THE ARCHAIC TO TRUE UPPER PALEOLITHIC INTERFACE:
THE CASE OF MIRA IN THE MIDDLE DNIEPER AREA

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Abstract

This paper presents the first results of the investigation of the new Early Upper Paleolithic open-air site of Mira in the
Middle Dnieper area, eastern Europe, Ukraine. Mira yields two distinct Paleolithic occupations (II/2 and I) separated by
the remains of a natural burning event (II/1). The Mira I assemblage exhibits a proliferation of Middle and Upper Paleol-
ithic features, while the underlying the Mira II/2 appears to be true UP. The archaeological evidence provides some
important clues to the problem of the Middle to Upper Paleolithic transition in eastern Europe. This paper deals mainly with
the characteristics of the lithic assemblages of layers II/2 and I.

GEOGRAPHIC SETTING
AND STRATIGRAPHY

The open-air site of Mira is located in the valley of the river Dnieper on the right bank, near the
village of Kanevskoye, about 15 km south of Zaporoziye, central Ukraine (47°40' of N latitude
and 34°50' of E longitude; see Fig. 1). Its deposits are incorporated within the alluvial terrace whose
altitude is about 18–20 m above the river level and 40 m a.s.l. (Stepanchuk et al., 1998; Stepan-
chuk and Cohen, 2001).

The stratigraphical record of Mira encompasses almost 12 m of sedimentary successions
exposed along the slope of a ravine descending to the Dnieper River. Dark gray sandy loams con-
taining remains of all archaeological layers appeared to be sandwiched between two sandy
members of the Dnieper alluvium, and overlain by subaerial sediments (Fig. 2).

N. Gerasimenko and P. Haesaerts recognize 28 distinct layers clustered into four stratigraphic
units (Haesaerts et al., in press; Stepanchuk et al., in press). Lithological, geomorphological, pal-
ynological, anthropological, micro- and megafaunal analyses as well as radiometric (AMS and
conventional \(^{14}\)C) data allow an accurate correla-
tion of the culture-bearing layers with the De-
nekamp/late Vitachiv/Bryansk interstadial of the
Middle Pleniglacial and place both Paleolithic oc-
cupations between 27–28 ky BP.

Eight conventional radiocarbon dates were
obtained in the Kiev laboratory and three AMS in
Groningen, the latter on the samples analyzed for
charcoal by F. Dambon (Table 1). The data sug-
gest both successive Paleolithic occupations and
an interbedded episode of natural conflagration
dated to between 27–28 ky BP. In accordance
with geological data and on the basis of the radio-
metric dates of layers I, II/1, and II/2, they are all
separated by relatively short span of time.

Detailed descriptions of the stratigraphic suc-
cession, the palynological record, the anthro-
cological analysis, and the environmental
evolution are being published elsewhere (Ha-
esaerts et al., in press; Stepanchuk et al., in press).
These data indicate that the Paleolithic occupa-
tions accumulated in the alluvial plain of the
Dnieper, at some distance from the valley slope,
probably in the vicinity of the fluvial channel. The
occupation of layer II/2 took place in a grass and
sedge environment of the flood plain during the
time of soil formation at the top of layer 27. Ar-
chaeological layer I is associated with the base of
the A1 horizon of layer 24, characterized by a prevalence of meadow vegetation, and later on with the occurrence of pine and juniper (Fig. 2).

**TAPHONOMIC ISSUES**

Both Mira I and Mira II/2 are associated with the soil formation processes. The remains of human activities were likely quickly buried after the occupation, ensuring the good preservation of artifacts and the site’s structure. Special analyses of taphonomic aspects of both geological and archaeological layers were undertaken (Stepanchuk, 2004a). The following factors were examined, namely: geological indications of water erosion, colluvial processes, cryogenic transformations, archaeological indications on the spatial and 3D distribution of different categories of paleontological, lithic and bone artifacts, various pits and objects. These analyses point to the
MIRA
Litostratigraphy of the main sequence
Northern profile
(after P. Haesaerts and N. Gerasimenko)

Fig. 2. Stratigraphical sequence of the site of Mira (after P. Haesaerts et al., in press). Graphic symbols: 1 – sandy loess; 2 – sand; 3 – strong humiferous horizon; 4 – weak humiferous sediment; 5 – pale brown sandy loess; 6 – prismatic structure; 7 – bleached horizon with iron staining; 8 – root tracks; 9 – krotovina; 10 – charcoal concentration; 11 – artifact; 12 – bone; 13 – lithostratigráfic unit; 14 and 15 – archaeological layers.
good state of preservation of Mira—both in the geological and archaeological senses. The importance of the Mira cultural sequence calls for a thorough examination of data, which would permit the evaluation of the homogeneity of Paleolithic occupations (Stepanchuk, in press). The lithological layers, including the remains of archaeological occupations, provide no evidence of intensive water erosion and cryogenic transformations. The position of the remains on a practically horizontal surface eliminates the potential action of slope processes during the accumulation of the remains as well as the post-depositional phase. The analysis of the orientation of the larger faunal remains from the archaeological layers shows a random distribution. There are no indications of a disturbance of the faunal remains due to the action of water flows.

The presence of anatomically corresponding groups of bones in layer I testify to a minimal rate of redeposition. There is a clear discordance in the distribution of “meaty” and “not meaty” parts of the skeletons of mega and middle-size fauna.

