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The late Gravettian of Borshevo 5 in the context of the Kostenki-Borshevo sites (Don basin, Russia)

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ABSTRACT

The multilayered site Borshevo 5 is one of the recently excavated Upper Paleolithic settlements in the Kostenki-Borshevo location (Russia). Borshevo 5 has been investigated over a total area of 130 m^2 since 2002. Five habitation levels of the Upper Paleolithic were established. The uppermost first cultural layer was associated with the Gravettian ^{14}C dated 22–20 ka BP uncal.

It was discovered in the excavation area 2009–2010 that the first cultural layer upslope was split in two separate cultural horizons divided by a sterile loam. Horizons 1a and 1b were associated with two different paleosols. Both of the horizons yielded almost typologically identical stone assemblages.

The stone industry was based on the exploitation of mainly Cretaceous and some Carboniferous flints as well as quartzite, sandstone, and slate raw materials. According to the typology of tools, 1a and 1b assemblages of Borshevo 5 have analogies in the neighboring Gravettian sites Kostenki 9 and Kostenki 4. A clear feature of the assemblages is the occurrence of slate and dolomite artifacts treated by polishing. It seems that this kind of culture had no relations with the typical Eastern Gravettian Kostenki-Avdejevo culture. According to the features in knapping (wedge cores and small blades size), as well as tool composition (Gravette and Vachon points), Borshevo 5 should be called late Gravettian or early Epigravettian. The cultural roots of these communities may originate from the Central European context such as Milovice (upper layer), with similar ^{14}C dates and stone industries.

1. Location

The multi-layer site Borshevo 5 is situated in the Kostenki-Borshevo location of the Upper Paleolithic in the middle course of the river Don. Borshevo 5 is the one of the southernmost sites of this location in the vicinity of the Borshevo 2 and Borshevo 6 sites. The position of the site is associated with the second terrace of the Don valley (about 35 m above water level) on the right side of a large ravine mouth. The surface of the terrace rapidly declines towards the north. Borshevo 5 occupies the central terrace adjacent to the eroded bedrock chalk plateau (Fig. 1).

2. History of research

The field survey of the site started in 1998 after the local landowner had brought stray finds to Kostenki museum. In the first test pit, the cultural layer comprising flint artifacts and mammoth bones deposited in situ below the chernozem bed was uncovered. The stone assemblage was attributed to the Gravettian (Karikh et al., 1999).

During the 2002–2012 excavations about 120 m^2 of the site was uncovered at depths from 2 to 6 m. Five cultural layers were recorded. The uppermost Gravettian one was associated with a paleosol horizon deposited in the loessic loam bed.

3. Stratigraphy

The most complete stratigraphic sequence in Borshevo 5, about 6 m thick, was recorded in testpits 3–5 in 2002–2003, and in excavation area I in 2004 (Lisitsyn, 2004) and adjacent excavation area III in 2008. The top of the column with the Gravettian finds was as follows:

0.0–0.40 m – plow layer;
0.40–0.90 m – modern chernozem soil;
0.90–2.40 m – non-homogeneous loessic loam with dispersed chalk gravel.

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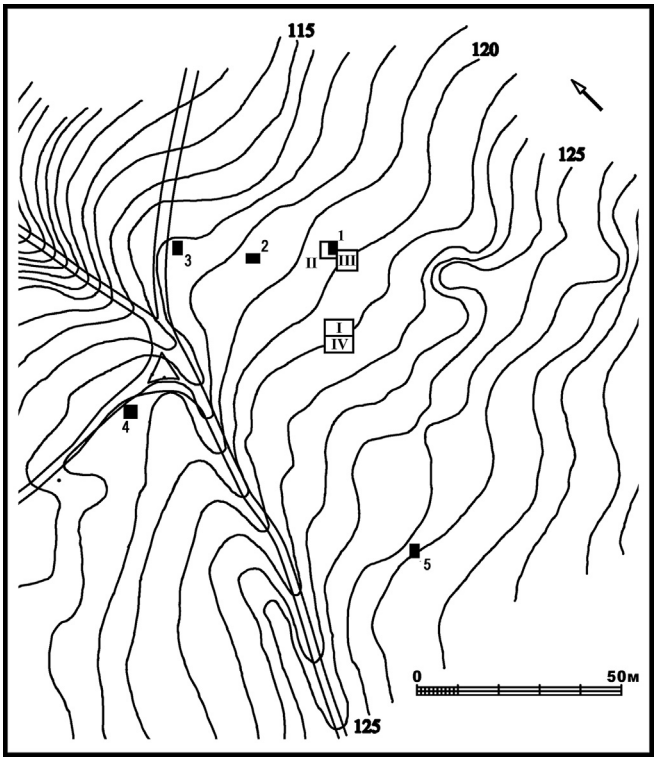

Fig. 1. Topography of Borshevo 5 with plotted testpits (black) and excavation areas (unshaded).

Inside the loessic loam stratum from 1 to 2 m below surface, a bed consisted of two contiguous paleosols. This pedocomplex contains artifacts of the Gravettian cultural layer. The upper one (thickness 10–15 cm) with separate light-brownish lenses was separated from the underlying paleosol by 10–15 cm horizon of chalk breccia mixed with loess. The lower paleosol (thickness 20–40 cm) has continuous extent in all the excavated areas on the site. According to data from multi-layer sites such as Kostenki 1, Kostenki 21, and Kostenki 14, the Gravettian cultural layers were considered to be enclosed in the pre-LGM Gmelin paleosol with ^{14}C age 23–21 ka BP uncal.

Under the previous investigations of Borshevo 5, the Gravettian artifacts were associated with a continuous paleosol which was also attributed as Gmelin. However, recent field work revealed that the corresponding pedocomplex strata of Borshevo 5 consists of two paleosol horizons. The loess bed with simultaneous pedogenesis in Kostenki 14 had similar multiple structure in horizons 2–4, but only the lowest of these was regarded as the Gmelin paleosol.

In excavation area IV, both Borshevo 5 paleosol formations were in association with cultural remains. Therefore, the Gravettian cultural layer was divided according to the bed of deposition. The upper fragmentary paleosol was named layer 1a, and the lower continuous one, 1b.

4. Pattern structure of the Gravettian cultural layer

The pre-LGM pedocomplex in the different excavated areas of the site varied by morphology and by the position of cultural remains. The Gravettian cultural layer was embedded at depth 2.2–2.4 m below the surface downslope in excavation areas II and III. The cultural remains, with the exception of several flakes from the chernozem and from numerous rodent burrows in the loess loam were deposited in the 1b paleosol. Its thickness exceeded 0.4 m. The lenses of 1a paleosol were separated from 1b by a sterile loess horizon 0.1–0.2 m thickness.

The cultural remains were represented mainly by mammoth and horse bones, spaced irregularly. In the southeast units (X198-199/Y50-51) there was an agglomeration of two mammoth mandibles embedded one upon the other, and a flat-lying scapula which was perforated in the center. A complete thoracic spinal column of mammoth was located to the north (Fig. 2).

In all other units, no structural features were detected. Teeth, feet bones and ribs of horse, and the equivalent bones of mammoth including parts of skull and pelvis together with other indefinable fragments were uncovered. A *Canis lupus* mandible was found in unit X192-193/Y50.

No pits, ochre colored spots, or ash content were documented. Excavated areas II and III contained 25 stone artifacts made of flint.

Tools were represented by 3 pièce èscaillèe, 1 basal part of a fragmented Gravette point, and 2 backed pieces. Artifacts did not form concentrations and were not related to the bones. The planigraphy can be treated as a peripheral settlement pattern.

Another situation was revealed in 2008–2010 in excavation area IV, adjacent to excavation area I that had been investigated in 2003. Excavation area I yielded only 434 artifacts and few faunal remains in the Gravettian cultural layer. This assemblage was associated with the Gmelin paleosol, initially defined as a monolithic bed because a considerable part of the area was eroded by a large cryogenic collapse feature, which appeared to be a complicating factor for fine stratification (Lisitsyn, 2004).

