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VERTEBRATE FAUNA AT THE NEOLITHIC AND ENEOLITHIC SITES IN VOJVODINA (SERBIA)

ABSTRACT: Based on current research results, a total of 40 vertebrate species from 4 classes have been registered at 10 archaeological sites from the **Neolithic period** in Vojvodina (Serbia). The most numerous one is the mammal class (Mammalia) with 25 species, then bird class (Aves) with 9 species, osteichthyes (Osteichthyes) are represented by 5 species, while reptiles (Reptilia) are the poorest class with only one species. For the **Eneolithic period**, at 7 archaeological sites, a total of 11 species members of Mammalia class have been registered.

KEYWORDS: Archaeological sites, Neolithic period, Eneolithic period, vertebrate fauna, Vojvodina (Serbia)

INTRODUCTION

Over the past eighty years or so, archaeozoological researches of various periods have been done at dozens of sites in Vojvodina. The collected sample is immense, and it predominantly consists of vertebrate bones (Vertebrata), seashells and snail shells (Mollusca). The paper shows data from 10 sites from the **Neolithic** and 7 sites from the **Eneolithic period**. Bones were collected for the first time in 1932 at **Starčevo** Neolithic site, where the research continued between 1969 and 1970 [Clason, 1980]. Sites **Nosa-Biserna Obala**, where works started in 1957 [Bórkönyi, 1974], and **Ludaš-Budžak** where the archaeological digs were done in 1965 [Bórkönyi, 1974] also belong to this period. **Golokut** near Vizić was researched in 1973 and 1976 [Blažić, 1984], and **Donja Branjevina** near Deronje in 1987 [Blažić, 1992a]. Osteological

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materials at multilayered **Gomolava** archaeological site, where the digs initially started in 1953 [Petrović, 1984], have been systematically collected since 1971. There are 4 and 6 sites from the **Neolithic** and **Eneolithic period** respectively along the highway through Srem (Neolithic sites: **Malo Kuvalovo-Krnješevci**, **Prosine-Pećinci**, **Zlatara-Ruma** and **Kudoš-Šašinci**, and Eneolithic sites: **Zlatara-Ruma**, **Žirovac-Ruma**, **Kudoš-Šašinci**, **Livade-Sremska Mitrovica**, **Mitrovačke livade-Sremska Mitrovica** and **Erem-Sremska Mitrovica**) [Blažić, 1992b].

Faunal communities, which have been successively changing in the territory of Vojvodina during the Pleistocene and the early Holocene, are indicators of climatic conditions. They help the reconstruction of environments and are significant for studying periods and human cultures [Nedeljković, 1993]. Current thorough archaeozoological researches in the territory of Vojvodina show that present fauna is just the remnant of a far richer fauna from the early Holocene.

MATERIAL AND METHODS

This paper shows results of the vertebrate (Vertebrata) fauna research from 10 archaeological sites in Vojvodina from the **Neolithic** and 7 sites from the **Eneolithic period** (Map 1). Osteological material comes from the settlements and necropoleis. Determination has been done according to the keys by Driesch [1976], Schmid [1972] and comparative osteological collections.

RESULTS AND DISCUSSION

The period that the collected and processed material from archaeological sites in Vojvodina originates from, is divided into nine phases, of which the **Neolithic** (6000–3200 BC) and the **Eneolithic period** (3200–2000 BC) can be singled out. The most important archaeological site in Vojvodina is **Gomolava-Hrtkovci**, where eight cultural layers have been recorded. For the purposes of this paper, the following periods receive special attention: **late Neolithic – early Eneolithic** (3800–3400 BC) (marked with “I” in the text); **middle Eneolithic** (3400–2800 BC) and **late Eneolithic** (2800–2000 BC) [Petrović, 1984]. The second and third layer in this paper are marked with “II–III”.

Map 1. Map of Vojvodina with marked sites (1–14) with dating given for each site (I for the Neolithic and II–III for the Eneolithic).

