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HUMAN-ANIMAL INTERACTIONS AT KORMAN' 9, UKRAINE

The maximum ice sheet expansions of the Last Glacial Maximum between 26.5 and 22 ka cal BP (e. g., the maximum glacial extents Leszno and Frankfurt) are followed by a succession of interstadial (e. g., Cosăuți V Interstadial) and stadial conditions toward the end of the Late Pleniglacial. This period is generally thought to have witnessed a European-wide decline in population density, and is characterized by a scarcity of sites. Here, we report on one such site, Korman' 9, Archaeological Layer (AL) I, dated to ca. 21.9 ka cal BP located in the Dniester valley. The archaeology — assigned to the Epigravettian — is situated in a pedogenesis horizon consistent with the Cosăuți V Interstadial. Here we describe the human-animal interaction based on faunal evidence comprising both dietary as well as secondary exploitation of the faunal remains. Analyses include spatial distribution of the bones, the interplay of carnivore and human mediation of the faunal assemblage. In particular we describe human modifications both in terms of dietary exploitation as well as organic technology. Our results indicate that Epigravettian hunter-gatherers were the main accumulator of the faunal assemblage, whereas carnivores had only secondary access. All recovered taxa show traces of human exploitation. Horse, reindeer and hare were exploited for dietary purposes shown by evidence for skinning, dismembering and filleting. There is evidence for on-site working of reindeer antler and a needle fragment attests of bone tool technology. Fox teeth, freshwater and fossil shells were used as beads for personal ornamentation. Thus, in addition to dietary exploitation, animal remains formed a common and diverse part of socio-economic behaviour and were well-incorporated in hunter-gatherer technological and symbolic expression during the Korman' 9, AL I, Epigravettian.

Keywords: Zooarchaeology, faunal exploitation, Upper Palaeolithic, Late Pleistocene, Epigravettian.

Introduction. The Last Glacial Maximum (LGM) in Eastern Europe is characterised by increasingly cold and deteriorating climatic conditions. The maximum ice sheet expansions of the LGM between 26.5 and 22 ka cal BP (e. g., the maximum glacial extents Leszno and Frankfurt) are followed by a succession of interstadial (e. g., Cosăuți V Interstadial) and stadial conditions toward the end of the Late Pleniglacial (see, e. g., Haesaerts et al. 2003; 2010). This period is generally thought to have witnessed a European-wide decline in population density, and several complementary hypotheses about the behavioural adaptations in terms of subsistence strategy, mobility and landscape use have been proposed. One such response is the retreat of both animals and humans in refugial areas across southern Europe, e. g., the Iberian and Apennine peninsulas (e. g., van Andel, Tzedakis 1996; Banks et al. 2011; Burke et al. 2017; Cascalheira et al. 2021) and the Balkans (e. g., Dogandžić et al. 2014; Stiner et al. 2022; Mihailovnc 2014). However, data on climate modelling has suggested that larger parts of Europe remained available for human occupation during the LGM (see, e. g., Klein et al. 2021; Tallavaara et al. 2015).

For the East Carpathian Area it has been hypothesised that deteriorating conditions led to group size reduction and an increase in residential mobility resulting in short term ephemeral archaeological occurrences (see, e. g., Demay et al. 2016; 2021; Кулаковська та ін. 2019; Kulakovska et al. 2021; Noiret 2009; Soffer 1985; 1990; Hoffecker 2002).

Sites dating to the LGM in Eastern Europe are rare, which limits our knowledge of animal exploitation patterns during this period (but see Черныш 1973; Demay et al. 2016, 2021; Нае-

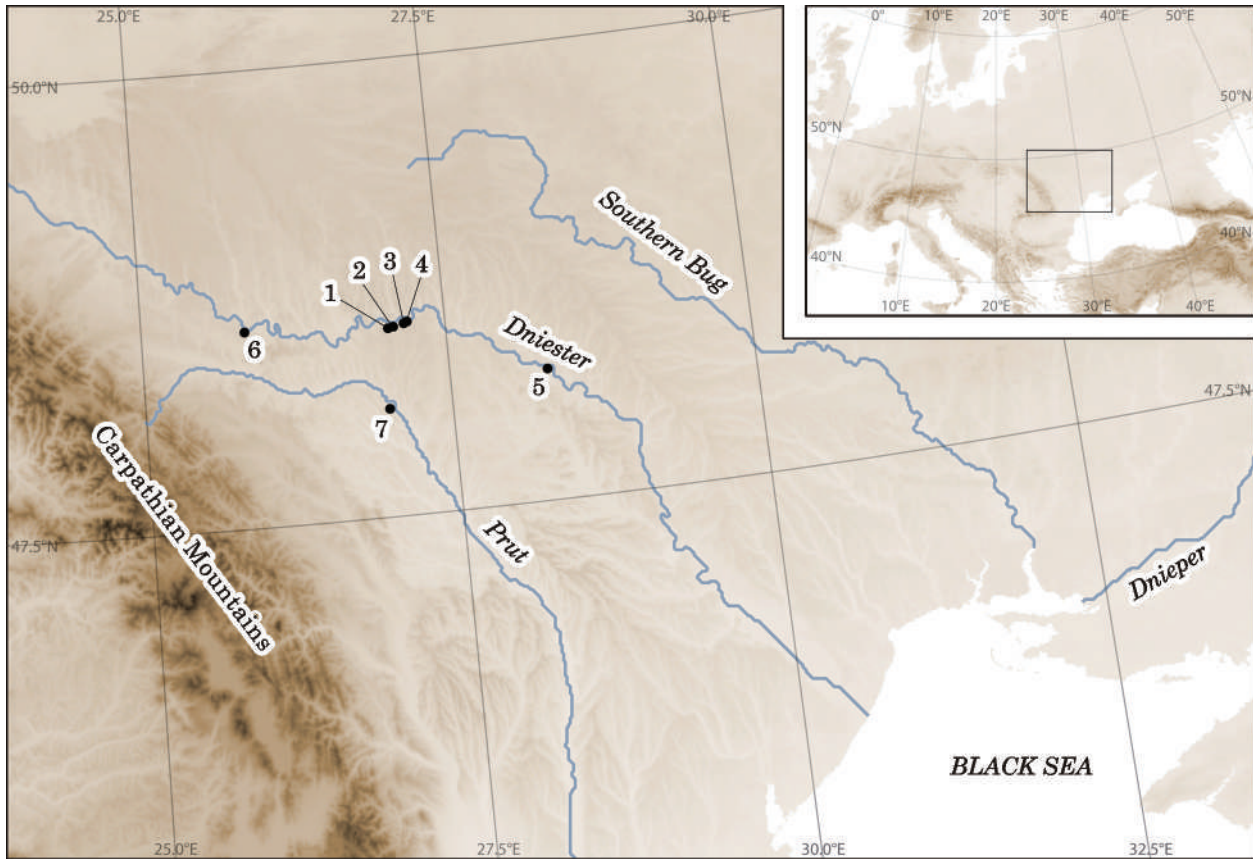


Fig. 1. Location of Korman' 9 and selected other sites in the East Carpathian region: 1 — Molodova V; 2 — Molodova I; 3 — Korman' 9; 4 — Korman' IV; 5 — Cosăuți; 6 — Dorochivtsi III; 7 — Mitoc-Malu Galben. Basemap and rivers: HYDRO1K dataset from U. S. Geological Survey Earth Resources Observation and Science Center, DOI: 10.5066/F77P8WN0. GIS and graphic: P. R Nigst

saerts et al. 2020; Ivanova, Chernysh 1965; Klein 1973; Кулаковська та ін. 2019; Kulakovska et al. 2015, 2021; Noiret 2009; Stiner et al. 2022; Pinhasi et al. 2014; Połtowicz-Bobak et al. 2022). Here, we present zooarchaeological investigations of the Epigravettian at Korman' 9 (Dniester Valley, Ukraine). We focus on Archaeological Layer (AL) I which is dated to ca. 21.9 ka cal BP (GrA-59996: 17.950 ± 80 BP) and can be placed at the onset of the Cosăuți V Interstadial in a humid horizon immediately succeeding the maximum ice-sheet expansion during the Frankfurt glacial extent (ca. 19–18 ka cal BP; Kulakovska et al. 2021). In particular we focus on the types of human-animal interactions comprising both primary or dietary exploitation as well as secondary exploitation of faunal remains for their fur, and hard tissues for tools and personal ornamentation. Our analyses centre on the spatial distribution of faunal remains, the identification of the main agents responsible for assemblage accumulation and the sequence of access to the material by carnivores and humans through the study of human and carnivore modifications on the bones. Finally, we describe the nature of the represented organic technology, insights into manufacture processes and use of organic objects made from various animal tissues.

Site background. Site location, stratigraphy, chronology and palaeoenvironment.

The open-air site Korman' 9 ($48^{\circ}34'25.18''$ N, $27^{\circ}8'53.57''$ E) is located in the Dniester valley northwest of the village Korman', approximately 1 km upstream of the Middle and Upper Palaeolithic site Korman' IV (Черныш 1977; Иванова 1959; 1977). It is nowadays situated directly on the southern bank of the Dniester reservoir lake (fig. 2: 1). The site is being eroded by the changing water table of the reservoir lake and this erosion created an approximately 4 m high cliff / exposure that is approximately 50 m in length. The exposure comprises a succession of silt and sandy silt deposits, which appear to be capped by the Holocene illuviated horizon (fig. 2: 2).

In 2012 and 2013 we studied that sequence over about 20 m along the bank of the Dniester reservoir lake, i. e., the western half of the approximately 50 metres-long exposure (Кулаковська та ін. 2013; 2019; Kulakovska et al. 2021). In 2012 we only cleaned a long section and collected materials from that section, while in 2013 we excavated two trenches and cleaned two sections between the trenches and to the west of them (fig. 3). The Korman' 9 sequence (fig. 4) comprises eight climatic cycles including a sedimentation phase and subsequently a stabilisation phase with pedogen-

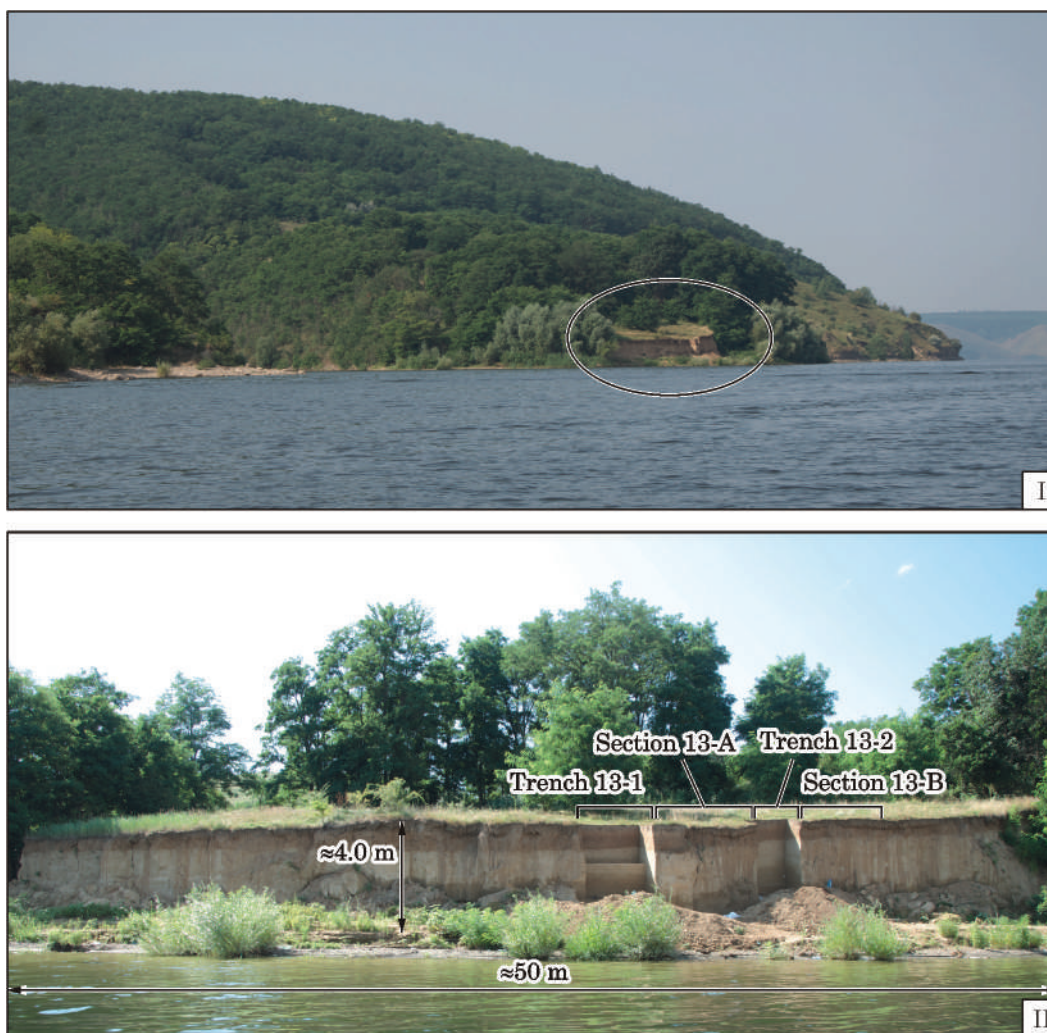


Fig. 2. Photos showing the Korman' 9 exposure: 1 — Photo showing site location on the bank of Dniester reservoir lake; 2 — View of the site during excavation in 2013 from the Dniester reservoir lake. Photos and Graphic: P. R. Nigst

esis (Kulakovska et al. 2021). AL I is situated in one of those pedogenesis horizons (sub-unit 4-1a). It can be described as a bioturbated horizon and signals a phase of stabilization of the landscape under herbaceous cover suggesting medium-cold to boreal-cold type environmental conditions. These findings are corroborated by habitat reconstructions based on the malacofauna and microfauna (Kulakovska et al. 2021). The microfauna spectrum is fairly monotonous comprising cold-tolerant species, but no arctic taxa. The spectrum suggests well-watered tundra-like habitat with dry slopes covered in treeless steppic vegetation. Equally, the malacological spectrum is quite narrow and points to arid environmental conditions as well as the predominance of open landscapes (Kulakovska et al. 2021).