Lithic artifacts are not rolled and do not show evidence of patination. It is worthwhile to note the presence of compact micro-concentrations of tiny waste accumulations from tool re-sharpening and modification. Individual peculiarities of raw materials in such micro-concentrations probably suggest discrete episodes of curation of isolated tools. There are clear differences in the spatial distribution of petrographically different artifacts. If flint artifacts of the dominating group Ia1 are represented throughout all the excavated area of layer I, artifacts of groups Ia–b (A, B, C, and D) are localized within a few distinct areas.

The comparison of the distribution of different categories of tools – e.g., bifacial pieces, endscrapers, sidescrapers, points, tools on micro-flakes – clearly illustrates the presence of spatially separated areas of a comparatively high concentration. Layer I provides numerous small-sized (up to 15 mm) fragments of different rocks. They are not found in either layer II/1 or II/2 and permits us to conclude that there is an absence of vertical migration of the smallest sized remains.

It is worth stressing that there is a lack of evidence of overlapped objects within the each single occupation and spatial mismatching of concentrations of the remains in different layers.

In sum, currently there are no signs of any natural or anthropogenic mechanism that would

<table>
<thead>
<tr>
<th>Site/Layer</th>
<th>Type of Industry</th>
<th>Determination B.P.</th>
<th>Sample</th>
<th>Lab. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mira: I</td>
<td>archaic UP</td>
<td>27600 ± 370</td>
<td>charcoal</td>
<td>Ki-8152</td>
</tr>
<tr>
<td>Mira: I</td>
<td>archaic UP</td>
<td>27200 ± 380</td>
<td>charcoal</td>
<td>Ki-8153a</td>
</tr>
<tr>
<td>Mira: I</td>
<td>archaic UP</td>
<td>27300 ± 390</td>
<td>charcoal</td>
<td>Ki-8154</td>
</tr>
<tr>
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<td>archaic UP</td>
<td>27050 ± 350</td>
<td>bone</td>
<td>Ki-8158</td>
</tr>
<tr>
<td>Mira: I</td>
<td>archaic UP</td>
<td>26610 ± 400</td>
<td>bone</td>
<td>Ki-10283</td>
</tr>
<tr>
<td>Mira: I</td>
<td>archaic UP</td>
<td>27080 ± 400</td>
<td>charcoal</td>
<td>Ki-10284</td>
</tr>
<tr>
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<td>archaic UP</td>
<td>28450 ± 1100</td>
<td>soil</td>
<td>Ki-8381</td>
</tr>
<tr>
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<td>archaic UP</td>
<td>26590 ± 490/460</td>
<td>charcoal</td>
<td>GrA-20019</td>
</tr>
<tr>
<td>Mira: II/1</td>
<td>natural conflagration</td>
<td>26800 ± 390</td>
<td>charcoal</td>
<td>Ki-8155</td>
</tr>
<tr>
<td>Mira: II/1</td>
<td>natural conflagration</td>
<td>27160 ± 390</td>
<td>charcoal</td>
<td>Ki-10346</td>
</tr>
<tr>
<td>Mira: II/1</td>
<td>natural conflagration</td>
<td>27830 ± 580/540</td>
<td>charcoal</td>
<td>GrA-20020</td>
</tr>
<tr>
<td>Mira: II/2</td>
<td>&quot;Gravettian&quot;</td>
<td>27200 ± 360</td>
<td>charcoal</td>
<td>Ki-8156</td>
</tr>
<tr>
<td>Mira: II/2</td>
<td>&quot;Gravettian&quot;</td>
<td>27510 ± 400</td>
<td>charcoal</td>
<td>Ki-8201</td>
</tr>
<tr>
<td>Mira: II/2</td>
<td>&quot;Gravettian&quot;</td>
<td>27750 ± 590/550</td>
<td>charcoal</td>
<td>GrA-20033</td>
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</table>
explain the mixed typological characteristics of the artifacts of layer I as the results of a palimpsest. Hence, Mira layers I and II/I represent separate and homogeneous short-term occupations, the remains of which provide good examples of well-preserved living floors.

FLINT INDUSTRY OF THE LOWER PALEOLITHIC OCCUPATION (LAYER II/2)

The occupation of layer II/2 was uncovered over an area ca. 60 m². This layer contains several utilitarian pits, several dozen splintered bones of bison and wild horse, and about 200 knapped flints. According to petrographical determination (V. Petrougne), the outcrops used for lithic raw materials were remote—at least 300 to 350 km from the site and might be localized somewhere in the western Ukraine.

The assemblage is very small. Therefore, there is little technological and typological information to report. There are a few flakes, flake tools and the micro-waste of tools resulting from rejuvenation and reshaping are dominant (Table 2).

