HUNTING PROJECTILE WEAPONRY OF BYKI LATE UPPER PALEOLITHIC SITES (CENTER OF EASTERN EUROPE): THE COEXISTENCE OF BONE AND FLINT POINTS

Armas arrojadizas de caza de yacimientos del Paleolítico Superior Final de Byki (centro de Europa del Este): Coexistencia de puntas de hueso y puntas de sílex

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ABSTRACT The article deals with a specific Late Upper Paleolithic Byki site complex, situated in the Seim river basin, in the center of Eastern Europe. Main feature of Byki 1, 2, 3, 7 (cultural layers I and Ia) sites is presence of geometric microliths (triangles) in their flint assemblages. The sites' radiocarbon uncalibrated dates are in between 18000 and 16 000 BP. Late Upper Paleolithic human visitors at Byki sites have been not living for a long time there. Byki site fauna collections are characterized by a dominance of ungulate and fur game species, while the rest known Late Last Glacial sites in the center of Eastern Europe and in the Seim river basin show a clear prevalence of mammoth. The aim of the present study was to understand a relationship between bone and flint hunting projectile weaponry at Byki sites. Our study showed a singleness of bone points there, although rather numerous and various bone / antler and ivory artifacts are well known in the Byki assemblages. At the same time, serial flint triangles serving, high likely, as arrowheads, have been basic hunting projectile weaponry elements for Byki site human inhabitants.

Key words: European Late Upper Paleolithic, Byki Sites, Bone and Flint Projectile Hunting Weaponry.

RESUMEN El artículo trata de un complejo específico de yacimientos de Byki del Paleolítico Superior Reciente, situado en la cuenca del río Seim, en el centro de Europa del Este. La característica principal de los yacimientos Byki 1, 2, 3, 7 (horizontes culturales I y Ia) es la presencia de microlitos geométricos (triángulos) en su industria de sílex. Las fechas de radiocarbono sin calibrar se distribuyen entre 18000 y 16000 BP. Los

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visitantes humanos del Paleolítico Superior Reciente en los yacimientos de Byki no han estado viviendo allí durante mucho tiempo. Las colecciones de fauna se caracterizan por el predominio de especies de ungulados y animales de caza, mientras que el resto de los yacimientos conocidos del final del último Glacial en el centro de Europa del Este y en la cuenca del río Seim muestran una clara prevalencia del mamut. El objetivo del presente estudio es comprender la relación entre los proyectiles de caza de hueso y de sílex de los yacimientos de Byki. Nuestro estudio muestra una singularidad de las puntas óseas, aunque se conocen bastante numerosos y diversos artefactos de huesos/asta y marfil de los conjuntos de Byki. Al mismo tiempo, las series de triángulos de sílex que probablemente sirvieron como puntas de flecha, han sido los elementos básicos de los proyectiles de caza para los habitantes de Byki.

Palabras clave: Paleolítico Superior Reciente europeo, Yacimientos de Byki, Proyectiles de hueso y sílex del armamento de caza.

MATERIALS AND METHODS

There was obtained a good material database on the specific Byki Late Upper Paleolithic site complex located on the left bank of Seim river in Desna river basin (Russia) (fig. 1) during last two decades (Grigorieva and Filippov, 1978; Chubur, 2001; Akhmetgaleeva, 2004a, 2004b, 2004c, 2006, 2007, 2008, 2009; Akhmetgaleeva and Burova, 2001-2002, 2008). The main industrial feature of Peny, Byki 1, 2, 3 and 7 (Ia & I layers) sites' flint assemblages is presence of geometric microliths, namely triangles, in a Late Upper Paleolithic archaeological and faunal context. The great similarity of the sites' artifacts points out their generic industrial unity.

The analysis of Byki fauna materials has definitely showed the presence of a boreal sub-complex of so-called Late Last Glacial mammoth faunal complex (studies of A. A. Chubur initially and then by N. D. Burova). Basic hunting animals for human inhabitants of Byki sites were hare, arctic fox, reindeer and horse (*Equus ferus*). Such hunting orientation of Byki sites' humans puts a series of reasonable questions. What tools have been used for hunting of the different animals? How does it connect to the known characteristics of the Byki sites' artifact assemblages? How do the bone and flint points correlate for the Byki sites' assemblages? These questions are tried to be understand now and the present paper represents the first stage of our studies in this field.

There will be discussed some study results for the most representative Byki sites' materials coming from Byki 1 site (excavations of A. A. Chubur) and Byki 7 site, layers Ia and I (excavations of N. B. Akhmetgaleeva) in the present paper. Byki I site has a series of uncalibrated radiocarbon dates around 18000–17000 BP. Byki 7 site also has a series of radiocarbon dates that puts layer I to *ca*. 17000 BP uncalibrated and layer Ia to *ca*. 16000 BP uncalibrated (table 1).

The analyses of Byki sites' bone and flint points was realized through both typological and use-wear studies.

The typological study is based on a regular approach including blank data and retouch characteristics for flint triangles and morphology data for bone points. Also, if it was possible, some projectile damage has been recognized for the flint triangles.

Fig. 1.—Localization of the Byki sites.

TABLE 1
RADIOCARBON DATES (UNCALIBRATED)

Peny	21 600±50 (LE-1434a) 23 100±280 (LE -1434b) 25 200±350 (LE -1434в)
Byki-1	17 570±120 (GIN -8408) 17 640±130 (GIN -8409) 17 200±300 (GIN -8408a) 16 600±180 (GIN -8409a)
Byki-7 Layer Ia	17 320 ± 640 (LE – 7794) 16 000 ±130 (GIN – 11755) 14 300 ± 370 (GIN – 13082)
Byki-7 Layer I	17 000 ± 90 (GIN – 11753) 15 600 ± 400 (GIN – 13084)

The flint triangles will be compared to some basic European Magdalenian triangle data being the only comparable tool type within the context of the European Late Upper Paleolithic record. At the same time, some other comparisons will be done with the chronologically later Pan-European Final Paleolithic and Mesolithic triangles.

The use —wear study for both micro— and macro analyses of worked bone and flint objects are based on methodology developed by the Saint Petersburg Use-

Wear Lab (Institute of History of Material Culture, Russian Academy of Sciences) (e.g., Semenov 1952, 1957; Semenov and Korobkova, 1983; Filippov, 1977, 1983; Schelinsky, 1983; Korobkova and Schelinsky, 1996). All bone artifacts have been studied with magnification up to 84× using the "Altami CM-TII" entity microscope. Flint tools were also analyzed using a metallographic microscope "Polam" (magnification up to 200×). The realized analysis was also based on samples of experiments conducted by Akhmetgaleeva.

