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► **To cite this version:**

Éva Daschek, Zsolt Mester. A site with mixed occupation: Neanderthals and carnivores at Érd (Hungary). *Journal of Archaeological Science: Reports*, 2020, 29, pp.102116. 10.1016/j.jasrep.2019.102116 . hal-03352125v2

**HAL Id: hal-03352125**

**<https://hal.science/hal-03352125v2>**

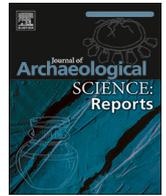
Submitted on 2 May 2023

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# A site with mixed occupation: Neanderthals and carnivores at Érd (Hungary)

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## ARTICLE INFO

### Keywords:

Hungary  
Middle Palaeolithic  
Neanderthal  
Quina Mousterian  
Bear Exploitation  
Archaeozoology  
Lithic Technology

## ABSTRACT

The Middle Palaeolithic open-air site of Érd, near Budapest (Transdanubia, Hungary), with its specific lithic industry on quartzite pebbles, combustion structures and abundant animal bone material dominated by cave bears, was long time considered as one of the best example of a long-term camp of Neanderthals specializing in cave bear hunting. This interpretation of the site was based on the knowledge of the late 1960s. However, the association of carnivore remains and lithic artefacts found in cave or sheltered sites of the Palaeolithic period raises questions about the formation processes of the bone accumulations and about the relationships between these different agents. The development in methodology, both in archaeozoology and lithic technology, allows to apply new approaches in the study of this complex problematic. Independent new analyses of the lithic assemblage and the osteological material of Érd resulted completely new conclusions concerning past human activities at the site as well as the presence and the role of cave bear and cave hyena. An interpretation of the site as a refuge or den for these predators together with the undeniable presence of humans implies a mixed functioning through recurrent occupations.

## 1. Introduction

The Middle Palaeolithic site of Érd was long-time famous by its unique archaeological context: a faunal assemblage largely dominated by cave bear, found in an open-air settlement together with Quina type Mousterian (Charentian) tool-kit in six levels, dated before the first glacial maximum of the Weichselian (Würmian) glaciation (Gábori-Csánk, 1968a; Gábori, 1976: 74–77; Gamble, 1986: 169, 318; Otte, 1996: 120; Dobosi, 2000, 2005: 56–57). Due to this context, the site was interpreted as a camp of Neanderthals, specialized in cave bear hunting, showing cultural development along the sequence (Gábori-Csánk, 1968a; Gábori, 1976: 202, 1979: 243; Gábori and Gábori-Csánk, 1977; Gamble 1999: 235), however some scholars disputed this conclusion (e.g. Gamble, 1986: 318–319; Tillet and Binford, 2002).

The base of the interpretation of the site as a hunting camp was the observation that the lithic artefacts have been usually found inside the bone accumulations. The excavators regarded this as a proof of the direct relation between human occupation and the bone accumulation. Since the publication of the monograph of the site (Gábori-Csánk, 1968a), the coexistence of lithic artefacts and carnivore, especially cave bear, bones in cave sites have been arised many questions, therefore hypotheses have been proposed for alternative interpretation (Stiner, 1994, 1998; Villa and Soressi, 2000; Faith et al., 2007; Torres et al.,

2007; Rosell et al., 2010, 2017; Diedrich, 2011; Discamps, 2011; Airvaux et al., 2012; Discamps et al., 2012), including hunting and scavenging (Auguste, 1995; Armand et al., 2003, 2004, 2018; Münzel and Conard, 2004, Romandini et al., 2018). Several researchers have attempted to characterize ursid assemblages and their importance in the food cycle (Quilès, 2004; Diedrich, 2012; Fourvel et al., 2014; Fourvel et al., 2017), but also their role as a taphonomic agent (Crégut-Bonnoure and Fosse, 2001; Quilès et al., 2006; Rabal-Garcés et al., 2012; Pinto and Andrews, 2004; Stiner, 1999; Stiner et al., 1996). Hominids and carnivores used the same spaces and consumed/hunted the same species during the Pleistocene (Brugal and Fosse, 2004). Thus, their co-occurrences in terms of hominid-carnivore relationship arised questions and studies about (their) competition of resources, interactions, avoidance of confrontation by both of them (e.g. Rosell and Blasco, 2009). Several palaeontological and actualistic researches focused on carnivores' and scavengers' behaviour, their interactions, and its archaeological implications (Brain, 1981; Bunn, 1983; Haynes, 1983; Fosse, 1994; Brugal et al., 1997; Fosse et al., 1998; Horwitz, 1998; Castel, 2004; Brugal and Fosse, 2004; Quilès, 2004; Selvaggio and Wilder, 2001; Stiner, 2004; Diedrich, 2006a, 2006b; Beauval and Morin, 2010; Brugal, 2011; Diedrich, 2012; Fourvel, 2012; Fourvel et al., 2014; Camarós et al., 2013; Arilla et al., 2014), especially since the hyena is well known as a bone collector and modifier (e.g. Sutcliffe,

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1970). These studies shed light on the potential traces of animal activities in archaeological sites and help to distinguish between agents in animal bone assemblages (Cruz-Urbe, 1991; Villa et al., 2004; Fourvel, 2012; Costamagno et al., 2005; Kuhn et al., 2010; Pickering, 2002).

At Érd, the idea of a slow cultural development along the levels of the site was based on the increasing number of the tools and of the tool-types (according to Bordes' classification), the increasing percentage of the so-called Upper Palaeolithic types, of the non-quartzite raw materials and of the smaller tools (< 30 mm) (Gábori-Csánk, 1968a: 183–196, 1968c). Parallely, a shifting in the orientation of hunting was also supposed by the increasing ratio of the horses and the rhinos in the bone material (Gábori-Csánk, 1968a, 1968c). The tool production technology of the industry was thought to be a specific method linked to the local raw material for slicing the pebbles, similar to the technique applied in the Pontinian of Central Italy (Gábori-Csánk, 1968a: 115–125). Due to the methodological development in French Prehistory, from 1980 onward, the technological approach in the study of the Palaeolithic tool production became a new research axis with elaborated research methodology, terminology, and analytical tools (Tixier et al., 1980; Inizan et al., 1999; Tixier, 2012). Based on the *chaîne opératoire* concept (Leroi-Gourhan, 1964: 164, 1965: 9–62; 1993: 114, 219–255; Pelegrin et al., 1988; Boëda et al., 1990; Karlin et al., 1991; Sellet, 1993; Bar-Yosef and Van Peer, 2009; Soressi and Geneste, 2011; Audouze and Karlin, 2017) and on the results of a lot of knapping experiments, a series of different debitage concepts and modalities were recognized and (re)defined (Boëda, 1993, 1994; Bourguignon, 1996; Inizan et al., 1999; Peresani, 2003). The application of the technological approach brought new elements to characterize the Quina type Mousterian (Charentian) industries (Turq, 1989; Bourguignon, 1997; Geneste et al., 1997; Hiscock et al., 2009), to reconsider the Pontian tool production (Bietti and Grimaldi, 1993, 1996; Grimaldi, 1996), as well as to study the industries using quartzite as raw material (Jaubert and Mourre, 1996; Mourre, 1997; Moncel, 1998; Cologne and Mourre, 2009; Di Modica and Bonjean, 2009).

All these results and developments provided to study the problematic of the human and carnivore presence in the site of Érd in much more complex way. Detailed re-analyses of the lithic and faunal assemblages of the site permitted to formulate new conclusions concerning the human technical activities and the presence and the role of cave bear and cave hyena (Daschek, 2014). The technological analysis of the lithic assemblage revealed the presence of different debitage concepts with the aim of producing special blanks and an expressed homogeneity of the blank morphometry along the sequence (Mester, 2004, 2012; Mester and Moncel, 2006). The comprehensive archaeozoological analysis of the animal bone assemblage demonstrated that, beside human occupation, the site have been used as a den by cave bears, as well as a refuge by cave hyenas (Daschek, 2014). In this paper, we consider the possible interpretation of a mixed occupations of the site by human and carnivores in the light of these new results.

## 2. The archaeological site of Érd

The site is located SW of Budapest, the capital of Hungary, on the Érd–Tétény Plateau (Fig. 1: A). The upper part of this plateau is built up of younger middle Miocene (Sarmatian) limestone. An important valley, named Fundoklia, developed along a fault line in NW-SE direction, cutting in the plateau (Hunyadi, 1962; Kriván in Gábori-Csánk, 1968a: 33). In the slope of the Fundoklia valley, erosional processes formed small depressions, interpreted as short vallons (Gábori-Csánk, 1968a), which were filled up and covered by quaternary sediments. The whole archaeological site was unearthed in two, 18–20 m long and 3–4 m deep, parallel depressions (“vallon I and II”) in the upper section of the Fundoklia (Kriván in Gábori-Csánk, 1968: 33–38) (Fig. 1: B).

The stratigraphic sequence of the vallons is composed of weathered limestone and loessic sediments, deposited during the Upper Pleistocene (Fig. 2). Traces of periglacial (ice wedges, solifluction) and

pedogenetic (rendzines) processes were observed in the sequence, demonstrating different climatic conditions during the accumulation period.

The site was discovered in 1961 by local people who found fossil bones. Hunyadi (1962) made geological observations and a small-scale palaeontological excavation. He supposed that there was a collapsed cave because of the presence of species of cave fauna. Next year lithic artefacts have been found also. Archaeological excavations of the site took place on a surface of 214 m<sup>2</sup> in 1963–1964 led by V. Gábori-Csánk from the Budapest History Museum (Gábori-Csánk, 1967, 1968a, 1968b). Animal bones and lithic artefacts have been found in loessic sediments in a depth between 130 and 150 cm (level a) and 215–240 cm (level e) in the upper archaeological layer, as well as in 260–280 cm in the lower archaeological layer (level A) (Gábori-Csánk, 1968a: 17–32) (Fig. 2). Based on the published observations, it seems to be rational to distinguish the lower (level d–e) and the upper parts (level a–c) of the upper archaeological layer because of some changes in the sediment sequence, already marked on the stratigraphic section. The two archaeological layers was separated by a 20 cm thick sterile layer. Two hearths were unearthed in level d in both vallons, and traces of combustions were observed in other levels too. During the excavations, a rich archaeological material was collected: among 50,000 about 15,000 determinable (14,930 after the table of fauna spectrum) animal bones and 3093 lithic artefacts according to Gábori-Csánk (1968a: 61, 62, 111). Palaeontological analysis of the osteological assemblage was performed by M. Kretzoi with a palaeoecological and chronostratigraphic conclusion (Gábori-Csánk, 1968a: 59–104). Petrographic description and characterization of the raw materials was made by I. Dienes, concluding to a local origin of them from a pebble formation of Burdigalian (Helvetian) age (Dienes in Gábori-Csánk, 1968: 111–114). A global description of the technology and a very detailed analysis of the typology of the tools were performed by V. Gábori-Csánk. V. Gábori-Csánk and M. Kretzoi evaluated the zoological material in terms of the reconstruction of hunting strategies and acquisition of food, based on their original methodology named “archaeological zoology” (Gábori-Csánk and Kretzoi in Gábori-Csánk, 1968: 223–244).

## 3. Material and methods

The re-analyses of this archaeological material was motivated by the international methodological development of the concerned research fields, archaeozoology and lithic technology. Both of us are trained by the “French school” of the field (Patou-Mathis, 1997a, 1997b; Tixier, 2012; Inizan et al., 1999; Patou-Mathis, 1993). Because the site was recovered after the excavations, direct study of the stratigraphic and geomorphologic situation was not possible. We can base our analyses on the archaeological documentation, which is stored in the Archives of the Budapest History Museum. Planigraphic and stratigraphic drawings according to levels, photographs and diapositives recorded by Miklós Gábori during the excavation works, and published observations were at our disposal.

The excavation methodology applied at the site was common in the early 1960s. During the first excavation season in 1963 a big trench (10 m × 4 m) was dug out, while the 1964's excavation area was subdivided in 2–3 m wide trenches (in total 30), opened according to the progress of the excavation. The digging was carried out with hand tools, all the sediments were dry sieved (Gábori-Csánk, 1968a: 15) with 15–20 mm mesh size. Provenience data of the finds (lithics and bones) were recorded with the identification of the trench and the level.

### 3.1. Lithic assemblage

The lithic artefacts are stored at the Prehistory collection of the Budapest History Museum Aquincum Museum. Altogether 1,844 pieces have been studied, including retouched tools, cores, blanks, stone hammers and raw material blocks (pebbles) (Table 1). The main aims

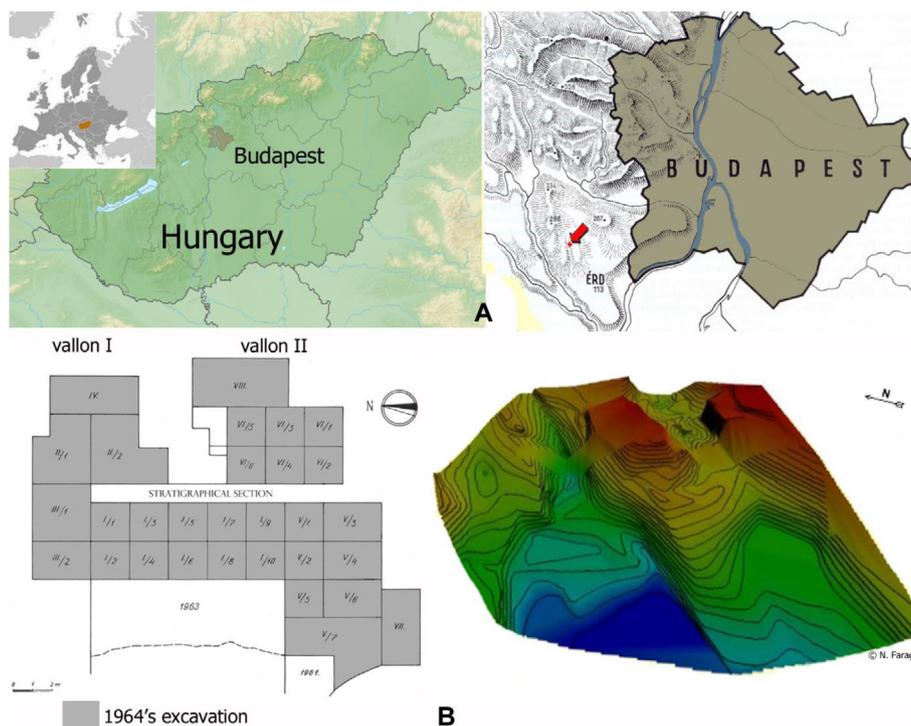


Fig. 1. Geographic location of Érd near Budapest (A) and morphological character (B) of the site (3D model by © N. Faragó).

were to verify if the tool production system of the industry is really specific and adapted to the pebble raw material, as it was supposed; if the standardization of the tool-kit correspond to the size of the raw material or to some cultural aspect; if the apparent homogeneity of the industry along the occupation levels reflect a very low tendency for cultural changes over long time periods (from the end of the Last Interglacial to the Lower Pleniglacial) or it suggests rather problems of interpretation concerning the archaeological stratigraphy of the site.

