COMPLEMENTARY ANALYSES OF THE FAUNAL REMAINS OF THE LOWER LEVEL OF CLIMĂUȚI II (REPUBLIC OF MOLDOVA)

BY
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Abstract:
The paleolithic site of Climăuți II, discovered in 1989, yielded two archaeological layers, the upper one, the most famous, and the lower one, on which we are focusing on. This layer is relied to the beginning ou the Upper Pleniglacial, before the Last Glacial Maximum. Our aim is to bring more data on this assemblage basing on the faunal remains, applying zooarchaeological methods to better understand the assemblage itself but also to better determine the anthropogenic activities. The main exploited taxa are horse, reindeer and bison, then wolf and mammoth. These remains are associated with a lithic industry linked to butchering activities. For the first three species, it could correspond to a secondary butchering treatment of carcasses. For mammoths we did not obtained clear data. They could have been hunted or mammoth dried bones could have been used by humans as material support, particularly ribs, to process to furskin activities of herbivorous but also wolves. The presence of burned bones, as fuel but also cooked, shows that at least a hearth was present in the camp. This layer corresponds to a temporary camp in the warm season in a strategic place.
Keywords*: Zooarchaeology; Taphonomy; Dniester valley; Upper Palaeolithic; Epiaurignacian; Upper Pleniglacial.*

THE ARCHAEOLOGICAL CONTEXT

The Dniester and Prut basins were settled by Paleolithic human populations. Key information was provided by reference sites in this area such as Molodova V, Korman IV, Dorochivtsy III, Mitoc-Malu-Galben, Cotu-Miculinți and Cosăuți in Ukraine, Romania and Republic of Moldova. It permited to highlight chrono-cultural and palaeoenvironmental frameworks between 33,000 and 10,000 BP[1].

Moreover, in this area a particular facies was developed within the Gravettian called Molodovian or Eastern Gravettian and Epigravettian of Ukraine[2]. In addition, several sites are characterized by the resurgence of techniques used in the Aurignacian, such as Rașkov VII and Climăuți II[3].

We focus here on the layer 2 of Climăuți II.

In 1971, I. Borziac made the first archaeological discoveries in Climăuți de Jos (District Soldănești, Republic of Moldova) with Climăuți I site. Then, in 1989, the building of a kindergarten permitted to process to researche. On this occasion, T. Obadă found the site of Climăuți II (47°56' N, 28°48' E) (Pl. I.1). Rescue excavations were carried out under the direction of I. Borziac[4]. A monography was written about the results yielded by the material analyses[5].

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[1] CHERNYSH 1959; IVANOVA, TZEITLIN 1987; OTTE *et alii* 1996; DAMBLON, HAESAERTS 1997; NOIRET 2007a; HAESAERTS *et alii* 2007; KOULAKOVSKA, USIK, HAESAERTS 2012; CHIRICA, BODI 2014; DEMAY, PATOU-MATHIS, KOULAKOVSKA 2015.

[2] BORISKOVSKYI 1953; GRIGOR'EV 1970; OTTE *et alii* 1996; BORZIAC 1998; BORZIAC, KOULAKOVSKA 1998; BORZIAC, CHIRICA 1999; BORZIAC, HAESAERTS, CHIRICA 2005; NOIRET 2009; NUZHNYI 2009.

[3] COVALENCO 2003-2004; ZWYNS 2004; BORZIAC, CHIRICA, DAVID 2007; NOIRET 2007; CHIRICA, VALEANU 2007.

[4] BORZIAC 1990; BORZIAC, DAVID, OBADA 1992.

[5] BORZIAC, CHIRICA, DAVID 2007.

The archaeological site is located on a promontory formed by the Dniester and Gârla riverbeds. It is situated on the third terrace of the right bank of the Dniester, 27-35 meters high above the river.

The cultural remains were situated in loessic loams, which would correspond to the first part of Upper Pleniglacial (between 26 000 and 20 000 BP)[6].

Two cultural layers were discovered in the lithological layer no. 3: the upper layer (1,50-2,20 meters deep from the zero point, 1,60-2,30 meters deep from the actual surface; 0,25-0,30 meters thick in the northeastern part and 0.50-0.60 meters thick in the southwest part) and the lower layer, which is situated around 0,30-0,50 meters below. It is 0,10-0,15 meters thick (Pl. I. 2). The lower layer was situated just above the lithological layer no. 4 which corresponds to a paleosoil. It was identified as Dofinovka type which corresponds to Briansk–Paudorf–Stillfried B paleosoils dated between 29,000 and 24-23.000 BP. Two archaeological surveys were also made in 2000 and in 2017, where both layers were also identified. Two radiocarbon dates were realized. The upper layer furnished a result of 20.350 ± 230 BP (LU-2431; M.V. Lomonosov University of Saint-Petersburg) from a mammoth cheek tooth. The lower layer was dated from 24.840 ± 230 BP (LU- 2351; Institute of Geography of the Academy of Sciences of Moldova) from humus.

According to the palynological data from S. Medeanik and I. Borziac[7], the lithological layer no. 4 is characterized by more wooded landscapes. With the lithological layer no. 3, including the lower layer, the herbaceous pollens increase considerably. Pollens of *Pinus silvestris* (scots pine), *Pinus cembra* (arolla pine) and *Picea* sp.(spruce) were identified. Xerophile species were also identified, such as *Betula nana* (dwarf birch), *Betula fruticosa* (dwarf bog birch) and *Botrychium boreale* (moonwort). The main part of pollens is represented by *Chenopodiaceaea* and *Poaceae*: *Artemisia* sp. (artemisia), *Plantago major* (greater plantain), *Plantago lanceolata* (ribwort plantain), *Polygonum aviculare* (common knotgrass), *Agrimonia eupatoria* (common agrimony). These plant communities are associated with a cooling of the climate. Although riverine forest was present, the landscapes were more open with bushes, flowers and steppic communities.

Some terrestrial molluscs were discovered and identified by A. Prepelitsa[8]. The upper part of the paleosoil yielded 192 remains, mainly of *Pupilla muscorum* (Moss Chrysalis Snail), then *Succinea oblonga* (Small Amber Snail) and *Vallonia pulchella* (Smooth Grass Snail). The clay level, corresponding to the lower layer yielded 181 remains, mainly of *Pupilla* sp., then *Vallonia tenuilabris*, *Pupilla muscorum* and *Pupilla sterrii*. These species are linked to cold and arid periglacial steppe with more temperate species relied to hotter and wetter environment. It could be linked to the presence of riverine forest and/or the alternation of seasons.

In 1989, the lower layer was excavated over 600 m^2. It furnished less remains (lithic and faunal remains) than the upper layer. No structure or area of activity has been identified.

According to the identified fauna (194 remains; 9 individuals) by I. Borziac, A. David and T. Obadă [9], the faunal spectrum is dominated by mammoth (*Mammuthus primigenius*) and horse (*Equus latipes*), then reindeer (*Rangifer tarandus*) and bison (*Bison priscus*), and wolf (*Canis lupus*) and cave lion (*Panthera spelaea*), typical of the periglacial steppe. Three bone pieces were shaped by humans[10]. They include a pointed mammoth bone, a bone awl fragment and a sawn reindeer antler fragment with a transverse waist. No ocher was found in this layer contrary to the upper one.

Concerning the lithic industry, the lower layer yielded 623 lithic remains whose 105 tools.

The lithic industry was made of greyish pebble flint, the provenance of which is not specified; 17 pieces are in sandstone, schist and granit[11]. There are mainly flakes, then nucleus, blades and tools, and splinters (Pl. II.3). The cores are mainly subprismatic, with one or two striking platforms, and intended for the production of blades and flakes. There are also a few discoid, flat cores and narrow slice of block. The flakes and blades thus obtained are quite large. The supports used in the tooling rather attest to a low use of laminar debitage products (rather unipolar), effectively producing large, wide and elongated blades with a slightly curved profile. A significant portion of the tools were made on flakes, sometimes still partially cortical.

Tools are dominated by endscrapers, burins, retouched blades and flakes, associated to nucleiform pieces, combinated, notched and denticulate pieces and few points and scrapers (Pl. II.4). This industry is characterized by the

[6] BORZIAC, DAVID, OBADĂ 1992; OBADĂ, DAVID, BORZIAC 1994; NOIRET 2009.

[7] BORZIAC *et alii* 1992; BORZIAC, CHIRICA, DAVID 2007: 22-27, Fig. 4a.

[8] BORZIAC, CHIRICA, DAVID 2007: 42-44.

[9] BORZIAC, DAVID, OBADA 1992; DAVID, OBADA, BORZIAC 1995; BORZIAC, CHIRICA, DAVID 2007: 28-41.

[10] BORZIAC, DAVID, OBADA 1992

[11] BORZIAC, DAVID, OBADA 1992; BORZIAC, CHIRICA, DAVID 2007: 112-122.

absence of gravettian pieces, such as gravettian points. There are also no bladelets. However, there are carenated nucleiform endscrapers, carenated scrapers, scrapers, dihedral burins mainly made on massive flakes and pieces with scaled semi-abrupt retouches. This particular typology is of Aurignacian tradition.

Several other sites of the region present this particularity: Climăuți I, Rașkov VII, Zeleny Khutor I and II, maybe Valea Morilor, called as Lower Dniestr Culture by S. Covalenco[12].

THE AIM OF THE STUDY

The goal of this paper is to bring more data with the zooarchaeological methods, particularly focusing on the taphonomy, the anatomical representation and the anthropogenic activities, to better understand the modalities of adaptation of human groups during the beginning of the OIS 2 notably characterized by the Last Glacial Maximum.

METHODS AND MATERIAL

We proceeded to the zooarchaeological analyzes of the faunal remains of the excavations from 1989. This material is kept in the Institute of Zoology in Chișinău (Republic of Moldova).

The study includes paleontological analyzes, the biology and ethology of the species, by means of actual comparisons. In addition, the description and quantitative analysis of the anatomical elements associated with taphonomy (climate and edaphic factors and non-human biological agents) will make it possible to identify the conditions that make up the fossil assemblage. The combination of these analyzes in relation to the stigmas that may have been left by humans, will lead to a better understanding of the anthropogenic impact on this assemblage[13]. Taxonomic references and systematics are based on the zoological nomenclature code of ICZN. The vernacular anatomical terms are used according to the criteria of R. Barone[14] taking into account the current nomenclatures. Here we adopt the quantization units defined by F. Poplin[15], and R. L. Lyman[16]. The skull (cranium and face) is considered an element. The frontal appendages can also be considered as a separate element. The hemi-mandible is counted as an element, except for the mammoth whose mandible is a complete element. A tooth, whether isolated or in place, is considered as an element. To estimate the Minimal Number of Individuals (MNI) we proceeded to reassembling, pairing, associations, according to the criteria of age and sex.

Osteometric measurements follow the procedures of A. von den Driesch[17], and concerning mammoth, of L. Agenbroad[18]. For the identification of mammoths (*Mammuthus primigenius*), age determination is based on epiphyseal stages of long bones and eruption and eruption/wear sequence of the cheek teeth[19]. The identification of sex is based on the morphometry of the bones[20] and compared with specimens of reference[21]. For the age identification of horses (*Equus* sp.) we used epiphyseal stages of long bones and teeth eruption and wear[22] and specimen of reference for the osteometry[23]. It is also the case for bison (*Bison* sp.)[24] and for sex attribution we used specimens of reference[25]. We used the same

[12] COVALENCO 1996.

