

THE QUATERNARY FAUNA OF THE VERTEBRATES OF CAVES FROM DOLINA WODĄCA (KRAKÓW-CZĘSTOCHOWA UPLAND, POLAND)

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ABSTRACT

There were found some traces of a multicultural and polyphase settlement from the beginning of the Odra glaciation (Saale) (before 240 000 B. P.) to Middle Ages in sediments of caves located in the middle part of Jura Krakowsko-Częstochowska. In Poland these are the oldest middle Palaeolithic cave cultural levels with the rich fauna embracing more than seventy species of the vertebrates. Multidisciplinary research, including archaeology, geology, palaeozoology, speleology, reconstructed the settlement and changes of natural environment lasting for the last 250 000 years. This palaeological analysis enabled to study long-lasting environmental changes which consisted of series of sediments accumulated in the periods when the climate got sharpened and there appeared animals connected with the tundra and steppe-tundra environment as the periods of warming up with the supremacy of the forest fauna. It is worthy of notice that there were found numerous devices made of bone and lithic artefacts as well as a middle Palaeolithic construction of place to live and to work antlers.

INTRODUCTION

Dolina Wodąca is situated in the central part of Krakowsko-Częstochowska Upland. It was created in rocky limestone of Upper Oxford. This currently dry valley is 3,8 km long and the height of rocks reaches 100 meters. It is known that there are approximately 60 caves and their length ranges from 3 to 155 meters. Their bigger part are 10 - meter-long shelters. The typical thing for them are rich, loamy sediments with an addition of limestone debris or humus, containing traces of human being's presence from the Stone Age to the modern times. (CYREK, 1992, 1994, 1998, 1999, CYREK et al., 1999, KOWALSKI, 1951, MUZOLF et al., 1999, WISZNIOWSKA, 1998.)

There are numerous groups of rocks there and the most interesting of them are: Zegarowe Rocks with the following caves: Zegar, Jasna, and Pośrednia and Biśnik Rock with Biśnik Cave and adjoining shelters. Undoubtedly these caves were used by a man in the past because there can be found silex, parts of clay utensils and plentiful of antediluvian animals bones, remains of skeletons, fragments of a cinerary urn as well as sharpened silex. (KOWALSKI, 1951, SZALEREWICZ & GÓRNY, 1986, WISZNIOWSKA, 1998). This source is likely to refer to Zegar Cave.

In the nineties intensive studies have been initiated in order to learn about sediments, remains of animals and traces of a human presence in Wodąca Valley. At first sediments of Biśnik Cave, located at the bottom of Wodąca Valley, were examined. After that the complex of Zegarowe Rocks was explored.

This research delivered plenty of vertebrates' bony remains. Among them the most plentiful ones belonged to mammals and birds. (Tab. 1)

In this examined material, coming from the exploration of sediments from various caves, the presence of remains belonged to 46 species of mammals and 24 species of birds was discovered.

The groups of animals, discovered in particular series of sediments, were paleoecologically analysed in order to show changes in a composition of the fauna during a deposition of singled out levels and sequences of climatic changes recorded as quality and quantity changes of particular groups.

The following ecological groups of species were singled

out: steppe – tundra (the term used only in a context of Pleistocene), eurytopic and forest-dwelling ones. Species, living close to reservoirs, were singled out separately, as species having always been connected with water. A group containing domesticated animals also appeared in the latest series of sediments.

A dominant species in a group of big mammals was a cave bear and the bony remains of tiny mammals were represented by creatures liking cold temperatures (steppe pikas, arctic lemmings, narrow skulled voles). Among birds the grouse family dominated with such species as: a willow grouse, rock grouse and wood grouse. A percentage of other animals was much less and differentiated in separated levels.