Excavation area IV was adjacent to the collapsed area along the southwest profile of area I (Fig. 3).

0.0–0.25 m – plow layer;
0.25–0.55 m – modern chernozem soil;
0.55–0.79 m – light-brownish loessic loam interstratified with lenses of dark-fulvous paleosol (position of the cultural horizon 1a);
0.79–0.86 m – inhomogeneous light-brownish loessic loam with dispersed chalk gravel;
0.86–1.18 m – grey-brown paleosol (position of the cultural horizon 1b) locally underlain by amorphous lenses of loessic loam;
1.18–1.85 m – dark-brown loam bed inclosing varicoloured humus and carbonate lenses (position of cultural layer 2).

The finds of layer la in excavation area IV started from 0.6 m depth. The thickness of the layer according to leveling datum was about 0.15–0.20 m. The faunal remains and stone artifacts were concentrated in the central and northern part of the area (Fig. 4). Units X221/Y48 contained a mandible, and X221-222Y/X50 contained limb bones of a baby mammoth in anatomical linkage.

In the northwestern part, a mammoth tusk was found in a semi-vertical position dislocated and crushed by cryoturbation. It was mounted in a dense concentration of flint finds and quartzite slabs thought to be a frost crack infilling. No other features differing either in color or consistency from the surrounding deposits were traced, with the exception of a structureless conglomeration of chalk gravel in the southernmost part of the excavated area. The sporadic occurrence of charcoals and bone-coals did not form local concentrations.

Almost all the remainder of the faunal remains, represented by fragments of mammoth and horse bones, as well as the majority of stone artifacts, were visually oriented downslope without order. A considerable number of finds was documented in conditions indicating ancient slope wash processes.

Layer 1b was associated with the lower paleosol (Gmelin) and started at 1.2 m below the surface. In the western and central

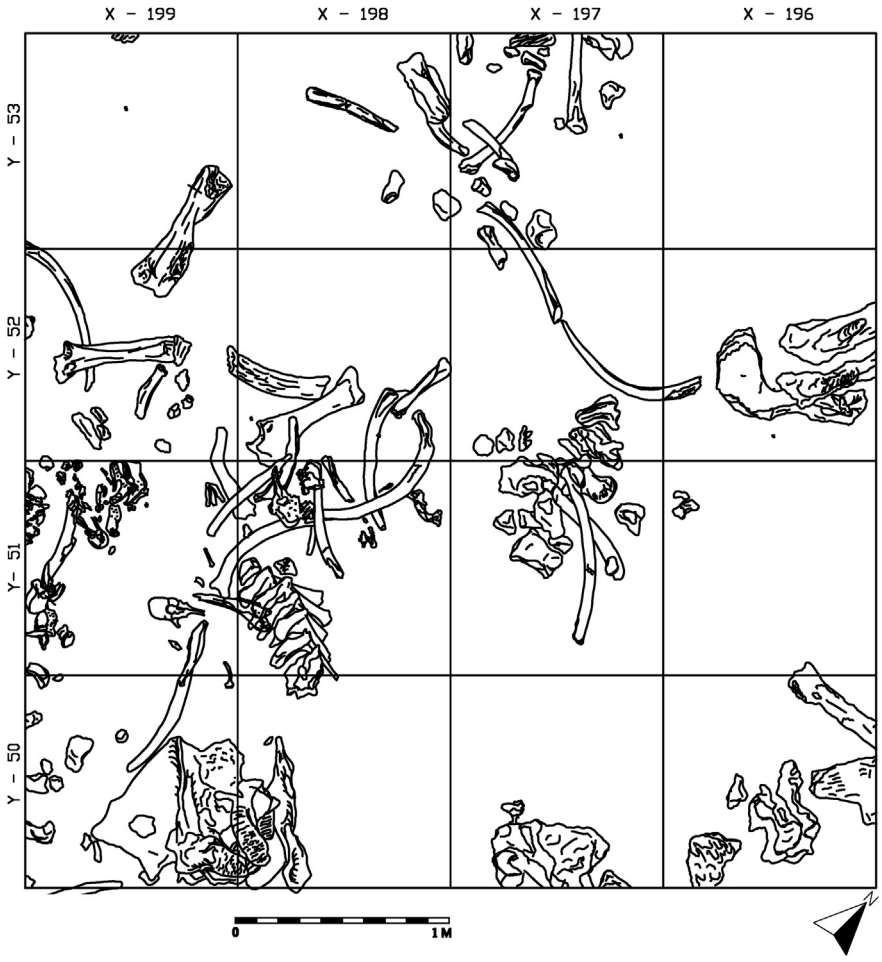

Fig. 2. Borshevo 5. Finds of the 1st cultural layer in excavation area II.

parts of the excavated area, the lower paleosol was isolated from the upper one by chalk gravel intercalations, but in the northernmost part both paleosols seemed to be uninterruptedly in sequence.

The Gmelin paleosol in Borshevo 5 varied from brown to cinereous. The enclosed layer 1b finds were concentrated in the northern corner of the excavated area.

The composition of the layer 1b finds was similar to layer 1a (Fig. 6). Flint artifacts, quartzite slabs and faunal remains occurred in disorder, but in relatively dense conditions. There was also a charcoal accumulation consisting of several interlaid lenses. According to its extent (~1.2 × 3.5 m) it appears to be ejection from the fireplace. Some of the lenses located upslope were burnt and also lacked archeological finds.

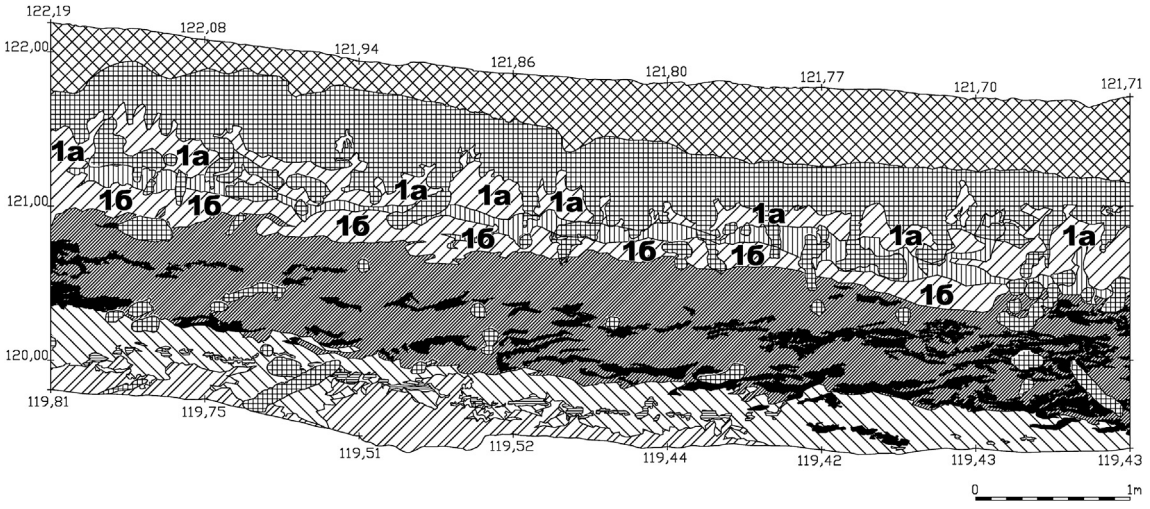

Fig. 3. Borshevo 5. Stratigraphy of the southwest profile in excavation area IV (2008–2009): lenses of paleosols with remains of cultural layers 1a and 1b are marked.

The layer 1b finds have attributes of positioning in situ. Thus, in units X50-51/Y219, an unbroken ivory plate with dimensions 5 × 45 and thickness about 1 cm was found. Unit X52/Y220 contained 3 backed microblades which seem to be inserts of a single slot tool.