[13] POPLIN 1976; BINFORD 1979; BEHRENSMEYER 1978; LYMAN 1994; DENYS, PATOU-MATHIS 2014.

[14] BARONE 1986.

[15] POPLIN 1976.

[16] LYMAN 2008.

[17] VON DEN DRIESCH 1976.

[18] AGENBROAD 1994.

[19] LAWS 1966; KRUMREY, BUSS 1968; HAYNES 1991.

[20] AVERIANOV 1996; SHOSHANI, TASSY 1996; LISTER 1999.

[21] FELIX 1912; TOEPFER 1957; SIEGFRIED 1959; KOENIGSWALD 1989; ZIEGLER 2001; LISTER 2009.

[22] BARONE 1966; GUADELLI 1998.

[23] BELAN 1995; DAVID *et alli* 2003; SAVOY *et alli*, 2012; online data V. Eisenmann.

[24] BARONE 1966; KOCH 1935; GRANT 1982.

[25] PRAT *et alii* 2003.

methods for reindeer (*Rangifer tarandus*)[26] and we especially used antlers[27] in bounds with the seasonal cycles[28]. For wolf (*Canis lupus*)[29], we used the same methods. For the osteometric comparisons we used the mediolateral diameter (MLD), the antero-posterior diameter (APD) and the dorsoventral diameter (DVD).

The skeletal preservation on %MAU by anatomical segments related with bones density are based on Y. M. Lam *et alii* 1999[30] for horse.

The nutritional strategies[31] are estimated from A. Outram and P. Rowley-Conwy[32] and E. Morin[33] for horse.

To estimate the bone conservation between the initial material of the excavations and the current preservated material, we based on the monography[34].

FAUNAL REMAINS ANALYSES

RESULTS

Faunal spectrum

We studied 175 bone remains. We identified bones of woolly mammoth, horse, bison, reindeer, wolf and cave lion (Tabl. 1).

Comparing to the precedent data, we have relatively the same proportions, except for mammoth of which we do not have all the bones (Pl. III.5).

Concerning the preservation of bones and taphonomy, bones are quite well preserved, however surfaces are often abraded. Some of them bear dissolution marks. All bones were affected by manganese and iron deposits (Pl. III.6).

Regarding on each species/category we observe some differences between mammoth/large-sized mammal and the others (Tabl. 2). Indeed, there are more affected by weathering and dissolution. Moreover, the surface of lion bone is not affected by weathering and surfaces, angles and edges are blunt (Pl. IX.17).

According to the taphonomic data, it is possible that remains were relatively quickly buried in wet conditions, more slowly for mammoth bones which are more massive or because there are older. The lion bone could be older than the assemblage.

Focusing on paleontology and skeletal preservation, mammoths are represented by 14 remains corresponding to 13 elements, belonging to at least 2 individuals. There are axis and cranial bones (a fragment of tusk, four vertebrae), long and short bones (a fragment of a proximal diaphysis of an ulna, a triquetrum, a right metatarsal III, two left talus, two naviculars and a phalanx) (Pl. IV.7). Comparing with the published data, even if we have few elements, different anatomical parts are represented (cranial and axial skeleton, anterior upper parts, basipods and metapods and acropods). Shoulder and pelvic girdles are absent also as posterior upper parts (Pl. IV.8). This type of anatomical representation shows that these mammoths died nearby the site.

According to the size of a talus (length: 128; width: 112 mm), it belongs to a female or a young male. We obtain the same results for a triquetrum (DVD: 86; MLD: 102; APD: 126 mm).

Horses are represented by 43 remains which correspond to at least 41 elements, belonging to at least 3 individuals. According to the osteometry of P_3/P_4 (occlusal vestibulo lingual diameter x occlusal mesiodistal diameter: 17x31; 20x31; 21x27 mm) and M_1/M_2 (occlusal vestibulo lingual diameter x occlusal mesiodistal diameter: 17x32; 17x25; 17x28 mm) these horses are identified as *E. latipes*. To the long bones and teeth, they are all adults *s.l.*

There are mainly teeth, then scapulas, tibias and carpals/tarsals, metapodials and phalanges (Pl. V.9). According to the published data, two vertebrae were also present (Pl. V.10).

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[26] BOUCHUD 1954; MILLER 1974; HUFTHAMMER 1995.

[27] MURRAY 1993; STEFANIAK *et alli* 2012.

[28] MURRAY 1993.

[29] BARONE 1966; GIBSON *et alli* 2000.

[30] LAM *et alii* 1999.

[31] LYMAN 1994.

[32] OUTRAM, ROWLEY-CONWY 1998.

[33] MORIN 2012.

[34] BORZIAC, CHIRICA, DAVID 2007.

Considering the skeletal preservation by anatomical part in %MAU related to the density of bones (R=0,50; p-value= 0,000911/significant at $p < 0.10$ and at $p < 0.01$), this type of preservation is not due to natural processes of dispersion.

Looking at the nutritional values it corresponds to the *reverse bulk strategy*, the less nutritive parts, more related to marrow consumption (Pl. VI.11A and B). The data are not enough to conclude to this observation.

A bison is represented by 11 elements, long bones, short bones, and a mandible with teeth (Pl. VII.12,13). According to the bone fusion and teeth development this individual was more than 60 months old so it was an adult *s.l.*. According to the mediolateral diameters of the distal extremity of the metacarpal (77 mm) and of the proximal epiphysis of the radius (93 mm), this individual was a female.

Two reindeers are represented by 11 elements, antlers, cheekteeth and autopod bones (Pl. VIII.14). According to the published data, vertebrae and long bones were also present (Pl. VIII.15). From bones and teeth, both are adults *s.l.*. Two non-shed antlers belong to two different individuals. They are of quite great sizes more typical from Eastern Europe. One of them is a large-sized male (APD: 49; MLD: 40 mm). The second one is more difficult to identify, it could be a young male or an adult female (APD: 24; MLD: 17 mm).

Wolves are represented by 14 elements belonging to at least two individuals, a part of diaphysis of a radius, mandibles, and teeth (Pl. IX.16). According to the wear of teeth, there are an adult and an old adult.

A cave lion is represented by a distal part of a humerus (Pl. IX.17).

Concerning the anthropogenic marks and/or modifications we identified several marks due to modern tools. A bone splinter of medium-sized mammal showing helicoidal breakages, is characterized by an abrasion of the extremity (Pl. X.18A). It could have been used by humans. A bison metacarpal is characterized by helicoidal breakages (fig. XXIX). It could be relied to the marrow removal (Pl. X.18B). A large-sized mammal rib (probably mammoth) is characterized by polished surfaces, abraded edges, and micro-striations (Pl. X.18C). It could have been used as a *lissoir*. Another large-sized mammal rib (probably mammoth) bears several old grooves on the internal surface (Pl. X.18D). This rib could have been longitudinally broken.

Futhermore, 44 burned bones are present. There are mainly undetermined and from large-sized mammal bone fragments. Among the undetermined splinters, teeth were present. Whereas bone splinters were carbonized, teeth were more often just heated. There are also skull, rib and long bone fragments. So, we observe a difference between small fragments and bigger parts of bones. Several horses broken metapodials were also heated.

Human behaviors

In the lower layer of Climăuți II people used polyfunctional lithic tools more related to the treatment of animal resources, horse, bison and reindeer. Carcasses are mainly represented by cranial and limb bones, which could correspond to a secondary butchering treatment. Marrow was removed and consumed. According to the non-shed antlers, the reindeers were killed by humans during the warm season.

Concerning mammoths, carcasses were more complete, so contrary to the other herbivorous, these individuals could be died *in situ*. We do not have enough indices to confirm or deny if they were also killed and consumed by humans (as suggested by the age of the individuals) or if there are dried carcasses (as potentially suggested by the taphonomic observations). However, large-sized mammal ribs, which could belong to mammoth were used probably as *lissoir*.

Wolves could have been killed for fur.

On this occupation, there is no manufactured bone pieces but modified pieces by utilization. They seem to be relied to the furskin activities.

Furthermore, according to the burned bones, it seems that several activities were related to the fire: a part probably as fuel, some bones were just waste, and maybe that some of them were cooked.

The low number of archaeological remains attest that the lower layer corresponds to a short-term occupation, during the warm season.

Comparisons between the lower and the upper layer[35] permit to highlight that both lithic toolkits were characterized by aurignacian features. However, the behaviors are different with a more important camp and many activities in the upper layer (a large number of archaeological remains, a larger lithic and faunal spectrum, shaped boneous pieces, mammoth hunting, use of mammoth bones to make a structure) (Pl. XI.19).

[35] BORZIAC, CHIRICA, DAVID 2007; DEMAY *et alii* in press.

Furthermore, according to the taphonomic data the conditions of preservation are different between both layers (Pl. XI.20). The lower layer seems to have been buried quickly than the upper layer, deeply, with few soil movements. The water effects are important, especially percolation water with intensive deposits of manganese oxides. It could be interpreted as an intensification of the loessic and permafrost activities after the occupation(s) of the lower layer.

Looking on the Middle Dniester area, between 26,000 and 23,000 BP, we know few sites more or less well dated in Republic of Moldova and in Ukraine: the layer III of the Brânzeni Cave[36] and the open-air sites of Corpaci-Mas[37], Korman IV/7 and 6[38], Molodova V/8 and 7[39] and Oselivka 1/III[40] (Tabl. 3). The site of Brânzeni interpreted as several temporary camps raises questions about the conditions of preservation with potentially mixed material. Another site, Corpaci-Mas is characterized by the presence of aurignacoid pieces within the lithic industry. The other sites present gravettian lithic industries. There are mainly temporary camps. Oselivka 1/III showed a flint workshop occupation. Furthermore, the layer 7 of Molodova V is characterized by more varied activities and a more structured camp showing the establishment of a base camp.

Concerning the subsistence strategies, the flint is generally coming from local deposits and the main exploited taxa are reindeers, horses, mammoths and sometimes bisons.

Hence, the lower layer of Climăuți II shows quite similar subsistence activities to the other sites, however, we cannot relied it to them from cultural lithic industries.

Conclusions

The lower layer of Climăuți II shows human occupation(s) of the Middle Dniester at the beginning of an intensification of loessic deposits which could be relied to the period just before the Last Glacial Maximum.

The lithic industry was made on the site linked to butchering activities of animal carcasses. The main exploited taxa are horse, reindeer, and bison, then wolf and mammoth. According to the skeletal representation of the first three species, it could correspond to a secondary butchering treatment of carcasses, with heads and limbs and the breakage of bones to remove marrow. Mammoth bones could be dried bones and they were used as material support, particularly ribs, to process to furskin activities. Moreover, complete carcasses of wolves could also have been brought on the site to remove fur. Eventually, the presence of burned bones shows that at least a hearth was probably present in the camp. Therefore, this layer correspond to a temporary camp in the warm season in a strategic place. These subsistence activities are quite common in the region during this period. However, we cannot distinguish technocultural similarities with other sites through the lithic assemblage. And even if some aurignacian pieces are present within the lithic industry, as the upper layer of the site, we have no certainty about the same ethnicity.