This faunistic class, containing representatives of the mentioned above ecological groups, includes a lot of creatures (30 species), living presently in the moderate zone, connected with meadows, forests (for example thrushes, owls, hawfinches, fat dormice, bank voles, European pine voles, European lynxes, wild boars, red deer, roe deer) (BOCHEŃSKI, 1974, COBERT, 1978, MADEYSKA, 1981, NADACHOWSKI, 1982), and as well as tundra and taiga - typical for the north areas of Europe and Asia (14 species) (BOCHEŃSKI, 1974, COBERT, 1978, NADACHOWSKI, 1982). Out of the hoofed there were reindeers and musk oxen which currently lives in the area of north Eurasia and America. Out of the leporine – mountain hares, out of the rodents – arctic lemmings, Norway lemmings and narrow skulled voles, out of the grouse - birds. Except from the mentioned above species connected with arctic tundra there also lived units of classification connected with the steppe, grassy flora, like wild horses, steppe pikas, common hamsters, narrow skulled voles (KOWALSKI, 1959, NADACHOWSKI, 1982). The other recognised mammals were carnivorous ones living also today and being able to get used to various surroundings.

Apart from them there were also found 7 extinct species of mammals in this analysed class, such as: a cave bear, cave lion, cave hyena, woolly rhinoceros, Irish elk, steppe bison, aurochs, (Tab. 1) (KOWALSKI, 1959).

Tab. 1 The list of species of mammals and birds from the quaternary sediments of the caves from Wodąca Valley.

Mammals		Locality		Birds		Locality	
	Eurytopic species				Eurytopic species		
1	Sorex araneus L.	B, Z	●		Pica pica (L.)	B	●
2	Myotis cf. mystacinus (K.)	B	●		Steppe-tundra species		
3	Microtus arvalis (P.)	B, Z, J	●		Lagopus lagopus (L.)	B, J	○
4	Microtus agrestis (L.)	B, Z	●		Lagopus mutus (M.)	B	○
5	Pitymys subterraneus (d. S-L.)	B	●		Forest-dwelling species		
6	Vulpes vulpes (L.)	B, Z	●		Tetrao urogallus L.	B, J	●
7	Canis lupus L.	B, Z	●		Lyrurus tetrix (L.)	B, J	●
8	Ursus spelaeus R.	B, Z, S	⊕		Strix aluco L.	B, J	●
9	Crocota crocuta spelaea (G.)	B, Z	⊕		Asio otus (L.)	B	●
10	Panthera leo spelaea (G.)	B, Z	⊕		Turdus torquatus L.	B	●
11	Mustela putorius L.	B	●		Turdus iliacus L.	B	●
12	Mustela erminea L.	B	●		Turdus philomelos C. L. B.	B	●
13	Mustela nivalis L.	B	●		Falco tinunculus L.	B	●
	Steppe-tundra species				Corvus monedula L.	B	●
14	Dicrostonyx gulielmi (S.)	B, Z, S, J	○		Garrulus glandarius (L.)	B	●
15	Lemmus lemmus (L.)	B, Z, S, J	○		Scolopax rusticola L.	B	●
16	Microuis gregalis (P.)	B, S, J	○		Bonasa bonasia (L.)	B	●
17	Cricetus cricetus (L.)	B	●		Coccothraustes coccothraustes (L.)	B	●
18	Lepus timidus L.	B	●		Columba palumbus L.	B	●
19	Ochotona pusilla (P.)	B	○		Regulus regulus (L.)	B	●
20	Mustela eversmanni Les.	B	●		Species connected with wather		
21	Coelodontia antiquitatis (B.)	B, Z, S	⊕		Anas platyrhynchos L.	B	●
22	Equus caballus (L.)	B, Z, S, J	◆		Anas acuta L.	B	●
23	Megaloceros giganteus B.	B, Z	⊕		Squartola squartola L.	B	○
24	Rangifer tarandus (L.)	B, Z, S, J	○		Rallus aquaticus L.	B	●
25	Rupicapra rupicapra (L.)	B, Z, J	●		Pluvialis apricaria (L.)	B, J	●
26	Bison priscus (B.)	B, Z	⊕		Vanellus vanellus (L.)	B	●
27	Ovibos moschatus d B.	B	○		Tringa totanus (L.)	B	●
	Forest-dwelling species				Asio flammeus (P.)	B	●
28	Clethrionomys glareolus (S.)	B, Z	●		Domesticated species		
29	Apodemus sylvaticus (L.)	B	●		Gallus gallus f. domestica L.	B	◆
30	Apodemus flavicollis (M.)	B	●				
31	Glis glis (L.)	B, Z	●				
32	Muscardinus avellanarius (L.)	B	●				
33	Ursus arctos L.	B, J	●		Legend:		
34	Felis silvestris S.	B	●		● - Breeding in Poland		
35	Meles meles (L.)	B, Z	●		○ - Not living in Poland		
36	Martes martes L.	B	●		◆ - Domesticated		
37	Sus scrofa (L.)	B, Z, J	●		⊕ - Extinct		
38	Capreolus capreolus (L.)	B	●				
39	Cervus elaphus L.	B, Z	●				
40	Alces alces (L.)	B	●		Z - Zegar Cave		
41	Bos primigenius B.	B, S	⊕		S - Pośrednie Cave		
42	Bison bonasus (L.)	B	●		J - Jasna Smoleńska Cave		
	Species connected with wather				B - Biśnik Cave		
43	Microtus oeconomus (P.)	B, Z	●				
44	Arvicola terrestris (L.)	B, Z	●				
45	Castor fiber L.	B	●				
	Domesticated species						
46	Bos primigenius f. taurus B.	Z, J	◆				

