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An Antlered Skull of a Subfossil Red Deer, *Cervus elaphus* L., 1758 (Mammalia: Cervidae), from Eastern Romania

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Abstract: A subfossil antlered braincase of red deer discovered in the Holocene gravel deposits of Eastern Romania is described. The morphology of antlers suggests that the studied specimen is related to the Caucasian and Caspian stags and belongs to the oriental subspecies *Cervus elaphus maral* OGILBY, 1840. An overview and discussion of taxonomical issues regarding modern red deer from South-eastern Europe and some fossil forms of the region are proposed. The so-called Pannonian red deer (*Cervus elaphus pannoniensis* BANWELL, 1997) is considered a junior synonym of *Cervus elaphus maral* OGILBY, 1840. *Cervus elaphus aretinus* AZZAROLI, 1961 from the last interglacial stage of Italy seems to be very close to *Cervus elaphus maral*.

Key Words: Carpathian red deer, *Cervus elaphus maral*, morphology, systematics, taxonomy, Romania

Introduction

The subspecies status and systematic position of the red deer from the Carpathian Mts. is still a matter of discussions. The comparatively larger Carpathian red deer has massive antlers with less developed crown tines as compared to the red deer subspecies from Western Europe. It was assigned to two subspecies, *C. vulgaris montanus* BOTEZAT, 1903 (the "mountain common deer") and *C. vulgaris campestris* BOTEZAT, 1903 (the "lowland common deer"). BOTEZAT (1903) proposed for red deer species the name *Cervus vulgaris*, since, according to his opinion, the Linnaean Greek-Latin name *Cervus elaphus* is tautological.

LYDEKKER (1915) and GRUBB (2000) considered the name *C. vulgaris* as a junior synonym of *C. elaphus*. LYDEKKER (1898) included the Eastern Carpathians in the geographical range of the Caspian red deer *Cervus elaphus maral* OGILBY. Nonetheless, in his later publication, LYDEKKER (1915) generally accepted BOTEZAT's viewpoint on the taxonomical distinctiveness between the two Carpathian forms of red deer. However, LYDEKKER (1915) indicated that *C. vulgaris campestris* is preoccupied since it has been used as *Cervus campestris* CUVIER, 1817 (a junior synonym of *Odocoileus virginianus*). Therefore, LYDEKKER (1915) considered the red deer from the typical locality Marmoros and Bukovina districts of the Hungarian and Galician Carpathians as *Cervus elaphus* ssp. According to LYDEKKER (1915) this deer may be to some degree intermediate between *Cervus elaphus germanicus* from Central Europe and *Cervus elaphus maral* from Northern Iran and Caucasus. With some doubts, LYDEKKER (1915) included *C. vulgaris montanus* in the synonymy of *Cervus elaphus maral* and suggested that both Carpathian red deer forms described by BOTEZAT may represent recently immigrated dwarfed forms of *C. elaphus maral*.

HEPTNER & ZALKIN (1947) also rejected BOTEZAT's subspecies name *campestris* as preoccupied; however, they recognized the validity of *Cervus elaphus montanus* BOTEZAT with type locality in Bukovina (Romania) and the vast area of distribution that included the entire Carpathian-Balkan region. This subspecies is characterised by underdeveloped neck mane, the missing black stripe bordering the rump patch (or caudal disk), generally grayish colour of pelage, poorly developed distal crown in antlers, and comparatively larger body size (HEPTNER & ZALKIN 1947).

FLEROV (1952) and SOKOLOV (1959) placed the Carpathian red deer in the nominotypical subspecies *Cervus elaphus elaphus* Linnaeus since the diagnostic characters of antler morphology, pelage colour as well as body size used for the description of the Carpathian red deer are not constant characters and, therefore, are not suitable for subspecies designation. According to FLEROV (1952), the morphological peculiarities of the Carpathian and Crimean red deer are insignificant and do not permit to place those populations in any separate subspecies. ALMAŞAN *et al.* (1977) referred the Carpathian red deer to the Central European subspecies *Cervus elaphus hippelaphus* ERXLEBEN, 1777. According to DANILKIN (1999), the "Carpathian race" *montanus* is a transitional form between the Western European *C. elaphus elaphus* and the Caucasian *C. elaphus maral*. TATARINOV (1956) applied a new subspecies name *Cervus elaphus carpathicus* for the red deer from the Ukrainian part of the Carpathian Mts. HEPTNER *et al.* (1988) regarded TATARINOV's subspecies as a junior synonym of *campestris* and *montanus* and considered it as a *nomen nudum*.

GRUBB (2000) considered *C. vulgaris campestris* BOTEZAT and *C. vulgaris montanus* BOTEZAT as homonyms of *Cervus campestris* CUVIER, 1817 and *Cervus montanus* CATON, 1881, respectively, and, therefore, both names were suggested to be invalid.

BANWELL (1997) proposed another new subspecies name, *Cervus elaphus pannoniensis*, for red deer from Hungary, Romania and the Balkan Peninsula. BANWELL (1997, 1998) described a set of specific morphological characters that distinguish the so-called "maraloid" Pannonian red deer from the Western European red deer. However, BANWELL did not provide the diagnostic characters distinguishing *Cervus elaphus pannoniensis* from *Cervus elaphus maral*. Nonetheless, BANWELL 's subspecies *C. elaphus pannoniensis* was accepted by several authors (GROVES & GRUBB 2011; MARKOV 2014) and even its taxonomic status was raised to the species level (GROVES & GRUBB 2011). ZACHOS *et al.* (2013) regard the full-species status for the Pannonian red deer as an objectionable "taxonomic inflation".

