PADINA AND STARČEVO: GAME, FISH AND CATTLE

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CONTENTS

1. INTRODUCTION*

In 1971 Prof. Dr. R. W. Ehrich[1]), one of the excavators of the settlement of Starčevo, asked me to study the animal remains which were collected during the excavations in 1932, 1969 and 1970. Some years later Dr. B. Jovanović[2]) invited me to study the faunal remains which were collected during the excavation of the Late Mesolithic/Early Neolithic settlement of Padina in the Djerdap region (Iron Gate). Since both sites are situated on a bank of the Danube in Yugoslavia (fig. 1), and both are important for our understanding of the end of the Mesolithic period and the introduction of agriculture in Central Europe, I decided to review the results of both studies together.

For several reasons it would have been pointless to estimate the minimum number of individuals, the meat yield of the different species and their contribution to the daily diet of the former inhabitants. In the first place a large proportion of the animal remains were not collected. In the second place the former inhabitants used numerous bones for making tools. Especially those of Starčevo had the habit of carving segments out of the long bones of cattle and red deer to make large fish-hooks. Not to mention the spoons carved out of the metapodiae of cattle (Nandris, 1972). The inhabitants of Padina also used bones to fabricate tools. In the third place only a small, much disturbed, part of the settlement of Starčevo could be excavated for most of it had been destroyed. Nothing is known about its extensions, number of houses, etc. This also applies to a certain extent to Padina, although this site was more completely excavated.

Because of these reasons only the number of bones will be given and the percentages in which they were collected. Small species are in this way certainly underrepresented. Of the large mammal species probably the same percentages have been thrown away as were collected, so that these percentages are at least an indication for the percentages in which the species were kept, or better slaughtered or killed in hunting.

* Tables 7-60 have been reproduced as microfiches, which are furnished in an envelope attached to the rear cover of this volume.

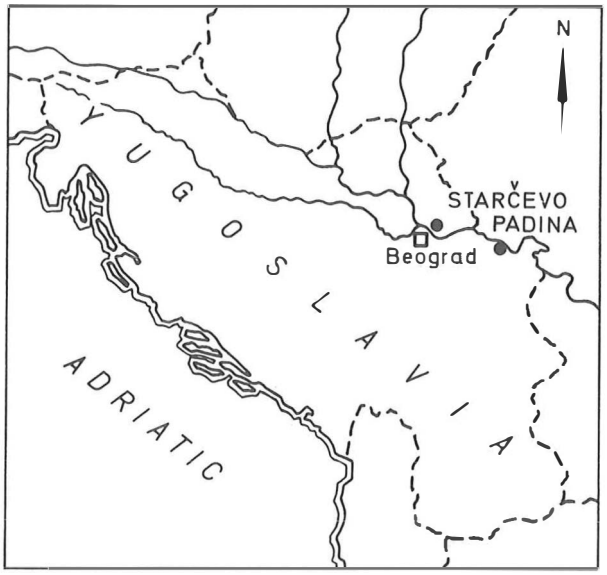


Fig. 1. The geographic situation of Padina and Starčevo.

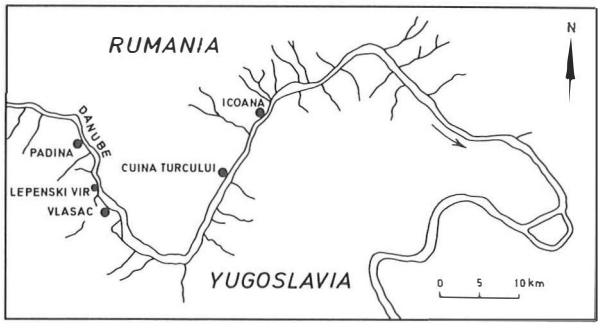


Fig. 2. The settlements Padina, Lepenski Vir, Vlasac, Cuina Turcului and Icoana in the Iron Gate. The Danube is the boundary between Yugoslavia and Romania.

2. THE SITES

2.1. Padina

Padina is situated on a narrow strip of loess in the Iron Gate (Djerdap) on the Yugoslavian side of the Danube (fig. 2). The area of the settlement was divided by Jovanović (1971, 1974) in three main sectors (fig. 3), in which he could distinguish three major habitation periods:

I. The prehistoric period. Late Mesolithic (Epipalaeolithic) of the lower basin of the Danube (A), Old Neolithic

of the Djerdap (Iron Gate), a variation of the complex of Starčevo-Çris culture (B), Recent Eneolithic of the central Danube basin (Kostolac-Coţofeni) which are restricted to isolated finds (C), Iron Age of the central and lower Danube basin (the type of Basarabia-Gomolava-Bosut) (D).

II. The classical period is represented by the foundations of a Roman tower, some objects and cremation graves (E).

III. The medieval period is represented by silver and gold coins of the second half of the XIVth century.

Remains of the Late Mesolithic (A) were found in sector I and II. The Neolithic (B) could be divided into three phases B_1, B_2 and B_3. The first row of houses, nr. 5-10 in sector III, along the Danube belongs to phase B_1. The first row of houses in sector I, nr. 1-3, and the second row in sector III, nr. 11-15, belong to phase B_2. The third row of houses in sector III, nr. 16-21, belongs to phase B_3 (fig. 4). No traces of this phase were found in sector

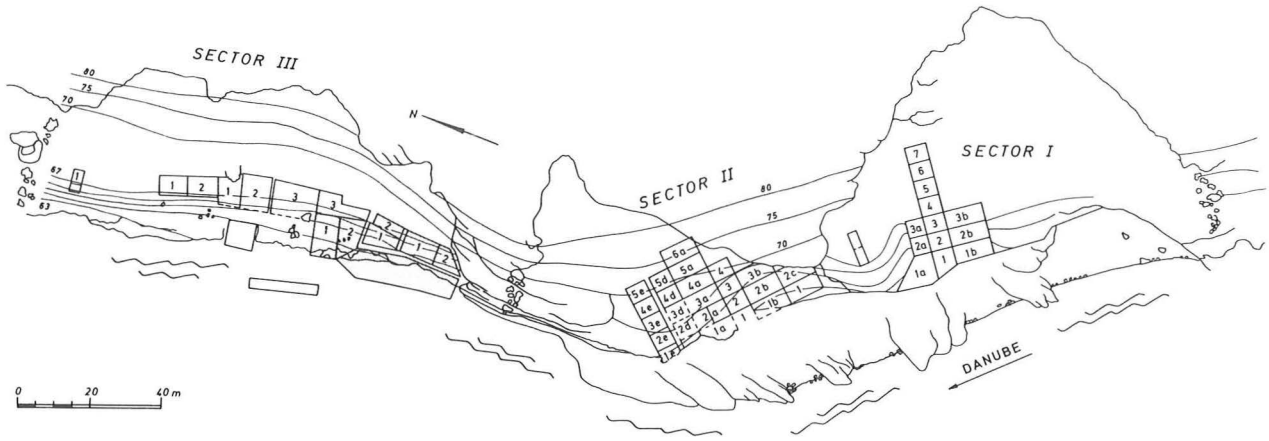
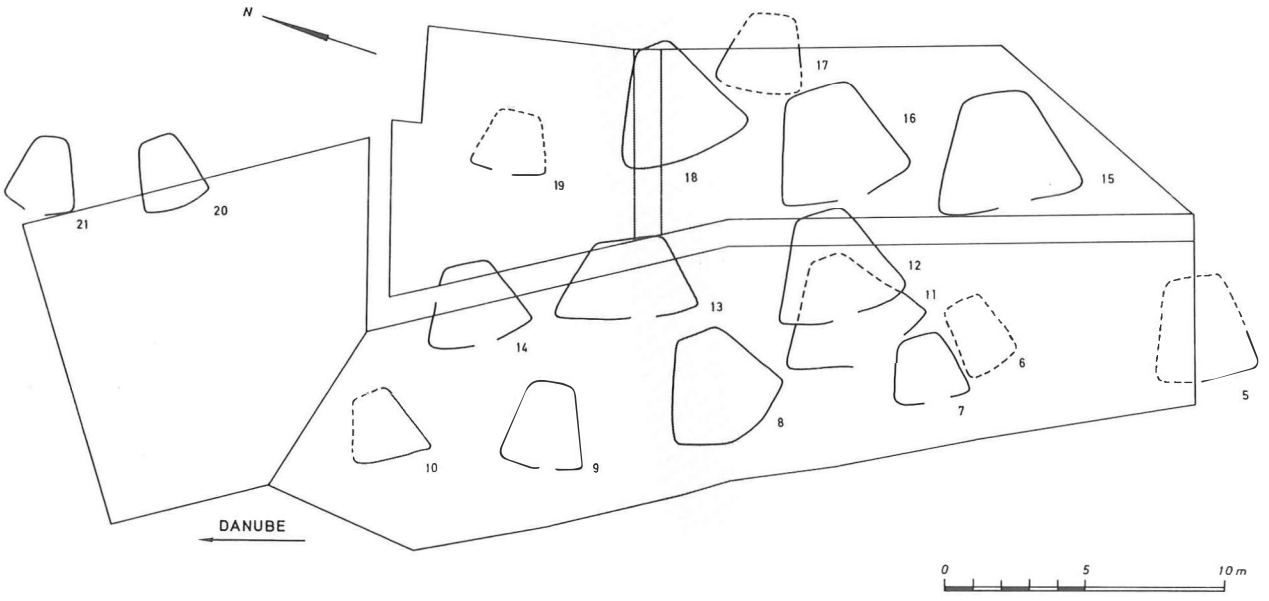


Fig. 3. The excavated area at Padina in the Iron Gate (after Jovanović, 1971). The shaded area in sector III is given in detail in fig. 4.

Fig. 4. Detail of sector III with the house places 5-21. A cross-section of the shaded area is given in fig. 5 (adapted from Jovanović, 1971).



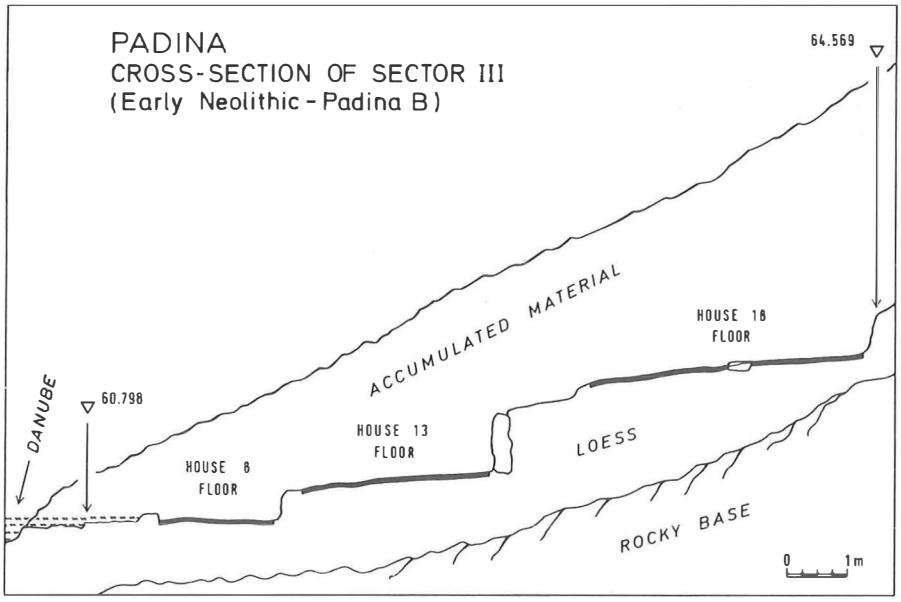


Fig. 5. Proposed cross-section of sector III of Padina. Early Neolithic – Padina B (data provided by Jovanović).

I. The floor plan of the houses is trapezoid, with a hearth in the middle. The walls were of dry-stacked stones. The backs of the houses were cut into the loess plateau on which the settlement was situated. The roofs were probably of wood. In this way the Neolithic village consisted of three rows of houses on different levels (fig. 5). According to Jovanović not all houses were inhabited at the same time. He bases this assumption on the finds associated with the houses, but this assumption is not corroborated by C^{14}-dates. The C^{14}-dates seem to suggest that what must have been the first two phases were younger than the two younger phases. The same confusion in C^{14}-dates is found in Lepenski Vir and Vlasac (table 1). The fact that the C^{14}-dates do not confirm the archaeological stratification, can be possibly explained by taking into account the fact that these narrow loess strips along the gorge were intensively used during the period during which they were inhabited. Owing to this organic material could have easily become mixed, unobserved by the excavators[3]).

Because of the slope, could earlier material from higher up have slid down over later deposits (fig. 5). The kind of excavation by horizontal layers would mask this. Also, if there were sloping levels, excavation by artificial strata could produce contemporaneity on one level and a reversed stratigraphy as well.

It is for this reason that the faunal remains were divided into only five main groups: I. Late Mesolithic; II. Late Mesolithic/Early Neolithic; III. Early Neolithic; IV. Early Neolithic/Early Iron Age; V. Iron Age/Roman period. The majority of

TABLE 1

Chronology and C^{14}-dates of Padina, Lepenski Vir and Vlasac.