Archaeological Layer. AL I was observed in Trench 13-1 and 13-2, Section 13-A and 13-B. In total, approximately 6 m² of deposits containing AL I were excavated during our 2013 fieldwork. AL I is with 9983 archaeological remains by far the richest of the four archaeological layers at

Table 1. Korman' 9, overview of excavated materials per Archaeological Layer (AL)

Find category	AL 0	AL I	AL II	AL III
Lithic	2	6930	14	932
Fauna	—	2938	1	23
Stone / Mineral	—	29	—	—
Ochre	—	5	—	—
Amber	—	2	—	—
Charcoal	—	79	15	2
Total	2	9983	30	957

Korman' 9 (table 1). The finds include lithic artefacts, faunal remains, pieces of red ochre, stones / minerals, charcoals, and organic artefacts including a needle fragment, pendants and beads. For lithic artefacts we have studied both the large (>10 mm) and the small fraction (from wet-sieving).

We documented in AL I (sub-unit 4-1a) areas characterised by reddish coloured sediment, over-

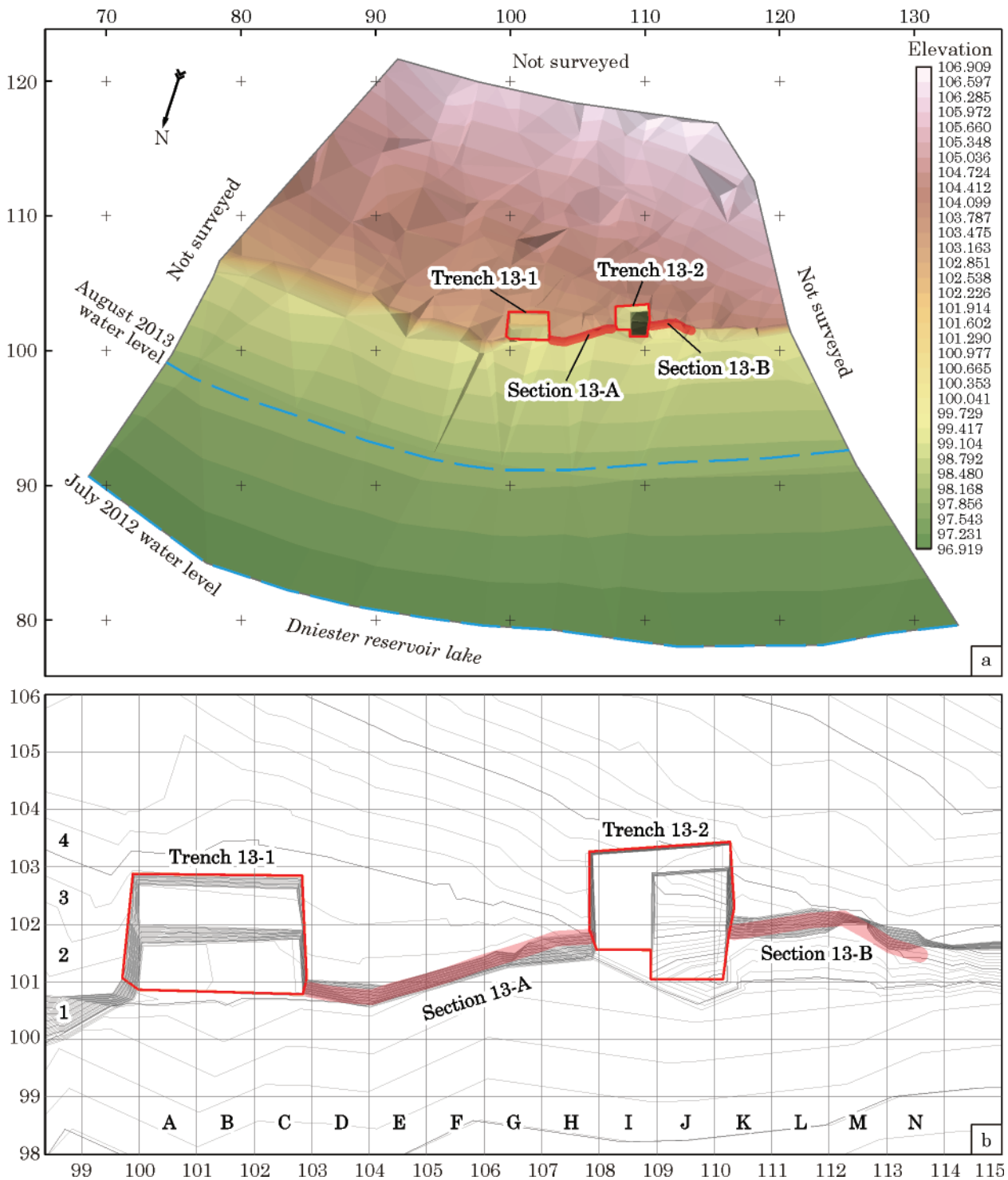


Fig. 3. Korman' 9: Location of the trenches: a — Digital elevation model of the site in 2013 and location of Trenches 13-1 and 13-2 and Sections 13-A and 13-B; b — Contours (contour interval: 0.1 m) showing elevation and location of Trenches 13-1 and 13-2 and Sections 13-A and 13-B. Local grid and square system shown. GIS and graphic: P. R Nigst

lying blackish coloured sediment and again overlying (dark) greyish-brownish sediment, which most probably represent combustion features. In Trench 13-1, combustion feature 1 is located in squares B2 and C2 and stretched by solifluction. Combustion feature 2, located in squares I4 and J4 in Trench 13-2, appears less clear and probably also slightly stretched along the slope by solifluction. Detailed studies on these combustion

features including micromorphological analysis are in progress.

The lithic artefacts of AL I ($n = 6930$) are predominately made on local Turonian raw material. The assemblage is dominated by chips (87.19 %, $n = 6042$) (Kulakovska et al. 2021). All other categories do not amount to more than 5 % of the lithic assemblage, e. g., flakes are with 4.99 % ($n = 346$) the second most abundant category. All stages of core

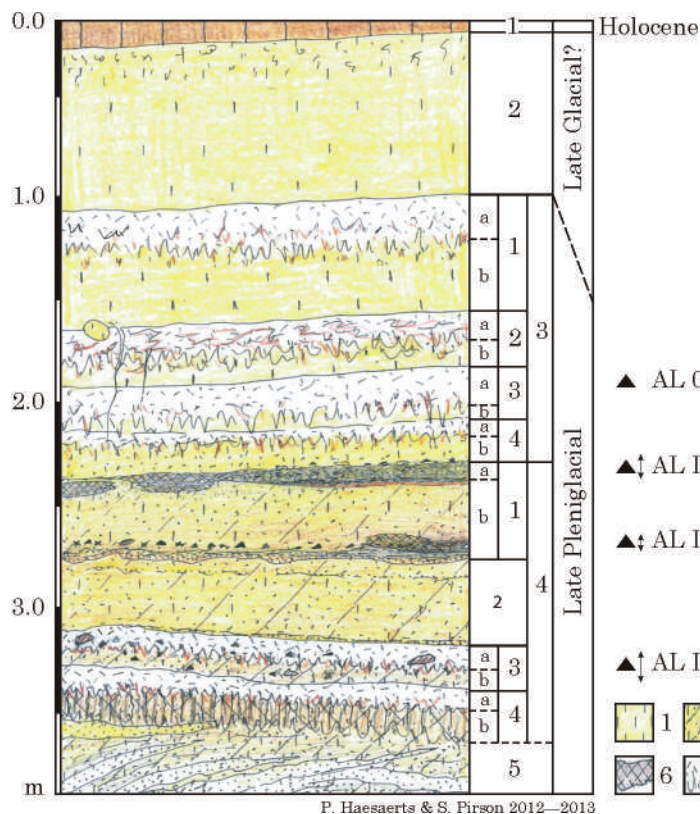


Fig. 4. Pedosedimentary sequence of Korman' 9. Lithostratigraphic units are shown on right. Archaeological Layers (AL) and radiocarbon dates on left. Graphic symbols: 1 — silt; 2 — sandy silt; 3 — sand; 4 — Bt horizon; 5 — bioturbated horizon; 6 — humic lenses; 7 — grey silt (tundra gley); 8 — iron staining; 9 — burned horizon; 10 — lithic artefacts and faunal remains. **Abbreviation:** AL — Archaeological Layer. For calibration details of radiocarbon dates see: (Kulakovska et al. 2021). Graphic: P. Haesaerts, S. Pirson and P. R. Nigst

- ▲ AL 0
- ▲↑ AL I — **17,950 ± 80 BP** [22,032—21,742 cal BP] (GrA-59996, A-2551, *Picea* charcoal)
- ▲↓ AL II — **18,440 ± 80 BP** [22,436—22,229 cal BP] (GrA-59993, A-2559, *Picea* charcoal)
- ▲↑ AL III

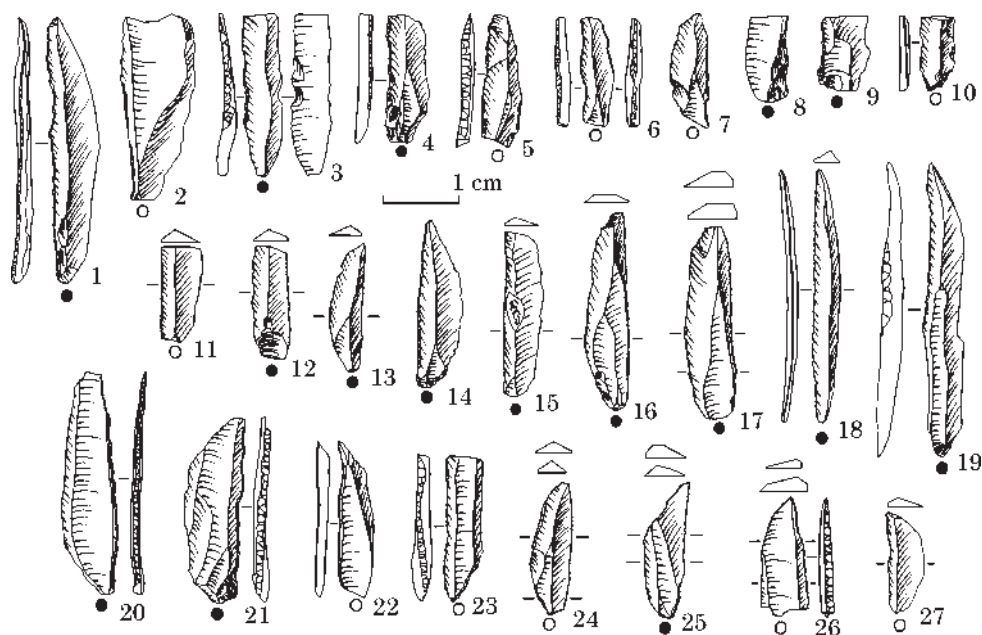


Fig. 5. Korman' 9, AL I: Examples of microliths on bladelets and microblades: 1, 3, 7, 8, 11, 13—16, 18, 19 — unilaterally retouched (backing) microliths on microblades; 11, 13—16, 18, 19 — unilaterally retouched (marginal fine edge retouch) microliths on microblades; 4—6, 10 — bilaterally retouched (backing) microliths on microblades; 12, 17 — bilaterally retouched (marginal fine edge retouch) microliths on microblades; 22—25, 27 — bilaterally retouched (combination of backing and marginal fine edge retouch) microliths on microblades; 2, 9 — unilaterally retouched (backing) microliths on bladelets; 20, 21, 26 — bilaterally retouched (combination of backing and marginal fine edge retouch) microliths on bladelets. Drawings: O. Kononenko

reduction / blank production are documented in the assemblage, including blanks with 100 % dorsal cortex coverage and pre-cores, cores, and core fragments. Microblade production is demonstrated by cores for microblade production. The retouched tool assemblage ($n = 92$) is dominated by tools made on

microblades ($n = 61$) (Kulakovska et al. 2021). The majority of tools is classified as microliths made on microblades ($n = 60$) and bladelets ($n = 9$). Microliths comprise uni- and bilaterally retouched specimens; the retouch types represented are backed and marginal fine retouch (fig. 5). Next to microliths, there

Table 2. Korman' 9, AL I, summary of vertebrate remains *

Species	<i>n</i>	NISP	MNE	MNI	MNI-age
<i>Rangifer tarandus</i>	742	128	58	3	3
<i>Equus</i> sp.	441	72	21	1	2
<i>Lepus timidus</i>	27	7	5	1	2
<i>Lepus</i> sp.	25	12	11	—	—
<i>Vulpes</i> sp.	1	1	1	1	1
Aves	6	4	1	1	1
Microfauna	4	1	—	—	—
Size 2	164	1	—	—	—
Size 2-3	114	16	—	—	—
Size 3	792	238	—	—	—
Size 3-4	84	27	—	—	—
Size 4	307	99	—	—	—
Size 5	4	1	—	—	—
NID	227	0	—	—	—
Total	2938	607	—	—	—

* Please note the updated size classes compared to (Kulakovska et al. 2021), see section «Fauna analysis methods» for more information.