GEIST (1998), in his comprehensive publication on evolution, biology and systematics of red deer and wapiti (*C. elaphus canadensis* ERXLEBEN, 1777, or *Cervus canadensis* according to the latest genetic studies, see e.g. POLZIEHN & STROBECK 2002), did not indicate explicitly the systematical position of the Carpathian red deer. However, he supported BOTEZAT's idea on the presence of two forms of red deer in the Carpathian region. According to GEIST (1998), European west (*C. elaphus elaphus*) and east (*C. elaphus maral*) types of red deer meet in the Balkans. Within this context, GEIST (1998) also discussed the so-called "cave stag", *Strongyloceros spelaeus* OWEN, 1846 from Western Europe, a Glacial Age wapiti that rivalled the size of the giant deer *Megaloceros giganteus* Blumenbach, 1799. GEIST (1998), taking in consideration PHILIPOWICZ's (1961) description of the Carpathian red deer, presumed that the largest European red deer with somewhat simplified smooth antlers (not pearled as in West European red deer) from the Carpathian Alpine meadows is a descent of the giant Glacial Age wapiti. Later, GEIST (2007) placed the Carpathian red deer in Central European subspecies *Cervus elaphus hippelaphus* KERR, 1792 [Sic! The authorship of subspecies *Cervus elaphus hippelaphus* belongs to ERXLEBEN (1777) who first applied this name for the red deer from Germany and Ardennes and gave its scientific description supplemented with synonymy and detailed bibliographic references. Later, KERR (1792) applied the species and subspecies name *Cervus elaphus hippelaphus* ("maned stag") with a reference to ERXLEBEN's (1777) work.].

The recently published results on genetic analysis of red deer populations from Western Eurasia bring new views on systematic position and taxonomical status of red deer from the Carpathian region. According to LUDT *et al.* (2004), the analysis of mtDNA cytochrome b sequence could not distinguish the red deer from the Balkan-Carpathian region from the red deer forms of Central and Western Europe. However, the study

of LUDT *et al.* (2004) confirmed the subspecies status of *C. elaphus barbarus* from North Africa, *C. elaphus maral* from the Caspian Region, and *C. elaphus bactrianus* and *C. elaphus yarkandensis* from Central Asia. All the mentioned subspecies and forms of red deer are included in the so-called Western group of red deer. KUZNETZOVA *et al.* (2007) confirmed that the molecular-genetic analysis of red deer from Eastern Europe did not support the validity of red deer subspecies *C. elaphus montanus* from the Balkan-Carpathian area and *C. elaphus brauneri* from Crimea as well as *C. elaphus maral* from North Caucasus. The genetic integrity of the Carpathian populations of red deer was confirmed through the haplotype distribution, private alleles and genetic distances (FEULNER *et al.* 2004). Therefore, the complicated ancestral pattern for Carpathian red deer suggested by Geist (1998) was not supported. SKOG *et al.* (2009) and ZACHOS & HARTL (2011) suggested that the modern Carpathian red deer had originated from the Balkan Late Glacial refugium. SKOG *et al.* (2009) also assumed that the Balkan Late Glacial refugium could extend further to the south-east (Turkey and Middle East). SOMMER *et al.* (2008) regarded Moldova (East Carpathian foothills) as a part of the East European Late Glacial refugium.

However, a certain caution is needed with the results of the genetic analysis. MICU *et al.* (2009) reported that the Austrian red deer with multi-tine crowns were introduced to Romania in the 19th and early 20th centuries in order to "improve" the quality of antlers of the local red deer race. Therefore, although the level of genetic introgression may be low, the modern populations of Carpathian red deer are not truly natural anymore (ZACHOS & HARTL 2011).

The taxonomic status and systematic position of the Carpathian red deer is complicated further by the fact that the previously published data on morphology of *Cervus elaphus* from the Carpathian Region are poor and quite superficial (ALMAŞAN *et al.* 1977; SARAIMAN & ŢARĂLUNGĂ 1978).

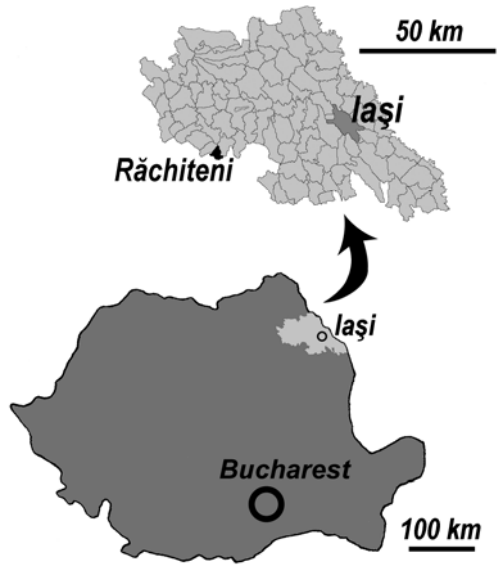

Fig. 1. Geographical location of the Răchiteni site, Iaşi County, Romania

In the context of the above-mentioned controversies, the new subfossil material of red deer from the Carpathian Region represents a special interest and may elucidate the systematic position of the aboriginal red deer forms. In the present work, we propose a morphological description of the well preserved antlered braincase from Holocene gravel deposits in Eastern Romania and a discussion on the systematic position of the original red deer from the Eastern Carpathian area.

