Osteological remains from the feudal castle Przewłoka (13-14th centuries AD, Poland)

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ABSTRACT

Representative skeletal collections, consisting of remains of mammals, birds and fishes (total 1,704 bones) were obtained during the excavations of the medieval castle Przewłoka 1 in 2015. Analysis of these remains and its comparison with collections from other sites have established some common feudal settlements in Poland and the special features of economic activity and the hunting of castle owners in 13-14th centuries. The pig predominates among domestic animals, wild boar and bison – among hunting animals, aurochs are sporadically presented. The proportion of wild birds in relation to domestic ones is not as high as the proportion of remains of hunted to domestic mammals. Cluster analysis of the fish fauna of some medieval settlements in Poland showed that the fauna of the Przewłoka castle is part of a group of localities combining fortified cities, monasteries and possessory feudal castles. The diversity of mammals, fish and birds reflects the high social status of the castle owners, and allows reconstructing a medieval landscape of the north-eastern Wielkopolska as well as water bodies near the Przewłoka castle.

Key words: Przewłoka castle, late medieval, fishery, birds, mammals, archaeozoology.

Introduction

The late medieval castle Przewłoka has been excavated during the 9th International Archaeological Camp “Przewłoka 2015” under the guidance of K. Gorczyca and K. Schellner with the participation of archaeologists from Poznań, Berlin, Bryansk, Kyiv, Chernigov and Minsk. Those excavations were organized by the district museum in Konin and the Association of Cooperation between Poland and the East. The works were held on the stronghold “motte-and-bailey” in Przewłoka. That place had not been a site of excavations earlier; however, it is mentioned in the literature (Kozierowski 1939; Witkowska 1950; Kowalenko 1952; Kamińska 1953; Naumowiczówna 1962; Wędzki 1966; Guldon, Powierski 1974; Hensel, Hilczer-Kurnatowska 1995).

Przewłoka lies within the Lake District Kujawski, forming the southern boundary of Wielkopolska Lakeland (Fig. 1). The site is located on the sandy northern shore of Ślesin Lake, at the western edge of the Warta-Gopło Channel. Przewłoka is the name of the lost village which has survived in the name of the hill, formerly an island, located in the northern part of the Ślesin Lake and Ślesin Forests. The settlement is situated within a narrow and shallow valley connecting the Ślesin Lake with the Noteć River and Gopło Lake which are located northwards. The name Przewłoka most likely comes from the boat landing site on the Ślesin Lake-Gopło route (Kowalenko, 1952; Woźny, 2011).

The excavation was carried out as a single, long trench survey. Trench no. 1 has been marked, guided by the criterion of object behavior, taking its beginning at the top of the mound and carried through fortification ditches and earth ramparts. The trench was one meter wide and 73.5 meters long. The survey was performed on the NS axis with an inclination towards the east (azimuth 48°).

The archeological material and stratigraphy suggest the separation of two phases of human habitation this area. The older one is related to the incidence of older primary humus (with medieval ceramics) at the top and slope of the mound. It is associated with a medieval settlement (late 13th century – beginning 14th century), and is mentioned in documents of AD 1314 and 1316, with the owners of this settlement listed as “Lascz and Pervold de Przewłoky” (Kowalenko, 1952).

Unfortunately, written sources concerning the Przewłoka castle are limited to only a few brief messages about its owners and some military events. It is not possible to extract almost any information about the economy of the settlement from these sources. That is why archaeozoological data, despite possible incompleteness, are especially valuable for the understanding of this site.

The earlier phase of inhabitation of the settlement took place on two natural hills. That phase of the land-use episode ended with the burning of buildings, visible as a layer of burnt material, which is visible at the top of the hill. During this period the object was additionally reinforced with a wooden fence on the margin of the plateau and on both ramparts. The early phase of peopling can be attributed to the 2nd half of the 14th century. The relics of medieval residential buildings have not

been preserved. Unfortunately the central part of the plateau was destroyed by the large trench made by the Germans during the First World War.

The total inventory yielded 1377 pieces of pottery, 2882 fragments of daub, 1704 bones, 485 metal objects (nails, hardware, keys, crossbow bolts, pieces of axes, spurs, horseshoes, sickles, pieces of dress ornaments, coins, etc.). The aim of this study is to present results of the study of numerous bone remains obtained during the excavations of the Przewłoka castle.

Material and methods

1492 remains of mammals (with 1049 diagnostic), 85 disarticulated fish bones (including 29 diagnostic), and 127 bird remains (with 75 diagnostic) from the Przewłoka castle were analysed and described here for the first time. Representative skeletal collections were derived during the excavations at the Przewłoka 1 in 2015 (Table 1). The saturation of the cultural layer is irregular: from >100 bones/m³ (living area) to 0 (shafts of the fort). In most cases examined bones are kitchen waste. The osteological material is deposited in the Konin district museum (Poland).

Preservation of the bones, estimated on the 5-point scale (Antipina, 2004), is 4 points: bones are broken, but they retain the shape and characteristics of the surface. There are some cracks and peeling of the outer layer (it is observed after cleaning and washing of the bones).