1. Gomolava-Hrtkovci (I, II–III), 2. Golokut-Vizić (I), 3. Donja Branjevina-Deronje (I), 4. Nosa-Biserna obala (I), 5. Ludaš-Budžak (I), 6. Starčevo (I), 7. Malo Kupalovo-Krnješevci (I), 8. Prosine-Pećinci (I), 9. Zlatara-Ruma (I, II–III), 10. Žirovac-Ruma (II–III); 11. Kudoš-Šašinci (I, II–III); 12. Livade-Sremska Mitrovica (II–III); 13. Mitrovačke livade-Sremska Mitrovica (II–III); 14. Erem-Sremska Mitrovica (II–III)



Based on current research results, a total of 40 vertebrate species from 4 classes have been registered at 10 archaeological sites in Vojvodina (Serbia) from the **Neolithic period**. The most numerous one is the mammal class (Mammalia) with 25 species classified in 5 orders, of which Carnivora and Artiodactyla are present with 10 and 8 species respectively. Bird class (Aves) is represented by 9 species classified into 4 orders, while from the Accipitriformes order determination could be done only to genus. Osteichthyes (Osteichthyes) are present with 5 species classified into 3 orders, while reptiles (Reptilia) are the poorest class with only one species (Table 1).

Table 1. Fauna of some archaeological sites in Vojvodina during the Neolithic (I) and Eneolithic (II–III)

TAXON	DATING	SITE AND AUTHOR
Classis MAMMALIA		
Ordo Rodentia		
<i>Castor fiber</i> L. 1758	I	1[2],[14]; 3[3]; 5[9]; 6[15]
Ordo Lagomorpha		
<i>Lepus europaeus</i> Pall. 1778	I II–III	1[2],[14]; 2[1]; 3[3]; 4[9]; 5[9]; 9[4] 11[4]
<i>Lepus capensis</i> L. 1758	I	1[2],[14]
Ordo Carnivora		
<i>Canis familiaris</i> L.	I II–III	1[2],[14]; 2[1]; 3[3]; 5[9]; 6[15]; 7,9[4] 1[2]; 9,11[4]
<i>Canis lupus</i> L. 1758	I	1[2],[14]; 2[1]; 5[9]; 6[15]
<i>Vulpes vulpes</i> (L. 1758)	I	1[2],[14]; 3[3]; 5[9]; 6[15]; 9[4]
<i>Ursus arctos</i> L. 1758	I	1[2],[14]; 6[15]
<i>Mustela nivalis</i> L. 1766	I	1[2],[14]
<i>Martes martes</i> (L. 1758)	I	3[3]; 9[4]
<i>Meles meles</i> (L. 1758)	I	1[2],[14]; 4[9]; 5[9]; 6[15]
<i>Lutra lutra</i> (L. 1758)	I	1[2],[14]; 3[3]; 6[15]
<i>Felis silvestris</i> Schreber 1777	I	1[2],[14]; 5[9]; 6[15]
<i>Lynx lynx</i> (L. 1758)	I	1[2],[14]
Ordo Perissodactyla		
<i>Equus hydruntinus</i> Regalia 1907	I	4[9]; 5[9]; 6[15]
<i>Equus ferus</i> Boddaert 1785	I	1[2],[14]
<i>Equus przewalski</i> Poliakov, 1881	I	6[15]
<i>Equus caballus</i> L. 1758	I II–III	1[2],[14] 11,14[4]
Ordo Artiodactyla		
<i>Sus scrofa domestica</i> L. 1758	I II–III	1[2],[14]; 2[1]; 3[3]; 5[9]; 6[15]; 7,8,9[4] 1[2]; 9-14[4]
<i>Sus scrofa</i> L. 1758	I II–III	1[2],[14]; 2[1]; 3[3]; 4[9]; 5[9]; 6[15]; 9,11[4] 1[2]; 10,11,14[4]
<i>Sus</i> sp.	I	1[2],[14]; 6[15]
<i>Cervus elaphus</i> L. 1758	I III–III	1[2],[14]; 2[1]; 3[3]; 4[9]; 5[9]; 6[15]; 7,8,9[4] 1[2]; 9,10,11,13,14[4]