Padina	*Lepenski Vir*	*Vlasac*
B_3 Neolithic (Starč./Çris) 5125 ± 50 BC Sector I no houses Sector II houses no. 16-21	III not dated (Starčevo)	III 5490 ± 100 BC
B_2 Neolithic (Starč./Çris) 5150 ± 80 BC Sector I houses no. 1-3 Sector III houses no. 11-15	II 4610 ± 100 BC 4680 ± 100 BC	II 5525 – 5985 ± 100 BC
B_1 Older Neolithic (Starč./Çris) Sector III houses no. 5-10 4620 ± 55 BC 5115 ± 110 BC	I 4670 ± 5330 BC	I b4915 5880 ± 100 BC – a4965 ± 100 BC
(possible Proto Padina was not found)	Proto Lepenski Vir not dated	
A. Late Palaeolithic 4615 ± 40 BC (charcoal) Sector I and II 7500-5500 BC (human bones)		

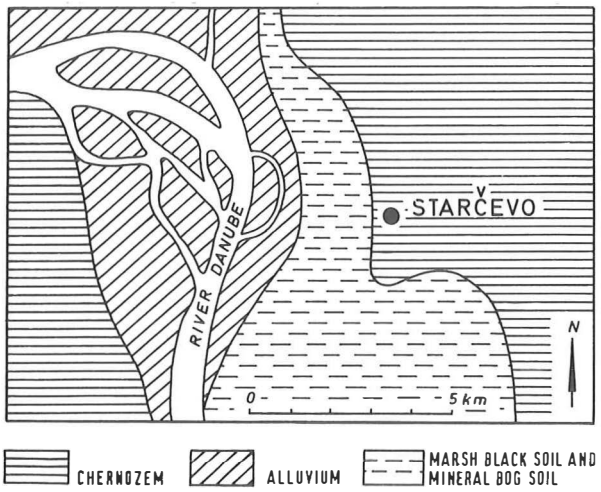


Fig. 6. The geographic situation of Starčevo (adapted from Barker, 1975).

the faunal remains belongs to the Late Mesolithic and Early Neolithic. The differences in the percentages of the species in both groups, seem to indicate that the material was rightly alloted to these phases. It seems that they also correspond with changes in the pottery belonging to the complex of the Starčevo-Çris-Körös culture. Group I can be probably roughly dated in the sixth millennium B.C. and group III at the end of the second half of the sixth millennium and the first half of the fifth millennium B.C.

2.2. Starčevo

Starčevo, the site that gave the name to the Starčevo culture, lies upstream from Padina on the left bank of the Danube in the central Danube basin near the modern town of Pančevo and the village of Starčevo. The settlement was built on an old bank of the Danube at the edge of its flood plain (fig. 6). Today the Danube flows approximately 3.5 km to the West, and the plain is protected against the river by dikes. In prehistoric times the plain would have been marshy with cut-off meanders, small streams, and ponds bordered by reeds. The plain would have been partly covered by woods and copses, but there were also open spaces. The river probably flowed much nearer to the settlement than it does today. Since 1912 the loess deposits, on which the ancient settlement was situated, were used by brickmakers, who destroyed most of the settlement. Starčevo was first excavated in 1931 by Grbić and Fewkes, who examined two pits (1 and 2), the contents of which, including the animal bones, were brought to the Peabody Museum of Harvard University and were not available to me (Ehrich, 1977).

In 1932 the major excavation of Starčevo took place under the direction of Fewkes and Ehrich. After a lapse of nearly 40 years, Ehrich and Dr. Garašanin of the National Museum in Beograd excavated three trenches on the upper flatland, somewhat to the North and West of the old excavations. These were dug in public land under cultivation while five others were opened in private garden land to the South. The inhabitants of the village improved their land with the humic earth from the prehistoric sites, which makes the faunal remains unreliable. They are partly mixed with recent bones. The stratification is not certain.

In 1932 four main levels were recognized which were then called humus, subhumus, culture and pit level. These levels were later renamed humus, level I, level II and level III. The pits opened from (pit)level III and penetrated into the loess. The pits contain mostly uncontaminated Starčevo material, as does (pit)level III. The bones from the pits are yellow. The same applies to the bones of (pit)level III. Levels II and I are partly contaminated with younger material. Also in 1932 two sounding trenches, 1932A-A extension and B, were opened some 150 m to the North of the main excavation (fig. 7). These trenches showed also no good stratification and contained some younger material down to the loess.

In 1932 bones were collected only in so far as it was thought possible to identify them, all the others were discarded. None of the earth was sieved, which is clearly demonstrated by the fish remains which all belong to large catfish and carp species.

In 1969 and 1970 part of the earth was sieved with the result that bones of smaller fish- and bird species were found. Since the material from 1969 and 1971 was mixed and contaminated with younger and even recent material, the bones that looked prehistoric were counted and partly measured, but not otherwise described.

The bones collected in 1932 (fig. 7, 8) are divided into 22 units: A-V. In table 5, 6 the number of bones of the species found in each of these units is given, together with those found in the pits, level III (pit), level II (culture), level I (subhumus), trench A-A extension, trench B, and the trenches of 1969/1970.

No traces of dwellings were found. The irregular pits are not considered to have served as houses.

There are six C^{14}-dates, four from animal bones, one from human bones and a sixth from sherds. This last date is unreliable. The other four indicate that Starčevo was inhabited during the first half of the fifth millennium B.C.

GrN-6626	Starčevo	1 bone	6610 ± 65 – 4660 BC
GrN-6627	,,	2 bones	6545 ± 105 – 4595 BC
GrN-6628	,,	3 sherds	7615 ± 50 –
GrN-6629	,,	4 bones	6615 ± 65 – 4665 BC
GrN-7154	,,	5 human bones	6610 ± 100 – 4660 BC
GrN-7155	,,	6 bones	6835 ± 70 – 4885 BC

Uncorrected dates. Calibration would make them some 800 years earlier.

These dates mean that the occupation of Starčevo is more or less contemporaneous with that of the Neolithic levels B_1-B_3 of Padina. According to Ehrich (1977) the Starčevo culture can be divided into early and late periods, and Starčevo itself belongs to the later Starčevo period.

3. THE SPECIES

Bones or shells of the following species were collected: hedgehog, brown hare, beaver, fox, dog, wolf, badger, otter, pine marten, wild cat, lynx, brown bear, wild/domestic horse, wild ass, wild/domestic pig, roe deer, red deer, wild/domestic cattle, sheep, goat, chamois, black-throated diver, white pelican, cormorant, shoveler, shell-duck, grey-lag goose, bean goose, mute swan, whooper swan, sea-eagle, kite, eagle, harrier, vulture, crane, great bustard, curlew, raven, rook, domestic fowl, European pond terrapin, Danube salmon, sturgeons, pike, catfish, carp, carp fishes, bream, asp, mussel, edible snail (tables 2-6).

3.1. Mammals

Hedgehog – *Erinaceus europaeus* Linnaeus, 1758

Of this species a left ulna was found in the Neolithic layer (III) of Padina. The distal epiphysis was broken off. Of the hedgehog three varieties, differing in the colour of the fur, are known. According

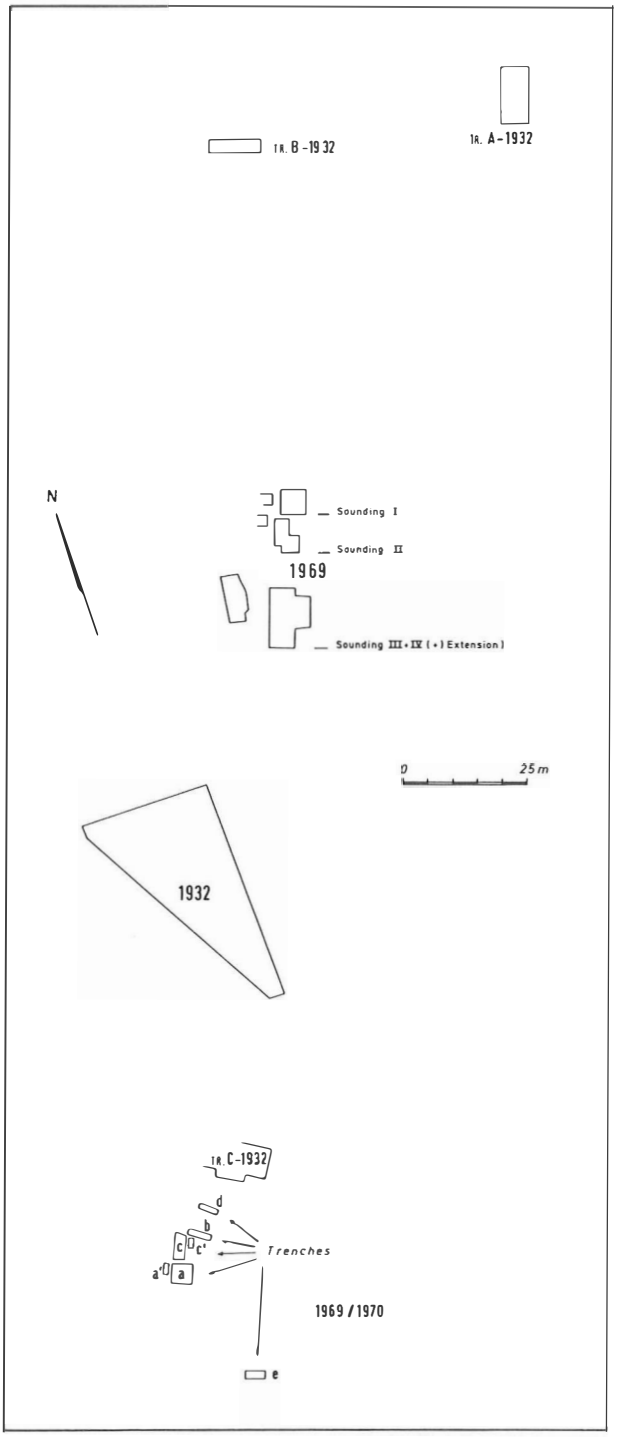


Fig. 7. The trenches excavated at Starčevo in 1932, 1969 and 1970 (data provided by Ehrich).

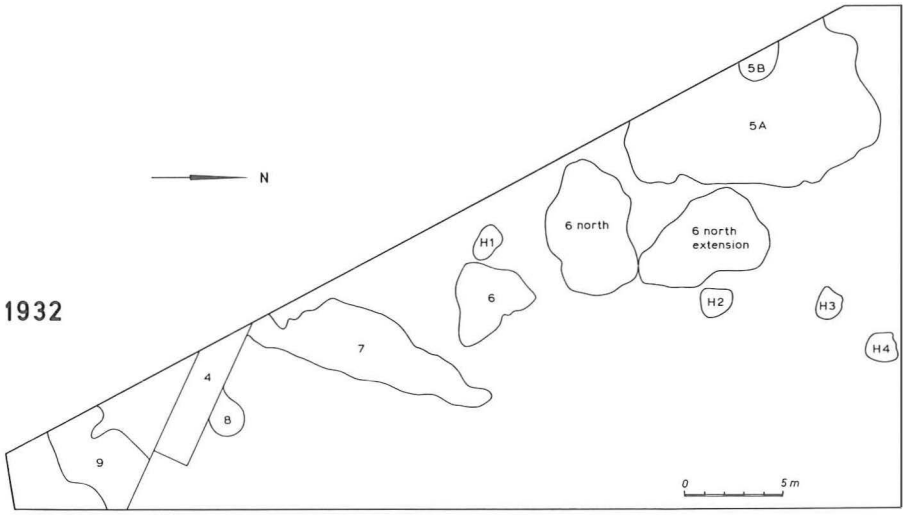


Fig. 8. The pits in the large trench excavated in 1932. Pit 4 is probably a recent, partly filled with old material, ditch (data provided by Ehrich).

to Miller (1966 (1912)) the east form cannot be distinguished from the west form with certainty without comparing the skull and teeth. Whether there is also a difference in other skeletal parts is not mentioned. At present the eastern variety has a white spot on its breast which is sharply set off from the grey brown colour of the rest of the fur. In Yugoslavia the east variety is living today (Van den Brink, 1968).

The hedgehog is found on dry ground with bushes, hedges, etc., but not in deep woods. The hedgehog makes excellent food.

Brown hare – *Lepus capensis* Linnaeus, 1758

From the hare an ulna and probably a femur were found in Neolithic (III) Padina. An ulna, femur, tibia, and calcaneus were found in the Mesolithic (I) layers, and an undated pelvic bone. No hare remains were found in Starčevo. This is probably due to the way in which the animal remains were collected, since the environment of Starčevo seems more suitable for hares than that of Padina, although hare remains were also found in Vlasac and in Romanian sites from the same period on the opposite bank (Bolomey, 1973). Although the hare prefers open country, the species can also live in deciduous woods and on mountains. The hare makes excellent food, has a useful fur and its bones can be used to make tools.

Beaver – *Castor fiber* Linnaeus, 1758

The remains of beaver are more abundant in Padina than in Starčevo (fig. 10). In the last site a tibia, a mandibula and a humerus were found in pits, and 5 bones in the excavation trenches of 1969 and 1970. The measurements of the few beaver remains from Starčevo fall into the range of measurements of those of Padina.

In Padina both in period I as III mandibulae were found of which the lower border and the incisors are missing. It might be that the lower border was cut away to obtain the incisors which could be used as implements. No part of the skull and maxilla were collected. Mandibulae were found in the following numbers:

	r.	l.	l./r.	
Mesolithic	19	5	1	lower border
Neolithic	3	4	–	

The length of the tooth row was 34.5-41.0 mm. According to Gaffrey (1953) the length of the tooth-row of recent beaver in Central Europe lies between 32.6-40.0 mm. Bökönyi (1976) mentions for Obre measurements of 39.0, 39.5, 41.0 and 44.0 mm. Boessneck (1963) found in Burgäschisee-Süd in Switzerland measurements which lie between 33.0-37.5 mm. For Eneolithic Vlaardingen in the Netherlands they were 32.5-38.2 mm (Clason, 1967). The Yugoslavian animals seem to be relatively large.

TABLE 2 The mammal species (wild and domesticated) collected in Padina, and the number of bones that were found of each of them.