The species identification and anatomical determination of fish and bird remains were carried out using the comparative osteological collection in the Department of Paleontology, National Museum of Natural History (National Academy of Sciences of Ukraine, Kyiv). The fish systematics in this paper follows Nelson (2006). Identification and anatomical determination of mammals are based on special literature (Gromova, 1950, 1960; Schmid, 1972; Lasota-Moskalewska, 1997; Hillson, 2005). Methodology of Zeder and Lapham (2010) was used for the separation of postcranial fragments of a goat or sheep. High fragmentation of their remains does not allow for the precise species identification. Thus, few fragments diagnostic to the species belong to sheep. The bones of wild ungulates can also be distinguished by the specific density and color. In contrast, domestic mammals (cattle, pig), bones of wild animals (ox, bison, wild boar) are more dense and have a red-brown cast. In addition, the bones of wild animals often have a more pronounced relief at the attachment points of muscles and tendons.

The age of domestic mammals (cattle, sheep, pig, horse) was determined, as a rule, on the degree of development of the dental system and wear of the teeth (although the latter character depends on the quality of feed and the presence of natural abrasives such as sand). Such techniques are well-known and frequently discussed in literature (Karelin, 1972; Slutskiy, 2014; Timofeev, 2006) and osteological atlases (Schmid, 1972, Tab. X). Information about the time of ossification of the connection between epiphyses and diaphyses of long bones in limbs was used as a helper method (Schmid, 1972, Tab. IX). This method is not always effective and not very accurate when the

examined material is strongly fragmented; however, it confidently allowed the separation of juvenile and young animals from mature and old ones.

Ecological analysis of the identified taxa is based on ecotopic preferences of their recent analogues. The obtained data were significantly supplemented by the information from literature (Tsalkin, 1956; Sokolov, 1963; Iwaszkiewicz, 1979, 1991; Benecke, 1986; Sobociński, 1987; Makowiecki, 2001, 2003). The fish fauna of 24 localities of the same age (13-14th centuries AD) in Poland were analysed statistically using the cluster analysis (Ward's method). Traces of cutting and bone damage were studied with the aid of USB hand microscope "Bresser" (20-200×). Abbreviations used in the paper: CRA – cranial bones; MNI – minimum number of individuals; NISP – number of identifiable specimens; PCRA – postcranial bones. Number of individuals was the highest number of bones of either left or right side of the body.

Results

For this study, only 25 fish bones and 4 complete scales were identified to the family level, most of them – to the species level. Seven species and genera representing five families (Acipenseridae, Cyprinidae, Siluridae, Esocidae, and Percidae) were recognized (Table 2). Most of the remains were those of catfish *Silurus glanis* (NISP=10) and perch *Perca fluviatilis* (NISP=6). Bream *Abramis brama*, pike *Esox lucius* and zander *Sander lucioperca* were of minor importance numerically (NISP=3). Other species (sturgeons Acipenseridae gen. et sp. indet., and tench *Tinca tinca*) are recorded by 1 or 2 bones. There are disarticulated remains with a slight predominance of cranial elements in the processed material (Table 3). In addition, numerous bones are represented by their small fragments and/or shards; therefore they belong to a combined group – Teleostei incertae sedis. The variety of definable fish bones is relatively high (13 different bones, as well as single complete and broken scales). The most numerous bones in examined material are dentaries (n=4) and opercular bones (n=5). Centra predominate among the postcranial bones (n=8), pectoral spines are less numerous (n=2). The small size of the pectoral spine of the sturgeon does not allow determining it closer than to family. This bone may belong to the European sea sturgeon (*Acipenser sturio*) which is a common species within the Baltic Sea basin (Kottelat, Freyhof, 2007).

The results of determination of the bird bones from the Przewłoka are presented in the Table 4. The vast majority of the remains belongs to poultry – chicken and domestic goose. It should be noted that bones of the domestic duck are completely absent. It is noteworthy that wild birds are not so numerous while the remains of hunted mammals predominate (see Table 5). This situation is typical for other medieval sites in Poland (e.g., Gdańsk and Kołobrzeg), with the difference that the remains of mallard *Anas platyrhynchos*/*Anas platyrhynchos* f. *domestica* were found (Makowiecki, Gotfredsen, 2002). At the same time, in the East Slavs during the late Middle Ages the situation is the opposite – the amount of hunted mammal species is much smaller than that of domestic ones,

while wild birds account for more than half of the bird remains (Gorobets, Kovalchuk, 2015). The structure of one coracoid belonging to the domestic goose is unusual. There is a closed incisura on the medial edge of the scapular part of diaphysis. A similar feature was found in the skeleton of a modern individual of nonpedigreed domestic goose from 10 examined in the NMNHU-P collection, as well as in one individual of domestic goose from the East Slavic locality Stadnyky dated as 11th century AD (Gorobets et al., 2014). In modern birds incisura is shown only at the left coracoid, the right is the same as those in most of the geese. It is interesting that both coracoids from Przewłoka and Stadnyky are from the left side. Perhaps, this feature appears only in the left-hand sides; however this conclusion is only tentative.

