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# PALEOBIOLOGY AS A CLUE TO PALEOLITHIC TAPHONOMY: THE CASE OF REINDEER HUNTING IN MOLDOVA



Roman CROITOR<sup>1</sup>

## ABSTRACT

The article proposes an interpretation of hunting strategy of Late Paleolithic hunters from Moldova based on demographic structure of reindeer remains (sex ratio and proportion of juvenile remains) and reindeer paleobiology and ecology. The obtained results demonstrate a flexible strategy of game procurement of Paleolithic hunters ensuring the optimal energy investment/ food gain ratio. The hunting strategy was influenced by prey ecology, seasonal biological cycle, paleogeographic conditions, prey availability, cultural traditions, and available human resources.

**Key-words:** *Rangifer tarandus*, taphonomy, paleobiology, Upper Paleolithic, hunting strategy.

## RÉSUMÉ

LA PALÉOBIOLOGIE COMME CLEF EN TAPHONOMIE PALÉOLITHIQUE : L'EXEMPLE DE LA CHASSE AU RENNE EN MOLDAVIE

Cet article propose une reconstitution des stratégies de chasse au Paléolithique supérieur en Moldavie, fondée sur la démographie des populations de renne fossile (sex-ratio et nombre de restes de jeunes) en relation avec la paléobiologie et l'écologie de cette espèce. Les résultats indiquent des stratégies flexibles dans l'acquisition de ce gibier permettant un rapport optimisé entre investissement énergétique et gain alimentaire. Les stratégies de chasse sont influencées par l'écologie du gibier, leur cycle saisonnier et leur disponibilité, les conditions paléogéographiques et les traditions culturelles des groupes humains et leurs autres ressources.

**Mots-clefs :** *Rangifer tarandus*, taphonomie, paléobiologie, Paléolithique supérieur, stratégie de chasse.

## 1 - INTRODUCTION

Pleistocene reindeer is a particularly suitable prey species for study of hunting strategy of Paleolithic hunters. Reindeer remains are numerous in Paleolithic sites and permit a continent-wide comparative biometric analysis. The well-expressed sexual dimorphism and available data on ontogenetic development of dentition and postcranial skeleton in modern conspecifics make the estimation of demographic structure (sex ratio, age group ratio) of archaeozoological remains easy and provide the information on specific prey selection of Paleolithic hunters (Weinstock, 2002). The flexible reindeer ecology, variable postcranial eco-morphology, and the unique among mammals capacity to evolve ecotypes (Flerov, 1952) represent an important source of information on interrelationship between paleoenvironment and Paleolithic human hunting activity. Finally, reindeer is characterized by an optimal for Paleolithic hunters body size that permitted to transport the entire killed prey to butchering sites (Bouchud, 1966), therefore the Paleolithic reindeer

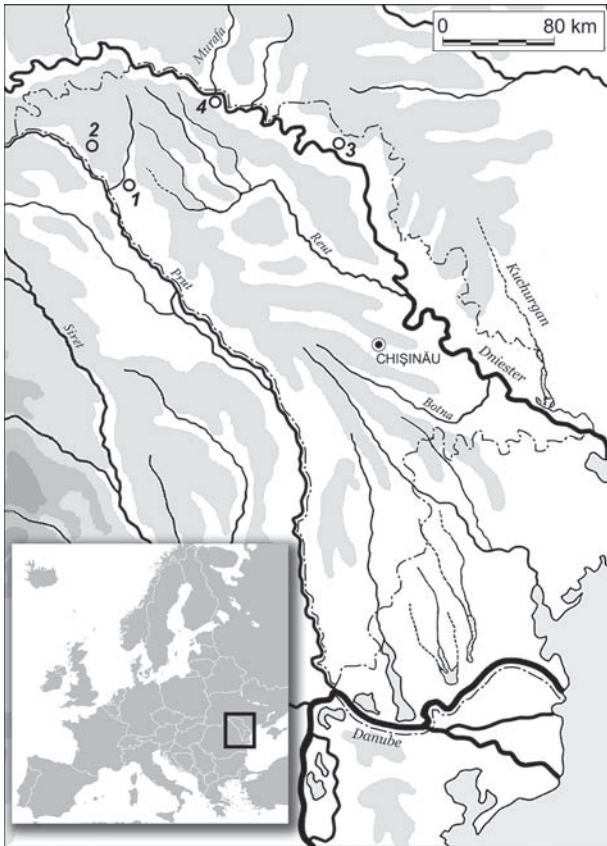
material in most cases represent a complete unbiased archaeozoological source of information.