Backed blades (Fig. 3) represent the only group of tools. These tools are made on narrow (8–9 mm) and thin (2–3 mm) blades, which are slightly curved in profile. From a technological viewpoint such blanks clearly differ from the flake products of layer I. As it seems, these blades were struck from comparatively small single-platform cores with rather narrow flaking surface. Butts of the blades have been removed by

<table>
<thead>
<tr>
<th>Artifact</th>
<th>N</th>
<th>%</th>
<th>without chips, N</th>
<th>without chips, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flakes</td>
<td>5</td>
<td>3.067</td>
<td>5</td>
<td>33.333</td>
</tr>
<tr>
<td>Flake tools</td>
<td>10</td>
<td>6.135</td>
<td>10</td>
<td>66.666</td>
</tr>
<tr>
<td>Chips</td>
<td>148</td>
<td>90.798</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>163</td>
<td>100.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2
Mira layer II/2: General structure of flint assemblage (including fragmented artifacts)

Fig. 3. Mira layer II/2 flint artifacts; 1–5, complete and fragmented backed blades
retouch. The flake butts are linear and lipped. There is one piece with traces of abrasion on the striking platform. Thus, the typology is of a typical Upper Paleolithic soft hammer knapping technique.

The typological list consists of five complete and fragmented backed blades, one ordinary thin angle endscraper, two fragments of flake tools, and two micro-flakes with retouch of utilization. Backed blades are rather small, about four cm long, delicate, and quasi-triangular pieces. The slightly concave or straight right edge is shaped by direct abrupt retouch, varying in type depending on the thickness of the area along the edge of each blank. A short left edge associated with proximal end of a blade is bluntly retouched and is classified as oblique truncation. Both convergent retouched edges form an acute angle. Analogies to this morphologically consistent series of backed blades appear to be in Gravettian assemblages. However, there are no morphological counterparts in chronologically corresponding assemblages of adjacent territories but perhaps in distant Gravettian assemblages (e.g., Otte, 1985; Kozlowski, 1986; Harrold, 1993; Svoboda, 1996; Svoboda et al., 1996; Amirkhanov, 1998).

Instead, a good resemblance may be found in the Aurignacian horizon 24A1 of grotte Paglicci in Italy, dated to ca. 29 ky BP (Palma di Cesnola, 1996). Palma di Cesnola’s (2000) description of backed bladelets of type Paglicci 24A1 is strikingly similar to Mira II/2 backed implements. However, at this point in our research there is no need for further discussion of the nature of such a resemblance until additional data on Mira layer II/2 is available.

**FLINT INDUSTRY OF THE UPPER PALEOLITHIC OCCUPATION (LAYER I)**

About 50 m² were exposed. This layer represents an intensively utilized area with hearths, various pits, abundant faunal remains, and lithics. The peculiarities of the flint industry allow us to suggest its origin in the east Carpathians. The presence of quantitatively rare typical flints from the valleys of big rivers localized between the Romanian east Carpathians and the Dnieper River points to a comparatively rapid migration. Faunal analyses show a predominance of wild horse (71.8% of NIB), followed by fox, steppe and polar fox (21.6%); *Asinus hyruntinus*, giant deer, red deer, reindeer, bison, mammoth, and wild boar are present in low frequencies. The overwhelming majority of the remains of *Equus latipes* indicates intentional hunting. The presence of almost all of the components of these horse skeletons suggests that the hunting and butchering took place in proximity to the site. The skeletal remains include six young, two semi-adult and eight adult individuals. Two canines indicate the presence of one adult stallion. The entire set of horse remains appears to be the result of one episode of hunting on a harem group of horses.

The specifics of the spatial distribution of various pits, especially postholes and hearths, as well as the regularities of localized “meaty” and “not-meaty” parts of the skeletons of large animals, remains of carnivores, as well as the flint working waste concentration, allow us to reconstruct dwelling construction in the southeast segment of the exposed area. Judging by the data, the structure was a permanent spherical dwelling, opened to the river, with a covered area of about 14.5 m² (Stepanchuk, 2004b). A fragment of a human molar identified by C. Turner (Stepanchuk et al., 2004a) as belonging to *Homo sapiens sapiens* was discovered within the contour of a dwelling structure, where a pierced carnivore tooth and fragments of engraved bone pieces were located.

**Layer I**

The petrographical analyses of the lithics (V. Petrourgne in Stepanchuk et al., 2004a) demonstrated that the largest portion of the flints was imported from very remote outcrops. The overall weight of both flint and stone artifacts of presumably east Carpathian origins did not exceed 5 kg.

The layer I flint assemblage expresses an extremely transformed industry, which resulted from the intensive utilization and re-utilization of limited number of initially thoroughly sorted lithic artifacts. There are almost no cores and ordinary products of core knapping. Their absence creates an additional difficulty in reconstructing the technological parameters of knapping. The only available cores are fully exhausted as well as a few small fragments of raw materials, series of flakes, flake tools, bifacial tools, and crucially...
Table 3
Mira layer I: General structure of flint assemblage (including fragmented artifacts)

<table>
<thead>
<tr>
<th>Artifact</th>
<th>N</th>
<th>%</th>
<th>without chips, N</th>
<th>without chips, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>fragments of raw materials</td>
<td>5</td>
<td>0.009</td>
<td>5</td>
<td>0.364</td>
</tr>
<tr>
<td>cores</td>
<td>2</td>
<td>0.004</td>
<td>2</td>
<td>0.145</td>
</tr>
<tr>
<td>flakes</td>
<td>579</td>
<td>1.093</td>
<td>579</td>
<td>42.109</td>
</tr>
<tr>
<td>blades</td>
<td>26</td>
<td>0.049</td>
<td>26</td>
<td>1.891</td>
</tr>
<tr>
<td>bladelets</td>
<td>10</td>
<td>0.019</td>
<td>10</td>
<td>0.727</td>
</tr>
<tr>
<td>flake tools</td>
<td>721</td>
<td>1.36</td>
<td>721</td>
<td>52.436</td>
</tr>
<tr>
<td>bifacial tools</td>
<td>32</td>
<td>0.06</td>
<td>32</td>
<td>2.327</td>
</tr>
<tr>
<td>chips</td>
<td>51,615</td>
<td>97.405</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>52,990</td>
<td>99.999</td>
<td>1,375</td>
<td>99.999</td>
</tr>
</tbody>
</table>

dominating chips or micro-wastes of bifacial and flake tools’ knapping, sharpening and reshaping (Table 3).