According to these aims technological studies was performed using the technological reading method (*lecture technologique*) (Inizan et al., 1999; Tixier, 2012). Because of the specific features of the quartzite pebbles, dominant raw material of the industry, special methodologies applied to the study of such assemblages were also taken into consideration (Jaubert and Mourre, 1996; Mourre, 1997). The problem of the standardization have been studied by reconstructing the objective of the blank production using a morphometric analysis based on the statistic distribution of selected metric parameters. We calculated statistic distribution of the length, width and thickness values, as well as two ratios, which can describe the overall character of the blank (Mester, 2004, 2012; Mester and Moncel, 2006). These are the *length/*

*width* (hereafter length-width ratio) and the *min(length, width)/thickness* (hereafter thickness ratio). For the length-width ratio, a blank is called “short” having a value below 1.0, “ordinary” between 1.0 and 1.9, and “allongated” equal or over 2.0. For the thickness ratio, a blank is called “thick” having a value below 3.0, “ordinary” between 3.0 and 4.9, and “thin” equal or over 5.0. For studying the problem of occupation levels, a spatial analysis were performed, based on the distribution of technological groups of artefacts as well as on refittings. Concerning this latter analysis, it is important to highlight that the archaeological material, as the osteological one, were recorded according to excavation units: by trenches of different size and by levels of 20 cm. These conditions limit the scope of the analysis and the conclusions.

### 3.2. Animal bone assemblage

Bone material is stored in the Mines and Geology Department and the Prehistory collection of the Budapest History Museum, Aquincum Museum, as the lithic collection.

The osteological material currently includes 18,074 remains studied in total, uncovered from the 1961, 1963, 1964's excavations seasons.

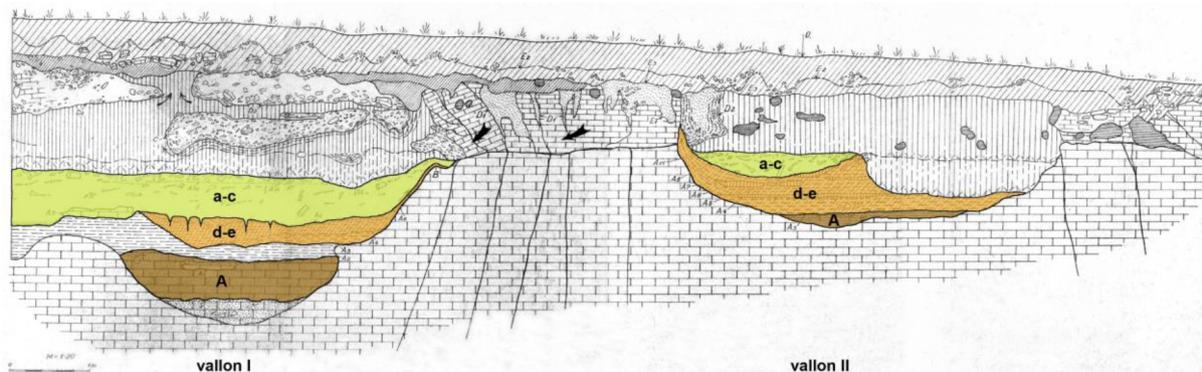


Fig. 2. Stratigraphic sequence of the site in the main cross-section (after the original drawing, which was never published entirely, cf. Gábori-Csánk, 1968a: Fig. 10A, modified). A: lower archaeological layer; d-e: lower horizon of the upper archaeological layer; a-c: upper horizon of the upper archaeological layer.

**Table 1**  
Composition of the industry in vallon I and II according to the levels.

Level	vallon I					vallon II					Total
	Tool	Flake	Core	Pebble	Total	Tool	Flake	Core	Pebble	Total	
a	189	258		38	485	15	27	8	17	67	552
b	148	272	4	72	496	32	16	3	3	54	550
c	122	86	7	20	235	48	78	1	6	133	368
d	88	88	3	7	186	22	11	2	6	41	227
e	80	21	1	1	103	3	4			7	110
A	11	15	1	7	34	2	1			3	37
<b>Total</b>	<b>638</b>	<b>740</b>	<b>16</b>	<b>145</b>	<b>1539</b>	<b>122</b>	<b>137</b>	<b>14</b>	<b>32</b>	<b>305</b>	<b>1844</b>
%	41.46	48.08	1.04	9.42	100.00	40.00	44.92	4.59	10.49	100.00	

Taxonomic identification revealed the following species (in descending order for the entire site and excluding microvertebrates and other identified small species, cf. Kretzoi, 1968: 59–204): *Ursus spelaeus* (average 86% NISP), *Equus caballus*, *Coelodonta antiquitatis*, *Crocota spelaea*, *Canis lupus*, *Bos/Bison*, *Mammuthus primigenius*, *Equus hydruntinus*, *Megaloceros giganteus*, *Panthera (Leo) spelaea* and, with less than 20 remains: *Cervus elaphus*, *Lepus timidus*, *Rangifer tarandus* and *Mustela sp.* and *Vulpes/Alopex sp.*, *Felis silvestris* (not identified by M. Kretzoi) and *Ursus arctos*. The upper layers have delivered almost the same species in both vallons: the *Mustelidae* and the fox are absent in vallon II, while the cave lion and the brown bear are absent in the other (vallon I). There is a great diversity among large mammals. Ursid and perissodactyls are the most abundant groups of the 17 species of large mammals. Most of them which represent a major ecological type, the mammoth steppe (Kretzoi, 1968).

The Danube and its alluvial plain, less than 5 km to the east, could be transformed into a grassy (Kretzoi, 1968: 240) or a marshy area, depending on the climate or the season. For climatological and climatostratigraphical interpretations, it is risky to rely on small vertebrates, which are too few in number (excavation or sieving bias). Large mammals, – a priori completely collected and taxonomically identified by a renowned palaeontologist –, appear to be less anthropogenic (Daschek, 2014) than interpreted (Gábori-Csánk, 1968a). Based on the large mammals, the environment was open with a coniferous forest and the climate (in the upper levels) was cold (woolly rhinoceros presence) and relatively humid. In the absence of reliable and grouped levels, it is not possible to know whether it represents contemporary palaeoecological conditions or reflects a chronological change (Daschek, 2014). For the moment, we do not have modern analyses concerning sediments and stratigraphy, whose data are lacking for further interpretation, including in climatological terms.

This study deals with only the osteological remains of 1964's excavation period and focusing on the determined remains of the better represented large and mega-herbivores (*Equus sp.*, *Coelodonta antiquitatis*) species that are analysed in comparison with those of the main carnivores at Érd (*Ursus spelaeus*, *Crocota c. spelaea*). The whole of these 4 species constitutes a sample of 8,070 remains. Indeed, a previous study was carried out and published on the available bone material (Daschek, 2014), to which new materials have been added since then.

The archaeozoological (including taphonomic observations) analysis was conducted to describe and characterize the assemblage of these species (skeletal and age representations, modification of bone surfaces). Ultimately, the final objective is to know the place of these species in the diet of Neanderthal groups of Érd and to know if our study can bring some inferences on duration of human occupations.

Thus, for the description of bone material and the assessment of taxonomic abundance, quantitative variables such as the NISP (number of identified specimen) and the MNI (minimum number of individuals) (Lyman, 1994) of combination were used. Age at death is calculated almost exclusively based on isolated teeth, were established according to dental wear according to the methods established by Louguet-Lefebvre (2005) for rhinos, Fernandez (2009) for horses, Brugal et al.

(1997), Mills (1982), Kruuk (1972), and Stiner (1994) for hyenas, Quilès (2003)<sup>1</sup> for bears, as well as the fusion of epiphyses. Then, they were grouped into 4 age groups: infantile, subadult, adult and old/senile, in order to simplify comparisons.

The taphonomic study of bones (% NISP) is based on the identification of the stigmas of diagenetic alterations, as well as non-human and anthropogenic origins. Their precise identification and the description of their characteristics (stages, aspects) allows the distinction of accumulators-modifying agents (e.g. Behrensmeier, 1978; Binford, 1981; Brain, 1981; Bunn, 1983; Blumenschine, 1986; Blumenschine and Selvaggio, 1988; Haynes, 1983; Lyman, 1994; Fisher, 1995; Guadelli, 2008), which in turn makes it possible to highlight the order of access to carcasses (e.g. Costamagno et al., 2005). The type of fragmentation-fracturing contributes to this interpretation (types and aspects – Villa and Mahieu (1991), circumference – Bunn (1983), and diaphysis length, stigmas). Tooth-mark distribution on bone portions was done by following the methods of (Selvaggio and Wilder, 2001). Skeletal representations include shafts and are standardized by Minimum Animal Unit (% MAU, defined by Binford, 1981).

The study carried out by M. Kretzoi (in Gábori-Csánk, 1968: 59–104) is based on an analysis of the material by levels (i.e. occupation levels a-e, A). He grouped the bones of the two vallons together because of the supposed synchrony of their deposits (Gábori-Csánk, 1968a). In our study, the vallons were distinguished and treated separately in order to compare them, particularly with the hypotheses on their respective roles. Conversely, the levels were grouped, based on lithic and then bone refitting. In this study, we deal with the upper grouped levels' osteological material only and such for both vallons.

An original study (Discamps and Favre, 2017) was recently carried out on the analysis of old material, highlighting the very significant impact of excavation and incomplete recovery methods. This, in fact, can result in substantial biases not only on skeletal part profiles, but also on taxonomic frequencies as proven by the recent excavations and lithic/osteological studies. In the case of Érd, our criticism can only be based on old information as well as osteological material and related data. Érd represents the osteologically richest hungarian site, which characteristics are: (1) 15,000 remains determined out of 50,000 (whole site) with 30% determination rate; (2) great variety of taxa<sup>2</sup>, variety of animals of sizes and masses, variety of skeletal items; (3) (fragments of) shafts more numerous than epiphyses (large > mega > medium > small/micro size mammals, in decreasing frequencies); (4) presence of shafts among the taxonomic and anatomically determined taxa and the undetermined ones. M. Kretzoi (Gábori-Csánk and Kretzoi, 1968) do not study the undetermined fragments. We do not know what

<sup>1</sup> The results obtained with this method are similar to those obtained with M. Stiner's (1998) methodology.

<sup>2</sup> According to Kretzoi (1968), 45 species including 31 for 1964's year and 18 species of microand 7 small vertebrates representing < 100 remains of which 1/3 remains find by sieving) was identified; 18 macromammals was identified for 1964's year (Daschek, 2014).

type of remains he stored among the undeterminable remains: (1) how much may missing the anatomically identifiable remains (in terms of size classes, at least), (2) in what proportion were included the shaft fragments or, in general, the anatomically identified fragments. However, for the main species (cave bear, for the ‘secondary’ species (horse, rhino, hyena) and for the underterminable items, the anatomically determined elements could be assigned to diverse mammalian size classes. This testify to the presence of all skeletal items (including shafts). Remains smaller than 2 cm<sup>3</sup> are very scarce as well as medium to micro-size mammal’s remains (both for those of determined and undetermined ones: possible sieving or taphonomic bias among other reasons). According to Gábori-Csánk (1968a), only (very) small/tiny, very fragmented, pieces were not collected. According to all these aspects, it possible to use the species spectrum and skeletal/age representations as reliable, at least for large/megamammals. More generally, the interpretation of the site as an open-air area at the beginning of the excavations influenced the excavations (methods) and subsequent analyses: (1) choice of the use of dry sieving and little use of water sieving, although commonly used since the 1950s in palaeontological excavations, (2) archaeozoological interpretations: long-term settlement with hunting strategies, hunting of cave bears and most species/individuals, secondary specialisation in horses and rhinos, seasonality, biomass disponibility which were thought to be necessarily linked to human activities. However, the researchers (Gábori-Csánk and Kretzoi, 1968) took into account observations of direct spatial relationships of bone and lithic material and different vertical and horizontal densities (“heaps”) to refine their interpretations.

## 4. Results

### 4.1. Lithic analyses

Our technological analysis revealed that the pebble slice as blanks were produced with Quina debitage concept. Moreover the Pontinian industry of Central Italy was also reconsidered in the 1990s by A. Bietti and S. Grimaldi who recognized the application of debitage systems by which the pebbles have been exploited as uni- and bidirectional or centripetal flake cores (Bietti and Grimaldi, 1993, 1996; Grimaldi, 1996). In the blank production at Érd, we recognized three different debitage concepts: bifacial discoid, unifacial discoid or semi-discoid and Quina (Mester, 2004: 238–239; Mester and Moncel, 2006: 225–228) (Fig. 3: A). These concepts were applied according to the original morphology of the pebble as raw material block, in other words, the prehistoric knapper selected those pebbles for raw material which corresponded the most to the expected debitage (Mester, 2012: 11–12) (Fig. 3: B). As a consequence, characteristic flake types could be linked to each debitage: the bifacial discoid debitage yielded triangular or subtriangular flakes with non-cortical butt, the unifacial discoid resulted similar flakes with convex cortical butt, and the Quina produced the pebble slices with quasi parallel faces and cortex on the butt or the back (Mester, 2004: Fig. 4–5, 2012: Figs. 3–4; Mester and Moncel, 2006: Figs. 6–8) (Fig. 3: C).

Respecting the attribution of the artefacts to level made by V. Gábori-Csánk and recorded in the inventory book or on the labels, the composition of the studied assemblage according to main categories show a high ratio of retouched tools which reach 40% in both vallon I and II (Table 1). The category “pebble” contains all non-modified pebble which could be either raw material blocks or hammerstones. In some cases, characteristic traces of a use as hammerstone can be observed too. About the cores it is important to mention that all but one are of quartzite, however 22% of the assemblage were made on non-quartzite raw materials, such as cherts (including nummulitic chert –

Markó and Kázmér, 2004, and Buda hornstone – Faragó et al., 2018), silicified wood, jasper, radiolarite. The exception is a huge block of silicified wood of very bad quality, found in level b of vallon I. This block is so special that one can easily recognized the flakes originated from the block.