The present communication proposes a study of hunting strategy of Paleolithic hunters based on eco-morphological and paleoecological interpretations of demographic structure of reindeer remains from several Late Paleolithic sites of Northern Moldova (fig. 1).

## 2 - MATERIAL AND RESEARCH METHOD

The main part of archaeozoological material is stored in the Institute of Zoology of the Academy of Sciences of Moldova. A part of material from Duruitoarea Veche is stored in the Museum of Ethnography and Natural History of Moldova (Chişinău). The minimum number of individuals (MNI) is used for description of structure of archaeozoological assemblages. The demographic analysis of reindeer remains is based on a better preserved skeletal element: talus. The percentage of remains of juvenile and young individuals (< 3 years) in

<sup>1</sup> Aix-Marseille University, CNRS, UMR 7269, MMSH BP674, 5, rue du Château-de-l'Horloge, FR-13094 AIX-EN-PROVENCE.  
Courriel: romancroitor@europe.com



**Fig. 1: Geographic location of the Late Paleolithic sites discussed in the present study.**

1/ Duruitoarea Veche; 2/ Brînzani-I; 3/ Raşcov-7; 4/ Cosăuți.

Fig. 1 : Localisation géographique des sites du Paléolithique supérieur discutés dans le texte. 1/ Duruitoarea Veche; 2/ Brînzani-I; 3/ Raşcov-7; 4/ Cosăuți.

the samples from Brînzani-I and Raşcov-7 is based on number of skeletal remains with unfused epiphyses. Only large-sized herbivores with body mass above 20 kg are considered in this study as prey species.

### 3 - DESCRIPTION AND DISCUSSION

#### 3.1 - DURUITOAREA VECHE (DV), LAYERS III AND IV

The site was discovered in a grotto that apparently represents a remnant of a larger cave (David & Chetaru, 1970). Chetaru (1973) approached the stone artefacts to the Tayac type and referred to the “pre-Mousterian” age. The archaeozoological assemblage is rich in species but quite restricted in MNI (100 prey mammal individuals represented by 3,239 bone fragments) (David, 1980). The archaeofauna is dominated by horse (MNI = 25) and megaherbivores (*Mammuthus primigenius* and *Coelodonta antiquitatis*, MNI = 16) that define the specific character of the whole archaeozoologic assemblage (fig. 2). *Cervus elaphus* (MNI = 8), *Equus hydruntinus* (MNI = 6), *Capreolus capreolus* (MNI = 1), and *Saiga tatarica* (MNI = 1) are less common prey species (David, 1980). Reindeer is represented by a large form with elongated metapodials resembling modern forest rein-

deer (Croitor, 2010a), however, its importance as a prey species was rather insignificant in the total prey biomass (323 bone fragments of 15 individuals).

#### 3.2 - DURUITOAREA VECHE, LAYER II

The archaeological complex is referred to the “early Magdalenian” age of Late Paleolithic (Chetaru, 1973). The assemblage of mammal remains contains scarce remains of carnivores (David, 1980). *C. elaphus* (MNI = 6), *Alces alces* (MNI = 1), *Sus scrofa* (MNI = 1), and *Saiga tatarica* (MNI = 1) are quite rare, but noteworthy as indicators of patchy woodland paleoenvironment. The prey species are represented by 1,078 bone remains (MNI = 181). Horse (MNI = 91) is a dominant prey species in the archaeozoological assemblage (fig. 2). Reindeer is the second prey species according to number of identified remains and individuals (1,249 bone remains; MNI = 35), however its real importance as a meat source must be less important than that of bison (MNI = 25). The reindeer remains are characterized by a very broad size variation due to the presence of bones belonging to exceptionally large males (Croitor, 2010a). The male/female ratio of reindeer remains is 50:50%.

