Volume XIII • Issue 1/2022 • Online First

INTERDISCIPLINARIA ARCHAEOLOGICA
NATURAL SCIENCES IN ARCHAEOLOGY
homepage: http://www.iansa.eu

Archaeozoological Analysis of Animal Remains from the Mesolithic Site of Kukrek Culture Igren' 8 (Ukraine)

Alina Stupak[1,2], Leonid Gorobets[1], Smagol Viktoria[1], Leonid Zalizniak[3]

[1]*Department of Paleontology, National Museum of Natural History, Ukrainian National Academy of Sciences, 01030, 15 Bohdan Khmelnitsky Street, Ukraine*
[2]*Department of Archaeology, National University of "Kyiv-Mohyla Academy", Skovorody 2, Kyiv 0470, Ukraine*
[3]*Department of Stone Age, Institute of Archaeology, Ukrainian National Academy of Sciences, 04210, 12 Heroiv Stalingrada Avenue, Ukraine*

ARTICLE INFO

Article history:
Received: 7th June 2021
Accepted: 31st January 2022

Key words:
Mesolithic
Archaeozoology
pit-dwellings
Igren 8

ABSTRACT

Igren 8 is a settlement of hunter-gatherers of the Mesolithic period. In total, 10 pit-dwellings were found, having been constructed by the people of the Kukrek Culture (the 8th – 7th Millenia BC). The present study focuses on revising the animal osteological material according to modern archaeozoological techniques. The study findings are related to the seasonal fluctuations of the settlement, the hunting specialisation of its inhabitants, and the details of taphonomy of the bones found. Moreover, a group of bone fragments were distinguished that constituted the waste material from bone tool production. The major groups of osseous industry are also described.

1. Introduction

The archaeological site Igren 8 is a seasonal settlement of the Mesolithic hunter-gatherer tribes of the Kukrek Culture. These former residents left behind some well-persevered remains of 10 pit-dwellings. Complete research of all categories of archaeological material has a high potential for the reconstruction of the economy and everyday life of the Mesolithic tribes who inhabited the river zones of the Ukrainian territory.

The Igren 8 settlement belongs to the full-grown stage of Kukrek cultural development (Zalizniak, 2005, pp.74–82). The Kukrek Culture (10th – 7th Millenia BC) was developed on local bases of the Epigravettian Palaeolithic culture. The earliest sites of the Kukrek Culture were located in the territory of the Crimean Peninsula and the northern Black Sea region. As time progressed, Kukrek tribes appeared in areas of the Lower and Middle Dnieper River. They settled in such sites as Kamiana Mohyla, Dobrianka, Gorodock, Popovy Mys and others. The Kukrek Culture reflects a basic development in the early Neolithic cultures of the Crimea and Middle Dnieper area, namely the Olexiivska and Surska Cultures (Yanevich, 1987, pp.7–18).

This site is represented within the scientific literature by two names: Igren 8 and Ogrin 8. The difference is due to the Russian and Ukrainian divergence in the naming of this location. In English-language publications, the name Igren 8 has been referred to the most. In this article, we will continue to use this name for convenience.

The archaeological site is located in the Middle Dnieper area, which belongs to the forest-steppe temperate-climate ecotone. This settlement of Mesolithic hunter-gatherers was discovered in the Igren peninsula, the Samara district of the Dnieper site, in particular its left cape. At this location, the Samara River joins the Dnieper River (GPS coordinates: 48°26'34.2"N; 35°06'46.8"E).

Sand deposits on rows of granite shaped the Igren peninsula. The granite ridges formed river rapids that lay along and across the Dnieper River. The sandy substrate of the peninsula had led to the formation of dunes. The peninsula

*Corresponding author. E-mail: lusyleakey@gmail.com

Figure 1. Igren peninsula location.

was connected to the natural ground of a geological plate covered by a loess plateau. The coast of the Igren peninsula was destroyed by the river over a long time period.

1.1 Discovery and history of site investigation

The natural erosion of the bank of the Igren peninsula was the reason for the organisation of an exploration of the area by the archaeologist M. Miller. He worked as a member of an archaeological rescue expedition during the building of the Dnieper Hydroelectric Station (1929 to 1932) (Miller, 1935, pp.162–177).

From the territory of the Igren peninsula and the neighbouring area has arisen the discovery of ten different archaeological sites from distinct historical periods. The Mesolithic site was labelled number 8. During 1946–1947, excavation was continued by the archaeologist A. Dobrovolski. He was able to fix the layers with the remains of burned wooden elements of a pit-dwelling construction. The researcher thought that it was a part of the dwelling's structure (Telegin, 2000, pp.1–86).

These types of findings became the reason to start regular excavations of the Mesolithic layers at the Igren 8 sites. Regular archaeological operations were held in 1973–1976, 1978, 1982, 1986, 1988, and 1990, in which D. Telegin led all these expeditions. Archaeologists L. Zalizniak and D. Nuzhnyi took an active part in the excavation and research.

This work resulted in the discovery of the remains of 10 pit-dwellings (Zalizniak, 2018; Telegin, 2000). They were located along the river bank. The pit-dwellings number 5 and number 10 were complete, but the river water erosion had partly destroyed the others. All of the pit-dwellings had a round form that ranged from 7 to 10 m in diameter with the vestiges of a fire at their centre. The dwelling's floor had been deepened to about 0.5–0.7 m lower than the former ground level.

The filling of the dwelling surface consists of a humous layer of sand mixed with grey ash. Many gastropod freshwater molluscs, the large freshwater snail *Viviparus viviparous,* were found in the floor area of every pit-dwelling. The presence of this species of mollusc in large numbers in the Mesolithic cultural layers indicated a pit-dwelling. The molluscs got into the filling of the pit-dwelling naturally after the seasonal overbank flooding. The ground floor of every pit-dwelling was covered with microlithic flint, animal bones and tools. The big collection of findings inside the pit-dwellings included animal bones, which were the kitchen waste of the site's inhabitants.