Unlike the northern concentration of layer 1b, the empty southern part of excavated area IV contained a large cryogenic collapse, traced in the neighboring excavation area I in 2003. It comprised the mixed finds of 1a and 1b layers, including a mammoth femur.

The faunal list comprises a limited amount of species (Tables 1–3).

Table 1
Borshevo 5. Faunal remains of the Gravettian layers 1a–1b.

NISP/MNI:	1a	1a/1b	1b
Mammuthus primigenius (mammoth)	49/2	76/2	60/2
Equus ferus (horse)	34/2	8/1	56/2
Lepus tanaiticus (hare)	19/1		8/1
Canis lupus (wolf)	–	4/2	2/1
Alopex lagopus (arctic fox)	12/2	1/1	8/1
Undefined bone fragments	248	95	256
Total bones	362	184	390

Table 2
Borshevo 5. Stone industry in layers 1a–1b.

Artifacts	Layer 1a	Layer 1b
Flakes	462 (40.50%)	147 (23.10%)
Blades	212 (18.50%)	28 (4.40%)
Microblades	27 (2.00%)	39 (6.10%)
Chips	117 (9.93%)	252 (39.60%)
Small pieces	5 (0.40%)	4 (0.60%)
Large fragments	11 (0.90%)	2 (0.30%)
Cores	4 (0.30%)	1 (0.10%)
Burins	23 (2.00%)	12 (1.80%)
Backed microblades	56 (4.80%)	33 (5.20%)
Scrapers	12 (1.00%)	1 (0.10%)
Side-scrapers	1 (0.09%)	0 (0.00%)
Points	26 (2.00%)	16 (2.50%)
Pièces ecaillées	21 (1.80%)	5 (0.70%)
Perforators	1 (0.09%)	1 (0.10%)
Kostenki knives	2 (0.09%)	1 (0.10%)
Retouched flakes	27 (2.00%)	25 (3.90%)
Retouched blades	72 (6.30%)	30 (4.70%)
Retouched microblades	4 (0.30%)	3 (0.40%)
Burin spalls	29 (4.90%)	27 (5.20%)
Crested blades	11 (0.90%)	3 (0.40%)
Kostenki knives spalls	8 (0.70%)	1 (0.10%)
Polished artifacts	3 (0.20%)	1 (0.10%)
Atypical forms	4 (0.30%)	3 (0.40%)
TOTAL	1138 (100%)	635 (100%)

Table 3
^{14}C dating of Borshevo 5 Gravettian.

Material	Lab.	^{14}C (uncal.) BP
Bone (horse udef.)	LE-6809	14,060 ± 110
Bone (mammoth rib)	LE -5571	17,400 ± 2000
Bone (mammoth tooth)	LE -6947	20,000 ± 300
Bone (mammoth rib)	GIN-10239	22,500 ± 700

5. Stone assemblage

Layer 1a in the excavated area IV yielded 1138 stone artifacts. Most of these were made of the black Cretaceous flint covered with opaque patina (1077 items), and others from Carboniferous and Cretaceous varicolored translucent flints (24 items), gaize (fine-grained silica, 14 items), quartzite (13 items), and slate (3 items).

The cortical pieces (112) were not numerous, and crested blades were present (11 items). The minimum number (4 items) of cores represented by exhausted single-platform prismatic and wedge forms indicates the nominal value of knapping procedures.

The stone inventory of layer 1a is lamellar. The tools number 141 items (12.4% from the collection), with the most numerous being backed microblades (56 items). Most of these are retouched at the ends with ventral trimming (Fig. 5: 1–3, 6–7). This technological trimming applied to the blanks even prior to retouching of the microblades (Fig. 5: 5) characterizes the Gravettian industry of Borshevo 5.

Burins are represented mainly by dihedral and lateral types, with 23 items (Fig. 5: 25–26, 29, 33). Scrapers made on blade-like flakes (10 items) and blades (2 items) had marginal retouching.

Points (26 items) varied in form. Common were leaf-points on large blades found in pieces with contour dorsal retouching (Fig. 5: 21–22, 23–24). The most regular were the Gravettian backed points on bladelets, asymmetrical ones on microblades (Fig. 5: 8–9, 12–13) and symmetrical flechettes. There were 2 Pavlovian points with ventral treating on the ends (Fig. 5: 10–11). The series of pièce èscaillèe comprised 21 items (Fig. 5: 23). One burinated perforator was found (Fig. 5: 20).

It is important to note the presence of 2 Kostenki knives (Fig. 5: 34) accompanied by 8 trimming knives spalls and 2 ambiguous shouldered points (Fig. 5: 21–22). The last ones are rather doubtful according to their indistinct morphology. These are the only Eastern Gravettian features found in the assemblage.

Items treated by polishing were discovered (Fig. 8). The first one was an elaborately worked quadrangular billet of drab-green slate with smoothed margins (Fig. 8: 4). Another counterpart billet was found in excavation area I in 2003 at 2 m distance. Both parts were fitted into a single object 12 cm long. The jointed artifact had both ends broken. It had been elaborately polished over the whole surface and after damage was secondarily utilized as an anvil or a retoucher.

The second tool was a dolabriform made of yellow dolomite (Fig. 8: 3). It has a quadrangular biconvex shape with two opposite edges truncated by impact usage. A similar axe-shaped tool of the same raw material was also found nearby in excavation area I in 2003 (Fig. 8: 2). Unlike the previous one, it was an oviform with a single working edge blunted by chopping.

The last artifact was a semi-convex discoid made of drab-green slate with fine abraded edges. Both sides were treated by polishing, picketage, and further scratching (Fig. 8: 1).

The collection of the 1b layer (635 items) including the tools (69 items, 10.86% of the assemblage without considering the utilization retouched pieces) almost completely duplicates layer 1a. The raw materials comprise Cretaceous black flint (602 items), Carboniferous and Cretaceous varicolored flint (15 items), gaize (8 items), and quartzite (6 items).

Burins numbered 12 items, mainly dihedral and lateral (Fig. 7: 22–23, 26). Only one scraper on a flake was found (Fig. 7: 30). Among the backed microblades (16 items) were variations with arch (Fig. 7: 1, 3–4) and transversal (Fig. 7: 2, 5–6) ventral trimming on the ends. Points (16 items) comprised gravette and flechette types (Fig. 7: 7–8; 10, 19). The larger foliate ones were found in pieces with the exception of a single unbroken point made on the elongated blade with contour dorsal retouching (Fig. 7: 28).

Similar in appearance were the pièce èscaillèes (5 items) on flakes (Fig. 7: 39–40) and a perforator (Fig. 7: 27). Single finds were a fragment of Kostenki knife (Fig. 7: 38) and a broken backed point with ventral retouching on the tip similar to the shouldered points of layer 1a.