Material and Methods

The studied specimen represents an antlered braincase with almost complete left antler and proximal part of the right antler. The specimen was discovered in a gravel pit located in the area of Răchiteni Village, Iasi County, north of the Roman town (Fig. 1). Most likely, the gravel deposits from Răchiteni are of Post-Glacial (Holocene) age (Paul TIBULEAC, personal communication). The cranial measurements are taken according to von den DRIESCH (1976). The antler measurements are taken following HEINTZ (1970). The terminology of antler morphology is according LISTER (1996).

Results

Systematics

Genus *Cervus* LINNAEUS, 1758

Cervus elaphus LINNAEUS, 1758

Cervus elaphus maral OGILBY, 1840

1898: *Cervus elaphus maral* OGILBY, 1840: LYDEKKER, p. 79.
1903: *Cervus vulgaris campestris* BOTEZAT, p. 154.
1903: *Cervus vulgaris montanus* BOTEZAT, p. 155.
1915: *Cervus elaphus* ssp.: LYDEKKER, p. 125.
1915: (?) *Cervus elaphus maral* OGILBY, 1840: LYDEKKER, p. 126.
1947: *Cervus elaphus montanus* BOTEZAT, 1903: HEPTNER & ZALKIN, p. 75.
1952: *Cervus elaphus elaphus* LINNAEUS, 1758: FLEROV, p. 261.
1956: *Cervus elaphus carpathicus* TATARINOV, p. 103.
1959: *Cervus elaphus elaphus* LINNAEUS, 1758: SOKOLOV, p. 216.
1977: *Cervus elaphus hippelaphus* ERXLEBEN, 1777: ALMASAN *et al.*, p. 17.
1997: *Cervus elaphus pannoniensis* BANWELL, p. 275.
2007: *Cervus elaphus hippelaphus* KERR, 1792: GEIST, p. 26.
2011: *Cervus pannoniensis* BANWELL, 1997: GROVES & GRUBB, p. 95.
2015: *Cervus elaphus montanus* BOTEZAT, 1903: SPASSOV *et al.*, p. 14.

Description

The antlered skull of red deer from Răchiteni belongs to a mature but not old male individual: its pedicles are rather short and robust (their height is significantly smaller than their diameter; Table 1, Fig. 2), the bone sutures of neurocranium are still visible but in some places (the area between pedicles) are completely obliterated and, therefore, indicate the fully mature age (MYSTKOWSKA 1966). We assume, therefore, that the antlers of the red deer from Răchiteni most probably attained their maximal development.

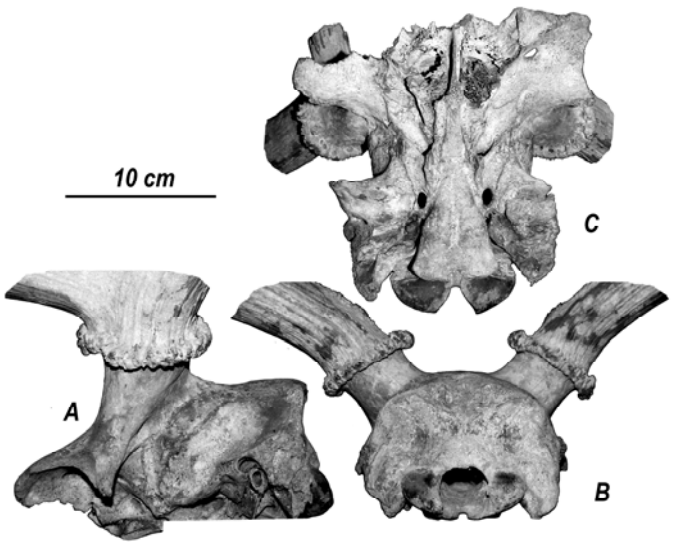

Fig. 2. *Cervus elaphus maral* OGILBY from Răchiteni: A, lateral view of the braincase; B, occipital view of the braincase; C basal view of the braincase.

