FUNNEL BEAKER ANIMAL HUSBANDRY AT BRONOCICE

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Abstract

The Funnel Beaker or *Tricterbecher* (TRB) occupation at Bronocice, southeastern Poland (Małopolska) was based on a mixed farming economy, the cultivation of cereals and the keeping of domesticated animals. A zooarchaeological analysis and interpretation of the faunal assemblage from three phases of Funnel Beaker occupation (3800-3100 BC) revealed significant trends and patterns in animal husbandry practices reflective of increasing social complexity and specialization. In comparison with other sites in southeastern Poland the faunal data from Bronocice stands out as unique among Funnel Beaker sites with the exception of Zawarża.

Introduction

This article presents the results of a zooarchaeological analysis and interpretation of the faunal assemblage from the Funnel Beaker or *Trichterbecher* (TRB) occupation at Bronocice, southeastern Poland (Małopolska). The Funnel Beaker people subsisted on a mixed farming economy, comprised of the cultivation of cereals and the keeping of domesticated animals. In this article we will concentrate primarily on the role of the domestic animals.

The large and complex faunal assemblage recovered from Bronocice spans six phases of occupation (3800-2700 BC). This discussion is limited to the data from the three Funnel Beaker phases, 1, 3, and 4 (3800-3100 BC). In an earlier study trends and patterns were recognized that merited further investigation. Various issues were identified through comparison of the ratios of wild mammal to domesticated mammal, the ratios of domesticated species over time, and the age at death profiles of domesticated mammals.

Using these standard tools we will consider the evidence for shifting animal exploitation over time and its significance in terms of animal husbandry practices, hunting and social relationships among residents at Bronocice and people living in other settlements. The results will be compared with available data from other Funnel Beaker sites with large samples of faunal remains in southeastern Poland: Ćmielów (Krysiak 1950, 1952), Gródek Nadbużny (Krysiak 1956, Guminski 1989), Kamień Łukawski (Krysiak and Lasota 1971), Niedźwiedź (Kruk 1980, Makowicz-Poliszot 1997), Zawarża (Makowicz-Poliszot 2002) and Zawichost-Podgórze (Krysiak 1966/1967)

Benecke (1994) and Döhle (1994) have surveyed the exploitation of domestic and wild animals by various Neolithic cultures in central Europe. Recently Steffens (2007) published an article about the role of hunting in the Funnel Beaker populations of Scandinavia and central Europe. Most Funnel Beaker faunal data has been recovered from sites in Denmark, eastern Germany and Poland (Midgley 1992). There are some general patterns among Funnel Beaker faunal assemblages. Two of the most commonly observed patterns are that sites in the north tend to have higher frequencies of wild mammals to domesticated mammals and that pigs are the second most frequent domesticated mammal species after cattle (Midgley 1992, Steffens 2007). Sites further south and west have noticeably smaller frequencies of wild mammals and a corresponding increase in domesticated mammals, though generally pig is found to be the second most frequent domesticated species after cattle. At Bronocice pig was always the third most frequent domesticated mammal species during all phases.

Bronocice excavations

The State University of New York at Buffalo and the Polish Academy of Sciences conducted a cooperative archaeological project at the Bronocice site, Świętokrzyskie province, 1974-78. The objectives of this archaeological project were twofold: 1) to investigate the prehistoric environment, chronology, economy, settlement system, and social organization of the Middle Neolithic (TRB or Funnel Beaker culture) and Late Neolithic (Funnel Beaker-Baden) communities and 2) to demonstrate the origin of complex societies in the Nidzica River basin, southeastern Poland.

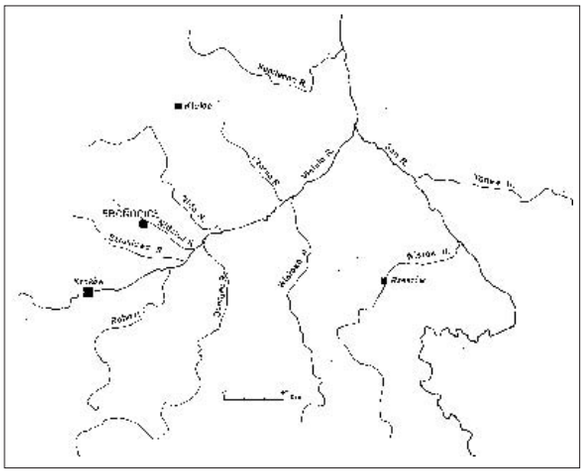

Fig. 1. Map showing the location of Bronocice in southeastern Poland.