		I	II	III	IV	V	VI	I %	II %	III %	IV %	V %	VI %
Mammalia													
A. Domesticated													
Bos taurus	– domestic cattle	7	–	21	–	7	1	10.4	–	9.9	–	33.3	–
Capra/Ovis	– goat/sheep	6	–	6	–	8	1	8.9	–	2.8	–	38.0	–
Sus domesticus	– domestic pig	12	2	5	2	2	–	17.9	–	2.3	–	9.5	–
Canis familiaris	– dog	42	1	179	–	4	7	62.6	–	84.8	–	19.0	–
B. Wild, insectivores, lagomorphs, rodents, carnivores													
Erinaceus europaeus	– hedgehog	–	–	1	–	–	–	–	–	–	–	–	–
Lepus capensis	– brown hare	4	–	1	–	–	1	–	–	–	–	–	–
Castor fiber	– beaver	37	–	10	–	–	–	–	–	–	–	–	–
Vulpes vulpes	– fox	6	–	–	–	–	–	–	–	–	–	–	–
Canis/lupus	– dog/wolf	–	–	3	–	–	–	–	–	–	–	–	–
Canis lupus	– wolf	6	–	3	–	–	–	–	–	–	–	–	–
Martes martes	– pine marten	3	–	2	–	–	–	–	–	–	–	–	–
Martes sp.	– marten	3	–	4	–	–	–	–	–	–	–	–	–
Felis silvestris	– wild cat	4	–	5	–	–	–	–	–	–	–	–	–
Lynx lynx	– lynx	2	–	2	–	–	–	–	–	–	–	–	–
Meles meles	– badger	1	–	–	–	–	–	–	–	–	–	–	–
Ursus arctos	– brown bear	30	1	15	–	5	1	–	–	–	–	–	–
C. Wild, ungulates													
Equus przewalskii	– wild horse	–	–	–	–	–	–	–	–	–	–	–	–
Equus sp.		1	–	–	–	1	1	0.1	–	–	–	2.4	–
Sus scrofa	– wild boar	55	–	50	–	2	1	5.6	–	13.4	–	4.8	–
Sus sp.	– wild/domestic boar	23	–	10	6	–	–	2.3	–	2.6	–	–	–
Capreolus capreolus	– roe deer	37	–	9	–	–	1	3.8	–	2.4	–	–	–
Cervus elaphus	– red deer	763+114*	4+10*	263+50*	2*	31+2*	8	78.8	–	70.6	–	75.6	–
Bos/Cervus	– cattle/red deer	41	–	12	–	–	–	4.2	–	3.2	–	–	–
Bos primigenius	– aurochs	28	–	8	–	4	1	2.8	–	2.1	–	9.7	–
Bos sp.	– cattle	17	2	20	–	3	–	1.7	–	5.3	–	7.3	–
Rupicapra rupicapra	– chamois	3	–	–	–	–	–	0.3	–	–	–	–	–
D. *Homo sapiens*	– man		+	+									
Sum A		67	3	211	2	21	9	5.9	30.0	33.5	25.0	31.3	39.1
Sum B		96	1	46	–	5	2	8.4	10.0	7.3	–	7.4	8.6
Sum C		968	6	372	6	41	12	85.5	60.0	59.1	75.0	61.1	52.1
Sum A + B + C		1131	10	629	8	67	23						

* antler

TABLE 3 The bird, reptile, fish and molluscs species collected in Padina, and the number of bones that were found of each of them.

		I	II	III	IV	V	VI
E. *Aves*	– birds						
Gavia arctica	– black-throated diver	1	–	–	–	–	–
Pelecanus onocrotalus	– white pelican	–	–	1	–	–	3
Phalacrocorax carbo	– cormorant	1	–	–	–	–	–
Cygnus olor	– mute swan	1	–	–	–	–	–
Cygnus sp.		–	–	–	–	–	1
Anser anser	– grey-lag goose	2	–	–	–	–	–
Tadorna tadorna	– shell-duck	–	–	1	–	–	–
cf. *Haliaeëtus albicilla*	– eagle	7	–	1	–	–	–
	– small bird of prey	1	–	–	–	–	–
Gypaetus barbatus / *Aegypius monachus*	– vulture	–	–	1	–	–	–
Gyps fulvus		–	–	–	–	–	–
Corvus corax	– raven	1	–	1	–	–	–
Corvus frugilegus	– rook	–	–	1	–	–	–
Aves indet.	– unidentified	2	–	1	–	–	–
Sum		16	–	7	–	–	4
F. *Reptilia*	– reptiles						
Emys orbicularis	– European pond terrapin	1	–	1	–	–	–
G. *Pisces*	– fishes						
Hucho hucho	– Danube salmon	15	–	41	–	–	–
Acipenser sp./*Huso huso*	– sturgeon	8	1	55	–	–	–
Siluris glanis	– catfish	201(24)	2	1298	–	1	–
Cyprinus carpio	– carp	–	–	32	–	–	–
Cyprinidae	– carp fishes	80	6	229	–	–	–
Indet.	– unidentified	63	–	620	–	–	–
Sum		367	9	2275	–	1	–
H. *Mollusca*	– molluscs						
Unio crassus	– mussel	4	–	47	–	–	–
Helix sp.	– edible snail	1	1	8	–	–	–
Cepaea sp.		–	–	2	–	1	–
Indet.	– unidentified	–	–	1	–	–	–
Sum		5	1	58	–	1	–

TABLE 4

Padina I-VI. The percentages of A, B, C, E, F, G and H.

	I	II	III	IV	V	VI	I %	II %	III %	IV %	V %	VI %
A	67	3	211	2	21	9	4.4	15.0	7.1	–	30.4	33.3
B	96	1	46	–	5	2	6.3	5.0	1.5	–	7.2	7.4
C	968	6	372	6	41	12	63.6	30.0	12.5	–	59.4	44.4
E	16	–	7	–	–	4	1.0	–	0.2	–	–	14.8
F	1	–	1	–	–	–	0.06	–	0.03	–	–	–
G	367	9	2275	–	1	–	24.1	45.0	76.5	–	1.4	–
H	5	1	58	–	1	–	0.3	5.0	1.9	–	1.4	–
Sum	1520	20	2970	8	69	27						

The beaver needs light deciduous woods with undergrowth along rivers and lakes. This biotope was available in the vicinity of both settlements.

The beaver has tasty meat, good fur, and the beaver has castoreum.

Fox – *Vulpes vulpes* Linnaeus, 1758

In Mesolithic Padina (I) five bones and a tooth of fox were found: two mandibulae, one tooth, one scapula, and two calcanea. In Starčevo only one bone of a fox was collected during the excavation in 1970.

The fox can adapt itself to many biotopes, although it prefers dry ground and the vicinity of woods and light brush.

The fox might have been hunted in the first place for its fur. Since the dog was also an appreciated food animal in Padina, the fox might have been eaten as well.

Wolf – *Canis lupus* Linnaeus, 1758

In the layers of Mesolithic Padina (I) six bones of wolf were found, in the Neolithic layers (III) three. In Starčevo one tibia was found in a pit. No skull fragments were collected.

According to Bökönyi (1975) in Late Mesolithic Vlasac the wolf was in process of being domesticated. In Padina this could not be proved. In this respect Padina resembles Lepenski Vir (I, II) and the Romanian sites on the other side of the Danube.

The wolf is found in wooded plains and in mountainous areas, but it can also live in open ground with cover.

The wolf might have been hunted as predator, the fur can have been used and the meat might have been eaten.

Domestic dog – *Canis familiaris* Linnaeus

Bones of dogs were abundant in the Mesolithic (I) and Neolithic (III) layers of Padina. In Starčevo only a small amount of dog bones were found in the Neolithic pits as well as in the other layers (fig. 10).

No complete skulls were recovered and many of the Padina mandibulae are broken, show carving and gnawing marks and have been in contact with fire (fig. 11). Also the long bones are broken. The broken or natural ends are often scorched by fire. Apparently dogs were used as food. The same was found in Vlasac and Lepenski Vir (I, II). In Vlasac and the first two stages of Lepenski Vir the dog was the only domestic animal (Bökönyi, 1973, 1975).

Of the 34 mandibulae of Padina III, 14 had been in contact with fire of which 1 had a burned underside and three were burned on the labial side. None of the fragments were calcinated, only one was burned completely black. This seems to indicate that the mandibulae were roasted on a fire and not cooked or devoured fresh. The point has been made, and observed among the Eskimos that an uncooked bone must be split to get at the marrow, whereas if cooked and broken across, the marrow can be sucked or fished out. The many gnawing marks indicate that living dogs were walking free through the village. In most cases only the pars molaris was left, the pars incisiva and the vertical ramus was cut or gnawed off.

Most dogs were slaughtered when they had already an adult dentition, with two exceptions. One of those still had milk back teeth p_2p_3 while M_1 was breaking through. Of the second mandibula M_3 was breaking through. It is not yet known whether there is much difference in the sequence and age of

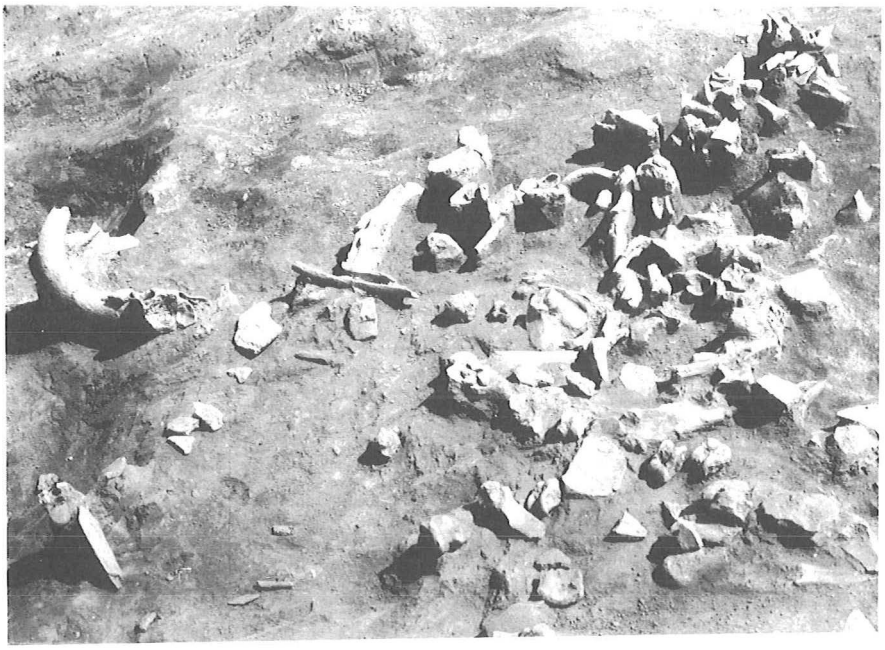


Fig. 9. Bones found together with pottery sherds in the midden overlaying pit 6, unit K (bag nr. 383-384) in 1932 (see table 13) (photo: R. W. Ehrich).

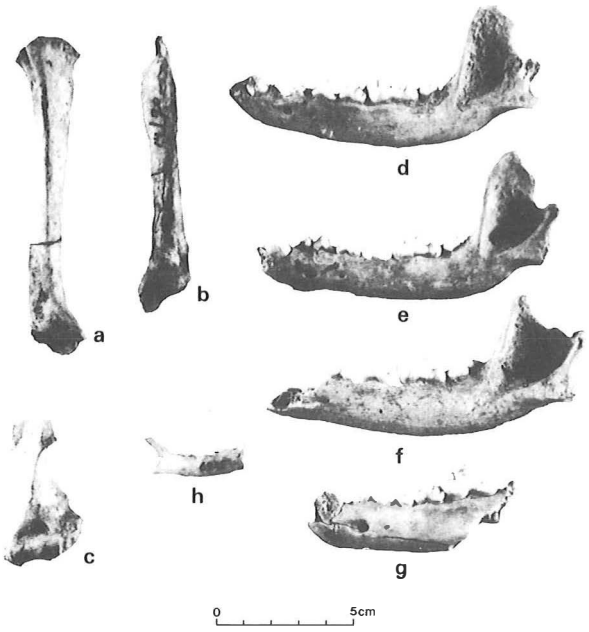


Fig. 10. Starčevo, *Castor fiber*, a (?), b (14/1970) – tibia, c (J bag 379) – humerus; *Canis familiaris*, d, e, g (U bag 498/499), f (?) – mandibula; *Felis silvestris*, h (1969/25) – mandibula (photo: National Museum, Belgrade).

Fig. 11. Padina, *Canis familiaris* – three mandibulae from the Early Neolithic layer in sector III. The teeth of two lower mandibulae were scorched by fire (photo: C.F.D., R.U. Groningen).

TABLE 5 Starčevo, the domesticated and wild mammal species, and the number of bones collected of each in 1932 (A-V) and the excavations in 1969 and 1970.

Mammalia		pits A	B	C	D	E	F	G	H	I	J	K	L	Sum	%
A. Domesticated															
Bos taurus	– domestic cattle	15	31	27	62	24	50	39	24	103	51	71	8	505	66.7
Capra/Ovis	– goat/sheep	8	12	7	13	8	6	17	6	46	32	48	10	213	28.1
Ovis aries	– sheep	1	–	–	–	1	1	1	–	–	–	–	–	4	0.5
Capra hircus	– goat	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sus domesticus	– domestic pig	–	3	–	2	6	4	–	–	5	7	4	–	31	4.1
Canis familiaris	– dog	–	–	–	–	–	–	1	–	1	–	–	1	3	0.3
B. Wild, rodents, carnivores															
Castor fiber	– beaver	–	–	–	1	–	–	–	–	–	2	–	–	3	–
Vulpes vulpes	– fox	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Canis lupus	– wolf	–	–	–	–	–	–	–	–	–	1	–	–	1	–
Ursus arctos	– brown bear	–	–	–	1	–	–	–	–	–	–	–	–	1	–
Meles meles	– badger	–	–	–	–	–	–	–	–	1	–	–	–	1	–
Lutra lutra	– otter	–	–	–	–	1	–	1	–	–	–	–	–	2	–
Felis silvestris	– wild cat	–	–	–	1	–	–	–	–	–	–	–	–	1	–
C. Wild, ungulates															
Equus przewalskii	– wild horse	–	3	–	–	–	–	–	–	2	–	–	–	5	1.2
Equus cf. *hydruntinus*		–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sus scrofa	– wild pig	–	2	3	13	16	39	2	2	8	7	7	4	103	26.1
Sus sp.	– pig?	–	2	–	4	6	9	3	2	11	4	2	–	43	10.9
Cervus elaphus	– red deer	3	2	1*	15+1*	9+1*	12+1*	9+9*	5+2*	17+1*	33+11*	8	–	113	28.6
Bos/Cervus	– cattle/red deer	1	–	–	–	–	1	–	–	–	–	–	–	2	0.5
Capreolus capreolus	– roe deer	–	1	2	–	3	1	1	–	–	1+1*	–	–	9	2.2
Bos primigenius	– aurochs	1	1	–	6	6	7	7	–	9	–	3	–	40	10.1
Bos sp.	– cattle	2	–	1	16	8	24	1	–	10	1	13	3	79	20.0
D. *Homo sapiens*	– man	–	1	–	–	1	–	–	–	–	2	–	1	5	–
Sum A		24	46	34	77	39	61	58	30	155	90	123	19	756	–
Sum B		–	–	–	3	1	–	1	–	1	3	–	–	9	–
Sum C		7	11	6	54	48	93	23	9	57	46	33	7	394	–
Sum A + B + C		31	57	40	134	88	154	82	39	213	139	156	26	1159	–
A %		77.4	80.7	85.0	57.4	44.3	39.6	70.7	76.9	72.7	64.7	78.8	73.0	65.2	–
B %		–	–	–	2.2	1.1	–	1.2	–	0.4	2.1	–	–	0.7	–
C %		22.5	19.2	15.0	40.2	54.5	60.3	28.0	23.0	26.7	33.0	21.1	26.9	33.9	–