<i>Capreolus capreolus</i> (L. 1758)	I II–III	1[2],[14]; 2[1]; 3[3]; 4[9]; 5[9]; 6[15]; 7,8,9[4] 1[2]; 9,13[4]
<i>Bos taurus</i> L.	I II–III	1[2],[14]; 2[1]; 3[3]; 4[9]; 5[9]; 6[15]; 7,8,9,11[4] 1[2]; 9–14 [4]
<i>Bos primigenius</i> (Bojanus 1827)	I II–III	1[2],[14]; 2[1]; 3[3]; 4[9]; 5[9]; 6[15] 10,11[4]
Bos sp.	I	6 [15]
<i>Ovis aries</i> L. 1758	I II–III	1[2],[14]; 2[1]; 3[3]; 4[9]; 5[9]; 6[15]; 7,9,11[4] 1[2]; 9–14 [4]
<i>Capra hircus</i> L.1758	I II–III	1[2],[14]; 2[1]; 3[3]; 4[9]; 5[9]; 6[15]; 7,9,11[4] 1[2]; 9–14 [4]
Classis AVES		
Ordo Anseriformes		
<i>Anas clypeata</i> L. 1758	I	6[15]
<i>Anser anser</i> (L. 1758)	I	1[2],[14]; 6[15]
<i>Anser fabalis</i> (Latham 1787)	I	6[15]
<i>Cygnus olor</i> (Gmelin 1789)	I	6[15]
<i>Cygnus cygnus</i> (L. 1758)	I	6[15]
Ordo Accipitriformes		
Milvus sp.	I	6[15]
Aquila sp.	I	6[15]
Circus sp.	I	6[15]
Ordo Galliformes		
<i>Gallus domesticus</i> (L. 1758)	I	6[15]
Ordo Gruiformes		
<i>Grus grus</i> (L. 1758)	I	6[15]
<i>Otis tarda</i> L. 1758	I	3[3]; 4[9]; 6[15]
Ordo Charadriiformes		
<i>Numenius arquata</i> (L. 1758)	I	6[15]
Classis REPTILIA		
Ordo Testudines		
<i>Emys orbicularis</i> (L. 1758)	I	1[2],[14]; 3[3]; 5[9]
Classis OSTEICHTHYS		
Ordo Salmoniformes		
<i>Esox lucius</i> L. 1758	I	1[2],[14]; 3[3]; 5[9]; 6[15]

Ordo Cypriniformes		
<i>Aspius aspius</i> (L. 1758)	I	6[15]
<i>Abramis brama</i> (L. 1758)	I	6[15]
<i>Cyprinus carpio</i> L. 1758	I	1[2],[14]; 3[3]; 5[9]; 6[15]
Ordo Siluriformes		
<i>Silurus glanis</i> L. 1758	I	1[2],[14]; 3[3]; 5[9]; 6[15]

N.B. The number in the square brackets is the reference number; the number outside the square brackets is the site number