The results of determination of mammal bones from the Przewłoka are presented in the Tables 5 and 6. Total of 453 specimens (small fragments of ribs, portions of diaphyses, etc.) are indeterminate fragments, including ten remains belonging to embryos (presumably the cattle and pig). Domestic mammals are represented only by three species: cattle, sheep and pig. Remains of the horse are completely absent. The estimation the number of cattle and sheep was carried out by counts of their scapulae. The cattle *Bos taurus* is the second most abundant species among the mammals. However, skulls, lower jaws and caudal vertebrae are almost completely absent, and the bones of extremities also are not numerous. It is suggested that the slaughtering and butchering of carcasses were carried out beyond the walls of estates.

The very small number of metacarpals and metatarsals can be explained by the continued use of these bones in manufacturing. Medieval monuments, studied over a large area, show that first metacarpal and metatarsal bones of cattle with a dense and thick compact tissue were the raw material for bone carvers in manufacturing of different things (Chubur, Minenko, 2008; Sergeeva, 2011). There is a reason to suppose that the small number of these bones in Przewłoka can be explained similarly: some of them were used by local carvers. Support for this is the discovery of a knife with a rough handle from a sawed-off fragment of metacarpal bone.

Most of the cattle bones belonged to 2 year-old animals, according to the degree of coalescence of epiphysis and diaphysis. A few jaw fragments allow determining the age of 15-24 months.

Some morphometric data of above described skeletal remains are presented in the Table 7.

The sheep is the third most abundant species in locality after pigs and cows. Slaughtering and butchering were conducted outside the fort: skulls and single bones of the extremities also are not represented. The fragmentation of the material does not allow estimating the age composition of the herd.

MNI for the domestic pig *Sus domestica* at the early stage of peopling was determined by the number of upper jaws as well as by the number of scapulae and jaws at the later stage. This is the most abundant species among those represented in the osteological collection. The nearly complete range of skeletal elements present may indicate that the slaughtering and butchering of carcasses

were carried out directly in the estate. Full skeletal structure, probably, is also related with gastronomic features. The carcass including the head and distal extremities was utilized for a variety of dishes. The majority of the bones belonged to juvenile (nearly 1 year-old) animals. The last molar has not yet appeared, or is just beginning to erupt in many animals. Pigs actively gain the weight during this time. Subsequently the growth slowed, but the amount of food needed does not decrease. So, most of the animals were killed in the age of 1.5-2 years. Morphometric parameters of the bones of domestic pig are presented in the Table 8. There are no bones of a suckling pig among all kitchen wastes.

Wild mammals are represented by a larger number of species as compared to domestic mammals. Only one tibia of aurochs *Bos primigenius* or a large individual of the forest bison *Bison bonasus* was found in the early stage of peopling the castle. The surface of the diaphysis and the junction with the tendons have well-expressed relief. Bones of the forest bison *Bison bonasus* also differ from those in cattle by larger linear dimensions, a more expressive surface relief, and a greater density of the compact substance. The carcasses of bisons, judging by the relatively complete skeletal structure, were completely cut up on the site. However, there are no skull bones – possibly the heads were separated as hunting trophies. Nearly all bones of the bison are highly fragmented. The lack of the limb bones among the remains of roe deer *Capreolus capreolus* deserves a special mention. Only five bones belonged to the red deer *Cervus elaphus*.

The wild boar *Sus scrofa* is represented at both early and late stage of peopling (MNI=1 and 4, respectively). Domestic pigs, pastured in the forest, can interbreed with wild boar.

The marten *Martes martes* belongs to the early period of peopling. The small-sized fox *Vulpes vulpes* comes from the late habitation period of the ancient city. These mammals confirm episodic hunting for fur animals in the owner's estate.

Discussion

The fish species composition from the Przewłoka castle despite the relatively small sample allows characterising environmental conditions in the nearest water body. Most likely it was a large pool on the Warta River. Bream and perch indicate heavily overgrown sections with a sandy or muddy bottom and a slow current, catfish – the presence of sloughs and backwaters (Kottelat, Freyhof, 2007). Tench is related to stagnant water habitat (Penczak et al., 2004). Pike indicates a shallow, moderately productive and vegetated water course (Harvey, 2009). Some parts of the water body were slow-flowing, muddy and sparsely vegetated, as indicated by the presence of zander (Kottelat, Freyhof, 2007). Sturgeon could have been purchased and imported into the castle (Makowiecki, 2003).

Along with our own data we also used information about the qualitative composition of fish remains from other 23 localities of the same age (13-15th centuries AD) in Poland (Kaj, 1960;

Iwaszkiewicz, 1979; Benecke, 1986; Sobociński, 1987; Iwaszkiewicz, 1991; Makowiecki, 1999, 2000a, 2000b, 2001, 2002, 2003). There are about 24 fish species recorded in these publications (Table 9). They belong to 11 families, such as sturgeons (Acipenseridae), freshwater eels (Anguillidae), herrings (Clupeidae), minnows (Cyprinidae), sheatfishes (Siluridae), whitefishes (Coregonidae), salmon (Salmonidae), pikes (Esocidae), cods (Gadidae), perches (Percidae), and righteysed flounders (Pleuronectidae). The vast majority of these fishes are common species in rivers and water bodies of Poland at the present time; however, some of them can be caught only in the Baltic Sea. The number of many of these species has undergone significant changes during the historical period, so the detection of uncommon taxa in materials of archaeological excavations may shed light on their past distribution and the faunal dynamics, respectively.