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[36] CHIRICA *et alli* 1996; DAVID, PASCARU 2005.

[37] BORZIAC, CHETRARU 1996.

[38] CHERNYSH 1977; TATARINOV 1977.

[39] CHERNYSH 1959; ALEKSEEVA 1987.

[40] BORZIAC *et alii* 2006.

BIBLIOGRAPHY

AGENBROAD 1994 Agenbroad, L. D., *Taxonomy of north american* Mammuthus *and biometrics of the hot springs mammoths*, in: Agenbroad, L. D., Mead, J. I. (eds.), *The Hot Springs mammoth site*, Fenske Printing, Rapid City, 158-207.

ALEKSEEVA 1987 Alekseeva, L. I., *Theriofauna of the multylayered site of Molodova V*, in: Ivanova, I. K., Tseitlin, S. M. (eds.), *The multilayered Paleolithic site Molodova V. People of stone age and environment*, Nauka, Moscow, 162-153. (in Russian)

BARONE 1986 Barone, R., *Anatomie comparée des mammifères domestiques, Tome 1: Ostéologie*, Vigot Frères, Paris.

BARONE 1966 Barone, R., *Anatomie comparée des mammifères domestiques, Tome 1: Ostéologie*, École nationale vétérinaire, Lyon.

BEHRENSMEYER 1978 Behrensmeyer, A. K., *Taphonomic and ecologic information from bone weathering*, in: *Paleobiology*, 4(2), 150-162.

BELAN 1985 Belan, N. G., *Late Pleistocene* Equus latipes *from Desna Basin*, in: *Trudy Zoologicheskogo Instituta*, 131, 50-83. (in Russian)

BINFORD 1979 Binford, L. R., *Organization and Formation Processes: Looking at Curated Technologies*, in: *Journal of Anthropological Research*, 35, 255-273.

BORISKOVSKYI 1953 Boriskovskyi, P. I., *Paleolit Ukrainy*, in: *Istoriko-arkheologicheskiye ocherki*, Moscow-Leningrad. (in Russian)

BORZIAC 1990 Borziac, I., *Otchet o provedenii spasatel'nykh nauchno-issledovatel'skikh rabot na verkhnepaleoliticheskoy stoyanki Klimautsy v 1989 godu*, Akademia Nauk Moldavskoj SSR, Kishinev. (in Russian)

BORZIAC, KOULAKOVSKA 1998 Borziac, I., Koulakovska, L. V., *Gravet podnistrovie. Zagalnij ogljad*, in: *Arkeologie*, 5, 55-64. (in Ukrainian)

BORZIAC, CHETRARU 1996 Borziac, I. A. et Chetraru, N. A., *La zone Dniestr-Prut*, in: Chirica, V., Borziac, I. A., Chetraru, N. A. (eds.), *Gisements du Paléolithique supérieur ancien entre le Dniestr et la Tissa*, Helios, Iași, in col. Bibliotheca Archaeologica Iassiensis, V, 6-69.

BORZIAC, CHIRICA 1999 Borziac, I., Chirica, V., *Considérations concernant le Gravettien de l'espace compris entre le Dniestr et les Carpates*, in: *Préhistoire Européenne*, 14, 67-78.

BORZIAC, CHIRICA, DAVID 2007 Borziac, I., Chirica, V., David, A., (eds), *L'aurignacien moyen et tardif de l'espace carpatique-dniestreen: le gisement Climauti II*, Académie roumaine – Filiale de Iasi/ Institut d'Archéologie, Bibliotheca Archaeologica Moldaviae, Iasi.

BORZIAC, CHIRICA, VALEANU 2006 Borziac, I., Chirica, V., Văleanu, M.-C., *Culture et sociétés pendant le Paléolithique supérieur à travers l'espace carpato-dniestréen*, Institut d'Archéologie, Pim, Iași, in col. Bibliotheca Archaeologica Moldaviae, VI.

BORZIAC, DAVID, OBADA 1992 Borziac, I. A., David, A., Obadă, T., *Climăuți II. Un site du Paléolithique supérieur avec faune de mammouths dans la région du Dniestr*, in: *Annuarul Muzeului Național de Istorie a Moldovei*, I, 75-94. (in Russian).

BORZIAC, HAESAERTS, CHIRICA 2005 Borziac, I., Haesaerts, P., Chirica, V., *Cadrul cronostratigrafical Paleoliticului superior cuprins între Carpații Orientali și Nistru*, in: *Revista Arheologică*, S.N., 1(2), 164-198.

BORZIAC, GOL'BERT, MEDEANIK, MOTOC 1992 Borziac, I. A., Gol'bert, A. V., Medeanik, S. I., Motoc, V. E., *Arheologija i paleogeografija stojanki Climautsy II*, in: *Materialy i issledovaija po arheologii i etnografii Moldavii*, Chishinev.

BOUCHUD 1954 Bouchud, J., *Dents de Rennes, bois de Rennes et migrations*, in: *Bulletin de la Société Préhistorique Française*, 51, 340-345.

CHERNYSH 1977 Chernysh, A. P., *Mnogosloynaya paleoliticheskaya stoyanka Korman' IV i yeyo mesto v paleolite*, in: Goretzky, G. I., Zeitlin, S. M. (eds.), *Mnogosloinaia paleoliticheskaia stoianka Korman IV na srednem Dniestr (A multistratified site Korman IV on Middle Dniester)*, Nauka, Moscow, 7-77. (in Russian)

CHERNYSH 1959 Chernysh, A. P., *Pozdnii paleolit Srednego Pridnestrov'ya*, in: Gromov, V. I., Okladnikov, A. I. (eds.), *Paleolit Srednego Pridnestrovja*, Izdate'lstvo Akademii nayk SSSR, Moscow, *Trudy Komissii po izucheniyu chetvertichnogo perioda*, 15, 5-214. (in Russian)

CHIRICA, BODI 2014 Chirica, V.-C., Bodi, G., *La chasse du renne et du cerf par les communautés humaines gravettiennes, épigravettiennes et mésolithiques de l'espace carpatique-dniestréen*, in: ArhMold, 37, 21-62.

CHIRICA, BORZIAC, CHETRARU 1996 Chirica V., Borziac I., Chetraru N., *Gisements du Paléolithique supérieur ancien entre le Dniestr et la Tissa*, in col. Bibliotheca Archaeologica Iassiensis, V, Ed. Helios, Iași.

CHIRICA, VALEANU 2007 Chirica, V., Văleanu, M.-C. (eds.), *Établissements et habitations préhistoriques. Structure, organisation, symbole*, in: *Actes du colloque de Iași, 10-12 Décembre 2007*, Ed. Pim, Iași, 159-158.

COVALENCO 2003-2004 Covalenco, S. I., *A Contribution to the Problem of the Dniester Epi-Aurignacien*, in: *Stratum Plus*, 1, 301-306. (in Russian)

COVALENCO 1996 Covalenco, S. I., *The Upper Palaeolithic industries in the Dniestr zone of Moldavia*, in: *Préhistoire européenne*, 9, 233-267.

DAMBLON, HAESAERTS 1997 Damblon, F., Haesaerts, P., *Radiocarbon chronology of representative Upper Palaeolithic sites in the Central European Plain: a contribution to the Sc-004 project*, in: *Préhistoire Européenne*, 11, 255-276.

DAVID, PASCARU 2005 David, A. et Pascaru, V., *Fauna stațiunii paleolitice Brânzeni I (Les restes faunistique de la grotte Brynzeni)*, in: *Tyragetia*, 14, 59-64.

DAVID, OBADA, BORZIAC 1995 David, A., Obadă, T., Borziac, A. I., *Restes squelettiques de mammifères dans les fouilles de la station paléolithique de Climăuți*, in: MemAntiq, 20, 185-193.

DAVID, NADACHOWSKI, PASCARU, WOJTAL, BORZIAC 1995 David, A., Nadachowski, A., Pascaru, V., Wojtal, P., Borziac, A. I., *Late Pleistocene fauna from the Late Palaeolithic butchering site Cosăuți I*, in: *Acta Zoologica*, 46(1), 85-96.

DEMAY, PATOU-MATHIS, KOULAKOVSKA 2015 Demay, L., Patou-Mathis, M., Kulakovska, L. V., *Zooarchaeology of the layers from Dorochivtsy III (Ukraine)*, in: *Quaternary International*, 359-360, 384-405.

DENYS, PATOU-MATHIS 2014 Denys, C., Patou-Mathis, M. (dir.), *Manuel de Taphonomie*, Collection Archéologiques, Éditions Errance, Paris.

VON DEN DRIESCH 1976 Driesch, A. von den., *A guide to the Measurement of Animal Bones from Archaeological Sites*, Peabody Museum of Archaeology and Ethnology 1, Harvard University, Cambridge.

FELIX 1912 Felix, J. P., *Das Mammut von Borna*, Voigtländer, Leipzig.

GIPSON, BALLARD, NOWAK, MECH 2000 Gipson, P. S., Ballard, W. B., Nowak, R. M., Mech, L. D., *Accuracy and precision of estimating age of gray wolves by tooth wear*, in: *Journal of Wildlife Management*, 64(3), 752-758.

GRANT 1982 Grant, A., *The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates*, in: Wilson, B., Grigson, C., Payne, S. (eds.), *Ageing and sexing animal bones from archaeological sites, British Archaeological Reports International Series,* 109, 91-108.

GRIGOR'EV 1970 Grigoriev, G. P., *Verchnij paleolit. Kamennyi vek na territorii SSSR*, Nauka, Moscow, 43-63. (in Russian)

GUADELLI 1998 Guadelli, J.-L., *Détermination des classes d'âge des chevaux*, in: *PALEO*, 10, 87-93.

HAESAERTS, BORZIAC, CHIRICA, DAMBLON, KOULAKOVSKA 2007 Haesaerts, P., Borziac, I., Chirica, V., Damblon, F., Koulakovska, L. V., *Cadre stratigraphique et chronologique du Gravettien en Europe centrale*, in: *Spéciale table ronde (1ère partie): Le Gravettien: entités régionales d'une paléoculture européenne*, Les Eyzies, juillet 2004, in: *PALEO*, 19, 31-52.

HAYNES 1991 Haynes, G., *Mammoths, Mastodonts and Elephants, Biology, behavior and the Fossil record*, Cambridge Press, Cambridge.

HUFTHAMMER 1995 Hufthammer, A. K., *Age determination of Reindeer (Rangifer tarandus L.)*, in: *Archaeozoologia*, 7(2), 33-42.

IVANOVA, TZEITLIN 1987 Ivanova, I. K., Tzeitlin, S. M. (eds.), *Mnogosloinaia paleoliticheskaia stoianka Molodova V. Liudi kamennogo veka i okruzhaiushchaia sreda*, Nauka, Moscow. (in Russian).

KOCH 1935 Koch, W., *The Age Order of Epiphyseal Union in the Skeleton of the European Bison (Bos bonasus L)*, in: *The Anatomical Record*, 61, 371-376.