Abbreviations: NID — unidentified; *n* — number of fragments; NISP — number of identifiable specimens; MNE — minimum number of elements; MNI — minimum number of individuals.

are also burins, endscrapers, bilateral points, borers, and combination tools represented.

The lithic assemblage is classified as Epi-gravettian based on the tool types, especially the abundant microliths (on microblade and bladelet blanks), and on the technological signature of the blank production / core reduction (Kulakovska et al. 2021). The radiocarbon date of ca. 17,950 BP (ca. 21,900 cal BP) is in excellent agreement with such an attribution.

Materials and Methods. Materials. The faunal assemblage is stored in the Museum of Archaeology, Institute of Archaeology, Ukrainian Academy of Sciences, in Kyiv, Ukraine. Faunal identification was conducted by one of us (PSM) between 2013 and 2015 and data recorded in a database. Analysis of the faunal data has been conducted by one of us (MDB) in 2020/2021 and 2024. For both the 2020/2021 and 2024 studies the faunal material has not been accessible due to the travel restrictions based on the Covid 19 pandemic (2020/2021) and the Russian war in Ukraine (2024).

Fieldwork methods. Fieldwork methods include stratigraphic excavations taking into consideration the lithostratigraphic boundaries and pedological horizons, piece-plotting of all finds >10 mm, and wet-sieving excavated sediments (for a description of the methodology see, e. g., Nigst et al. 2014). We use a system of units (and sub-units) to label lithostratigraphic units and provide unique identification for each documented of such units / sub-units. Occurrences of ar-

chaeological objects within the lithostratigraphic units are called archaeological layers (AL). For the fieldwork we established a local coordinate system with a grid system with letters in East-West direction and numbers in North-South direction. All finds were piece-plotted using total-stations (Leica TCR 805) and field data collectors (Trimble Recon) running a field database and EDM measurement software¹ (McPherron, Dibble 2002). Each piece-plotted find was assigned a unique ID — consisting of the abbreviation for the site (KRM9) and a running number from 1 to *n* (e. g., KRM9-100) — during the recording process by the EDM Mobile software.

Fauna analysis methods. Faunal data recording. The data in this paper are based on published data (Kulakovska et al. 2021). The original data recording was done by PSM using a Microsoft Access database. Microsoft Excel was used for the initial analysis and R 3.6.3 and the «stats» package (R Core Team 2020) for further analysis by MDB. Due to the geopolitical situation, it was not possible to re-access the bone assemblage. For this paper, the size-class data were altered slightly for comparative purposes and therefore differ from those used in our previous analysis (Kulakovska et al. 2021). Size classes are as follows: Size 1 (ca. 0.5—15 kg — e. g., fox, hare), Size 2 (ca. 20—85 kg — e. g., roe deer, chamois, wolf), Size 3 (ca. 85—315 kg — e. g., reindeer, wild boar, bear), Size 4 (ca. 400—700 kg — e. g., giant deer, horse, bison), Size 5 (>700 kg — e. g., woolly rhinoceros, woolly mammoth). Skeletal element identification was updated to follow the tripartite (element, portion, segment) system using element specific landmarks (e. g., Gifford, Crader 1977; Todd 1998). The longbone zones mentioned are after Marean, Spencer (1991). NISPs (number of identified specimens), MNE (minimum number of elements) and MNI (minimum number of individuals) were calculated after Grayson 1984; Lyman 2008; Reitz, Wing 2008). Here we focus our taphonomic investigations on primary breakage patterns, carnivore and human modifications. Recorded breakage types include: spiral or green breaks that occur on fresh / greasy bones, dry and recent breaks on dried defleshed bones. Carnivore mediation comprise carnivore gnawing and evidence of digestion. Human modifications include cutmarks as well as traces of manufacture and use such as: perforation, smoothing, polishing, signs of mineral colouration etc. The assessment of the recovered organic objects was carried out on the basis of field assessments by MDB and from new photographic material taken by Oksana Votikova from the Institute of Archaeology, National Academy of Sciences, Kyiv, Ukraine.

Technical notes on used maps showing the spatial distribution of materials. All spatial

1. EDM Mobile; <https://www.oldstoneage.com/osa/tech/edmmobile/>.

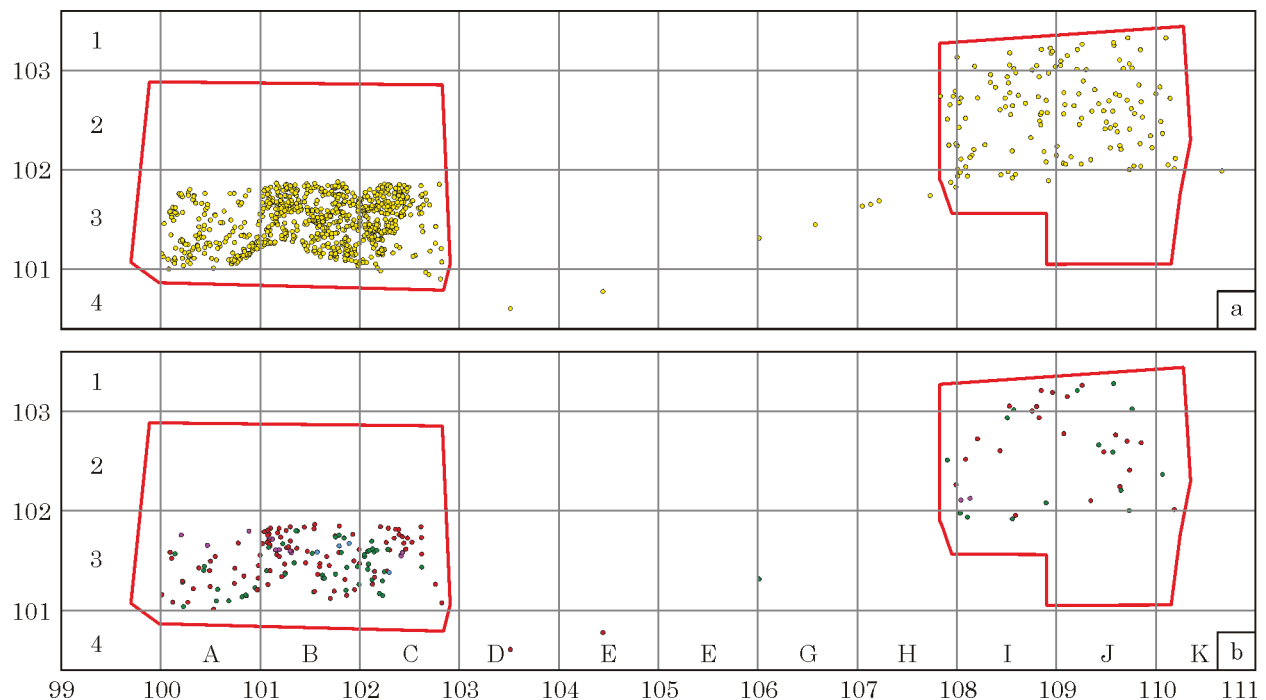


Fig. 6. Korman' 9, AL I: Spatial distribution of all faunal remains (a) and identified taxa (b). Colour codes: yellow: bone, dark red: *Rangifer tarandus*, green: *Equus* sp., purple: *Lepus timidus* and *Lepus* sp., blue: *Aves*. — Points outside of the red trench outlines are faunal remains from the section between and west of the trenches. GIS and graphic: P. R. Nigst

and contextual information are stored in a Microsoft Access database; its structure is compatible with the requirements of NewPlot software² (McPherron, Dibble 2002). Initial GIS analysis was conducted utilizing NewPlot. Further GIS analysis was done in QGIS³. Prior to importing data to QGIS, a table containing spatial and contextual information was exported from Microsoft Access as delimited text (.csv) file and subsequently imported to QGIS. Layouts produced in QGIS were exported as PDFs and post-processed (e. g., adding labels) in Adobe Illustrator (version 28.2).

Results. Faunal spectrum and composition. The large faunal spectrum of Korman' 9, AL I, (table 2) is fairly small, comprising typical cold-adapted taxa and includes reindeer (*Rangifer tarandus*), wild horse (*Equus* sp.), arctic hare (*Lepus timidus*), fox (*Vulpes* sp.) and birds (*Aves*). The vertebrate assemblage is accompanied by few invertebrate remains, namely the freshwater mollusc *Theodoxus* cf. *fluviatilis* and three tubular scaphopod fragments.

The bone assemblage counting 2938 fragments (*n*) and 607 identifiable specimens (NISP) is highly weathered and fragmentary and comprises most skeletal elements and animals of different demographic ages. The overall faunal representation as well as the assemblage's taphonomic signature has been described in (Kulakovska et al. 2021). Here we build on this initial analysis

focussing on the faunal spatial distribution and the nature of human-animal interactions.

The overall find density is higher in Trench 13-1 (fig. 6). The distribution of the three main taxa (reindeer, horse and hare) follow the overall faunal distribution across the excavated areas. In certain instances, animal remains were recovered in anatomical association. Such, as for example, a fragmentary reindeer antler (unfortunately without burr), mandible, three articulated vertebrae, a radius-ulna and a distal tibia with associated calcaneum and astragalus (fig. 7). Although the burr of the reindeer antler was not preserved, the presence of the mandible and three articulated vertebrae suggest that the antler came with the animal and was not collected after shedding.

We further reassessed the minimum number of individuals (MNI) per taxa taking available age-data into account (table 2: MNI-age). For reindeer specimens in three age-classes — juvenile, sub-adult and adult — were identified, mainly based on dental elements. This is the same as the minimum number of individuals derived from skeletal element tallies presented in Kulakovska et al. (2021). Based on substantial differences in the crown height of the maxillary dentition among the horse remains, a second individual not previously recognised could be identified. Equally, among the hare remains, most fragments that could be identified to the species level, i. e., *Lepus timidus* were of adults. Contrary most juvenile specimens could only be identified to the genus level, i. e., *Lepus* sp. This is not surprising as bones of juveniles often lack the epiphysial portions that carry

2. <https://www.oldstoneage.com/osa/tech/plot/>.

3. QGIS version 3.28.2-Firenze, QGIS Association, <http://www.qgis.org>.



Fig. 7. Korman' 9, AL I: Photo during excavation of squares A2/B2 showing location of *Rangifer tarandus* bones in anatomical association. Photo: P. R. Nigst

species specific markers. The presence of both juvenile and adult hares points to the presence of at least two individuals.

Carnivore and human access. Bones were modified in a fresh state. Of the 646 broken bones roughly 32 % ($n = 207$) display green breaks that occurred while the bones were still greasy. Both humans and carnivores can cause spiral or green fractures as part of their dietary behaviour. When humans break open bones for bone marrow extraction green breaks may be accompanied by so-called impact fractures at the location where the bone was hit (e. g., point of impact) and impact flakes that are detached from the bone shaft by the force of the impact. Unfortunately, no such fractures or flakes were recorded leaving the question who caused these fractures unresolved. However, from other cortical surface modifications it is clear that both carnivores and humans had access to the faunal remains.

Twenty specimens (3.1 %) show evidence of carnivore mediation. One specimen has passed through a carnivore's digestive tract and the remaining 19 had gnaw marks on them (table 3). Gnaw marks are more or less equally distributed between horse and reindeer remains as well as across most skeletal elements including those that could only be assigned a size class (2—4) and one unidentifiable bone. Axial elements and the articular ends of longbones (i. e., epiphyses and proximal / distal shafts) are most affected by carnivore mediation (fig. 8).