Cluster analysis (Ward's method, detrended correspondence analysis) was used for recognizing similarities between the fish species composition from the Przewłoka castle and other late medieval localities. It is shown that these localities are grouped into two clusters (Fig. 3). The first cluster contains 14 localities regarded as villages (*osada*) and towns (*miasto*, *gród*). The second group unites 10 monuments, most of which are fortified towns (e.g., Poznań, Gdańsk), castles (Przewłoka, Mała Nieszawka) and monasteries (e.g., Łekno, Łubin, Inowrocław). Fish remains described by Iwaszkiewicz (1991) from the Benedictine monastery Łubin (2nd half of the 13th – 15th cent. AD) are the most similar to those of the Przewłoka castle in species composition. Osteological material from the Franciscan monastery Inowrocław (Iwaszkiewicz, 1979), as well as Gdańsk, Olejarna 1295-1350 and 1350-1400 AD (Makowiecki, 2003) is less similar but also close to that of Przewłoka. Of course, such similarity can be explained by the high social status of their inhabitants. However, fishes from these localities cannot be considered as unique or rare. These are widespread common species, majority of which are popular due to its tasty meat. Pike was the main catch of fishers in the late medieval Poland: remains of this species are known from 19 of 24 localities (Table 3). Perch and catfish were also popular and uncovered in materials from 14 and 13 monuments, respectively. Bream and zander were caught less frequently: remains of these fishes were recorded from 11 (45.8%) late medieval localities (Kaj, 1960; Iwaszkiewicz, 1979, 1991; Makowiecki, 1999, 2000a, 2000b, 2003). Tench was reported only from the 9 monuments.

Many of the examined mammal bones bear traces of human activity and the impact of a man-made environment (Fig. 2). Butchering of cattle was carried out using an axe. Traces of butchering are observed on vertebrae, some long bones and the pelvis. Almost all long bones are broken; it is also typical for the kitchen waste. The presence of kitchen cutting is rather interesting: some ribs of sheep and pigs have notches and nicks made using a large kitchen knife. Similar marks on the ribs were observed in other medieval settlements, such as the Muszyn castle (Zielińska, 2011). Some of the bones (vertebrae, ribs, pelvis of the cattle, ribs and vertebrae of the sheep, some bison bones) have traces of charring, apparently as a result of cooking over an open fire. The presence of several

groups of still-connected vertebrae in the upper horizon reflects eating of the whole carcasses of the wild boar in the second stage of the castle peopling, shortly before the decline of the settlement. There are scrape marks made by dog canines at some of the bones. The bones of dogs are not represented in our collection. It is surprising to observe a very small number of bones in ditches of the fortifications. Usually, a lot of waste from medieval castles has been found in such places.

MNI of mammals for the early phase of peopling can have a substantial error when the amount of examined osteological material is extremely low. At the same time, large samples provide data which are closer to the real situation. It can be seen when comparing the shares of various types of NISP and MNI during the second phase of peopling the castle. The share of wild mammals by NISP was 21.9% for the first (early) stage and 17.8% for the second (late) stage. That large index is typical for feudal castles throughout Europe (Aleksandrovich, 1999; Chubur, Shinakov, 2006) and reflects the feudal privileges in hunting for large wild animals.

The ratio of bones belonging to domestic animals (cattle – 37%, pig – 49% and sheep – 14% on the composition of herd) is similar to those in materials from the Ostrów Lednicki 1 (Makowiecki, 2001). The only difference is that there are no bones of the horse in Przewłoka. Judging by the size of their metacarpals, the growth of cows reached 105-106 cm according to Tsalkin (1956). Dwarf breeds of the cattle can be considered as characteristic for representatives of the forest zone during the Middle Ages in the Eastern Europe. The overwhelming predominance of juvenile animals indicates the direction of livestock. It would be interesting to compare the age composition of cattle from Przewłoka with those from rustic surroundings. It is likely we would have observed the opposite pattern there, similar to dairy farming.

Remains of the wild mammals deserve a special attention. Most likely it is a result of hunting, organized by the castle owner. The bones of wild boar as opposed to pig bones have more raised attachment areas of muscles and tendons, compact and denser darker brown-reddish color. Based on the completeness of skeletal structures and the number of bones of the wild boar, their whole carcasses were delivered to the castle after the hunting. The meat of the boar was served as an essential component of the diet of inhabitants of the manor.

There appears to be one aurochs bone in the collection from Przewłoka. This species is scarce, but not rare in general in the territory of medieval Wielkopolska. The nearest findings of remains belonging to this species are known from the medieval cultural layers of Ostrów Lednicki (Makowiecki, 2001) and Konin – Stare Miasto (Gorczyca, Chubur, Turlakova, 2013).