KOENIGSWALD 1989 Koenigswald, W. V., *Das Mammut von Polch bei Mayen (Eifel)*, in: *Eiszeitalter und Gegenwart*, 39, 87-97.

KOULAKOVSKA, USIK, HAESAERTS 2012 Koulakovska, L. V., Usik, V. I., Haesaerts, P., *Dorochivtsy III- Gravettian site in the Dniester valley (Ukraine)*, in: *Stratum Plus*, 1, 131-150.

KRUMREY, BUSS 1968 Krumrey, W. A., Buss, I. O., *Age estimation, growth, and relationships between body dimensions of the female elephant*, in: *Journal of Mammalogy*, 49 (1), 22-31.

LAM, CHEN, PEARSON 1999 Lam, Y. M. Chen, X., Pearson, O. M., *Intertaxonomic variability in patterns of bone density and the differential representation of bovid, cervid, and equid elements in the archaeological record*, in: *American Antiquity*, 64, 343–362.

LAWS 1966 Laws, R. M., *Age criteria for the African elephant Loxodonta a. Africana*, in: *East African Wildlife Journal*, 4, 1-37.

LISTER 2009 Lister, A. M., *Late-glacial mammoth skeletons (Mammuthus primigenius) from Condover (Shropshire, UK): anatomy, pathology, taphonomy and chronological significance*, in: *Geological Journal*, 44, 447-479.

LYMAN 2008 Lyman, R. L., *Quantitative Paleozoology*, Cambridge University Press, New-York.

LYMAN 1994 Lyman, R. L., *Vertebrate taphonomy*, Cambridge University Press, Cambridge.

MILLER 1974 Miller, F. L., *Biology of the Kaminuriak population of Barren Ground Caribou. Part 2: Biology of the Kaminuriak population of barren-ground caribou: Part 2. Dentition as an indicator of age and sex; composition and socialization of the population*, Canadian Wildlife Service Reports, Ottawa.

MORIN 2012 Morin, E., *Reassessing paleolithic subsistence: the Neandertal and modern human foragers of Saint-Césaire*, Cambridge University Press, Cambridge.

MURRAY 1993 Murray, N. A., *The behavioural ecology of reindeer (Rangifer tarandus) during the last glaciation in Britain and its implications for human settelment, subsistence and mobility*. Ph.D. thesis, University of Edinburgh.

NOIRET 2007 Noiret, P., *Les industries aurignaciennes et « aurignacoïdes » en Moldavie après 30.000 BP*, in: *Annales d'Université « Valahia » Târgoviște, Section d'Archéologie et d'Histoire*, 8-9, 91-105.

NOIRET 2009 Noiret, P., *Le Paléolithique supérieur de la Moldavie. Essai de synthèse d'une évolution multi-culturelle*, Université de Liège, Liège.

NUZHNYI 2009 Nuzhnyi, D. Yu., *The industrial variability of the eastern Gravettian assemblages of Ukraine*, in: *Quartär*, 56, 159-174.

OBADĂ, DAVID, BORZIAC 1994 Obadă, T., David, A., Borziac, I., *Fauna de mamut din stațiunea paleolitică Climăuți II din Basarabia (La faune de mammouth de la station paléolithique de Climăuți II de Bessarabie)*, in: SCIVA, 45(3), 251-255.

OTTE, NOIRET, CHIRICA, BORZIAK 1996 Otte M., Noiret, P., Chirica, V., Borziak, I., *Rythme évolutif du Gravettien Oriental*, in: Palma di Cesnola, A., Montet-White, A., Valoch, K. (eds.), *XIII Congrès International d'U.I.S.P.P., Section 6: The Upper Palaeolithic. Colloquim XII. The Origin of the Gravettian*, Forli, Italy, 213-226.

OUTRAM, ROWLEY-CONWY 1998 Outram, A., Rowley-Conwy, P., *Meat and Marrow Utility Indices for Horse (Equus)*, in: *Journal of Archaeological Science*, 25, 839-849.

POPLIN 1976 Poplin, F., *Remarques théoriques et pratiques sur les unités utilisées dans les études d'ostéologie quantitative, particulièrement en archéologie préhistorique*, in: *IXe Congrès UISPP*, 13-18 septembre 1976, Nice, Thèmes spécialisés, B, Problèmes ethnographiques des vestiges osseux, CNRS. *Bulletin signalétique*, 31(2), 124-141.

PRAT, DELPECH, CANCEL, GUADELLI, SLOTT-MOLLER 2003 Prat, F., Delpech, F., Cancel, N., Guadelli, J.-L., Slott-Moller, R., *Le Bison des steppes, Bison priscus Bojanus*, 1827, *de la grotte d'Habarra à Arudy (Pyrénées-Atlantiques)*, in: *PALEO. Revue d'Archéologie Préhistorique, Société des amis du Musée national de préhistoire et de la recherche archéologique - SAMRA*, 15 – Cahier spécial, 1-102.

SAVOY, SCHERLER, BECKER 2012 Savoy, J., Scherler, L., Becker, D., *Variabilité morphologique et biométrique des dents d'*Equus germanicus *des dolines pléistocènes d'Ajoie (Jura, Suisse)*, in: *Actes 2012 de la Société jurassienne d'Emulation*, 17-36.

SIEGFRIED 1959 Siegfried, P., *Das Mammut von Ahlen, Mammonteus primigenius Blumenbach*, in: *Paleontologische Zeitschrift*, 33(3), 172-184.

STEFANIAK, PISKORSKA, WITKOWSKA, WOJTAL 2012 Stefaniak, K., Piskorska, T., Witkowska, A., Wojtal, P., *Morphometric variation of reindeer remains* (Rangifer tarandus*, Linnaeus, 1758) from Late Pleistocene cave localities in Poland*, in: *Annales Societatis Geologo-rum Poloniae*, 82, 177-191.

TATARINOV 1977 Tatarinov, K. A., *Vertebrate fauna of Korman IV site*, in: Goretzky, G. I., Zeitlin, S. M. (eds.), *Mnogosloinaia paleoliticheskaia stoianka Korman IV na srednem Dniestr*, Moscow, Nauka, 112-118. (in Russian)

TOEPFER 1957 Toepfer, V., *Die Mammutfunde von Pfännerhall im Geiseltal*, Veröffentlichungen des Landesmuseums für Vorgeschichte, Halle/Saale.

ZIEGLER 2001 Ziegler, R., *An extraordinary small mammoth (Mammuthus primigenius) from SW Germany. Geologie und Palaontologie*, in: *Stuttgarter Beitrage zur Naturkunde*, Series B 300, 1-41.

ZWYNS 2004 Zwyns, N., *La problématique de l'Aurignacien tardif dans la zone des steppes nord-pontiques / The late Aurignacian problematic in the north Pontic steppe zone*, in: *L'Anthropologie*, 108, 471-493.

Species	**Vernacular name**	**NR**	**MNE**	**MNI**
Mammuthus primigenius	Woolly Mammoth	14	13	2
Equus sp. (cf. *latipes*)	Horse	43	41	3
Bison sp. (cf. *priscus*)	Bison	11	11	1
R. tarandus	Reindeer	14	11	2
Canis lupus	Wolf	14	14	2
Panthera spelaea	Cave Lion	1	1	1
Number of identified specimens				
large-sized mammal		54	7	
medium-sized mammal		4	2	
undetermined		20		
TOTAL		**175**	**100**	**11**

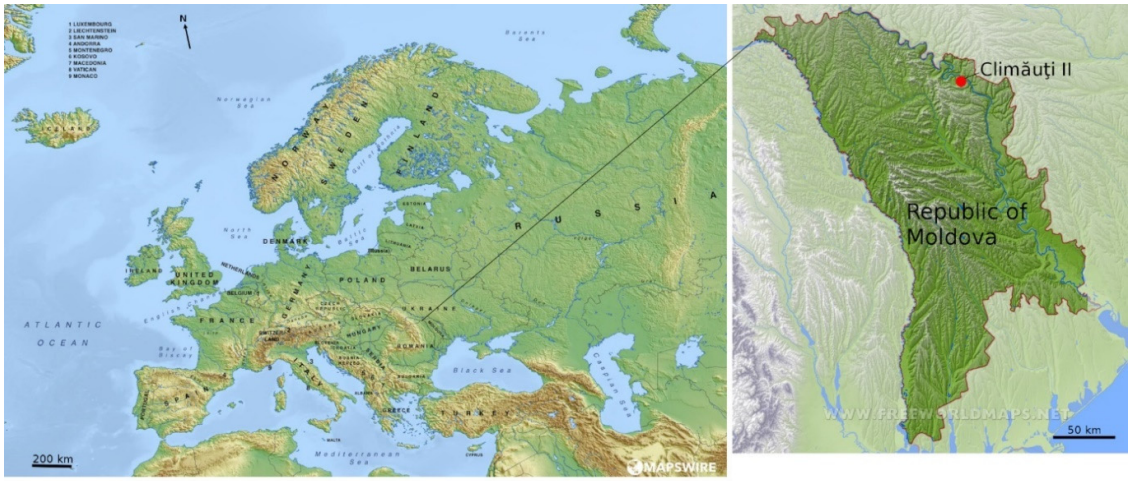
Tab. I. Counting of faunal remains of Climăuți II/lower in number of remains (NR), minimal number of element (MNE) and minimal number of individuals (MNI).

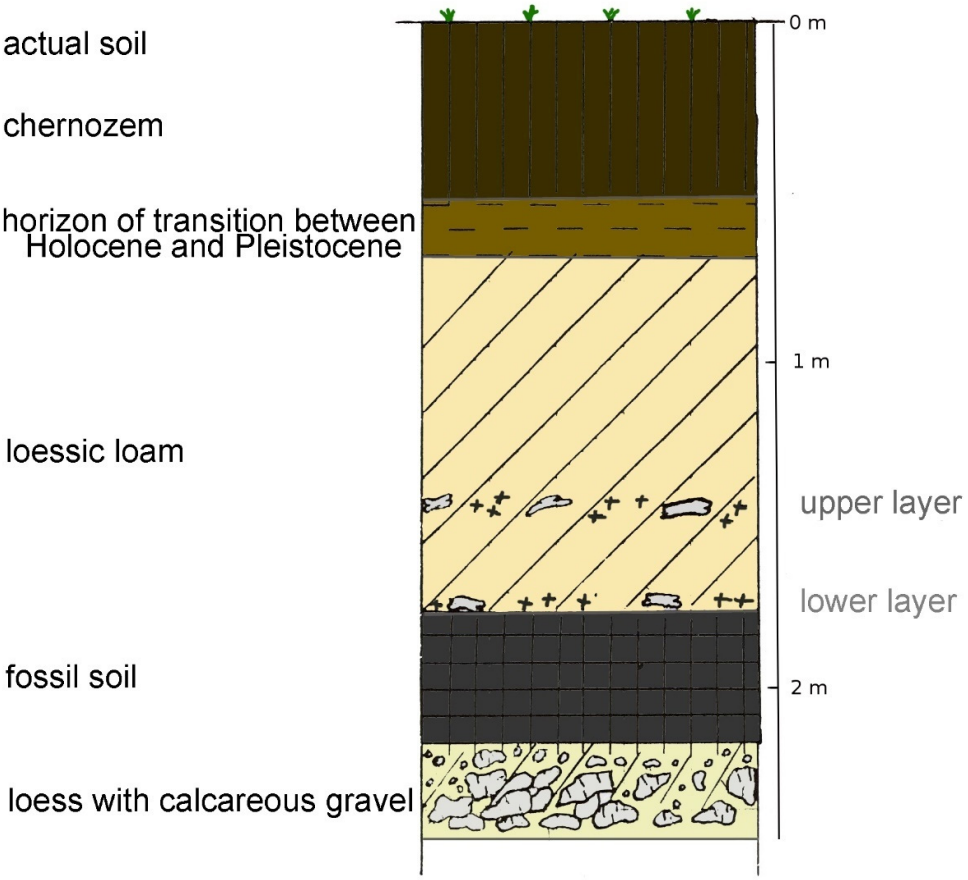
genus/species/category	**weathering**		**percolating water**		**runoff water/ mineral acids**		***charriage-à-sec*/ trampling**		**plant root marks**	
	NR	%NR	NR	%NR	NR	%NR	NR	%NR	NR	%NR
M. primigenius	10	71,4	14	100	11	78,6	0	0	0	0
Equus sp. (cf. *latipes*)	1	2,3	43	100	9	20,9	0	0	0	0
Bison sp.	0	0	11	100	3	27,3	1	9,1	0	0
R. tarandus	3	21,4	14	100	7	50,0	0	0	2	14,3
C. lupus	2	14,3	14	100	1	7,1	0	0	0	0
P. spelaea	0	0	1	100	1	100,0	0	0	0	0
large-sized mammal	2	3,7	54	100	45	83,3	1	1,9	1	1,9
medium-sized mammal	0	0	4	100	2	50,0	0	0	0	0
undetermined	0	0	20	100	0	0	0	0	0	0
TOTAL	18	10,3	175	100	79	45,1	2	1,1	3	1,7