Twenty-two specimens (3.4 %) exhibit cutmarks. Cutmarks were observed on reindeer,

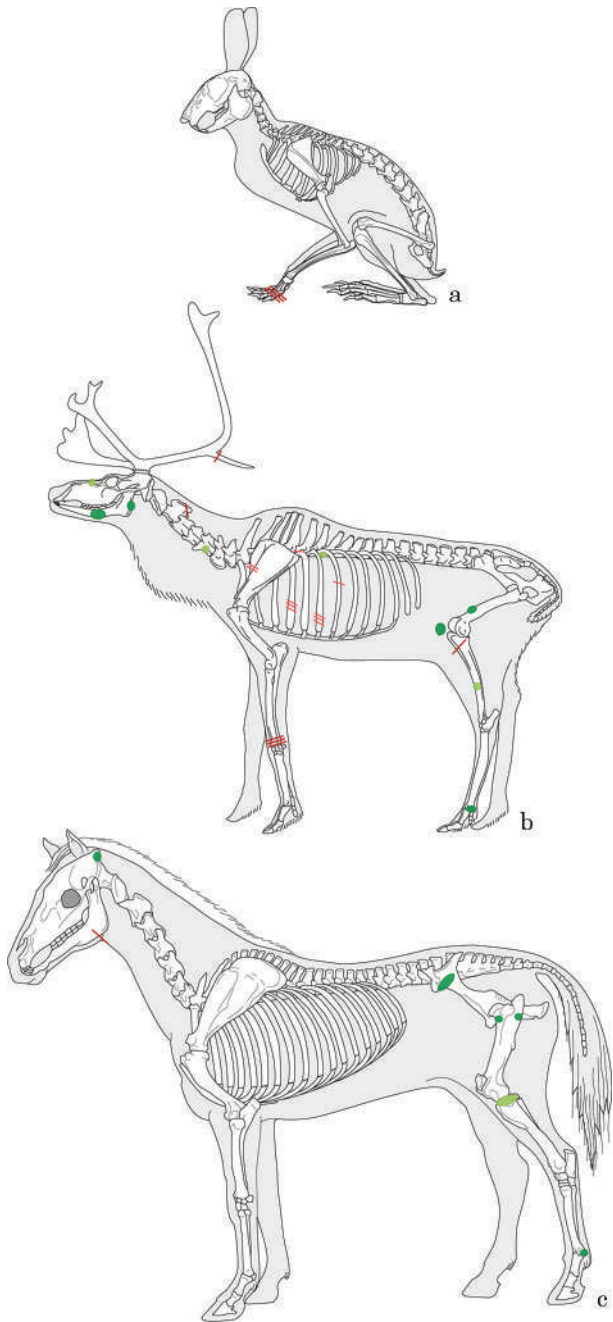


Fig. 8. Korman' 9, AL I: Location of cut marks (red / orange) and carnivore modifications (green / blue) on *Lepus* sp. (a), *Rangifer tarandus* (red / green) and size 3 (orange / blue) (b), and *Equus* sp. (red / green) and size 4 (blue) (c). Animals not to scale. Graphic: M. D. Bosch and P. R. Nigst, animal and bone drawings based on templates by <https://www.archeozoo.org/archeozootheque/> (Michel Coutureau [Inrap] in collaboration with Vianney Forest)

horse and hare as well as on bones of animals of size-classes 2—4 and two unidentifiable fragments (table 4). Cutmarks were present on animals of all age-classes (i. e., juvenile, sub-adult and adult) and generally concentrated on elements yielding high nutritional values (fig. 8). The placement of the observed cutmarks, especially for size-class 3 animals including reindeer

Table 3. Korman' 9, AL I: List of faunal remains with carnivore modifications

ID	Species	Element	Part	Primary breakage	Carnivore modification
KRM9-765b	<i>Equus</i> sp.	femur	trochanter minor	green	Gnawing
KRM9-778	<i>Equus</i> sp.	cranium	occipital condyle	dry	Gnawing
KRM9-765a	<i>Equus</i> sp.	femur	neck	dry	Gnawing
KRM9-1191	<i>Equus</i> sp.	illum	distal blade tuber coxae	dry	Gnawing
KRM9-461	<i>Equus</i> sp.	sesamoid	complete	n. a.	Gnawing
KRM9-1463	NID	spongy bone	NID	dry	Gnawing
KRM9-1170a	<i>Rangifer tarandus</i>	mandible	vertical ramus and condyle	dry	Gnawing
KRM9-965	<i>R. tarandus</i>	mandible	toothrow	dry	Digested
KRM9-1171	<i>R. tarandus</i>	femur	mid shaft	green	Gnawing
KRM9-1681e	<i>R. tarandus</i>	patella	complete	n. a.	Gnawing
KRM9-1912	<i>R. tarandus</i>	metapodial	condyles	dry	Gnawing
KRM9-271	size 2	rib	distal blade	dry	Gnawing
KRM9-1262	size 3	long bone fragment	shaft	dry	Gnawing
KRM9-1577	size 3	cranium	brain case	dry	Gnawing
KRM9-807	size 3	tibia	mid shaft	green	Gnawing
KRM9-1688	size 3	long bone fragment	shaft	green	Gnawing
KRM9-100	size 3	spongy bone	NID	dry	Gnawing
KRM9-1660	size 3	vertebra	NID	dry	Gnawing
KRM9-508	size 3	vertebra	centrum	dry	Gnawing
KRM9-345	size 4	tibia	condyles	dry	Gnawing

Abbreviations: NID — unidentified; n. a. — not applicable.

Table 4. Korman' 9, AL I: List of faunal remains with cutmarks

ID	Species	Element	Part	Primary breakage	n cut-marks	Interpretation
KRM9-254	<i>Equus</i> sp.	mandible	angle	dry	1	dismembering
KRM9-745	<i>Lepus</i> sp.	phalanx 1	complete	n. a.	3	skinning
KRM9-1840	NID	long bone fragment	shaft	green	1	filleting
KRM9-1114	NID	NID	NID	dry	2	—
KRM9-1330	<i>Rangifer tarandus</i>	ulna	distal shaft (zone 4)	green	3	dismembering
KRM9-1102	<i>R. tarandus</i>	antler	tine	dry	2	tool production
KRM9-619	<i>R. tarandus</i>	axis	neural arch and spine	dry	1	dismembering
KRM9-1177	<i>R. tarandus</i>	tibia	anterior crest	green	1	filleting
KRM9-1507	size 2	illum	onset blade above acetabulum	dry	2	dismembering
KRM9-1123	size 3	rib	distal shaft	dry	3	filleting
KRM9-1052	size 3	rib	distal shaft	dry	3	filleting
KRM9-1903	size 3	long bone fragment	shaft	green	3	filleting
KRM9-93	size 3	long bone fragment	shaft	dry	3	filleting
KRM9-1161a	size 3	long bone fragment	shaft	green	3	filleting
KRM9-632a	size 3	spongy bone	NID	dry	2	—
KRM9-322	size 3	long bone fragment	shaft	dry	2	filleting
KRM9-1059	size 3	scapula	cranial blade fragment with spine	dry	2	filleting
KRM9-217	size 3	rib	midshaft	dry	1	filleting
KRM9-705	size 3	thoracic vertebra	centrum	dry	1	dismembering
KRM9-596	size 3	long bone fragment	shaft	green	1	filleting
KRM9-388	size 3	long bone fragment	shaft	green	1	filleting
KRM9-1440	size 4	spongy bone	NID	dry	1	—

Abbreviations: NID — unidentified; n. a. — not applicable.

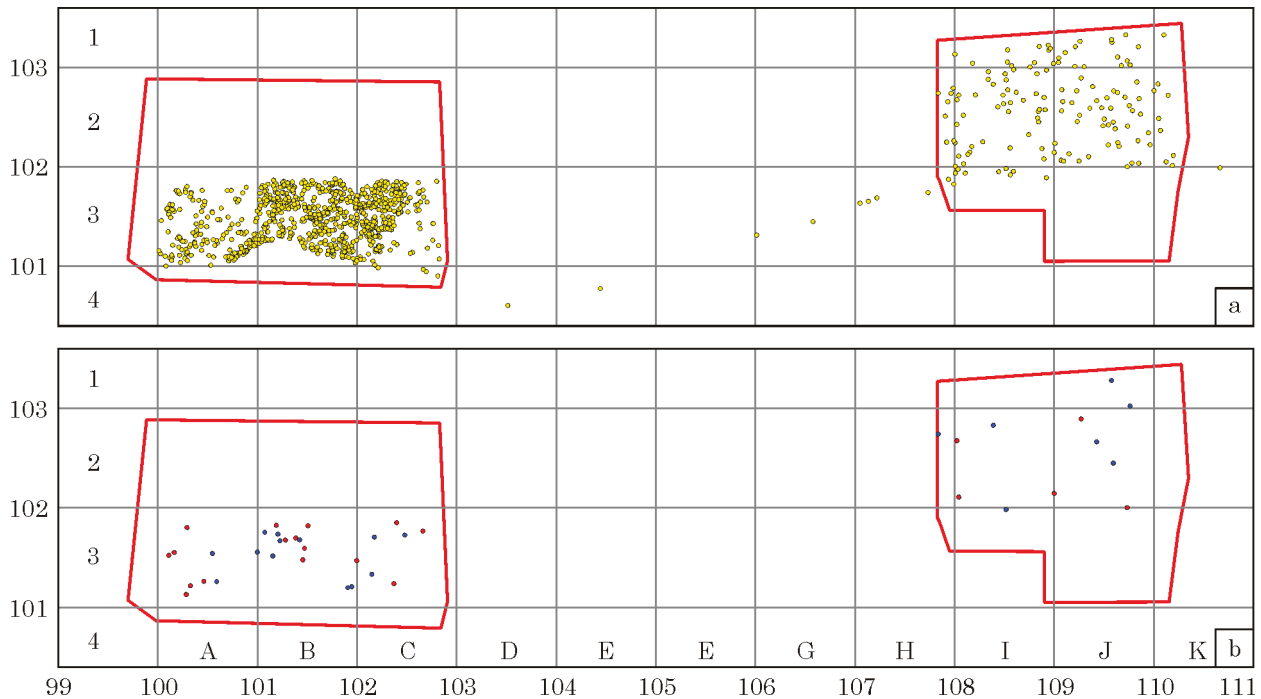


Fig. 9. Korman' 9, AL I: Spatial distribution of all faunal remains (a) and faunal remains with human or carnivore modifications (b). Colour codes: yellow: bone, red: cutmarks, blue: carnivore modification (gnawing and digestion). Points outside of the red trench outlines are faunal remains from the section between and west of the trenches. GIS and graphic: P. R. Nigst

points to a variety of activities such as dismembering, filleting, and skinning. Cutmarks on the neural arch of a reindeer axis, a thoracic vertebra of a size three ungulate and on the iliac blade just above the acetabulum of a size two ungulate innominate points to dismemberment of the axial skeleton of ungulates of size two and three (e. g., fox to reindeer sized). Cutmarks on a distal shaft of a reindeer radius points to additional dismemberment of the appendicular skeleton. Cutmarks on the angle of a horse mandible are congruent with cranial dismemberment to extract the tongue. Evidence for filleting or primary meat removal is presented by cutmarks on a proximal tibia shaft of a reindeer as well as on proximal and distal long bone shafts as well as the scapula of size three ungulates. Cutmarks on both mid- and distal rib shafts points to additional meat removal from the ribcage. A series of parallel cutmarks on the anterior surface of the proximal phalange of a hare point to the removal of its skin probably both to get to the meat and to use the pelt. Cutmarks at the base of an antler tine point to additional non-dietary exploitation of the faunal remains. The spatial distribution of both carnivore and human modified (i. e., cutmarked) bones does not show any clear pattern (fig. 9). Indeed, the frequency of cutmarked and gnawed bones mirrors more or less the spatial distribution of the overall faunal assemblage, i. e., more cutmarked and gnawed bones in Trench 13-1 and less in Trench 13-2. Thus so far, no clear activity area for animal exploitation could be identified.

Secondary exploitation (non-dietary exploitation). Three types of secondary or non-dietary exploitation were identified. First, cutmarks on the first phalanges of a juvenile hare points to the use of its skin. Second, although no formal antler tools were recovered, the above-mentioned cutmarks on an antler tine suggests that it was detached using the groove and snap technique likely to be used as a raw material for tool manufacture. In addition to this, a highly polished distal fragment of a bone needle was recovered (fig. 10: 1). It is unclear whether the specimen would have sported an eye, due to its distal breakage. The specimen's dimensions measure 24×2 mm with the sides slightly tapering toward the tip. The exterior surface is concave and smoothed, the interior surface convex probably mirroring the interior surface of the marrow cavity. The tip is intact and the top 10 mm are polished all around. Post-depositional surface weathering is slight (stage 2 after Behrensmeier 1978) and potentially affected by aerial weathering and geological staining. The third type of non-dietary faunal exploitation — personal ornamentation — is evidenced by a perforated fox carnassial (fig. 10: 5) and four shell beads (fig. 10: 2—4, 6). An amber bead completes the ornamental assemblage (fig. 10: 7). In the following we will describe the shell beads and the tooth pendant in more detail.

Perforated fox tooth. A well-preserved right upper fourth fox (*Vulpes* sp.) premolar has a large perforation through the tip of its posterior root (fig. 10: 5). The perforation is fairly straight probably achieved by bi-directional drilling. Perfo-



Fig. 10. Korman' 9, AL I: Organic objects and personal ornaments: 1 — Bone needle fragment; 2—4 — Dentaliidae shell beads; 5 — Fox (*Vulpes* sp.) tooth pendant; 6 — *Theodoxus* cf. *fluviatilis* shell bead; 7 — Amber bead. Photographs: O. Votiakova, Graphic: M. D. Bosch and P. R. Nigst

ration edges on the lingual side appear lightly smoothed. The buccal perforation edge is affected by post-depositional weathering and the internal surface of the perforation is covered by silty sediment. The enamel of the tooth is only lightly worn with fully formed roots (stage IV—V after Stiner 1994) suggesting the fox was in their early prime.