BIŚNIK CAVE

The research of sediments in Biśnik Cave delivered a lot of bones of the vertebrates. There were approximately 100 000 bony pieces coming from 27 species of birds and 45 species of mammals (Tab. 1) and 2 300 pieces of flint and bony articles. The paleoecological analysis allowed to observe long-lasting changes in the environment during the deposition of sediments from the beginning of glaciation to Holocene (MIROSLAW-GRABOWSKA, 1998). During studies of 47 explored levels there were recognised series of sediments which originated in periods of sharpened climatic regime (glacials, substages) with groups of animals living in a tundra and Pleistocene steppe-tundra (interglacials and intersubstages) with a domination of forests and species of animals which prefer this kind of environment (Fig. 1).

A roof of studied series was created by sediments dated from Holocene which confirm dynamic, connected with deglaciation, environmental changes, enlargement of a forest area and an intensive development of a settlement and agriculture there.

THE LAYER 1A-1B - Sediments of the layer 1a-1b were

dominated by bones of animals living in forest as brown bears, European lynxes, wild boars, roe deer, red deer.

These layers also contained single remains of steppe-tundra animals, mainly reindeers, Irish elks and willow grouses.

Other bones found there belonged to water-swamped species of birds, such as: redshanks, pintail mallards, golden plovers. A few bony pieces of eurytopic creatures belonged to red foxes, wolves, stone martens, ferrets, European stoats, cave bears.

There were remains of animals domesticated by a man in the series of sediments such as cattle, sheep, or goats, hens.

Sediments of this layer originated in Holocene. The environment was varied – boreal, a dense complex of forests typical for the moderate zone with great open areas, water reservoirs and wet soil.

THE LAYER 2 - This layer was dominated by eurytopic species which are known to be able to live in very different climatic and environment conditions. Among these species most pieces belonged to cave bears, bats and common voles. The other eurytopic creatures were not so numerous.

The second largest ecological group were species

connected with the Pleistocene steppe-tundra. The dominating species were reindeers and steppe bisons. Among the rodents, the most bony pieces belonged to arctic lemmings. This species is thought to be a typical representative of a dry and stony tundra, like currently remains of chamoises in sediments. The remains of birds were represented by bony pieces of rock and willow grouses.

Among few creatures connected with the forest environment, the remains of red deer and bank voles were found most often. This latter species is a permanent component of the flora known from a period of the last glaciation either from very cold or warmer phases. A presence of this species (remains of black grouses, long-eared owls or wood grouses) confirms existing denser or thicker forest areas. A wood grouse is found to be a typical for taiga.