THE BYKI SITES' BONE POINTS

1. Strictly speaking, points on organic materials are represented by a few items in the Byki assemblages but the associated some other worked bone pieces allow us to understand basic point production processes that happened at the sites. All the points can be named Byki type, which includes elongated points with a natural groove on one side (fig. 2). This type of tips got its name, because it has no analogues among other types of bone tips.

There were found ca. 300 worked bone pieces at Byki 1 site. There are 70 really produced items (supposed tools) and their fragments among the *ca*. 300 pieces. But only 3 items can be recognized as hunting projectile weaponry pieces there that is just 4,3% of all the bone tools and 1,0% of all the worked bone pieces there. All Byki' points were cut off from ungulates' bones (figs. 2B, 3 y 4:1).

The assemblage of Byki 7 site, layer I includes 127 worked bone pieces and 52 of them are supposed tools and their fragments. The Byki' points on again ungulates' bones account only 2 items that is only 3,8% of all the bone tools and 1,6% of all the worked bone pieces.

There were found only 40 worked bone pieces at Byki 7 site, layer Ia, although the layer was excavated for a much larger area in comparison to layer I. Ten items were recognized as produced items. Only a single fluted Byki' point produced on a reindeer's antler have been identified there (fig. 2A:6). It is 10% of all the bone tools and 2,5% of all the worked bone pieces.

2. All the Byki' points have been basically manufactured through one and the same technological tradition (Akchmetgaleeva, 2011). It was recognized *an interchangeability of the used raw materials* that also influenced some differences in a technological chain of the point production (figs. 3; 4). Basically, metatarsal bones of reindeer and horse, and long tubular bones of horse were used for the point manufacture. First, it was sawed off the distal end of a bone in the very beginning of the point production (fig. 5:3). A blade shaft was taken out after making two longitudinal slots (figs. 4:1; 5:1). First slot was usually made along central longitudinal axis of the bone blank and second slot was made on the reverse side of the blank, closer to its lateral face. An average length of the bone blank had to be *ca*. 18 – 22 cm. Then the blade bone shaft was planed/scraped (fig. 5:2). The only untreated part of the bone blank was its internal concave part with a width up to 0,4 cm. As

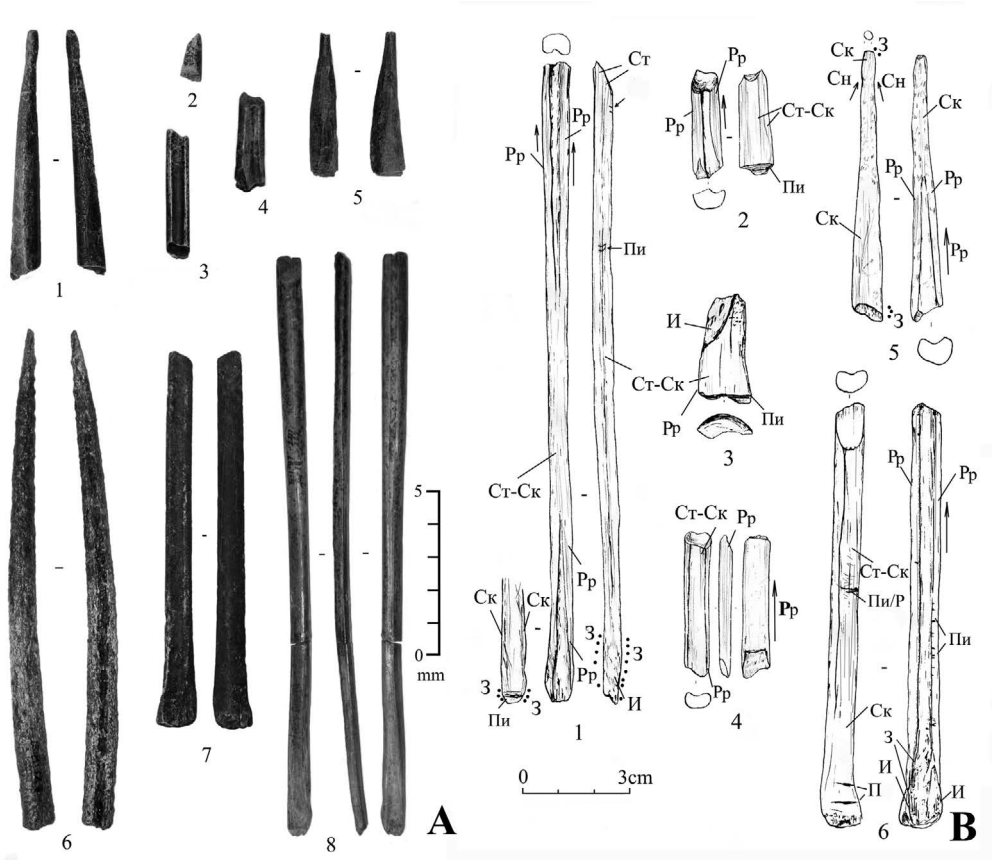

Fig. 2.—A) Bone artifacts: 1,7, fragments of projectile points from ungulates' bones (Byki-7, layer I); 2,5, points from ungulates' bones (Byki-1); 3,4,8, fragments of projectile points from ungulates' bones (Byki-1); 6, projectile point from reindeer's antler (Byki-7, layer Ia). B) Worked bone pieces: 1,2,4, fragments of projectile points from ungulates' bones (Byki-1); 3, waste product of a projectile manufacture from an ungulate bone (Byki-1); 5,6, fragments of projectile points from ungulates' bones (Byki-7, layer I). [Пи – *sawing*; Пи/Р – *notching*; Рр – *grooving;* Ст – *planing;* Ск – *scraping;* Сн – *scraping with pressure, 3 – maximal scuff,* И – *break,* П – *cutting on dismemberment*].

a result of the secondary treatment, there was formed not a deep slot with steep sides, starting from the point's base and becoming narrower to the pointed tip. There were sawn short deliberate transversal incisions in the middle part of points in the end of their secondary treatment (fig. 5:4). Traces the origin of which is associated with damage when used (traces attachment?) kept on one point of the Byki-1 site survived (fig. 5:5). So we see the traces of possibly throwing wear on the one point of the Byki-7 site, 1 layer (fig. 5:6).