Perforated Theodoxus cf. (*dniestroviansis*) *fluviatilis*. One perforated freshwater mollusc from the Neritidae family was recovered (fig. 10: 6). The specimen does not retain any of its natural pigmentation and displays some smoothing and edge damage that somewhat hinder taxonomic identification. The specimen is fairly elongated, low domed and has a well-developed spire. It falls well within the genus *Theodoxus* Montford, 1810,

therefore we used the morphological terminology for this genus (after Sands et al. 2020). The apex and spire are highly smoothed and offer no morphological characteristics. The columellar plate is robust and well-defined with an intact inner margin. The specimen shows remarkable resemblance with «*Theodoxus dniestroviansis*» (see Anistratenko et al. 2022: fig. 4: A—C) especially in the long and narrow periostracum shape, its strong spire and well-developed columellar plate. This morphology is also described for *Theodoxus sarmaticus* (Lindholm, 1901) which has a current distribution in Ukraine (Glöer 2019). However, this has also been listed as a synonym of *Theodoxus fluviatilis* (Glöer 2019). The specimen also to a certain extent resembles the morphology of *Theodoxus danubialis* that was present in

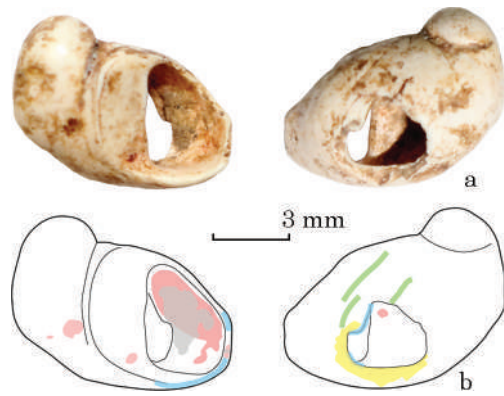


Fig. 11. Korman' 9, AL I: Perforated *Theodoxus* cf. *fluviatilis* shell: a — Ventral and dorsal views (photographs: O. Votiakova); b — Drawing showing traces of human mediation. Colour codes: red: red mineral pigment, blue: smoothing, yellow: chipping, green: cracks, grey: sediment. Graphic: M. D. Bosch and P. R. Nigst

Hungary and the Pannonian rivers during the late Pleistocene (e. g., Krolopp 2003; Feher et al. 2009). However, *Th. danubialis* has a fairly square columellar plate caused by a well-defined apertural shoulder terminating on the spire just within the shell margin. In *Th. dniestrovensis* this shoulder is much less pronounced and follows the outline of the columellar plate giving the plate a more rounded appearance. The latter state corresponds well with the Korman' 9 specimen. It has been hypothesised that *Th. dniestrovensis* Put', 1972 which is present throughout most of the Dniester River basin (Anistratenko et al. 2022) falls within the morphological range of *Theodoxus fluviatilis* Linnaeus, 1758 (see, e. g., Sands et al. 2020; Wesselingh et al. 2019), but the loss of the lectotype until recently prohibited a formal diagnosis. Anistratenko et al. (2022) were able to locate topotypic specimens in the National Museum of Natural History of the National Academy of Sciences of Ukraine (Kyiv) and were able to confirm the position of *Th. dniestrovensis* within the range of *Th. fluviatilis* making the former a junior synonym. The Korman' 9 specimen can therefore tentatively be assigned to *Th. fluviatilis*.

The specimen recovered from Korman' 9 shows manufacture traces of turning it into a bead and subsequent traces of use. The perforation is situated on the middle portion of the periostracum opposite the inner margin (fig. 11). Perforation edges are irregular with exterior chipping. Several semi-parallel cracks run from the perforation toward the aperture. Experimental work by MDB suggests that this is congruent with (in)direct percussion with a tipped implement (see also Benghiat et al. 2009; Bosch et al. 2023; d'Errico et al. 1993; Stiner et al. 2013). The exterior rim on the ventral side and the basal and apertural margin of the perforation edge show restricted smoothing congruent with use-wear

by loose suspension. Red mineral pigment is visible in spots on the ventral side of the spire, the columellar plate on both the interior and exterior surfaces and on the outer margin between two polished areas. The interior surface of the periostracum shows a large area with dispersed red pigment which is covered by adhering sediment congruent with the silty recovery sediment. This indicates that the red pigment was already present on the shell surface before deposition at the site.

Dentaliidae. The three recovered scaphopod fragments could not be assigned to a specific species or genus (fig. 10: 2—4). All three fragments display fairly strong ribs which is a common trait among the family of Dentaliidae, Children, 1834 (e. g., in the genus *Antalis*, *Dentalium* and *Fissidentalium* (see e. g., Harzhauser et al. 2011; Jovanović, Вољњак 2016; Steiner, Kabat 2004). All three fragments are tubular fragments of between 1—1.5 mm in bead length. Two of the fragments come from the middle to apertural segments roughly 4 mm in diameter and the third from the apical segment ca. 3 mm in diameter. No traces of ochre were observed. The first specimen (fig. 10: 2) shows smoothing of the breaks on both the apertural and apical side, the one side more superficial and still retaining a straight breakage surface, the smoothing on the other side is quite extensive and present all around the rim both on the internal and exterior surface. The second piece (fig. 10: 3) shows a straight breakage surface with superficial smoothing on the exterior surface. The other side shows an oblique break across the rim and is well polished in particular on the exterior surface of about half of the bead's circumference. The third specimen (fig. 10: 4) shows both straight apertural and apical breaks that are covered with silty sediment. Both sides show spatially restricted smoothing of the exterior edges that on the apical side at one point extends to the interior surface. The presence of polished surfaces together with the similarity in tubular fragment length are congruent with their use as beads. Sawing and grinding could both have been applied to reduce the bead length, but straight breaks are also common in palaeontological specimens. Microscopy analysis could be carried-out, to shed more light on manufacture processes and a more in-depth analyses of use-wear traces (such as the presence of striations and notches).

Discussion and Conclusion. Taphonomy-related features. The results of the spatial distribution of the Korman' 9, AL I, fauna and especially the presence of both articulated and anatomically associated remains suggests that although AL I was stretched and affected by solifluction, the material was not transported over long distances post-depositionally. Cortical surface weathering generally is moderate to extensive and the main actors appear to be sub-aerial

weathering, root etching and *in situ* fragmentation which is congruent with the stratigraphic position of the material within a pedogenesis horizon (sub-unit 4-1a) i.e., a period of stabilisation and affected by bioturbation (Kulakovska et al. 2021). Both the high fragmentation rate and presence of anatomically associated remains is mirrored in the microfauna the latter pointing to *in situ* decomposition. Additionally, the molluscan fauna is characterised by an autochthonous taxonomic spectrum, showing no evidence of redeposition of the material (e. g., Neogene or freshwater species commonly found in Pleistocene terrestrial deposits in the Dniester valley). Together these independent lines of evidence form a coherent view of the depositional context of AL I.

Palaeoenvironment. The taxonomic spectra across the malaco-, micro- and macrofauna are all fairly narrow and comprise of cold-tolerant but not necessarily arctic taxa. Taken together they point toward a well-watered tundra-like habitat with dry slopes covered in treeless steppic herbaceous vegetation. A predominance of open landscapes in medium-cold to boreal cold environmental conditions congruent with cold, but ameliorating conditions of the Cosăuți V Interstadial following a period of extreme cold (Kulakovska et al. 2021).

Human-animal interactions. The main accumulators and exploiters of faunal remains at Korman' 9, AL I, appear to be the Epigravettian hunter-gatherers. Carnivores contributed to the assemblage's taphonomic signature, but the distribution of carnivore damage on articular ends of longbones, suggests that they only had secondary access to the faunal remains. A similar succession of access has recently been described for the Epigravettian at Velika Pećina in the Balkans (Stiner et al. 2022). The Korman' 9 macrofaunal spectrum comprises reindeer (*Rangifer tarandus*), wild horse (*Equus* sp.), arctic hare (*Lepus timidus*), fox (*Vulpes* sp.), birds (Aves), a freshwater gastropod (*Theodoxus* cf. *fluviatilis*) and scaphopods (Dentaliidae). All of these taxa — including the bird remains if we consider burning traces on one of the fragments — show traces of human-mediation. Faunal exploitation served several distinct purposes. Horse, reindeer and probably hare and birds were obtained for subsistence purposes. In addition to dietary exploitation, hares were exploited for their skins and reindeer for their antler. If the concave-convex shape of the needle fragment represents the bone's original cortical thickness, this would suggest that it was made on a longbone of a small to medium animal (e. g., fox-ibex sized). The fox was exploited for personal ornamentation as were the molluscs. Anthropogenic modifications on a reindeer antler tine suggest that the manufacture of organic objects was practised at the site. The presence of bone needles or fine points as well as the on-site production of organic ob-

jects is mirrored at Velika Pećina although the latter evidenced on red deer antler and mammoth ivory (Stiner et al. 2022). Indeed, varied secondary exploitation of animal tissues is argued to be an integral part of the East European Gravettian (Velichko, Kurenkova 1990; Demay et al. 2021). Thus, in addition to dietary exploitation, animal remains formed a common and diverse part of socio-economic behaviour and were well-incorporated in hunter-gatherer technological and symbolic expression during the Epigravettian at Korman' 9, AL I.

Regional scope — Dietary exploitation.

In terms of dietary exploitation, the macrofaunal spectrum at Korman' 9, AL I, dominated by reindeer fits very well with the few other roughly contemporaneous Epigravettian occurrences in the Dniester valley such as Korman' IV, Layers 3—4, Molodova 5, Layer 4, and — slightly more downstream — Cosăuți, Layers 4 to 2b (see, e. g., Noiret 2009). Faunal exploitation in these sites also centres on reindeer with horse as a secondary favoured taxon. At Molodova V, Layer 4, and Korman' IV, Layer 4, horse is paralleled by mammoth in equal numbers. Bison and red deer occur in very low quantities. Noiret (2009) evaluated the faunal spectrum of these sites in terms of maximum meat acquisition. Due to the larger body-size of the wild horse, dietary return rates between reindeer and horse are more or less the same. Of course, in the instances where mammoth is present, the maximum potential of meat acquisition would have been several orders of magnitude greater, although it is unclear if that potential was also reached. At Korman' 9, AL I, it remains somewhat unclear if horse and reindeer exploitation followed the same pattern or if reindeer was exploited to a larger degree than horse. Skeletal element representation of both species suggests that head and appendicular parts were taken to the site and, in addition, axial parts of reindeer (Kulakovska et al. 2021). The sole cutmark on horse involves the extraction of the tongue, no fluting marks were observed on horse. It could be that different transport decisions and/or exploitation strategies were applied concerning reindeer and horse exploitation. Indeed, at Cosăuți, Layer 3, and Korman' IV, Layer 4 (Hofecker 2002, table 6.4), the NISP / MNI ratio is about 4 times higher for reindeer than for horse, pointing to a higher fragmentation rate of reindeer bones. This could be caused by differences in exploitation strategy (e. g., more intense marrow exploitation), and transport decisions, but could also be caused by differential preservation of more dense elements. More detailed analyses on density mediated attrition, and skeleton element representations in relation to food utility values should be carried out to further explore these issues. Overall faunal exploitation, however, is congruent with that of contemporary Epigravettian sites in the area providing more evidence that

next to the occupation of refugial areas in the more southern parts of Europe, open-air localities across the East Carpathian Area along the larger river systems such as the Dniester were also frequented during this time.

Regional scope — Organic technology.

Regarding the secondary exploitation of animal tissues, Korman' 9, AL I, shows — as mentioned above — similarities to other Epigravettian sites such as the refugial site of Velika Pečina in the Balkans (Stiner et al. 2022). Also closer to home, sites directly postdating the Frankfurt glacial extent such as at Korman' IV, Layer 4, there is evidence of worked antler and of a small bone point of about 7 cm length and 1 cm width. The cross section would be oval, were it not for an incision along one lateral side (Черныш 1977). At Molodova V, Layer 4, Noiret (2009) mentions organic weaponry made on both reindeer antler and mammoth ivory as well as evidence for bone and antler working at Cosăuți, Layer 4 to 2b. Most striking however, are the similarities with the organic objects from Cosăuți, Layers 3 and 3a. These layers' organic assemblages are richer than what we recovered at Korman' 9, AL I, and comprise projectile points in ivory, bone and antler as well as several objects made on ivory including bracelets (Layer 3a), decorated (incised) bones (Layer 3) and numerous beads made out of deer and fox canines (Layer 3), fossil shells and stone (both Layers) and one notably on amber (Layer 3a) as at Korman' 9, AL I. Amber beads are rare in this time period, although several hundreds of them were reported from Mezhirich on the Dnieper (see Soffer 1985). For Cosăuți, Layer 3a, Noiret (2009, fig. 231) further displays two tubular beads that are said to be made on coral, but show great resemblance to the Dentaliidae beads at Korman' 9, AL I. A small perforated fossil gastropod shell bead is recorded for Cosăuți, Layer 3, along with a number of perforated teeth, red deer canines in Layer 3 and fox canines in Layer 3b. However, there appears to be no direct parallel for the perforated fox car-nassial.

Thus human-animal interactions in the East Carpathian Area were diverse with a lot of variation at the site level. As seen for example by the presence of mammoth remains at some sites and their absence at others. Overall, however, sites show many similarities both in terms of dietary exploitation focussing on horse and reindeer and exploitation of pelts, on-site dismemberment and filleting of large fauna as well as on-site antler and bone working. Despite the scarcity of sites dating to this period, there is quite some variation in personal ornamentation. Although also some analogies in symbolic expression can be observed as well, in particular in raw-material choice, perforation technique and bead shape.

Acknowledgements. We thank the following individuals for support of our fieldwork and /

or laboratory research: P. Haesaerts, S. Pirson, F. Damblon, M. Shemonia, A. Kordunian, A. Pryor, C. Stimpson, G. Mutri, and E. Croxall. We also thank N. Gerasimenko and B. Riduch for exchange on topics related to our research at Korman' 9. We are grateful to O. Votiakova for photographing the beads and the needle. The fieldwork and analysis were funded by the following grants awarded to PRN: EC FP7 Marie Curie Career Integration Grant no. 322261 (NEMO-ADAP project), Leakey Foundation general grant (spring 2012 granting cycle), several D. M. McDonald Grants and Awards Fund grants, Isaac Newton Trust Small Grant, Isaac Newton Trust Matching Funding Grant, British Academy / Leverhulme Trust Small Grant, and the Max-Planck-Society. During the analysis for and the write-up of the current paper, PRN was supported by the University of Vienna. MDB was supported by a Seal of Excellence Fellowship of the Austrian Academy of Sciences (*TechnoBeads* project, grant no. 101061287). During the preparation of this manuscript VIU was supported by a Researchers at Risk Fellowship of the Czech Academy of Sciences. Author contributions: DMB, LK and PRN designed research, LK, VIU and PRN directed fieldwork, PSM collected faunal data, MDB analysed faunal data, PRN carried out the spatial analysis, LK, VIU and OK provided contextual data, DMB and PRN wrote the manuscript with input from all other authors.