The cranial measurements of the specimen suggest that the individual from Răchiteni was rather large, exceeding body size of modern red deer from Bialowieza Forest and Caucasus. The greatest breadth of the skull across orbits in males of *Cervus elaphus hippelaphus* from Bialowieza Forest (three individuals) range 165-181 mm; the breadth of occipital condyles ranges 72-76 mm (HEPTNER & ZALKIN 1947). The analogous measurements of males of *Cervus elaphus maral* from Caucasus (nine individuals) range 145-187 mm, and

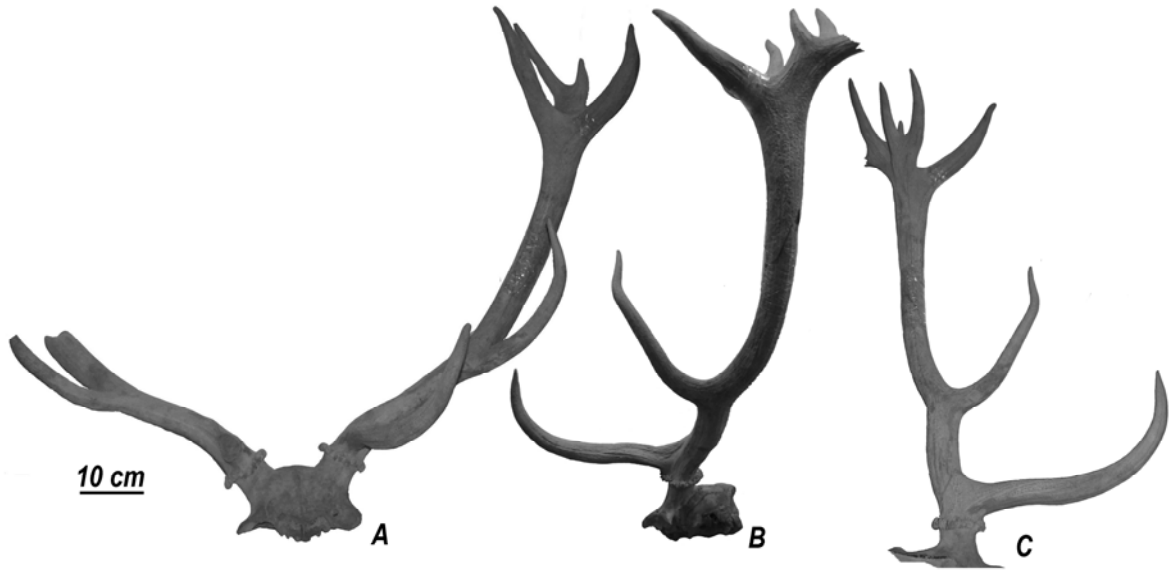

Fig. 3. *Cervus elaphus maral* OGILBY from Răchiteni: A, frontal view; B lateral view; C medial view of left antler.

from 67 mm to 80 mm, respectively (HEPTNER & ZALKIN 1947). The corresponding measurements of the skull from Răchiteni were greater than the measurements of the largest Caucasian stag reported by HEPTNER & ZALKIN (1947) with ca. 1 cm (the greatest breadth across the orbits and the breadth of occipital condyles were 198.0 mm and 87.8 mm, respectively).

The antlers from Răchiteni were characterized by a comparatively long curved brow (first) tine situated at a short distance from the burr, the missing bez (second) tine, and the rather long and strong trez (third) tine, which is, however, shorter than the brow tine (Table 2). The antler beam was somewhat bent toward the posterior at the level of trez tine insertion and after slightly arched acquiring the upright orientation in lateral view. The distal portion of antler formed a crown that consisted of six tines (Fig. 3). Therefore, the total number of antler tines amounted to eight. The crown of antler was formed by two transversely oriented forks, the additional prong and the apical tine (broken). The antler beam was curved towards the posterior in the area of distal crown and formed the pointed posterior axe of the crown, reminding the morphological pattern typical of the Caucasian and Caspian red deer *C. elaphus maral* (LYDEKKER 1915: 127, fig. 23). The antler surface was covered with a characteristic "pearling" specific for the so-called Western group of red deer (GEIST 1998).

Discussion

According to LYDEKKER (1898), the number of tines of *Cervus elaphus maral* seldom exceeded eight. GEIST (1998) described the antlers of Carpathian stags as large, heavy but poorly branched as compared to Western European red deer. LYDEKKER (1898) reported also a frequent poor development of bez tine in *Cervus elaphus maral*. According to LYDEKKER (1898), the bez tine was often much shorter than brow tine or even might be absent in the Carpathian red deer, as could be seen in the case of the specimen from Răchiteni.

The antlers of red deer from Prăjeşti (Siret Valley) described by SARAIMAN & ŢARĂLUNGĂ (1978) also show a rather weak bez tine, which is less developed than brow tine and much shorter than trez tine. The distal

crown in two better preserved larger antlers from Prăjeşti (SARAIMAN & ŢARĂLUNGĂ 1978: Pl. V, figs. 1, 2) is rather weak. It consists of four tines, of which the first crown tine is much distinct in the crown as in modern Caspian deer (see the description in LYDEKKER 1898). Therefore, the crown shape of red deer from Prăjeşti resembles the typical morphological condition seen in the Caucasian and Caspian red deer. The remains of red deer from Prăjeşti have been found together with a fragment of skull of *Bos primigenius*. SARAIMAN & ŢARĂLUNGĂ (1978) have suggested the Würmian age for the osteological remains from Prăjeşti.

SPASSOV *et al.* (2015) described from the Late Chalcolithic (4100-4500 BC) of North Bulgaria remains of a very large form of red deer that rivalled the size of Siberian maral *Cervus canadensis*. Besides the larger size, the subfossil red deer from Bulgaria was characterised by massive antler beams, a simplified antler crown and a relatively limited number of tines. This brief description generally corresponds to the characteristics of the Caucasian and Caspian red deer *Cervus elaphus maral* LYDEKKER, 1898, and suggests its close resemblance to the Romanian subfossil red deer. The larger size of the subfossil red deer, as compared to the modern forms from the same area, is explained by the long tradition of trophy hunting that has likely led to dwarfing of the populations of game species (SPASSOV *et al.* 2015).