There have been traced some basic similarities in production of *the point on a reindeer's antler* with the ones manufactured on the ungulates' bones (fig. 2A:6). The thickest tines of an antler and its beam were taken out by a gradual circular

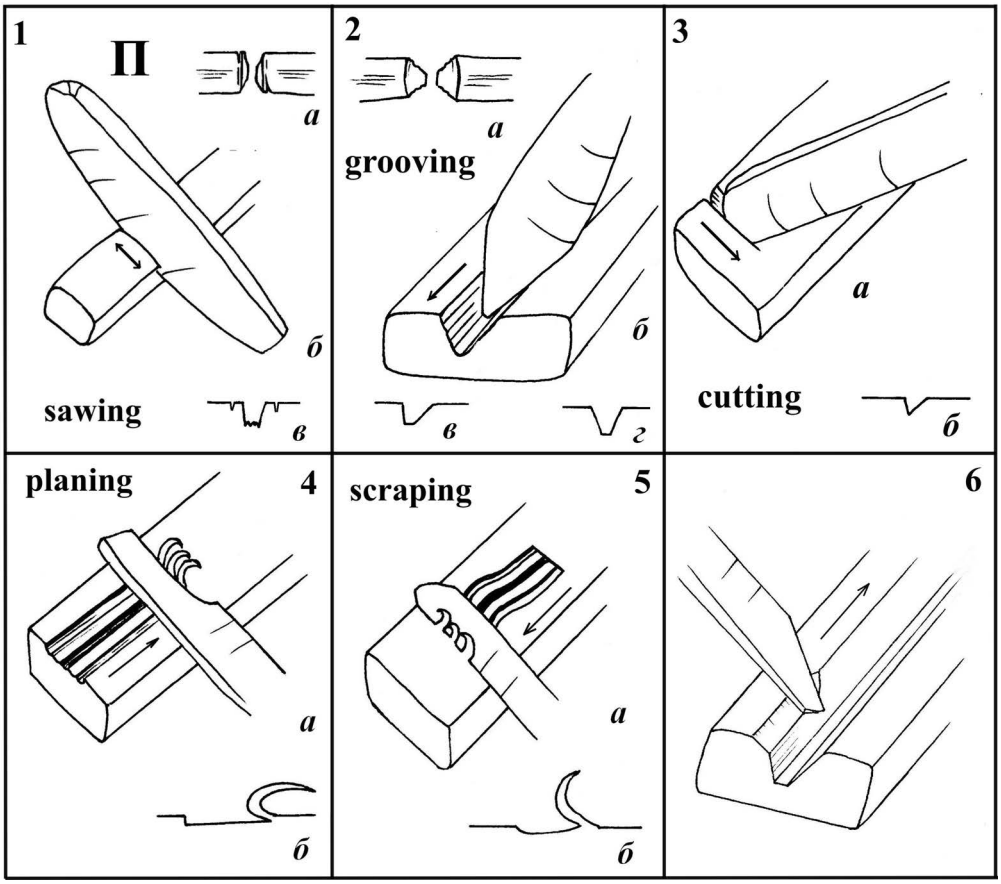

Fig. 3.—Processing techniques of bone/antler reindeer.

chopping. The thinner tines of an antler could be just cut off or even broken off. The point was again manufactured from a blade shaft that has been taken out using two opposite slots made before (fig. 4:2).

3. Analyzing the Byki' points' location in excavation blocks, their fragmentariness and the obvious small quantity, it is possible to say that *we are dealing with the needless fragmented examples*.

4. Taking into consideration the quality of bone blanks and their waste products found at the Byki sites, it is also possible to say that the bone secondary treatment processes did not have one of the main aims namely a serial production of bone projectile weaponry there.

5. *The technology of the natural fluted points' production at Byki sites was rather laborious and raw material wasteful* in comparison to the serial produc-