Concerning the question of standardization in the tool production at the site, we carried out morphometric analysis of the tool blanks. It was demonstrated that the blank production respected quite well defined parameters (Mester, 2012: 12–13). The mean size of the tools is 42 × 36 × 15 mm, and 50.78% of the 575 analysed tools fit within the standard deviation of all the three dimensions, as well as 53.57% of them fit within that of the two ratios (Mester, 2012: 12–13). Combining the two ratios, it become clear than the knappers at Érd preferred the short and thick or ordinary flakes for tool making, regardless the raw material (Fig. 4: A, Table 2 and 3). Moreover, no any modification in this sense could not be observed between the assemblages of each level (Mester and Moncel, 2006: 232) (Fig. 4: B). The size of the blanks is not determined by the size of the raw material because we found in the lithic assemblage partly exploited pebbles the dimensions of which are largely over the size variability of the tools. Based on her typological study according to the occupation levels within the upper archaeological layer, Gábori-Csánk detected some tendencies showing a kind of inner evolution of the industry during the life time of the site. These results of the morphometric analyses did not confirm the above-mentioned conclusions of Gábori-Csánk (1968a: 183–196) concerning correlate shift in tool type composition, raw material ratio, length of tools. Differences could be observed but no any tendency should be recognized. Even the question should be raised if these occupation levels really existed at the site. Lithic remains and heaps of animal bones were unearthed together. In these conditions, it is quite difficult to accept the existing of horizontal occupation levels in each 20 cm approximately (Gábori-Csánk, 1968a: 183). Refittings of pieces found in different levels argue also for the reconsideration of this aspect. The most spectacular refitting is represented by the abovementioned silicified wood block which has a huge block and 20 flakes in the whole assemblage. Four flake could be directly refitted on the block. The proveniences of the refitted flakes in their chronological order of the removal are level c → a → b → a in vallon I, while the block (core) have been found in level b also in vallon I (Mester, 2012: Fig. 9). The other corresponding flakes were unearthed in levels a, b, c and d in vallon I as well as in level a, b and e in vallon II.

For the spatial distribution study of the artefacts, artefact frequencies show the importance of the larger section of the bigger vallon I, closer to the Fundoklia valley, as well as the rear section of the smaller vallon II (Fig. 5). It is interesting that a very similar pattern was recorded in cave sites of the Bükk Mountains in Northeastern Hungary. In layer 11 of Subalyuk Cave, dated approximately to the end of MIS 4 stage (Mester and Patou-Mathis, 2016), people of the Quina type Mousterian occupied at the entrance of the cavity like in the vallon I of Érd (Mester, 2008: Fig. 9). In the Szeleta Cave, which should be dated to the Interpleniglacial (MIS 3), artefact density occurs, on the one hand, at the entrance and, on the other hand, at the very rear part of the cavity like in the vallon II of Érd (Ringer and Szolyák, 2004: Fig. 2). These analogies provide us to raise the original idea of L. Hunyadi (1962) whether there was a collapsed cavity at the site of Érd. V. Gábori-Csánk (1968a: 216) mentioned three workshops recognized by the frequency of cores and debris. According to the data of the inventory book, these were located at the rear part of the area (trenches II/1, III/1 and VIII). However, cores, hammerstones and raw material pebbles have been found dispersed over almost the whole excavated surface.

### 4.2. Archaeozoological analyses

Although some data from the entire stratigraphic sequence are available, this study focuses exclusively on the upper level (group) in

<sup>3</sup>Dimensions were measured only for the undertermined fragments (cf. Daschek, 2014).

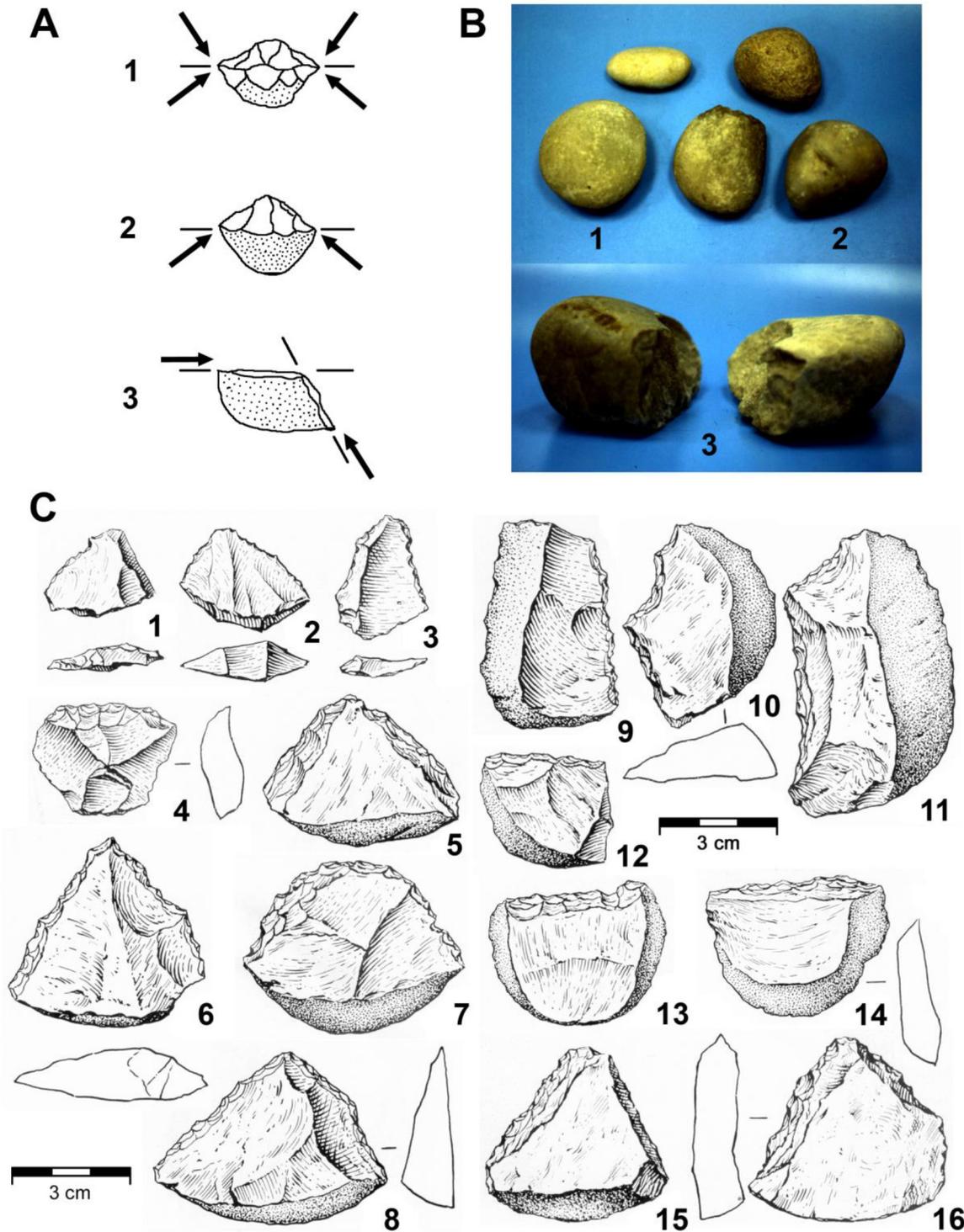


Fig. 3. Lithic production of the industry. A: schemas of the recognized bifacial discoid (1), unifacial discoid (2) and Quina (3) debitage; B: pebble morphologies for these debitage (respectively 1, 2 and 3); C: characteristic blanks of the bifacial discoid (1–4), the unifacial discoid (5–8) and the Quina (9–16) debitage.

each vallon (I and II) uncovered during the 1964's excavations, which involves the largest osteological material and an up-to-date archaeozoological study (Daschek, 2014).

Among 18,074 remains of the entire stratigraphic sequence, > 13,000 belongs to large mammals of the 1964's excavations and, among them, 8,070 NISP belongs to the 4 species studied here (horse, wholly rhinoceros, cave bear and cave hyena) (Table 4). By vallon, these remains correspond to 3,885 NISP (vallon I) and 4185 NISP (vallon II). Herbivores are represented by 786 remains, mainly from

horse. Ungulates represent 10% taxonomic NISP (75% without Ursids taking into account the whole faunal spectrum) from 1964, while carnivores constitute the bulk of the remains with 90% (3,8% without Ursids) with 7284 remains. The relative frequency indicates that cave bears are the most abundant among carnivores and clearly stand out the cave hyena.

The characteristics of the ungulate (*Equus sp.* and *C. antiquitatis*) and carnivore (*U. spelaeus* and *C. c. spelaea*) bone assemblages will be describe by age groups or age at death and body part frequencies. It will

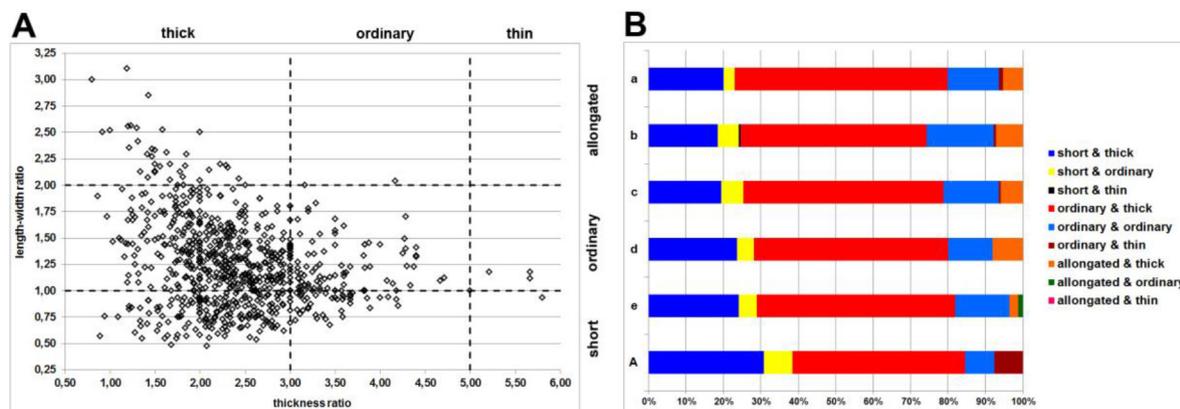


Fig. 4. Morphometric characteristics of the blanks. A: distribution of length-width and thickness ratios; B: distribution of blank types according to levels.

Table 2  
Morphometrics characteristics of the tools on quartzite.

		Length-width ratio						Total	%	
		0.1–0.4	0.5–0.9	1.0–1.4	1.5–1.9	2.0–2.4	2.5–2.9			3.0–3.4
Thickness ratio	0.5–0.9		2		1		1	1	5	0.87
	1.0–1.4		8	7	11	4	5	1	36	6.26
	1.5–1.9		22	38	32	15	1		108	18.78
	2.0–2.4		50	72	48	4			174	30.26
	2.5–2.9		39	81	17	1			138	24.00
	3.0–3.4		14	50	5	1			70	12.17
	3.5–3.9		10	16	2				28	4.87
	4.0–4.4		4	8		1			13	2.26
	4.5–4.9			1					1	0.17
	5.0–5.4			1					1	0.17
	5.5–5.9			1					1	0.17
> 5.9										
<b>Total</b>			<b>149</b>	<b>275</b>	<b>116</b>	<b>26</b>	<b>7</b>	<b>2</b>	<b>575</b>	<b>100.00</b>
<b>%</b>			<b>25.91</b>	<b>47.83</b>	<b>20.17</b>	<b>4.52</b>	<b>1.22</b>	<b>0.35</b>	<b>100.00</b>	

Table 3  
Morphometric characteristics of the tools on non-quartzite raw materials.

		Length-width ratio						Total	%	
		0.1–0.4	0.5–0.9	1.0–1.4	1.5–1.9	2.0–2.4	2.5–2.9			3.0–3.4
Thickness ratio	0.5–0.9									
	1.0–1.4		6	4	9	2			21	11.35
	1.5–1.9		6	11	12	4			33	17.84
	2.0–2.4		14	24	7	5	1		51	27.57
	2.5–2.9		10	21	8				39	21.08
	3.0–3.4		5	8	6				19	10.27
	3.5–3.9		3	5	3				11	5.95
	4.0–4.4			4	2				6	3.24
	4.5–4.9			1					1	0.54
	5.0–5.4			1					1	0.54
	5.5–5.9		1	1					2	1.08
> 5.9				1				1	0.54	
<b>Total</b>			<b>45</b>	<b>81</b>	<b>47</b>	<b>11</b>	<b>1</b>	<b>185</b>	<b>100.00</b>	
<b>%</b>			<b>24.32</b>	<b>43.78</b>	<b>25.41</b>	<b>5.95</b>	<b>0.54</b>	<b>100.00</b>		

be followed by a taphonomical description (bone surface conservation, bone fragmentation, carnivore damage and finally anthropogenic marks, cf. 4.3). The study of age structures makes it possible, on the one hand, to determine the function of the site, as for example, in the case of bears and hyenas, and/or to interpret the accumulating agent/process.

At Érd, the data for these 4 taxa indicate the presence of individuals of all age groups, except for rhino (both vallons) and hyena (both vallons). Old individuals are systematically present. Table 5 presents the allocation of ungulate and carnivore individuals to the 4 age classes. Adults sensu lato, represented by permanent teeth showing several

stages of wear, are most common in ungulates. In rhino, calves younger up to 1 year old is surprisingly rare, than adults sensu lato.

