sitlivy 1993</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Direct</td>
<td>Prepared</td>
<td>Blade core reduction</td>
<td>Direction of debitage</td>
<td>Platform (s)</td>
<td>Technique</td>
<td>Other methods</td>
<td>Tool-kit</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>----------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>-------------</td>
<td>-----------</td>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>Seclin</td>
<td>+ on nodules</td>
<td>+ on nodules crest</td>
<td>Wide + narrow sides (partially turned) and rare turned Narrow; sometimes extended to wide part</td>
<td>Bidirectional</td>
<td>Single-blow and faceted</td>
<td>Hard hammerstone</td>
<td>Levallois for flake(s): linear and recurrent (stages of one method?)</td>
<td>MP: scrapers, denticulates, notches and naturally backed knives</td>
</tr>
<tr>
<td>Révillon 1994.</td>
<td>+ on flakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saint-Germain-des-Vaux / Port-Racine</td>
<td>+ on pebbles</td>
<td>+ on pebbles</td>
<td>Wide + narrow (partially turned)</td>
<td>Unidirectional</td>
<td>Single-blow and by several scars</td>
<td>Hard hammerstone</td>
<td>Levallois recurrent for flakes</td>
<td>MP: notched, denticulates, retouched flakes and irregular scrapers</td>
</tr>
<tr>
<td>Cliquet 1992.</td>
<td>+</td>
<td>+ rare (some cortical blades)</td>
<td>Wide via narrow (partially turned); to narrow part</td>
<td>Bidirectional</td>
<td>Single-blow and by several scars</td>
<td>Hard hammerstone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Révillion 1994.</td>
<td>+ rare (some cortical crests (central and lateral))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cliquet 1992.</td>
<td>+</td>
<td>+</td>
<td>Wide side via narrow (partially turned); to narrow part</td>
<td>Bidirectional</td>
<td>Facetted</td>
<td>Hard hammer percussion</td>
<td>Levallois recurrent for flakes; Kombewa; rare unidirectional</td>
<td>MP: denticulates + notches = convergent scrapers = UP (burins, some backed blades and rare endscrapers)</td>
</tr>
<tr>
<td>Ameloot-Van der Heijden 1993; 1994.</td>
<td>+ rare (some cortical blades)</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gouédo 1994; Locht, Depaepe 1994; Deloze et al. 1994.</td>
<td>+ débordant</td>
<td>+ débordant</td>
<td>Partially turned: more on narrow with extension to wide side</td>
<td>Unidirectional and bidirectional</td>
<td>Facetted; Tablets</td>
<td>Hard hammer percussion + 1 case on anvil</td>
<td>Levallois recurrent uni/bidirectional; production of bifacial tools</td>
<td>MP: domination of simple scrapers; rare bifaces</td>
</tr>
<tr>
<td>Vinneuf, Level N 1</td>
<td>+ débordant</td>
<td>+ rare crest and bifacial pre-forms</td>
<td>Partially turned, from large to narrow part Prepared: crest on narrow part</td>
<td>Mostly bidirectional</td>
<td>Single-blow and by several removals; Facetted</td>
<td>Hard hammer percussion</td>
<td>Levallois recurrent uni/bidirectional for flakes and blades; production of bifacial tools</td>
<td>Bifaces + sidescrapers + denticulated/notched tools + retouched flakes and blades + some endscrapers and burins</td>
</tr>
<tr>
<td>Site</td>
<td>Direct</td>
<td>Prepared</td>
<td>Working surface (s), localisation</td>
<td>Direction of debitage</td>
<td>Platform (s)</td>
<td>Technique</td>
<td>Other methods</td>
<td>Tool-kit</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>--------</td>
<td>----------</td>
<td>-----------------------------------</td>
<td>-----------------------</td>
<td>--------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Bettencourt-Saint-Ouen, layer 3b</td>
<td>+</td>
<td>Partially turned (flakes and blades)</td>
<td>Unidirectional (blades); bidirectional (flakes)</td>
<td>Prepared by several blows</td>