#### 3.3 - BRÎNZANI-I (BR), LAYER III

The site was discovered in a grotto situated over the valley of the Racoveţ River. The third Paleolithic layer is of predominately anthropogenic origin and contains comparatively low number of remains of large carnivores (David, 1980). The radiocarbon dating yielded dispersed results ranging from 26 to 15 ky BP (Chirica *et al.*, 1996). The stone industry typology permits to assume even an older age corresponding to the Middle Würm or the second half of Würm (Chetaru, 1973). The comparatively rich archaeozoological assemblage contains 12,849 bones (MNI = 356) of prey species (David, 1980). As in the sample from DV (II), MNI of horse (194) represents more than a half of the total prey species MNI. Forest species (*C. elaphus*, *C. capreolus*, *A. alces*) are quite rare (MNI amounts to 8, 4, and 1 correspondingly), but are meaningful as indicators of wooded biotopes. Reindeer is the second important prey species represented by 3,987 bone remains that belong to 117 individuals (fig. 2). Complete male metacarpal and metatarsal bones are large and elongated approaching the size and proportions of metapodials of modern American forest caribou *R. tarandus terranova* (Croitor, 2010a). Unlike American woodland caribou, the antlers of reindeer from Brînzani-I are characterized by a low position of the second tine, which is situated close to the burr and the first tine as in American barren-ground caribou and all Eurasian reindeer forms. Relatively larger teeth are a peculiar feature distinguishing the reindeer from BR-I from modern reindeer (Croitor, 2010a). The reindeer from DV and BR-I, apparently, represent the same archaic large-sized form approaching the body size of modern woodland caribou. The presence of forest reindeer form and other woodland-dwelling species (red deer, roe deer, elk) in DV and BR-I in combination with typical open landscape herbivores (horse, bison, saiga antelope) is not