All groups of the material finds were studied and published. The complete research was issued by the Igren excavations leader D. Telegin (Telegin, 2000, pp.1–86). Telegin defined the technocomplex of the settlement up to the late stage of the Kukrek Culture (8th – 7th Millenia BC). It is correlated with the Late Mesolithic period in the whole Ukrainian territory. The radiocarbon dating of the site was made in the laboratories of Berlin, Groningen and Oxford (Telegin, 2000; Biagi, Kiosak, 2010; Lillie *et al.*, 2009). As a result, the leading group of dates lies between 8550 ±80 and 7640± 90 years BP. The earliest date is 9940 ±70 BP; it belongs to the dwelling number 2 (Table 1). As it appears from Telegin's notes, such a big spread of dates might indicate multiple usages of this place for living purposes and a seasonal cycle of housing in this settlement.

D. Nuzhnyi examined the features of the microlithic technocomplex. He also rebuilt a throwing weapon with microlithic elements. L. Zalizniak introduced a number of publications connected with cultural communications in the Igren settlement and a social reconstruction of the Mesolithic tribes (Zalizniak, 2018; Nuzhnyi, 2007; Benecke, 1997).

In July 2018, Zalizniak organised and led an archaeological expedition to the Igren peninsula. The expedition's principal goal implied a fixation of the Mesolithic cultural layer and the detection of new Mesolithic features. The results of the excavations were limited in the number of finds: the specialists found only some microlithic flint tools in

Table 1. The dating of Igren 8 site.

Pit-dwelling number	Lab Number	Material	Date BP	Calibration BC 1 sigma	Calibration BC 2 sigma	Reference
Pit-dwelling № 4	Bln-1798	Charcoal	8550 ±80	7670–7530	7780–7450	Telegin 2002
Pit-dwelling № 2	Bln-1797/1	Charcoal	8570 ±70	7680–7550	7770–7500	Telegin 2002
Archaeological layer	Bln-1707/2	Freshwater Shells	8570 ±70	8230–7990	8270–7840	Telegin 2002
Pit-dwelling № 2	Bln-1797/2	Charcoal	9940 ±70	9630–9330	9760–9280	Telegin 2002
Pit-dwelling № 4	GrA-33112	Long bone flake	8695 ±45	7770–7620	7910–7600	Biagi, Kiosak 2010
Pit-dwelling № 8	GrA-33113	Long bone flake	8880 ±45	8180–7960	8220–7820	Biagi, Kiosak 2010
Pit-dwelling № 8	OxA-17491	Fish bone	7640± 90	6590–6420	6650–6280	Lillie et al. 2009
Pit-dwelling № 8	OxA-17489	*Cervus* bone	8885±40	8180–7970	8220–7840	Lillie et al. 2009

the filling of the dwellings explored during the previous excavations (Zalizniak, 2019, pp.95–104).

The primary focus of this research is on the faunal material found in 9 pit-dwellings. Archaeozoologist V. Bibikova conducted the initial identification of the faunal remains. The results of her efforts were published in the Telegin's monograph (Telegin, 2000, pp.1–86): a list with different groups of animal species from the site. After further examination of Bibikova's investigations, we can conclude that the wild ox *Bos primigenius*, red deer *Cervus elaphus*, roe deer *Capreolus capreolus*, and other large ungulates made up the most important hunted resource. Among the traditional fur animals, a large number of fox *Vulpes vulpes*, hare *Lepus europeus*, wolf *Canis lupus*, and European polecat *Mustela putorius* bones were found. The bird fauna consisted mostly of river ducks, such as common goldeneye *Bucephala clangula*, mallard *Anas platyrhynchos*, and common pochard *Aythya ferina*.

Considering that the bones had been originally inspected very briefly, it appeared that more detailed research of the different kinds of faunal remains was needed. The primary goals of this research comprise the identification of species through bone fragments and observations of taphonomic details, along with analysis of use-wear traces and reconstruction of the production and wear cycle.

2. Material and methods

The animal bones collection consists of the material from 9 pit-dwellings. The faunal collection, in total 3,126 bone fragments, is preserved in the fund of the NASU Institute of Archaeology (The Institute of Archaeology of the Ukrainian National Academy of Sciences). Only 1115 (35%) bone fragments were identified. The biggest part of the animal remains belongs to mammals – 681 pieces (61.5%). The birds were represented by 118 pieces (10.5%), fish by 91 pieces (9%), freshwater turtles by 194 pieces (18%) and molluscs by 31 pieces (3%). A. Stupak studied the mammals and fish bones; V. Smagol performed the morphometry of the mammal bones. L. Gorobets identified the bird remains, while V. Anistratenko studied molluscs.

Species identification was made on the basis of the comparative collection of animal bones at the Palaeontology department of the NASU National Museum of Natural History. The archaeozoological methods were applied according to E. Reitz and E. Wing (Reitz, Wing, 2008). Age identification of mammals was made by analysis of the development of bone structure, and teeth enamel abrasion (Shostak, 1998; Kolda, 1936).

The bone measurements were made according to A. von den Driesh's methodology (Driesh, 1976). The taphonomy details were described via the recommendations of Y. Fernandez-Jalvo, P. Andrews, and A. Behrensmeyer (Fernandez-Javo, Andrews, 2016; Behrensmeyer, 1978). The red deer age was identified according to S. Shostak's methodology (Shostak, 1998). The mammoth's teeth were analysed according to V. Garutt and I. Foronova's methods (Garutt, Foronova, 1976; Foronova, 2001). Identification of fish bones was made via V. Radu's atlas of fish bones (Radu, 2005). Reconstruction of fish length and age was made following the investigative methods of V. Lebedev (Lebedev, 1960). The list of abbreviations for marking the overall quantity of inspected fragments included NISP as the Number of Individual Specimens and MNI as the Minimum Number of Individuals (Lee Lyman, 2008).