It is generally accepted that hominids hunt preferentially prime-adult (6–9 years) preys. However, individuals in this age group may also be well represented/present in hyena dens. Thus, according to Dusseldorp (2009: 140), taking the example of the horse, the respective age profile is indistinguishable between Lunel-Viel or Camiac (dens, cf. Guadelli, 1989) and Bau de l'Aubesier (camp). Nevertheless, social carnivores tend to hunt weak individuals (young, senile ones) (Brugal and Fosse, 2004). These two age groups are also well represented at

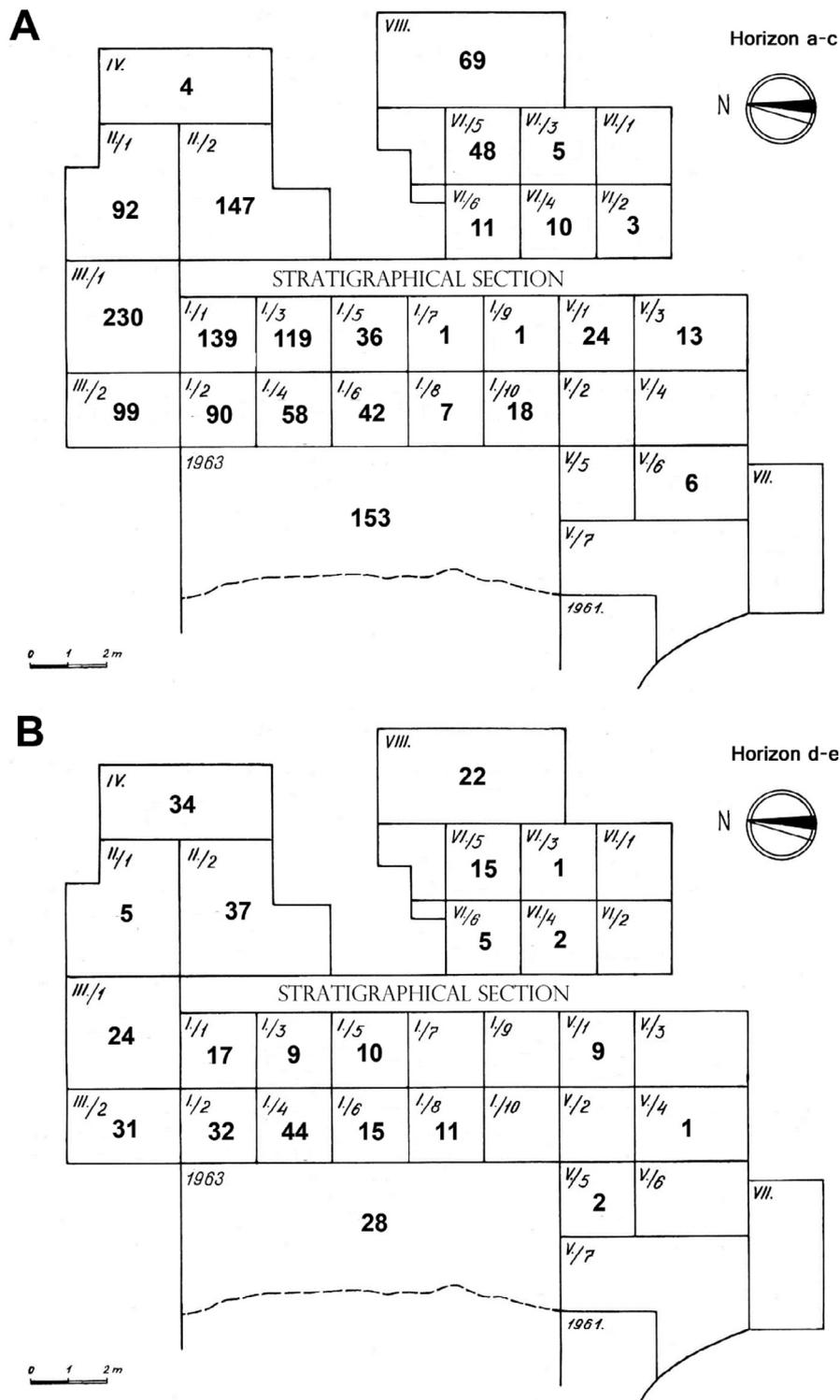


Fig. 5. Spatial distribution of the lithic artefacts according to the archaeological horizons. A: upper horizon of the upper archaeological layer; B: lower horizon of the upper archaeological layer (basic plan after Gábori-Csánk, 1968a: Fig. 2 modified).

Érd. This, and as well as the presence of different age groups, suggests a partial accumulation by carnivores and also by hominids, testifying to a mixed origin of the ungulate accumulations. According to [Diedrich \(2017\)](#), hyena hunts more particularly horses/any prey weighing > 250 kg and less than 1 year's rhino calves in groups or clans. The presence of adult individuals indicates a collaborative hunt by carnivores (hyena or wolf) or by hominids.

Among carnivores, subadults predominates, to which five unfused

or synostosing post-cranial remains contribute in the case of the hyena. Very young (foetuses/newborns) and first winter young (only few worned teeth with resorption signs lost during their life) bear cubs are uncommon (possible effect of sieving or taphonomic bias). Adult (sensu lato) males and (especially) females (pregnant or young mothers with their cubs) died in the site. The baculum confirms the presence of 15 and 14 males at least, respectively in vallon I and II. "Repeated predation on hibernating bears in a cave therefore should affect prime

**Table 4**  
Number of identified specimen (NISP) of the 4 main species in the upper (grouped) layers in vallon I and vallon II at Érd.

	vallon I	vallon II	Total
<i>Equus</i> sp.	446	123	569
<i>C. antiquitatis</i>	176	41	217
Total Herbivore	622	164	786
<i>U. spelaeus</i>	3121	3935	7056
<i>C. c. spelaea</i>	142	86	228
Total Carnivore	3263	4021	7284
<b>Total</b>	<b>3885</b>	<b>4185</b>	<b>8070</b>

adults, old adults, infants, and adolescents randomly, emulating their natural proportions in the living population sequestered in dens each year” (Stiner, 1998: 309). At Érd, this category is not prevailing, but well represented, and can represent multiple hunting/scavenging events. Age profile analysis show a mortality of recently independent and inexperienced subadults for cave bears, which is similar to those found in cave bear dens (Quilès, 2003, 2004; Fourvel, 2012) and attest to in situ winter/spring (hibernating, farrowing) mortality of all or some of them. Furthermore, in hyenid, many permanent teeth with fresh enamel and/or open or forming root with a thin root wall were not classified in the juvenile’s group (< 1 year old, according to Fourvel, 2012), but in the subadult’s group. Such inexperienced subadults can have died or may have been killed on site by other carnivores during intra- or interspecific competitions (Fosse, 1994). In the absence of juveniles (by deciduous teeth), the site cannot be interpreted as a nursery (natal den). However, this lack can be the result of sieving or diagenetic bias. If we consider, that these teeth were initially present at this site, the site can have played a role of nursery – in the case where the configuration of the site (cavity?), the suitability and the availability of space and resources may have been appropriate for such use –, or a consumption site (scavenging, communal den).

There is little evidence to indicate the seasonality of these multiple occupations at Érd. Despite the presence of juveniles in horses and rhinos, and bear cubs, all of which are possible prey for carnivores, and without anthropogenic traces on their remains, their summer mortality (if the rhino’s birth period was the same period of the year as for the other ungulates in periglacial context) could indicate acquisition by a pack of carnivores. Bear cubs died during winter/spring as has already been proposed (Gábori-Csánk and Kretzoi, 1968; Daschek, 2014). The hyena can currently have young all year round, this way it cannot provide us with more details on the period of occupancy. However, if the presence of the subadults or older individuals is due to an incursion at the site where they died, then their presence was very short; in other cases (socio-educational reason, catchment, ...), it was more longer/multimonthly.

For these 4 herbivores and carnivores dental remains are dominant. One observe that the best represented skeletal items in ungulates are those belonging to cranial and appendicular ones. There is little or no presence of axial skeleton and belts, whatever the species or the vallon, except for cave bears. The remains of horses in vallon II are much less

numerous than in vallon I.

The distribution of the skeletal elements in % MAU in both ungulates reveals, that almost all elements are represented (Fig. 6: A, B) and that the majority of the elements belong to the cranium (isolated teeth or dental crowns, often whole, but few skull bones) and to the autopodial. In both, humeri and tibiae are the most common items. The femur is absent in horses, present in rhino (2 remains) just like the patella (2 and 1 remains, respectively, in horse and rhino). We can assume that the entire limb was transported to the site initially, at least sometimes. Except humerus, the fleshy part of the limbs (scapula, femur) is almost absent, but marrow rich content bones as tibiae are frequent. The denser elements of the autopodial are not necessarily better represented than long bones or upper limb bones, except in bears and horses and lesser in hyena. These biases could be interpreted as the result of better conservation of the more resistant autopodial bones to destruction by both carnivores and geological processes, but not only.

There is a partial relationship between bone density (after Lam et al., 1999) and the anatomical representation in horses in both vallons (test on the entire skeletal elements including absent element/portion, respectively, in the vallon I:  $r_s = 0,425$ ,  $p < 0,0001$  and in the vallon II:  $r_s = 0,489$ ,  $p < 0,0001$ ). No long bones are whole, except some metapodials.

In general, within a den, the femur is one of the less abundant or absent element and the presence of (sub)complet metapodials is characteristic. Carnivores often disdain these latter in the presence of more interesting elements because they are very compact in their proximal epiphyses (Michel, 2005). It cannot be ruled out that the rhino’s meat was brought in the site without bones. Although fracturing their long bones is not interesting nutritionally, as the marrow is not accessible (Niven, 2006), unlike (sometimes) mammoth bones (marrow, tool, raw material, cf. Boschian et al., 2019). At Érd, both megaherbivore’s bones present fractured long bones. Teeth are more represented than bones. This difference, beyond intraspecies differential conservation sensu lato may reflect the existence of several episodes of accumulations. Various factors seem to be involved in the representation of the skeletal elements of these ungulates, especially for the rhinos’ remains, which should be better represented because of the intrinsic characteristic of their bones. The carcass of an adult pachyderm is likely to be available for longer, especially if hyenas have to wait for human intervention to access subcutaneous contents (Dusseldorp, 2009: 140).

The distribution of the skeletal elements in % MAU in both carnivores reveals that all skeletal units and each skeletal part are represented in bears and, in vallon II almost in hyenas (Fig. 6: C–F). This latter species ranks second after bears in terms of abundance of these skeletal remains (NISP, MNI) among the six carnivore species identified in these treated levels with 228 remains (25% NISP and 50% MNI when excluding bears). Cave bear remains are more numerous in vallon II, but fewer in MNI. Overall, the half of the osteological material consists of isolated teeth of both. Unlike ungulates, numerous and varied cranial bone fragments testify to the presence of the bears’ head, few in hyenas. Long bones are the second best represented unit in % MAU (but not in NISP, in vallon I). Bones that can remain in the skin and small

**Table 5**  
Age groups of the 4 main species (*Equus* sp., *C. antiquitatis*, *U. spelaeus*, *C. c. spelaea*) in the upper (grouped) layers in vallon I and vallon II at Érd. MNIc: Minimum Number of Individuals by combination. \*For *U. spelaeus*, Infantile = Foetal + Infantile and Subadult = Juvenile + Subadult (modified, after Quilès, 2003).

Species	vallon	Infantile*	Subadult*	Adult	Old + Senile	Total	MNIc
<i>Equus</i> sp.	I	20.0	36.0	20.0	24.0	100.0	25
<i>Equus</i> sp.	II	25.0	12.5	37.5	25.0	100.0	8
<i>C. antiquitatis</i>	I	33.3	16.6	33.3	33.3	100.0	6
<i>C. antiquitatis</i>	II	0.0	25.0	25.0	50.0	100.0	4
<i>U. spelaeus</i> *	I	11.8	57.5	18.9	11.8	100.0	127
<i>U. spelaeus</i> *	II	8.7	64.4	23.1	3.8	100.0	104
<i>C. c. spelaea</i>	I	0.0	55.6	22.2	22.2	100.0	9
<i>C. c. spelaea</i>	II	0.0	33.3	16.7	50.0	100.0	6