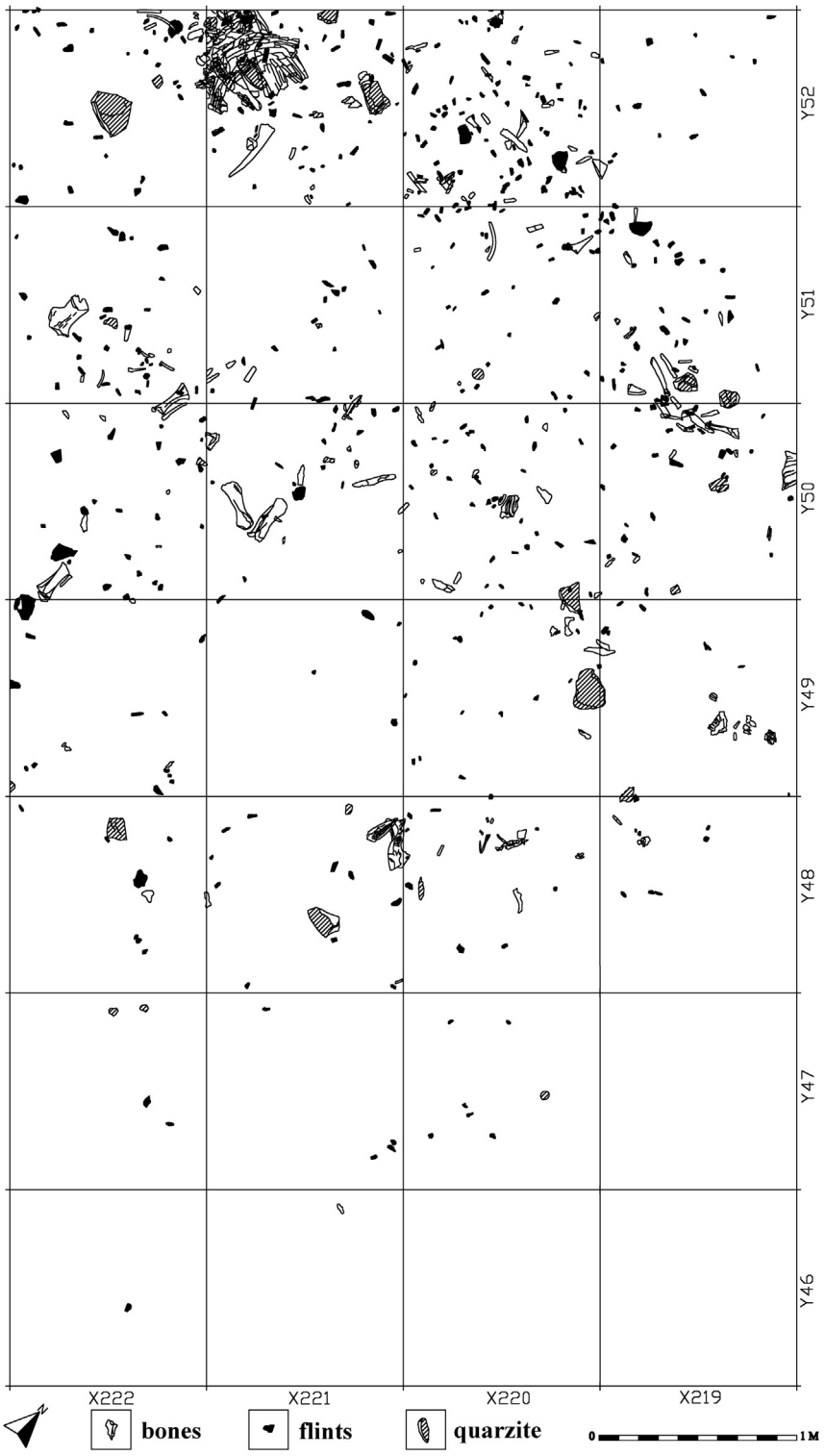

Fig. 4. Borshevo 5. Finds in cultural layer 1a in excavation area IV.

In spite of the almost double number of artifacts in the layer 1a collection over 1b, both assemblages are very similar with minor percentage variances. Originally, the only difference was traced in the lack of the polished artifacts made of soft stones such as slate and dolomite. Later the single artifact presumably treated by polishing in 1b layer was recognized as an oval pebble of solid quartzite with two opposite faces smoothed by fine grinding over the roughness surface (Fig. 8: 5). It had no other traces of utilization and therefore might be a polisher.

Whereas 1a and 1b layers belong to one industry, their chronostratigraphical subsequence varies from one excavation area to another. In excavation area IV, there was no clear discontinuity of

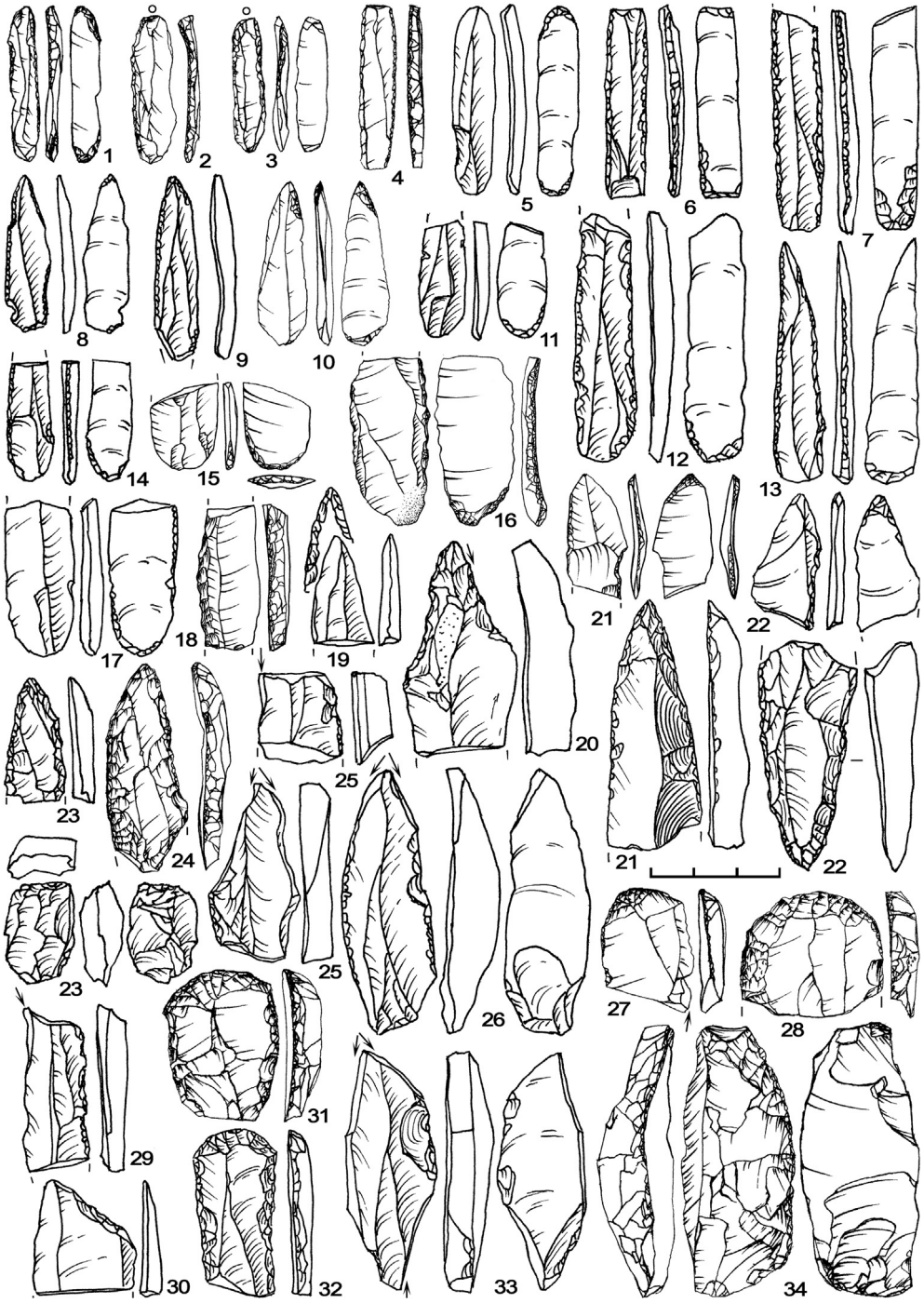

Fig. 5. Borshevo 5. Stone inventory of cultural layer 1a from excavation area IV (drawing by N.A. Tsvetkova).

artifacts deposition between layers 1a and 1b. Hypsometrically downslope, the Gravettian cultural remains in excavation areas II and III were associated only with the lower paleosol, corresponding to the position of cultural layer 1b. The upper paleosol was practically sterile, with 1a layer finds.