After long-term preservation, a part of the collection was lost, and the horizons of the pit-dwellings got mixed up. Mammal bones were grouped by species and not by pit-dwellings. The field codes written on the bones helped to rebuild their belonging to each pit-dwelling. This situation is associated with the primary research tasks of V. Bibikova and general development of the archaeozoological discipline. Materials from the fifth and eighth pit-dwellings were the most well-preserved. The sand surface of the Igren peninsula provided a good preservation substrate for the bone material. A large number of bones, namely 680 pieces (63.2%), were covered with an ash-grey deposit. One group of bones, 16 pieces (1.4%), had signs of weathering. These bones were covered with specific cracks left after seasonal temperature and long-time humidity changes. Another 40 pieces (6%) had a post-fire black colour. The signs of rodent-gnawing were recognised on 6 bones. The bones of all the animal species were crushed into small pieces as a

result of human activity. Every bone was crushed into three or more pieces.

The sandy substrate of the Igren peninsula contributed to the high-quality of preservation of organic material, including the animal bones. Any destruction of the bones, besides the crushing, had occurred mainly because of human activity, not the natural conditions.

3. Results

In total, mammals are represented by 13 species at the Igren 8 site. Large ungulates, such as wild ox and red deer, seemed to have a prominent economic role here. All the anatomical parts of these animals, including the not very nutritious elements such as metapodium and phalanx bones, are represented on the site. The wild ox *Bos primigenius* (NISP = 125, MNI = 6) represents one of the most critical ungulates, the age group of adult animals dominating; besides that, there are 3 subadults and 2 juveniles. The measurements of wild ox bones were taken from the 4 specimens of the talus. It was determined that Bd of the talus bone of wild ox on average is (n=4) 5.3±0.18 sm, Glm 7.9±0.07 sm (n=4), Gli 8.4±0.06 (n=4), and Dm 4.1±0.12 sm (n=4). The mid-coefficient of the variability of the four patterns is 3.74±1.26%, the smallest coefficient belongs to the Gli = 1.49%, and the biggest one to Bd = 6.71%. It means that the wild ox of this collection has a low level of variability.

The Cervidae family is represented by such species as the red deer *Cervus elaphus* (NISP = 175, MNI = 7); roe deer *Capreolus capreolus* (NISP = 48, MNI = 5), and elk *Alces alces* (NISP = 11, MNI = 1). Many red deer remains are represented by antler pieces – 45 pieces (26% from all red deer remains). The red deer antlers were used as a base for tool making. The found fragments contained the waste of the tool-making process. The burr of a red deer antler, which fell out in a natural way, is also one of the specimens. The antlers of the male individuals of red deer fall out every year in February or early March. Some parts of the antler fragments may be connected with the burr gathering. The age groups of red deer are represented mostly by adult individuals. There are 3 bone specimens of subadult age and 1 individual of juvenile age.

The Bd dimension of the talus bones of red deer on average equalled 3.72±0.07 sm (n=5), Glm 5.56±0.14 sm (n=5), Gli 5.98±0.13 (n=5), Dm 3.26±0.12 sm (n=5), and Di 3.1±0.05 sm (n=5). The mid-coefficient variability of the five patterns amounts to 5.52±0.76%, the smallest one coefficient belongs to the Di = 3.95%, and the biggest to the Dm = 8.28%. The

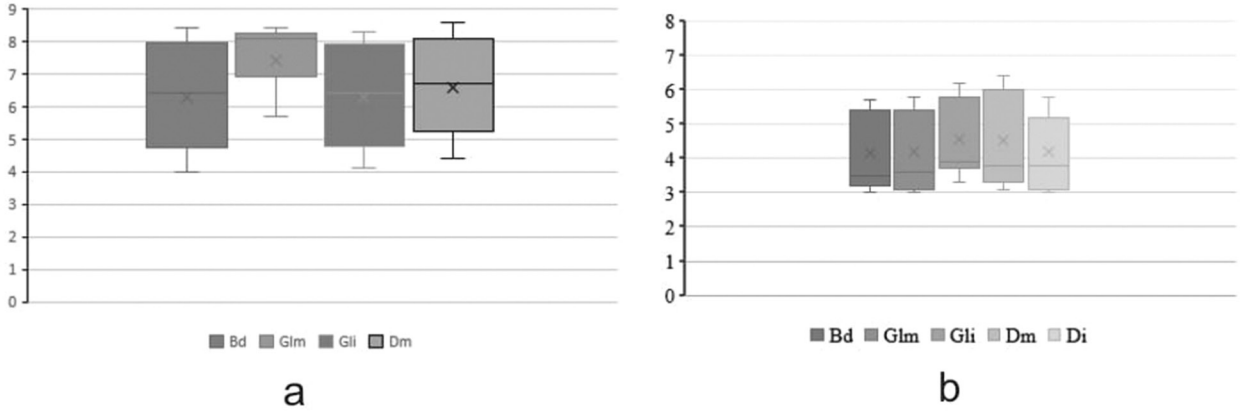

Figure 2. Dimensions of the talus bone of the: a – wild ox, b – red deer.

Table 2. The age group representation of the ungulates.

Species	Infant	Juvenis	Subadult	Adult	Sinilis
Bos primigenius; Wild ox	–	1	2	40	–
Cervus elaphus; Red deer	–	1	2	20	1
Capreolus capreolus; Roe deer	–	2	15	1	–
Sus scrofa ferus; Wild pig	–		1	1	–
Alces alces; Elk	–	–	–	3	–
Equus sp.; Wild horse	–	–	1	5	–
Canis lupus; Wolf	–	–	4	16	–
Vulpes vulpes; Fox	–	–	3	12	–
Lepus europeus; Hare	–	–	2	18	–
Castor fiber; Beaver	–	–	1	1	–

matrix relation correlation of the talus bone dimensions points to a strong dependence between its different patterns. It was determined that the correlation coefficient deals with the changes from the Gli to Glm patterns (r=0.94). A lesser index was associated with modifications of the Glm and Bd (r=0.48) values.

Table 3. The list of mammal species representation and the fresh water turtle.