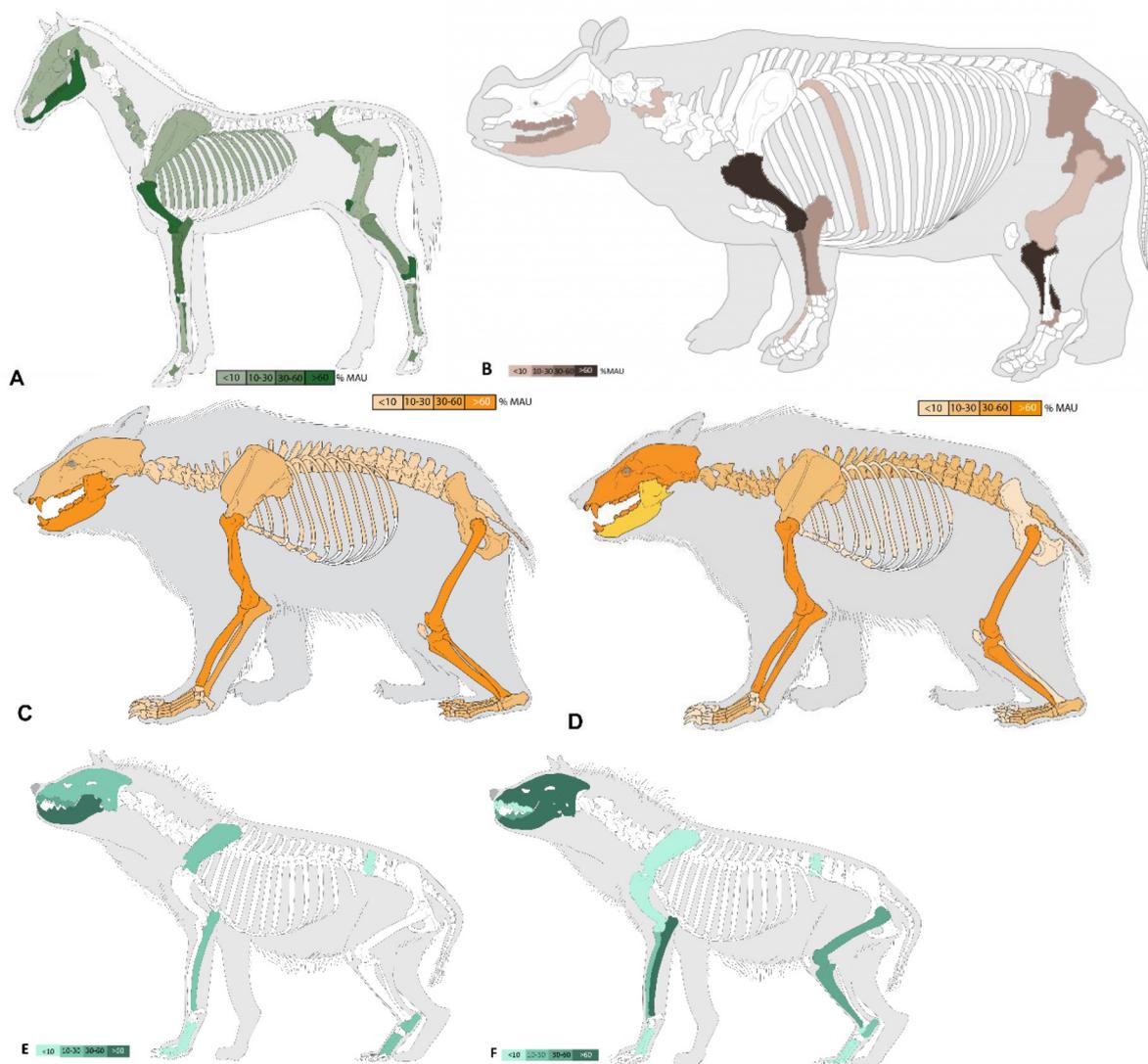
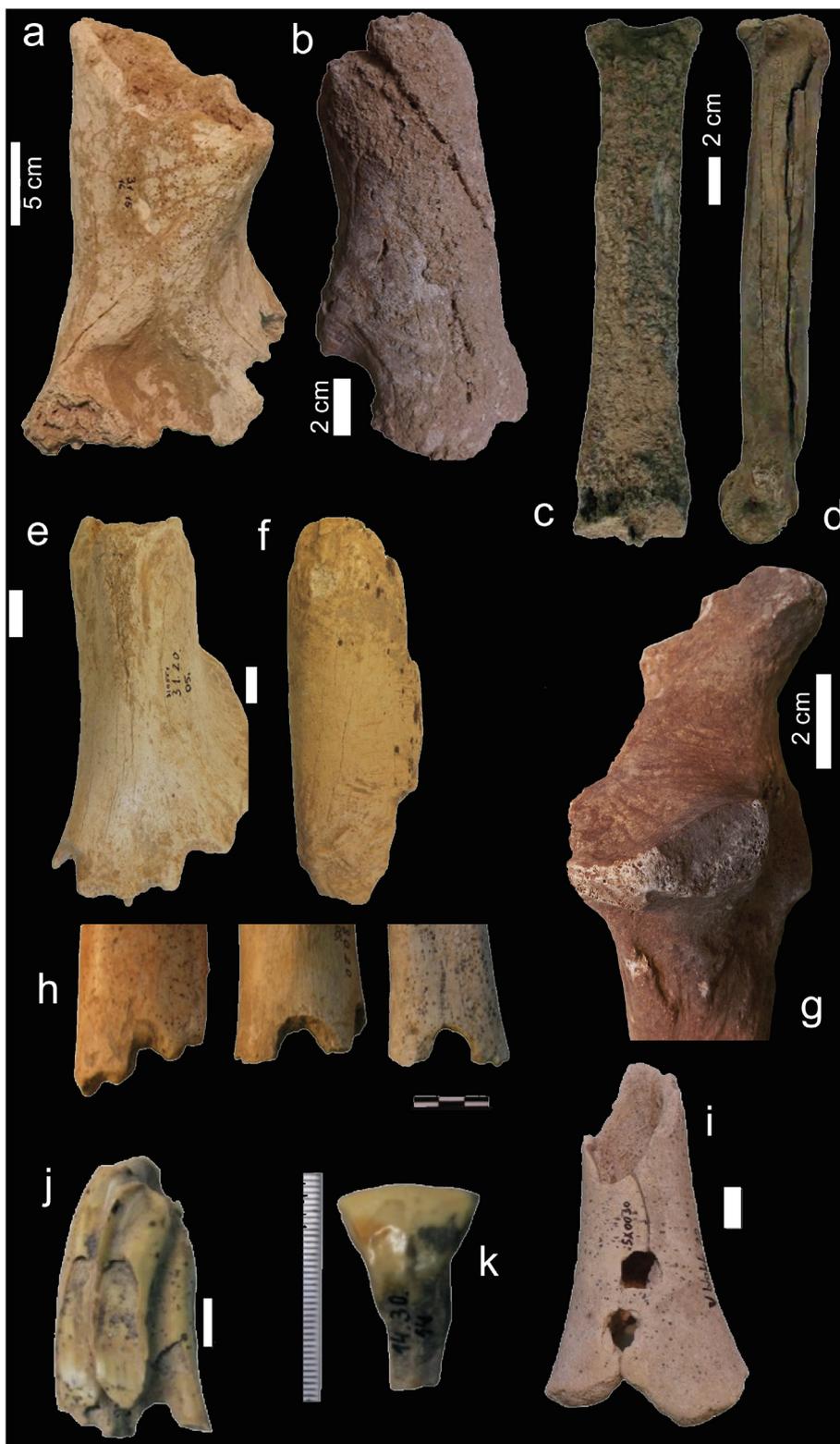


Fig. 6. Skeletal representation of the 4 main species in upper levels at Érd, expressed by % MAU. A: *Equus* sp. (left, green); B: *Coelodonta antiquitatis* (right, red-brown) in vallon I. C: *Ursus spelaeus* in vallon I (left); D: *Ursus spelaeus* in vallon II (right); E: *C. c. crocuta* in vallon I (left); F: *C. c. crocuta* in vallon II (right).

basipodials bones are rare in both species, but mainly in hyena. Epiphyseal destruction is very high in bears (< 5% NISP). The epiphyses of preserved long bones are often the densest, but not always, indicating a conservation bias which is, at least, not completely diagenetic. Axial and belts are under-represented, including in bears. However, many anatomically identified fragments that may belong to the same mammalian size class have been found in these levels. Especially in hyenas, the diversity of skeletal representation is greater in vallon II, in which the bones of the limbs are better represented thanks to the ulnae and the tibiae. No carnivore long bones are whole and the circumference of their diaphysis is almost complete. 12 (fragments of) coprolites, not mentioned in the monograph (Gábori-Csánk, 1968a), were unearthed at the same depths as their bones. They indicate the use of the site or some areas such as latrine. The features (according to Jouy-Avantin et al., 2003) of the bigger and complete fragments suggest that they belong to hyena. Some massive bones have been discovered, which may belong to female hyena. The remains of the hyena were discovered near the walls (wall effect) (Gábori-Csánk, 1968a).

To sum up, assuming, that the carcasses were complete at least for carnivores and probably partially for horse, the bone deficit is very high regardless of species (11 to 18 in ungulates, 15 and 16 in hyena, respectively in vallon I and II); it is better for the bear (30 and 38 per singula, respectively in vallon I and II). The isolated teeth clearly show

a conservation bias in their favour (differential conservation). The even elements are balanced in cave bear and more variable among the other species with less remains per element. No anatomical connections were found. “The presence of (partially) complete bear skeleton is one of the most significant criteria for bear hibernation characterization (e.g. Stiner et al., 1996; Quilès, 2004)” (Fourvel et al., 2014). This kind of skeletal distribution suggests typical natural (living) “population” from bear hibernation levels. “In the case of [this kind of] level, it appears difficult to determine carnivore impact based on skeletal part distribution” (Fourvel et al., 2014). However, we cannot exclude an occasional contribution of carcass pieces by carnivores. Carnivore (hyena) dens, in general, regularly contain gnawed bear remains, who seem (according to Fourvel et al., 2014: 237) to collect few, preferentially meaty parts, of them. The horse carcasses were transported in part complete to the site or in several pieces, in both vallons, and the rhino in pieces (including rare axial elements and foot), as well as the head. This confirms the observation of V. Gábori-Csánk and M. Kretzoi (Gábori-Csánk and Kretzoi in Gábori-Csánk, 1968: 232) regarding the proximity of the slaughter/acquisition and the site. At Bolomor Cave (Spain), Neanderthals carried proboscidian skulls on a difficult path to reach their camp because of its nutritional value (Agam and Barkai, 2016, 2018). The description of the age groups and skeletal remains of preys and carnivores show, that Érd corresponds to a consumption/



**Plate 1.** Illustrations of elements of the site of Érd (from upper level): rhinoceros (a, b), horse (c, d, j, k), cave bear (e, g, h, i) remains and an indeterminate long bone shift fragment (f). © É.J. Daschek.

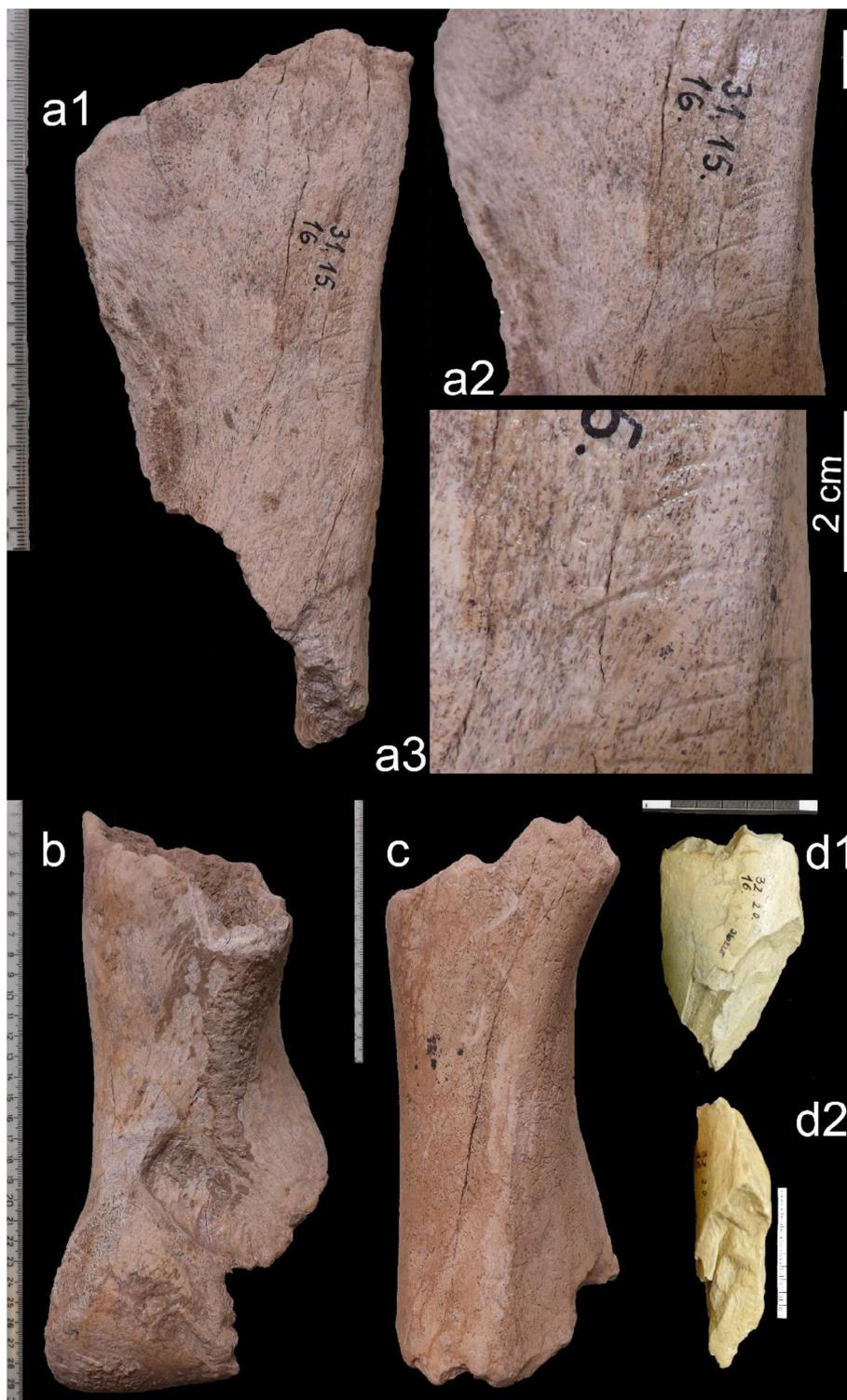
catch site, with periods of using as a den/refuge, but not as a nursery (natal den).

### 4.3. Taphonomy

The taphonomic study will allow us to evaluate the respective roles

of humans and carnivores in the accumulation and modification of this assemblage, especially through the information provided by the traces left by carnivores and humans on bone remains.

The general conservation of the remains of this material is often good and do not prevent the reading of surfaces, although some of them (horse remains and especially rhinoceros) are particularly altered (stage



**Plate 2.** Illustrations of elements of the site of Érd: rhinoceros elements showing a1-3) cut marks on a tibia; b) carnivore ravaging with characteristic hyena consumption morphotype; c) carnivore ravaging; d1-2) hominid-made fracturation splinter on fresh bone a mega-sized ungulate. © É.J. Daschek.

3 of weathering and severe root edges traces). Bone surfaces show various diagenetic or biological alterations: mainly oxidation (mainly stage 1, black oxid), breccia (upper part of the upper level), traces of plant roots (from coloration to total surface dissolution, Plate 1: c), trampling (17% on average). Evidence of rounding or polishing of the bone remains were found. The remains belonging to the hyenas are more altered in vallon II, while the other species are more altered in vallon I. Advanced weathering, various stages of alteration (absent to

very damaged), sometimes on the same item, indicate the presence of: (1) fleshless (elements) carcasses, (2) the remains in open-air or at shallow depths. So, these show difficult/slow burial or re-exposure and, therefore, multiple burial conditions and periods, and (sub)surface disturbances. We must temper this statement since bones and teeth (rarely broken and with fragments not always found) have a well-preserved appearance, which is due to either: (1) rapid burial (sedimentation rate unknown for the site), (2) burial in a cavity context

protecting from direct external weathering, (3) weak or moderate biological disturbances (trampling, other activities by bears...) leading to re-exposure, for example.

Excavation and conditioning-damages have been identified on the material (recent breaks on 43% NISP, but only 1,5% NISP, < 100 items, were particularly damaged). The cranial fragments and the abundance of isolated teeth show that the heads were transported to the site and exploited (mandibles, green fracturation patterns) in cave bear, rhino and horse (also tooth crown/pillar fracturation, [Plate 3](#): e). Fresh fracture patterns observed on bones due to intentional breakage and carnivore consumption are much more frequent than those implying fragmentation on dry bone ([Plate 1](#): d). There are in situ post-depositional fractures and we can therefore conclude that there is a primary deposit. Fragmentation of ungulate and bear (long) bones is important. Indeed, except for horse metapodials, long bones are rather incomplete, including in bears. Shaft circumference is often complete for whatever species. The absence of marrow cavity in rhino's long bones and the thickness of them explain the quasi-absence of fracturation and their consumption by hyenas, who gnawed them from their epiphyses. The fragmentation does not explain the abundance of rhino remains; the incomplete elements are especially due to gnawing. However, it can explain, at least in part, the incompleteness of the remains belonging to the large herbivores – anatomically determined fragments and undetermined) – belonging mainly to the size-class “large herbivores/large mammals/large carnivores”.