Technological aspect of Mira Layer I assemblage

Technical indices were obtained on 650 comparatively large flakes (including retouched samples) from the sample from the 2000 excavation season.

Flakes of this series indicate a high level of faceting (IF = 31.6; Ifs = 26.57), modest level of blade products (Ilam = 15.56), quite high percentage of flakes with a centripetal dorsal pattern (14.51) but a prevailing parallel scar pattern (43.14). At the same time the evidence of soft hammer is common (index of lipping = 60.48).

A more detailed examination of technical parameters of flake products is based on the morphology of the blanks. The indices of IF and Ilam obtained for different groups of flakes are presented in Table 4. These results reflect only the main core reduction trajectories. The commonly accepted complex set of correlated attributes including the dorsal pattern type, butt, profile, strike zone preparation method (e.g., Anikovich et al., 1997) were used for distinguishing flakes resulting from biface curation. Specific groups consist of flakes struck from the interior surface of flake tools and represent products that emanate from various ventral thinning techniques. The main features of these products are straight profile, plain dorsal scar pattern and faceted butts (remnant of the retouched edge of the thinned tool). These flakes are somewhat similar to the products of the Kombewa technique, but only in a formal way. Massive and comparatively large blanks with straight profiles and large butts were considered as products of regular knapping of cores. All the available complete flakes have been taken into account in this study and only the series of flakes presumably struck from cores are regarded as objectively characterizing the technical aspects of core reduction. The evidence that no parallel bidirectional dorsal pattern was observed on flake products is a definite indication that the cores had only one striking platform. The pre-core stage included the removal of ridge blades preparation as shown by the rare crested products in the assemblage.

Table 4
Mira Layer I: The main technical indices of different groups of flakes

<table>
<thead>
<tr>
<th></th>
<th>Only flakes presumably struck from cores</th>
<th>Only waste flakes of biface working</th>
<th>Only waste flakes of flake tool thinning</th>
<th>Flakes of undefinable origins</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 257</td>
<td>N = 336</td>
<td>N = 34</td>
<td>N = 659</td>
<td>N = 1286</td>
</tr>
<tr>
<td>IF</td>
<td>11</td>
<td>12.09</td>
<td>145</td>
<td>53.31</td>
<td>12</td>
</tr>
<tr>
<td>Ifs</td>
<td>7</td>
<td>7.69</td>
<td>140</td>
<td>51.47</td>
<td>10</td>
</tr>
<tr>
<td>Ilam</td>
<td>47</td>
<td>38.52</td>
<td>16</td>
<td>2.38</td>
<td>1</td>
</tr>
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</table>
Mira Layer I: Types of initial blanks of flake tools

<table>
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<tr>
<th>Categories of flake tools</th>
<th>0</th>
<th>1</th>
<th>I or II</th>
<th>II</th>
<th>III</th>
<th>IVa</th>
<th>IVb</th>
<th>IVc</th>
<th>??</th>
<th>Total N</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>-</td>
<td>6</td>
<td></td>
<td>9</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>10</td>
<td>36</td>
<td>4.99</td>
</tr>
<tr>
<td>UP</td>
<td>-</td>
<td>9</td>
<td>1</td>
<td>21</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>10</td>
<td>59</td>
<td>8.18</td>
</tr>
<tr>
<td>Micro-component</td>
<td>-</td>
<td>7</td>
<td>3</td>
<td>29</td>
<td>-</td>
<td>178</td>
<td>34</td>
<td>2</td>
<td>23</td>
<td>276</td>
<td>38.28</td>
</tr>
<tr>
<td>Indifferent</td>
<td>1</td>
<td>21</td>
<td>7</td>
<td>57</td>
<td>-</td>
<td>49</td>
<td>34</td>
<td>24</td>
<td>157</td>
<td>350</td>
<td>48.54</td>
</tr>
<tr>
<td>Total N</td>
<td>1</td>
<td>43</td>
<td>11</td>
<td>116</td>
<td>2</td>
<td>233</td>
<td>70</td>
<td>45</td>
<td>200</td>
<td>721</td>
<td>99.99</td>
</tr>
<tr>
<td>Total %</td>
<td>0.14</td>
<td>5.96</td>
<td>1.53</td>
<td>16.09</td>
<td>0.27</td>
<td>32.32</td>
<td>9.71</td>
<td>6.24</td>
<td>27.73</td>
<td>99.99</td>
<td></td>
</tr>
</tbody>
</table>

Table 5

Similar observations were made on the primary blanks of 39 of the transformed tools. Twenty-seven (69%) have been manufactured on blades or bladecy flakes. Their average width and thickness constitute 24.96 and 8.59 mm, respectively. Twelve artifacts are large flakes, one of which most likely resulted from the preparation of a bifacial piece.