* antler

level III				level II					level I		trench A					trench B		trenches 1969/1970				
M	N	Sum	%	O	P	Q	Sum	%	R	%	S	T	U	Sum	%	V	%	1969	69/70	1970	Sum	%
58	73	131	59.5	84	117	52	253	72.9	162	69.8	117	73	75	265	83.5	148	71.8	265	46	275	586	67.7
53	23	76	34.5	42	2	31	75	21.6	47	20.2	19	10	13	42	13.2	53	25.7	75	40	134+1[ind]	250	28.9
–	–	–	–	1	–	–	1	0.2	–	–	–	–	–	–	–	2	0.9	–	–	1	1	0.1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	0.1
5	4	9	4.0	11	4	–	15	4.3	19	8.1	2	3	1	6	1.8	1	0.4	7	2	17	26	3.0
2	2	4	1.8	–	3	–	3	0.8	4	1.7	–	1	3	4	1.2	2	0.9	–	–	1	1	0.1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	3	5	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	4	–	4	3.4	8	11.2	–	–	–	–	–	–	–	2	–	–	2	1.6
–	–	–	–	–	–	1	1	0.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–
16	6	22	30.5	13	9	8	30	25.8	18	25.3	–	–	–	–	–	6	10.3	1	4	8	13	10.8
–	5	5	6.9	1	2	–	3	2.5	10	14.0	–	–	–	–	–	3	5.1	2	1	7	10	8.3
19+1*	9+1*	28+2*	38.8	18	25	18+3*	61+3*	52.5	25+1*	35.2	6	5	1*	11+1*	–	35+9*	60.3	15+10*	6	45	66	55.0
1	–	1	1.3	–	2	1	3	2.5	1	1.4	–	–	–	–	–	1	1.7	–	–	–	–	–
1	–	1	1.3	–	–	–	–	–	3+1*	4.2	–	–	–	–	–	2	3.4	5	1	9	15	12.5
3	4	7	9.7	5	4	2	11	9.4	3	4.2	4	2	10	16	–	9	15.5	1	–	5	6	5.0
2	6	8	11.1	2	–	1	3	2.5	3	4.2	2	2	8	12	–	2	3.4	3	–	5	8	6.6
–	–	–	–	1	–	–	1	–	2	–	–	2	–	2	–	–	–	–	1	1	2	–
118	102	220	–	138	126	83	347	–	232	–	138	87	92	317	–	206	–	347	88	430	865	–
–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	2	4	6	–
42	30	72	–	39	46	31	116	–	71	–	12	9	18	39	–	58	–	29	12	79	120	–
160	132	292	–	177	172	114	463	–	303	–	150	97	110	357	–	264	–	376	102	513	991	–
73.7	77.2	75.3	–	77.9	73.2	72.8	74.9	–	76.5	–	92.0	89.6	83.6	88.7	–	78.0	–	92.2	86.2	83.8	87.2	–
–	–	–	–	–	–	–	–	–	–	–	–	1.0	–	0.2	–	–	–	–	1.9	0.7	0.6	–
26.2	22.7	24.6	–	22.0	26.7	27.1	25.0	–	23.4	–	8.0	9.2	16.3	10.9	–	21.9	–	7.7	11.7	15.3	12.1	–

TABLE 6

Starčevo; the bird, fish and mollusc species and the numbers recovered.

		B	C	D	F	H	I	J	K	Sum	M	P	Q	Sum	R	S	1969	1970
E. Aves	– birds																	
Domesticated																		
Gallus gallus domesticus	– domestic fowl	–	–	–	–	–	–	–	–	–	–	–	2	2	1	–	–	–
Wild																		
Anas cf. *clypeata*	– duck (shoveler)	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–
Anser anser	– grey-lag goose	–	–	–	–	1	–	–	1	2	–	–	–	–	–	1	–	–
Anser cf. *anser fabalis*	– goose (bean)	2	–	1	–	–	–	–	–	3	–	–	–	–	–	–	–	–
Cygnus cf. *olor*	– swan (mute)	–	–	–	–	–	–	1	1	2	–	1	–	1	–	–	–	–
Cygnus cf. *cygnus*	– swan (whooper)	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Milvus sp.	– kite	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–
Aquila sp.	– eagle	–	–	–	1	–	–	–	–	1	–		–	–	–	–	–	–
Circus sp.	– harrier	–	–	–	–	–	–	(1)	–	(1)	–	–	–	–	–	–	–	–
Grus grus	– crane	–	–	–	–	–	1	–	–	1	1	–	–	1	–	–	–	–
Otis tarda	– great bustard	–	–	–	–	–	2	2	1	5	–	–	–	–	–	–	–	1
Numenius arquata	– curlew	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
G. Pisces	– fishes																	
Esox lucius	– pike	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Aspius aspius	– asp	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Abramis brama	– bream	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Cyprinidae	carp fishes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Cyprinus carpio	– carp	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	3
Siluris glanis	– catfish	–	5	3	2	–	–	5	2	17	–	–	–	–	–	–	28	16
Indet.	– unidentified	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
H. Mollusca	– molluscs																	
Viviparus viviparus		–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–
Unio crassus crassus		–	–	–	1	–	–	2	–	3	–	–	–	–	–	–	–	–

shedding teeth and teeth eruption between the many races of dogs, but according to Habermehl (1975) this is probably not so. All dogs have their adult dentition at the age of 6-7 months, M_1 erupts between $3\frac{1}{2}$-5 months, M_3 between 6-7 months. If we assume that the young dogs were born in early May, like wolf pups, the young dogs were slaughtered in August and November. At present dogs mate the year around.

Of a left tibia the distal suture was not yet com-

pletely closed, which indicates that the dog was slaughtered when it was approximately 15 months old in summer. Of a second left tibia both the distal and proximal epiphyses were not yet fused with the shaft. This animal could not have been older than 15 months. Probably it was younger.

Of the Mesolithic dogs in Padina one was slaughtered before the distal suture of the femur was closed, before it was 18 months old. Of one tibia the prox. epiphyses was not fused with the diaphyses.

Mesolithic

maxilla	r.	mandibula	r.	l.
adult dentition	1	adult dentition	4	3
		(one had been in contact with fire)		

femur, distal suture not yet closed	1	> 18 months
tibia, prox. suture not yet closed	1	> 18 months

Neolithic

maxilla	r.	l.		
	1	1		
mandibula	r.	r.*	l.	l.*
	11	6	9	8

32 adult dentition	7 months or older
1 $p_2p_3M_1$ erupting	$3\frac{1}{2}$-5 months
1 M_3 erupting	6-7 months
femur, prox. suture still open	6-9 months
tibia, prox. + dist. ep. missing	> 15 months
prox. sut. not closed	± 15 months

* has been in contact with fire.

The bones of Padina III were broken to such an extent that they were hardly measurable. The length of the M_1 of the mandibula lies for Padina (III) between 19.0-23.0 mm with a mean of 21.2 mm. Compared with M_1 of dogs in Gomolava (Vinča and La Tène) and Roman Sirmium (Sremska Mitrovica) it shows that the dogs of Gomolava-Vinča were smaller than those of Padina III.

	18	19	20	21	22	23	24	25	26	mm
a	–	1	–	1	1	–	–	–	–	
b	1	1	4	–	–	–	–	–	–	
c	–	2	6	2	3	2	–	–	1*	
d	–	–	1	1	–	–	–	–	–	
e	–	–	1	1	–	–	–	–	–	
f	–	–	–	–	2	2	–	–	–	

Canis familiaris. M_1, max. length: a Starčevo; b Gomolava – Vinča; c Padina III; d Gomolava – La Tène; e Padina V; f Sirmium. * *Canis lupus.*

If the withers height is calculated with the Harcourt formulae, we find in Starčevo for a humerus 39.8 cm. In Padina (III) for the humerus 58 cm and for the two tibiae 40.7 and 51.3 cm. All four heights fall within the limits given by Harcourt (1974) and Clutton Brock (Burleigh *et al.*, 1977) for English dogs in the Neolithic.

Badger – *Meles meles* Linnaeus, 1758

In the Mesolithic layer of Padina (I) a fragment – pars molaris – of a mandibula of a badger was found. The back teeth were missing. In Starčevo a left mandibula and a right ulna were found in a pit (I).

The badger lives in mixed, deciduous woods with open spots, not too far away from water, both in level and mountainous regions.

The skin is useful and the meat could have been used as food.

Otter – *Lutra lutra* Linnaeus, 1758

Of the otter two bones were collected from pits in Starčevo: a humerus and an ulna.

The otter lives along rivers and in marshy areas.

The meat is good and the fur beautiful.

Pine marten – *Martes martes* Linnaeus, 1758 and marten – *Martes sp.*

Both in Mesolithic (I) and Neolithic (III) Padina the remains of marten were found. In the Mesolithic layers three mandibulae and in the Neolithic two, which could be identified as pine marten because the foramina mentalia were placed far apart. This characteristic according to Gaffrey (1953) is specific for the pine marten. Three femora in Padina I, and four femora in Padina III could not be identified as to species. The small size of the three mandibulae which could be measured seems to indicate that they belonged to females. According to Gaffrey (1953) the length of the tooth row for recent pine marten lies between 31.5-33.5 mm for ♀♀, and between 35.5-38.0 mm for ♂♂. For the beech marten between 31.3-33.0 mm for ♀♀, and between 34.0-36.0 mm for ♂♂. The long bones could belong to either species, but because the mandibulae belong to the pine marten the long bones probably do too.

The pine marten is found both in deciduous and pine woods, the beech marten at the edge of woods

in rocky and mountainous areas. Today the last species is a culture follower and lives in the vicinity of human settlements.

Whether the meat would have been eaten is questionable. The furs however would have been useful.

Wild cat – *Felis silvestris* Schreber, 1777
Remains of the wild cat were found both in Starčevo and Padina. One mandibula in Starčevo (fig. 10). In Neolithic Padina (III) four bones may have belonged to the same animal. Of the distal part of a humerus, the suture was closed. In a domestic cat this happens approximately at the age of 8½ months. On the distal half of a radius the suture was open. With the domestic cat it closes at approximately 11½ months, and of a femur the suture of the trochanter major was still open. In a domestic cat this suture closes at approximately 8½ months (Habermehl, 1975). The fourth bone is a metatarsus IV. A metatarsus II may have belonged to a second animal.

It seems that the first wild cat was killed when it was approximately 8½-9 months old. The young of the wild cat are born in April or May, so that this animal was caught in winter.

The biotope the wild cat prefers is wood with open spaces, or wood steppes.

The meat of the animal is good for eating, and the fur would also have been useful.

Lynx – *Lynx lynx* Linnaeus, 1758
Remains of the lynx are found in both Mesolithic (I) and Neolithic (III) Padina. In the first phase a humerus (fig. 12) and a metatarsus II, in the second a small part of the cranium – a l. os temporale – and a calcaneus. The distal end of the humerus was burned black. It seems that also the lynx was used as food. The lynx is living in woods.

Brown bear – *Ursus arctos* Linnaeus, 1758
Of the brown bear one metacarpus V came from a pit in Starčevo. Around Padina both in the Mesolithic as well in the later periods bears must have been hunted occasionally. All remains belonged to adult animals. A skull fragment, fragments of lower jaw, loose elements of the lower jaw, as well as fragments of long bones (fig. 13) with carving marks and burned patches show that the bears were brought to the village and were used as food. Probably the hides were also used.

Bears live in large, extended woods both on the plains and in the mountains.

Fig. 12. Padina, *Lynx lynx* – humerus, found in sector II, Late Mesolithic (photo: C.F.D., R.U. Groningen).

Horse – *Equus przewalskii* Poliakov, 1881
Wild ass – *Equus hydruntinus*
During the Mesolithic and Neolithic two equid species lived in Central and Southern Europe, the wild horse – *Equus przewalskii* – and a wild ass or zebroid equid – *Equus hydruntinus*. Remains of both species may be present.

In pit four (B) in Starčevo a little used incisor was found of a young animal, indicating that the animal it belonged to was young when it died. A fragment of a calcaneus and a phalanx II were found in the same pit. Both bones belonged to a horse[4]). In unit I a molar of a maxilla and an as-

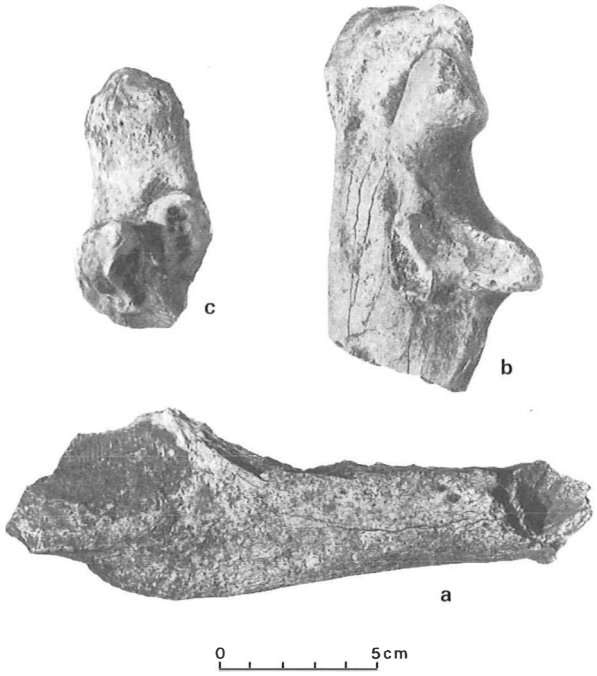


Fig. 13. Padina, *Ursus arctos*, a – mandibula, Late Neolithic – Early Iron Age; b – ulna, Late Mesolithic; c – calcaneus, Late Mesolithic (photo: C.F.D., R.U. Groningen).

tragalus, both of a horse, were found. A humerus, radius, pelvis and phalanx I of a horse were collected from unit P. A M_2 from unit Q could have belonged to an *Equus hydruntinus*, but this is not certain. In unit R a r. M^1, a M_2, an incisor of the mandibula or maxilla, the distal part of a radius, a distal part of a tibia of which the suture was not yet closed (the distal suture of the tibia of a horse closes at the age of 2 years; this was a young animal), an astragalus, two phalanx 1 belonged to a horse.