Understanding the significance of the observed peculiarities of antler morphology of fossil and subfossil red deer from Eastern Romania and neighbouring countries, and their resemblance to the Caucasian and Caspian modern red deer, requires a discussion of already described taxa of red deer from Southeastern Europe. A conspicuously weak bez tine may be also noticed in the modern Crimean deer, which is often regarded as a true subspecies: *Cervus elaphus brauneri* CHARLEMAGNE, 1920. DANILKIN (1999: fig. 122-2) presented the antlered skull of Crimean red deer from the collection of the Zoological Museum of the Moscow State University that shows a very weak bez tine on the left antler and a missing bez tine on the right antler, while its distal crown reminds the morphological condition of *Cervus elaphus maral*.

The origin of the modern Crimean population is not clear and its taxonomic status is controversial. FLEROV (1952: 162) placed the Crimean stag in an informal group together with the Balkan and Carpathian red deer within the European subspecies *Cervus elaphus elaphus*, since, according to his opinion, the morphological peculiarities of the above mentioned populations are not taxonomically significant. SOKOLOV (1959: 219) also considered that the separation of the Crimean subspecies *brauneri* is not justified. Nonetheless, HEPTNER *et al.* (1988) believed that the Crimean deer represented a taxonomically independent form that occupied an intermediate position between the Carpathian and Caucasian red deer. DANILKIN (1999) regarded the Crimean population of red deer as a small-sized "insular" form of North-Caucasian red deer that was introduced in Crimea in the early 20th century. Finally, VOLOKH (2012) reported multiple and uncontrolled introductions of red deer individuals to Crimea at least from the times of the Crimean Khanate until very recent times. Therefore, the debates on the taxonomical status of the modern Crimean red deer become useless. LUDT *et al.* (2004) discovered that the modern red deer from Crimea belongs to the haplogroup of Western European red deer. However, this conclusion was based only on two modern specimens from Crimea. Obviously, the adequate results of genetic analysis could be obtained only from subfossil and archaeozoological remains. STANKOVIC *et al.* (2011) analysed the ancient DNA sequences of Late Pleistocene red deer from Crimea and revealed a very interesting fact: the Crimean Peninsula was colonized several times by various forms of red deer of different zoogeographic origin: the youngest form of red deer from Crimea (two specimens dated 33.100 ± 400 BP and 42.000 ± 1200 BP) are genetically close to *C. elaphus songaricus* from China, while the older specimen (>47,000 BP) is close to the Balkan populations of red deer. The origin of indigenous Holocene Crimean population of red deer still remains unclear. It is necessary to mention that the subfossil red deer from Crimea (early Iron Age,

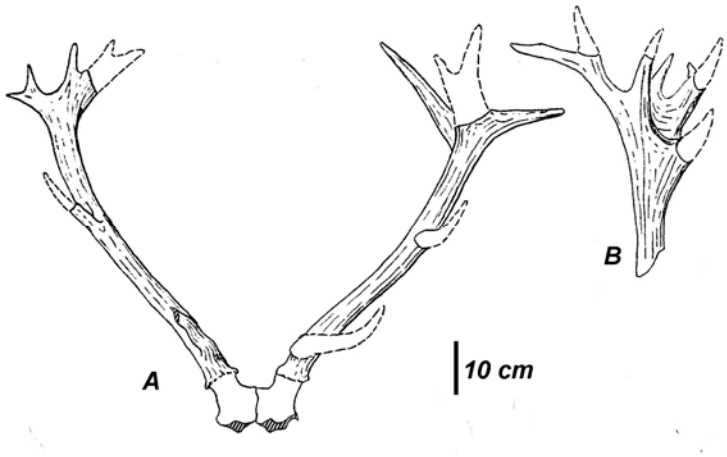

Fig. 4. *Cervus elaphus aretinus* AZZAROLI from the last interglacial phase of Val di Chiana, Italy (adapted from AZZAROLI 1961): A frontal view of antlered frontlet; B lateral view of antler crown.

settlement of Uch-Bash, Sevastopol) is characterised by a peculiar high frequency of primitive unmolarised lower fourth premolar (P_4), which distinguishes this population from *Cervus elaphus* of Western Europe (CROITOR, 2012).