The large primary dimensions of biface objects are also confirmed by the presence of comparatively large flakes among the numerous biface waste flakes, which have no metric consistency with the available bifacial tools.

Table 5 provides information on the presumed position of the tool blanks in the technological chain of utilization of raw materials. The following groups of blanks with respect to their more likely origins are emphasized: I – testing of raw materials; II – initial decortication of nodules; III – reshaping of cores or half-made bifacial objects; IVa – reshaping of flake tools; IVb – resharpening of bifacial tools; IVc – modification of pre-shaped flake tools; and finally the category of “indefinable”.

It seems that the appearance of artifacts as Middle and/or Upper Paleolithic, is reflected in the micro-components that comprise both retouched micro-flakes and micro-blades made from all types of available blanks.

Thus, the primary composition of the industry includes: a) massive and wide blades/bladecy flakes (probably struck by parallel single-platform volumetric cores); and b) large bifacial pieces. Retouched flake tools and bifacial tools and/or pre-forms, and probably certain quantity of raw materials by way of blanks and tested pieces have been procured and brought to the site. The following techniques were chosen for further transformation of the initial flint artifacts: intentional fragmentation, reshaping and rejuvenation, thinning that includes core-like thinning, knapping of bifacial blanks and largest blades and flakes, as well as knapping of raw material pieces. Two cores are inferred to be the products of centrifetal knapping as determined by their morphology; one of them is bifacial. A comparatively high frequency of faceted butts points to the application of the Middle Paleolithic mode of core reduction. Biface waste flakes demonstrate the usual Middle Paleolithic appearance. Prevalence of lipped platforms reflects soft hammer use. The Mira sample shows frequent evidence of trimming on the exterior margin of the striking platforms of the majority of flake products (trimming = 44.36), which is very common with the Upper Paleolithic mode of reduction (Girya and Nekhoroshev, 1993). Thus, Mira Layer I demonstrates a mixture of Middle and Upper Paleolithic technological features.

Typological aspect of Mira Layer I assemblage

The typological variability of this industry shows evident amalgamation of those features, which are traditionally understood as either Middle or Upper Paleolithic ones (Table 6). These are a combination of Middle and Upper Paleolithic elements including those of the Aurignacian industries. Table 7 summarizes the numbers and
Mira Layer I: Typological composition of tools on flakes

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>Category</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mousterian point</td>
<td>13</td>
<td>Krems point</td>
<td>4</td>
</tr>
<tr>
<td>Canted point</td>
<td>3</td>
<td>Micro-point</td>
<td>7</td>
</tr>
<tr>
<td>Simple sidescraper</td>
<td>3</td>
<td>Dufour bladelet</td>
<td>15</td>
</tr>
<tr>
<td>Double sidescraper</td>
<td>2</td>
<td>non-geometrical microliths</td>
<td>138</td>
</tr>
<tr>
<td>Canted sidescraper</td>
<td>5</td>
<td>Truncations</td>
<td>6</td>
</tr>
<tr>
<td>Convergent sidescraper</td>
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<td>Scaled pieces</td>
<td>20</td>
</tr>
<tr>
<td>Double convergent sidescraper</td>
<td>2</td>
<td>Borer</td>
<td>8</td>
</tr>
<tr>
<td>Sidescraper</td>
<td>3</td>
<td>Blade retouched</td>
<td>45</td>
</tr>
<tr>
<td>Combined tool</td>
<td>15</td>
<td>Bladelet retouched</td>
<td>50</td>
</tr>
<tr>
<td>Endscraper</td>
<td>36</td>
<td>Flake retouched</td>
<td>81</td>
</tr>
<tr>
<td>Burin</td>
<td>5</td>
<td>Micro-flake retouched</td>
<td>87</td>
</tr>
<tr>
<td>Points</td>
<td>18</td>
<td>Fragments of tools</td>
<td>153</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>721</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

frequencies of well-shaped macro-forms with reference to their traditional terminology and periodization. Middle Paleolithic types are the points and sidescrapers on flakes (Fig. 4). The presence of canted points, various sidescrapers, and both thinned sidescrapers and points must be emphasized. Upper Paleolithic types make up for a well-defined group of endscrapers, among which the subtriangular endscraper with retouched lateral edges is morphologically characteristic (Fig. 5). There are no carinated forms that would indicate an Aurignacian affiliation, although many of endscrapers are rather thick. Burins are few and show no resharpencing; angle burins prevail.

Special attention is paid to the bifacial tools, combined tools, retouched and backed bladelets, and retouched and used micro-flakes.