In Padina I a r. calcaneus of a horse was found. It could not be measured. In the layer belonging to the Roman period a part of a right mandible of a horse was found with P_2 and P_3. In this period the animal was probably domesticated.

Equus hydruntinus is thought to have been a steppe animal, suggesting that the inhabitants of Starčevo were able to hunt these animals in the vicinity of their settlement, but the environment of Padina seems to have been a less suitable biotope for this species. Remains of *Equus hydruntinus* were, however, also found in Lepenski Vir (Bökönyi, 1973).

Both horse and wild ass could have been used as food, the bones could have been worked into tools, and the hides into garments.

Wild boar – *Sus scrofa* Linnaeus, 1758
Domestic pig – *Sus scrofa domesticus*
In both settlements remains of wild boar as well as those of domestic pig have been found in small numbers (fig. 14). It is not always possible to establish with certainty whether a bone belonged to a domestic or a wild animal. It seems that a few bones found in Padina both in Mesolithic as in Neolithic levels are so small that they must have belonged to domesticated animals. Probably also in the cave of Icoana in Romania remains of domestic animals were found in Mesolithic layers (Bolomey, 1973).

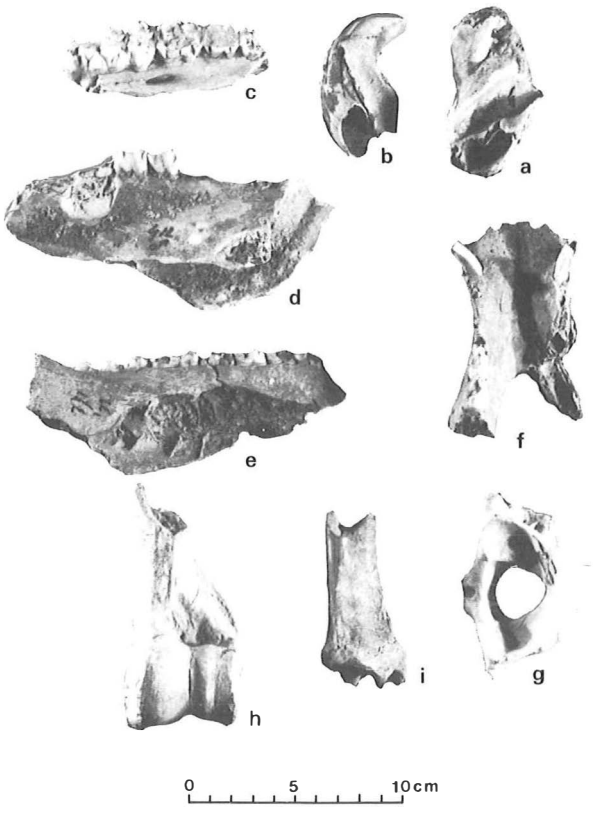


Fig. 14. Starčevo, *Sus*, a – maxilla ♂ (D bag 387); b – maxilla ♀ (E bag 412); c – maxilla (E bag 412); d – mandibula ♂ (E bag 412); e – mandibula ♀ (E bag 412); f – mandibula ♀ (M bag 371); g – atlas (E bag 412); h – humerus (D bag 387); i – tibia (E bag 412) (photo: National Museum, Belgrade).

A number of measurements of the bones from Starčevo were compared with those of pig remains found in the Vinča and La Tène layers of Gomolava (Hrtkovci) and layers of Roman Sirmium (Sremska Mitrovica)[5] . Some of the bones found in levels II and I and trench A were of small sized animals and are comparable with those of the La Tène and Roman layers of the other sites. They are an indication that level II and I contain material from younger periods (tables 38-41).

In Mesolithic Padina (I) 15 canines of the lower jaw of ♂ wild boar were found of which 11 were worked into tools. From the Neolithic (III) layers only 3 worked C fragments were collected.

The age at which the animals were killed could in some cases be established by the dentition of upper and lower jaw and by the state of fusion of the distal and proximal ends of the long bones.

Late Mesolithic

Sus scrofa				
Mandibula	r.	l.	r./l.	
$M_1M_2M_3$	–	2	–	2 years or older
pars incisiva	–	–	1	?
Sus sp.				
Maxilla				
$p^1p^2p^3M^1$?	–	1	–	> 2 years
Mandibula				
$p_1p_2p_3M_1$	2	–	–	3 months
$M_1M_2M_3$	1+1 ♀	–	–	< 2 years

Early Neolithic

Sus scrofa				
Mandibula				
$M_1M_2M_3$	2+1 ♂	1 ♂	1	2 years or older
Sus sp.				
Mandibula				
$M_1M_2M_3$	2 (1)	–	–	2 years or older

Of one of the humeri the proximal suture was still open, and of three others the sutures were closed. Of the tibiae 1 proximal suture was closed, of the distal end, 2 were found with closed and 2 with open sutures. With domestic pigs the proximal sutures of the humerus and tibia close at the age of $3\frac{1}{2}$ years, the distal suture of the tibia fuses at the age of two years (Habermehl, 1975). A small number of bones belonged to domestic pig.

In Starčevo half of the animals were killed before reaching the age of two years, according to the dentition of maxillae and mandibulae (table 36, 37).

The presence of two animals ca. 1 month old, gives a slaughter period of late spring or early summer.

Pigs live in mixed deciduous forests with underbrush and water in the vicinity. The marshy flood plain of the Danube would have been a suitable biotope for pigs. The environment of Padina probably offered a less favourable habitat for this species either wild or domesticated.

The meat of pig is good and the bones as well as the canine of the mandibula of the male wild boar have been used to make tools. The skin could have been made into leather and used for clothing or other purposes.

Roe deer – *Capreolus capreolus* Linnaeus, 1758

Roe deer remains were found in both sites in small numbers. In Mesolithic Padina a maxilla and a mandibula with mature dentition were collected and a single p2. Apparently also young animals were caught. In Neolithic (III) Padina a mandibula with mature dentition was collected. Roe deer remains were more numerous in Starčevo (fig. 22).

Roe deer live in a large variety of biotopes from the lowland up to the timberline in mountains but favour open country with good cover.

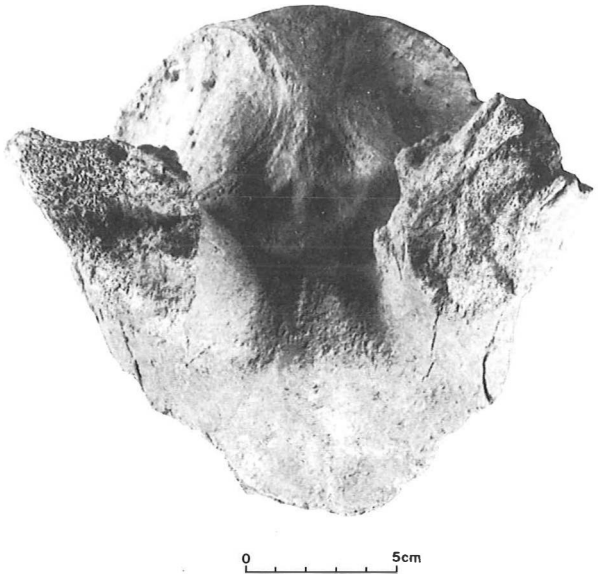


Fig. 15. Starčevo, *Cervus elaphus* – skull of a stag (V bag 345) (photo: National Museum, Belgrade).

Fig. 16. Starčevo, *Cervus elaphus* – natural shed antlers (J bag 379) midden overlaying pit 6 (photo: National Museum, Belgrade).

Red deer – *Cervus elaphus* Linnaeus, 1758

In both settlements the remains of red deer are the most numerous of the wild mammals. In Padina it was also the most important mammal species, with percentages of 78.8 (I), 70.6 (III), 75.6 (V) (table 2). In Starčevo only maxillae and mandibulae of mature animals were found (table 36, 37). The same was true in Mesolithic Padina (I), but in the Late Neolithic (III) a maxilla was found with an immature dentition and one loose p1 or p2. The mandibulae had a mature dentition.

Late Mesolithic

Mandibula	r.	l.	r./l.	
juv.	–	1	2	
$P_2P_3P_4M_1M_2M_3$	2	1	1	2 years or older

Neolithic

Maxilla				
$p^2p^3M^1$	–	1	–	?
Mandibula				
$P_2P_3P_4M_1M_2M_3$	2	6	–	2 years or older

Most bones belong to the post cranial skeleton. The almost complete absence of skulls, maxillae and mandibulae is conspicuous.

In Starčevo one fragment of a cranium was found but no antlers that were still attached to the skull (fig. 15). The antlers were all fragmented and

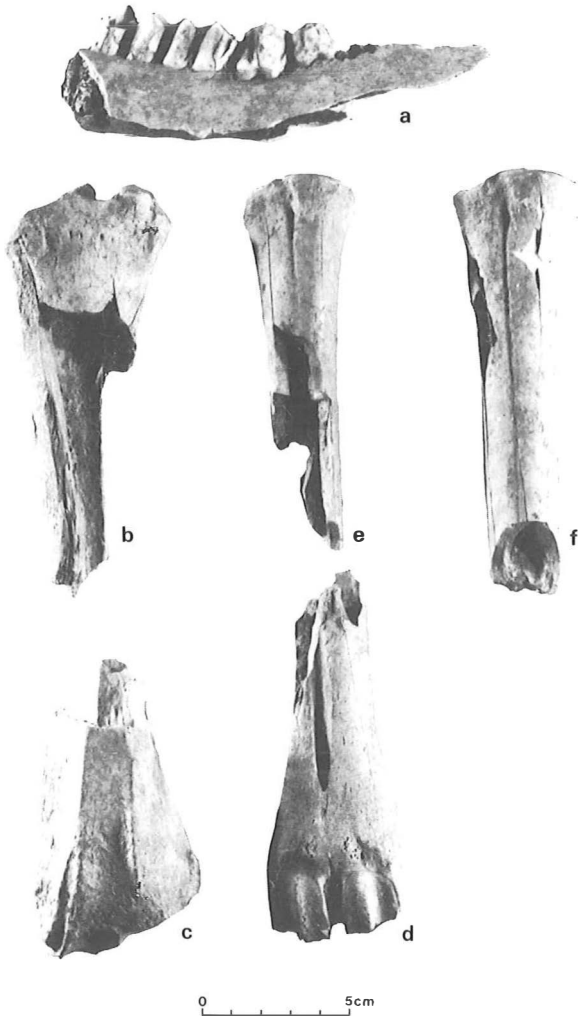


Fig. 17. Starčevo, *Cervus elaphus*, a – mandibula (E bag 412); b – radius prox. (D bag 387); c – radius dist. (D bag 387); d – metatarsus dist. (D bag 387); e, f – metacarpus (I bag 382) (photo: National Museum, Belgrade).

it could not be established whether or not they belonged to shed antlers, with the exception of three shed antlers collected in the midden overlaying pit 6 (fig. 16, 9).

In Late Mesolithic Padina (I) four antlers were still attached to a skull fragment and there were four shed antlers. There were also 98 unworked antler fragments and 16 worked fragments. Of these fragments it could not be established whether they belonged to shed or unshed antlers. The four shed antlers show that antlers were collected.

In the Early Neolithic (III) layers one antler attached to the skull was found, and three natural shed antlers. There were 37 unworked antler fragments and 10 worked ones.

Most of the long bones were broken (fig. 17). When we compare the measurements of the long bones from Padina and Starčevo with those from the Vinča levels of the dwelling mound of Gomolava in the Vojvodina on the Sava, it appears that the lowland red deer were slightly larger than those hunted by the inhabitants of Padina during the Mesolithic and Neolithic. The measurements presented in table 42-49 which can also be compared with those of red deer remains from Obre in Bosnia (Bökönyi, 1976).

The measurements of red deer found in Obre I (late Starčevo) and Obre II (Butmir culture) in Bosnia (Bökönyi, 1976), seem to range between the measurements of the gorge and the lowland, while the means of Obre I are closer to those of the gorge, and the means of Obre II closer to those of the lowland sites of Starčevo and Gomolava.

Compared with the measurements of red deer in Neolithic Romania and Hungary (Pietschmann, 1977), it appears that the Romanian red deer might have been even slightly larger than those of the lowland deer of the central Danube basin. The maxima of both Hungarian and Romanian measurements are higher than those from the gorge. According to Pietschmann there is a dwarfing of red deer from the South-East to the North-West, and on the Peninsulae of Greece and Italy from North to South. Other investigators have also noted the phenomenon and commented upon it. There is also a dwarfing through time which, although not apparent in Obre, probably can be observed in other later sites in Yugoslavia. The red deer remains of the La Tène layers of Gomolava (Clason, 1979) and Roman layers of nearby Sremska Mitrovica[5]) – Roman Sirmium – seem to be smaller than those of Vinča, Gomolava and Padina. Apparently the lowland conditions in the Neolithic period were more favourable for red deer than in the wooded mountains around Padina. This changed later. Red deer can live in a variety of biotopes but favours open woods with undercover and open spaces. They live in the lowland as well as in mountains to an altitude of 2000 m.

Red deer meat has a good flavour, the bones and antlers can be used for tools, the hide can be used to make clothes, shoes and other objects.