Species	NISP	MNI	%
Bos primigenius; Wild ox	125	6	18.3
Cervus elaphus; Red deer	175	7	26.1
Alces alces; Elk	11	1	1.6
Capreolus capreolus; Roe deer	48	5	7.
Equus sp.; Wild horse	18	2	2.6
Sus scrofa; Wild pig	27	2	4
Canis lupus; Wolf	68	4	10
Vulpes vulpes; Fox	122	5	18
Lepus europeus; Hare	71	5	10.4
Castor fiber; Beaver	11	2	1.6
Felis silvestris; Wild cat	1	1	0.14
Mustela lutreola; European mink	1	1	0.14
Mustela putorius; European polecat	1	1	0.14
Mammuthus primigenius; Woolly mammoth	1	1	0.14
Mammals in total	681		
Emys orbicularis; Fresh water turtle	194	24	

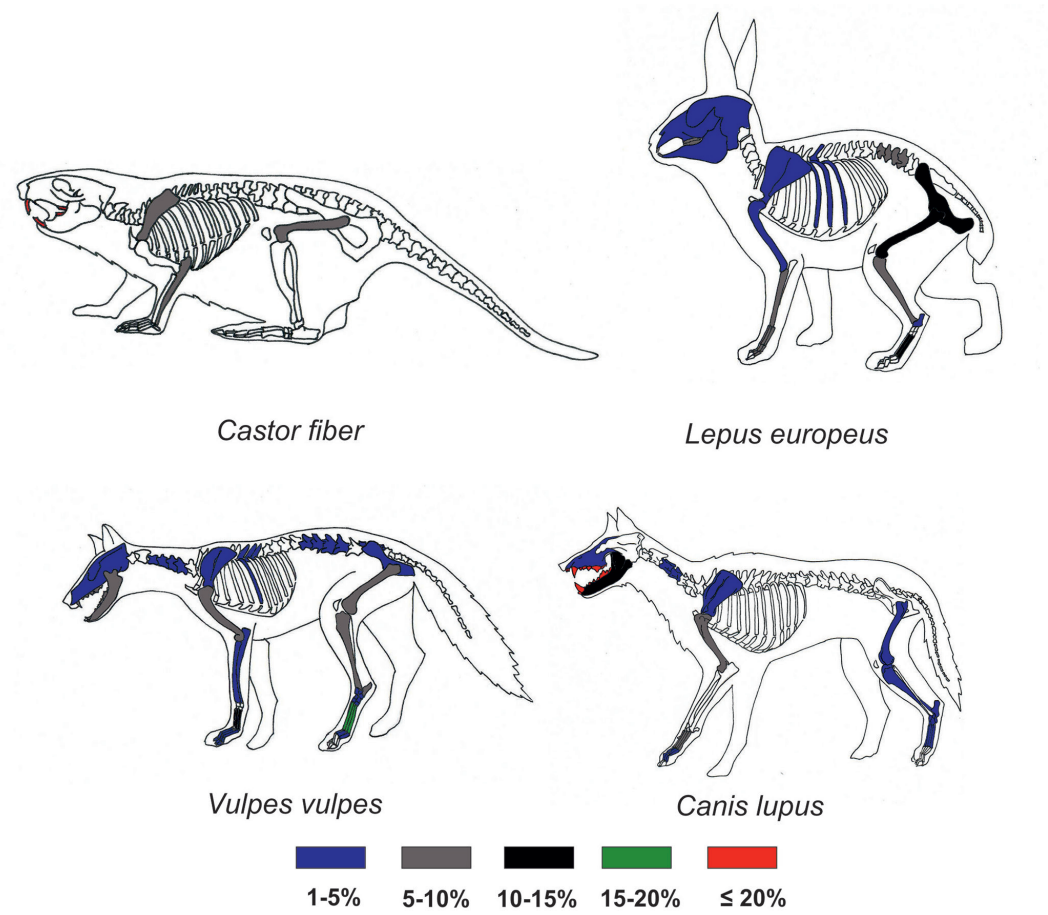

Figure 3. Anatomical representation of ungulates.

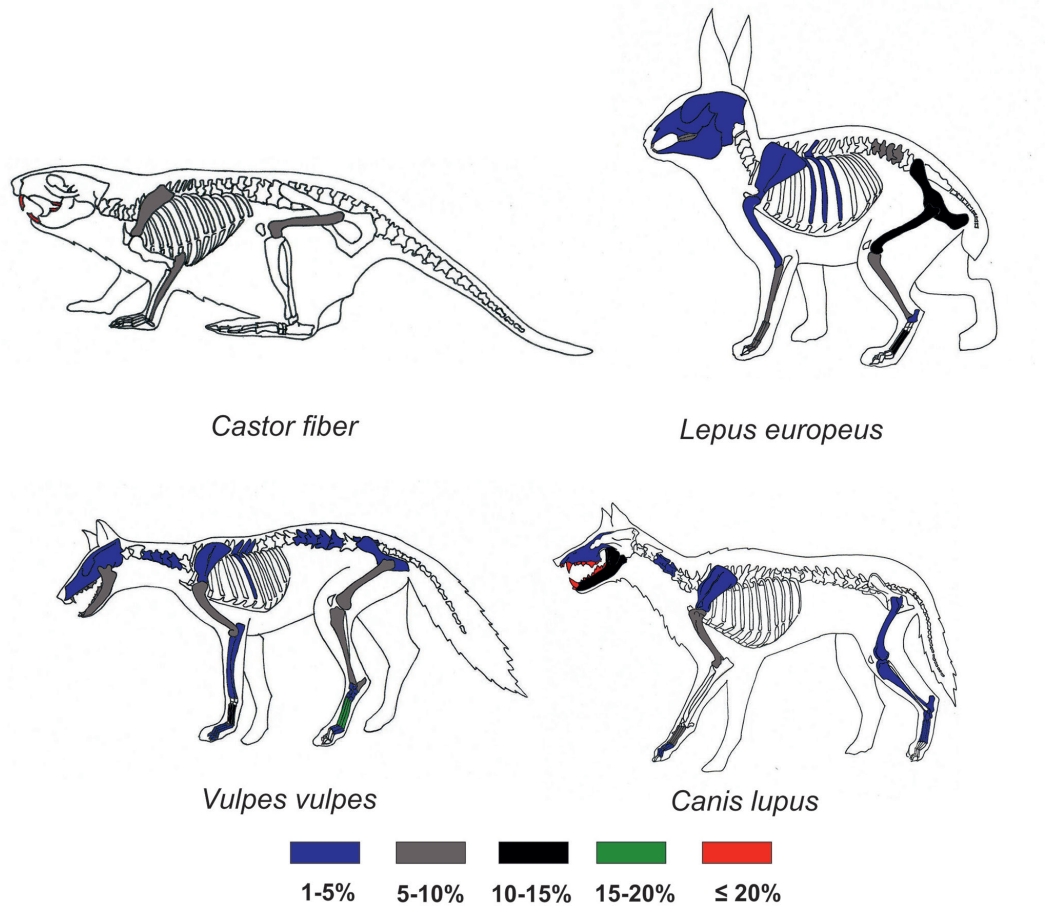

Figure 4. Anatomical representation of carnivores, beaver and hare.