Bifacial tools of layer I are represented by four complete forms as well as a series of fragments. There are 16 complete and fragments (tip pieces) of leaf-shaped points and regular points, one convergent sidescraper, and 15 indefinable fragments (Fig. 6). Plano-convex profiles are the most common. As a rule the retouched edges are associated with more convex surfaces. The method of initial rough flaking and further retouching corresponds to the characteristic fashioning of similar objects across central and eastern European Micoquian of Middle Paleolithic age (Bosinski, 1967; Wetzel and Bosinski, 1969). At the same time, there are no signs of technical innovations inherent in Upper Paleolithic bifacial manufacture (Bradley et al., 1995; Girya, 1997), and recognized in eastern European EUP industries such as the Streletskaian in the Don basin and Buran-Kaya III: C in Crimea (Rogachev and Anikovich, 1984; Marks and Monigal, 2000; Chabai, 2004). The assemblage of Mira layer I contains fine examples of true bifacial tools with fine lateral retouch (two slightly asymmetrical points and one leaf point (Fig. 6a-c) and one example of a completely exhausted bifacial form (formally defined as a leaf point; Fig. 6d). From the typological viewpoint, the above

**Table 6**

<table>
<thead>
<tr>
<th>Macroliths</th>
<th>12</th>
<th>26</th>
<th>35.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle Paleolithic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>point</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sidescraper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Paleolithic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>endscraper</td>
<td>42</td>
<td>47</td>
<td>64.4%</td>
</tr>
<tr>
<td>burin</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fig. 4. Mira layer I flint artifacts. 1 – canted point with ventral thinning opposed to tip; 2 – canted sidescraper/point with opposed ventral thinning; 3 – Mousterian point/pointed blade; 4 – Mousterian point with ventrally thinned base; 5 – double canted sidescraper; 6 – Mousterian point/fragment of Mousterian point-endscraper; 7–8 – simple sidescraper; 9 – canted sidescraper; 10 – double convergent sidescraper (limace)

mentioned asymmetrical points have direct analogies in the context of the Middle Paleolithic Micoquian (or Keilmesser group; Bosinski 2000–2001), while leaf points are known both European Middle and Upper Paleolithic contexts.

The category of combined tools include 15 pieces. There are various combinations of endscrapers, sidescrapers, points, scaled thinnings, etc. The examples of endscrapers–Mousterian points (Fig. 5d–f) are the closest analogies to the above-mentioned subtriangular laterally retouched endscrapers. The presence of combined
tools demonstrates the coherent character of Middle and Upper Paleolithic attributes in the assemblage under discussion.

Retouched and used (i.e., with retouch of utilization) bladelets comprise several dozen pieces. There are rather atypical inversely retouched lamelles (Fig. 7c–i) and Krems-like points (Fig. 7a–b), micro-truncations, and a series of morphologically indeterminate pieces with light, often partial, edge retouch. The major portion of these artifacts represents the products of slightly elongated micro-flakes appearing in the
Fig. 6. Mira layer I flint artifacts: 1 – point on fragment of plano-convex biface; 2 – bifacial leafpoint; 3 – plano-convex bifacial point with back or backed knife; 4 – bifacial leafpoint-like form, exhausted through knapping

course of reshaping and rejuvenation of flakes and more rarely of bifacial tools. They have rather short proportions and occasionally a twisted profile. Dufour-like bladelets at Mira are rather atypical and they are not consistent with respect to the morphology of the used blanks or the method of edge retouching. Some of them are similar to the Dufour bladelet subtype, while others resemble more closely the Roc de Combe subtype (Demars and Laurent, 1989). There is no need to suppose the reduction of core-like pieces to explain the origin of these artifacts. The analysis of the chips resulting from retouch, accumulated in Mira layer I, demonstrates the presence of more than four hundred atypical bladelets, of which 149 are straight in profile, 136 are slightly curved, 73 are curved, and 72 are twisted (Fig. 7j–l). Worth noting is the presence of regular retouched bladelets.

The next highly unique feature of the Mira layer I assemblage is the presence of a large series of micro-flakes with blunted transverse edges, either intentionally retouched or due to use-wear resulting in retouch. These artifacts, provisionally named as "non-geometrical" microliths of Mira type, number ca. 140 pieces and represent mostly short trapeze-like chips (Fig. 7:16–7:31). Sometimes the retouched edge is along the striking axis or obliquely to the striking platform. Retouch on the two-edges is rare. Some specimens bear what seems to have been the result of use-wear damage (Fig. 7:17, 7:19, 7:26, 7:28) frequently associated with the ventral surface of the edge opposed to the retouched one. The blanks of these artifacts are the rejuvenation or resharpening flakes of uni-or bifacial tools. Hence, they are very small in size and their dimensions hardly exceed 20 mm in length or width. To our knowledge these artifacts are not known from other European Paleolithic assemblages of comparable and more recent age. We suggest that Mira type non-geometrical mi-
Fig. 7. Mira layer I flint artifacts: 1–2 – Krems-Dufour point; 3–9 – Dufour bladelets; 10–12 – bladelets; 13–14 – micro-points on bladelets; 15 – micro-point on waste flake of reshaping of tip of bifacial pointed tool; 16–26, 27–29, 31 – non-geometrical microliths of Mira type on waste flakes of resharpening and reshaping of flake tools; 30 – non-geometrical microlith of Mira type on waste flake of resharpening and reshaping of bifacial tool.

croliths represent, although morphologically not compatible, a similar idea to the use of micro-components in the late Aurignacian assemblages of eastern European. Employing tiny waste blanks and retouching them in order to have a secondary worked edge is the common concept between Mira I and the other assemblages.

The appearance of the original micro-compo-
ponent of Mira layer I, as well as the Aurignacian-like bladelet, have to be understood as an independent innovation under the circumstances of a scarcity of raw materials. On the other hand, it cannot be excluded that there was either direct or indirect impact by the Aurignacian on the local groups, which resulted in imitation of the use of micro implements. In any case, the currently available data are not sufficient for resolving this question.