<td>Hard hammer percussion</td>
<td>Levallois for flakes; non-Levallois; orthogonal, discoidal, un-prepared for points</td>
<td>Rare tools: scrapers, notches, backed knife on blade and endscraper</td>
<td>MP; OIS 5d</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ partial crest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bettencourt-Saint-Ouen, layer 3a</td>
<td>+</td>
<td>Narrow with reduction to flat core (refitted core)</td>
<td>Bidirectional</td>
<td>Single-blow + elimination of overhang</td>
<td>Hard hammer percussion</td>
<td>Non-Levallois for flakes: uni/bidirectional; Levallois for points (by-products: blades and débordant lakes); Levallois for points (repeated on two large sides of the core)</td>
<td>Rare tools: sidescrapers, notches, endscrapers</td>
<td>Brorup MP; OIS 5a</td>
</tr>
<tr>
<td>+ on flakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bettencourt-Saint-Ouen, layer 2b</td>
<td>+</td>
<td>Partially turned; turned</td>
<td>Bidirectional</td>
<td>Single-blow and dihedral</td>
<td>Hard hammer percussion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(trench 1 and 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bettencourt-Saint-Ouen, layer 2b</td>
<td>+</td>
<td>Partially turned; Rare turned</td>
<td>Unidirectional</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(trench 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locht 2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lailly / le Fond de la Tournerie</td>
<td>+</td>
<td>Two narrow cores and bidirectional</td>
<td>Unidirectional and bidirectional</td>
<td>Single-blow with marginal facetting</td>
<td>Hard hammerstone?</td>
<td>Levallois for flakes and points (recurrent)</td>
<td>MP: sidescrapers, bifaces, including Micoquian UP: retouched blades, backed blades</td>
<td>MP with Micoquian elements</td>
</tr>
<tr>
<td>Locht, Depaepe 1994</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pech de l’Azé 1b</td>
<td>+ by means of naturally backed flakes</td>
<td>-</td>
<td>Wide with light extension to narrow parts</td>
<td>Unidirectional via bidirectional; Bidirectional</td>
<td>Single-blow</td>
<td>Hard hammer percussion</td>
<td>Flakes originated from the same method</td>
<td>Scrapers (irregular), backed knives, denticulates and notches, some endscrapers and burins (mostly atypical); raclette type of retouch</td>
</tr>
<tr>
<td>Pelegrin 1990</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Direct</td>
<td>Prepared</td>
<td>Working surface (s), localisation</td>
<td>Direction of debitage</td>
<td>Platform (s)</td>
<td>Technique</td>
<td>Other methods</td>
<td>Tool-kit</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
<td>-------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>----------------------------------------</td>
<td>---------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Pech de l’Azé I, layer 5-7</strong></td>
<td>+ by means of blades and flakes à dos cortical</td>
<td>Partially turned: from intersection (ridge) of narrow and wide surfaces via wide side (min. on two sides with extension to the third); Narrow</td>
<td>Unidirectional and rare bidirectional; Unidirectional with preparation of the opposite core end.</td>
<td>Single-blow</td>
<td>Hard hammer percussion</td>
<td>Levallois and discoidal</td>
<td>idem</td>
<td>MTA, type A and B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Soressi 2002</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Roc-de-Combe, layer 8 and La Côte, layer III</strong></td>
<td>+ different crests (max. 3 positions on the core)</td>
<td>Partially turned: wide via narrow; narrow via wide; narrow sides</td>
<td>Bidirectional (often opposed platform were used for debitage maintenance); Bidirectional</td>
<td>Single-blow; tablets</td>
<td>Mostly soft hammer</td>