After the analysis of the fauna at archaeological sites, it can be concluded that, when it comes to mammals, the most diverse fauna is at **Gomolava** (site no. 1) where 22 species of this class have been registered, together with only one bird species, one reptile species and 3 fish species [Clason, 1979^[14]; Blažić, 1986^[2]]. The next in line is **Starčevo** (site no. 6) where 18 mammal species, 9 bird species (which is the greatest diversity of this vertebrate class at the Neolithic sites in Vojvodina) and 5 fish species have been registered [Clason, 1980^[15]]. Similar situation is at **Donja Branjevina** (site no. 3) where 14 mammal species, 3 fish species, one reptile species and one bird species have been registered [Blažić, 1992a^[3]]. With 16 mammal species, 3 fish species and one reptile species, **Ludaš-Budžak** (site no. 5) is not far behind [Bőkönyi, 1974^[9]]. At **Golokut** (site no. 2), as well as at sites along highway though Srem: **Malo Kivalovo-Krnješevci** (site no. 7), **Prosine-Pećinci** (site no. 8), **Zlatara-Ruma** (site no. 9) and **Kudoš-Šašinci** (site no. 11) only mammals have been registered, while the greatest number of species (11) has been recorded at **Golokut** and **Zlatara** [Blažić, 1984^[1]; 1992b^[14]] (Table 1).

Bos taurus is the only species present at all ten above-mentioned sites from the Neolithic period. The proportion of this species in mammal fauna at several Neolithic sites in Romania is over 50% and its presence in relation to domesticated mammal species is over 70% [Stanc et al., 2010]. Domination of ox is also discussed by Blažić et Radmanović [2011] in Kolubara basin in Serbia. As opposed to these findings, for domestic species, beside *Bos taurus*, Susi [2007] also mentions *Canis familiaris*, *Ovis aries*, *Capra hircus* and *Sus scrofa domestica* present at several Neolithic sites in the territory of Romanian Banat and Transylvania.

The aforementioned composition of wild fauna is, above all, a result of the fact that at the end of the Pleistocene and the beginning of the Holocene there was a **drastic climactic changes** that affected flora and fauna of Europe [Sommer et Benecke, 2006], and therefore of the Pannonian Plain. The climactic changes were the aftermath of lowering of glaciers all the way to Pannonian Plain and their subsequent retreat. During the glacial (Günz, Mindel,

Riss, Würm) Pannonia was almost completely surrounded by glaciers. Melt downs occurred in certain time intervals when interglacial periods appeared (Günz/Mindel, Mindel/Riss, Riss/ Würm) and when glaciers retreated far to the north [Nedeljković, 1993]. As it can be seen from the Table 1, at Gomolava, Donja Branjevina, Nosa-Biserna Obala, Ludaš-Budžak, Starčevo and Zlatara sites, the presence of the following species has been registered: *Meles meles*, *Martes martes*, *Mustela nivalis* and *Lutra lutra* (Carnivora order). This is very significant because, after the last glaciation, the populations of the first three species were separated in Iberian, Italian and Balkan peninsula, and the species *Lutra lutra* is considered to be the Holocene immigrant. *Felis silvestris* also re-colonised Europe during the last glaciation from the above-mentioned refugiums [Sommer et Benecke, 2004; 2006]. *Cervus elaphus* appeared in the territory of Serbia during the Riss/Würm interglacial. It continued to exist in the Holocene, therefore it frequently occurred at archaeological sites in Vojvodina, mostly because it was an important game. *Bos primigenius* is a form of Bison typical for a warmer climate, and it appeared in the Pleistocene (Würm) inter-stages. It was also widespread during the Holocene [Nedeljković, 1993]. *Equus hydruntinus* survived climactic changes at the end of the Pleistocene and came to the fore at the beginning of the Neolithic, characterising thus the wild fauna of the Kőröš culture (Nosa-Biserna obala and Ludaš-Budžak) [Lazić, 1988].