The presence of a few bones of bison in the fauna of Przewłoka is rather interesting. Remains of this species are not reported at all in 70 km eastwards of the royal residence of the Piast dynasty (Ostrów Lednicki) (Makowiecki, 2001). At the same time the findings of bison bones in medieval feudal settlements westwards of the castle Przewłoka became frequent. The bison remains exceed 12% of all bones in the material from the Grodno castle, dated to 13-14th centuries (Tsalkin, 1956).

The part of this species in Przewłoka is <3%, but the presence of this animal is rather important. Findings of bison bones, of course, testify to the feudal privileges in the hunting for large animals. The information about the habitats of hunting animals can complete our knowledge about the natural environment near the castle during the Middle Ages. For example, the fox is an environmentally labile species and it lived in different habitats (even in the man-made landscape). The marten usually lives in mixed and deciduous forests. Red deer and forest bison prefer forested areas, but avoid coniferous forests and non-forested areas. Deer, like a marten, willingly lived in deciduous and mixed forests, interspersed with meadows and hilly terrain. Bison prefers mixed forests, interspersed with meadows and woods with well-developed underbrush of hardwoods. At the same time the aurochs was an inhabitant of open spaces in the forest-steppe and steppe zones. The name and heraldic symbols of the Turek town, located about 40 km southwards of Przewłoka, are associated with the aurochs (Slavic "tur"). The simultaneous presence of bison and aurochs in the collection may indicate the location of the castle on the spread border of forests and open landscapes. Remains of the wild boar are the most numerous in materials from Przewłoka. This species tends to live in wet, marshy places near water bodies with mud puddles. The favourite places for the wild boar are reed thickets and impenetrable shrubs along the shores of lakes and rivers. These lakes are located in vicinities of the Przewłoka castle.

Conclusions

Osteological material from the Przewłoka castle is represented by the kitchen waste with different degree of fragmentation. The pig predominates among pets and may have been slaughtered in the castle: anatomical structure of this species is fully represented. Cattle and sheep, apparently, were delivered to the castle. The presence of a significant number of bones belonging to game animals suggests hunting privileges of the feudal lords – the owners of the castle. The wild boar was the most popular prey. The bison remains are quite rare. The role of this species in hunting trophies reduced to the west of the castle and increased eastward according to a comparative analysis of the fauna of the late medieval feudal settlements. The cluster analysis of the fish fauna of medieval settlements showed that the fauna of the Przewłoka castle is a part of the group of localities combining fortified cities, monasteries and possessory feudal castles. This similarity can be allocated to the consumers with a higher social status, although most of the fish species are not unique and rare. The part of wild birds in comparison with domestic ones is not as high as the proportion of hunting mammal remains to domestic mammals. This situation is typical for other medieval monuments in Poland. At the same time, the situation is opposite in the East Slavs during the late Middle Ages – wild birds constituted more than a half of all bird bones. The fauna of mammals allows reconstructing the medieval landscape of the north-eastern Wielkopolska. There were deciduous and mixed forests, interspersed with open meadow and steppe formation areas and

significant wetlands with beds of rush and shrubs on the lake. The fish species composition from Przewłoka allows characterizing the features of nearby water body: it was a shallow drainage lake with heavily overgrown areas, with sandy and muddy bottom, as well as stagnate water in some places. The lakeside was a meadow and partly swampy.

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References

- Aleksandrovich N.P. 1999. Zubr (*Bison bonasus bonasus* Linnaeus, 1758) v okhotnich'ey dobyche naseleniya srednevekovykh belorusskikh gorodov (X-XVII vv.). *Belovezhskaya pushcha na rubezhe tret'ego tysyacheletiya. Materialy nauchno-prakticheskoy konferentsii*. Minsk: 247-248.
- Antipina E.E. 2004. *Sovremennyy podkhod k izucheniyu kostey zhivotnykh iz arkheologicheskikh pamyatnikov*, available at: http://imperium.archeologia.ru/discussion/articles/antipina_article.htm (Accessed 18 October 2015).
- Benecke N. 1986. Materiał kostny zwierzęcy z późnośredniowiecznego grodziska stożkowatego w Dąbrówce. *Roczniki Akademii Rolniczej w Poznaniu* 172, *Archeozoologia* 11: 3-18.
- Chubur A.A., Shinakov E.A. 2006. O sovremennom sostoyanii arkheozoologicheskoy izuchennosti romensko-drevnerusskikh poseleniy Bryanskogo Podesen'ya. *Arkheologiya Yugo-Vostoka Rusi*. Elets: 248-264.
- Chubur A.A., Minenko V.V. 2008. Archeozoologiya pozdnesrednevekovogo Smolenska (po dannym raskopok 2004-2005 gg.). *Verhnee Podon'e: archeologiya, istoriya*. Vypusk 3. Tula. 42-52
- Gorobets L.V., Bondarchuk A.A., Zarutskaya V.V. 2014. Birds from the Old East Slavic settlement Stadnyky 11th century. *Pryroda Zahidnogo Polissja ta pryleglyh terytorij* 11: 309-15.
- Gorczyca K., Chubur A.A., Turlakova E.S. 2013. Osteologicheskii material, kak indikator statusa pozdnesrednevekovogo poseleniya Stare Miasto 5. *Istoriya i arkheologiya vostochnoevropeyskoy derevni. Materialy mezhdunarodnoy nauchnoy konferentsii “Problemy agrarnoy istorii i arkheologii Vostochnoy Evropy”*, 2. BGSKhA, Bryansk: 55-58.