Tab. II. Alterations due to climate and edaphic factors and biological non-human agents in number of remains by species of Climăuți II/lower.

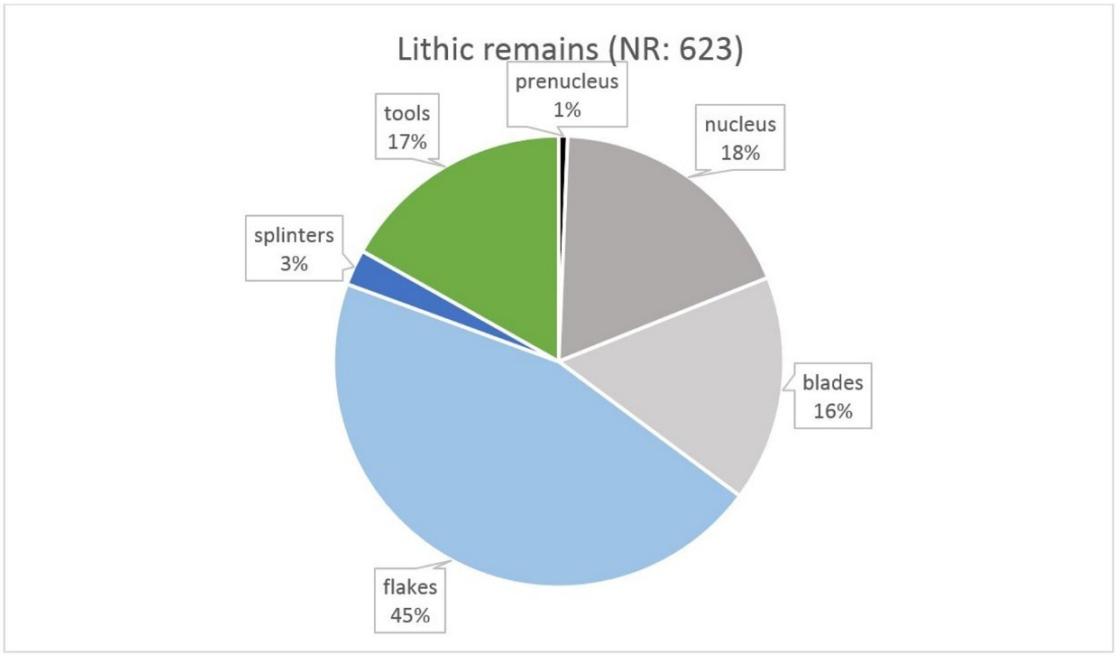
Site	**Type**	**Technocomplex**	**Dominant tools**	**Raw material origin**	**Dominant mammal species**	**Bone industry**	**Art**	**Structure**
Brânzeni/III	temporary camp	Brynzenian	blades, denticulates, retouched flakes, burins, endscrapers	local +exogenous	Horse, Reindeer, Marmot, Bison	yes	no	-hearth
Corpaci-Mas	temporary camp	Aurignacoid Gravettian	retouched flakes, endscrapers, denticulates, then burins	/	Few fragments	no	no	-hearth
Korman IV/7	/	Gravettian	endscrapers, burins	/	Mammoth, Red Deer	no	no	-hearths
Korman IV/6	temporary camp	Gravettian	endscrapers, burins, retouched blades	/	Mammoth, Horse, then Reindeer	yes	no	-hearths
Molodova V/8	temporary camp	Gravettian	burins, endscrapers, retouched blades	local +Volhyn flint	Reindeer, Horse, then Mammoth	yes	yes	-hearths -huts
Molodova V/7	base camp	Gravettian	burins, endscrapers, retouched blades	local	Reindeer, Horse, Mammoth	yes	yes	-hearths -huts
Oselivka 1/III	flint workshop	Gravettian	points, burins, endscraper	/	Reindeer, Horse	no	no	no

Tab. III. Main archaeological sites in the Middle Dniester area, between 26,000 and 23,000 BP and data.





Pl. I. 1. Location of Climăuți II site; 2. Stratigraphy of Climăuți II site.



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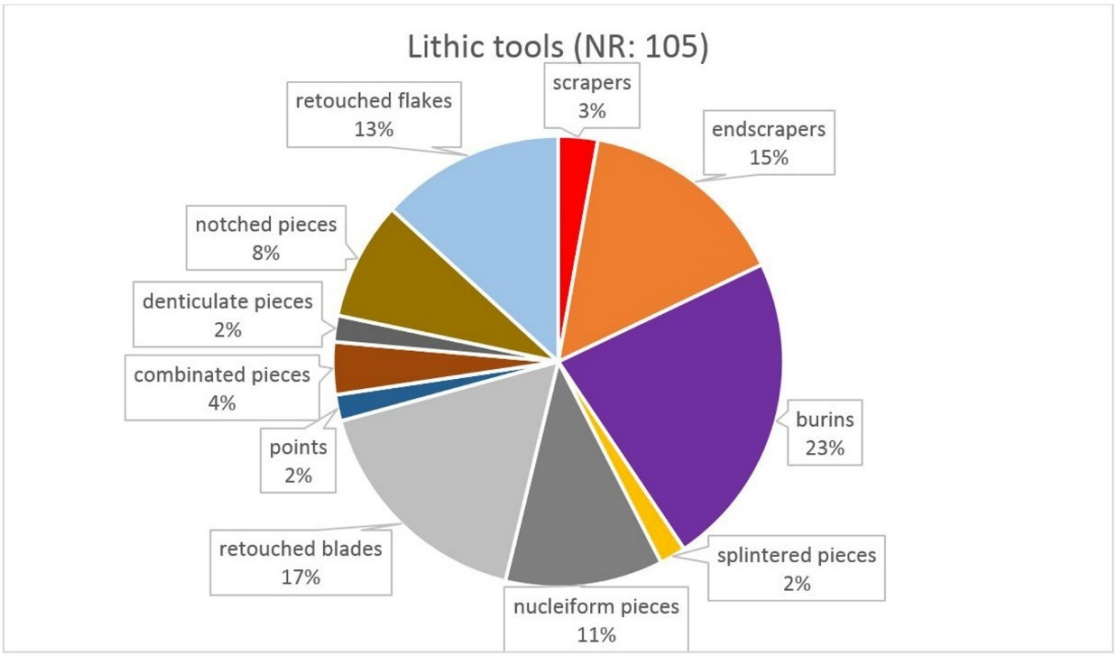

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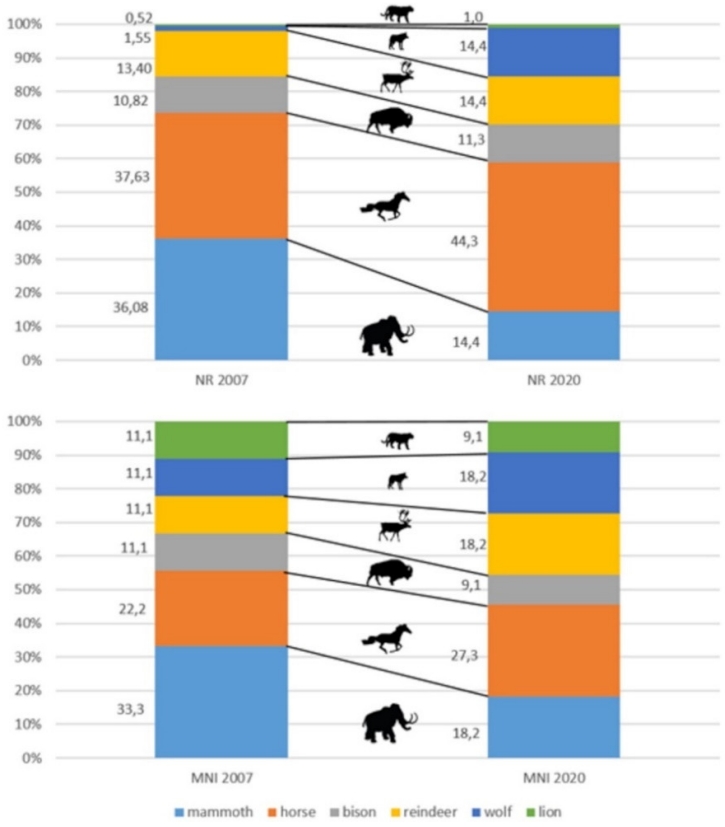
Pl. II. 3. Lithic remains of Climăuți II/lower; 4. Lithic tools of Climăuți II/lower.