According to the results of the 2008–2010 excavations, a pair of alternative interpretations should be assumed: 1) Artifacts of 1a and 1b layers represent two separate cultural Gravettian layers deposited in the stratigraphic sequence; 2) Both layers belong to the single cultural layer, but 1b lies in situ while the scattered 1a layer is redeposited from upslope. Considering the lack of the Gravettian finds in the upper part of the site, which was purposefully test-pitted in 2002, as well as the embedding of layer 1a into the chalk gravel bed, it can be supposed that layer 1a could be the result of slope erosion.

6. Radiocarbon dating

All 4 radiocarbon dates were obtained before the Gravettian layer was finally separated into 1a and 1b layers. The new dates are still in analysis.

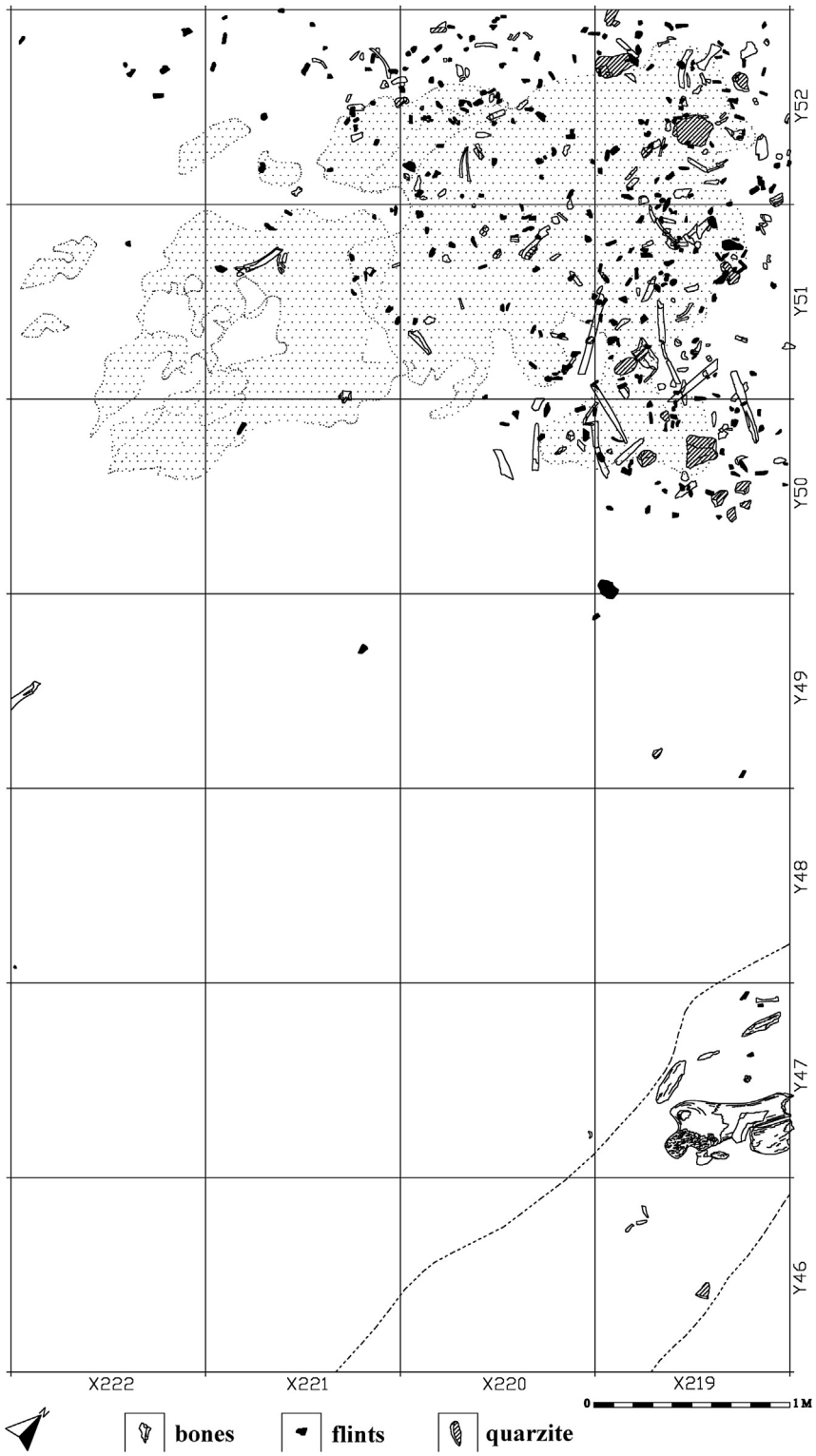

Fig. 6. Borshevo 5. Finds in cultural layer 1b in excavation area IV.

The position of the Gmelin paleosol, identical to other Kostenki Gravettian sites on a stratigraphical basis, should correspond to the period not earlier than 22 ka uncal BP. In the context of the 1b layer, indicated by the pre-LGM 22/20 ka and post-LGM 17/14 ka dates, two distinct episodes of Late Glacial habitation might be assumed. However, as determinations 17,400 ± 2000 and 22,500 ± 700 were obtained in two different laboratories from a single bone sample, an older age for the Gravettian settlement of Borshevo 5 based on the latest dating is arguable. Even though layers 1a and 1b had successive chronostratigraphical positions, the time gap between them would not be excessive, similarly to the correlative cultural layers of