From the perspective of both typology and technology, the Mira layer I industry demonstrates the coherent presence of Middle and Upper Paleolithic features. It seems originally to have been oriented toward the manufacture of blade/bladelet and bifacial blanks that have undergone a substantial secondary transformation. An extremely high rate of additional transformation of the lithic artifacts is probably due to mass fragmentation, knapping and re-shaping of curated lithic artifacts.

**BONE AND ANTLER IMPLEMENTS**

Bone and antler artifacts were found only in layer I. The assemblage consists of numerous complete and fragmented retouchers, several fragments of points (?) and two polishers.

There are many (up to 30) retouchers mostly made on the diaphyses of the long bones of ungulates. These tools are similar to those known elsewhere, especially in the context of bifacial Middle Paleolithic industries. Both polishers are complete, one of them is prepared on fragment of long bone and demonstrates traces of intentional shaping through scraping.

The assemblage contains two fragments of tips of points (awl/s?) with flattened cross-section. Both fragments are small-sized ($34 \times 12 \times 5$ and $14 \times 8 \times 5$ mm) and one of them was formed on deer antler (Fig. 8a). There is a possibly mid-portion of a needle ($7 \times 2 \times 2$ mm), thoroughly rounded in cross-section (Fig. 8b). Finally, a shaft of an antler (?) with an artificial hollow containing a broken flint tool completes the collection.

**BONE, TOOTH, AND AMBER ORNAMENTS**

These objects were uncovered only in Mira layer I. There is a series of ten complete and fragmented perforated fox and polar fox teeth.
DISCUSSION AND CONCLUSION

The combination of Middle and Upper Paleolithic attributes in the materials of Mira layer I is directly related to the well-known debate concerning of the Middle to Upper Paleolithic transition in eastern Europe. Layer I industry cannot be assigned to a genuine chronologically initial Upper Paleolithic, although there are grounds to consider it as a "transitional" one.

The problem of the Middle to Upper Paleolithic transition is associated with the replacement of Neanderthals by physically modern people, a subject that remains highly controversial in the Stone Age archaeology of Europe. It is actually a problem of the "pre-Aurignacian" Upper Paleolithic, which is extremely variable and exhibits no links with the preceding Middle Paleolithic and has no continuation in the subsequent Upper Paleolithic records. In eastern Europe industries such as Kostenki 12: IV, V, Kostenki 14: IVb and Kostenki 17: II in the Don basin are all dated to ca. 40–42 ky BP (Anikovich et al., 2004; Sinitsyn et al., 2004) and, probably, the 38–39 ky BP site of Sokimtisa in the Ukrainian Transcarpathians (Usik et al., 2004). Sometimes the term "initial Upper Paleolithic" is proposed for these east European industries (Hoffecker et al., 2003). Nevertheless, it must be stressed that all of the chronologically early Upper Paleolithic show no signs of evolution from Middle Paleolithic background. In this sense their "IUP" position is justified only by the range of their early age.

The traditional European Early Upper Paleolithic represented by Aurignacian and local transitional industries like the Castelperronian, Uluzzian, Szeletian, Bohunician are easily recognizable in eastern Europe. During the period between 36–28 ky BP Aurignacian occupations are known in the Don area (Kostenki 14, "horizon of volcanic ash"; Kostenki I: III), in Crimea (Suteren I), in Prut-Dniester interfluve (Sinitsyn, 2002; Demidenko et al., 1998; Haesaerts et al., 2003). Archaic or, in other terms "transitional" UP industries are known in the Don basin (斯特列茨卡伊 in Kostenki 12: III and 1a, Kostenki 1: V, Kostenki 6; Gorodtsov in Kostenki 14: 2, Kostenki 12: 1; Kostenki 15; Kostenki 16), western Ukraine (Kulyčivka), in Middle Dnieper (Mira: I), and in the Crimea (Буранны-Кая III: C) (Rogachev and Anikovich, 1984; Anikovich, 1999, 2004; Meignen et al., 2000; Stepanchuk and Cohen, 2000–2001; Stepanchuk et al., 2004a; Marks, 1998; Marks and Monigal, 2000a). The final stage of the period is marked by the appearance of Gravettian occupations at Kostenki 8: II (Don area), Mira: II/2 (Middle Dnieper), Mołodowa and Mitoc-Malul-Galben (Prut-Dniester) (Praslov and Rogachev, 1982; Stepanchuk et al., 2004a; Chernysh, 1987; Goretski and Ivanova, 1982; Ivanova and Tsetlin, 1987; Haesaerts et al., 2003). With the rise of the Gravettian at the end of early stage of the Upper Paleolithic and the further transformations of the Upper Paleolithic, this set of complex culture is known across Europe (Djindjian et al., 1999; Amiranov, 1998; Kozlowski, 1986).