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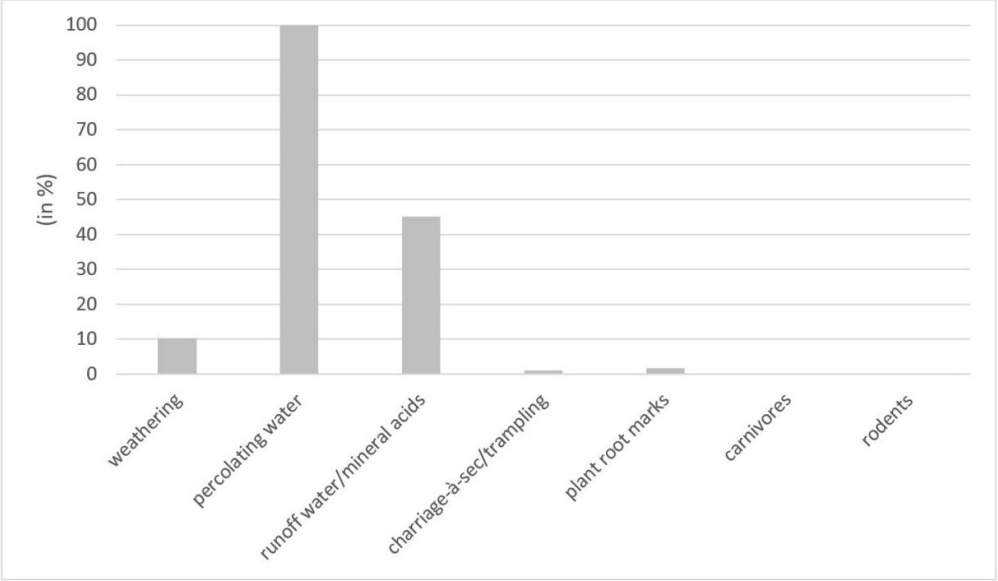

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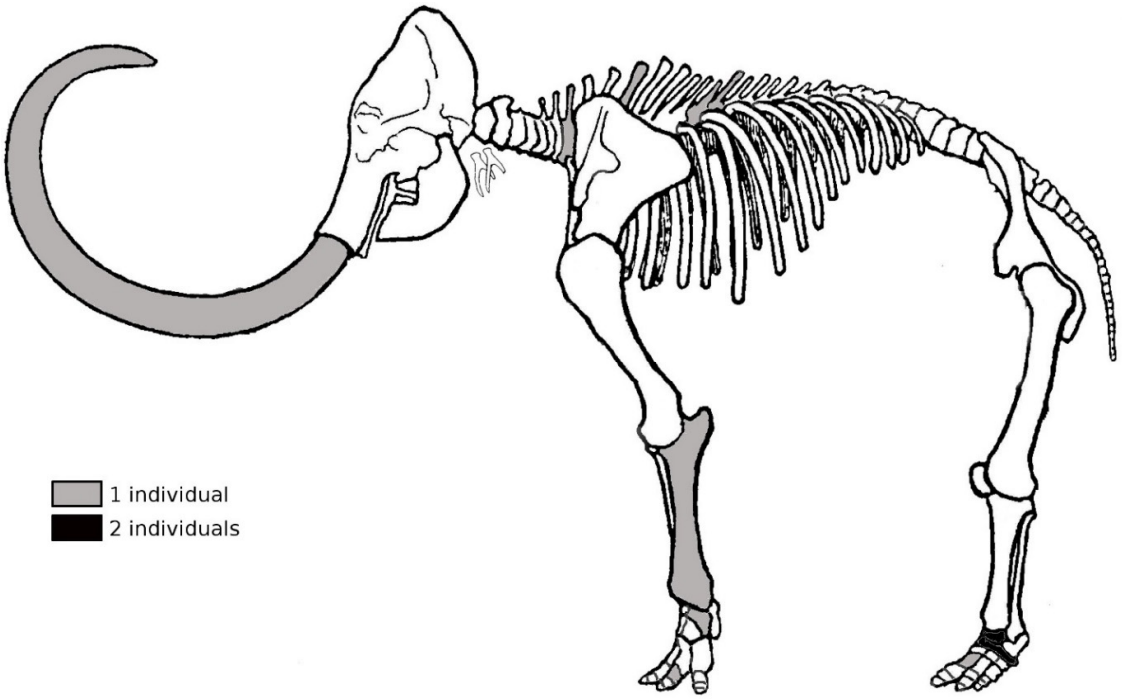
Pl. III. 5. Comparisons between the number of remains (NR) and the minimum number of individuals (MNI), in percentage, from 2007 (BORZIAC, CHIRICA and DAVID, 2007) and this study (2020) of Climăuți II/lower; 6. Alterations due to climato-edaphic and non-human biological agents in percentage of number of remains of Climăuți II/lower.



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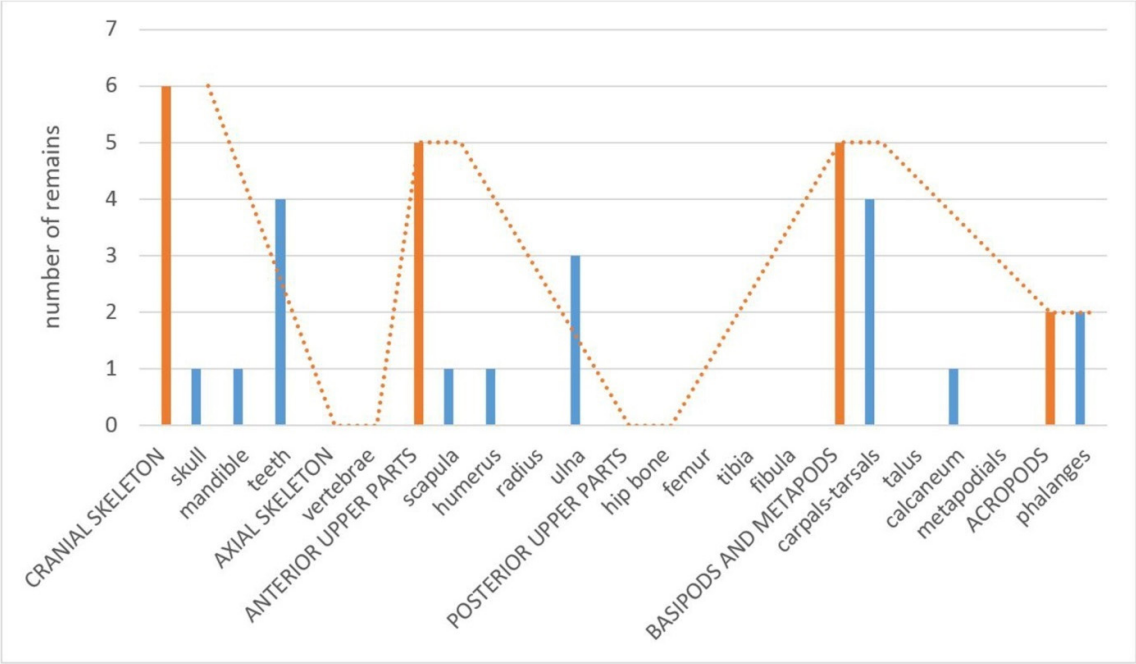

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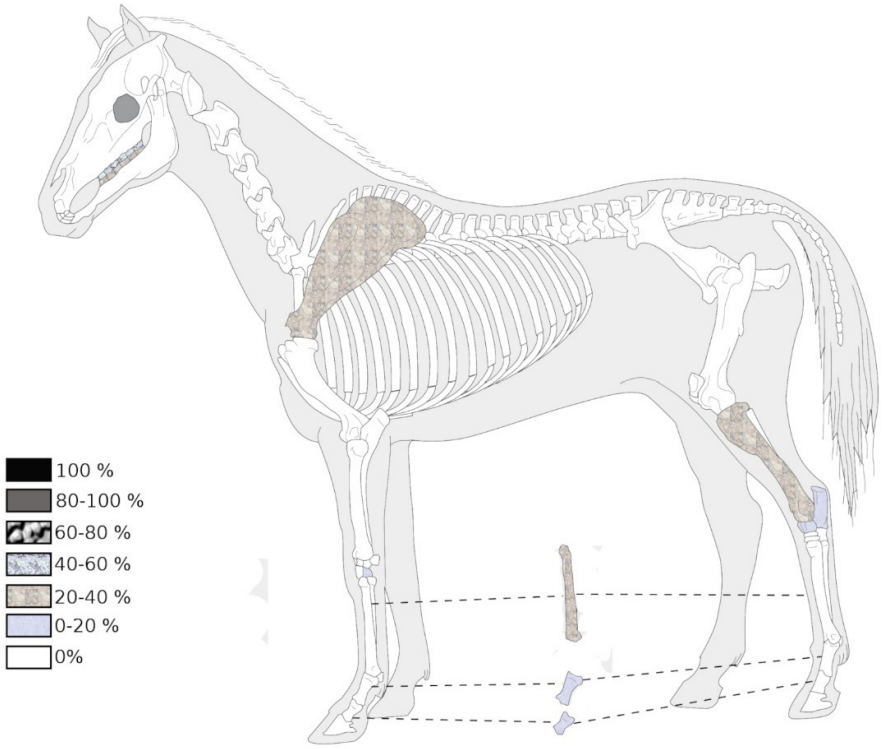
Pl. IV. 7. Skeletal preservation of mammoths of Climăuți II/lower;
8. Skeletal preservation of mammoth of Climăuți II/lower from 2007.



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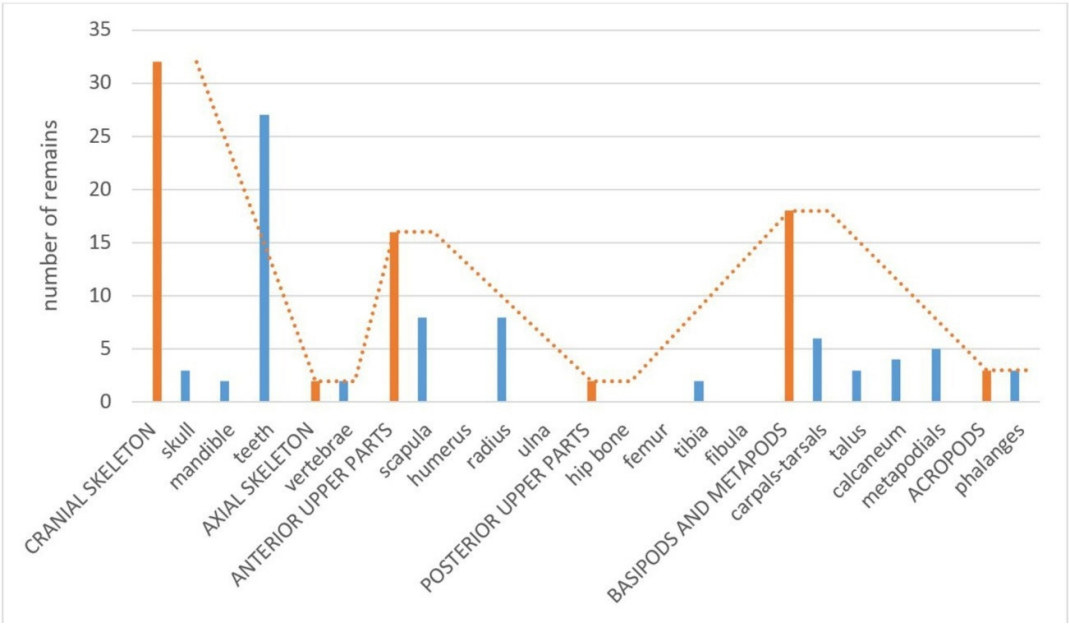