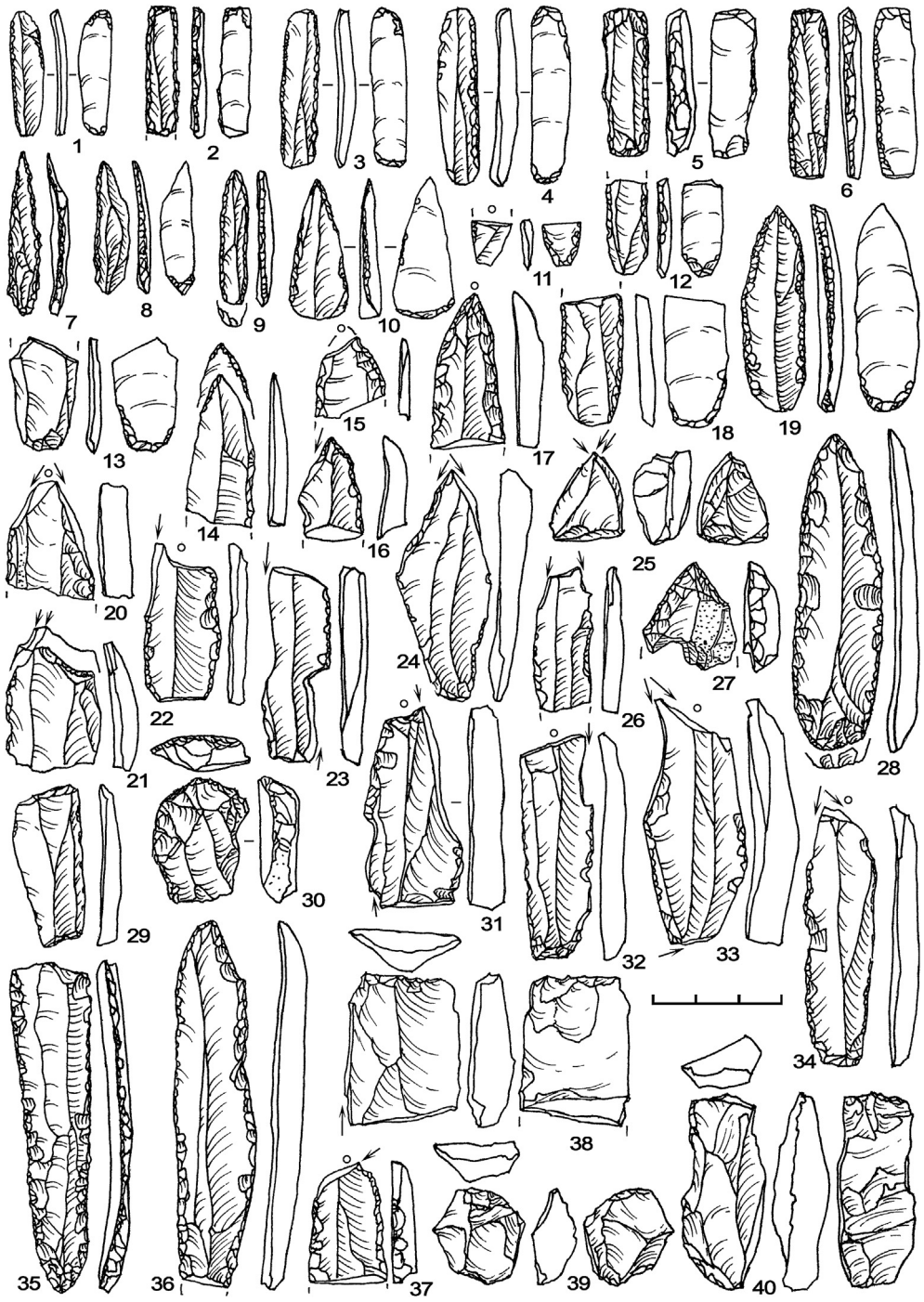

Fig. 7. Borshevo 5. Stone inventory of cultural layer 1b from excavation area IV (drawing by N.A. Tsvetkova).

Kostenki 4 and Kostenki 21 deposited in the same loess bed and dated 23–20 ka uncal BP.

7. Cultural attribution

The identity with the Gravettian technocomplex of the 1st cultural layer of Borshevo 5 was established during the initial investigations (Lisitsyn, 2002), although its cultural attribution remained debatable. Other late Gravettian sites in the location of Kostenki-Borshevo show several cultural variants of this technocomplex comparable with Borshevo 5/I (Sinitsyn, 2007).

The most abundant is the Willenorf-Kostenki-Avdeevo culture (the Eastern Gravettian stricto sensu) represented by the assemblages Kostenki 1/I, 14/I, 13, and 18. Knapping of the Eastern Gravettian is based on the differentiation of blade blanks production ranging from the enlarged ones and medium sized to fine microblades. However, the Borshevo 5/I industry does not comprise large blades, but only moderately sized ones.

The tool inventory of Borshevo 5/I is rather different in the context of the nominal presence of the Kostenki knives and shouldered points. The Eastern Gravettian typological variety also lacks flechettes and typical Gravette points. The predominance of

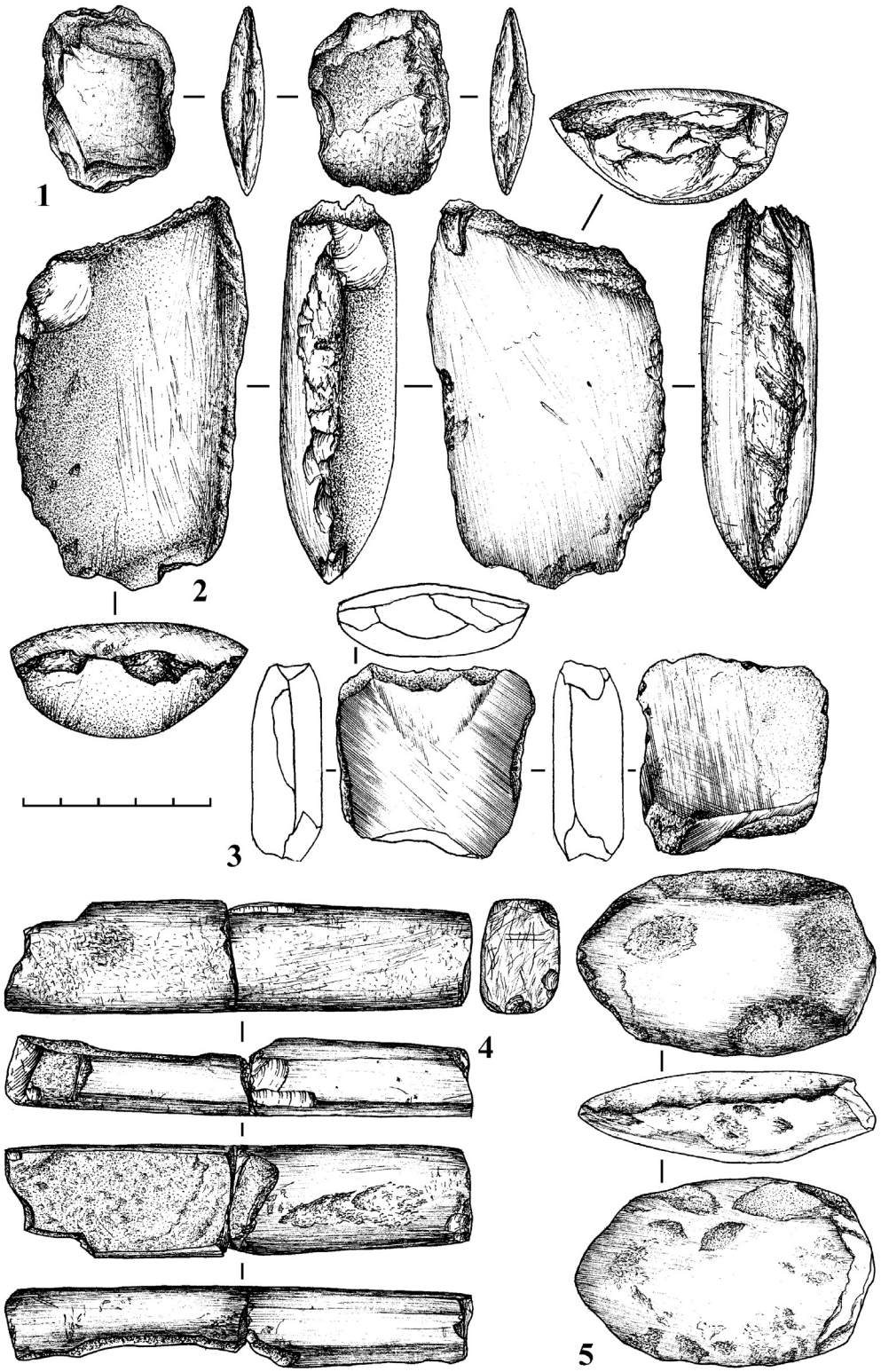

Fig. 8. Borshevo 5. Stone artifacts treated by polishing. 1–4 – from cultural layer 1a, 5 – from cultural layer 1b (drawing by N.A. Tsvetkova).

ventral ends treatment for backed microblades and micropoints in Borshevo 5/I is also a distinctive feature, contrary to the Eastern Gravettian dorsal preference.

Another Anosovka-Gmelin variant of the Kostenkian Gravettian is presented by assemblages Kostenki 11/II and Kostenki 21/III. These follow Borshevo 5/I in the categories of the inventory including the presence of unusual abraded artifacts made of soft stones (The Paleolithic … 1982; Ivanova, 1985; Anikovich et al., 2008).