- Gorobets L., Kovalchuk O. in press. Birds in the Medieval culture and economy of the East Slavs in the 10-13th cent. AD. *Environmental Archaeology*.
- Gromova V. 1950 Opredelitel' mlekopitayushchikh SSSR po kostyam skeleta Vypusk 1. Opredelitel' po krupnym trubchatym kostyam. *Trudy komissii po izucheniyu chetvertichnogo perioda*, **9**. Izdatel'stvo Akademii nauk SSSR, Moskva-Leningrad.
- Gromova V. 1960. Opredelitel' mlekopitayushchikh SSSR po kostyam skeleta. Vypusk 2. Opredelitel' po krupnym kostyam zaplyusny. *Trudy komissii po izucheniyu chetvertichnogo perioda*, **16**. Izdatel'stvo Akademii nauk SSSR, Moskva.
- Guldon Z., Powierski J. 1974. *Podziały administracyjne Kujaw i Ziemi Dobrzyńskiej w XIII i XIV wieku*, Warszawa-Poznań.
- Iwaszkiewicz M. 1979. Szczątki ryb. In Cofta-Broniewska A. (ed.), *Zaplecze gospodarcze konwentu OO. Franciskanów w Inowrocławiu od połowy XIII w. do XV w.* Poznań: 176-177.
- Harvey B. 2009. A biological synopsis of northern pike (*Esox lucius*). *Canadian Manuscript Report of Fisheries and Aquatic Sciences* **2885**: i-v+31 p.
- Hensel W., Hilczer-Kurnatowska Z. 1995. *Studia i materiały do osadnictwa Wielkopolski wczesnohistorycznej*, t. VII, Poznań-Toruń.
- Hillson S. 2005. *Teeth* / Second Edition. Cambridge University Press.
- Iwaszkiewicz M. 1991. Szczątki ryb z wykopalisk Opactwa Benedyktynów w Lubinie, woj. leszczyńskie. *Roczniki Akademii Rolniczej w Poznaniu* 221, *Archeozoologia* **15**: 3-8.
- Kaj J. 1960. Szczątki ryb ze stanowiska Ostrów Tumski 13. In Niesiołowska A., Petrzyńska M., Żak J. (eds.), *Poznań we wczesnym średniowieczu* **2**. Warszawa-Wrocław.
- Kamińska J. 1953. *Grody wczesnośredniowieczne ziem Polski Środkowej na tle osadnictwa*, Łódź.
- Karelin V.N. (ed.) 1972. *Spravochnik zootehnika-selekcionera i kontrol'-assistentu po molochnomu skotovodstvu*. Uradzhaj. Minsk.
- Kolberg O. 1962. *Dziela wszystkie*, t. 4, Kujawy, cz. II, Wrocław-Poznań.
- Kolberg O. 1964. *Dziela wszystkie*, t. 23. Kaliskie, Wrocław-Poznań.
- Kottelat M., Freyhof J. 2007. *Handbook of European freshwater fishes*. Berlin.
- Kovalchuk O., Gorobets L. 2015. Fish and Birds in the Trypillia Economy and Culture (5.4–2.7 kya BC): Evidence from Ukraine. *International Journal of Osteoarchaeology* doi: 10.1002/oa.2489.
- Kowalenko W. 1952. Przewłoka na szlaku żeglugowym Warta-Gopło-Wisła, *Przegląd Zachodni* **2**. 46-100.
- Kozierowski S. 1939. *Badania nazw topograficznych Starej Wielkopolski*, Poznań.
- Lasota-Moskalewska A. 1997. *Podstawy archeozoologii. Szczątki ssaków*. Wyd. Naukowe PWN, Warszawa.
- Makowiecki D. 1999. Pozostałości ichtiologiczne. In Rębkowski M. (ed.), *Archeologia średniowiecznego Kołobrzegu*. Kołobrzeg: 351-321.