Table 4. The measurements of the mammoth tooth fragment.

Mammuthus tooth measurements (mm)	
High of the tooth crown	118
Breadth of the tooth crown	82
Length of the tooth plate	13
Width of dental enamel	1,7

The smaller group of animal remains is represented by wild horse *Equus pieces* (NISP = 18, MNI = 2) and wild pig *Sus scrofa* (NISP = 27, MNI = 2).

A large number of bone remains belong to traditional fur animals. There are: wolfs *Canis lupus* (NISP = 68, MNI = 4); foxes *Vulpes vulpes* (NISP = 122, MNI = 5); hares *Lepus europeus* (NISP = 71, MNI = 5); and beavers *Castor fiber* (NISP = 11, MNI = 2). All anatomical parts of these animals are represented. The numerous parts of the fox's metapodial bones 33 ft (27%) may signify the result of the skinning process (Val, Mallye, 2011). In individual cases, there were identified the mandible of a wild cat *Felis silvestris* (NISP=1), humerus bone of a European mink *Mustela lutreola* (NISP=1), and mandible of a European polecat *Mustela putorius* (NISP=1).

The bone material also contained a fragment of a mandible tooth M 1–3 of a mammoth. It was taken from the natural ground of the site (layer D2–D3, square G 6–10), together with the mass of freshwater molluscs. The mammoth tooth fragment consists of the tooth crown with the destroyed masticatory surface and roots. The exterior surface of the tooth is covered with an ash-grey deposit similar to the one found on the other bone item from the site. After the correlation between the length of the tooth plate and the width of the dental enamel, the tooth fragment confirmed the early form of *Mammuthus primigenius* (MIS 6–7). The village of Stari Kodaki appeared to be the nearest natural spot where this type of faunal complex was found; it is situated about 7 km from the Igren peninsula. One of the possible options implies that this tooth (or its part) was brought naturally.

The bird bone remains, 118 ft (9% of whole bone collection) in total, are mainly represented by ducks: 11 species and 1 bustard *Otis tarda* (NISP = 3, MNI = 3). The leading number of remains belong to duck species, such as common goldeneye *Bucephala clangula* (NISP = 30, MNI = 9), mallard *Anas platyrhynchos* (NISP = 25, MNI = 9), ferruginous duck *Aythya nyroca* (NISP = 10, MNI = 4), and common pochard *Aythya ferina* (NISP = 9, MNI = 5). The bones of red-necked grebe *Podyceps grisegena* (NISP = 1), gadwall *Anas strepera* (NISP = 1), northern pintail *Anas acuta* (NISP = 2 MNI = 1), northern shoveler *Anas clypeata* (NISP = 5, MNI = 3), Eurasian teal *Anas crecca* (NISP = 2, MNI = 1), smew *Mergus albellus* (NISP = 3, MNI = 2), common

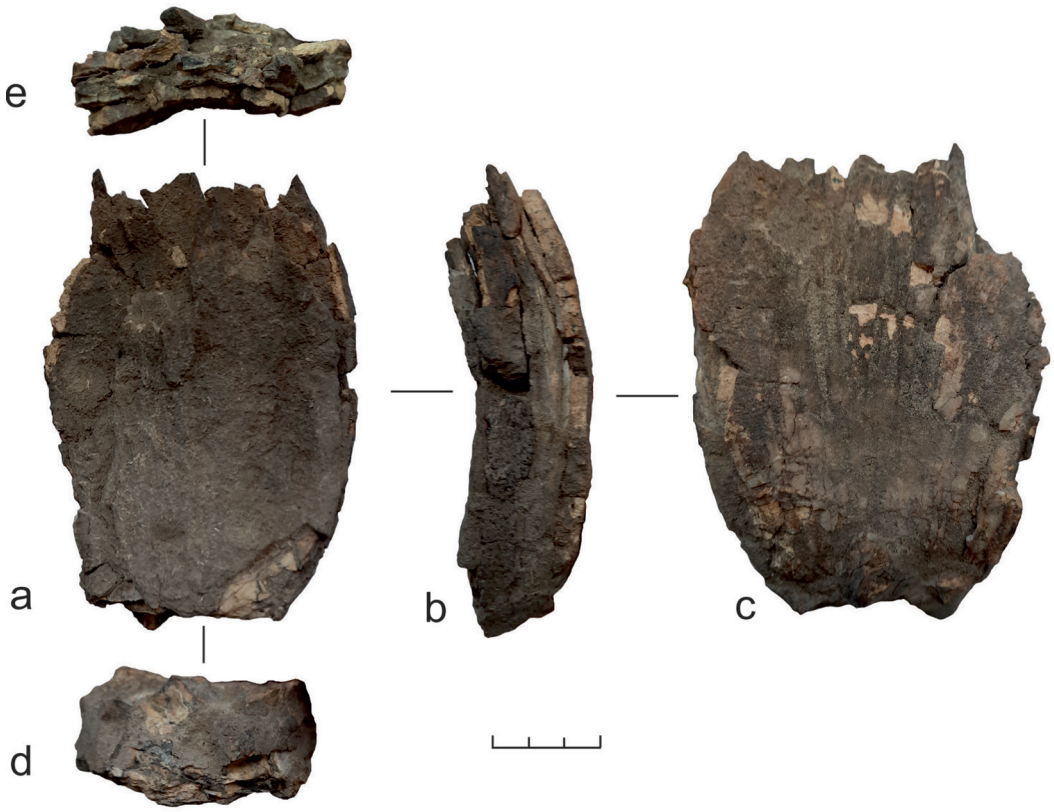

Figure 5. Mammoth's tooth fragment: a – ventral plane; b – median plane; c – dorsal plane; d – roots of tooth; e – masticatory surface.

scoter *Melanitta nigra* (MNI = 1), and different kinds of duck species *Anantini* indeterminata (NISP = 26) are represented in the smaller number.