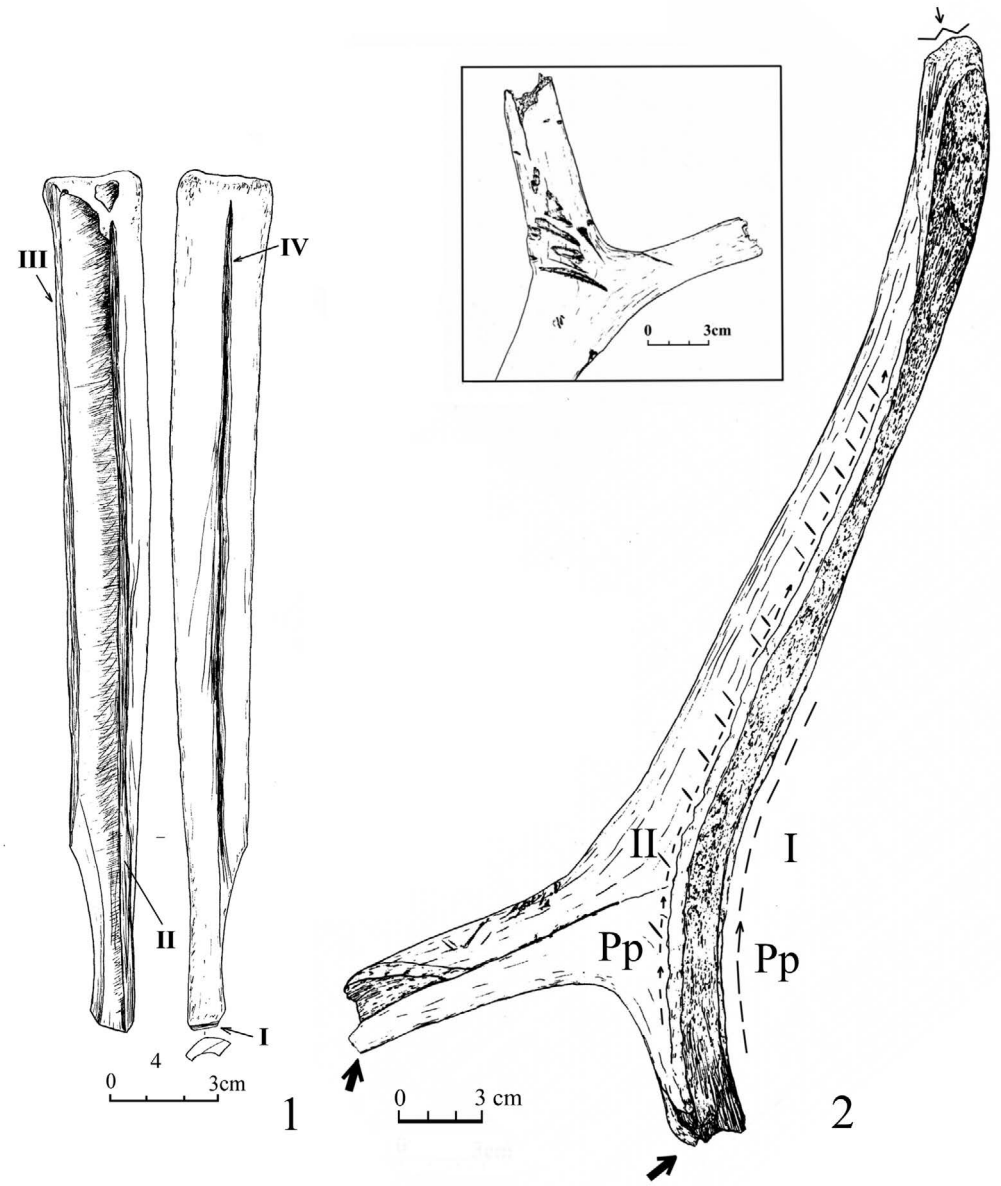

Fig. 4.—Waste products of bone and antler: 1) Raw material to the production of points from ungulates' bone (Byki-1). Sequence of technical operations: *I – transversal sawing; II, III, IV – groove cutting with a burin- like stone tool.* 2) Worked fragment of reindeer's antler (Byki-7, layer Ia) and sequence of manufacture: Pp – *groove cutting with a burin- like stone tool; I – breakage of first slot; II – breakage of second slot and subsequent chopping using an intermediate tool*.

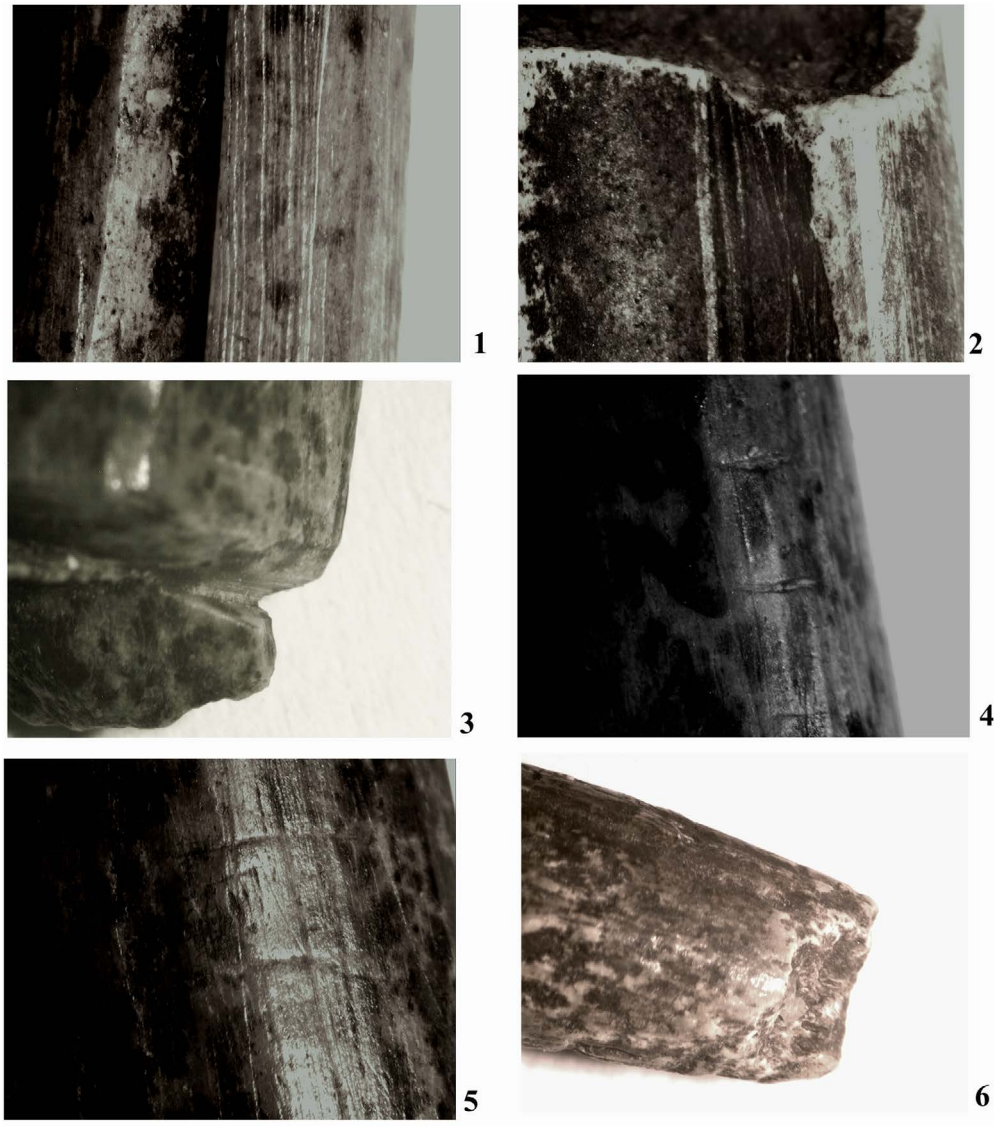

Fig. 5.—1: Traces of groove cutting with a burin-like stone tool on the point n.º 7 in fig. 1A (magnification × 30). 2: Traces of scraping on the point n.º 7 in fig. 2A (magnification × 30). 3: Traces of groove cutting with a burin-like stone tool on the point n.º 7 in fig. 2A (magnification × 30). 4: Short perpendicular sawing lines on edges of point n.º 7 in fig. 2A (magnification × 30). 5: Transverse incisions on edges of point n.º 7 in fig. 2A (magnification × 30). 6: Pointed tip of point n.º 5 in fig. 2A (magnification × 30).

tion of points from shaft blanks received from just one mammoth ivory piece or a reindeer's antler practiced at some other known East European Upper Paleolithic sites (Hlopachev, 2006; Akchmetgaleeva, 2012).