A presence of the big hoofed in studied sediments confirms that there were water currents or swamped areas there. It is also proved by a presence of two species of the rodents: water voles, root voles and birds, such as mallards, pintails, short-eared owls and grey plovers. The mentioned above species of the rodents are reckoned among eurytopic creatures, but they were excluded as a separate group considering their ecological requirements. Although root voles recognised as a eurytopic species were associated with the cold climate and it accompanied animals preferring coldness in pleistocene sediments.

Deposition of sediments in the layer 2 occurred in the period of the cold and dry climate which some tendencies to getting warm. Appearance of European pine voles, Pintails or jackdaws can point at the main substage of the last glacial.

THE LAYER 4 AND 5 - In a faunistic group, bones of cave bears dominated among other bony pieces of this layer. The other bones belonged to steppe-tundra creatures represented by such species as: reindeers, steppe bisons, Irish elks, horses, willow grouses. There was a lack of animals, typical for forest areas.

Sediments of the layer 4 and 5 originated rather in a cold climate. The neighbourhood of the cave was surrounded by a cold steppe and tundra.

THE LAYER 6 - There are not any bones of species connected with forests and a presence of such species as reindeer, bison, horse shows that deposition of sediments took part in cold climate conditions in an open area similar to steppe or tundra.

THE LAYER 7 - The remains of eurytopic species dominated in this layer. There were found representatives of steppe-tundra animals with a domination of steppe bisons, Irish elks, reindeers, woolly rhinoceros, horses, willow grouses. Bones of forest-dwelling species were few and there were dominated by red deer. Other found bones belonged to such birds as wood grouses and water species that usually live in forests of the cool climatic zone. In the analysed material there were found bony pieces of European beavers and mallards – species connected with water environment. Deposition of sediments of this layer occurred in a period of a cool climate in open areas such as a steppe or tundra, with a presence of wet forests and reservoirs or water currents.

In this layer some fragments of chipped antlers of mentioned above deer with some traces of working were discovered. A lot of dropped antlers, gathered there by a man, may suggest a season of the year in which a man was staying in the cave and its neighbourhood. The deer family get rid of their antlers at the turn of winter and spring or in early spring. Either a character of preserved antlers and their fragments or signs of smoothing and cutting pointed at an intentional activity of a man who used antlers and bones to make tools.

THE LAYER 8 - During the research there were discovered representatives of eurytopic species with a domination of carnivorous mammals among examined ecological groups.

THE LAYER 9 - A dominated ecological group is eurytopic species. But steppe-tundra creatures, like steppe bisons, Irish elks, chamoisis and forest-dwelling species and having always been connected water ones are less numerous.

Remains of animals discovered in these layers got gathered in a cool period with a domination of open areas like a rocky steppe-tundra.

THE LAYER 10 - Representatives of eurytopic species with a domination of cave bears' bony pieces and remains of bats were most strongly represented. The second most numerous creature was a common vole.

Steppe-tundra species were represented by reindeers, steppe bisons, Irish elks, willow grouses as well as arctic lemmings, Norway lemmings and narrow skulled voles. Among them arctic lemmings were most strongly represented. Forest-dwelling and water creatures were less numerous.

Deposition of sediments of this layer occurred in a cool period in open areas of a steppe-tundra, as well as forest complexes with a presence of water currents.

THE LAYER 11 - In this layer all ecological groups were represented with a domination of eurytopic forms. Out of forest-dwelling creatures, red deer, wild boars, fat dormice and wood grouses were discovered. Out of steppe-tundra species there occurred lemmings, steppe pikas, steppe bisons, Irish elks and woolly rhinoceros in this layer.

A climatic cooling accompanied gathering of bony remains with a possibility of appeasement of climatic regime and a presence of areas with permanent afforestation and water currents, with preservation of open areas.