The fishbone remains belong to 8 species, which live in the deep and littoral part of the river water. Archaeologists discovered 91 fragments of fish bones on the settlement. All of the identified fish species are typical for freshwater basins in the area. In turn, the remains of sturgeon family species NISP = 8, MNI = 3 are exclusive; fish species of the sturgeon family migrated to the lower part of the Dnieper River during the spawning period. They do not live in the river today. A large part of the bones belongs to pike *Esox lucius* (NISP = 35, MNI = 12), wels catfish (sheatfish) *Silurus glanis* (NISP = 18, MNI = 12), and sander *Sander lucioperca* (NISP = 3, MNI = 2). The carp *Cyprinus carpio* (NISP = 10, MNI = 6) has the

Table 5. The list of bird species represented.

Species	NISP	MNI	%
Podyceps grisegena; Red-necked grebe	1	1	0.8
Anas platyrhynchos; Mallard	25	9	21.1
Anas strepera; Gadwall	1	1	0.8
Anas acuta; Northern pintail	2	1	1.6
Anas clypeata; Northern schovrler	5	3	5.43
Anas crecca; Eurasian teal	2	1	1.7
Aythya nyroca; Eurasian teal	10	4	8.5
Melanitta nigra; Common scoter	1	1	0.8
Aythya ferina; *Common pochard*	9	5	7.6
Bucephala clangula; Common goldeneye	30	9	25.4
Mergus albellus; Smew	3	2	2.5
Otis tarda; Bustard	3	3	2.5
Anantini indet.	26		22.03
In total	118		

Table 6. The list of fish species represented.

Species	NISP	MNI	%
Esox lucius Pike	35	12	38.4
Silurus glanis; Sheatfish	18	12	20
Ruthilus ruthilus; Common roach	6	2	6.6
Cyprinus carpio; Carp	10	6	11
Cyprinidae gen. *et* sp.; Carp family species	5	1	5.4
Sander lucioperca; Sander	3	2	3.2
Acipenser sp.; Strugeon family species	8	3	8.7
Tinca tinca; Tench	1	1	1.1
Ruthilus frisii; Black sea roach	5	3	5.4
In total	91		

Table 7. Reconstruction of the length and age of some fish individuals.

Species	Skeletal element	Length ofbody (sm)	Age(years)
Esox lucius Pike	Vertebra precaudal	41	–
	Vertebra abdominal	85.2	–
Silurus glanis Sheatfisch	Vertebra abdominal	150	14
	Vertebra abdominal	160	16
	Vertebra abdominal	100	10

dominant role in the carp family species. Such species as Black Sea roach *Rutilus frisii* (NISP = 5, MNI = 3), common roach *Ruthilus ruthilus* (NISP = 6, MNI = 2), tench *Tinca tinca* (NISP = 1, MNI = 1), and different kinds of carp family species Cyprinidae gen. et pieces (NISP = 5) are represented in a smaller number. According to the reconstruction of the length of the fish body, the size of pike was about 40–90 cm, and the size of sheatfish was about 60–160 cm.

Some parts of freshwater turtle shell *Emys orbicularis* (NISP = 194, MNI = 24) were found in all pit-dwellings.

A relatively small number of 31 specimen (3%) remains belong to the freshwater molluscs. Potentially it represents a small part of all of the molluscs which were found in the fillings of dwellings. Perhaps, some exemplars from some species were taken for identification during the excavation. The freshwater molluscs belong to non-nutritious elements of the collection of the site. The accumulation of freshwater snail *Viviparus viviparus* (MNI = 17) shells is considered as a sign of a pit-dwelling (Miller, 1935, pp.162–177). Another mollusc species belongs to the painter's mussel *Unio pictrorun* (MNI = 4) and nut orb mussel *Sphaerium rivicola* (MNI = 10). The molluscs probably got into the dwellings during seasonal floods.

The main results of the species identification are similar to V. Bibikova's research. She worked with this material in the 1980s (Telegin, 2000). Additionally, we identified the remains of small carnivores, European polecat *Mustela putorius* and European mink *Mustella lutreola*. Still, we did not find animal remains of an onager (Asiatic wild ass) *Equus hemionus* and European badger *Meles meles*. This kind of situation can be associated with the long-term preservation of the bone collection and the consequent loss of a part of it.

Table 8. The list of mollusc species represented.

Species	NISP	%
Viviparus viviparus	17	54
Unio pictrorum	4	13
Sphaerium rivicola	10	32
In total	31	

4. Discussion

4.1 Ecological implications

The Middle Dnieper area belongs to the forest-steppe geographical zone and borders on the steppe region. The species composition of this collection is typical for mixed landscapes. The bones of the bustard *Otis tarda* on the settlement reflect the steppe elements of the environment. These results prove the presence of forests and steppe elements near the peninsula. A similar landscape in the Igren peninsula was also typical in Mediaeval times. The faunal remains from archaeological objects of the 11th – 13th century contain many wild animals like elk, red deer, and European polecat. This type of landscape was destroyed in the modern period after the city of Dnipro's development (Zalizniak, 2019, pp.95–104).

4.2 Reconstruction of the year cycle on the settlement

The results of species identification allow a determination

to be made of the yearly seasonal type of settlement. Archaeologist D. Telegin attributed this settlement as a winter seasonal site. The Mesolithic tribes used to return to the Igren peninsula every winter (Fesenko, Bokotei, 2002, p.86). This version proceeds from the fact that the Mesolithic period is characterised by two types of buildings: deepened semi-subterranean and above-ground dwellings. A deepened semi-subterranean pit-dwelling is warmer and better for the winter season; the other type, at the ground surface, is cooler and more mobile, which is useful for the summer (Telegin, 2000, pp.1–86).