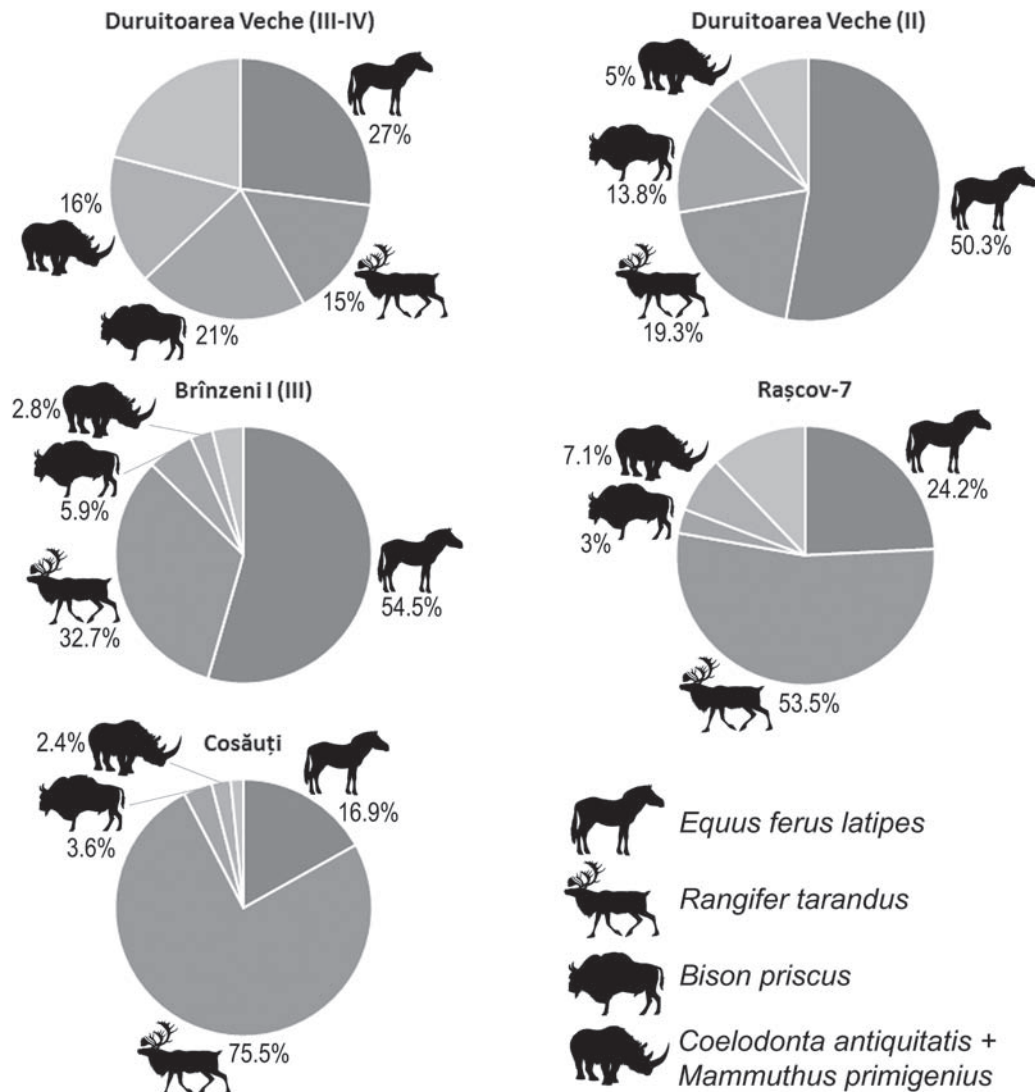


Fig. 2: Systematic composition and structure (% MNI) of prey species from the studied Paleolithic sites.

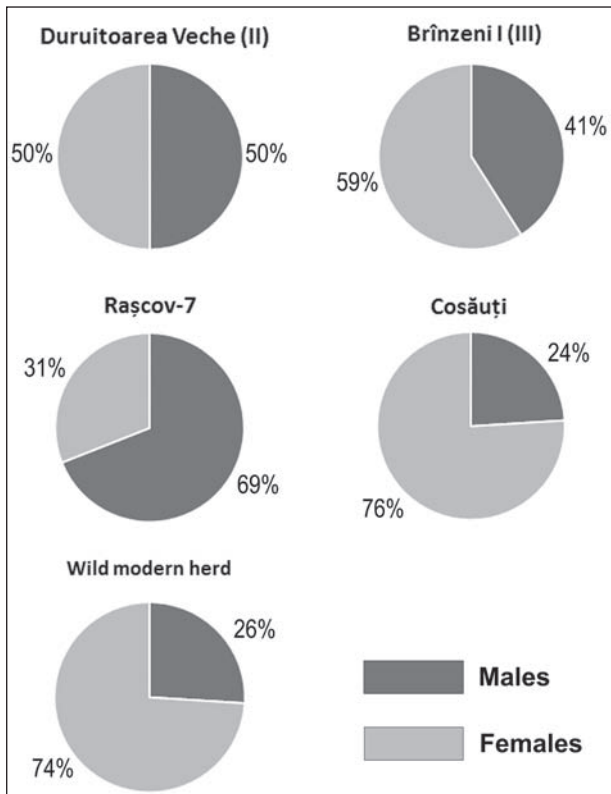
Fig. 2 : Composition systématique et structure (% NMI) des espèces proies des sites étudiés du Paléolithique supérieur.

surprising, since the Paleolithic sites under consideration are located in a transitional area between the Carpathian Foothills, the East European Plane, and the Balkan Glacial refugium.

The male/female ratio in the reindeer sample from BR-I is 41:59%. The number of remains of individuals younger than 3 years attains 14.6% of the sample (Croitor, 2010a).

The reindeer was a secondary prey species in BR-I and DV, outnumbered by horses (both in MNI and biomass) and exceeded in biomass by larger herbivores *Bison priscus*, *Coelodonta antiquitatis*, and *Mammuthus primigenius*. The systematical composition and structure of prey species assemblage from the layers III-IV of DV suggest a hunting specialization focused upon very large prey, while the inhabitants of DV (II) and BR-I were specialized horse hunters (fig. 2). The hunting for reindeer was rather selective, since the number of remains of reindeer males in the samples is relatively higher than number of bucks in modern wild populations (fig. 3). The prey selection for large males was caused by the specific ecology of forest reindeer, which, according to Flerov

(1952) and Baskin (1990), are solitary or live in small groups. The hunting success depends of the optimal energy loss/food gain ratio that should cover the energy demands not only for prey search, procurement, and processing, but also physiological demands of hunters and the entire associated human group that ensure its stability and survivorship. Therefore, large reindeer males represent an energetically less costly and more desired prey. This principle of energetic balance explains why large males are overrepresented in the samples from DV and BR-I and suggests an application of specific hunting strategy. The number of remains of young individuals (below the age of 3 years) in BR-I (14.6% of the total sample; fig. 3) apparently is below the critical proportion reported by Semionov-Tian-Shanski (1977, 1980) for modern reindeer depressive populations (5-17% of population number for first year calves only). Possibly, the underrepresented young and juvenile reindeer remains indicate a prey selection for mature individuals, but also may be simply biased due to the poor preservation of poorly mineralized remains of young animals.