The recently established new subspecies *Cervus elaphus pannoniensis* BANWELL, 1997 from the Middle Danube area also requires a special discussion here. Although BANWELL (1997, 1998) had the opportunity to see the red deer from Anatolia and the Balkan Peninsula, the description of his new subspecies was based only on morphological differences between the so-called Pannonian red deer and Western European ("Atlantic") *Cervus elaphus hippelaphus*, while a differential diagnosis between *Cervus elaphus pannoniensis* and *Cervus elaphus maral* and a comparison of these two subspecies were not provided. The antlered skull from Southern Hungary (displayed in the Chateau Chambord) presented by BANWELL (1997), should be considered as a type specimen (lectotype according to GROVES & GRUBB 2011). Its extremely large antlers bear additional long tines on its beams and crowns, well-developed both brow and bez tines and apparently represent an exceptional hunter's trophy specimen. BANWELL (1998) provides a good and very detailed morphological description of the Pannonian red deer, which are distinguished from the Western European forms, according to the description, by the larger size and elongated Roman-nosed face (obviously, these two characters are correlated), poorly developed mane, underdeveloped caudal disk, large antlers with poorly developed distal crown. Finally, as BANWELL (1997, 1998, 2002) reasonably noticed, the Pannonian red deer belongs to the Oriental "maraloid" type. The area of distribution of the new Pannonian subspecies includes, according to BANWELL (1998), Hungary, Romania, the Western Balkan states, Bulgaria, and may range until Crimea, Eastern Turkey and Iran. One can notice that the assumed area of distribution of BANWELL's subspecies broadly overlaps with the known area of distribution of *Cervus elaphus maral*. Although GROVES & GRUBB (2011) affirm that BANWELL has provided a set of characters (colour, spotting, mane and antlers) distinguishing *Cervus elaphus pannoniensis* from *Cervus elaphus maral*, such data are not available. The latter subspecies was ignored in BANWELL's (1994, 1997, 1998, 2002) publications. Therefore, taking in consideration the absence of distinguishing diagnostic characters and the overlapping of claimed areas of distribution, we regard *Cervus elaphus pannoniensis* BANWELL as a junior synonym of *Cervus elaphus maral* OGILBY.

Most probably, the studied fossil and sub-fossil Carpathian red deer are also closely related to *Cervus elaphus aretinus* AZZAROLI, 1961 from the last interglacial phase of Val di Chiana (Central Italy). The Italian fossil red deer is characterised by a presence of only one basal tine (the brow tine) and a massive distal crown, which, however, still resembles the *maral* type (Fig. 4). It is necessary to mention here the observed by BANWELL (1998, 2002) development of slight distal palmation in the so-called Pannonian red deer; in our opinion, this also makes it similar to *Cervus elaphus aretinus*. One of the authors of the present study

(CROITOR 2001, 2006) assumed in his previous publications that *Cervus elaphus aretinus* (or *Cervus aretinus*) represents a local archaic specialized form. However, the morphological resemblance between the fossil form *Cervus elaphus aretinus* and the modern *Cervus elaphus maral*, in our opinion, is obvious and one may not exclude that those two subspecies could be even synonymous. Another antlered fragment of skull that strongly reminds the morphology of *Cervus elaphus maral* is reported from the Late Pleistocene of Liguria (Le Prince, Italy; BARRAL & SIMONE 1968: 87, Figs. 14-1).

Apparently, the origin of the indigenous Carpathian red deer is linked to the Balkan-Anatolian-Caucasian glacial refugium (SOMMER *et al.* 2008; SKOG *et al.* 2009; MEIRI *et al.* 2013). The Italian *Cervus elaphus aretinus* could be very close also to the red deer form from the glacial refugium in Eastern Europe. The placement of the postglacial Carpathian red deer in the subspecies *Cervus elaphus maral*, according to our opinion, is supported by the reported in the present study antler morphology. Nonetheless, the history of the red deer from the Carpathian-Balkan area and the adjacent regions requires a more complex and extensive interdisciplinary research combining zoological, archaeozoological, palaeontological and genetic data in the future.

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References

ALMASAN H., E. ILIE & G. M. SCARLATESCU 1977. Date somatometrice la cerbul comun (*Cervus elaphus hippelaphus* ERXL.) din România. – *Analele ICAS (revista de silvicultură şi ştiinţele mediului*, **35** (1): 17-28.

AZZAROLI A. 1961. Il nanismo nei cervi insulari. – *Palaeontographia Italica*, **26**: 1-31, Pisa.

BANWELL B. D. 1994. The Pannonians – a Forgotten Race? – *Deer*, **9** (3): 164-166.

BANWELL B. D. 1997. The Pannonians – *Cervus elaphus pannoniensis* – a race apart. – *Deer*, **10** (5): 275-277.

BANWELL B. D. 1998. Identification of the Pannonian, or Danubian, Red Deer. – *Deer*, **10** (8): 495-497.

Banwell B. D. 2002. In defence of the Pannonian *Cervus elaphus pannoniensis*. – *Deer*, **12** (3): 198-203.

BARRAL L. & SIMONE S. 1968. Préhistoire de la Côte d'Azur orientale. Imprimerie nationale de Monaco. Monaco, 136 p.

BOTEZAT E. 1903. Gestaltung und Klassifikation der Geweihe des Edelhirsches, nebst einem Anhange über die Stärke der Karpathenhirsche und die zwei Rassen derselben. – *Gegenbaurs Morphologisches Jahrbuch*, **32**: 104-158.

CHARLEMAGNE N. 1920. Les Mammiferes de l'Oukraine. Court manuel de determination, collection et observation des mammiferes de l'Oukraine. Sous la redaction de M. l'Academicien M. KASTCHENKO. Kyiv, 35 p. (In Ukrainian).

CROITOR R. 2001. Functional morphology of small-sized deer from the early and middle Pleistocene of Italy: implication to the paleolandscape reconstruction. – In: G. CAVARRETTA, P. GIOIA, M. MUSSI & M. R. PALOMBO (Eds.): La Terra degli Elefanti, Proceedings of the First International Congress, Rome, 97-102.