The hunting of animals is reasonable for the winter when animal fur is of high quality. The bone of the common scoter *Melanitta nigra* indicates winter season activity on the settlement*, since t*hese birds migrate to Ukrainian territory only in the winter. Besides that, turtles are active in the warm season. The best time for catching turtles is April when they have a mating season. During this period, turtles are in place along the river bank, making them easy prey.

The type of bone structure development inherent to mammals helped to identify one individual of wild ox and one of red deer, both being about 6 months old. This may indicate an autumn hunting season.

The granite Dnipro rapids prevented the icing over of the river waters during the winter. It explains why fishing was possible during all seasons. Besides which, fish remains also include the bones of representatives of the sturgeon family (*Acipenseridae* indet.). In the early Holocene, species of this family used to migrate to freshwater basins during the spawning period in spring (March and April) and autumn (September and October). Consequently, the archaeozoological methods confirm the wintertime activity at the settlement. Also, habitants lived in this place every year, potentially from September till April.

4.3 Animals in the context of food production

The kitchen waste, 754 pieces (70% of bone finds), from the site inhabitants represents the central part of the bone collection at the site. These kinds of bones have signs of chopping or fire. The hunting of large ungulates, such as wild ox, red deer, and roe deer, was essential for this type of economy. The significant proportion of meat from these animals can provide provision for a long time. Concerning the kitchen-waste bones, all anatomical parts of animals were represented. The fish and bird meat used to constitute an element of the habitants´ diet. The finding of 21 specimens of turtle shells, with signs of fire, and 12 specimens with the cut marks, point to the usage of this meat in their diet. There is no other evidence for the use of the turtle shells for any other purposes than for the extraction of their meat.

The massive part of the collection consists of the bones of traditional fur animals, such as foxes, wolves, and hares. A large number of metapodial bones of fur animals can denote a sign of the skinning process. Also, there are examples of the tibia bone of fox with a group of characteristic skinning marks. Similar marks were detected during the skinning experiment of A. Val and J.-B. Mallye (Val, Mallye, 2011). The bones of the animals reflect all the anatomical parts inherent to fur species. One fox bone had signs of fire; the five specimens of long bones of wolf preserved the signs of chopping. This means that the meat of fur animal was part of the people's diet.

4.4 Osseous industry

The bone industry of the Igren 8 complex has been researched by D. Telegin and L. Zalizniak and published. Following the results from their data, about 150 artifacts of bone and antler tool production were found. There are arrow-heads, the base of spear-pointed heads with microlithic embedding, harpoons and hooks, and various other items.

Antler manufacturing formed the basis of the bone tool-making process. Signs of cutting are visible in the fragments from the antler species identified as the *Cervidae* family. These kinds of signs are regularly met on the deer antlers. The finding of separated antler burrs of red deer confirms the presence of their gathering. Specific cutting marks across the bone are present on the one long bone of a duck (*Anatidae* indet.); this probably played the role of the base for small arrow-heads that were the typical Mesolithic tools. A similar sign of cutting is present on the two examples of fox tibia bones. There are no tools made from this kind of material in the collection. One example of the long bone fragment has signs of polishing; however, it could have been the waste from some destroyed tools.

4.5 Igren 8 in the cultural context of the Mesolithic of Ukraine

The beginning of the Holocene coincided with environmental changes. The megafauna and herd animals, such as bison and reindeer, were replaced in Eurasia by mainly solitary animals – elk, red deer and roe deer. The environmental transformation and megafauna extinction brought about a reduction in potential biomass available for the provision of food. These factors contributed to the development of a diversification in the hunter-gathering economy. In particular, fishing, bird hunting, along with ungulate hunting and gathering began to play a greater role (Zalizniak, 1990; Zalizniak, 1997). This contributed to the spread of the adaptation model of the river hunters and fishermen to whom this study belongs.

The Igren 8 site is an example of a settlement of hunter-gatherers and fishermen tribes. These groups used to settle the banks of rivers or large water basins for a complex use of environmental resources. There are Holocene hunter-gatherer settlements in Ukraine that are located on the islands or peninsulas of rivers. There are archaeological sites of the Neolithic Surska culture on the Dnieper islands of the Middle Dnieper region (Zalizniak, 2009). The tribes of the Buh-Dnister Neolithic Culture located their settlements on the banks and islands of the Southern Buh River. The faunal assemblages of these types of sites are similar. The living strategy of the Mesolithic tribes of riverine areas were completed by the hunting of large solitary ungulates and fishing. Such a mixed-economy strategy is useful in crisis periods. Elements of the hunter strategy similar to that of Igren 8 have

been described as the basis of the island archaeological site of Dudka (Poland) and Zamostje 2 (Russia) (Guminski, 2003; Lozovski, and Lozovskaya, 2013).

Remains similar to that of the Igren 8 pit-dwellings have been found on the Early Mesolithic site of the Zymivnyky Culture Viazivok 4A (Zalizniak, 2018). A similar model of settlement location is characteristic for some other hunter-gatherer settlements of Eurasia. For example, the large number of Mesolithic sites of Belorussia are located near the Neman and *Pripyat* Rivers (Aszejczyk, 2016). Similar dwellings to to the Igren 8 pit-dwellings have been founded in the context of the Jászság Mesolithic archaeological site (Hungary) (Kertesz, 2002).

5. Conclusion

The hunting economy of the Mesolithic tribes of the Igren peninsula was very diverse. It was based on the hunting of large ungulates and complemented by the hunting of birds, fishing, and turtle catching. The sufficient level of preservation has enabled the identification of species from the bone material. The hunting of large animals like wild ox, red deer, roe deer, and other big ungulates had a paramount role. The presence of the remains of typical fur animals served as evidence of a formerly high level of skinning and fur preparation. Usage of all the resources of the environment was once the key feature of the river hunter-gatherer primitive tribes. This research has confirmed the wintertime activity of the settlement and clarified the periods of its seasonal activity. The findings of bone and antler tools prove the past value of the animal-derived type of production. The results of the comprehensive analysis of all the findings at Igren 8 illustrate the variability of the economic strategy of Mesolithic tribes from such riverine areas.