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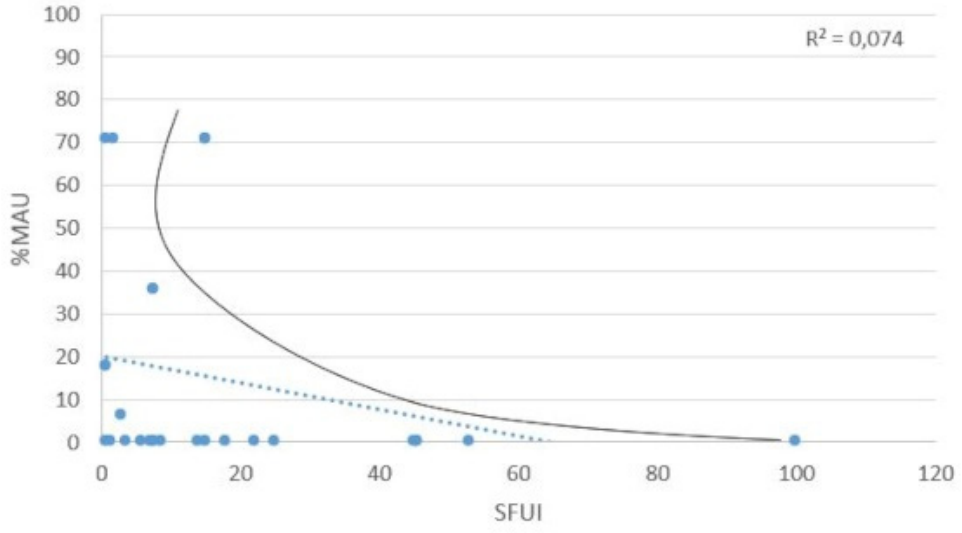
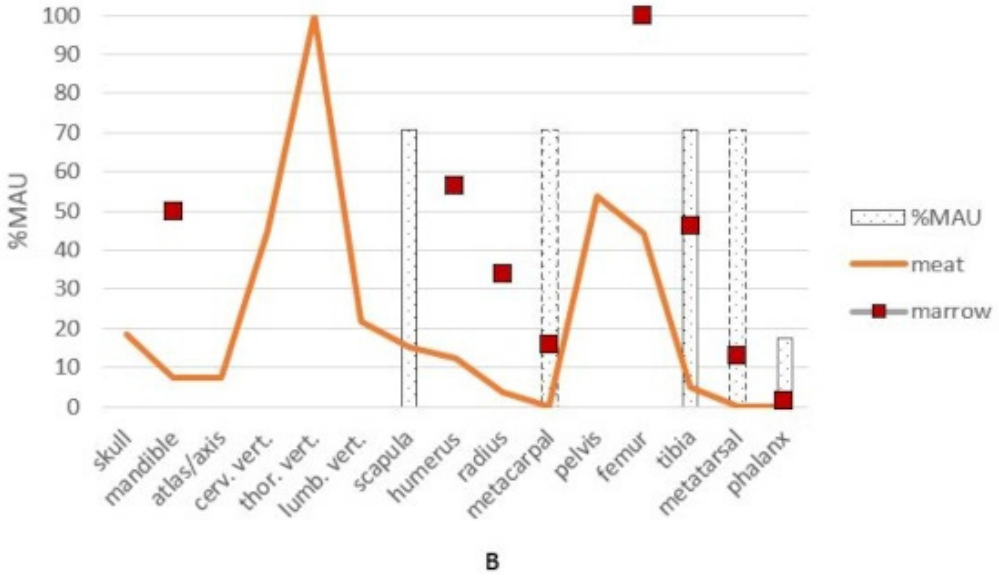
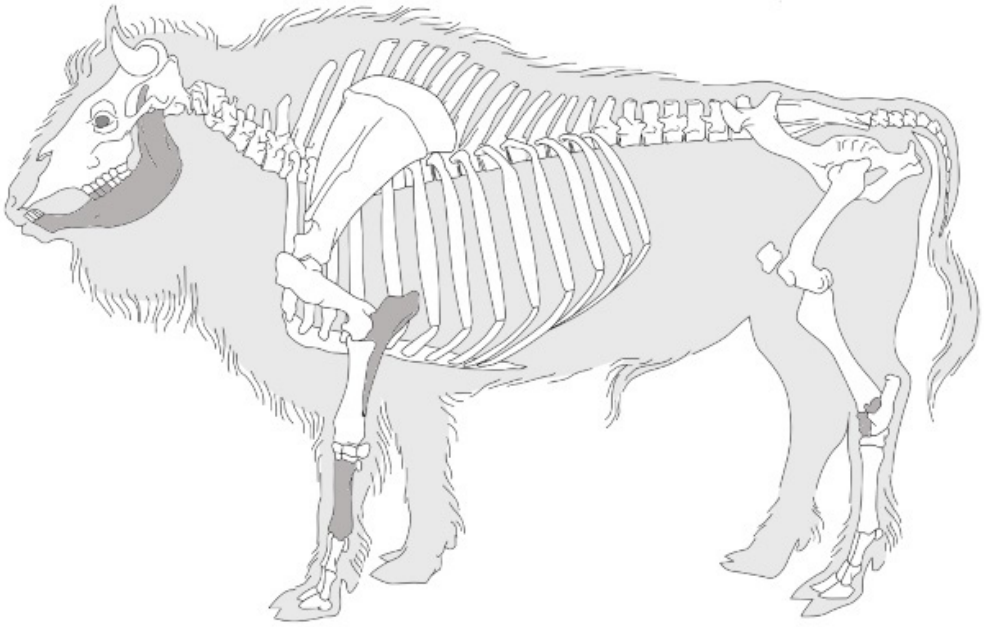
Pl. V. 9. Skeletal representation of horses in percentage survivorship from Climăuți II/lower;
10. Skeletal preservation of horse of Climăuți II/lower from 2007.





Pl. VI. 11. Skeletal preservation of horses related to nutritional values of Climăuți II/lower.
A: nutritional values by anatomical segments; B: in %MAU by anatomical elements, related to the meat and marrow indexes.
(dotted lines correspond to undetermined metapodial).



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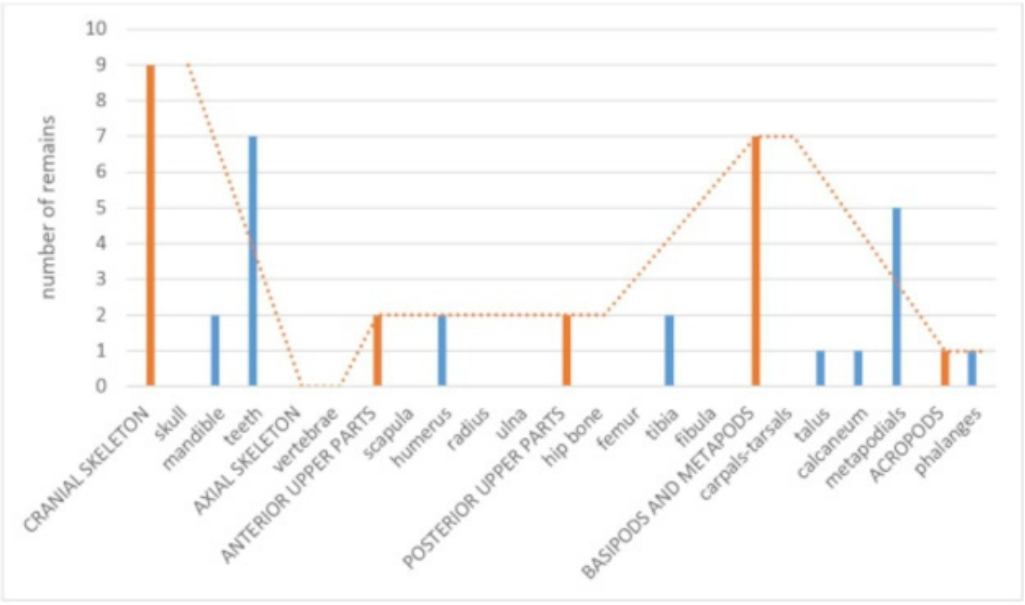

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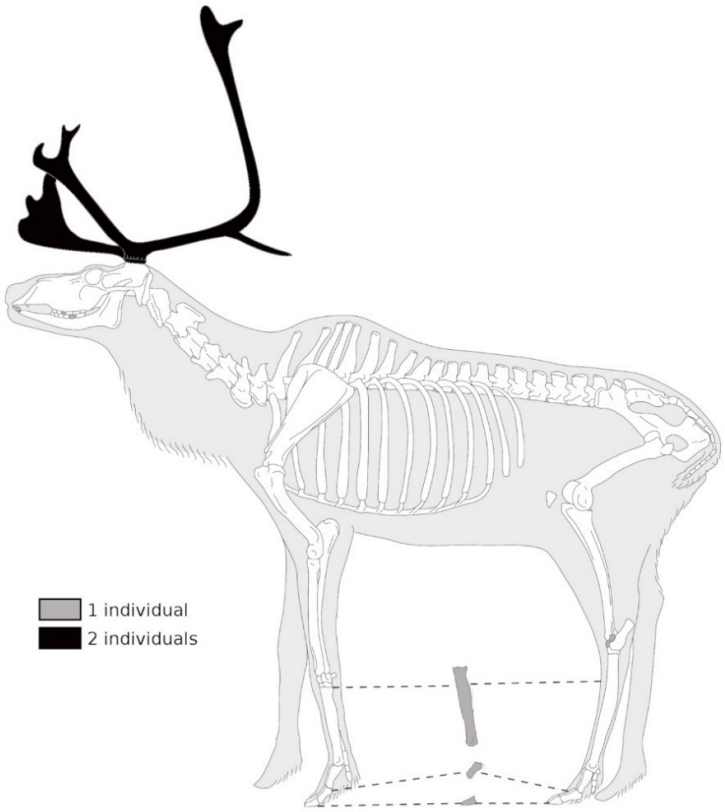
Pl. VII. 12. Skeletal preservation of bison of Climăuți II/lower;
13. Skeletal preservation of bison of Climăuți II/lower from 2007.