- Makowiecki D. 2000a. Rybołówstwo i konsumpcja ryb w średniowiecznym Kołobrzegu. In Leciejewicz L., Rębkowski M. (eds.), *Salsa Cholbergiensis. Kołobrzeg w średniowieczu*. Kołobrzeg: 223-232.
- Makowiecki D. 2000b. Źródła archeoichtiologiczne do poznania konsumpcji ryb i rybołówstwa w średniowiecznym mikroregionie łekneńskim. In Wyrwa A.M. (ed.), *Studia i Materiały do dziejów Pałuk. Środowisko naturalne i osadnictwo w łekneńskim kompleksie osadniczym*. Poznań: 123-135.
- Makowiecki D. 2001. Hodowla oraz użytkowanie zwierząt na Ostrowie Lednickim w średniowieczu. Studium archeozoologiczne. *Biblioteka Studiów Lednickich* 6. Poznań.
- Makowiecki D. 2002. Badania archeozoologiczne pozostałości kostnych z obiektu gospodarczego klasztoru w Bierzwniku. *Zeszyty Bierzwnickie* 4: 105-124.
- Makowiecki D. 2003. *Historia ryb i rybołówstwa w holocenie na Niziu Polskim w świetle badań archeoichtiologicznych*. Poznań.
- Makowiecki D., Gotfredsen A.B. 2002. Bird remains of Medieval and Post-Medieval coastal sites at the Southern Baltic Sea, Poland. *Acta zoologica cracoviensia* 45 (special issue), 65-84.
- Naumowiczówna E. 1962. Wykaz nabytków Muzeum Archeologicznego w Poznaniu w latach 1959-1960, *Fontes Archaeologici Posnanienses* XIII. 364-385.
- Nelson J. 2006. *Fishes of the World*. John Wiley and Sons Inc., New York.
- Penczak T., Galicka W., Głowacki Ł., Koszaliński H., Kruk A., Zięba G., Kostrzewa J., Marszał L. 2004. Fish assemblage changes relative to environmental factors and time in the Warta River, Poland, and its oxbow lakes. *Journal of Fish Biology* 64: 483-501.
- Sergeeva M.S. 2011. *Kostorizna sprava u Starodavniomu Kyevi*. Institut aecheologii. Kyiv.
- Sluckij I. 2014. *Polnyj spravochnik zhivotnovoda*. AST, Moskva.
- Schmid E. 1972. *Atlas of Animal Bones: For Prehistorians, Archaeologists and Quaternary Geologists*. Elsevier Publishing Company.
- Sobociński M. 1987. Materiał kostny zwierząt z wykopalisk w Poznaniu – Stary Rynek 42 i 43. *Roczniki Akademii Rolniczej w Poznaniu* 184, *Archeozoologia* 12: 141-152.
- Sokolov II. 1963. (ed.) *Mlekopitayushchie fauny SSSR, 1-2*, Izdatel'stvo Akademii nauk SSSR, Moskow-Leningrad.
- Timofeev S.V. 2006. *Stomatologija zhivotnyh*. Agrovvet, Moskva.
- Tsalkin VV. 1956. Materiały dla historii skotovodstva i okhoty v drevney Rusi. *Materiały i issledovaniya po arkheologii SSSR*, 51. Izdatel'stvo Akademii nauk SSSR, Moskva-Leningrad.
- Wędzki A. 1966. *Rozwój osadnictwa i podziały terytorialne ziemi łódzkiej do końca XIV wieku*, Warszawa-Poznań.
- Witkowska A. 1950. Wykaz nabytków Muzeum Archeologicznego w Poznaniu w roku 1950, *Fontes Archaeologici Posnanienses* II. 285-311.

Woźny J. 2011. Pogranicze kujawsko-wielkopolskie w starożytności: szlaki, przejścia i przewłoki, Mietza A., Szczepankiewicz P. (red.) *Studia z dziejów pogranicza kujawsko-wielkopolskiego* **1**, Bydgoszcz-Wierzbinek: 7-15.

Zeder M., Lapham H. 2010. Assessing the reliability of criteria used to identify postcranial bones in sheep, *Ovis*, and goats, *Capra*. *Journal of Archaeological Science* **37**: 2887-2905.

Zielińska U. 2011 Zwierzęce szczątki kostne jako źródło do poznania diety mięsnej mieszkańców zamku w Muszynie. *Almanach Muszyny*. Muszyna: 133-137.

TABLES

Table 1. General composition of osteological material from the medieval layers of the Przewłoka castle.

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FIGURE CAPTIONS

Figure 1. Location of the Przewłoka castle (at the map of Europe, Poland and in LIDAR survey).

Figure 2. The man-made marks on the bones of mammals from the Przewłoka castle. 1-2. Traces of cutting: a longitudinally sectioned centrum (1), dissected block of humerus (2). 3 a-d. Transverse notches and cuts on the ribs.

Figure 3. Cladogram showing the similarities between the fish species composition from the Przewłoka and other late medieval localities in Poland (results of cluster analysis, Ward's method).

Table 1

General composition of osteological material
from the medieval layers of the Przewłoka castle

Group of animals	Early stage (the end of 13 th – the first third of 14 th century)		Late stage (the middle part of 14 th century)		Total
	diagnostic	not diagnosable	diagnostic	not diagnosable	
Mammals	63	37	976	416	1492
Birds	–	17	75	35	127
Fish	–	18	29	38	85
Total	63	72	1080	489	–
	135		1569		1704

List of identified fishes

Family	Species	NISP, n	NISP, %
Acipenseridae	Acipenseridae gen. et sp. indet.	1	3.45
Cyprinidae	Bream – <i>Abramis brama</i>	3	10.34
	Tench – <i>Tinca tinca</i>	1	3.45
	Cyprinidae gen. et sp. indet.	2	6.90
Siluridae	Catfish – <i>Silurus glanis</i>	10	34.34
Esocidae	Pike – <i>Esox lucius</i>	3	10.34
Percidae	Zander – <i>Sander lucioperca</i>	3	10.34
	Perch – <i>Perca fluviatilis</i>	6	20.70
Teleostei incertae sedis		56	N/A