CROITOR R. 2006. Early Pleistocene small-sized deer of Europe. – *Hellenic Journal of Geosciences*, **41**: 89-117.

CROITOR R. 2012. Archaeozoological assemblage from Uch-Bash settlement. – *Arheologia*, **2012** (1): 71-82. (In Ukrainian).

DANILKIN A. A. 1999. Deer (Cervidae). (Series: Mammals of Russia and adjacent regions). Moscow (Geos Publishing House), 552 p. (in Russian)

DRIESCH A. von den. 1976. A guide to the measurements to animal bones from archaeological sites. – *Peabody Museum Bulletin* (Harward University), 1-137.

ERXLEBEN J. C. P. 1777. Systema regni animalis per classes, ordines, genera, species, varietates cum synonymia et historia anialium. Göttingen, 636 p.

FEULNER P. G. D., W. BIELFELDT, F. E. ZACHOS, J. BRADVAROVIC, I. ECKERT & G. B. HARTL 2004. Mitochondrial DNA and microsatellite analyses of the genetic status of the presumed subspecies *Cervus elaphus montanus* (Carpathian red deer). – *Heredity*, **93**: 299-306.

FLEROV K. K. 1952. Musk deer and deer. The Fauna of USSR. Mammals, **1** (2). Moscow-Leningrad. 256 p. (in Russian).

GEIST V. 1998. Deer of the World: Their Evolution, Behaviour and Ecology. Mechanicsburg (Stackpole Books), 421 p.

GEIST V. 2007. Defining subspecies, invalid taxonomic tools, and the fate of the woodland caribou. – *Rangifer (special issue)*, **17**: 25-28.

GROVES C. & P. GRUBB 2011. Ungulate Taxonomy. Baltimore (John Hopkins University Press), 312 p.

GRUBB P. 2000. Valid and invalid nomenclature of living and fossil deer, Cervidae. – *Acta theriologica*, **45** (3): 289-307.

HEINTZ E. 1970. Les cervidés villafranchiens de France et d'Espagne. – *Mémoires du Muséum national d'histoire naturelle. Série C, Sciences de la terre*, **22** (1): 5-303 + (2) *Figures et tableaux*, 1-206.

HEPTNER V. G. & V. I. ZALKIN 1947. Deer of the USSR (Systematics and Zoogeography). – *Transactions on Study of Fauna and Flora of the USSR, the Moscow Society of Naturalists*, **10** (25): 1-176. (In Russian).

HEPTNER V. G., A. A. NASIMOVICH & A. G. BANNIKOV 1988. Artiodactyla and Perissodactyla. In: V. G. HEPTNER & N. P. NAUMOV (Eds.), R. S. HOFFMANN (English edition): Mammals of the Soviet Union, 1. Washington (Smithsonian Institution Libraries & The National Science Foundation), 1147 p.

KERR, R. 1792. The animal kingdom, or zoological system of the celebrated Sir Charles LINNAEUS. Edinburgh, 644 p.

KUZNETSOVA M. V., A. M. VOLOKH, V. I. DOMNICH, V. E. TYSHKEVITCH & A. A. DANILKIN 2007. Molecular Diversity of the Red Deer, *Cervus elaphus* (Cervidae), Inhabiting East Europe. – *Vestnik zoologii,* **41** (6): 505-509. (In Russian).

LISTER A. M. 1996. The Morphological Distinction Between Bones and Teeth of Fallow Deer (*Dama dama*) and Red Deer (*Cervus elaphus*). – *International Journal of Osteoarchaeology*, **6**: 119-143.

LUDT Ch., W. SCHROEDER, O. ROTTMANN & R. KUEHN 2004. Mitochondrial DNA phylogeography of red deer (*Cervus elaphus*). – *Molecular Phylogenetics and Evolution*, **31**: 1064-1083.

Lydekker R. 1898. Deer of all lands: A history of the family Cervidae living and extinct. London (Rowland Ward, Ltd.), 329 p.

Lydekker R. 1915. Catalogue of the ungulate mammals in the British Museum (Natural History). Vol. IV. Artiodactyla, Families Cervidae (Deer), Tragulidae (Chevrotains), Camelidae (Camels and Llamas), Suidae (Pigs and Peccaries), and Hippopotamidae (Hippopotamuses). London (Trustees of the British Museum), 438 p.

Markov G. 2014. Morphometric Variations in the Skull of the Red Deer (*Cervus elaphus* L.) in Bulgaria. – *Acta Zoologica Bulgarica*, **66** (4): 453-460.

Meiri, M., A. M. Lister, T. F. G. High am, J. R. Stewart, L. G. Straus, H. Obermaier, M. R. Gonzales Morales, A. B. Marin-Arroyo & I. Barnes 2013. Late-glacial recolonization and phylogeography of European red deer. – *Molecular Ecology*, **2013**: 1-12.

Micu I., A. Náhl ik, S. Neguş, I. Mihalache, & I. Szabó 2009. Ungulates and their management in Romania. In: M. Apoll onio, R. Andersen & R. J. Putman (eds.): European Ungulates and Their Management in the 21st Century. Cambridge (Cambridge University Press), 319-337.