Aurochs – *Bos primigenius* Bojanus, 1827
Domestic cattle – *Bos taurus* Linnaeus

In both Padina and Starčevo were remains collected of wild and domestic cattle but in Padina neither of the two occurred in large numbers.
In Starčevo domestic cattle are the most important domestic animals (fig. 18, 19, 20). A number of measurements of the bones from Starčevo were

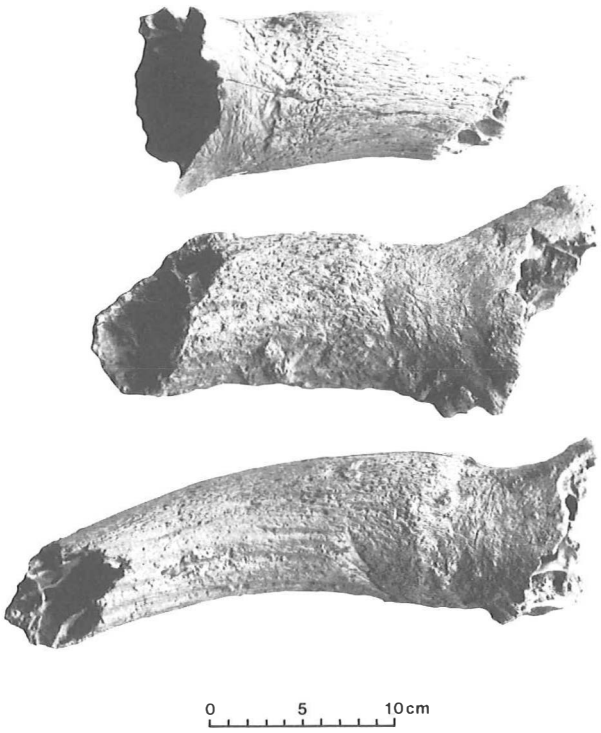


Fig. 18. Starčevo, *Bos taurus* – horncores (U bag 498) (photo: National Museum, Belgrade).

Fig. 19. Starčevo, *Bos taurus* – horncores (I bag 381) (photo: National Museum, Belgrade).

compared with those of cattle remains found in the Vinča and La Tène layers of Gomolava (Hrtkovci) and layers of Roman Sirmium (Sremska Mitrovica). Some of the bones found in levels II and I and trench A were of small sized animals and are comparable with those of the La Tène (Clason, 1979) and Roman layers[5]) of the other sites. They are also an indication that level II and I contain material from younger periods (tables 50-58, 60).

In Starčevo domestic cattle were slaughtered at different ages. According to the dentition of the mandibula ca. 50% of the animals were killed when 3 years old or older. Of the aurochs not only adult animals were hunted but also calves (table 37). In Padina cattle remains are found in such small numbers that it is not possible to say anything about the slaughter age. It seems however that most of the bones belonged to mature animals.

In Padina no complete metapodiae were found, so that it is impossible to say much about the withers height of cattle. In Starčevo there was a more or less undamaged metacarpus in level III (200.0 mm) and another in trench B (194.0 mm). This gives a withers height of ca. 120 cm and 116.4 cm when the factors of Fock (1966) are used. In a pit a complete metatarsus was found with a length of 223.0 mm, giving a withers height of 119.3 cm. If we had used the multiplying factor for bulls these figures would have been slightly higher. In Gomolava withers heights of 102 and 125 cm for Vinča level animals, and 92.0, 105.0, 109.0 and 113.0 cm for La Tène cattle were found.

Wild cattle could have lived in a variety of biotopes, but it is thought that they preferred open woods and open areas with some cover.

The aurochs and domestic cattle would have served as food, the hides could have been used for variety of purposes, the horns could have been made into drinking beakers and containers, while the bones were used to make tools.

Sheep – *Ovis aries* Linnaeus
Goat – *Capra hircus* Linnaeus

In Padina a small number of bones came from small ruminants. In Starčevo after domestic cattle they were second in importance. In Padina sheep were certainly kept, for goat this is not certain although a humerus of phase III may be of a goat.

In Starčevo both sheep and goat were kept. Horncores of both species were found. Sheep seems to

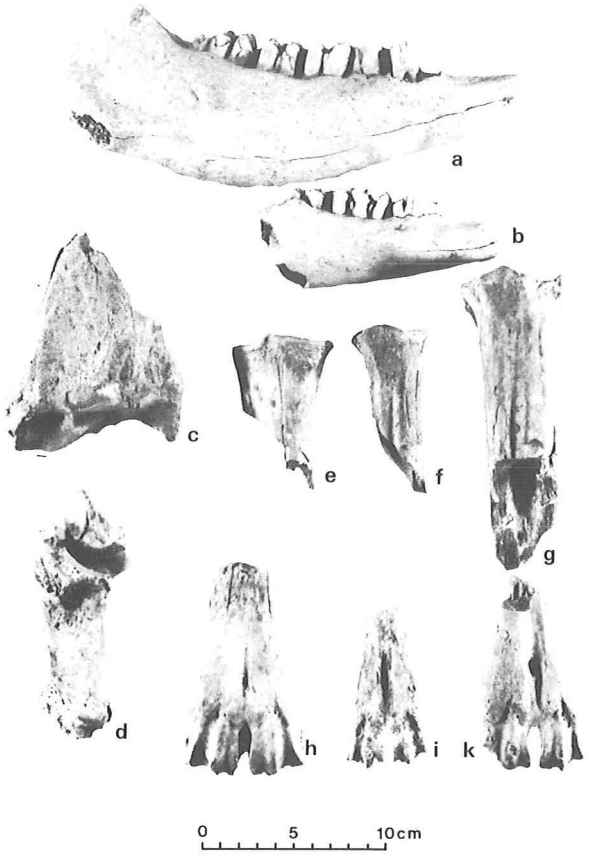


Fig. 20. Starčevo, *Bos taurus*, a, b – mandibula (D bag 387); *Bos primigenius*, c – radius dist. (N bag 417); *Bos taurus*, d – calcaneus (D bag 387); e – metacarpus prox. (D bag 387); f, g – metatarsus prox. (D bag 387, Q bag 361); h – metacarpus dist. (D bag 387); i, k – metatarsus dist. (D bag 387) (photo: National Museum, Belgrade).

have been heavily horned (fig. 21, 22). Although it is not always easy to separate sheep from goat bones, we get the impression that sheep were the more numerous. When we look at the dentition of the mandibula, 46.9% of the animals were slaughtered before reaching maturity. The number of animals ca. 3-6 months old is slightly higher than those of the other immature groups, which may indicate a slaughtering of lambs in autumn.

The animals seem to have been of small stature. The withers height calculated for a metacarpus of Padina V is 52.3 cm. In Starčevo two groups of heights were found: 1) calculated for the long bones; 2) calculated for the calcaneus and astragalus.

Radius	54.47 cm
Metacarpus	62.5, 57.5, 56.9 cm
Tibia	40.2 cm
Metatarsus	66.0, 58.1, 56.9, 57.6, 59.4, 56.2 cm
Astragalus	74.8, 68.0, 61.2, 73.7, 70.1 cm
Calcaneus	76.9, 71.2 cm

The multiplying factors of Teichert (1975) were used.

Teichert (1975) has mentioned that the astragalus and calcaneus are not very reliable for the calculation of withers height, because they represent only a small part of the height of the animal. A second reason for the difference in withers height may be that not all the bones are from sheep but some may also have belonged to goat. To calculate the withers height of goats, multiplying factors were worked out for humerus, radius, femur, tibia and the metapodiae by Schramm (Von den Driesch & Boessneck, 1974). The number of recent goats for which these factors were calculated is small. With the exception of the factor for the metatarsus, the calculated multiplying factors are lower for goat than for sheep, so that if we suppose that all bones were from goats, the withers height

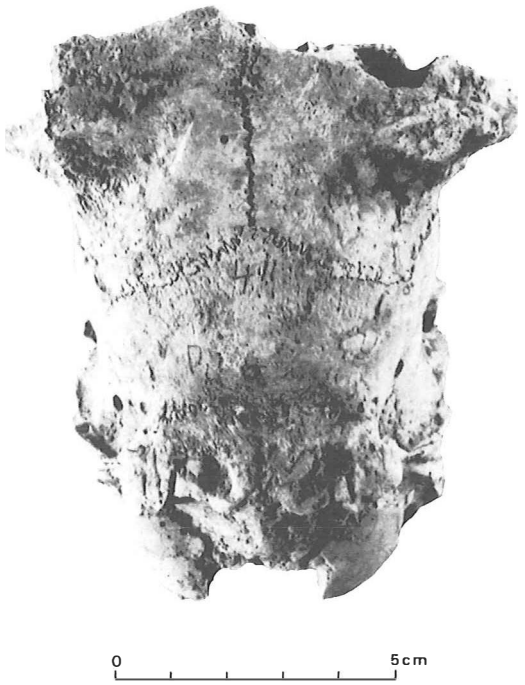


Fig. 21. Starčevo, *Ovis aries* – skull (G bag 411) (photo: National Museum, Belgrade).

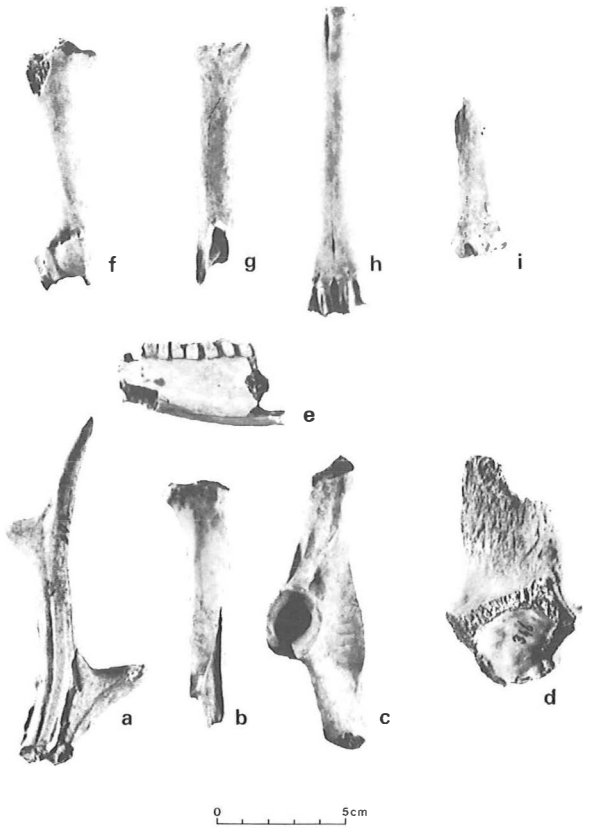


Fig. 22. Starčevo, *Capreolus capreolus*, a – antler (J bag 379); b – radius (E bag 412); c – pelvis (E bag 412); *Ovis aries*, d – horncore (V bag 346); *Capra/Ovis*, e – mandibula (D bag 387); f – humerus (D bag 387); g – radius (D bag 387); h – metacarpus (E bag 412); i – tibia (D bag 387) (photo: National Museum, Belgrade).

that could be calculated for the long bones would be lower.

In Padina the bones of sheep/goat could also have been confused with those of the chamois of which three horncores were found. The withers height calculated for the one metacarpus of Padina is too low for a chamois. The same seems to be true of the other measurements. That the Padina bones are from an ibex seems very unlikely, for these are large animals with a withers height of 105-125 cm ♀♀ and 130-150 cm ♂♂ (Van den Brink, 1968).

Chamois – *Rupicapra rupicapra* Linnaeus, 1758

Of the chamois three horncores were found in Padina I. Two were still attached to a part of the skull, of a third only the tip was found (fig. 23). It is possible that some of the bones assigned to sheep/goat are from the chamois, but it does not seem very likely. According to Van den Brink (1968) the chamois has a withers height of 75-85 cm and is larger than the European wild sheep, the moufflon, which has a withers height of 65-75 cm. Also remains of *Rupicapra* were found in other gorge settlements.

Today the chamois lives in the woods of medium high mountains up to the lower meadows at an altitude between 800-2300 m. In winter they live only in the woods, which can be of mixed deciduous woods or pine (conifer) in character.

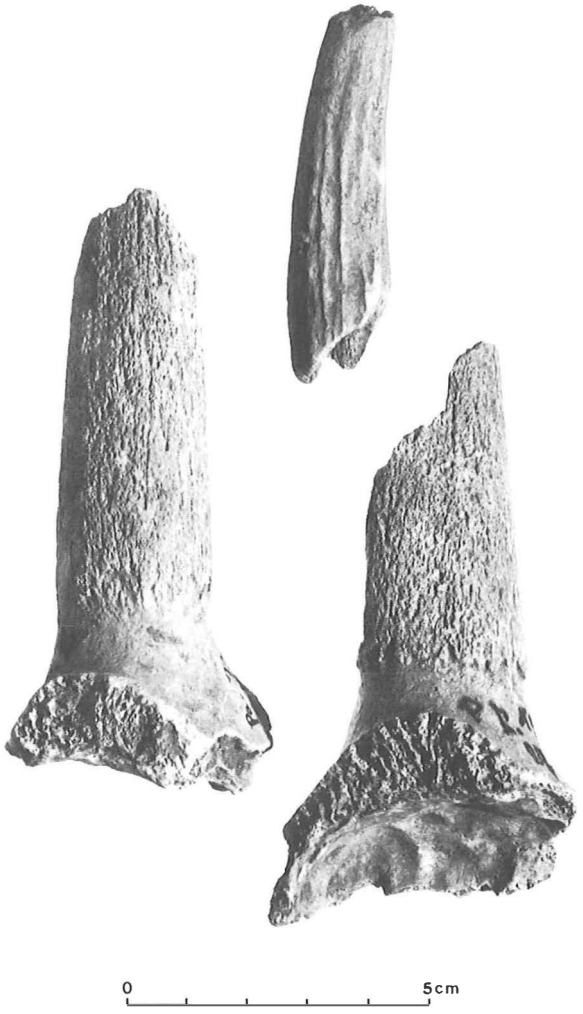


Fig. 23. Padina, *Rupicapra rupicapra* – 3 horncores, Late Mesolithic (photo: C.F.D., R.U. Groningen).

The chamois has fine tasting meat, and the hides, bones and horns can be used.

3.2. Birds

Both in Padina and Starčevo small numbers of bird bones representing at least 20 species were collected. Most of them could have been used for food, while the long bones could have also provided raw material for tools. In a number of cases the feathers could have been used for adornment, and other unknown purposes. (General literature: Bauer & Glutz von Blotzheim, 1966; Heinzel, Fitter & Parslow, 1972).