The results of the taphonomic study show that within this bone assemblage of Érd, traces from carnivores' activity are the most common biologic damages, regardless of these species. Such damage were observed on 21% NISP bone surfaces. Among the remains of the 4 species, a total of nearly 800 remains testify to the presence of tooth marks or a special consumption morphology ([Plate 1](#): a, b, e, f, g, h, i). These marks are pits, scores, furrowing, punctures, crenulated edges, gnawing. 65 remains have been digested ([Plate 1](#): j, k). The ingested remains found belong to the horse and bear, both young and adult. They are small; larger ones have only been gnawed, as observed by [Beauval and Morin \(2010\)](#).

Carnivore activity (tooth marks and bone breakage) in herbivores is less varied. Tooth marks were observed on long bones and autopodials. Items with traces of gnawing are variable in types and intensities.

Carnivore activity (tooth marks and bone breakage) appears on all skeletal elements (balanced even elements) in bears, predominantly on long bones, especially on humeri. Trabecular bones often carry the full range of various traces, especially grooves and perforations. Tooth mark distribution on long bone portions appears most frequently on the shaft (mainly like pittings, scorings). Gnawed extremities forming often a cylindrical shape are abundant. Gnawing at the ends of long bones indicates rapid access to carcasses. This suggests that these marks correspond to activities of consumption of external (meat...) and internal (marrow) resources and, on the other hand, to a complete carcass sequence consumption by carnivores ([Rosell and Blasco, 2009](#): 312). This corroborates an on-site mortality of some of these individuals. Skeletal elements damaged by carnivores belong in both young and adult individuals. They are divided among 80 individuals (MNIF), half of whom are juveniles (bear cubs, foals, calves of rhinos). Some of the same types of traces are observed on elements of juveniles rather than on those of adults'. Hyena bear some slight tooth mark of other carnivores and doesn't seem to be due to cannibalism. Taking into account all these aspects, neither bears nor herbivore carcasses were not systematically attractive for carnivores. Overall, the carnivore damage observed at Érd correspond to medium-sized carnivores (hyenas and/or wolves), some tooth mark indicates young, small or large carnivores' activities at the site.

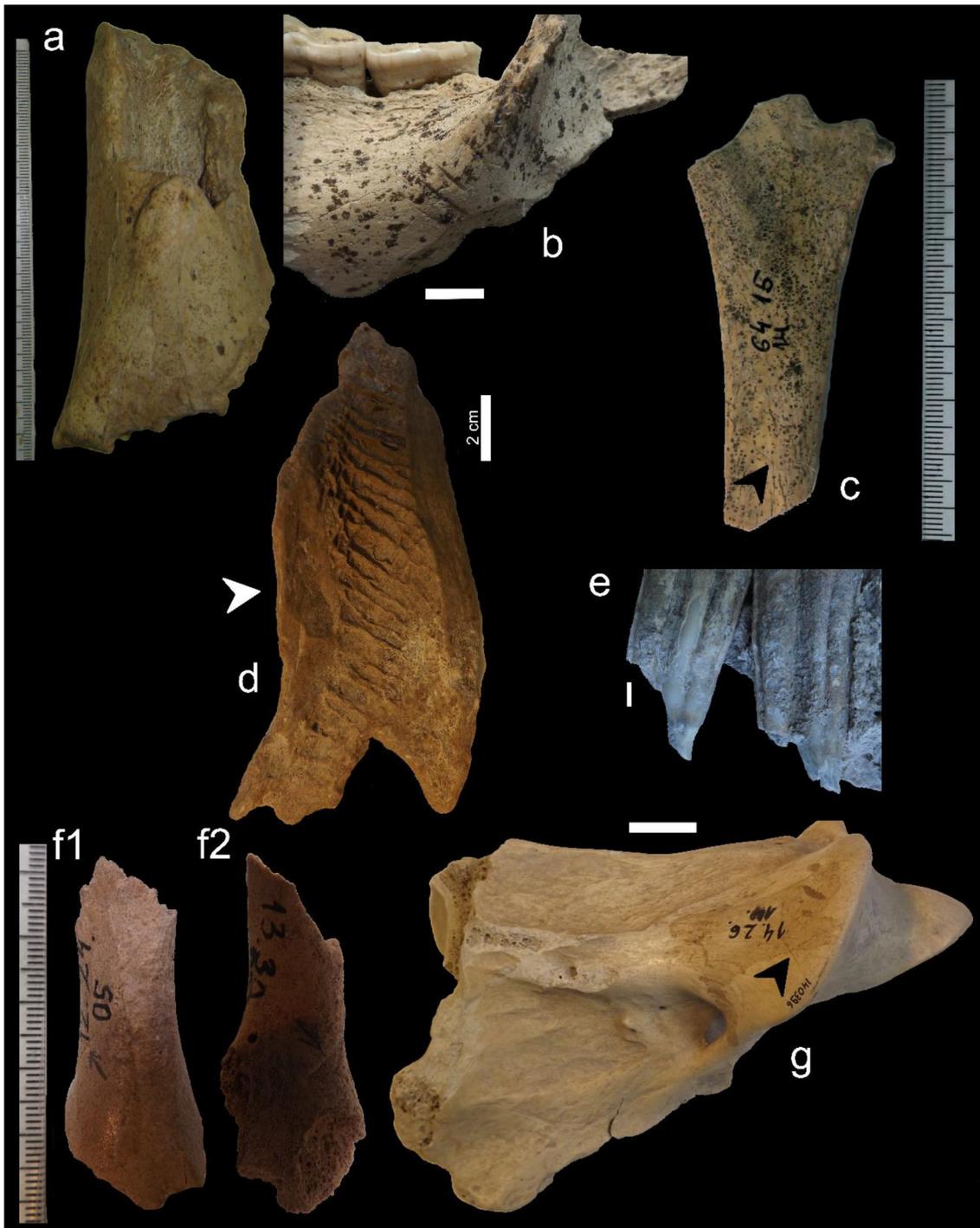
The results of the taphonomic study show that within this bone assemblage at Érd, traces from hominids' activity are also present. Anthropogenic damage are cut marks ([Plates 2–4](#)), intentional bone breakage ([Plates 3 and 4](#)), some burned bones. The anthropogenic

action is visible on more than 250 remains at least, or 3% NISP of these 4 species. Butchery marks appear on adult remains only (except in bears and possibly a sub-adult hyena). These marks were found in both vallons, except in hyena and rhino, where they appear in vallon I. Several mandibles and bones of hyenas (vallon I-II, see [Plate 4](#): a1, a1', a2, a2', c), 1–3 horse remains (vallon I, see [Plate 3](#): c, g), 4–5 long rhino bones (vallon I, radius, humerus, tibiae, see [Plate 2](#): a) and more than 100 bear remains (vallon I-II, mandibles, rib, vertebrae, scapula, long fleshy and marrow bones, metapodials, acropodials) bear cut marks ([Plate 3](#): b, f; [Plate 4](#): d). These are striae of defleshing (rhinoceros, bear, horse), disarticulation (bear), skinning (bear, maybe hyena).

The visible cut marks are either thin (most of the traces) or wide, as appearing on rhino's bones ([Plate 2](#): a1-3). The width of the striae would come either from worn tool edges or from a raw material other than flint, such as quartzite, unearched at the site. The use of this locally manufactured rock could support the hypothesis that it could be used for on-site activities, available in the vicinity of the site. The butchering process steps vary from species to species and correspond presumably to different acquisition episodes. Indeed, different strategies had to be implemented for the acquisition of rhinoceros and the bear (dangerous), such as the horse (high leakage speed and fast). As for the rhinoceros, based on the ethology of extant species, the mother and her young calf only separate when they reach a water point independently, in order to minimize the possibility of a possible attack by carnivores (and humans?) and reduce the risks associated with social interactions ([Law et al., 2018](#)). If this behaviour has existed in the past, this was a moment that have had certainly been used by the human and carnivore predators to kill the youngs. Impact points were observable, with sometimes notches, on the remains of rhinos ([Plate 2](#): d), horses ([Plate 3](#): e) and especially bears. Traces of fire were observed on remains of bears (half of them, or nearly 40 remains), horses, rhinos, hyenas. From all these elements, we can deduce that butchery and consumption activities of these preys had taken place at the Érd site. Possibly some of the horses, but certainly the rhinos have undergone pre-treatment butchery at the acquisition site with a selected transport of anatomical portions or all in quartered sections to the Érd site (appendicular meaty and marrow-rich content bones and heads). Some of the striae appear on the shaft (defleshing), and the presence of long bones of the upper limbs (including tibia) fleshy or containing marrow, suggest primary and rapid access to the carcasses of ungulates and bears. The combined presence, but not crossed, of gnawing and butchery marks appears on the remains of adult individuals of the 4 species (horse, rhino, hyena, bear) and juveniles (bear). They were observed on shafts, except those of the hyena (vallon II) and cubs. This means, that in these cases also, human had primary access to the corresponding parts of the carcasses. Very few remains are affected in horse (possible extraction of the tongue, cf. [Plate 3](#): c) a single tibia and 9 long bones (without metapodials) have green fracture patterns (including 2 with notches, cf. [Plate 3](#): d) without carnivore gnawing, hemimandibles ([Plate 3](#): e). These are followed by long bones and mandibles in hyena (occasional removal of the skin and possibly consumption, [Plate 4](#): a, b, c). Bear remains show the most numerous marks on fleshy or marrow-rich content bones suggesting a complete carcass processing (or resulting from an average of multiple processing events, [Plate 3](#): b, f; [Plate 4](#): d). As in the case of the rhinoceros, nearly half of these bones are eaten by a carnivore ([Plate 1](#): a, b, [Plate 2](#): b, c).

To sum up, carnivore activities are frequent, but not systematic, neither on bear remains nor on ungulates. Carnivores have contributed to bone accumulation and modification in two ways: by scavenging or killing bears, by scavenging abandoned ungulate remains by humans, and by a primary acquisition of ungulates (therefore by bringing some elements, even maybe bears), but also perhaps by taking them elsewhere. The two vallons seem to function differently: human action is very weak and can correspond to movements (by trampling or by secondary consumption) by carnivores in the vallon II from vallon I.

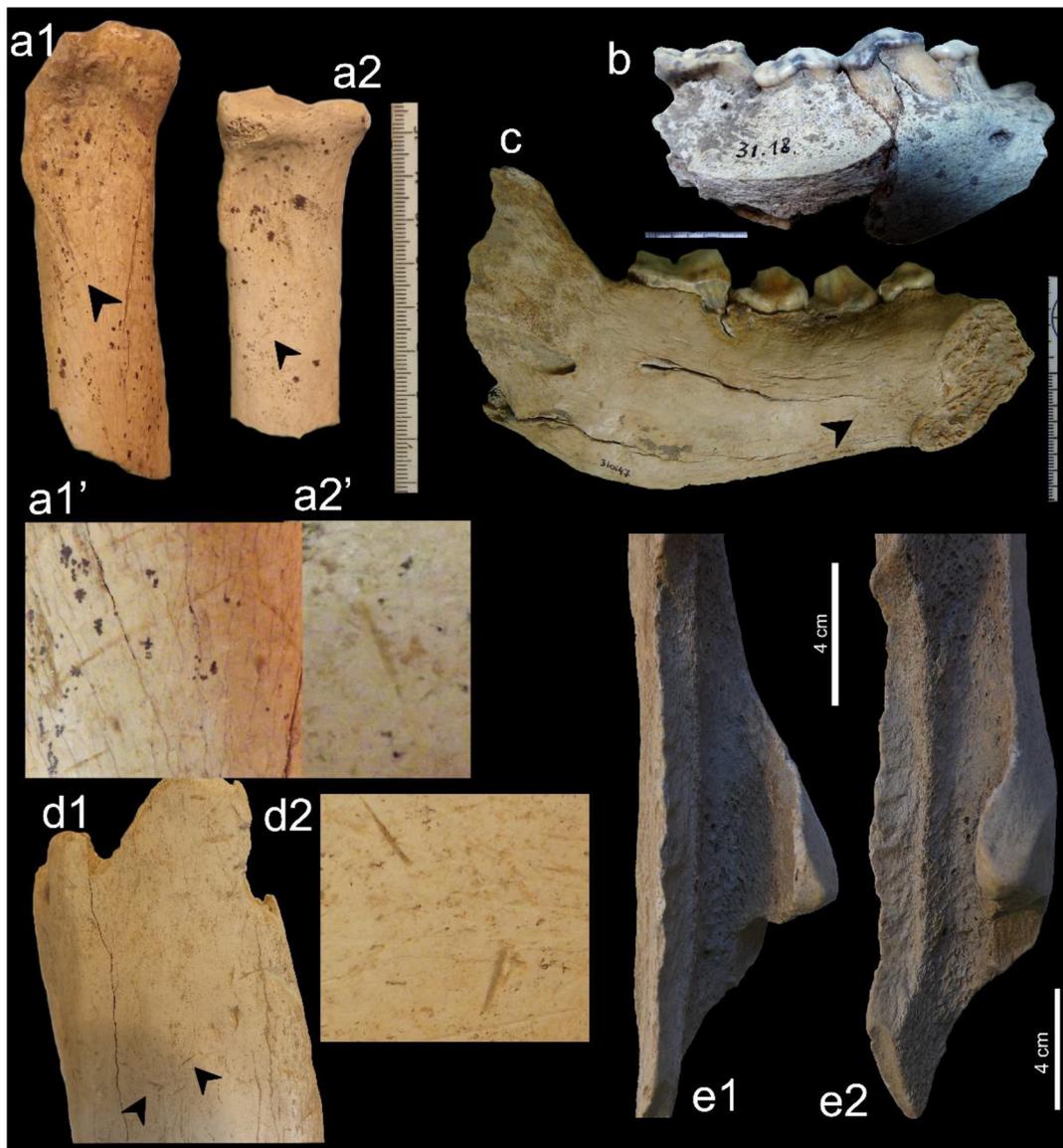
For the spatial distribution study of the artefacts, artefact



**Plate 3.** Illustrations of elements of the site of Érd: a) crenulated edges on cave bear long bone; b) butchery striae on cave bear mandible; c) probable butchery on horse hyoid bone; d) impact notch on horse bone; e) pillar fracturation on horse teeth; f1-2) butchery striae on very young cave bear bone; g) probable butchery striae on horse's axis. © É.J. Daschek.

frequencies show the importance of the larger section of the bigger vallon I, closer to the Fundoklia valley, as well as the rear section of the smaller vallon II (Fig. 7). Gábori-Csánk and Kretzoi (1968: 237, 237–244) mentioned 11 heaps recognized by the frequency and the density of bones and some recurring species, mostly horse and cave bear. According to the Fig. 43 in the monograph (Gábori-Csánk, 1968a: 243), these were located at the front part of the vallon I (trenches II, I/1–8 and continue partly in the area of the 1963's excavation) and the vallon II (trenches VI and mostly VIII, so the innermost area). Horse and other ungulate remains have been found dispersed in these same areas

(in grouped layers) (Daschek, 2014: Fig. 83–84). It is the same for the cut marks, which were found in the same areas, but with a greater extension to other excavated surfaces (trenches of square V) (Daschek, 2014: Fig. 86). We can observe here (Fig. 7), despite a similarity in the distribution of lithic (Fig. 5) and bone materials in both horizons (upper and lower), that bone material is not only much more frequent, but is also present in areas where the lithic is not (e.g. 1961's excavation area, VII, trench V partly) or very little (trench V partly). In contrast, three trenches (I/8, V/1, VI/6) in the lower horizon are empty of bone remains; only lithic material was found there. This may mean a distinct



**Plate 4.** Illustrations of elements of the site of Érd: a1) and a2) and their details a1') and a2') butchery striae on hyena long bone; b) fresh fracturation on hyena mandible; c) butchery striae on hyena mandible; d1-2) butchery striae on cave bear long bone; e1-2) human or rodent-made edge on cave bear long bone. © É.J. Daschek.

temporality, at least partially, between lithic and bone accumulations. As indicated, all the lithic remains and almost all of those of bones were collected (except “tiny-small” ones, but of unknown dimension), the dominant activity on the site was butchery and/or consumption.