Mystkowska E. 1966. Morphological Variability oi the Skull and Body Weight oi the Red Deer. – *Acta Theriologica*, **11** (5): 129-194.

Philipowicz I. 1961. Das Rotwild der Ostkarpaten. – *Zeitschrift für Jagdwissenschaft*, **7** (1): 1-18.

Polziehn R. O. & C. Strobeck 2002. A Phylogenetic Comparison of Red Deer and Wapiti Using Mitochondrial DNA. – *Molecular Phylogenetics and Evolution*, **22** (3): 342-356.

Saraiman A. & P. Ţarălungă 1978. Prezenţa speciilor *Bos primigenius* Boj. şi *Cervus elaphus* L., în terasa de 8-10 m a Siretului. – *Analele ştiinţifice ale Universităţii „Al. I. Cuza" din Iaşi (Serie nouă), secţiunea II*, **24**: 55-56.

Skog A., F. E. Zachos, E. K. Rueness , P. G. D. Feulner, A. Mysterud, R. Langvatn, R. Lorenzini, S. S. Hmwe, I. Lechoczky, B. Hartl, N. C. Stenseth & K. S. Jakobsen, 2009. Phylogeography of red deer (*Cervus elaphus*) in Europe. – *Journal of Biogeography*, **36**: 66-77.

Sokolov I. I. 1959. Hoofed animals (Orders Perissodactyla and Artiodactyla). Fauna of the USSR. Mammals, 1 (3). Moscow-Leningrad, 639 p. (In Russian).

Sommer R. S., F. E. Zachos, M. Street, O. Jöris, A. Skog & N. Benecke 2008. Late Quaternary distribution dynamics and phylogeography of the red deer (*Cervus elaphus*) in Europe. – *Quaternary Science Reviews*, **27** (7-8): 714-733.

Spassov N., N. Iliev, N. Karastoyanova & S. Chohadzhiev 2015. The Remains of Wild and Domestic Animals from the Late Chalcolithic Tell Settlement of Hotnitsa (Northern Bulgaria) – *Archaeologia Bulgarica*, **19** (2): 1-21.

Stankovic A., K. Doan, P. Mackiewicz, B. Ridush , M. Baca, R. Gromadka, P. Socha, P. Weglenski, A. Nadachowski & K. Stefaniak 2011. First ancient DNA sequences of the Late Pleistocene red deer (*Cervus elaphus*) from the Crimea, Ukraine. – *Quaternary International*, **245** (2): 262-267.

Tatarinov K. A. 1956. Mammals of Western Regions of Ukraine. Kyiv (Academy of Sciences of Ukrainian SSR), 188 p. (In Ukrainian).

Volokh A. M. 2012. Introduction of game animals in Crimea and its results. *Vestnik Ohotovedenia*, **9** (2): 237-252.

Zachos F. E., M. Apoll onio, E. V. Barmann, M. Festa-Bianchet, U. Gohl ich, J. C. Habel, E. Haring, L. Kruckenhauser, S. Lovari, A. D. McDevitt, C. Pertoldi, G. E. Rössner, M. R. Sanchez-Vill agra, M. Scandura & F. Suchentrunk 2013. Species inflation and taxonomic artefacts – A critical comment on recent trends in mammalian classification. – *Mammalian Biology*, **78**: 1-6.

Zachos F. E. & G. B. Hartl 2011. Phylogeography, population genetics and conservation of the European red deer *Cervus elaphus*. – *Mammal Review*, **41** (2): 138-150.

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Table 1. Measurements of the skull of *Cervus elaphus maral* OGILBY from Răchiteni (measurements are numbered according to von den Driesch 1976: fig. 11).

Measurements	**mm**	**notes**
dorsal view		
(10) Median frontal length	198.0	incompletely preserved
(11) Lambda – Nasion	152.0	incompletely preserved
(31) Least frontal breadth	178.0	orbits incompletely preserved
(32) Greatest breadth across the orbits	198.0	orbits incompletely preserved
(41) distal circumference of the burr	211.0	in both antlers
Distance between antler burrs	79.8	
Distance between pedicles and nucal crest	113.0	
lateral view		
(38) basion – the highest point of the superior nuchal crest	97.0	
(40) proximal circumference of the burr	190.0	
bazal view		
(6) basicranial axis	130.0	basicranium length
	91.0	taken from the visible suture to the posterior edge
(26) Greatest breadth of occipital condyles	87.8	
(28) Greatest breadth of the foramen magnum	35.4	
(27) Greatest breadth at the bases of the paraoccipital processes	158.0	incompletely preserved

Table 2. Measurements of the antlers of *Cervus elaphus maral* OGILBY from Răchiteni.

Measurements	***sin*, mm**	***dx*, mm**
Height of the pedicle	30.0	30.0
Diameter of the pedicle	56.6	52.9
Diameter of the burr	84.5	85.5
Heigth of the first ramification (brow tine)	70.5	67.8
Distance between the brow and the trez tines	254.0	215.0
Height of the second ramification (trez tine)	497.0	
Distance between the burr and the antler tip	894.0	
Length of the antler	1120.0	
Length of the brow tine	420.0	
Length of the threz tine	332.0	