Black-throated diver – *Gavia arctica* (Linnaeus)
The proximal part of an ulna came from Padina I. This was larger than those of the red-throated diver in the collection of the B.A.I. Because the black-throated diver is slightly larger than the red-throated diver, and is regularly found in Central Europe during its spring and autumn migrations, this ulna probably was from a black-throated diver. If the species had the same breeding and wintering areas as today, the bird was caught in spring or autumn.

Cormorant – *Phalacrocorax carbo* (Linnaeus)
A coracoid of a cormorant was found in Padina I. This species breeds nowadays in Yugoslavia. Birds from Northwestern Europe also move southward in winter. The shag – *Phalacrocorax aristotelis* – is smaller and almost exclusively marine. The cormorant feeds on fishes.

White pelican – *Pelecanus onocrotalus* (Linnaeus)
A coracoid of the white pelican was found in Padina III. An epistropheus, third and fourth vertebrae of the neck, also from Padina, are undated (fig. 24). These vertebrae belonged to the same individual.

At present the species nests in Bulgaria and Romania, but during prehistory it could also have nested in Yugoslavia. It is found in inland water, marshes and shallow lagoons.

Mute swan – *Cygnus olor* (Gmelin)
A scapula fragment of mute swan came from Padina I, an undated tibio-tarsus was not identified with certainty. In Starčevo three carpo-metacarpi, which were found in level II, and unit J and K also probably belong to the mute swan. The mute swan lives along coasts and on fresh water lakes.

Whooper swan – *Cygnus cygnus* (Linnaeus)
A tibio-tarsus found in unit B of Starčevo belongs

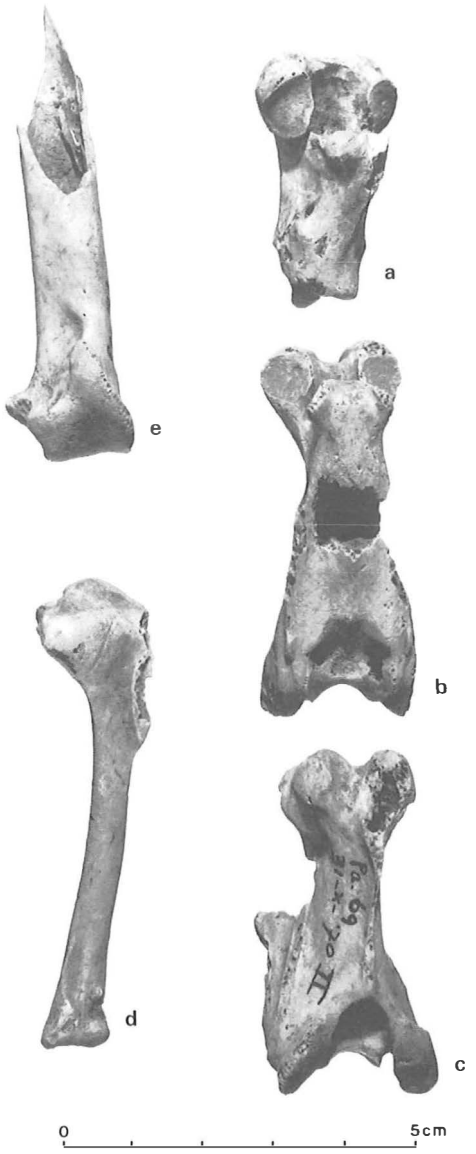


Fig. 24. Padina, *Pelecanus onocrotalus*, a – epistropheus; b – 3rd vertebra; c – 4th vertebra, not dated; *Corvus frugilegus*, d – humerus, Early Neolithic; cf. *Haliaëtus albicilla*, e – ulna, Early Neolithic (photo: C.F.D., R.U. Groningen).

probably to a whooper swan. The species breeds at present in Northwestern Europe, but migrates southward during winter. The swan was probably eaten.

Grey-lag goose – *Anser anser* (Linnaeus)
From Padina I a proximal and a distal part of a femur of the grey-lag goose represent two different birds. In Starčevo of this species, a carpo-metacarpus in unit K, two ulnae in units H and S, and one undated radius were found.

At present the grey-lag goose breeds in Eastern and Central Europe, nesting in marshes. During its migration period it looks for open spaces in the vicinity of the coasts, rivers and marshes. The environment of Starčevo would have been more suitable than that of Padina.

The goose would have provided good food, fat and feathers.

Grey-lag goose or bean goose – *Anser fabalis* (Latham)
Two humeri and an ulna of the grey-lag goose or bean goose (*Anser fabalis*) were found in unit B and D of Starčevo. This species nests in wooded areas in Northern Europe but migrates to the south in the winter where it favours the same habitat as the grey-lag goose. The skeletons of both species are much alike.

Shell-duck – *Tadorna tadorna* (Linnaeus)
A humerus of this species came from Padina III. The shell-duck breeds along the coasts of Northwestern Europe, but migrates to the south during the winter. It is mostly observed on plains near marshes and open water, but also in various other biotopes.

Shoveler – *Anas* cf. *clypeata*
A humerus from unit I of Starčevo probably belongs to a shoveler. The shoveler nests not only in extreme eutrophic inland lakes in Northwestern Europe and the central Danube basin but also in marshy areas. Its presence in Starčevo is therefore not surprising.

Sea-eagle – *Haliaeëtus albicilla* (Linnaeus)
A metacarpus, a femur, two tarso-metatarsi, 1 phalanx I and 2 phalanx II of a large bird of prey,

Fig. 25. Padina, *Haliaeëtus albicilla*, a – 2nd phalanx, Late Mesolithic; b – tibio-tarsus, Late Mesolithic; vulture, c – humerus, Early Neolithic (photo: C.F.D., R.U. Groningen).

probably a sea-eagle, came from levels of Padina I; an ulna from Padina III (fig. 24).

Eagles could have been hunted primarily for their feathers, which could have been used in making arrows.

Red or black kite – *Milvus milvus* Linnaeus – *Milvus migrans* (Boddaert)
A carpo-metacarpus of a kite was found in Starčevo in a trench excavated in 1969. An ulna comes from unit S (trench A). It is not certain whether this bone belongs to the Starčevo habitation period. There is not much difference between the red and

black kite but the biotope of Starčevo, both in prehistory and later, seems to indicate that we have to do with a black kite. The black kite nests in woods near lakes and marshes.

Eagle – *Aquila* sp.
A radius of a young individual that could not be identified as to species was found in Starčevo unit F.

Bird of prey – cf. *Circus*
The ulna of a young bird found in Starčevo, unit J, may belong to a harrier. A phalanx of a small bird of prey from Padina I could not be identified.

Vulture
The humerus of a vulture is from Padina III (fig. 25). It could not yet be identified as to species.

Crane – *Grus grus* (Linnaeus)
Two femora of a crane were found in Starčevo, in unit I and M. At present the crane breeds in Northern Europe and in Yugoslavia, nesting on the ground in humid areas, marshes and reed fields. In winter it is to be found in open country along rivers. Its meat is very good and tasty.

Great bustard – *Otis tarda* Linnaeus
Also found in Starčevo were bones of the great bustard. A carpo-metacarpus in unit I, and five femora. Two in unit J, one in unit I, one in unit K and the fifth in the trench opened during the excavation of 1970.

The bustard nests on the ground in Central and Eastern Europe and is nowadays to be found on open treeless plains or cornfields. Even today the bustard survives in the central Danube basin. Its presence in prehistoric times points to rather open country vegetation.

The bustard must have provided good food.

Curlew – *Numenius arquata* (Linnaeus)

A tarso-metatarsus of a curlew was collected in pit 4 (unit B) in Starčevo. Today the southern boundary of this species is the Danube and the coasts of the Black Sea. At present it still breeds in Hungary, making its nest in open country in the vicinity of water and feeding at sparsely vegetated grounds which are sometimes flooded.

Raven – *Corvus corax* Linnaeus
A distal part of a tarso-metatarsus of a raven comes from the Late Mesolithic levels of Padina I and Neolithic Padina III. The raven nests on high cliffs and in high trees. Its presence in Padina is therefore not surprising.

The raven is a scavenger. It was probably eaten.

Rook – *Corvus frugilegus* Linnaeus
A humerus was found in Neolithic Padina (III) (fig. 24). The rook also needs trees for nesting, but it feeds in more open areas than the raven.

Domestic fowl – *Gallus gallus domesticus*
Although more than one bone of domestic fowl came from Starčevo, a humerus in level I, one tibio-tarsus and one femur in level II, none were found in level III. This agrees with the supposition that the higher levels also contain younger material. The domestic fowl could not have been found in Central Europe before the Late Bronze Age, when it is found for the first time in Southern Europe (Gejvall, 1969). It was introduced from the South and was domesticated in India.

3.3. Reptiles

The remains of only one species were found.

European pond terrapin – *Emys orbicularis* Linnaeus, 1758
Of the European pond terrapin both in Starčevo and in Padina fragments of the carapace have been found. The terrapin lives in stagnant or slowly flowing water and lakes which have a rich, open vegetation. The species hibernates in the mud of the water in which it lives from September/October until March. Spring and summer are the seasons during which they could have been caught.

3.4. Fishes

In both Starčevo and Padina, but especially in Padina, fish must have formed a substantial part of the diet of the former inhabitants, and fishing would have been an important occupation. At present five species have been identified at Padina and also five at Starčevo. Only the remains of large catfish were found in both settlements. In Starčevo

there were only two species in the material excavated in 1932 and five in the trenches excavated in 1970. Of these last it is not certain whether they belong to the Starčevo Neolithic material, the more so since even today all have economic value.

The fish bones of Padina were studied provisionally by drs. D. C. Brinkhuizen to get a first impression of the fish species present. He will look at them again in future. It seems quite probable that it will then be possible to identify more species. The fish bones from Starčevo were identified by Dr. J. Lepiksaar.

Sturgeons

In the Danube and its tributaries six species of sturgeon came, or still come upstream to spawn during spring and early summer (Terofal, 1971). These are:

Beluga	– *Huso huso* – max. 8.5 m, 1300 kg
Common sturgeon	– *Acipenser sturio* – ♂ 2 m, ♀ 6 m, 200 kg
Sterlet	– *Acipenser ruthenus* – ♀ 1 m, 6-10 kg
Stellate sturgeon	– *Acipenser stellatus* – ♀ 2,2 m, 68 kg
Russian sturgeon	– *Acipenser gueldenstaedti* – 4 m, 160 kg
Ship sturgeon	– *Acipenser nudiventris* – 2 m, 40-50 kg

It is established that in Padina at least the beluga, the common sturgeon and the sterlet are represented. It is possible that the remains of the other species are also present.

Beluga – *Huso huso*
The remains of this big Danube sturgeon were found in Padina I and III. This species lives in the Black Sea and the Adriatic, entering the Danube in May to spawn.

Today this fish is of enormous economic importance for its meat is good and in addition the ♀♀ provide caviar.

Sterlet – *Acipenser ruthenus*
In Padina a few remains of the sterlet were found. It lives in the northern part of the Black Sea as well as in the rivers. It is still an important food fish.

Sturgeon – *Acipenser sturio*
This sturgeon lives in the sea and spawns from April-July in the middle course of the Danube. It was commercially important until recently. Together with the beluga it would have provided a large percentage of food in spring and early summer. Whether the inhabitants of Starčevo and Padina had the knowledge to preserve fish is not known. Probably they did. Suggested by the specialised character of the hearths in the houses of Padina which are thought to be designed for drying and smoking fish.

Danube salmon – *Hucho hucho*
Remains of the Danube salmon were found at Padina I and III. This species can attain a weight of 12-32 kg. At present this fish is fished by sportfishers.

Pike – *Esox lucius*
Two bones of pike were found in Starčevo in the trench excavated in 1970. The fish can reach a length of 30-120 cm and a weight of 34 kg. It lives in stagnant or slowly flowing water. It is easy to catch and has a pleasant taste.

Asp – *Aspius aspius*
One bone of an asp was found in Starčevo in the trench excavated in 1970. The asp lives in the middle course of rivers in most of Europe. It can reach a length of 120 cm and a weight of 12 kg. Even today it is an important food fish.

Bream – *Abramis brama*
Two fragments of bream were found in the trench excavated in 1970. The bream is living in Central and Eastern Europe in slowly flowing rivers and lakes. In Central Europe today it has a large commercial value.

Carp – *Cyprinus carpio*
One carp bone was found in pit 5A, unit D of Starčevo and three in the trench excavated in 1970. In Neolithic Padina (III) 32 carp bones were found. This species can reach a length of 75 cm, and a weight of 19 kg. The carp lives in lakes and slowly running rivers. It still is an important food fish, as it was in prehistory.

Carp fishes – *Cyprinidae*
From both Padina (I, II and III) (fig. 26) and Star-

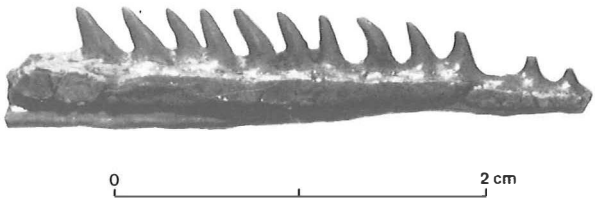


Fig. 26. Padina, skeletal element of a cyprinid (photo: C.F.D., R.U. Groningen).

čevo bones of carp fishes still have to be further identified.

Catfish – *Silurus glanis*
Catfish bones were found in several of the Starčevo pits and in the trenches excavated in 1969 and 1970. In Padina the majority of the fish bones collected belongs to catfish (fig. 27).

Catfish can reach a length of 4 meter and a weight of 300 kg. The length of the fish can be calculated from the width of the first vertebra, the atlas. In Padina 41 atlases were collected of which two could not be measured. From the width of the others the following lengths have been calculated

89.1, 113.8, 114.2, 118.0, 127.0, 130.3, 132.2, 133.6, 134.7, 137.3, 138.7, 142.7, 144.1, 146.1, 147.3, 147.7, 148.4, 148.7, 151.1, 151.2, 152.6, 153.3, 155.4, 155.4, 158.6, 161.3, 163.7, 163.7, 164.8, 168.5, 168.9, 171.2, 175.0, 181.3, 182.7, 194.5, 194,5 200.0, 204.0.