THE BYKI SITES' FLINT TRIANGLES (fig. 6)

1. The morphological and typological analyses of the Byki sites' flint triangles, as well as the rest flint artifacts of the sites, are still in progress. That's why some very basic considerations can be made so far. Keeping in mind that, on one hand, the only Late Upper Paleolithic chronologically about contemporaneous parallel to the Byki flint triangles are the European Magdalenian triangles (e.g., Sonneville-Bordes 1960; Petillon and Langlais, 2011; Straus *et al*., 2012) and, on the other hand, there is also some similarity in between the Byki triangles with the chronologically later Pan-European (including also Eastern Europe) Final Paleolithic and Mesolithic triangles (Kozlowski and Kozlowski 1975), it will be always important to note some similarities and dissimilarities in between the three complexes' triangles. That's because understanding these similarities and dissimilarities should help us a lot in a better understanding the unique Byki triangles.

2. The flint triangles do actually represent the most numerous tool classes in the flint assemblages of Byki 7, layer I and Byki 7, layer Ia, approaching *ca*. 50% of all the recognized tools there. The Byki 1 flint triangles, on the other hand, do account only *ca*. 12% of all tools, occupying the 4th numerical position after burins, end-scrapers and borers; although all the latter three tool classes occur in the Byki 7 two assemblages too. Such the triangle quantitative differences in between the two sites might speak about some definite site function differences in between human activities there.

3. Narrow (not more than 5 cm long), narrow (1,2 – 1,6 cm wide) and thin (0,2 – 0,3 cm thick) blades were main blanks for triangles in Byki. Triangles were rather short (1,0 – 3,6 cm) (Akhmetgaleeva and Demidenko, 2017).

By such blanks, the Byki triangles are similar to some European Final Paleolithic and Mesolithic triangles which are usually manufactured on narrow blades and also some flakes. At the same time, remembering that the very basic blanks for the European Magdalenian triangles were bladelets (blady proportion pieces with a width less than 1,2 cm, according to the classical definition of J. Tixier, 1974), we can say about the blank type real difference in between the Byki triangles and the European Magdalenian triangles.

4. The Byki sites' flint assemblage data do also testify the whole process of triangle production at the sites and not somewhere else, starting with the core blade reduction and finishing with the final triangle retouching and use.

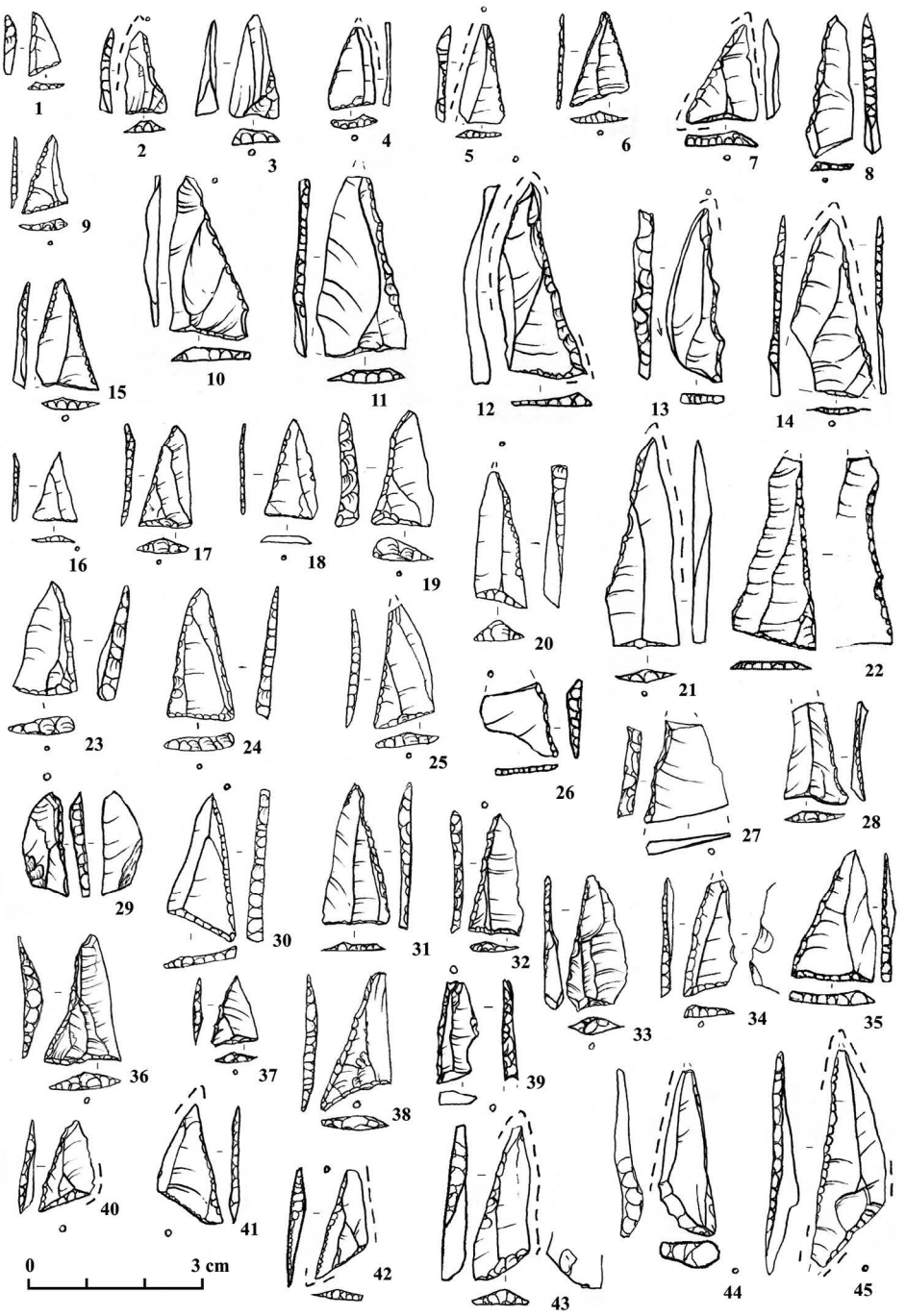

Fig. 6.—Flint triangles: 1-26,29,35 (Byki-7, layer I); 27,28,30-34,36-39 (Byki-7, layer Ia); 40-45 (Byki-1). The dotted lines mark localization of use-wear traces and arrow indicate macro-damage.