The same approach to spatial distribution by horizon has shown that the bones (in NISP) are distributed in the same areas of the vallons (Fig. 7) as the lithic material and confirms the main use of the large vallon in its front part and the rear of the smaller one. The two vallons were interconnected (Gábori-Csánk, 1968a: 10).

## 5. Discussion

### 5.1. Lithics

Based on the results of our analyses of the lithic assemblage, the interpretation of the site as a hunting camp used over a long time period could be supported no longer. The local tool production is demonstrated by the presence of all the technological categories, including raw material blocks, cores, blanks, retouched tools and hammerstones. But such high ratio of the retouched tools is uncommon at camp sites.

Moreover, only short debitage sequences could be identified, and several raw material types are represented only by less than a dozen of pieces. Besides the two hearths uncovered in level d in trenches I/4 and V/4 (Gábori-Csánk, 1968a: Figs. 6–7), there are no indications of longer human staying at the site. These data argue for recurrent short occupations by small human groups or passages of hunters during some activities or mobility. Non-quartzite raw materials allow to suppose a wider territory in the northeastern part of Transdanubia for the groups frequenting the site of Érd. The presence, in very few quantity and only in form of blank or tool, of the Buda hornstone and the radiolarite extend this territory 15 km north-eastward and 40 km north-westward. Though the nummulitic chert has outcrops not far from the site too, the common use of this raw material is recorded in Middle Palaeolithic sites in the region of the Cserhát Mountains in northern Hungary about 90 km from Érd (Markó and Kázmér, 2004: Map 1).

### 5.2. Fauna

As for the lithic assemblage, based on the results of our analyses of the osteological assemblage, the interpretation of the site as a hunting

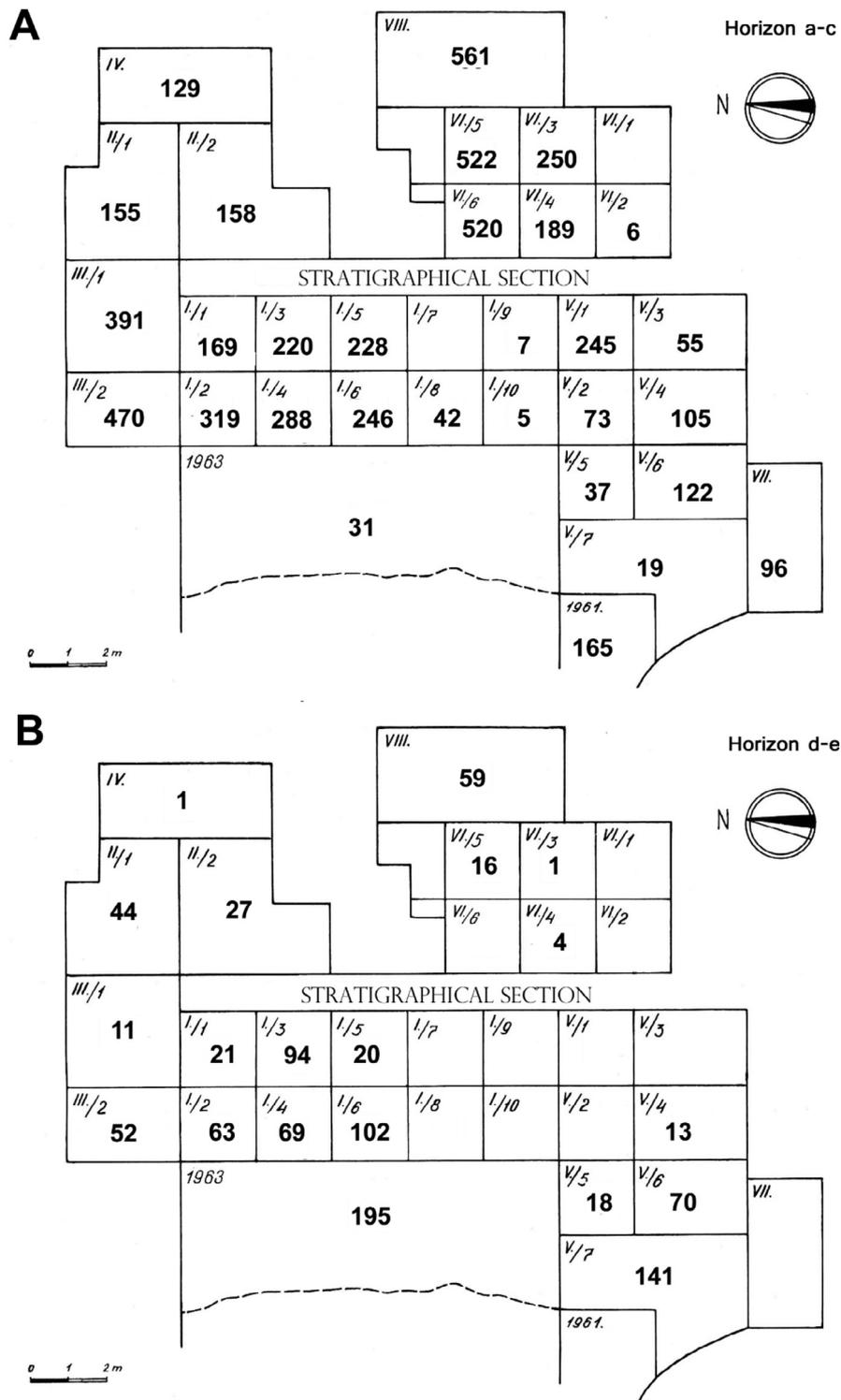


Fig. 7. Spatial distribution of the osteological material according to the archaeological horizons. A: upper horizon of the upper archaeological layer; B: lower horizon of the upper archaeological layer (basic plan after Gábori-Csánk, 1968a: Fig. 2 modified).

camp used over a long time period could be supported no longer. The (1) recurrent human occupations with hearths, (2) short seasonal periods (summer according to foals from family herds and probably rhino calves, winter according to bears cubs (with 1–2 bones with butchery mark), and indefinite occupancies in hyenas, (3) consumption of the carcasses by hyenas even those abandoned by hominids or brought by themselves (prey deposit or consumption site, so, post-human and post-ursine presence), (4) trampling marks (post-hyene occupancy), (5)

incomplete butchery sequence (maybe what survived the consumption of hyenas), (6) part of which was carried out at the place of killed/dead (e.g. rhinoceros) with a view to transport to Érd, (7) gnawed rhinoceros remains (presence of hyenas before and after the Neanderthal abandonment), (8) “chaîne opératoire” complete of the manufacture of quartzite lithic tools, (9) in situ production of most of the tools from local origin, but with short sequences, few remains concerned, (10) “couche-repare” (short-time bear-den level), (11) origin of local

species (only regional migration of both ungulates), one can say that all these 11 aspects suggest short but recurring occupations at Érd.

One of the *sine qua non* criteria for characterizing a hyena den (Fosse, 1994; Pickering, 2002; Kuhn et al., 2010) is that of the mortality structure of hyenas, in particular the presence of juveniles (native den and communal until the definitive weaning of cubs until about 30 months according to Kruuk, 1972), that of the abundance of hyenas (in NISP and MNI, see Fourvel, 2012 for a detailed census), and to a lesser extent, the presence of digested elements and coprolites; their absence would not rule out the presence of hyena (Sauqué et al., 2014: 16). Except for juveniles, all age groups are represented at Érd in both vallons (NMic = 15) and the number of remains is quite significant in Europe (NISP = 204). A few dozen remains have been ingested (mainly horses/foals and bears/cubs), but other species/taxonomic groups are also concerned; most of them are herbivores. The 12 coprolites and fragments attest to the use of certain areas as latrines.

In terms of the length of time occupied by hyenas, since (current) hyenas can give birth all year round and occupy a place for less than 4 months (such as a season), this species does not provide precise information on the period or length of time a site has been occupied, except for a multiplicity of episodes and therefore recurrences. Except for the winter and spring seasons when bears occupied the site, it had to be available the rest of the year (Diedrich, 2012). At least some of the foals killed and brought back to the site could attest to their presence in the vicinity during the summer.

The apparent specialization of hominids (in horses, rhinos) observed by Gábori-Csánk and Kretzoi (1968), may be the consequence of the activity of hyenas and other carnivores (packs), both are able to hunt adult ungulates or preys heavier than 250 kg of weight. Wolves are very frequently associated with *Crocota* according to Brugal and Fosse (2004), that may be able to consume/reduce the entire carcass of small-to-medium-sized species; only the teeth of the most frequently consumed species would be represented. Among the elements ingested, we note the presence of milk teeth and permanent teeth with buds/unused or worn in addition to bone remains: the remains of a vulpine, a small undetermined mammal, a wolf and; for larger species: five remains of *E. hydruntinus* only in the upper parts and especially in vallon I and a hyena (data including other years of excavations and levels), in addition to a few dozen remains belonging to large- and mega-herbivores. All these species are also represented by undigested (adult) dental or bone remains. These small/medium sized herbivores, although not included in this study, were included in this discussion to shed light on the possible loss of smaller bone remains due to excavation, registration or sorting bias during the specific determination (Gábori-Csánk, 1968a). This category of species is identified only by cranial (almost always dental) and autopodial (often whole metapodials, basipodial, rarely acropodial) remains, which is entirely consistent with those observed in other lair sites (e.g. Fouvent site, Fourvel et al., 2014). They are present exceptionally by elements of long bone, belt or axial bone (lion, mammoth, hare, fox, wolf, large bovine, in one and/or the other vallon), including rare young or subadult, whether small/medium or larger species. Juveniles are not very common in Érd, including large and mega-herbivores. In addition, some of these species such as reindeer, migratory (beyond a region) and those such as small bovids, occupying a mountain/rock environment (qualified as “alpine” species by Diedrich, 2012: 75) are, therefore, naturally not or poorly represented near the site (valley bottom-plateau 15 m difference in altitude).

The hyena is able to transport pieces of carcasses over long distances (Dusseldorp, 2009). Thus, carnivores consuming most of the animals killed on site and bringing only a few elements back to their refuges and being able to consume the entirety of a smaller carcass (size class or juvenile of larger species including mega-herbivores) (ethology), the presence or not of an ecological niche near the site, differential conservation (small, medium size class or juvenile), differential representation (dental and autopodials almost exclusively), can also explain the rarity of this category of ungulates. However, since the very

large quantity of osteological material is lost, it is not possible to exclude only large mesh sieving and specific determination sorting from the “undetermined”. Potential harms are difficult to quantify in terms of skeletal representations (including shafts), the infant-juvenile age group, the smallest species and elements in general. However, several arguments can be put forward in favour of a correct, significant, representation of Érd's osteological material. These arguments concern the different species studied in this article and are of different kinds: odontological, taphonomic, ethological.

For bears (for both vallons), the main species (> 80% NISP), the representation of all ages with a peak at the younger and vulnerable subadults (1st and 2nd years, then inexperienced like in Fate, Basura, Hortus or Abreda, cf. Quilès, 2004) and a significant decrease in prime-age adult mortality is consistent with those observed in other mixed (bear) sites/levels. The individuals come from living populations (complete skeletons with balanced sides, stigmas of fracturing teeth *in vivo*) with on-site mortality reflecting hibernation and not reported exclusively or so from hunting (contrary to what has been stated, see Gábori-Csánk and Kretzoi, 1968). The individuals found perished during their wintering and calving periods, sometimes in vulnerable situations (isolated inexperienced subadults, females with young, seniles), or following a possible attack by predators such as hyena (Diedrich, 2012). Various age groups, especially for horse and rhinoceros, could reflect a mixed, carnivore-hyena and human procurement at Érd. Competitive with humans, this large predator-scavenger has hunted/scavenged the same species as hominids. The faunal spectrum of Érd, associating gregarious and (semi-)migratory species, is as diverse as that of hyena dens (notably OIS 3) with carnivores (hyena, lion, wolf, fox, bear, not to mention here the mustelidae and wild cat), small and medium sized ungulates (reindeer, *E. hydruntinus*, red deer and, if we add species outside the sector/layer, such as wild boar, chamois, small bovidae), large ungulates (horse, bison and aurochs, megaceros) and mega-herbivores (rhinoceros and mammoth). Some of the pleistocene dens show similar association, as in Fouvent (Fourvel et al., 2014), Camiac (Guadelli, 1989), Les Plumettes (Beauval and Morin, 2010) or Unikoté (Michel, 2005).

According to Fourvel et al. (2014: 234), the remains of bears killed on-site or brought as carrion to mixed (hominid-carnivore) sites or more specifically to hyena dens concern: either remains belonging to the head and limbs, or random and varied remains. According to the same author (Fourvel et al., 2014: 234), “In the case of bear hibernation level, it appears difficult to determine carnivore impact based on skeletal part distribution”. Each skeletal part is represented which is typical to a natural “population”, despite a strong differential conservation process where isolated teeth are the dominant material. Carnivores came to take advantage of naturally dead bear carcasses; each representative skeletal item of a bear carcass shows carnivore tooth mark (significant fragmentation, bone consumption morphotypes).