Bronocice (50 21'00'' N latitude, 20 19'30'' E longitude) is located on the highest local elevation above the Nidzica River floodplain, near the small town of Działoszyce, Świętokryskie province (Fig. 1). The site has a total area of 52 ha; its length is about 1600 m and its width varies from 300 to 500 m.

Excavations were carried out in three natural topographic areas: A 18 ha, B 18 ha and C 16 ha. A total of 25 excavation units, encompassing approximately over 7300 square meters (0.73 ha) were uncovered (Fig. 2). Over 650 pits, 3 ditches, and 26 burials were excavated at Bronocice (Kruk and Milisauskas 1981; Milisauskas and Kruk 1984, 1989).

Chronology and cultural sequence in the Bronocice region

The Linear Pottery (*Linearbandkeramik*) culture, which was the earliest Neolithic occupation in the Bronocice region, is dated from 5400-4800 BC. With the disappearance of the Linear Pottery ceramics, Lengyel-Polgár ceramics began to dominate in the Bronocice region around 4700 BC. This stylistic change signified in the traditional nomenclature marks the beginnings of the Middle Neolithic in southeastern Poland. By 3800 BC the earliest Funnel Beaker material is found in the Bronocice region, disappearing around 3100 BC. The Funnel Beaker culture is found in Denmark, southern Norway, southern Sweden, the Netherlands, Germany, the Czech Republic, northeastern Austria, Slovakia, Poland and northwestern Ukraine. In Scandinavia it is the earliest Neolithic or farming culture (Midgley 1992). Funnel Beaker-Baden, Globular Amphora, and Corded Ware material are found during the Late Neolithic in the Bronocice region.

The location of all Funnel Beaker sites within Bronocice region was recorded by a systematic survey conducted in an area 314 km² centered on the site of Bronocice. This survey has located 106 Funnel Beaker settlements and they ranged from 1 ha to 21 ha in area at one time period.

The radiocarbon dates and typology of ceramics indicate that the Funnel Beaker occupation lasted for approximately 700 years at Bronocice and it is associated with three phases (Table 1).

Table 1. Chronological Sequence at Bronocice.

Phase	Culture	Dates BC cal.
1	Funnel Beaker	3800-3700
2	Lublin-Volhynian	3700-3650
3	Funnel Beaker	3650-3400
4	Funnel Beaker	3400-3100
5	Funnel Beaker-Baden	3100-2900
6	Funnel Beaker-Baden	2900-2700

Phase 1 represents Bronocice's earliest occupation of the Funnel Beaker culture on the loess uplands of southeastern Poland. It was a small settlement, approximately 2 ha, located principally in area C of Bronocice, whose duration was short, approximately 100 years (Milisauskas and Kruk 1984).

Following the disappearance of the early Funnel Beaker settlement in area C, a late Lublin-Volhynian (Phase 2) fortified settlement was established in its place. The Lublin-Volhynian settlement was of short duration, probably one or two generations. After the Lublin-Volhynian settlement period, a large Funnel Beaker settlement occurred in the eastern part of the elevation in area A, which consists of two Funnel Beaker occupation phases.

Phase 3 represents the "classic" Funnel Beaker phase on the loess uplands. This phase settlement occupied an 8 ha area. Phase 4 is associated with the later development of the classic phase. The Phase 4 settlement extended over 21 ha area. A Funnel Beaker cemetery located in area C is associated with either one or both of these phases. The cemetery is situated on the highest point of area C, where early Funnel Beaker (Phase 1) and Lublin-Volhynian settlements had been previously located. Thus they erased the memory of the Lublin-Volhynian presence in area C. Phase 4 is followed by Phases 5 and 6, which are associated with a local Funnel Beaker-Baden group (Kruk and Milisauskas 1983:272-276).

The faunal remains were identified by Danuta Makowicz-Poliszot during the 1980's and 1990's. The data were originally generated in Polish and have since been transcribed into English and entered into Micro-