ЛІТЕРАТУРА

- Иванова, И. К. 1959. Геологические условия нахождения палеолитических стоянок Среднего Приднестровья. *Труды Комиссии по изучению четвертичного периода*, XV, с. 215-278.
- Иванова, И. К. 1977. Геология и палеогеография стоянки Кормань IV на общем фоне геологической истории каменного века Среднего Приднестровья. В: Горецкий, Г. И., Цейтлин, С. М. (ред.). *Много-слойная палеолитическая стоянка Кормань IV на Среднем Днестре. К X Конгрессу INQUA (Великобритания, 1977)*. Москва: Наука, с. 126-171.
- Кулаковська, Л., Усик, В., Нігст, Ф., Езартс, П. 2013. Палеолітичні новини з Середнього Подністер'я. *Археологічні дослідження в Україні 2012 р.*, с. 369-370.
- Кулаковська, Л. В., Усик, В. І., Езартс, П., Пірсон, С., Кононенко, О. М., Нігст, Ф. 2019. Верхньопалеолітична стоянка Кормань 9. *Археологія і давня історія України*, 3 (32), с. 111-125.
- Черныш, А. П. 1973. *Палеолит и мезолит Приднестровья (карты и каталог местонахождений)*. Москва: Наука.
- Черныш, А. П. 1977. Многослойная палеолитическая стоянка Кормань IV и ее место в палеолите. В: Горецкий, Г. И., Цейтлин, С. М. (ред.). *Много-слойная палеолитическая стоянка Кормань IV на Среднем Днестре. К X Конгрессу INQUA (Великобритания, 1977)*. Москва: Наука, с. 7-66.
- Anistratenko, O. Y., Degtyarenko, E. V., Osipova, D. S., Maksymenko, Y. V., Anistratenko, V. V. 2022.

A neritid gastropod name «*Theodoxus dniestrovienensis* Put', 1972» is a junior subjective synonym of *Th. fluviatilis* (L., 1758): decision based on the topotypic specimens study. *Ruthenica*, 32, 2, p. 61-68.

Banks, W. E., Aubry, T., d'Errico, F., Zilhão, J., Lira-Noriega, A., Townsend Peterson, A. 2011. Eco-cultural niches of the Badegoulian: Unraveling links between cultural adaptation and ecology during the Last Glacial Maximum in France. *Journal of Anthropological Archaeology*, 30, 3, p. 359-374.

Behrensmeier, A. K. 1978. Taphonomic and ecologic information from bone weathering. *Paleobiology*, 4, 2, p. 150-162.

Benghiat, S., Komšo, D., Miracle, P. T. 2009. An experimental analysis of perforated shells from the site of Šebirn Abri (Istria), Croatia. In: McCartan, S., Schulting, R., Warren, G., Woodman, P. (eds.). *Mesolithic Horizons: Papers Presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005*. Oxford, p. 730-736.

Bosch, M. D., Buck, L. T., Strauss, A. 2023. Perforations in *Columbellidae* shells: Using 3D models to differentiate anthropogenic piercing from natural perforations. *Journal of Archaeological Science: Reports*, 49, 103937.

Burke, A., Kageyama, M., Latombe, G., Fasel, M., Vrac, M., Ramstein, G., James, P. M. A. 2017. Risky business: The impact of climate and climate variability on human population dynamics in Western Europe during the Last Glacial Maximum. *Quaternary Science Reviews*, 164, p. 217-229.

Cascalheira, J., Alcaraz-Castaño, M., Alcolea-González, J., de Andrés-Herrero, M., Arrizabalaga, A., Aura Tortosa, J. E., Garcia-Ibaibarriaga, N., Iriarte-Chiapusso, M.-J. 2021. Paleoenvironments and human adaptations during the Last Glacial Maximum in the Iberian Peninsula: a review. *Quaternary International*, 581—582, p. 28-51.

d'Errico, F., Jardon-Giner, P., Soler-Mayor, B. 1993. Critères a base expérimentale pour l'étude des perforations naturelles et intentionnelles sur coquillages. In: Anderson, P. C., Beyries, S., Otte, M., Plisson, H. (eds.). *Traces et fonction: les gestes retrouvés*. Liege, p. 243-254.

Demay, L., Belyaeva, V. I., Kulakovksa, L. V., Patou-Mathis, M., Péan, S., Stupak, D. V., Vasil'ev, P. M., Otte, M., Noiret, P. 2016. New evidences about human activities during the first part of the Upper Pleniglacial in Ukraine from zooarchaeological studies. *Quaternary International*, 412, p. 16-36.

Demay, L., Julien, M. A., Anghelinu, M., Shydlovskiy, P. S., Koulakovska, L. V., Péan, S., Stupak, D. V., Vasyliiev, P. M., Obáda, T., Wojtal, P., Belyaeva, V. I. 2021. Study of human behaviors during the Late Pleniglacial in the East European Plain through their relation to the animal world. *Quaternary International*, 581—582, p. 258-289.

Dogandžić, T., McPherron, S. P., Mihailović, D. 2014. Middle and Upper Paleolithic in the Balkans: Continuities and discontinuities of human occupations. In: Mihailović, D. (ed.). *Palaeolithic and Mesolithic Research in the Central Balkans*. Belgrade, p. 83-96.

Fehér, Z., Zettler, M., Bozsó, M., Szabó, K. 2009. An attempt to reveal the systematic relationship between *Theodoxus prevostianus* (C. Pfeiffer, 1828) and *Theodoxus danubialis* (C. Pfeiffer, 1828) (Mollusca, Gastropoda, Neritidae). *Mollusca*, 27, 2, p. 95-107.

Gifford, D. P., Crader, D. C. 1977. A Computer Coding System for Archaeological Faunal Remains. *American Antiquity*, 42, 2, p. 225.

Glöer, P. 2019. *The Freshwater Gastropods of the West-Palaeoarctis*. I: Fresh- and brackish waters except spring and subterranean snails. Hetlingen: Biodiversity Research Lab.

Grayson, D. K. 1984. *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. Orlando: Academic Press.

Haesaerts, P., Borziac, I., Chekha, V. P., Chirica, V., Drozdov, N. I., Koulakovska, L., Orlova, L. A., Plicht, J. van der, Damblon, F. 2010. Charcoal and wood remains for radiocarbon dating Upper Pleistocene loess sequences in Eastern Europe and Central Siberia. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 291, 1—2, p. 106-127.

Haesaerts, P., Borziac, I., Chirica, V., Damblon, F., Koulakovska, L., Van der Plicht, J. 2003. The East Carpathian Loess Record: A Reference for the Middle and Late Pleniglacial Stratigraphy in Central Europe. *Quaternaire*, 14, 3, p. 163-188.

Haesaerts, P., Gerasimenko, N., Damblon, F., Yurchenko, T., Kulakovska, L., Usik, V., Ridush, B. 2020. The Upper Palaeolithic site Doroshivtsi III: A new chronostratigraphic and environmental record of the Late Pleniglacial in the regional context of the Middle Dniester-Prut loess domain (Western Ukraine). *Quaternary International*, 546, p. 196-215.

Harzhauser, M., Mandić, O., Schlögl, J. 2011. A late Burdigalian bathyal mollusc fauna from the Vienna Basin (Slovakia). *Geologica Carpathica*, 62, 3, p. 211-231.

Hoffecker, J. F. 2002. *Desolate landscapes: Ice-Age settlement in Eastern Europe*. Rutgers University.

Ivanova, I. K., Chernysh, A. P. 1965. The Paleolithic site of Molodova V on the Middle Dniestr. *Quaternaria*, VII, p. 197-217.

Jovanović, G., Вољњак, M. 2016. Fissidentalium badense (Partsch in Hupnes, 1856) from the Badenian deposits of the south and southwestern margin of the Pannonian Basin System (Central Paratethys). *Geologica Croatica*, 69, 2, p. 195-200.

Klein, R. G. 1973. *Ice-Age Hunters of the Ukraine*. Chicago: University of Chicago.

Klein, K., Wegener, C., Schmidt, I., Rostami, M., Ludwig, P., Ulbrich, S., Richter, J., Weniger, G.-C., Shao, Y. 2021. Human existence potential in Europe during the Last Glacial Maximum. *Quaternary International*, 581—582, p. 7-27.

Krolopp, E. 2003. Mollusc species of the Hungarian Pleistocene formations (as of Dec 31 of year 2002). *Malakológiai Tájékoztató*, 21, p. 13-18.

Kulakovska, L., Usik, V., Haesaerts, P., Ridush, B., Uthmeier, T., Hauck, T. C. 2015. Upper Paleolithic of Middle Dniester: Doroshivtsi III site. *Quaternary International*, 359, p. 347-361.

Kulakovska, L., Kononenko, O., Haesaerts, P., Pirson, S., Spry-Marqués, P., Bosch, M. D., Popova, L., Popiuk, Y., Damblon, F., Usik, V., Nigst, P. R. 2021. The new Upper Palaeolithic site Korman' 9 in the Middle Dniester valley (Ukraine): Human occupation during the Last Glacial Maximum. *Quaternary International*, 587—588, p. 230-250.

Lyman, R. L. 2008. *Quantitative paleozoology*. Cambridge: Cambridge University.

Marean, C. W., Spencer, L. M. 1991. Impact of carnivore ravaging on zooarchaeological measures of element abundance. *American Antiquity*, 56, p. 645-658.

McPherron, S. P., Dibble, H. L. 2002. *Using Computers in Archaeology: A Practical Guide*. Boston: McGraw-Hill.

- Mihailović, D. 2014. *Palaeolithic and Mesolithic Research in the Central Balkans*. Belgrade: Serbian Archaeological Society.
- Nigst, P. R., Haesaerts, P., Damblon, F., Frank-Fellner, C., Mallol, C., Viola, B., Götzinger, M., Niven, L., Trnka, G., Hublin, J.-J. 2014. Early modern human settlement of Europe north of the Alps occurred 43,500 years ago in a cold steppe-type environment. *Proceedings of the National Academy of Sciences*, 111, 40, p. 14394-14399.
- Noiret, P. 2009. *Le Paléolithique supérieur de Moldavie. Essai de synthèse d'une évolution multi-culturelle*. Liège: Université de Liège.
- Pinhasi, R., Meshveliani, T., Matskevich, Z., Bar-Oz, G., Weissbrod, L., Miller, C. E., Wilkinson, K., Lordkipanidze, D., Jakeli, N., Kvavadze, E., Higham, T. F. G., Belfer-Cohen, A. 2014. Satsurblia: New Insights of Human Response and Survival across the Last Glacial Maximum in the Southern Caucasus. *Plos one*, 9 (10), e111271.
- Poltowicz-Bobak, M., Kulakovska, L., Bobak, D., Usik, V., Kononenko, O., Łanczont, M., Mroczek, P., Standzikowski, K., Demay, L., Nadachowski, A., Lemaniak, A. 2022. Old site, new problems: the Gravettian campsite of Doroshivtsi III, Middle Dniester River Valley, western Ukraine. *Antiquity*, 96 (388), p. 1-10.
- R Core Team 2020. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- Reitz, E. J., Wing, E. S. 2008. *Zooarchaeology*. Cambridge: Cambridge University.
- Sands, A. F., Glöer, P., Gürlek, M. E., Albrecht, C., Neubauer, T. A. 2020. A revision of the extant species of Theodoxus (Gastropoda, Neritidae) in Asia, with the description of three new species. *Zoosystematics and Evolution*, 96, 1, p. 25-66.
- Soffer, O. 1985. *The Upper Paleolithic of the central Russian plain*. Academic Press.
- Soffer, O. 1990. The Russian Plain at the Last Glacial Maximum. In: Soffer, O., Gamble, C. (eds.). *The World at 18000 BP: High Latitudes*. London, p. 228-254.
- Steiner, G., Kabat, A. R. 2004. *Catalog of species-group names of Recent and fossil Scaphopoda (Mollusca)*. Publications Scientifiques du Muséum national d'Histoire naturelle Paris. Paris.
- Stiner, M. C. 1994. *Honor among thieves: A zooarchaeological study of Neandertal ecology*. Princeton: Princeton University.
- Stiner, M. C., Kuhn, S. L., Güleç, E. 2013. Early Upper Paleolithic shell beads at Üçağızlı Cave I (Turkey): technology and the socioeconomic context of ornament life-histories. *Journal of Human Evolution*, 64, 5, p. 380-398.
- Stiner, M. C., Dimitrijević, V., Mihailović, D., Kuhn, S. L. 2022. Velika Pećina: Zooarchaeology, taphonomy and technology of a LGM Upper Paleolithic site in the central Balkans (Serbia). *Journal of Archaeological Science: Reports*, 41, 103328.
- Tallavaara, M., Luoto, M., Korhonen, N., Järvinen, H., Seppä, H. 2015. Human population dynamics in Europe over the Last Glacial Maximum. *Proceedings of the National Academy of Sciences*, 112, 27, p. 8232-8237.
- Todd, L. C. 1998. *Bison osteology and bone coding field guide*. Unpublished guide, Colorado State University.
- Van Andel, T. H., Tzedakis, P. C. 1996. Palaeolithic landscapes of Europe and environs, 150,000—25,000 years ago: an overview. *Quaternary science reviews*, 15, 5—6, p. 481-500.
- Velichko, A. A., Kurenkova, E. I. 1990. Environmental conditions and human occupation of northern Eurasia during the Late Valdai. In: Soffer, O., Gamble, C. (eds.). *The World at 18000 BP: High Latitudes*. London, p. 255-265.
- Wesselingh, F. P., Neubauer, T. A., Anistratenko, V. V., Maxim, V. V., Yanina, T., Ter Poorten, J. J., Kijashko, P., Albrecht, C., Anistratenko, O. Y., D'Hont, A., Frolov, P., Ándara, A. M., Gittenberger, A., Gogaladze, A., Mikhail, K., Lattuada, M., Popa, L., Sands, A. F., Lde, S. V. V., Vandendorpe, J., Wilke, T. 2019. Mollusc species from the Pontocaspian region — an expert opinion list. *Zookeys*, 827, p. 31-124.