Chronologically, and sometimes spatially, the Early Upper Paleolithic of eastern Europe is contemporary with the late Middle Paleolithic of the region (Sinitsyn and Praslov, 1997; Cohen and Stepanchuk, 1999; Chabai et al., 1998). The most convincing and reliable data on the late chronological position of the regional Middle Paleolithic is reported for the Crimea (Chabai, 2004). To date, approximately 30 occupation episodes have radiocarbon determinations younger than 40 ky BP, of which eight postdate 30 ky BP (Stepanchuk et al., 2004b). Both the Middle Paleolithic Micouquian (Заскальня VI, Заскальня V, Пrolom I, Prolom II, Buran-Kaya III, etc.), and the typical Mousterian (Atlasheh Grot, Kabazi II, Shaitan-Koba II, etc.) occupy the same chronological position. The temporal contemporaneity of the Upper and the Middle Paleolithic industries of the Crimean peninsula is supported by the superposition of corresponding occupations.
within a single sequence such as the archaic Upper Paleolithic of Buran-Kaya III: C that overlies the Middle Paleolithic of Buran-Kaya: B1 (Marks and Monigal, 2000a, 2000b). The chronological position of the Middle Paleolithic occupations outside of Crimea is known in less detail. Nevertheless, there are both geochronometrically (Zhorov, western Ukraine) and geologically (Belokuzminovka, Donetska area, eastern Ukraine) argued final – postdated to 30 ky BP – ages of some Middle Paleolithic sites in the continental Ukraine (Fiasetski, 1992; Kolesnik, 2003). At present, the dates of the latest MP in the basins of the Dniester (Molodova I, V. Korman, Rupocen-Izvor) and the Don (Biriuca Balka) are at the range of 40 ky BP and even earlier (Paunescu, 1993; Chernysh, 1987; Matiukhin, 2004). This is while in the northern Caucasus the records suggest the existence of Middle Paleolithic population until ca. 35–34 ky BP (in Barakaievskaya, Monasheskaia and Mezmiskaia (Liubin and Beliava, personal communication; Golovanova et al., 1999).

Therefore, the eastern European records roughly between, 45 and 28 ky BP exhibit a complex picture of coexisting Middle and Upper Paleolithic industries. The first Upper Paleolithic records predating 38–40 ky BP provide no signs of either interrelation with local Middle Paleolithic nor in situ development from a Mousterian background. More complex and ambiguous is the mosaic of simultaneous development of true Upper Paleolithic (Aurignacian and early Gravettian) and archaic Upper Paleolithic (industries combined MP and UP techno-typological and behavioral features such as Streletskaia, Gorodtsovskaya, etc.). The inherent character of the Middle Paleolithic complex in eastern European with industries dated between 36–28 ky BP calls for probably a symbiotic relationship between the local MP traditions and the newer UP industries. The late age of the local Middle Paleolithic occupations suggest the probability of contacts between Neanderthals and physically modern humans. The appearance of the first Gravettian occupations ca. 28–30 ky BP marks the end of Early Upper Paleolithic and the rise of the first pan-European civilization.

The period of Middle to Upper Paleolithic transition in eastern Europe appears with no signs of unilinear gradual and predictable development. Instead, there is a complex picture of co-existence of Late Middle, Early Upper and archaic industries whose chronological correlation, interactions, and liaisons are still poorly understood.

To date, the site of Mira represents a unique instance of well-documented archaeological records recovered in continental Ukraine and directly related to the final stage of the long period of co-existence of Middle and various kinds of Upper Paleolithic cultures in eastern Europe. The large and reliable body of data from the Mira site provides the potential for reviewing in detail many aspects of cultural and behavioral mutations from the perspective of the Middle to Upper Paleolithic transition in eastern Europe. These kinds of data are still under study but the most important points should be stressed as follows: the geological, faunal and absolute chronology unanimously position both the Paleolithic occupations of Mira within the interstadial of the Middle Pleniglacial. Occupations are associated with the Denekamp–Late Vitachi-Bryansk buried soil and aged to about 28 ky BP. The taphonomic characteristics and the richness of the cultural remains make Mira an ideal locus for a case study. The site provides a clear example in layer II/2 of the superposition of the technologically and typologically more advanced industry of definite Upper Paleolithic appearance than the more archaic assemblage of layer I industry where both Middle and Upper Paleolithic features are present. The Mira layer I assemblage yields a combination of traits of the Crimean Middle Paleolithic Micoquian (Kolosov et al., 1993) and the Upper Paleolithic “Aurignacian” technical method with the Gorodtsovian EUP of the river Don area (Synatsyn, 1996, 2000). The lack of any other Aurignacian lithic technological features except for the rather atypical micro-components (and probably blades) and the presence of highly original non-geometrical microliths raises the potential for understanding the probable independent invention of micro-backed implements.

The evidence from Mira layer I hints at the association of the eastern European Szeletoide sensu lato or post-Micoquian industries with Homo sapiens sapiens. Despite the quite developed Middle Paleolithic components, the evidence from Mira layer I displays fully Upper
Paleolithic behavior, including the personal adornments, advanced bone technology, dwelling structures, and evidence of extremely long distance migration.

Although quantitatively limited, the Mira layer II/2 assemblage provides sharply different technology and typology. Broad analogies may be seen in the early Gravettian of central and eastern Europe, although the closest morphological analogies are provided by the south Italian Aurignacian site of Paglicci.

Being chronologically close to each other, the occupations of layer I and II/2 clearly mirror the coexistent occurrences of different traditions, namely (post) Micoquian, Aurignacian and Gravettian in the eastern Europe roughly around 30 ky BP. Indeed, problems of the complex eastern European transition from the Middle to the Upper Paleolithic could not be explained exclusively by data from Mira. Nevertheless, the richness of the site may provide clues to some important aspects of this issue.

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