Characteristics of sites also affect the fauna composition. **Gomolava** was erected on the Sava River left bank [Petrović, 1984]. During the middle Neolithic, the area around this site, as well as the Fruška Gora Mountain, were covered in mixed deciduous oak forests in which there were small glades covered with grass and underbrush. Apart from this, there was also a wetland area in the old abandoned branch of the Sava River. This environment affected the richness of the vertebrate fauna [Classon, 1979]. Remains of wild animals from the archaeological site **Golokut**, to a certain extent, also represent the image of fauna of the Fruška Gora Mountain, which has been changed today [Blažić, 1984]. In the flat part of Srem, between southern slopes of the Fruška Gora Mountain and Sava River, in fertile plain rich in water streams, the following archaeological sites are located: **Malo Kupalovo**, **Prosine**, **Zlatara** and **Kudoš**. In the natural environment that offered good life conditions, flora and fauna were rich [Blažić, 1992b]. Settlement **Starčevo** was on the old Danube bank, at the border of river valley near Pančevo [Classon, 1980]. In prehistoric times, river valley was a wetland, intersected with meanders, streams and marshes overgrown with reed. The valley was most likely combination of forests and open areas. The river was much closer to the settlement than it is today. *Cervus elaphus*, *Sus scrofa* and *Bos taurus* are the signs of the forest-steppe surroundings of the site, while the remaining wild species are the signs of a wetland terrain [Lazić, 1988]. **Donja Branjevina** site is characteried by

the vicinity of the Danube, rich forests, and low banks with wetland habitats [Blažić, 1992a]. In the northern part of Vojvodina there are **Nosa-Biserna Obala** and **Ludaš-Budžak** Neolithic sites, where first proofs of ox domestication have been found [Bőkőnyi, 1974]. The presence of *Equus hydruntinus* and *Capreolus capreolus* at Nosa-Biserna Obala site are signs of the forest-steppe surroundings of the site.

Apart from the climactic changes and characteristics of the areas, fauna composition of the archaeological sites from the Neolithic period was also influenced by the fact that the basic characteristics of this period were the economy based on agriculture and animal husbandry, as well as the beginning of the animal domestication process [Blažić, 1997]. It can be stated that domestic species have been regularly found at corresponding sites in Pannonia and South-Eastern Europe. Concerning the wild species, there are certain differences between the sites in Vojvodina, other regions in Serbia, as well as neighbouring countries. Bőkőnyi [1974], at Polgar-Csőszhalom site in Hungary, apart from the species registered in Serbia, lists also findings of *Ardea purpurea* and *Bubo bubo*, and at Rösztke-Lúdvár site 9 more bird species not registered in Vojvodina. The same author drew attention to the Rebensteiner Mauer site in Austria from the same period, where the presence of *Erinaceus europaeus* and *Sciurus vulgaris* has been registered. In comparison with Neolithic sites of Crkvine and Belež in Kolubara basin [Blažić and Radmanović, 2011] and Divostin near Kragujevac in Serbia [Bőkőnyi, 1988], then Anza near Štip in FYR Macedonia [Bőkőnyi, 1976], Obre I and Obre II near Kakanj in Bosnia [Bőkőnyi, 1977] and Sitagroi in Greece [Bőkőnyi, 1986], greater diversity of vertebrate fauna has been registered at sites in Vojvodina from the same period. Nevertheless, it should be stated that, in comparison with the last-mentioned site, mammals *Rupicapra rupicapra*, *Dama* sp. and *Erinaceus europaeus*, and bird species *Anas platyrhynchos*, *Mergus merganser* and *Coturnix coturnix* have not been registered in Vojvodina. Absence of *Gyps fulvus* in Vojvodina is in relation with the zoogeographical distribution of these species. In comparison with Obre I site, squirrel - *Sciurus vulgaris* has not been registered in Vojvodina. The absence of *Rupicapra rupicapra* in Vojvodina has been registered when compared with the Neolithic sites of Lepenski Vir III [Bőkőnyi, 1969] and Padina [Clason, 1980], while at Padina *Erinaceus europaeus* has also been present, as well as a greater number of bird species. In comparison with Petnica site, where only mammals have been registered [Greenfield, 1986], there is a greater diversity of this vertebrate class in Vojvodina. Vertebrate fauna of the Neolithic sites in Vojvodina does not significantly differ from the fauna of Vinča-Belo Brdo site [Dimitrijević, 2006], noting that *Lutra lutra* has not been registered in Vojvodina.