THE LAYER 12 - In this layer there were remains of typically steppe-tundra species, such as: reindeers, steppe bisons, Irish elks, arctic lemmings, Norway lemmings, steppe pikas and narrow skulled voles. Out of forest-dwelling species, except from Irish elks and bank voles there were also roe deer and wood grouses. Water species occurred there, too.

In a period of sediments deposition of this layer, in environment with a domination of open areas with afforestation and water currencies, the climate was cool enough so that species, accustomed to such conditions, could exist.

THE LAYER 13 - In this layer creatures belonged to the eurytopic group had a dominant position. Among steppe-tundra remains there were ones belonged to reindeers, steppe bisons, Norway lemmings, narrow skulled voles and common hamsters. There was almost a lack of forest-dwelling and water species. But a presence of remains of wild boars, bank voles and red squirrels in the layer is worth of notice.

THE LAYER 14 - Deposition of this layer took place in conditions which enabled cold-liked species to exist in environment with a dominance of open areas with little afforestation and water currents. These sediments were dominated by forms connected with Pleistocene steppe-tundra and eurytopic elements. Remains of steppe pikas, narrow skulled voles, Irish elks, reindeer, steppe bisons and woolly rhinoceros dominated among cold-liked species. In the analysed group a percentage of forest-dwelling and water species was rather small.

Gathering of sediments in his layer occurred in a cold climate. Open areas with tiny afforestation and water currencies dominated in the neighbourhood of the cave.

THE LAYER 15 - Remains of eurytopic forms dominated in this layer. Among steppe-tundra species there occurred bones of big mammals, such as: woolly rhinoceros, Irish elks, reindeers, steppe bisons, lemmings, narrow skulled vole. The other ecological groups were not numerous.

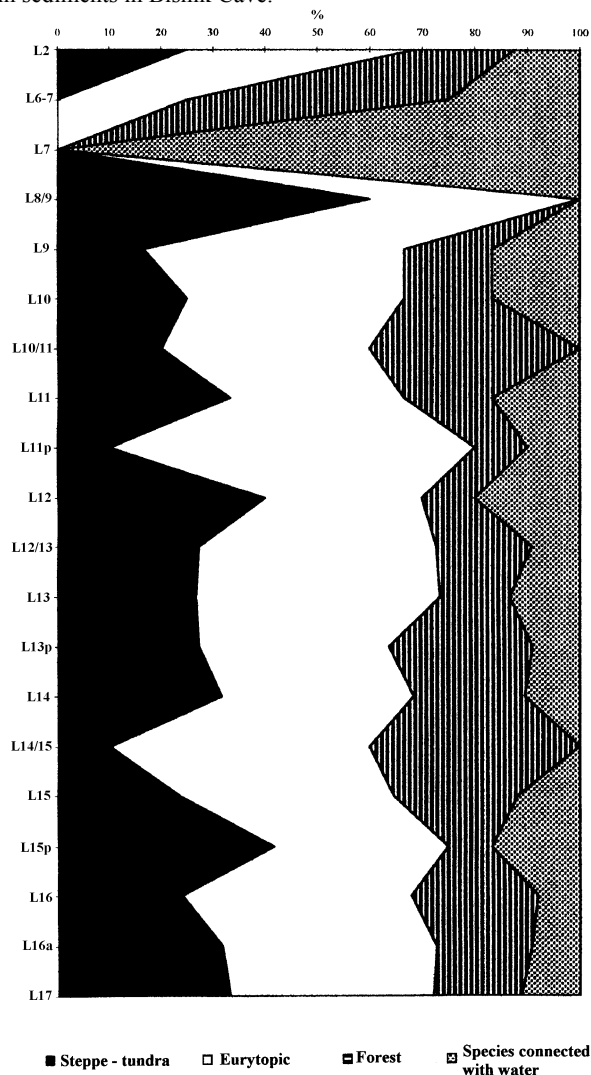
During deposition of sediments a ruling cold climate got warmer. In a surrounding of the cave there were areas with dense afforestation and water currents. But open areas were not exceptions there.