5. All the three Byki sites' triangle sets from Byki 1, Byki 7, layer I and Byki 7, layer Ia are characterized by series of both elongated and short items (fig. 6). There is just one basic morphological difference in between the triangles from Byki 1 site and Byki 7, layers I and Ia. The Byki 1 triangles are usually with an obliquely truncated base, while the Byki 7 triangles are characterized by items with both an obliquely truncated and a straight truncated base. The latter Byki 7 triangle sub-type was already additionally named as a triangular point with a backed edge (Akhmetgaleeva 2004a; 2004b; 2004c, 2015). At the same time, all the other morphological features of the three Byki sites' triangles are the same. They have a truncated base and also the retouched one lateral edge with the formed pointed tip by the lateral retouch. The retouched lateral edge is almost always the longest one on triangles. Moreover, the two retouched edges (the lateral edge and the base) are characterized by a real backed abrupt retouch and not by any semi-abrupt and/or flat retouch.

It is possible to summarize shortly the Byki triangles in following way continuing their comparisons with the European Magdalenian and some Final Paleolithic and Mesolithic triangles. By shape and two edges retouched, remembering that the longest lateral edge is usually retouched, the Byki triangles are similar to some Final Paleolithic and Mesolithic triangles. On the other hand, by the proper retouch characteristics – really backed abrupt retouch, the Byki triangles are similar to the Magdalenian triangles, also usually bearing backed abrupt retouch. As a result, the Byki triangles have an intriguing mixture of both Magdalenian and some Final Paleolithic/Mesolithic triangles.

A thorough morphological study of the Byki triangles also has showed one more their similarity to some Final Paleolithic/Mesolithic triangles. This is presence of projectile damage macro traces on some Byki triangles. The projectile damage traces are located on either a pointed tip and/or a lateral edge near the basal part there for both Byki and some Final Paleolithic/Mesolithic triangles. On the other hand, the Magdalenian triangles do usually bear projectile damage, when it is present, on the longest unretouched edge. Such projectile damage data might speak on the Byki triangles' functional role. The European Magdalenian humans were putting flint triangles and also backed bladelets (the latter pieces and also a real core bladelet reduction do not present at all for the Byki flint assemblages) as just lateral components (inserts) of javelins for using them with an atlatl during a hunt (Larsson and Sjostrom 2011). Some Final Paleolithic/Mesolithic triangles, those are similar to the Byki ones by blank, retouch and projectile damage locations, were put as arrowheads for using them on arrows with a bow. Accordingly, we may speculate that the Byki triangles are different from the rather chronologically contemporaneous with them Magdalenian triangles, but still both of them do have the backed abrupt retouch, because of the different their possible functional usage – as either arrowheads or inserts of javelins.

Also, two more interesting observations were made by N. B. Akhmetgaleeva during the process of excavations of Byki 7 site. *First*, some of the triangles, when they were found in archeological layers, had a peculiar patina feature, when a piece was longitudinally half patinated with the not retouched lateral edge and the pointed

tip and another longitudinal part with retouched lateral edge was not patinated (fig. 7:6). *Second*, there was also sometimes clearly recognized presence of several triangles together (3 – 5 pieces) at one spot in an archeological layer that means either a possibility of putting several triangles into an arrow or their restricted manufacture at some special site places. The situation should be again more evaluated and studied.

Finishing with the Byki triangles' morphological characteristics, it is important to note that there were also recognized some pseudo-microburins[1] among the sites' flint artifacts (fig. 7:1-3). These tiny items having the laterally retouched pointed tip and an oblique unretouched basal breakage certainly point out the two important inferences. First, presence of the pseudo-microburins is explained by some mistakes made during the retouching of triangles' lateral edge near the tip, when a too strong blow accidentally removes the tip. That's why the resulted tiny pieces are pseudo-microburins and not at all true micro-burins characteristic for some Final Paleolithic and Mesolithic assemblages. Second, the serial pseudo-microburin presence in the Byki sites' flint assemblages once again confirms production of these geometric microliths at the sites. Adding here the already mentioned some projectile damage traces on some triangles, we are definitely able to postulate that triangles were both produced at the sites and were also used around the sites for hunting purposes with bringing then by the sites' human inhabitants some arrows with still preserved triangles there back to the sites.

6. Some use-wear studies have been already conducted for the Byki triangles. It was established that the use traces data are about the same for all triangle sub-types meaning the triangles' usage for similar purposes. Basically, there is the following combination of use and not use features on the triangles: absence of any wear traces on a majority of the pieces, presence of projectile damage traces on some pieces (fig. 6). Location of linear traces and triangles' projectile damage data indicate oblique position (fig. 7:1,3) of the blade of a triangle as arrowheads of the majority of them (Nuzhnyi, 2008, 2015). Some micro-traces on the triangles' retouched edges also show a contact with a wood, why we can suggest an inserting of the triangles into a wooden shaft of arrows. Results of studies of damage on triangles and their comparison with experimental data (see also Lombard and Pargeter, 2008, 2010; Nushny, 2015), showed different position of triangles in shafts at each Byki site. Angle of inclination of a triangle could be changed as a variation of a projectile point (figs. 7:5, 8 and 9). This fact together with small amount of bone projectile heads compared with flint ones argues against the possibility of use of bone points as probable holders for composite tools. Parameters of shallow grooves also support this.

1. The pseudo-microburins have been only identified for the flint assemblage of Byki 7, layer I so far, as the Byki 1 and Byki 7, layer Ia tiny flint chips were not thoroughly studied yet.