**Fig. 3: Male/female ratio (based on skeletal elements) in the reindeer osteological samples from Paleolithic sites compared to the structure of modern migrating herd of *R. tarandus tarandus* (according to Semionov-Tian-Shanskiy, 1977).**

*Fig. 3 : Sex-ratio (à partir des éléments squelettiques) dans les ensembles osseux de renne des sites paléolithiques, comparé à la structure des troupeaux actuels de *R. tarandus tarandus* migrant (selon Semionov-Tian-Shanskiy, 1977).*

### 3.4 - RAȘCOV-7 (RS-7)

Rașcov-7 is an open-air paleolithic site that yielded the stone industry of Epi-Aurignac type (Chetraru *et al.*, 2007). The radiocarbon analysis gave the absolute age ca. 19 ky BP (*ibidem*). The sample of prey species mammals is represented by 8,440 bone remains that belong to 99 individuals (David, 1980). The bone remains are strongly fragmented and weathered. Reindeer represent more than a half of prey MNI (53 individuals represented by 6,109 bone remains) in the sample (fig. 2). The reindeer of RS-7 is somewhat smaller than *R. tarandus* from DV and BR-I. The postcranial measurements of the reindeer from RS-7 overlap with measurements of small-sized Late Pleistocene reindeer from Jaurens (Corrèze, France) and modern tundra reindeer (Croitor, 2010a). The reduced size of cheek teeth is the most peculiar distinguishing characteristic of the reindeer from RS-7 that approach it to the French Paleolithic reindeer. This biometric resemblance permitted to describe the reindeer from RS-7 as *R. tarandus* cf. *quettardi*. However, the reindeer from RS-7 possibly is a dwarfed descent of the larger reindeer from DV and BR-I that evolved in less favorable environmental conditions, therefore, the observed biometric affinity with Western European reindeer may be superficial (Croitor, 2010a).

The archaeozoological assemblage from RS-7 is peculiar. Reindeer is a quite important prey animal with the

largest number of MNI (fig. 2); however, mammoth and rhinoceros are still an important source of food (up to 46% of prey biomass) (Covalenco & Croitor, 2016b). Red deer (MNI = 7), roe deer (MNI = 2), and wild boar (MNI = 1) are less important prey species (David, 1980). The majority of reindeer remains from RS-7 belongs to males (fig. 3). The sex ratio of reindeer remains shows a strong selection in the favour of males (fig. 3), suggesting that large bulls were intentionally chosen and pursued by hunters. The comparatively high number of remains of young and juvenile individuals (23.2%) along with the strong selection in the favour of males and the high degree of diagenetic destruction rather suggests that the hunted reindeer population was not depressed, even if a reduction of body size is suggested for the reindeer form from RS-7. The good demographic state of the reindeer population partially explains why this species was easily available and therefore preferred by the inhabitants of the RS-7 site. The specific hunting strategy (large prey specialization) is explained by the allochthonous origin of Rașcov hunters and their connection to the Central European Aurignacian tradition (Covalenco & Croitor, 2016b).

### 3.5 - COSĂUȚI (CS)

This site in some publications is spelled as Kosoutsy (20-16 ky BP; Borziac, 2008) and is a multilayered seasonal open-air Paleolithic site (Borziac, 1993). The site yielded a particularly rich but strongly weathered and fragmented remains of prey species (33,474 bone remains; MNI = 249). The prey species assemblage is dominated by *R. tarandus* remains (31,600 bone fragments; MNI = 188), therefore CS may be regarded as a specialized reindeer hunting site (fig. 2). Horse is the second important prey species (1,693 bone remains, MNI = 42), while the remains of bison and pachyderms are rare (David *et al.*, 2003). Scanty remains of *C. elaphus* and *C. capreolus* are reported from the youngest layer I (17,200 ± 300 yr BP; David *et al.*, 2003). The presence of *A. alces* based on a single questionable specimen from the layer VI (David *et al.*, 2003) is doubtful and therefore this species should be excluded from the faunal list (Covalenco & Croitor, 2016a). The reindeer is characterized by relatively short limbs (a complete female tibia is available), a rather small body size similar to modern tundra reindeer *R. tarandus tarandus*, and relatively large cheek teeth as in the type specimen of *R. tarandus constantini* Flerov, 1934 from the Late Paleolithic site of Malta near Irkutsk. The antlers are thin, poorly branched, cylinder-shaped, with a small distal palmation. The comparatively small body size, relatively short limb bones, simple branched antlers with weak palmations, and large cheek-teeth define the Siberian reindeer as a peculiar open-landscape grazing form that inhabited tundra-steppe. The sex ratio shown by different skeletal parts is similar (Croitor, 2010a), confirming the assumption that the entire killed reindeer were brought to the butchering site. The archaic forest reindeer from the Prut-Dniester area was substituted by *R. tarandus constantini* 19-20 ka BP (Croitor, 2010b). This seemingly unremarkable event is a part of