THE LAYER 16 - Steppe-tundra forms were strongly represented. Remains of steppe pikas, narrow skulled voles and arctic lemmings as well as woolly rhinoceros, reindeers and steppe bisons were discovered within this group. Remains of bats, common voles and cave bears dominated within eurytopic forms. Forest-dwelling species were represented mainly by red deer, roe

deer, and bank voles. Remains of root voles dominated among species connected with water environment. Sedimentation of this layer occurred in a cool and wet climate with a tendency to getting warmer. The environment was typical for steppe-tundra with dense afforested areas. In the neighbourhood there were water currents or reservoirs.

THE LAYER 17 - Steppe-tundra forms dominated here like in the layer 16. The second most numerous group were species connected with water environment. Eurytopic and forest-dwelling ones were less numerous. Deposition was similar like in the layer 16.

Fig. 1: A list of small mammals in accordance with their numbers in sediments in Biśnik Cave.

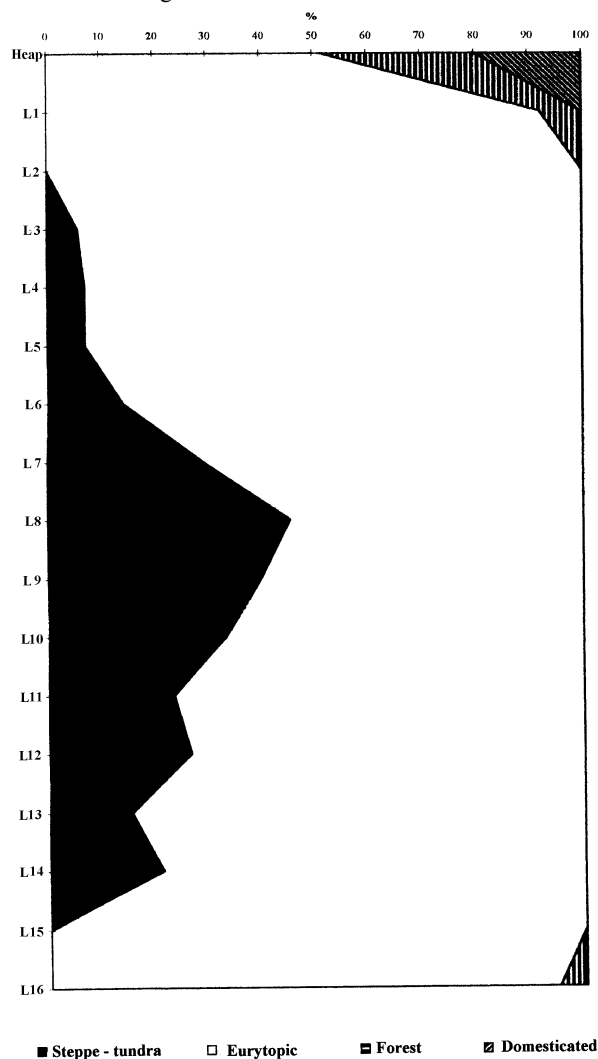


ZEGAROWE ROCKS

In the complex of Zegarowe Rocks the following caves were singled out for research: Zegar Cave, Jasna Cave and Pośrednie Cave. In Jaskinia Zegar, sediments exploration was done either within the cave or outside it. Out of work outside there were discovered 2 000 bony pieces belonged to 21 species of mammals (MUZOŹ, et. al., 1999) (Tab. 1). A paleoecological analysis showed that a sediment origin occurred in a cold climate with a tendency to getting warmer in a roof of a profile. The studies of sediments, fulfilled the cave inside, consisted of 16 layers, enabled to distinguish a faunistical group, containing approximately 6 000 bones and their fragments and represented by 24 mammals. Deposition of sediments making floor and roof of examining series occurred when a climate was getting warmer

and areas got afforested. This statement is confirmed by more numerous occurrence of forms connected with this kind of environment. The other sediments originated in cool climate conditions with a tendency to sharpening of climatic regime, containing a period of the last glacial. The fauna from this period is typical for open areas of tundra and steppe-Pleistocene tundra with such characteristic species as lemmings, reindeers, steppe bisons, Irish elks and horses. (Fig. 2)

Fig. 2: A list of mammals in accordance with their numbers in sediments of Zegar Cave.