These differences were caused by geographical location, habitat conditions, social-economic organisation of settlements, and span of archaeological research.

From the **Eneolithic period**, at 7 archaeological sites, a total of 11 species members of Mammalia class classified into 4 orders have been registered. The greatest number of species (8) belongs to the Artiodactyla order (Table 1). The number of species goes from 4 at **Livade**-Sremska Mitrovica (site no. 12) to 10 at **Kudoš** (site no. 11) [Blažić, 1992b^[4]]. *Bos taurus*, which dominated animal husbandry in this period, is present at all sites [Blažić, 1997], and apart from this species, *Sus scrofa domestica*, *Ovis aries* and *Capra hircus* are also present (Table 1). After comparing findings from the territory of Vojvodina with neighbouring countries, it can be stated that significant diversity of ornithofauna has been recorded at two sites in south-east Romania and at several sites in Bulgaria dating from the Eneolithic period [Gal et Kessler, 2002; Boev, 1993], while at Bodrogszadány archaeological site in Hungary, Bőkőnyi [1974] also registered *Esox lucius*. In contrast to these statements, vertebrate fauna of the Eneolithic sites in Vojvodina is almost identical to the one at the sites from the same period in the territory of Romania, also mentioned by Susi [1983]. However, in relation to the statements by this author from 1993, regarding the Eneolithic sites in Romania, there have been no *Meles meles*, *Martes martes*, *Ursus arctos*, *Vulpes vulpes*, *Canis lupus*, *Lynx lynx* and *Castor fiber* in Serbia.

The above-mentioned differences are most likely caused by the research span.

CONCLUSIONS

Based on current research results from 10 archaeological sites in Vojvodina (Serbia) from the **Neolithic** and 7 sites from the **Eneolithic period**, the following can be concluded:

- 40 vertebrate species belonging to 4 classes have been registered from the **Neolithic period**. The most numerous one is the mammal class (Mammalia) with 25 species, then bird class (Aves) with 9 species, osteichthyes (Osteichthyes) are present with 5 species, while the poorest class is reptiles (Reptilia) with only one species.
- From the **Eneolithic period**, a total of 11 species members of Mammalia class have been registered.
- The most diverse vertebrate fauna from the **Neolithic period** is at Gomolava, while the greatest diversity of birds has been recorded at Starčevo.
- *Bos taurus* is the only species present at all 10 above-mentioned sites from the **Neolithic period**.
- From the **Eneolithic period**, at all 7 sites, the following species have been registered: *Bos taurus*, *Sus scrofa domestica*, *Ovis aries* and *Capra hircus*.

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ФАУНА КИЧМЕЊАКА НЕОЛИТСКИХ И ЕНЕОЛИТСКИХ ЛОКАЛИТЕТА У ВОЈВОДИНИ (СРБИЈА)

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САЖЕТАК: На основу досадашњих резултата истраживања, са 10 археолошких локалитета из неолита у Војводини (Србија), детерминисано је укупно 40 врста кичмењака припадника четири класе. Најбројнија је класа sisara (Mammalia) са 25 врста, следи класа птица (Aves) са девет врста, класа кошљориба (Osteichthyes) са пет врста, док је најсиромашнија класа гмизаваца (Reptilia) са само једном врстом. У периоду енеолита на седам археолошких локалитета регистровано је укупно 11 врста припадника класе sisara (Mammalia). У неолиту фауна sisara најразноврснија је на Гомолави, док је највећи диверзитет птица забележен на локалитету Старчево.

На свих 10 приказаних локалитета из периода неолита присутан је једино *Bos taurus*. У енеолиту на свих седам локалитета регистровани су: *Bos taurus*, *Sus scrofa domestica*, *Ovis aries* и *Capra hircus*.

КЉУЧНЕ РЕЧИ: Археолошки локалитети, фауна кичмењака, енеолит, неолит, Војводина (Србија)