REFERENCES

- Ivanova, I. K. 1959. Geologicheskie usloviia nakhozhdeniia paleoliticheskikh stoiianok Srednego Pridnestrovia. *Trudy Komissii po izucheniiu chetvertichnogo perioda*, XV, s. 215-278.
- Ivanova, I. K. 1977. Geologiiia i paleogeografiia stoiianki Korman IV na obshchem fone geologicheskoi istorii kamenogo veka Srednego Pridnestrovia. In: Goretskii, G. I., Tseitlin, S. M. (eds.). *Mnogoslinaia paleoliticheskaia stoiianka Korman IV na Srednem Dnestre. K X Kongressu INQUA (Velikobritaniia, 1977)*. Moskva: Nauka, s. 126-171.
- Kulakovska, L., Usyk, V., Nigst, Ph., Haesaerts, P. 2013. Paleolitychni novyny z Serednoho Podnister'ia. *Arkheolohichni doslidzhennia v Ukraini 2012 r.*, s. 369-370.
- Kulakovska, L. V., Usyk, V. I., Haesaerts, P., Pirson, S., Kononenko, O. M., Nigst, Ph. 2019. Verkhnapaleolitychna stoiianka Korman 9. *Arkheolohiia i davnia istoriia Ukrainy*, 3 (32), s. 111-125.
- Chernysh, A. P. 1973. *Paleolit i mezolit Pridnestrovia (karty i katalog mestonakhozhdenii)*. Moskva: Nauka.
- Chernysh, A. P. 1977. Mnogoslinaia paleoliticheskaia stoiianka Korman IV i ee mesto v paleolite. In: Goretskii, G. I., Tseitlin, S. M. (eds.). *Mnogoslinaia paleoliticheskaia stoiianka Korman IV na Srednem Dnestre. K X Kongressu INQUA (Velikobritaniia, 1977)*. Moskva: Nauka, s. 7-66.
- Anistratenko, O. Y., Degtyarenko, E. V., Osipova, D. S., Maksymenko, Y. V., Anistratenko, V. V. 2022. A neritid gastropod name «*Theodoxus dniestrovensis* Put', 1972» is a junior subjective synonym of *Th. fluviatilis* (L., 1758): decision based on the topotypic specimens study. *Ruthenica*, 32, 2, p. 61-68.
- Banks, W. E., Aubry, T., d'Errico, F., Zilhão, J., Lira-Noriega, A., Townsend Peterson, A. 2011. Eco-cultural niches of the Badegoulian: Unraveling links between cultural adaptation and ecology during the Last Glacial Maximum in France. *Journal of Anthropological Archaeology*, 30, 3, p. 359-374.
- Behrensmeier, A. K. 1978. Taphonomic and ecologic information from bone weathering. *Paleobiology*, 4, 2, p. 150-162.
- Benghiat, S., Komšo, D., Miracle, P. T. 2009. An experimental analysis of perforated shells from the site of Šebri Abri (Istria), Croatia. In: McCartan, S., Schulting, R., Warren, G., Woodman, P. (eds.). *Mesolithic Horizons: Papers Presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005*. Oxford, p. 730-736.
- Bosch, M. D., Buck, L. T., Strauss, A. 2023. Perforations in *Columbellidae* shells: Using 3D models to differentiate anthropogenic piercing from natural perforations. *Journal of Archaeological Science: Reports*, 49, 103937.
- Burke, A., Kageyama, M., Latombe, G., Fasel, M., Vrac, M., Ramstein, G., James, P. M. A. 2017. Risky business: The impact of climate and climate variability on human population dynamics in Western Europe during the Last Glacial Maximum. *Quaternary Science Reviews*, 164, p. 217-229.
- Cascalheira, J., Alcaraz-Castaño, M., Alcolea-González, J., de Andrés-Herrero, M., Arrizabalaga, A., Aura Tortosa, J. E., Garcia-Ibaibarriaga, N., Iriarte-Chiapusso, M.-J. 2021. Paleoenvironments and human adaptations during the Last

- Glacial Maximum in the Iberian Peninsula: a review. *Quaternary International*, 581—582, p. 28-51.
- d'Errico, F., Jardon-Giner, P., Soler-Mayor, B. 1993. Critères a base expérimentale pour l'étude des perforations naturelles et intentionnelles sur coquillages. In: Anderson, P. C., Beyries, S., Otte, M., Plisson, H. (eds.). *Traces et fonction: les gestes retrouvés*. Liege, p. 243-254.
- Demay, L., Belyaeva, V. I., Kulakovska, L. V., Patou-Mathis, M., Péan, S., Stupak, D. V., Vasil'ev, P. M., Otte, M., Noiret, P. 2016. New evidences about human activities during the first part of the Upper Pleniglacial in Ukraine from zooarchaeological studies. *Quaternary International*, 412, p. 16-36.
- Demay, L., Julien, M. A., Anghelinu, M., Shydlovskiy, P. S., Koulikovska, L. V., Péan, S., Stupak, D. V., Vasyliiev, P. M., Obāda, T., Wojtal, P., Belyaeva, V. I. 2021. Study of human behaviors during the Late Pleniglacial in the East European Plain through their relation to the animal world. *Quaternary International*, 581—582, p. 258-289.
- Dogandžić, T., McPherron, S. P., Mihailović, D. 2014. Middle and Upper Paleolithic in the Balkans: Continuities and discontinuities of human occupations. In: Mihailović, D. (ed.). *Palaeolithic and Mesolithic Research in the Central Balkans*. Belgrade, p. 83-96.
- Fehér, Z., Zettler, M., Bozsó, M., Szabó, K. 2009. An attempt to reveal the systematic relationship between *Theodoxus prevostianus* (C. Pfeiffer, 1828) and *Theodoxus danubialis* (C. Pfeiffer, 1828) (Mollusca, Gastropoda, Neritidae). *Mollusca*, 27, 2, p. 95-107.
- Gifford, D. P., Crader, D. C. 1977. A Computer Coding System for Archaeological Faunal Remains. *American Antiquity*, 42, 2, p. 225.
- Glöer, P. 2019. *The Freshwater Gastropods of the West-Palaeoarctis*. I: Fresh- and brackish waters except spring and subterranean snails. Hetlingen: Biodiversity Research Lab.
- Grayson, D. K. 1984. *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. Orlando: Academic Press.
- Haesaerts, P., Borziac, I., Chekha, V. P., Chirica, V., Drozdov, N. I., Koulikovska, L., Orlova, L. A., Plicht, J. van der, Damblon, F. 2010. Charcoal and wood remains for radiocarbon dating Upper Pleistocene loess sequences in Eastern Europe and Central Siberia. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 291, 1—2, p. 106-127.
- Haesaerts, P., Borziac, I., Chirica, V., Damblon, F., Koulikovska, L., Van der Plicht, J. 2003. The East Carpathian Loess Record: A Reference for the Middle and Late Pleniglacial Stratigraphy in Central Europe. *Quaternaire*, 14, 3, p. 163-188.
- Haesaerts, P., Gerasimenko, N., Damblon, F., Yurchenko, T., Kulakovska, L., Usik, V., Ridush, B. 2020. The Upper Palaeolithic site Doroshivtsi III: A new chronostratigraphic and environmental record of the Late Pleniglacial in the regional context of the Middle Dniester-Prut loess domain (Western Ukraine). *Quaternary International*, 546, p. 196-215.
- Harzhauser, M., Mandic, O., Schlögl, J. 2011. A late Burdigalian bathyal mollusc fauna from the Vienna Basin (Slovakia). *Geologica Carpathica*, 62, 3, p. 211-231.
- Hoffecker, J. F. 2002. *Desolate landscapes: Ice-Age settlement in Eastern Europe*. Rutgers University.
- Ivanova, I. K., Chernysh, A. P. 1965. The Paleolithic site of Molodova V on the Middle Dniestr. *Quaternaria*, VII, p. 197-217.
- Jovanović, G., Bošnjak, M. 2016. Fissidentalium badense (Partsch in Hörnes, 1856) from the Badenian deposits of the south and southwestern margin of the Pannonian Basin System (Central Paratethys). *Geologia Croatica*, 69, 2, p. 195-200.
- Klein, R. G. 1973. *Ice-Age Hunters of the Ukraine*. Chicago: University of Chicago.
- Klein, K., Wegener, C., Schmidt, I., Rostami, M., Ludwig, P., Ulbrich, S., Richter, J., Weniger, G.-C., Shao, Y. 2021. Human existence potential in Europe during the Last Glacial Maximum. *Quaternary International*, 581—582, p. 7-27.
- Krolopp, E. 2003. Mollusc species of the Hungarian Pleistocene formations (as of Dec 31 of year 2002). *Malakológiai Tájékoztató*, 21, p. 13-18.
- Kulakovska, L., Usik, V., Haesaerts, P., Ridush, B., Uthmeier, T., Hauck, T. C. 2015. Upper Paleolithic of Middle Dniester: Doroshivtsi III site. *Quaternary International*, 359, p. 347-361.
- Kulakovska, L., Kononenko, O., Haesaerts, P., Pirson, S., Spry-Marqués, P., Bosch, M. D., Popova, L., Popiuk, Y., Damblon, F., Usik, V., Nigst, P. R. 2021. The new Upper Palaeolithic site Korman' 9 in the Middle Dniester valley (Ukraine): Human occupation during the Last Glacial Maximum. *Quaternary International*, 587—588, p. 230-250.
- Lyman, R. L. 2008. *Quantitative paleozoology*. Cambridge: Cambridge University.
- Marean, C. W., Spencer, L. M. 1991. Impact of carnivore ravaging on zooarchaeological measures of element abundance. *American Antiquity*, 56, p. 645-658.
- McPherron, S. P., Dibble, H. L. 2002. *Using Computers in Archaeology: A Practical Guide*. Boston: McGraw-Hill.
- Mihailović, D. 2014. *Palaeolithic and Mesolithic Research in the Central Balkans*. Belgrade: Serbian Archaeological Society.
- Nigst, P. R., Haesaerts, P., Damblon, F., Frank-Fellner, C., Mallol, C., Viola, B., Göttinger, M., Niven, L., Trnka, G., Hublin, J.-J. 2014. Early modern human settlement of Europe north of the Alps occurred 43,500 years ago in a cold steppe-type environment. *Proceedings of the National Academy of Sciences*, 111, 40, p. 14394-14399.
- Noiret, P. 2009. *Le Paléolithique supérieur de Moldavie. Essai de synthèse d'une évolution multi-culturelle*. Liège: Université de Liège.
- Pinhasi, R., Meshveliani, T., Matskevich, Z., Bar-Oz, G., Weissbrod, L., Miller, C. E., Wilkinson, K., Lordkipanidze, D., Jakeli, N., Kvavadze, E., Higham, T. F. G., Belfer-Cohen, A. 2014. Satsurblia: New Insights of Human Response and Survival across the Last Glacial Maximum in the Southern Caucasus. *Plos one*, 9 (10), e111271.
- Poltowicz-Bobak, M., Kulakovska, L., Bobak, D., Usik, V., Kononenko, O., Lanczont, M., Mroczek, P., Standzikowski, K., Demay, L., Nadachowski, A., Lemanik, A. 2022. Old site, new problems: the Gravettian campsite of Doroshivtsi III, Middle Dniester River Valley, western Ukraine. *Antiquity*, 96 (388), p. 1-10.
- R Core Team 2020. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- Reitz, E. J., Wing, E. S. 2008. *Zooarchaeology*. Cambridge: Cambridge University.
- Sands, A. F., Glöer, P., Gürlek, M. E., Albrecht, C., Neubauer, T. A. 2020. A revision of the extant species of *Theodoxus* (Gastropoda, Neritidae) in Asia, with the description of three new species. *Zoosystematics and Evolution*, 96, 1, p. 25-66.
- Soffer, O. 1985. *The Upper Paleolithic of the central Russian plain*. Academic Press.
- Soffer, O. 1990. The Russian Plain at the Last Glacial Maximum. In: Soffer, O., Gamble, C. (eds.). *The World at 18000 BP: High Latitudes*. London, p. 228-254.
- Steiner, G., Kabat, A. R. 2004. *Catalog of species-group names of Recent and fossil Scaphopoda (Mollusca)*. Publications Scientifiques du Muséum national d'Histoire naturelle Paris. Paris.
- Stiner, M. C. 1994. *Honor among thieves: A zooarchaeological study of Neandertal ecology*. Princeton: Princeton University.
- Stiner, M. C., Kuhn, S. L., Güleç, E. 2013. Early Upper Paleolithic shell beads at Üçağızlı Cave I (Turkey): technology and the socioeconomic context of ornament life-histories. *Journal of Human Evolution*, 64, 5, p. 380-398.
- Stiner, M. C., Dimitrijević, V., Mihailović, D., Kuhn, S. L. 2022. Velika Pečina: Zooarchaeology, taphonomy and technology of a LGM Upper Paleolithic site in the central Balkans (Serbia). *Journal of Archaeological Science: Reports*, 41, 103328.
- Tallavaara, M., Luoto, M., Korhonen, N., Järvinen, H., Seppä, H. 2015. Human population dynamics in Europe over the Last Glacial Maximum. *Proceedings of the National Academy of Sciences*, 112, 27, p. 8232-8237.
- Todd, L. C. 1998. *Bison osteology and bone coding field guide*. Unpublished guide, Colorado State University.
- Van Andel, T. H., Tzedakis, P. C. 1996. Palaeolithic landscapes of Europe and environs, 150,000—25,000 years ago:

an overview. *Quaternary science reviews*, 15, 5—6, p. 481-500.