Acknowledgments

The authors would like to thank Oleksandr Kovalchuk for consultation with interpretation of fish remains, Bohdan Ridush for help with studying the mammoth tooth, and Vitaliy Anistratenko for mollusc identification.

References

ASHEJCZYK, W., 2016. Kultura janislawicka na Bialorusi. Stan i wybrane aspekty badan. *Podlaskie Zeszyty Archeologiczne*, 12, 21–57.

BENECKE, N. 1997. Archeozoological studies on the transition from the Mesolithic to the Neolithic in the North Pontic Region. *Anthropozoologia,* 25–26, 631–641.

BIAGI, P., KIOSAK, D., 2010. The Mesolithic of the northwestern Pontic region: new AMS dates for the origin and spread of the blade and trapeze industries in southern Europe. *Eurasia Antiqua*, 16, 21–41.

DRIESH, A. 1976. A guide to the measurement of animal bones from archaeological sites. *Peabody Museum Bulletin*, 1, 1–137.

FERNANDEZ-JALVO, Y., ANDREWS, P., 2016. *Atlas of taphonomic identification*. Switzerland: Springer.

FESENKO, H.V., BOKOTEI, A.A., 2002. *Ptakhy fauny Ukrainy (Polovyi vyznachnyk).* Kyiv: Ukrainske tovarystvo okhorony ptakhiv.

FORONOVA, I.V., 2001. *Chetvertichnye mlekopitayuschie jugo-vostoka Zapadnoj Sibiri*. Novosibirsk: Izdatelstvo SO RAN.

GARUTT, V.Y., Foronova, I.V., 1976. *Issledovaniye zubov vymershykh slonov.* Novosibirsk: Isdatelstvo SO RAN.

GASKEWYCH, D., 2018. Materials of Buh-Dnister Neolithic culture from the Dnister river valley within Ukraine. *Archaeology and Ancient History of Ukraine*, 3(28), 7–22. DOI: 10.37445/aidu.2018.03.02

GUMINSKI, W., 2003. Big game and sparse forest – relations between mammal species and the surrounding environment at the prehistoric fishing campsite of Dudka in Masuria, NE-Poland. *Archeozoologia*, 21, 59–73.

KERTESZ, R. 2002. Mesolithic hunter-gatherers in the northwestern part of the Great Hungarian Plain. *Praehistoria,* 3, 281–304.

KOLDA, J. 1936. *Srovnávací anatomie zvířat domácích se zřetelem k anatomii člověka*. Brno: Jan Kolda.

LEBEDEV, V.D., 1960. *Presnovodnaja chetvertichnaja ikhtiofauna Yevropeiskoy chasti SSSR.* Moskva: Izdatelstvo Moskovskogo Universiteta.

LEE LYMAN, R., 2008. *Quantitative Paleozoology*. Cambridge: Cambridge University Press.

LILLIE, M., *et al.*, 2009. The radiocarbon reservoir effect: new evidence from the cemeteries of the middle and lower Dnieper basin, Ukraine. *Journal of Archaeological Science*, 36, 256–264.

LOZOVSKI, M., LOZOVSKAYA, V., 2013. Zamostje 2: *Lake settlement of the Mesolithic and Neolithic Fisherman in Upper Volga region*. St. Petersbourg: Russian Academy of Science.

MILLER, M.O., 1935. Pamiatniki rodovogo obschestva na Igrenskom poluostrove. *Problemy istorii dokapitalisticheskich obschestv,* 9–10, 162–178.

MOVCHAN, Y.V., 2008–2009. Ryby Ukrainy (taksonomiia, nomenklatura, zauva-zhennia). *Proceeding of Zoological Museum*, 40, 47–86.

NUZHNYI, D.Y., 2007. *Rozvytok mikrolitychnoyi tekhniky v kamianomu vitsi: udoskonalennia zbroi pervisnykh myslyvtsiv*. Kyiv: KNT.

RADU, V., 2005. *Atlas for the identification of bony fish bones from the archaeological sites*. Bucuresti: Contrast.

REITZ, J.E., WING, E.S., 2008. *Zooarchaeology*. Cambridge: Cambridge University Press.

BEHRENSMEYER, A.K., 1978. Taphonomic and ecologic information from bone weathering. *Paleobiology*, 4(2), 150–162.

SHOSTAK, S.V., 1988. *Opredelenie vozrasta evropejskogo blagorodnogo olenia*. Minsk: Uradzhaj.

SOKOLOVA, Z.P., 2009. *Khanty I mansi: vzgliad iz XXI veka*. Moskva: Nauka.

TELEGIN, D.Y., 2000. Igrenske poselennia na Podniprovyi ta problema zhytlobuduvannia v mesoliti Skhidnoyi Yevropy. *Storozhytnosti stepovoho Prychornomorya ta Krymu*, 8, 1–86.

VAL, A., MALLYE, J.-B., 2011. Small carnivore skinning by professionals: skeletal modifications and Implications for the European Upper Palaeolithic. *Journal of Taphonomy,* 9, 221–243.

YANEVICH, O.O., 1987. Etapy rozvytku kultury kukrek v Krymu. *Archeologia*, 58, 7–18.

ZALIZNIAK, L.L., 1990. Types of economy and ethno-cultural processes in Final Palaeolithic and Mesolithic. *Archaeology*, 1, 3–9.

ZALIZNIAK, L.L., 1997. Ways of life hunting communities in Ukraine on the border of Pleistocene and Holocene. Archaeology, 1, 17–28.

ZALIZNIAK, L.L., 2005. *Finalny paleolit i mesolit kontynentalnoji Ukrainy*. Kyiv: Shliakh.

ZALIZNIAK, L.L., 2009. *Mezolit Zakhodu Skhidnoi Evropy*. Kyiv: Slakh.

ZALIZNIAK, L.L., 2018. Mesolithic hunters and fishermen of Nadporizhzhia on the materials of Igren 8 site in Dnipro city. *Archaeology*, 3, 3–19. DOI: 10.15407/archaeologyua2018.03.003

ZALIZNIAK, L.L., 2019. "Rus city names Peresechen" in Dnipro city and archaeological reality. *Archaeology,* 1, 95–104. DOI: 10.15407/archaeologyua2019.01.095