<td>Flakes are by-products of blade technology</td>
<td>Chatelperronian points, endscrapers, backed knives, burins, notched and denticulated tools</td>
<td>Chatelperronian</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pelegrin 1990, 1995; Bodéda 1990.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Arcy-sur-Cure, la grotte du Renne</strong></td>
<td>+</td>
<td></td>
<td>Partially turned; 2 or 3 flaking surfaces: 1) from narrow to wide and back; 2) from narrow to wide; 3) wide with slight extension to narrow sides</td>
<td>Unidirectional and bidirectional (for maintenance of blade debitage with straight profile)</td>
<td>Single-blow; tablets; plunging removals</td>
<td>Soft and hard hammer percussion</td>
<td>Flat centripetal cores; exhausted (resembling Levallois)</td>
<td>Chatelperronian points, endscrapers, burins, notches, denticulates, sidescrapers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Farizy 1990; Gouédé 1990; Bodu 1990.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Direct</td>
<td>Prepared</td>
<td>Working surface</td>
<td>Direction of debitage</td>
<td>Platform (s)</td>
<td>Technique</td>
<td>Other methods</td>
<td>Tool-kit</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------</td>
<td>----------</td>
<td>-----------------</td>
<td>-----------------------</td>
<td>--------------</td>
<td>----------</td>
<td>------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td><strong>Korolevo II, complex II</strong></td>
<td>Rare (mostly on pebbles)</td>
<td>+ bifacial shaping (narrow wedge-shaped bifacial pre-core with central crest); one- and two-sloped crests; neo-crests</td>
<td>Narrow part was reduced to flat cores with wide surface; narrow, wedge-like surface; partially turned; rare turned</td>
<td>Bidirectional; unidirectional (mostly exhausted)</td>
<td>Single-blow and faceted before blade removing; abrasion</td>
<td>Mostly hard stone percussion</td>
<td>-</td>
<td>UP: 40 % (endscrapers, retouched blades); MP: 24 % (scrapers etc.); Bifacial leaf-points</td>
</tr>
<tr>
<td><strong>Korolevo I, complex Ia</strong></td>
<td>-</td>
<td>+ lateral (one-sloped) crest on the ridge between dorsal and ventral lake surfaces; rare bifacial shaping</td>
<td>Wide with slight extension to sides; Partially turned; Rare turned; Rocourt type (partially turned core with two opposed platforms: refitted sequence)</td>
<td>Unidirectional; bidirectional (mostly exhausted)</td>
<td>Single-blow; several removals or dihedral; tablets</td>
<td>Soft and hard hammer percussion</td>
<td>Non-Levallois flake production based on core on lake (transversal reduction of flake slice; ventral face is used as a platform); trifacial cores</td>
<td>UP: 63 % (endscrapers, rare burins, retouched blades) MP: 25 % (retouched flakes, sidescrapers etc.)</td>
</tr>
<tr>
<td><strong>Sokyrnitsa IA, layer 3</strong></td>
<td>+</td>
<td>Most on full debitage stage (lateral crest)</td>
<td>Partially turned; Narrow (often on massive lakes)</td>
<td>Unidirectional and bidirectional</td>
<td>Single-blow; rare several scars</td>
<td>Hard hammer percussion</td>
<td>-</td>
<td>Numerous burins, retouched blades and flakes, some sidescrapers</td>
</tr>
<tr>
<td><strong>Temnata layer VI, trench TD-II</strong></td>
<td>+</td>
<td>+ crests: central, lateral, secondary, postero-lateral</td>
<td>Narrow; Wide; Narrow and wide; Narrow with extension to wide side (flake/blade cores). Common and isolated flaking surfaces (from narrow to wide)</td>
<td>Bidirectional; Unidirectional</td>
<td>Single-blow; tablets</td>
<td>Hard hammer percussion</td>
<td>Levallois bidirectional for blades and flakes; discoidal</td>
<td>MP &lt; UP (retouched flakes and blades, endscrapers, burins, sidescrapers, some Mousterian points)</td>
</tr>
</tbody>
</table>