However, a substantive typological difference is represented by the occurrence of lanceolate points with dorsal arched edges and transversally retouched ends. Ventral treatment of tools was not

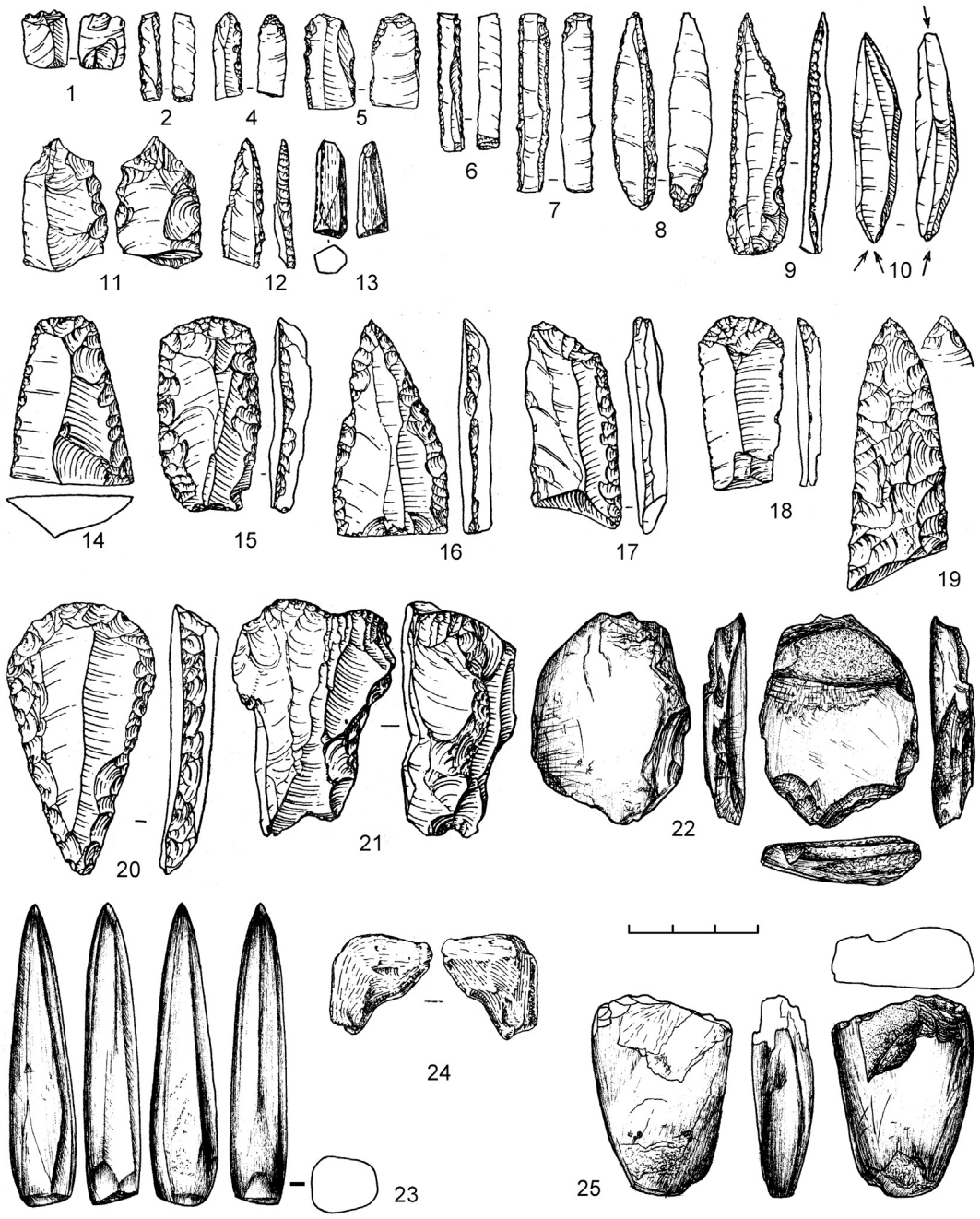

Fig. 9. Kostenki 9. Stone inventory (adapted from: The Paleolithic … 1982): 1–21 – flint, 22–25 – polished soft stones.

used, with the exception of a single foliate point from Kostenki 11/II. In addition, the southern dwelling complex of Kostenki 21/III contains a fundamentally different set of micro-inventory, including shouldered micropoints and narrow acicular backed microblades.

The Alexandrovka-type Gravettian presented by Kostenki 4 comprises two contiguous cultural layers I and II, thought to be independent industries (Rogachev, 1955; Paleolithic …,1982). More recent research has cast doubt upon the cultural heterogeneity of both layers assemblages that were synthetically separated by A.N. Rogachev in the course of post-field study (Zheltova, 2008, 2009, this volume).

The parallels with Borshevo 5/Ia-1b assemblage can be illustrated across both Kostenki 4 I and II cultural layers. Similar to Kostenki 4/I upper layer are the backed micropoints with ventrally retouched ends, large foliate points on blades with contour dorsal retouching and also numerous slate and dolomite artifacts treated by polishing (discs, billets, and awls).

The lower cultural layer of Kostenki 4 is analogous to Borshevo 5/Ia-1b in a series of pièce èscaillées, forms of backed microblades, flechettes, and Gravette points. Apart from the compatible tools there are bifacial points from Kostenki 4/I accompanied by asymmetrical triangles points and denticulate microforms in Kostenki 4/II. Taking into account the undifferentiated ^{14}C dates of 23–21 ka BP uncal. of Kostenki 4/I-II, close to 22.5–20 ka obtained in Borshevo 5/Ia-1b, these industries might be considered correlative.

Another single-layer site, Kostenki 9, yielded a late Gravettian assemblage (about 2300 artifacts), most similar to Borshevo 5/I. The

Kostenki 9 cultural layer was associated with the second Don terrace level in the same way as Borshevo 5, and was deposited in the loess loam 1.5 m below the modern soil (Litouchanka, 1966).

Assemblages Kostenki 9 and Borshevo 5/I are similar (Fig. 9) in the forms of backed microblades and micropoints with ventral retouch on the ends as well as ordinal forms of scrapers and burins. Almost identical are large foliate points with contour retouch and a series of pièce èscaillèes. However, most remarkable is the presence of 4 slate slab pieces and 2 quadrihedral awls treated by polishing. Hence with the exception of Kostenki knives and shouldered points in Borshevo 5/I both assemblages belong to a single archaeological culture.

When initially excavated, Kostenki 9 had no radiocarbon dates and was attributed to the middle Upper Paleolithic by the geological context. According to the opinion of Anikovich et al. (2008), this industry combined both Aurignacian-Gorotsovian and Gravettian features including backing and contour retouching tools with small chisels. Nevertheless, considering the invariable analogies of Kostenki 9 with Borshevo 5/I and Kostenki 4/I-II, all these comprise a local Kostenki-Borshevo group of the late Gravettian industry.

The assemblage of Borshevo 5/I has indirect similarities with Khotylevo 2 and Gagarino. The stone assemblage of site Khotylevo 2, situated along the Desna River, comprises artifacts made on large blades accompanied by the microlithic inventory (Gavrilov, 2004, 2008).

The ordinal tools, scrapers and burins of Khotylevo 2, are larger than in Borshevo 5/I, which may result from the proximity to outcrops of flint. The backed tools of Khotylevo 2 have similar features, in the manner of ventral retouching on the gravette and shouldered points and backed microblades, but differ in predominant vertical backing with opposite retouching.

The stone assemblage of Gagarino in the Upper Don course looks even more microlithic than those in Khotylevo 2. From the categories of artifacts, both industries are almost identical, but the microtools of Gagarino including the series of shouldered microblade points are more diminutive (Tarasov, 1979). According to Anikovich (1998), the assemblages of Khotylevo 2 and Gagarino dated respectively 24–21 and 21–20 ka uncal. BP, evolved from the Pavlovian in the context of their cultural distinction from the simultaneous Eastern Gravettian, although no real Pavlovian assemblages were proposed as real progenitors.