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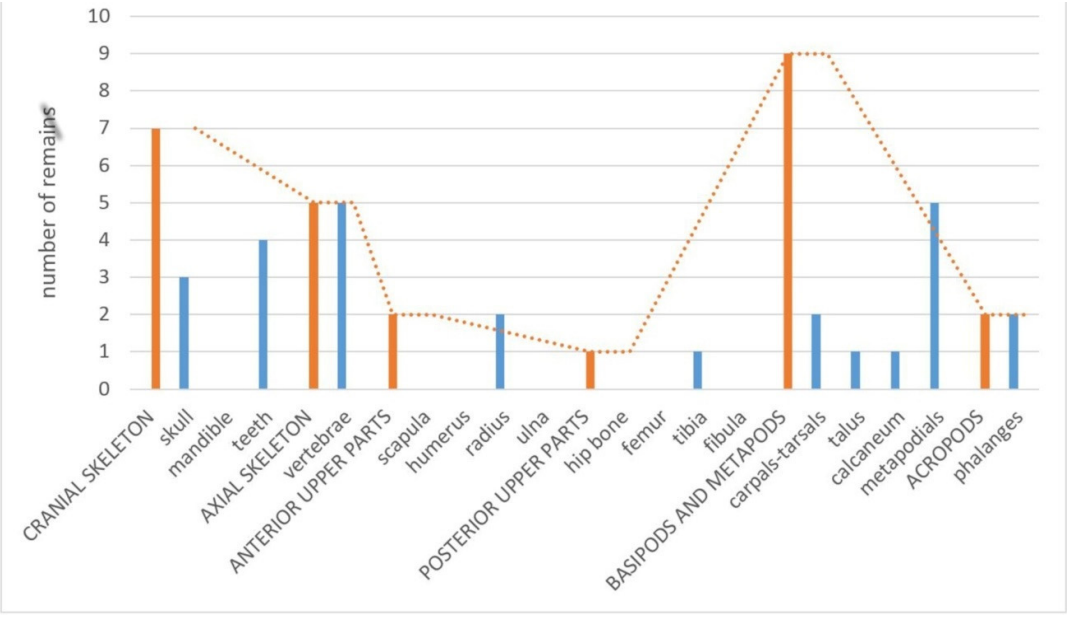

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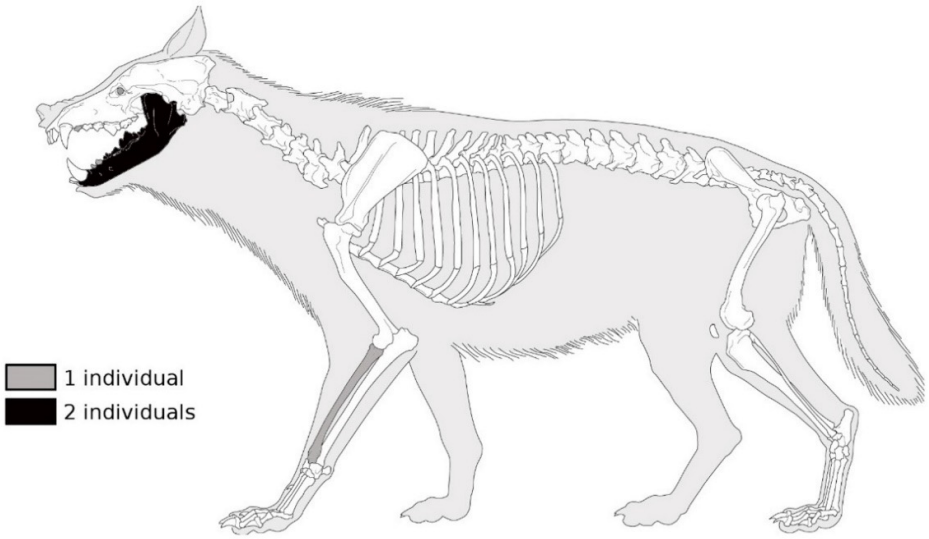
Pl. VIII. 14. Skeletal preservation of reindeers of Climăuți II/lower;
15. Skeletal preservation of reindeer of Climăuți II/lower from 2007.



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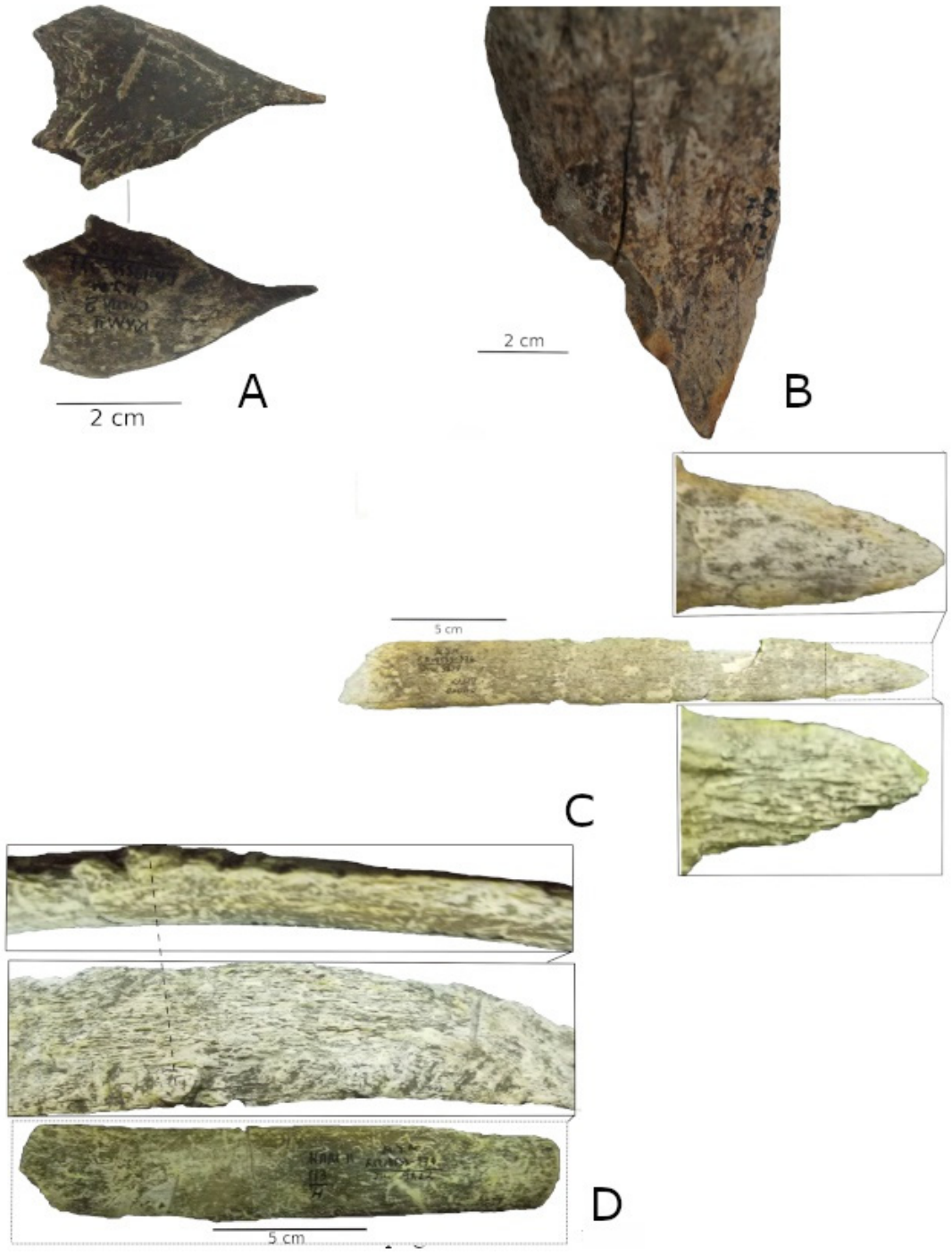
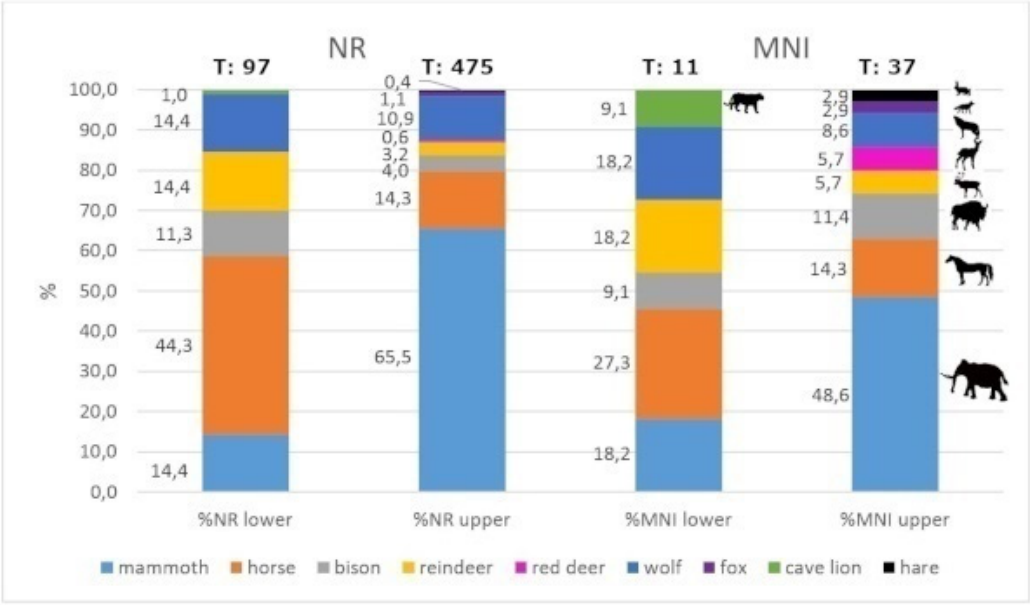
Pl. IX. 16. Skeletal preservation of wolves of Climăuți II/lower;
17. Right humerus of cave lion of Climăuți II/lower in posterior view.



Pl. X. 18. Bones with anthropogenic modifications of Climăuți II/lower. A: fragment of medium-sized mammal long bone with blunt point; B: bison metacarpal with helicoidal breakages; C: large-sized mammal rib with blunt edges and smoothed surface of the extremity; D: large-sized mammal rib with impacts on the internal surface.



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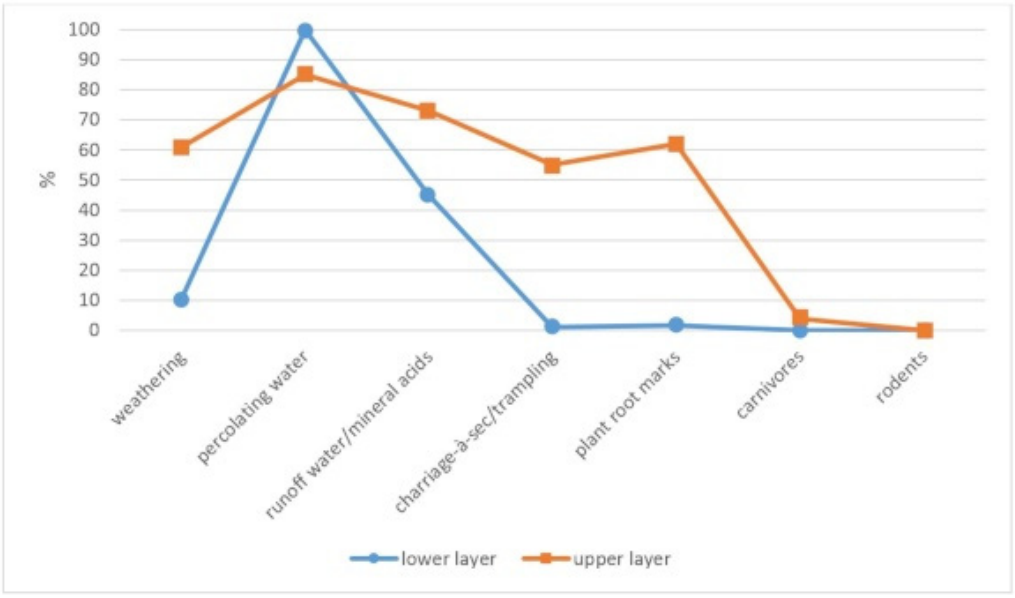

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Pl. XI. 19. Number of remains and number of individuals of lower and upper layers of Climăuți II, in percentage, from this study and DEMAY et al. (in press); 20. Alterations due to climato-edaphic and non-human biological agents in percentage of number of remains of Climăuți II/lower and upper.