The skeletal representation, even if very large artificial biases are admitted, shows a similar profile to those of bear sites described as “bear hibernation level” of “short” duration, such as Hortus or Abreda (Quilès, 2004: Fig. 2), both in terms of types of remains and proportions of units with skeletal elements indicating whole carcasses and the absence of transport (at least in visible quantity) with selection, although hyenas may have removed or brought pieces (Diedrich, 2012; Fourvel et al., 2014). There is no significant over-representation between the anterior and posterior anatomical parts and between even items (balanced). Bone loss in favour of isolated teeth (about 50% NISP, but many as bones in vallon II, NMIf close between dental and some post-cranial in vallon I, but double to the benefit of teeth in vallon II, in both humerus and radius-ulna are the most frequent) appears to be due to several factors (trampling, differential identification of the axial skeleton which is very present among the anatomical determined remains, differential conservation with elements, sometimes very fragile). The bear mortality structure and the taphonomic analysis suggest that the site was used primarily as a wintering site for cave bears.

In terms of spatial distribution (average by at least 4 m<sup>2</sup>), one observe a bimodality of the spatial distribution (Figs. 5 and 7): human groups (lithic remains, cut marks) tended to concentrate their activities at the “entrance” of the site (mainly in the larger vallon), whereas carnivores seemed to use of the inner areas (trenche VIII is the main concentration of cave bear), even if any sex and age are located in all squares (high dispersion, trampling, refitting). According to the experimental study by Camarós et al. (2013), the bear is the most intense modifier carnivore, which can destroy and reorganize space and structures (hearths dispersed, destroyed). At least two certain fireplaces are preserved (level d in both vallons) in Érd, but several ash and charcoal areas have been observed, which at least partially limits their destructive action.

The taphonomic analysis made it possible to highlight, that carnivores (< 10% NISP, without bear remains) played a significant role in the site's bone accumulation. Gnawing damage is observed on the limb bones of ungulates; skeletal elements in herbivores and carnivores are differently represented, few coprolites are present (latrine). The absence of juveniles among non-ursine carnivores can result either from a diagenetic problem or from a function of the place other than a nursery (natal den). Young hyena remains might also be collected by other bone-accumulating animals (Kuhn et al., 2010: 33). Cannibalism seems to be absent.

The action of hyenas appears on each of the elements of a bear carcass (or an average of different episodes), young or adult *sensu lato*, but not systematically (20% NISP) and explain the relative frequency/position of “survived” (?) anthropogenic cut marks. The morphotypes of fragmentation and consumption (by the hyena, see Fourvel et al., 2014: Figs. 3 and 4) of long bones ranging from cylinders to small fragments with very incomplete and variable circumference coexist. The appendicular skeleton represents, respectively, 1/3 and 1/2 bear remains.

Skeletal part profiles constitute an important analytical approach to the understanding of site formation processes and to the reconstruction of the carcasses' acquisition strategies by hominids (vs carnivore-made), especially by the derived data and inferences from the appendicular skeleton (i.e. epiphyses only vs shaft and epiphyses). According to Costamagno et al. (2005; and e.g. Marean and Kim, 1998), the skeleton, although subjected to various destructive factors/processes that can lead to the same result, recommends the integration and use of shafts in taphonomic analysis. Shafts are resistant post-cranial elements, in relation to the axial skeleton and compact bones, more intensely destroyed by carnivores; shaft that can be used to interpret human and carnivorous subsistence strategies by studying the marks observed on the different bone portions (epiphyses, metaphyses and shaft). According to Rosell et al., (2017: 207) in particular, « a high proportion of limb bones and cut marks on the mid-shaft of these bones (which are associated to removal of large muscle masses), leads us to suggest a probably human primary access to the prey (...) [indicating strategies] based on the transport of selected anatomical portions of the hunted ungulates to the cave, which includes mainly the appendicular bones with higher content of meat and marrow (...)”. The long bones of adult rhinos are a perfect example of this, but they have probably been scavenged, with enough early/quick access, by both hominid and hyena, and consume the same elements. The game was butchered on-site for meat and marrow, and partly on the kill-site/scavenging place (rhino). According to Dusseldorp (2009: 140), hyenas could not scavenge pieces of adult rhino carcasses because of its thick skin that only after the human butcher treatment.

However, hyena animal has played a major role in the constitution of this assemblage, explaining probably in part the rarity of small-to-medium-sized species and, above all, the relative frequency/position of cut marks.

Very few remains are affected in horse (possible extraction of the tongue, marrow consumption), hyena (occasional removal of the skin and possibly consumption) and rhino (rapid access with meat consumption and perhaps occasional marrow extraction inspite of

inadequate characteristic of rhino's long bones). Bear remains show the most numerous marks on fleshy or marrow-rich content bones suggesting a complete carcass processing or resulting from an average of multiple processing events. As in the case of the rhinoceros, nearly half of these bones are eaten by a carnivore (bone consumption morphotypes).

Entire epiphyses, abundant in hominid-made accumulations, are very few in both herbivores and carnivores and suggest various attrition processes. Processed carnivore remains have been occasionally documented (e.g. Rosell and Blasco, 2009). Bear hunting has been demonstrated in rare cases. At Érd, no evidence was found of such a fragment of arm embedded in cave bear bone attesting the existence of a hunt. Only at Hohle Fels in Germany (Münzel and Conard, 2004) or at Kraków-Spadzista in Poland (Wojtal et al., 2019) that such proof were discovered, respectively, a flint fragment in a vertebra in a cave bear and in a rib in a woolly mammoth. Both sites date back to the Gravettian period.

While the hunting strategy is difficult to identify, based on indirect elements, it has been demonstrated in Mujina Pećina (Miracle, 2005), Taubach (Bratlund, 1999), Biache-Saint-Vaast (Auguste, 1995, 2003) while bear exploitation (without inferring the method of acquisition) is increasingly documented, as for example in Rio Secco (Romandini et al., 2018 and for a list of sites see Fig. 1), Le Regourdou (Cavanhié, 2009–2010). D. Armand (2018: Figs. 1, 4–7) recently published an update of 53 sites/levels indicating exploitation (including hunting) of bears (U. deningeri, spelaeus, thibetanus, arctos, sp.). According to M. Patou-Mathis (2012: 286–287), in Eastern Europe carnivores are not exploited, except towards the Balkans (Crimea), but would involve “transitional industries”. At Érd, despite a higher frequency of anthropogenic marks on cave bear bones, no specialization can be retained, even less a secondary specialization (horse, rhino), although all these species indicate human acquisition, at least partially and to different degrees. However, the detection of anthropogenic traces (cut marks, percussion stigmas) involving butchery activities (skinning, defleshing, bone marrow consumption) shows that these bears and much lesser, ungulates and hyenas are being exploited. Hunting/scavenging took place in close vicinity and on-site, thus confirming previous interpretations (Gábori-Csánk and Kretzoi, 1968; Daschek, 2014).

These two carnivores are cavernicolous and show mortality and skeletal profiles, as well as the result of a characteristic consumption (gnawing and fragmentation morphotypes), which could be interpreted in relation to their ethology. Excluding bears because of the nature of their deposition and their possible occasional carnivory or scavenging without being an accumulator, the proportion of the other categories follows the following order: majority herbivores (3/4) then hyena and finally carnivores (without the hyenidae), in both vallons. The respective proportions could also correspond to a hyena den, such as Joint Minor Cave, as well as to a presence in a mixed site, such as Pair-non-Pair c. FF' (Fosse, 1996: Table 4), to which wolves and other small carnivores had to contribute. This is corroborated, at Érd, by the carnivore/ungulate ratio, according to K. Cruz-Urbe (1991), allowing discernment between hominid-made accumulations (below 13% NISP), versus those of hyena/carnivore's-made (> 20%). In both vallons, without bear remains, this ratio is above the 13%, (15 and 24% NISP) and suggests multiple occupancies of various intensities. All this attests to the complex history of this site. In the smaller vallon (II), hominid and carnivore activities are less important than in the other one (vallon I); this vallon (II) was used principally by bears.

## 6. Conclusions

In conclusion, new interpretations were proposed and discussed in our paper. The study of this museum collection has therefore proved its significant value and good quality, through a careful taphonomic study, in the understanding of the subsistence behaviours of these Neanderthals and their settlement patterns at this site. Indeed, the

re-interpretation of the spatial data according to the evident two large stratigraphic units (at the upper level treated in this study) with the combination of other aspects, in particular taphonomic, has made it possible to propose not only a distinct occupation/use of the site by hominids and carnivores, but also a new interpretation of the (morphological) formation of the Érd. The debate on the type of site, our new suggestion and other clues on the site formation process make it necessary to carry out a thorough study (with the limitations that an old excavation implies) and will be the subject of an upcoming publication.

Possible evidence of (at least partly) non-selective carcass transport suggests that, for these large and mega-herbivores, hunting/scavenging took place in close vicinity the site (presence on a regional scale: plateau overlooking the site and the alluvial plain of the Danube) and, all the more so, since these species are highly dependent on the presence of water and (seasonally) abundant ecological resources. The bears represented individuals from a local living population who came to settle in this site, where some of them died.

Palimpsest (or “amalgam” according to Brugal and Fosse, 2004: 591) were generated, mainly, by hominids, bears and hyenas. The presence of various carnivores – of different families –, by both sexes in bears, and Neanderthals tend to underlie two aspects of site use: (1) mutual and temporal avoidance, (2) and distinct use of the space between carnivores, mainly at the bottom of the vallons, and hominids, mainly in front of the great vallon (I) in the widest space (at the assumed access area). Mutual avoidance has sometimes been broken. Indeed, direct and indirect temporal contact between these occupants could be identified. Direct contact concerns: (1) the action of carnivores on bear carcasses (killed or scavenged) and (2) the action of hominids on bear and hyena carcasses (killed or scavenged). Indirect contact occurs through the action of carnivores on ungulate remains abandoned by humans (secondary scavenging) as evidenced the better by striae and tooth marks present jointly on several bones without overlapping. As a matter of fact, an undisputable faunal/lithic relationship has been demonstrated based on the presence of stigma, evidence of past human activities and indirect observations (choice of individuals’ ages, species, and carcass pieces), in addition to a spatial relationship. This latter can result from a disturbance by carnivores, such as that highlighted by experimental work by Camarós et al. (2013). The faunal/lithic remains, not always associated, suggests on the one hand, that there are settlements that are less or not anthropized (ursines, carnivores or hyenines): 150–180 cm (level b), 180–200 cm (c), 200–220 cm (d), and maybe the lower layer (A) can be subdivided in two sublevels, and on the other hand, they would be interrupted by periods of tranquillity (or of lower intensity) long enough for the development of a thin vegetal soil (plant root edges, formation of an early humus soil/rendzine).

The presence of these ungulates, of mixed origin, corresponds to the food choice of hyenas and hominids of predatory/scavenging activities. Almost exclusively, it is the large and mega-herbivores, that constitute the basis of their respective diets (herein, for the other species, see Daschek, 2014 and forthcoming publication) in a topographical context favourable to the implementation of variable acquisition strategies, mainly on the mammoth steppe. The palaeotopography of the site is located on a passage of herbivores and in an advantageous crossroads situation of several regional-local biotopes: swamp or alluvial plain, plateau, “shelter” with the presence coniferous trees *Larix-Picea* and species with varying behaviour during the year in terms of family/specific links (grouping-separation) and/or territorial use (territoriality, routine paths, time or place of birth).

As far as the lithic industry is concerned, the production is neither specific nor specially adapted to the local raw material, the proven standardization cannot be linked to any cultural trait and the homogeneity of the industry does not reflect any internal evolution, nor a co-evolution parallel to the supposed specializations. On the other hand, it suggests a stratigraphic problem. Indeed, the study of lithic refitting (but also bony refitting) points in this direction. In addition, the unprecedented spatial distribution of the lithic remains by horizon (upper

and lower and lower layer A), not by individual level or grouping, highlights the two same, denser, occupancy areas at the entrance to the site (vallon I) and at the bottom of the smaller vallon (II).

Many aspects of taphonomy, ethology, sedimentology, geology/geomorphology, (micro-)climatology/environment and biology would support the idea of a (more) closed/protected structure type or an “open/opening” structure type (in the dynamic sense of the term), at least partially or temporarily (Daschek, ongoing research) and/or quick burial process (sedimentation rate unknown). Among these aspects, archaeological one permit too to formulate a similar problem. The abovementioned bimodal spatial distribution of accumulations would support the hypothesis of a possible roof, present above at least part of the space (or spaces), which would gradually recede and disappear completely at the end of the LGM (Late Glacial Maximum), giving rise to an open-air site during part of the last (human) occupations. This progressive destruction at work is quite visible on the stratigraphic section (Fig. 2: black arrows, fragments of limestone tilted towards the interior of the vallon). Erosion of the cavity walls (and roof?) would be allowed by the very nature of the surrounding limestone, porous and friable, between much harder layers, due to natural erosion. The relatively large size of the site excludes from the outset any formation or expansion due to biological agents (digging of bears and effects of their bioglyphs, burrowing animals, as can be seen today in the current environment). Thus, despite the absence of a karstic environment, sensu L. Straus (1990), a double cavity have had could form in areas of geological “weaknesses” along tectonic faults, providing a relatively protected and adequate environment for the various occupants of the site.

In that respect, on the basis of human activity (butchery activities, sequential carcass processing and transport, few(er) species concerned by the anthropogenic activities, seasonal occupation), on the high rate of retouched tools, on short debitage sequences, several raw material type poorly represented, makes it possible to propose an alternative interpretation of the duration of occupations: recurrent short occupations by small human groups or passages of hunters during some activities or mobility. However, the lithic industry do not support the hypothesis of an internal cultural evolution. Archaeozoological data do not prove bear hunting or specialization; however, there is no doubt about the exploitation of this and other animals. Hyenas’ role is predominant in the site formation. Hominids and hyena hunted or scavenged the same big games. So, the site is much more complex in its functioning and history than previously said. New absolute datation and new taphonomic data appear as a necessity for a climato-chronological re-evaluation in order to place the site in a broader regional and European context, at the Late Middle Palaeolithic.

## Acknowledgements

We are indebted to László Makádi in charge of the collections of the Hungarian Mining and Geological Survey of Hungary, as well as to András Tóth who is responsible for the archaeological collection at the Budapest History Museum, Aquincum Museum, for giving access to the materials of the site, and for providing good working conditions during this long study period. Colleagues at the Archives of the Budapest History Museum are acknowledged too for helping to study the documentation. Two recent travels of Éva J. Daschek to Budapest received financial support from the National Museum of Natural History, Paris (UMR 7194 NOMADE). Zsolt Mester thanks Norbert Faragó from the Institute of Archaeological Sciences of the Eötvös Loránd University, Budapest for preparing the 3D model of the site presented on Fig. 1. The authors would like to thank much the three anonymous reviewers for their relevant comments on this paper.

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