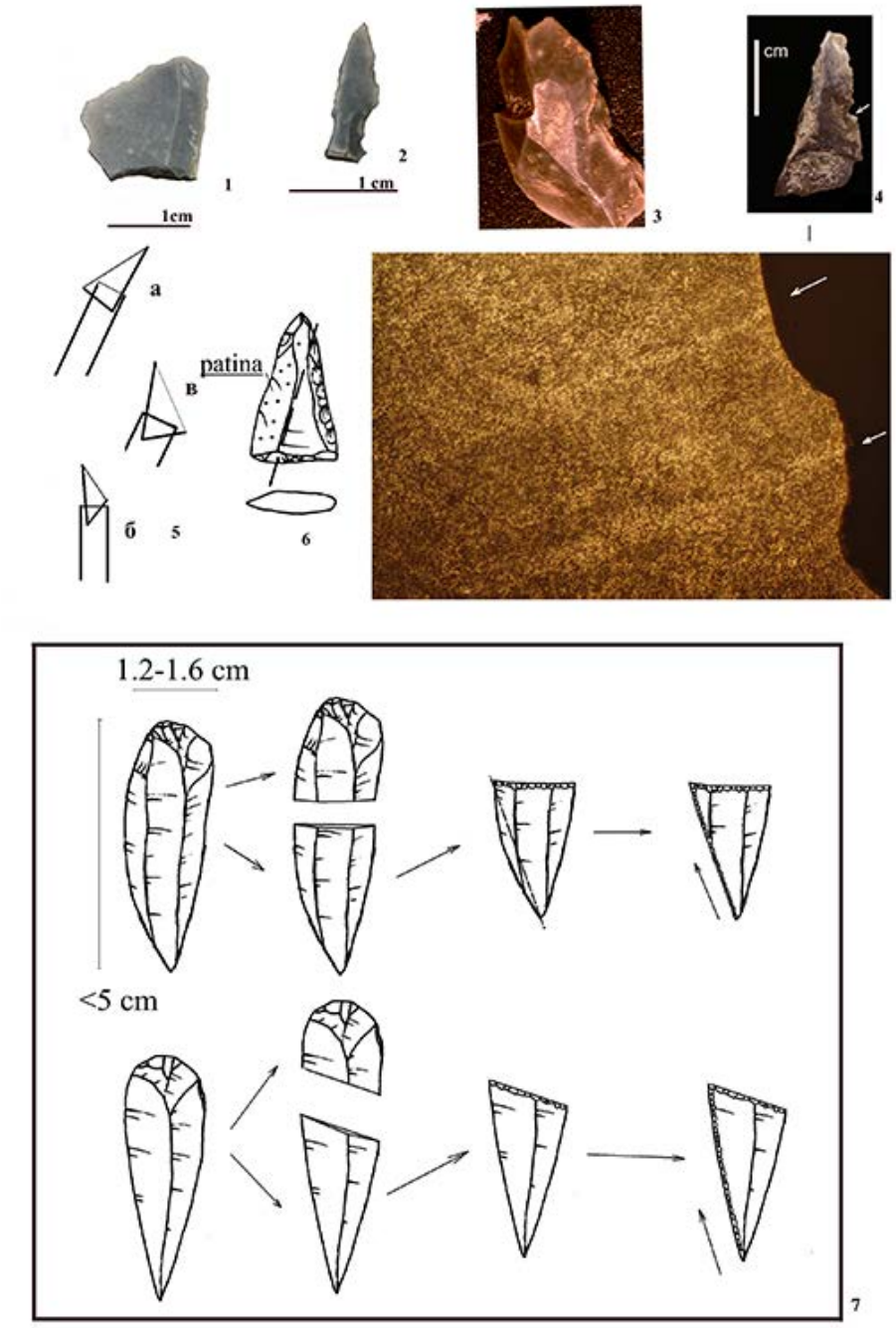

Fig. 7.—1-3, pseudo-microburins (Byki-7, layer I); 4, flint triangle with projectile damage (microfoto magnification ×100) from Byki-7, layer I; 5, the most common procedures for inserting the triangles from Byki sites in the shaft; 6, scheme of patina formation on flint triangles from Byki-7, layer I; 7, scheme of the most typical production of triangles in Byki sites.

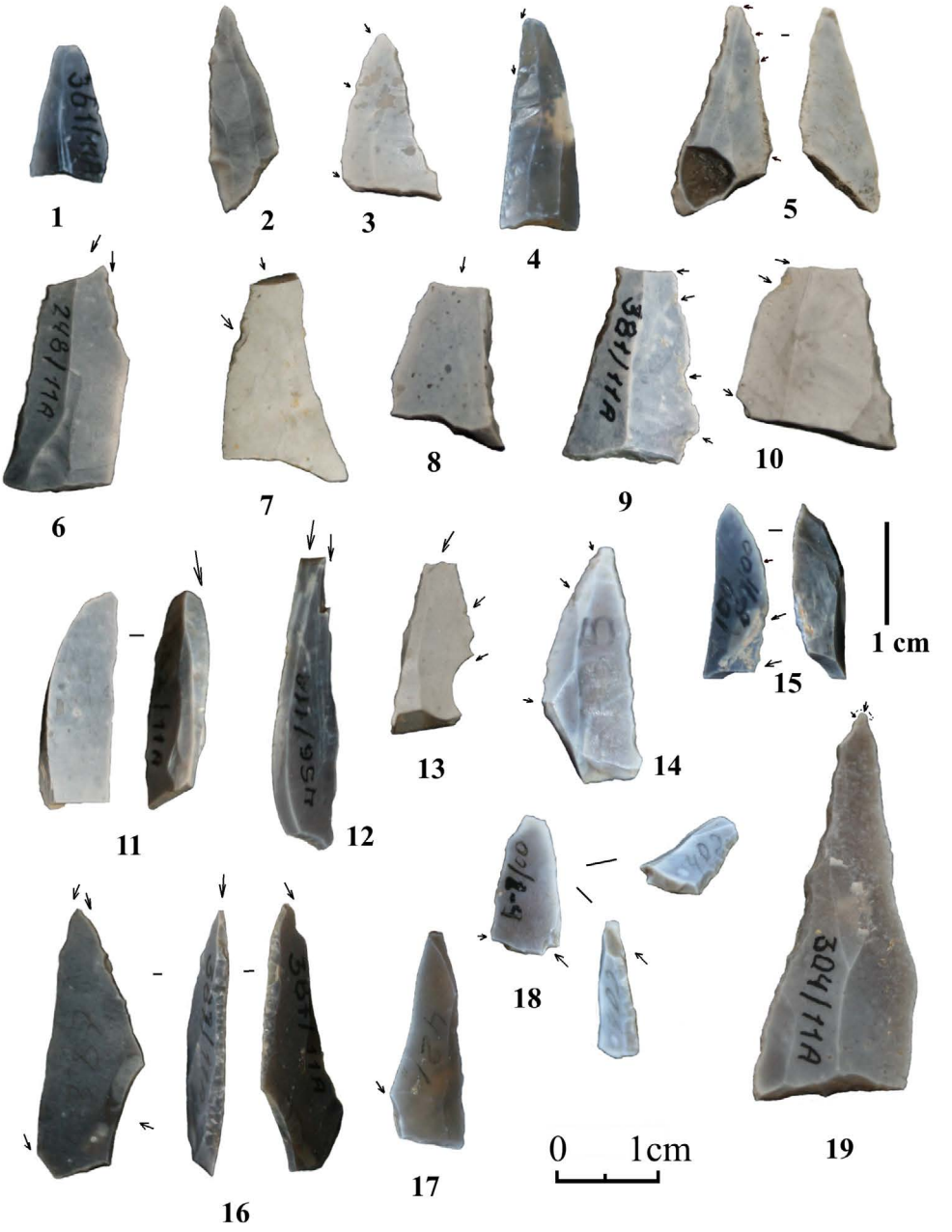

Fig. 8.—Flint triangles: 1,4,6,9,11,12,14-19 (Byki-7, layer I); 2,5 (Byki-1); 3,7,8,10,13 (Byki-7, layer Ia).