From this list we get the impression that the largest catfish were not caught. However, although the smaller ones are also missing from the series, it seems quite possible that the remains of the smaller catfish were thrown away or missed during the excavation.

Catfish live in large rivers and muddy lakes. They are economically important today. They can be caught with baited fish-hooks, and large hooks were found in Starčevo.

3.5. Molluscs

In both sites shells and bivalves of molluscs were collected.

The edible snail – *Helix* sp.
The edible snail must have been numerous in both settlements, but only in Padina was a large number of shells preserved.
These snails are best for eating in the autumn.

Unio – *Unio crassus crassus* Retzius, 1788
Big unio shells are quite common in prehistoric settlements in Central Europe. Shells were found in both sites, but most of those available were probably thrown away. Dr. Van der Spoel, who identified the Starčevo shells, pointed to the fact that they were damaged at the points where they could have been opened most easily, at the ends of the shells. It is not known whether they were eaten. It is also possible that they were only collected for their attractive mother of pearl layers. Since however no mother of pearl objects are known from Padina or Starčevo, it seems more likely that they were used as food. Another possibility is that they served as bait for fishing. In Starčevo 3 shells were collected: 2 in unit I and 1 in F.

Viviparus viviparus Linnaeus, 1758
Three shells came from Starčevo. This species lives in water and empty shells were possibly washed ashore. According Dr. Van der Spoel the following three points suggest this: 1) the shells were large and of old animals; 2) in the clay in the shells, fragments of other shells were found; 3) only in one case the way in which the shell was damaged could indicate that the body might have been taken out by man.

4. DISCUSSION

4.1. Near East

It is by now well-known that in the Near East some 10.000 years ago hunter-gatherers turned into agriculturalists. This means that they isolated small groups of several animal species from the main herds and brought them under control. These species at first were wolf – *Canis lupus*, sheep – *Ovis ammon*, goat – *Capra hircus*, later also the wild ox – *Bos primigenius* – and the wild boar – *Sus scrofa*. This process, which would have been gradual, we call domestication.

What first caused this domestication is not yet clear, although it seems that the possession of a

Fig. 27. Padina *Silnris glanis* – vertebrae and other parts of the skeleton (photo: C.F.D., R.U. Groningen).

permanent settlement may have been one of the prerequisites for its beginning.

In the Near East at the end of the last Ice Age the weather changed, gradually becoming warmer and more humid. The artemisia steppes disappeared and were followed by grass steppes or open woods. In the same period hunters and gatherers in this area exploited their surrounding ever more efficiently. Not only did they hunt big mammals but also birds, small mammals, reptiles and amphibians together with the gathering of molluscs and crustaceans, and fishing. In favourable areas this led to a surplus of food which thus enabled man to chose a permanent habitat. Wild grains could then be harvested and stored away.

One interpretation is that this favourable food situation led to a denser human population, which led in the end to overpopulation, which led people to migrating to other places where the possibilities for hunting and gathering were less favourable. In order to maintain the sedentary life to which they had become accustomed they started to keep the animals, which were abundant in the area they came from. Also in the nucleus area the constant population-pressure would lead in the end to stock-breeding and land cultivation to enable the people to keep their sedentary way of life. This process could have been repeated again and again, and spread from the Near East and from possible other nuclear areas in Europe, Asia and Africa, until by 2000 B.C. in Europe all the areas that were then suitable for cultivation, were occupied by farmers.

4.2. Southern Europe

In Southern Europe no permanent open-air settlements of hunter-gatherers are known at the end of the Mesolithic (Epipalaeolithic) outside the Iron Gate area. Even though caves would have been more or less continuously inhabited from the Late Palaeolithic (Epipalaeolithic) till the Neolithic or even later. One of the oldest known farming settlements in Europe is that of Lerna on the Peloponnesus (Gejvall, 1969). As early as the seventh mil-

lennium B.C. the inhabitants of Lerna kept cattle, sheep, goat, pig and dog. More to the North the inhabitants of Argissa Magula built houses and also kept domestic animals in the seventh millennium B.C. (Boessneck, 1961, 1962), although they did not know pottery. Also at Nea Nicomedeia in the plain of Macedonia the people kept cattle, small ruminants, pigs and dogs, at the end of the seventh millennium, as did the inhabitants of Knossos on the Isle of Crete in the Aegean (Jarman and Jarman, 1968).

Far to the Northeast, in the Masica valley, at the tell of Karanovo in Bulgaria, the inhabitants of the earliest settlements of around ca. 5500 B.C. kept domestic animals. In none of these settlements was hunting important. Sheep (and goat) were the most important domestic animals.

The oldest known farming settlements in Romania in the lower Danube plain are as old as those of Karanovo and belong to the Çris culture. The Çris culture farmers kept cattle, sheep, goat, pig and dog. In the central Danube basin lived at the same period the farmers of the Starčevo-Körös culture, which was closely related with the Çris culture (Tringham, 1971).

Neither on the lower Danube plain nor in the central Danube basin do we know of permanent settlements of hunter-gatherers. It seems plausible therefore that farmers entered those sparsely populated areas and settled at favourable spots.

4.3. The route to the middle Danube basin

There is more than one possible way by which the Early Neolithic people could have entered the middle Danubian basin. The Danube Gorge itself would have been virtually impossible, but there may well have been a traversible passage either to the North or South of it, that linked the lower and middle Danube basins.

A more traditionally accepted means would be by the so-called Vardar-Morava route from the Aegean. However, here too the terrain is extremely rugged and it would have been necessary to by-pass at least the Iron Gate of the Vardar and the gorges of the upper Morava south of Leskovac.

A third possibility might have been via the Struma, then westward along the Strumitsa and down the Bregalnica via the Ovce Palje to the Vardar which would account for the location of Anzabegovo and Vršnik. Yet a fourth might have gone further up the Struma crossed the divide either from the headwaters of the Struma or possibly the upper Timsk or Ogosta to run westward through the rugged gorges of the Nišava to the Morava valley.

So far in Bulgaria the Starčevo culture seems limited to the northwest section, with some occurrences in the hill caves near Sofia, and along the western border. To the East the Karanovo culture characterizes the Maritsa valley which drains to the Aegean, while the Starčevo-Körös-Çris complex is definitively middle Danubian.

4.4. The Iron Gate

The Iron Gate is a gorge approximately 100 km long, cut into the Southern Carpathians by the Danube. At many places steep cliffs reach to the water, while at others, where small rivers join the Danube, small loessic terraces were formed. These terraces may be up to twenty or thirty kms long and are some hundreds of meters deep. Low mountains or high hills behind the terraces isolated them from the outside world.

Some of these terraces were recognized by Late Mesolithic hunters and fishers as good places for hunting and fishing and in some the conditions were so favourable that the hunter-fishers could build permanent villages. One of these is Padina, others are Lepenski Vir and Vlasac also on the Yugoslavian right bank, and Cuina Turcului, Veteroni, Icoana and Rüzvrate on the Romanian left side of the river.

The oldest habitation is found in the cave of Cuina Turcului at ca. 10650 B.C. The hunting bag consisted at least 14 mammal species of which remains of beaver and wild pig were in the majority, followed by chamois and ibex. Birds were also hunted and shell-fish collected. Fishing was of no importance. After a hiatus of 2500 years the cave was again inhabited and some of the same species were hunted. New species are red deer and pole cat, the hunting of wild boar increased and fishing was basic (Bolomey, 1973).

During the following Late Mesolithic and Early Neolithic periods both banks of the river were inhabited. Faunal remains were collected during the

excavation of Icoana. Hunting, fishing and gathering of shell-fish were important. The inhabitants kept domestic dogs and the ages of the pig remains are suggestive of domestication: the fact that 52.6% of the animals were slaughtered between 6 and 11 months of age, points to a type planning that can only be effectuated with domestic animals (Bolomey, 1973).

4.5. Padina

On the Yugoslavian side among others were Padina, Vlasac and Lepenski Vir. The inhabitants of these settlements kept dogs and used them as food. In Padina it seems that domestic cattle, sheep, possible goat and domestic pig were also kept in small numbers. The inhabitants of Lepenski Vir III, and those of Cuina Turcului III, IV and V did the same. Hunting was important and a large number of mammal and bird species were on the menu. In Padina remains of red deer were most numerous, followed by wild boar. All species are more or less indicative of the wooded surroundings of the settlement. Fishing must have been very important and probably provided the main source of food for the settlements. Fish remains increase tremendously in Padina III, constituting 80% of all bones collected. Although this may be the result of a difference in the selection of bones by the excavators, it may indicate an improvement in fishing techniques. The species kept and hunted indicate that the settlement of Padina was permanently inhabited during all the seasons of the year, and this is probably also true for the other sites in the gorge. Although few in number the faunal remains of period V seem to indicate that hunting also had an important place in the Iron Age and Roman period, while fishing was no longer significant. We must however keep in mind that only a small number was available for research and that not all bones were collected.

The main picture we get from the Iron Gate area is that it is not a nucleus area of first domestication comparable with the Near East. Although Bökönyi (1975) made it acceptable that dogs were locally domesticated in Vlasac and the inhabitants of Padina I and Icoana kept pigs, this domestication and pig keeping did not take place before farmers settled in the lower and central Danube basin. It seems therefore more plausible that in the Iron Gate Gorge, which was difficult to reach, the original inhabitants of Central Europe found a refuge or could maintain themselves longer than in the plains. The unexpected favourable food situation made it possible to build permanent houses and live during long periods in the same area. Contacts with the surrounding areas have however always existed and gradually the Neolithic way of life of the Starčevo farmers was also accepted in the gorge.

4.6. Starčevo

The first farmers in the central Danube basin belonged to the Starčevo-Körös-Çris complex like those in Romania (Çris) and in Hungary (Körös). Starčevo was excavated in 1932, and it was then for the first time that finds belonging to what was later to be called the Starčevo culture were recognized as Early Neolithic. Excavations of other sites have indicated that an older and a younger phase are distinguishable in the Starčevo culture. Starčevo itself belonged to the younger phase. Thus the remains we are discussing in this paper are not those of the earliest Neolithic domestic animals that were kept in Central Europe.

The remains show that domestic animals were the main source of animal proteins in Starčevo. The more so since *Sus* sp., *Bos* sp. and *Bos/Cervus* are included in the sum of group C – wild ungulates. If we look at the percentages in which the domestic mammals, the rodents, and carnivores and the wild ungulates were collected, then there is a marked difference between the pits, 65.2% domestic mammals, and level I, level II, level III and trench B, with percentages of 75.3, 74.9, 76.5 and 78.0 and trench A – A extension and the trenches opened in 1969/'70 with percentages of 88.7, 92.2, 86.2, 83.8 and 87.2. It is tempting to explain this increase of the domestic animals as a sign of the increasing importance of stock-breeding. We must however be careful not to accept this explanation too easily because we have to remember that not all the bones were collected, and we have also to keep in mind that the higher levels and the material from the excavations of 1969/'70 are contaminated with younger material. If we assume that the same percentages of the bones of the larger species were

collected as were not collected, then the percentages more or less represent the proportions in which the animals were killed and possibly kept. In that case the percentages of the pits and level I are probably representative for the Starčevo occupation, but not the percentages of the higher levels and other trenches. This also seems to point to the fact that these two complexes are representative for the Starčevo period. Also in some of the other Starčevo settlements sheep remains were found in relative high numbers. If the plain had a more open vegetation than elsewhere in Europe, as the remains of horse and great bustard would seem to indicate, then the farmers of Starčevo could keep sheep and goats, but mainly sheep in larger numbers than was possible at other places. Domestic pigs were killed only in small numbers. The remains of wild boar are more numerous, and possibly it was easy to hunt them in the swampy flood plain of the Danube so that it was not necessary to keep a large number of domestic pigs. Wild boar and red deer were the most important wild animals which were hunted by the Starčevo farmers. Birds seem to have been unimportant. The same can be said for the fishes. Especially for this last it is not certain whether this is true, for there was no sieving done in 1932. Most of the remains of smaller fishes were found in 1969/'70 during sieving. Compared with Padina the absence of sturgeon remains is conspicuous. Scales of the large sturgeons would have been so recognizable that they would certainly have been collected if present, as they were in Padina. This absence of the large sturgeons in Starčevo is an important difference between Starčevo and Padina. Also in the Körös sites in Hungary remains of the catfish but not of sturgeons were found (Bökönyi, 1974). It seems unlikely that the Starčevo-Körös farmers were not able to catch sturgeon, for they were able to catch catfish and even in the Mesolithic the inhabitants of Padina were able to catch the big sturgeons. We must also consider the possibility that it was not possible to catch sturgeons in the vicinity of the Starčevo-Körös sites, but this also seems unlikely. Since at least *Huso huso*, *Acipenser nudiventris*, *Acipenser ruthenus*, and *Acipenser stellatus* reach the rivers of the central Danubian basin (Maitland, 1978), it seems that domestic and wild mammals were more important for the Starčevo farmers than for the inhabitants of Padina where certainly during the spring and early summer fish and especially catfish formed an important part of the food.

As a last group we must mention the molluscs. Probably, as in other settlements in Central Europe, the molluscs were much more important as food than one can conclude from table 6. There must have been large quantities of shell of the *Unio* and the edible snail which were not collected, or only in small number, during the excavations.

4.7. Recapitulation

We can say that it is only possible to guess at the total subsistence of the inhabitants of Padina and Starčevo. During Padina III there seems to have been a major emphases on fish, while at Starčevo domesticated animals seem to have supplied a larger share of protein than did hunting or fishing. Domesticated plants as well as gathered and cultivated plants seem to have been an important part of the diet, but the relationship and proportions of plant food to animal food cannot as yet be determined.

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The photographs of the bones from Padina were taken by Mr. S. Cordes of the Centrale Fotodienst (C.F.D) of the State University in Groningen. Those of Starčevo by a photographer of the National Museum in Belgrade in Yugoslavia.

6. NOTES

[1] At that time Department of Anthropology, Brooklyn College, New York. Current Research Associate, Peabody Museum of Harvard University.

[2] Director of the Archaeological Institute of the Yugoslavian Academy of Science in Beograd.

[3] This was a salvage excavation that had to be carried out in a short time.

[4] Pit 4 is probably a recent ditch, partly filled with old material.

[5] Unpublished data.

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