a more important local faunal turnover marked by disappearance of *Megaloceros giganteus*, *Crocota crocula spelaea*, and *Ursus spelaeus*, indicating deep changes in environmental conditions and a drop of ecological production of the paleoecosystem.

The sex ratio of reindeer from CS is very close to the structure of migrating herds of modern tundra reindeer (fig. 3), suggesting that the demographic profile of the sample under study has a “catastrophic” character. The site of CS apparently was a seasonal settlement with a strategic location controlling the seasonal migration path of reindeer (Covalenco & Croitor, 2016a). The middle Dniester passes through a deep gorge that must represent an unavoidable obstacle for migrating herds of Palaeolithic reindeer. The site of CS is situated near a natural ford permitting to cross the river’s gorge: the Valley of Murafa River, a tributary of Dniester that runs from the North, and the Valley of Iorjnița River that flows into Dniester from the opposite side, represent an easy but quite narrow ford allowing to traverse Dniester and its abrupt gorge (Covalenco & Croitor, 2016a). The most common type of weapons from CS is represented by spears and javelins permitting to strike prey from a distance of 20-35 m. Harpoon is another specific weapon found in CS and other ford-located Paleolithic settlements of Middle Dniester and Prut that apparently were used to drag the wounded animals from the water stream (Covalenco & Croitor, 2016a).

#### 4 - CONCLUSIONS

The reindeer hunting represents an interesting instance of flexible strategy of Paleolithic hunters depending of several mutually influencing factors: i) paleoecology of reindeer, ii) paleoenvironment; iii) biological cycle of reindeer; iv) body mass of prey; v) hunting traditions; and vi) human resources available. The paleoecology of reindeer is a variable factor that depends of population density, biotope characteristics, availability of ecological resources, and demographic cycle (Semionov-Tian-Shanski, 1977; Baskin, 1990). The applied hunting strategy ensured the optimal energy investment/food gain ratio. Forest reindeer that lived solitary or in small groups were chosen by hunters according to the individual energetic value of prey (body size, availability, etc.). Large males were a preferred prey in this case.

The predictable biological cycle of gregarious open-landscape reindeer opened a new possibility of prey resource exploitation for Paleolithic hunters: the seasonal ambush hunting of migrating reindeer herds. The hunting signature is unselective in this case; the osteological remains of reindeer are numerous and have a specific “catastrophic” demographic profile. The available human resources represent an important factor for ambush reindeer hunting. Otherwise, the hunting strategy must be focused upon larger males or may even have an opportunistic character with high proportion of such vulnerable individuals as females, seniles, and juveniles (Croitor & Covalenco, 2011). The phenomenon of prey selection in the Paleolithic sites is an important factor that should be

taken in account in biometric description of prey animals and interpretation of the obtained results. The strong hunting selection in the favor of a certain category of individuals causes a biased archaeozoological sample that may be wrongly interpreted as a climate-induced body change or even as a taxonomically meaningful characteristic.

Therefore, the starting point of taphonomical process in an archaeozoological assemblage is greatly influenced by the combination and mutual influence of several factors, such as prey paleobiology and body mass, hunting strategy, paleoenvironment, and demographic cycle of a prey species. Some of those factors (like demographic cycle) are difficult to assess. The relative abundance of quite fragile remains of juvenile individuals may be suggestive only if they represent a comparatively high percentage in the sample in combination with factors that indicate a prey selection against juveniles and/or a strong diagenetic destruction of fossil remains (the case of RS-7). A careful analysis of all available demographic, paleobiologic, faunistic, and morpho-functional data potentially permit a correct estimation and understanding of taphonomical processes in a Paleolithic site.

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