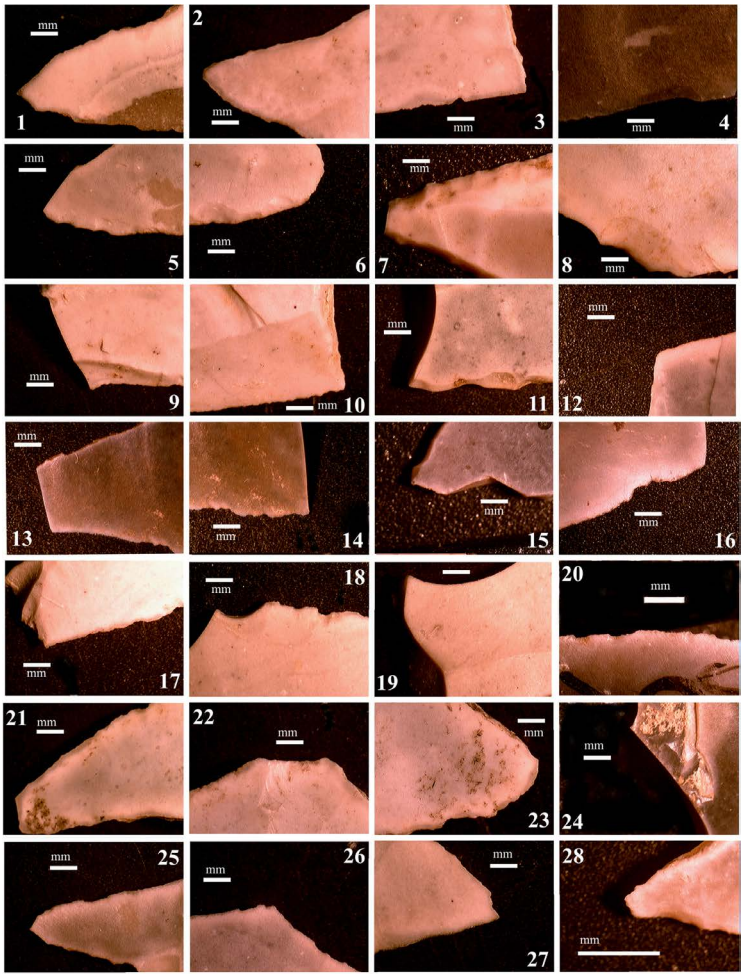

Fig. 9.—Macro photo of the edges of flint triangles and typical damages (photos taken through stereotinocular "Altami CM-TII"). 1: fresh edges on the triangle n.º 93/2014 (Byki-7, layer Ia); 2,3: visually not visible damages on the triangle n.º 12/2014 (Byki-7, layer Ia); 4: center of non-retouched laterals near the corner of the base break on the triangle n.º 117/2013 (Byki-7, layer Ia); 5,6: retouch of throwing wear on the point and the angle of the base from the ventral face on the triangle n 40/2013 (Byki-7, layer Ia); 7,8: burr point tip and diagonal bummer with facets at the angle of the unreturned lateral on the triangle n.º 135/2000 (Byki-7, layer I); 9,10: burr point tip and undamaged base on the triangle n.º 74/2014 (Byki-7, layer Ia); 11,12: pseudo-burins on the point and undamaged base on the triangle n.º 248/2003 (Byki-7, layer I); 13,14: middle fragment of the triangle n.º 322/2013 (Byki-7, layer Ia); 15: pseudo-burins lesions on the point, the triangle n.º 387/2003 (Byki-7, layer I); 16: transverse breakage of the point of the triangle n.º 173/2000 (Byki-7, layer I); 17-19: spin-off on the point, angle of fracture of the retouched lateral and fracture of the base on the triangle n.º 16/2013 (Byki-7, layer Ia); 20,24: the center of the retouched lateral and the angle of its fracture on the triangle n.º 100/2000 (Byki-7, layer Ia); 21-23: visually not visible damage to the point, the angle between the short lateral and the base and the angle between the long lateral and the base on the triangle n.º 27/2014 (Byki-1); 25-27: "fresh" edges on the tip, the angle between the short lateral and the base and the angle between the long lateral and the base on the triangle n.º 35/2014 (Byki-1) (1-19,21-24,25-27, magnification × 15; 20, magnification × 30; 28, magnification × 45).

SOME CONCLUDING REMARKS

Now we can postulate that the fluted Byki' points are represented by a few items in the Byki sites' inventories, whereas the flint triangles, being most likely mainly arrowheads, occupy the most significant role in the hunting projectile weaponry for the sites' human inhabitants. There are some data pointing out a save of flint and bone / antler materials of the Byki sites' human inhabitants that is maybe connected to their highly mobile way of life and/or a remoteness / limitation of the used raw materials.

Both the Byki bone / antler points and flint triangles do not exactly correspond to the already known tool types serving as "cultural-chronological identifiers" for many various European Late Upper Paleolithic industries. These elements of hunting projectile weaponry at Byki sites, as well as some other very special artifact types of the assemblages not discussed in the present paper (e.g., Byki 1 site's flat elongated shouldered borers produced on mainly ribs and some long bones of reindeer and horse –Akhmetgaleeva 1999, 2006), are indeed very specific ones that make the sites' archaeological context as the very distinct one among all known Late Upper Paleolithic industries in Europe. We did not find yet any really archaeologically comparable materials for the Byki data, although some European Magdalenian-like elements could be still distinguished. Technological peculiarities of Byki triangles especially retouching of the longest lateral side are connected with hafting of a microlith in a shaft. This possibly explains difference of Byki triangles from Magdalenian ones and presence of triangles in collections of Byki sites. At the same time backed microblades were used as side inserts of projectiles at synchronous sites of Eastern Europe, and triangle there never made series

The latter comparison fact opens a door for some other comparative studies for the Byki materials within the European Late Upper Paleolithic context.

For now, it is only possible to suggest that the discussing Byki elements of the projectile hunting weaponry might reflect an optimal choice for the sites' humans to use them in a hunt of both small-sized fur-bearing animals (hare and arctic fox) and ungulates (reindeer and horse). The flint triangles were the most preferable element of the weaponry.

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