When estimating Khotylevo-Gagarino industry with respect to the remote cultural relations with Central Europe as has been established before for the Willendorf-Kostenki-Avdejevo-Zaraysk sequence, this question cannot be judged at present (Gavrilov, 2008). ^{14}C dating of the Pavlovian sites Willendorf 2/VI-VIII, Dolni Vestonice, Pavlov 1, and Predmosti ranged from 27 to 25 ka uncal. BP (Haesaerts et al., 1996, 2004; Joris and Weninger, 2004) – much earlier than the average age of 23–21 ka uncal. BP for the Gravettian sites in the central Russian plain. The correlation between the latest Pavlovian sites younger than 25 ka BP such as Milovice, Jarosov and the Eastern Gravettian ones (Willendorf 2/IX, Petrkovice, Moravany, Krakow-Spadzista) with the dates 23–21 ka BP is debatable (Svoboda, 2007). In this context, the Borshevo 5/I together with Kostenki 9 and Kostenki 4/I-II assemblages can be related with the synchronous late Pavlovian of Moravia, unlike the Khotylevo-Gagarino industry which has closer typological features with the Eastern Gravettian.

Direct analogies for the Borshevo 5/I industry can be traced in the upper cultural layer of the site Milovice dated between 25.9 and 17.5 ka BP uncal., modal 24–22 ka BP uncal. (Oliva, 2009). The stone inventory of Milovice duplicates all the tool types of Borshevo 5/I, including the gravette and flechette points, backed microblades with ventral treatment on the ends, and the elongated foliate points with contour retouching. Both assemblages are characterized by minimal occurrence of the Eastern Gravettian elements (Kostenki knives, shouldered points) and presence of polished artifacts made of soft stones. A complete disc of marlstone polished over the surface was found in Milovice (Oliva, 2009, p.268) which was similar to the slate discoid from Borshevo 5/Ia. The only complete analogs of these could be detected in series from Kostenki 4/I (Rogachev, 1955) and Pavlov 1 (Škrdla, 2000).

Other Milovice-type assemblages are known as Kasovian, named after the Slovakian site Kasov with two cultural layers (Novak, 2004). The upper cultural layer of Kasov yielded a ^{14}C date of 18,600 ± 390 BP and was thought to be Epigravettian. The lower one dated 20 700 ± 350 BP, final Gravettian, although both layers contained some shouldered points. In Serbia, the transitional industry between the Gravettian and Epigravettian was associated with the 4th cultural layer of the cave Salitrena Pecina (Mihailovic and Mihailovic, 2007). According to Svoboda (2007), the spread of such industries was caused by the beginning of the early LGM cooling event, also accompanied by the appearance of the Badegoulian in western Europe and the Lipa culture or the Sagvarian to the east.

The common features for such assemblages were the reduction of blade size knapped from the single-platform or wedge cores, and the increase of the micro-Gravettian points and flechettes instead of other types of Gravettian projectiles. The Milovice-type sites were related with the impact from the Mediterranean Epigravettian followed by the retargeting of the local hunters to ungulate game instead of mammoths (Oliva, 2009, p. 276). Therefore, the appearance of the Kostenki-Borshevo variant of Latest- or Epi-Gravettian such as Borshevo 5/I, Kostenki 9 and Kostenki 4/I-II in the central Russian Plain was in context with the European early LGM.

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References

Anikovich, M.V., 1998. The Dnieper-don History-cultural Area of the Mammoth Hunters: from the Eastern Gravettian to the Eastern Epigravettian. In: Vostochyj Gravet. Nauchij Myr Press, Moscow, pp. 35–66 (in Russian).

Anikovich, M.V., Popov, V.V., Platonova, N.I., 2008. The Paleolithic of Kostenki-Borshevo Region in the Context of the Paleolithic of Europe. Nestor-Istorja Press, Saint-Petersburg (in Russian).

Gavrilov, K.N., 2004. The Typology and Cultural Attribution of Khotylevo Upper Paleolithic Site Stone Tools. In: The Problems of the Russian Plain Stone Age. Nauchnij Myr Press, Moscow, pp. 262–284 (in Russian).

Gavrilov, K.N., 2008. The Upper Paleolithic Site Khotylevo 2. TAUS Press, Moscow (in Russian).

Haesaerts, P., Damblon, F., Bachner, M., Trnka, G., 1996. Revised stratigraphy and chronology of the Willendorf II sequence, Lower Austria. Archaeologia Austriaca 80, 25–42.

Haesaerts, P., Borziak, I., Chirica, V., Damblon, F., Koulakovska, L., 2004. Cadre stratigraphique et chronologique du gravettien en Europe Centrale. The Gravettian along the Danube. In: Dolnověstonické Studie, vol. 11, pp. 33–56. Brno.

Ivanova, M.A., 1985. The Structure of the Gmelin Paleolithic Settlement. Moscow (in Russian).

Joris, O., Weninger, B., 2004. Coping with the Cold: on the Climatic Context of the Moravian Mid Upper Palaeolithic. The Gravettian along the Danube. In: Dolnověstonické Studie, vol. 11, pp. 57–70. Brno.

Karikh, A.V., Lisitsyn, S.N., Praslov, N.D., Sinitsyn, A.A., 1999. The Discovery of a New Upper Paleolithic Site in Kostenki-Borshevo Region in the River Don. In: Arheologicheskiye Vesti, vol. 6. Dmitrij Bulanin Press, Saint-Petersburg, pp. 71–75 (in Russian).

Lisitsyn, S.N., 2002. The Muli-layer Site Borshevo 5 in the Context of Geomorphology of Kostenki-Borshevo Region. Verhnij Laleolit – Verhnij Pleistocene. In: Dinamika Prirodnyh Sobyrij I Periodizatsija Arheologicheskih Kultur, Sant-peterburg, pp. 77–82 (in Russian).

Lisitsyn, S.N., 2004. The Chronostratigraphy of the Site Borshevo 5 on the Data of 2002-2003 Excavations. In: Kostenki i rannaya pora verhnego paleolita Evrazii. Voronezh, 66-79 (in Russian).

Litouchanka, L.M., 1966. The Paleolithic Site Biryuchij Log (Kostenki 9). In: Vestsi Akademie Nauka Belarus, vol. 3. Minsk (in Belorussian).

Mihailovic, D., Mihailovic, B., 2007. Considerations sur le Gravettien et l'Epigravettien ancien des Balkans de l'ouest. Paleo 19, 115–130.
Novák, M., 2004. Gravettian occupation in the lower layer of Kašov I. In: Svoboda, J.A., Sedláčková, L. (Eds.), The Gravettian Along the Danube, 11. Dolnověstonické Studie, Brno, pp. 217–242.
Oliva, M., 2009. Milovice: Site of the Mammoth People Below the Pavlov Hills (Brno).
Rogachev, A.N., 1955. Kostenki IV – Settlement of the Paleolithic in the River Don. In: MIA 45. Nauka Press, Moscow-Leningrad (in Russian).
Sinitsyn, A.A., 2007. Variabilite du Gravettien de Kostienki (bassin moyen du Don) et des territoires associes. Paleo 19, 181–202.
Svoboda, J.A., 2007. The gravettian on the middle Danube. Paleo 19, 203–220.
Škrdla, P., 2000. Zhodnocení Technologií Výroby Kamenných Nástrojů. Rekonstrukce a Experiment v Archeologii 1, 9–36. Hradec Králové.
Tarasov, L.M., 1979. Gagarino Site and its Position in the Paleolithic of Europe. Nauka Press, Leningrad (in Russian).
The Paleolithic of Kostenki-borshevo Region on the River Don 1879-1979: the Investigations Results, 1982. Nauka Press, Leningrad (in Russian).
Zheltova, M.N., 2008. The steps of investigations of Alexandrovskaya site (Kostenki 4). In: Hronologia, Periodizatsiya i Crosskulturnyie Svyazi v Kamennom Veke: Zamyatninskiy Sbornik, 1, pp. 118–127. Saint-Petersburg (in Russian).
Zheltova, M.N., 2009. Kostenki-4: the position of artefacts in space and time (analysis of the cultural layer). Arkheologiya, Etnografiya i Antropologiya Evrazii 2 (38), 19–27. Novosibirsk (in Russian).
Zheltova, M.N., 2014. Lithic Industries of Kostenki-4: “Gravettian of the East - not Eastern Gravettian”. Quaternary International.