Table 3

Anatomical distribution of examined fish remains

Bone	Acipenseridae gen.	<i>Abramis brama</i>	<i>Tinca tinca</i>	Cyprinidae gen.	<i>Silurus glanis</i>	<i>Esox lucius</i>	<i>Sander lucioperca</i>	<i>Perca fluviatilis</i>	n	%
Cranial skeleton (CRA)										
Vomer	–	–	–	–	–	1	–	–	1	3.45
Basioccipitale	–	–	–	–	1	–	–	–	1	3.45
Praemaxillare	–	–	–	–	–	–	1	–	1	3.45
Maxillare	–	–	–	–	–	1	–	–	1	3.45
Articulare	–	–	–	–	–	–	1	–	1	3.45
Dentale	–	2	1	–	–	1	–	–	4	13.79
Urohyale	–	–	–	–	–	–	1	–	1	3.45
Praeoperculare	–	–	–	–	–	–	–	2	2	6.89
Operculare	–	1	–	–	–	–	–	–	1	3.45
Interoperculare	–	–	–	–	1	–	–	–	1	3.45
Suboperculare	–	–	–	–	–	–	–	1	1	3.45
Postcranial skeleton (PCRA)										
Vertebrae	–	–	–	–	7	–	–	1	8	27.59
Pinna pectoralis I	1	–	–	–	1	–	–	–	2	6.89
Scales	–	–	–	2	–	–	–	2	4	13.79
Total	2	3	1	2	10	3	3	6	29	100

List of identified birds

Family	Species	NISP, n	MNI	MNI, %
Anatidae	Northern pintail – <i>Anas acuta</i>	2	1	3.2
	Greylag goose – <i>Anser anser</i>	2	1	3.2
	Domestic goose – <i>Anser domestica</i>	24	11	35.5
Phasianidae	Chicken – <i>Gallus gallus</i> f. <i>domestica</i>	18	18	58.1

Table 5

List of identified mammals

Species list	Early stage (the end of 13 th – the first third of 14 th century)				Late stage (the middle part of 14 th century)			
	NISP	NISP, %	MNI	MNI, %	NISP	NISP, %	MNI	MNI, %
Cattle – <i>Bos taurus</i>	31	42.5	1	10	287	29.5	4	18.4
Small cattle – <i>Ovis aries</i>	3	4.1	1	10	122	12.5	4	18.4
Pig – <i>Sus domestica</i>	23	31.4	2	20	393	40.2	5	21.8
Bison – <i>Bison bonasus</i>	3	4.1	1	10	33	3.4	2	9.2
Aurochs – <i>Bos primigenius</i>	1	1.4	1	10	–	–	–	–
Roe deer – <i>Capreolus capreolus</i>	3	4.1	1	10	17	1.7	1	4.6
Red deer – <i>Cervus elaphus</i>	1	1.4	1	10	4	0.4	1	4.6
Wild boar – <i>Sus scrofa</i>	6	8.2	1	10	113	11.6	4	18.4
Fox – <i>Vulpes vulpes</i>	–	–	–	–	7	0.7	1	4.6
Marten – <i>Martes martes</i>	2	2.8	1	10	–	–	–	–
Total	73	100	10	100	976	100	22	100

Table 6

Anatomical distribution of examined mammal remains

Bone	Cattle	Small cattle	Pig	Aurochs	Bison	Roe dear	Red dear	Wild boar	Fox	Marten
Cranium	8	1	75	–	–	1	–	27	1	–
Mandibula	2	–	18	–	–	1	–	5	–	–
Vertebra	84	26	102	–	5	4	2	19	–	–
Costae	143	65	104	–	12	13	–	35	–	1
Scapula	12	15	16	–	1	1	1	3	–	–
Humerus, ulna, radius	14	4	22	–	8	–	–	8	2	–
Pelvis	16	2	6	–	1	–	–	5	1	–
Femur, tibia, fibula	13	8	26	1	5	–	–	10	–	–
Distal extremitates	26	4	47	–	4	–	2	7	3	1
Total	318	125	416	1	36	23	5	119	7	2

Table 7

The morphometric data for the cattle from the Przewłoka castle

Bone	Measurement	n	Lim, mm	M, mm
Pelvis	diameter of acetabulum	1	—	40.0
Tibia	width of the distal epiphysis	1	—	50.0
Astragalus	length	1	—	56.0
	width	1	—	34.0
Metacarpale	length	2	186.0; 188.0	187.0
	the minimum width of diaphysis	2	18.0; 25.0	21.5
	width the distal epiphysis	2	44.0; 46.0	45.0
	width of the proximal epiphysis	2	38.0; 45.0	41.5

Table 8

The morphometric data for the domestic pig (*Sus domestica*) from the Przewłoka castle

Bone	Measurement	n	Lim, mm	M, mm
Humerus	width of the block	3	26.0–30.0	28.0
Astragalus	length	5	34.0–39.0	36.8
	width	5	18.0–22.0	20.0

Species diversity of fish in materials from the late medieval (13-15th cent. AD) localities of Poland
(based on literature data, except those from the Przewłoka castle)

[illegible]

Figure

1

2

a

b

c

d

3

Figure