The sediments of Jasna Cave, which was highest located, over the bottom of the valley, delivered about 200 bony pieces belonged to 10 species of mammals and 5 species of birds (Tab. 1). In the examined material there were two faunistical groups. The former one is in a roof of the sediments and consisted of pieces of domesticated and forest-dwelling animals pointed at the Holocene period of sediments deposition. In lower situated sediments of loess were animal remains connected with tundra and Pleistocene steppe-tundra, typical for cold periods of the last glacial.

Fragments of bones and teeth drawn out of shallow sediments of Pośrednia Cave were the least numerous. They belonged to only 8 species of mammals. Apart from discovered remains of cattle in a superficial humus layer, the other belonged to a cold-liked group of steppe-tundra and tundra forms out of the rest posts.

REMARKS

The information about the past of Upland is very few, especially connected with the periods before the last glacial. So research of preserved sediments of caves from Wodąca Valley can deliver a lot of information about history, changes in natural environment and primeval settlement in this area.

After analysing of animal remains coming from separated sediments, series of caves from Wodąca Valley can state that changes of the fauna were clear, however, they were in a different degree authoritative for particular layers. The environment of layers deposition distinguished itself in a great variety of landscape and groups of plants mainly by existence of animal species which required different ecological conditions. The main feature of the late – Pleistocene fauna of Krakowsko – Częstochowska Upland and other Polish regions is a permanent presence of forest-dwelling forms which is a proof of the forest-dwelling fauna permanent presence together with forms typical for other environments. The only changeable thing was a number of forest-dwelling species and their percentage in a general compilation.

The climatic conditions used to change in areas occupied by tundra, taiga, the conifers and deciduous. In periods of less severe climatic regime forests undoubtedly occupied considerable areas but a presence of steppe-tundra species may be a proof of existing patches with the tundra or steppe fauna. In severer climatic conditions afforested areas survived in such places as: slopes or places sheltered from the wind. A state of the fauna suggests that in periods of sediments deposition there were lower temperatures than today. A mixed forest of climatic optimum (interglacial) probably changed into conifers woods and taiga, and during a serious cool made thicker and were replaced

by a steppe-tundra area.

These changes in the environment made a growth of tundra components at the cost of the forest fauna when steppe forms appeared. A presence of a differentiated group of big phytofagans let us draw a conclusion that there was a lack of the thin snow cover. When climatic conditions was getting better, there were more patches of the forest flora, more species of animals connected with forest areas but the number of steppe-tundra species decreased. A permanent part of species connected with water and swamps may suggest that there existed some water reservoirs and swamp areas. This conclusion also confirms a high percentage of the hoofed, for which water in a neighbourhood is a need.

Dwellers of Wodąca Valley caves, community representatives from the middle Palaeolithic and people from the upper Palaeolithic hunted mainly for huge animals guaranteeing that consumable needs would be met. Men hunted for Cave bears most often and for such steppe-tundra animals as reindeers, steppe bisons and horses which delivered a lot of food (meat, fat, marrow), material for clothes (skin, fur), for building houses (bones), for making tools (antlers, long bones, tendons, intestines), and for making such items as ornaments. Birds were treated as an enriching and nutritious element of food.

In the latest sediments considerable changes in the environment can be noticed. The main source of food were forest-dwelling animals such as: wild boars, deers, aurochs and animals living in open spaces, as: horses, and domesticated animals, as: cattle, sheep, goats, hens.

These results of paleoecological studies must be treated as preliminary. The chronological interpretation of levels is as a matter of discussion.

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