Usik 1989, 2002; Gladilin, Demidenko 1989; Stilivy and Zieba 2006
<table>
<thead>
<tr>
<th>Site</th>
<th>Direct</th>
<th>Prepared</th>
<th>Working surface(s), localisation</th>
<th>Direction of debitage</th>
<th>Platform(s)</th>
<th>Technique</th>
<th>Other methods</th>
<th>Tool-kit</th>
<th>Cultural and chronological attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temnata layer 4, trench TD-I, phases C, B, A</td>
<td>Rare + crests: partial, full prepared, central and lateral</td>
<td>Partially turned: on broad or narrow part with extension to the sides; rare turned idem</td>
<td>Unidirectional and bidirectional</td>
<td>Single-blow; tablets; facetted</td>
<td>Hard hammer percussion</td>
<td>-</td>
<td>UP: endscrapers, retouched blades and flakes, rare burins and truncated-facettet pieces; Aurignacian types occurred on the latter stages</td>
<td>EUP</td>
<td>~ 45- 31 ka BP</td>
</tr>
<tr>
<td>Piekary IIa, layer 7c</td>
<td>Rare</td>
<td>+</td>
<td>Narrow with extension to sides, partially turned</td>
<td>Bidirectional and unidirectional</td>
<td>Facetted; Single-blow; tablets; Some abrasion</td>
<td>Hard hammer percussion</td>
<td>Levallois linear for flakes; discoidal</td>
<td>Rare tools: sidescrapers, notches, retouched blades and flakes, several truncated-facettet pieces, backed blades, burin</td>
<td>Blade Levallois-Mousterian</td>
</tr>
<tr>
<td>Piekary IIa, layer 7b</td>
<td>Rare + lateral crests</td>
<td>Partially turned: from narrow to wide side?</td>
<td>Unidirectional</td>
<td>Single-blow; facetted; abrasion</td>
<td>Hard hammer percussion</td>
<td>Levallois recurrent centripetal for flakes; linear convergent for points (part of blades are by-products of this method); Discoidal; Kombewa</td>
<td>Rare tools: sidescrapers, notches, denticulates, backed knives, retouched flake and blade, truncated-facettet piece; Used flakes and blades</td>
<td>Levallois-Mousterian;</td>
<td>OIS 3; 39 ka BP</td>
</tr>
<tr>
<td>Piekary IIa, layer 7a</td>
<td>+ by cortically and débordant blades; bidirectional debitage; changes in orientation + lateral and central crests; bifacial pre-form; neo-crests</td>
<td>Partially turned: from narrow to wide side; from wide to narrow surfaces</td>
<td>Bidirectional prevailed</td>
<td>Single-blow; several scars; tablets; abrasion</td>
<td>Use of soft and hard hammer percussion</td>
<td>Discoidal; Rare Levallois recurrent centripetal</td>
<td>Domination of sidescrapers over notches, naturally backed knives, retouched flakes, splintered pieces, raclette; rare tools on blades</td>
<td>Blade Mousterian</td>
<td>46-33 ka BP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site</th>
<th>Direct Prepared</th>
<th>Working surface(s), localisation</th>
<th>Direction of debitage</th>
<th>Platform(s)</th>
<th>Technique</th>
<th>Other methods</th>
<th>Tool-kit</th>
<th>Cultural and chronological attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piekary IIa, layer 6</td>
<td>+ lateral and central crests (prevailing of one-sloped)</td>
<td>Turned: from the narrow opposing flaking surfaces to the large opposing sides Partially turned: from the narrow flaking surface to the large sides + several crest positions during reduction; neo-crests</td>
<td>Bidirectional</td>
<td>Single-blow; several scars; tablets; abrasion</td>
<td>Use of soft and hard hammer percussion</td>
<td>-</td>
<td>UP: retouched blades and flakes prevail over burins and endscrapers; rare sidescrapers.</td>
<td>EUP</td>
</tr>
<tr>
<td>Księżca Józefa, layer II</td>
<td>-</td>
<td>+ on nodules, frontal crests (one-sloped, partial) on narrow part; lateral and postero-lateral crests</td>
<td>Bidirectional</td>
<td>Prepared by several scars; faceted; partial tablets; abrasion</td>
<td>Hard stone percussion</td>
<td>Bladelet (core on flake)</td>
<td>Rare tools (lack of endscrapers and burins). Non-specific isolated types: sidescraper, retouched flake and blade, <em>raclette</em>, notch, splintered piece and borer</td>
<td>Blade workshop, EUP?</td>
</tr>
</tbody>
</table>