Velichko, A. A., Kurenkova, E. I. 1990. Environmental conditions and human occupation of northern Eurasia during the Late Valdai. In: Soffer, O., Gamble, C. (eds.). *The World at 18000 BP: High Latitudes*. London, p. 255-265.

Wesselingh, F. P., Neubauer, T. A., Anistratenko, V. V., Maxim, V. V., Yanina, T., Ter Poorten, J. J., Kijashko, P., Albrecht, C., Anistratenko, O. Y., D'Hont, A., Frolov, P., Andara, A. M., Gittenberger, A., Gogaladze, A., Mikhail, K., Lattuada, M., Popa, L., Sands, A. F., Lde, S. V. V., Vandendorpe, J., Wilke, T. 2019. Mollusc species from the Pontocaspian region — an expert opinion list. *Zookeys*, 827, p. 31-124.

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HUMAN-ANIMAL INTERACTIONS AT KORMAN' 9, UKRAINE

Located in the Middle Dniester valley the site of Korman' 9 is surrounded by well-known sites such as Korman' IV, Molodova I and V, and Dorochivtsi III. Compared to those sites Korman' 9 has a modest 4 m sequence containing four archaeological layers (AL). This paper focusses on the first archaeological layer AL I, which is dated to about 21.9 ka cal BP. The lithic spectrum can be firmly placed within the Epigravettian technocomplex and is characterised by abundant microliths on microblade and bladelet blanks. AL I is situated in stratigraphic sub-unit (SU) 4-1a, a pedogenic horizon, which represents a period of stabilisation in a medium-cold to boreal cold environment. During two excavation campaigns in 2012—2013, approximately 6 m² were excavated. Rich lithic ($n = 6930$) and faunal ($n = 2938$) assemblages were recovered. Two combustion features were documented for AL I.

The taxonomic spectra across the malaco-, micro- and macrofauna are all fairly narrow and comprise cold-tolerant but not necessarily arctic taxa. Taken together they point toward a well-watered tundra-like habitat with dry slopes covered in treeless steppic herbaceous vegetation. A predominance of open landscapes in medium-cold to boreal-cold environmental conditions. Taphonomic investigations of the entire faunal spectrum suggest a substantial amount of sub-aerial weathering and fragmentation congruent with their incorporation in a pedogenesis horizon affected by stretching and solifluction. However, an autochthonous malacological spectrum and anatomically associated remains among the macro- and microfauna suggests *in situ* decomposition and limited post-depositional movement, congruent with the pedological / lithostratigraphic assessment of the deposits.

The main accumulators and exploiters of macrofaunal remains at Korman' 9, AL I, were Epigravettian hunter-gatherers. Carnivores contributed to the assemblage's taphonomic signature, but the distribution of carnivore damage on articular ends of longbones suggests that they only had secondary access to the faunal remains.

The faunal spectrum comprises reindeer (*Rangifer tarandus*), wild horse (*Equus* sp.), arctic hare (*Lepus timidus*), fox (*Vulpes* sp.), birds (Aves), a freshwater gastropod (*Theodoxus* cf. *fluviatilis*) and scaphopods (Dentaliidae). All of these taxa — including the bird remains if we consider burning traces on one of the fragments — show traces of some form of human-mediation. Faunal exploitation served several distinct

purposes. Horse, reindeer and probably hare and birds were obtained for subsistence purposes. For example, butchery and cutmark evidence suggests that reindeer carcass exploitation included initial dismemberment, as well as meat removal or filleting and the frequency of green breaks on longbone shafts suggests that marrow exploitation may also have been practised, although the latter should still be confirmed by additional analyses. Further evidence for dietary exploitation consists of cutmarks on a horse mandible congruent with extraction of its tongue and cutmarks on a hare paw points to the removal of its skin. Evidence for skinning points to the use of the animals hide in addition to exploitation of its meat. Other evidence for non-dietary exploitation consists of cutmarks on an antler tine and a fragmented bone needle provide evidence for raw material extraction (both antler and bone) for making tools. Lastly, a right upper fourth premolar of a prime-aged fox was turned into an ornament by way of a perforation through its posterior root. A single river nerite (*Theodoxus* cf. *fluviatilis*) shell shows traces of intentional perforation, colouration with a red pigment and use-wear congruent with loose suspension. Three tubular tusk shell or scaphopod fragments equally show traces of being used as beads. Thus, animal remains formed a diverse and integral part of socio-economic behaviour and technological expression during the Epigravettian at Korman' 9.

In terms of dietary exploitation, the macrofaunal spectrum at Korman' 9, AL I, dominated by reindeer fits very well with the few other roughly contemporaneous Epigravettian occurrences in the Dniester Valley such as Korman' IV, Layers 3 to 4, Molodova V, Layer 4, and — slightly more downstream — Cosăuți, Layers 4—2b. Faunal exploitation in these sites also centres on reindeer with horse as a secondary favoured taxon. At Molodova V, Layer 4, and Korman' IV, Layer 4, horse is paralleled by mammoth in equal numbers. Bison and red deer occur in very low quantities. Noiret evaluated the faunal spectrum of these sites in terms of maximum meat acquisition. Due to the larger body-size of the wild horse, dietary return rates between reindeer and horse are more or less the same. Of course, in the instances where mammoth is present, the maximum potential of meat acquisition would have been several orders of magnitude greater, although it is unclear if that potential was also reached. Overall faunal exploitation at Korman' 9, AL I, is congruent with that of contemporary Epigravettian sites in the area providing more evidence that next to the occupation of refugial areas in the more southern parts of Europe, open-air localities across the East Carpathian Area along the larger river systems such as the Dniester were also frequented by hunter-gatherers during this time.

Regarding the secondary exploitation of animal tissues, Korman' 9, AL I, shows similarities to other Epigravettian sites such as the refugial site of Velika Pečina in the Balkans. Also closer to home at Korman' IV, Layer 4, Molodova V, Layer 4, and Cosăuți, Layers 4—2b, there is evidence of worked antler. The most striking resemblance with the organic objects from Korman' 9, AL I, comes from Cosăuți, Layers 3, 3a and 3b. Although not organic in origin, a strong link can be made by the presence of an amber bead at Layer 3a of Cosăuți. Noiret further displays two tubular beads that are said to be made on coral, but show great resemblance to the Dentaliidae beads at Korman' 9, AL I. A small perforated fossil gastropod shell bead is recorded for Cosăuți, Layer 3, along with a number of

perforated teeth, red deer canines in Layer 3 and fox canines in Layer 3b. However, there appears to be no direct parallel for the perforated fox carnassial or for that matter the freshwater nerite shell bead.

Thus, human-animal interactions in the East Carpathian Area were diverse with a lot of variation at the site level. As seen for example by the presence of mammoth remains at some sites and their absence at others. Overall, however, sites show many similarities both in terms of dietary exploitation focussing on horse and reindeer and exploitation of pelts, on-site dismemberment and filleting of large fauna as well as on-site antler and bone working. Despite the scarcity of sites dating to this period, there is quite some variation in personal ornamentation. Although also some analogies in symbolic expression can be observed as well in particular in raw-material choice perforation technique and bead shape.

Keywords: Zooarchaeology, faunal exploitation, Upper Palaeolithic, Late Pleistocene, Epigravettian.

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ВЗАЄМОДІЯ ЛЮДИНИ І ТВАРИНИ НА КОРМАНЬ 9, УКРАЇНА

Кормань 9 розташована в долині Середнього Дністра неподалік добре відомих стоянок — Кормань IV, Молодово I і V, Дорошівці III. Порівняно з цими пам'ятками, стратиграфічний розріз Корманя 9 є не досить потужним і досягає лише 4 м. У ньому відмічено чотири археологічні шари (AL). У статті йдеться переважно про перший шар (AL I), який датується приблизно 21,9 тис. до н. е. AL I зафіксовано у підгоризонті 4-1a.

Досліджена у 2013 р. площа складає близько 6 м², на якій відмічено залишки двох вогнищ, зібрано колекції крем'яних артефактів ($n = 6930$) та фауністичних решток ($n = 2938$).

Індустрія цього шару належить до епіграветського технокомплексу та характеризується великою кількістю мікролітів, виготовлених на пластинках та мікропластинах.

Таксономічні спектри малако-, мікро- та макрофауни включають холодостійкі види, що вказує на досить вологе середовище, схоже на тундру, із сухими схилами, які були вкриті безлісною степовою трав'янистою рослинністю. Переважають відкриті ландшафти від середньохолодних до бореально-холодних. Тафономічні дослідження фауністичних решток свідчать про значну кількість субаерального вивітрювання та фрагментації, що є підтвердженням їх знаходження у горизонті педогенезу, на який впливають розтягування та соліфлюкція. Однак автохтонний малакологічний спектр та анатомічно пов'язані залишки марко- та мікрофауни вказує на їх положення *in situ* та обмежене переміщення після накопичення відкладів, що відповідає педологічній/літостратиграфічній позиції.

Мешканцями ш. I Корманя 9 були епіграветські мисливці-збирачі.

За результатами аналізу макрофауни можна припустити, що хижі тварини мали доступ до кісткових решток, але сліди їх погризів на суглобових кінцях довгих кісток свідчать, швидше за все, про те, що вони мали вторинний доступ, власне, після того як м'ясо було використано мешканцями стоянки.

Фауністичний спектр складається з таких видів: північний олень (*Rangifer tarandus*), дикий кінь (*Equus* sp.), полярний заєць (*Lepus timidus*), лисиця (*Vulpes* sp.), птахи (*Aves*), прісноводні червононогі (*Theodoxus fluviatilis*) та скеленогі (*Dentaliidae*) молюски. Усі ці таксони разом з рештками пташок, мають сліди людської діяльності. Фауна використовувалася з різною метою. Для харчування використовували коня, північного оленя, ймовірно, зайця та птахів. Наприклад, сліди подрібнення кісток та порізи на них свідчать про те, що експлуатація туш північного оленя включала початкове розчленування, а також зрізання м'ясних частин. Численні надломи на довгих кістках вказують на використання кісткового мозку. Втім останнє припущення потребує додаткових аналізів. Ще одним доказом використання коня для харчування є порізи на нижній щелепі коня, що з'являються при витягуванні язика, а порізи на лапі зайця вказують на зняття шкіри. Білування невеликих тварин, наприклад, зайця говорить про те, що окрім м'яса використовували і шкірку. Кістки тварин та роги оленя використовувалися також як сировина для виготовлення різних виробничих знарядь (голки) та прикрас. Зокрема, правий верхній четвертий премоляр літньої лисиці був перетворений на прикрасу шляхом перфорації кореня. Мушля *Theodoxus fluviatilis* має сліди нависної перфорації, забарвлення червоним пігментом і сліди зносу. Ця річ, швидше за все, використовувалася як прикраса. На трьох трубчастих фрагментах бивня (?) або мушлі (?) помітні сліди використання як намистин. Таким чином, рештки тварин становили різноманітну та невід'ємну частину соціально-економічної поведінки та технологічного використання у епіграветських мисливців Кормань 9.

З точки зору харчової експлуатації спектр макрофауни в Кормань 9, ш. I, де домінують північні олені, дуже добре узгоджується з декількома приблизно одночасними епіграветськими стоянками в долині Дністра, такими як Кормань IV, шари 3—4, Молодово V, шар 4, і трохи нижче за течією — Косоць шарі 4—2b. П. Нуаре оцінив фауністичний спектр цих місць з точки зору максимального отримання м'яса. Завдяки більшому розміру тіла дикого коня, показники використання у раціоні оленя та коня більш-менш однакові. Звичайно, у випадках, коли присутній мамонт, максимальний потенціал отримання м'яса був би на кілька порядків більшим.

Способи використання мисливської здобичі на стоянці Кормань 9, ш. I аналогічні таким на інших епіграветських пам'ятках, поблизу названої стоянки (Кормань IV, шар 4, Молодово V, шар 4, Косоць шарі 4—2b) так і у більш віддалених регіонах (наприклад, Велика Печіна на Балканах). Варто звернути увагу на присутність бурштинових прикрас у шарі I Корманя 9 та шарі 3a Косоць та двох трубчастих намистин (корал), які за технікою виготовлення схожі на намистини *Dentaliidae* із Кормань 9, ш. I. Зустрічаються у Косоць також намистини із мушель та зубів благородного оленя і лисиці.

Отже, можна говорити про те, що у Східних Карпатах стратегія взаємодії людина — тваринний світ була досить різноманітною (варіативною). Зокрема це стосується використання північного оленя і коня для харчових потреб (розчленування), білування та обробки кістки і рогу безпосередньо на місці стоянки. Очевидна схожість простежується також у присутності особистих прикрас та технології їх виготовлення.

Ключові слова: зооархеологія, фауністична експлуатація, верхній палеоліт, пізній плейстоцен, епігравет.

Одержано 27.02.2024

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