for absolute dating see: Valladas et al. 2003; Chapter 5.
<table>
<thead>
<tr>
<th>Site</th>
<th>Blade core reduction</th>
<th>Other methods</th>
<th>Tool-kit</th>
<th>Cultural and chronological attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Księcia Józefa, layer III</td>
<td>Direct: + on nodules by means of naturally backed, and plunging blades; distal trimming</td>
<td>Prepared:</td>
<td>Direction of debitage</td>
<td>Platform(s)</td>
</tr>
<tr>
<td></td>
<td>Working surface(s), localisation</td>
<td>Partially turned: from narrow to wide side and inversely</td>
<td>Bidirectional with isolated surfaces</td>
<td>Dihedral</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially turned: from wide to narrow side; and inversely + convergent for point at the end of reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially turned: from narrow to large dorsal surface and back</td>
<td>Unidirectional</td>
<td>Flat (use of flake butt for core reduction)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partially turned: from narrow (crests) to wide surface (elongated point and bidirectional debitage)</td>
<td>Bidirectional</td>
<td>facetted; <em>chapeau de gendarme</em> platform for point removal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site</th>
<th>Direct</th>
<th>Prepared</th>
<th>Working surface(s), localisation</th>
<th>Direction of debitage</th>
<th>Platform(s)</th>
<th>Technique</th>
<th>Other methods</th>
<th>Tool-kit</th>
<th>Cultural and chronological attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kulychivka, layer III-d</td>
<td>+ crests: lateral (one and two-sloped); neo-crests + lateral crest</td>
<td>Partially turned; narrow flaking surface</td>
<td>Narrow (additional) surface of flat Levallois core</td>
<td>Bidirectional; rare unidirectional</td>
<td>Single-blow; facetted; tablets</td>
<td>Hard hammer percussion</td>
<td>Levallois recurrent mostly bidirectional for points and blades</td>
<td>Rare UP non-Aurignacian tools (endscrapers on cortical flakes) prevail over MP tools</td>
<td>Workshop (Meignen et al. 2004) EUP, Bohunician</td>
</tr>
<tr>
<td>Kabazi II, II/A-II/7</td>
<td>Rare: maintained by cortically backed blades/ flakes</td>
<td>+ crests: lateral, central (one and two-sloped); neo-crests</td>
<td>Partially turned: wide surface with extension to sides; Narrow and wedge-like</td>
<td>Bidirectional; Unidirectional</td>
<td>Facetted; Single-blow; Tablets; Elimination of overhang</td>
<td>Hard and soft hammerstones</td>
<td>Levallois linear for flakes; Recurrent mostly bidirectional for blades/flakes; Centripetal non-Levallois</td>
<td>Sidescrapers (mostly simple), Mousterian points, some denticulates and notches; UP tools: rare (endscraper, borer) or absent idem; MP tools on blades</td>
<td>Early stage of the Western Crimean Mousterian ~ 45-36 ± 3 ka BP</td>
</tr>
<tr>
<td>Kabazi II, II6-A,A</td>
<td>Rare</td>
<td>+ idem; Bifacial pre-core on flake</td>
<td>Partially turned: from narrow to wide surface</td>
<td>Bidirectional; Unidirectional</td>
<td>Facetted; Single-blow; Tablets</td>
<td>Hard and soft hammerstones</td>
<td>Levallois recurrent bidirectional for blades/flakes</td>
<td>Late stage of the Western Crimean Mousterian ~ 36-30 ka BP</td>
<td></td>
</tr>
<tr>
<td>Kurdiimovka</td>
<td>Reduction of naturally voluminous cylindrical nodules was predominant</td>
<td>+ rare crested flakes (mostly lateral)</td>
<td>Partially turned: from narrow to wide surface; idem + second narrow part</td>
<td>Unidirectional (opposed removals aimed to re-construct flaking surface)</td>
<td>Single-blow; tablets</td>
<td>Hard hammerstones</td>
<td>Non-Levallois: Discoidal; Centripetal; Uni- and bidirectional flat cores</td>
<td>Mousterian points on blades, sidescrapers, denticulates, naturally backed knives, truncated-faceted pieces</td>
<td>Workshop OIS 4 early Glacial</td>
</tr>
<tr>
<td>Kolesnik 2000; 2003; Sitiivy and Zięba 2006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shliakh, layer 8c</td>
<td>+ crests: on narrow side; distal part (narrow wedge-shaped cores)</td>
<td>Narrow surface with extension to wide side; Successive exploitation of two surfaces: narrow to wide</td>
<td>Unidirectional</td>
<td>Single-blow; Elimination of overhang occurred</td>
<td>Hard hammerstone</td>
<td>Levallois uni- and bidirectional</td>
<td>Mousterian points, truncated-faceted, sidescrapers, backed knives; Rare atypical burins and endscrapers on flakes and blades</td>
<td>Blade Levallois Mousterian OIS 3, ~ 46-45 ka BP</td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES


Technocomplexes: Dating, Stratigraphies, Cultural Implications, Trabalhos de Arqueologia 33, Instituto Português de Arqueologia, Lisboa, p. 223–244.


p. 439-454.


**Henshilwood C., d’Errico F., Yates R., Jacobi Z., Tribol C., Duller G.A.T., Mercier N., Sealy J. C., Valladas H.,**


JURA A., 1951a. Stanowisko kultury ścinankowej w Krakowie na Zvierzyńcu z ostatniego ingerialcju Masovien II (Riss Würm). In: Sprawozdania z czynności i posiedzeń PAU, 52, p. 64-66.


KOŁOZOWSKI J. K., 2000b. The Problem of Cultural Continuity between the Middle and Upper Paleolithic in Central and


Madeysa T., 1981. Śródkowisko człowieka w środkowym i górnym paleolicie na ziemach polskich w świetle badań geologicznych. In: Studia Geologica Polonica, 69, p. 7-125.


MORAWSKI W., 1975. Middle Palaeolithic Flint Assemblages from the Piekary II a Site. In: Światowit, 39, p. 139-146.