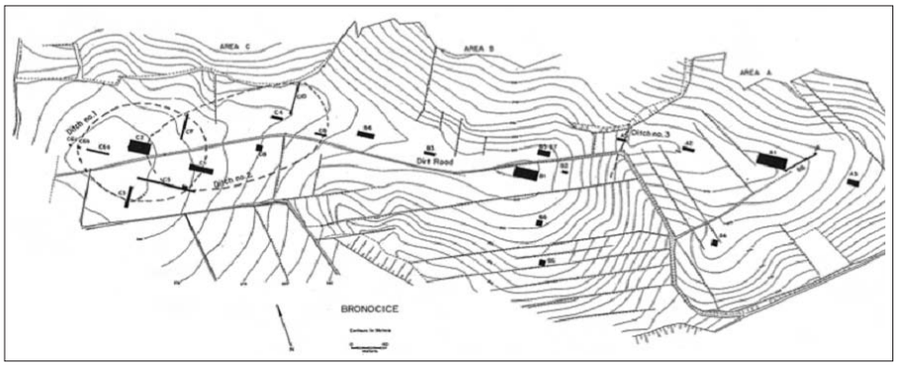

Fig. 2, Excavation units at Bronocice.

soft Office Access 2003. This program is a relational database that allows for easy manipulation of data. The coding system used for encoding the data was adapted by Marie-Lorraine Pipes based on the published version by Louis Berger & Associates, Inc. (Azizi et al. 1996). The Minimum Number of bone Units (MNU) is a reduction count similar to Number of Identified Specimens (NISP) but differing only slightly but in a significant way. The NISP count commonly used to quantify faunal remains is a cruder version of the MNU. NISP does not have the capacity to accommodate articulations often resulting in over-representation of taxa. The MNU count does so by being paired with a modifier that serves to indicate when multiple bones have been reduced to represent an articulation in the database. The MNU count describes what is being tabulated and in particular signals a reduction based on joints, or partial and whole skeletons, and on occasion loose teeth. Modifiers used in the database include Teeth (MNT or Minimum Number of Teeth), Elements (Minimum Number of skeletal Elements), Articulations (MNAE) and MNI (Minimum Number of Individuals). Age at death determinations were based on epiphyseal fusion and dental eruption indicators. Specific ages were not used. Instead four general age group designations were generated including of Juvenile, Subadult, Adult and Senile. Slaughter profiles and herd compositions were based upon these categories.

Faunal analysis concerns

Numerous authors have pointed out the difficulties in analyzing animal remains at archaeological sites and in accounting for taphonomic factors that potentially affect bone preservation (Meadow and Zeder 1978, Wilson, Grigson and Payne 1982, Grayson 1984, Klein and Cruz-Uribe 1984, Davis 1987, Daugnora and Girininkas 1996, Marciniak 1996, Lasota-Maskolewska 1997, Reitz and Wing 1999, O'Connor 2000). Observed differences in the relative abundance, and by default the assumed relative importance of animal species, may in fact, be due to differential preservation, chronological factors, excavation techniques, recovery methods, sampling errors, analytical methods, and taphonomic processes. However, observed patterning may also be the result of deliberate cultural practices which is a major reason why large samples recovered over long periods of time and from different contexts are critical in establishing whether or not patterns are valid.

There were a few other concerns worth mentioning. Archaeological remains are problematical in that depositional variability and collapsed time potentially skews the results of any analysis (Milner 2005). Constructing MNI counts was necessary for comparing the death profiles of livestock for each phase. This is problematical because of the temporal compression about which little can be done without refined C^{14} dates for every pit deposit. In an earlier publication we conducted an intensive pit by pit analysis in which we assumed that each one represented a short term deposit. The patterning discussed belowthat follows is in part supported by the results from that study. In this study many of the trends and patterns were similar which lends confidence to our findings in this article. The construction of MNIs presents some problems as well. They were generated by counting paired elements, stature, sex, and age groups within each pit. Entire carcasses were rarely present in pits. Instead they most often contained partial carcasses or single elements representing butcher waste, dietary refuse and craft manufacturing debris. Based on the disjointed remains most frequently encountered it is clear that meat was shared across households. So the method used to generate the MNI counts may possibly over-represent some of the animals. Another problem with MNIs is that several species are represented only by cranial bones. These generally consist of aurochs, wild pig and other ungulates. However, the same is true for domesticated pig. While domesticated pig is occasionally represented by meat cuts, most of the time cranial elements predominated. The end result is that the MNI counts are over-represented in these instances.

Faunal data summary: Bronocice

The animal bones from the Funnel Beaker occupation at Bronocice were derived from 119 pits. The Fun-

nel Beaker faunal assemblage consisted of 6047 bone fragments of which 2510 were identified. The entire analyzed faunal assemblage comprises 15,553 bone fragments of which 6,110 were identified. The rate of identified bones ranged from 34 percent to 49 percent. (Table 2). Sample sizes for each phase varied, increasing from Phase 1 up to Phase 4. It will be seen that within each phase pit bone volume varied considerably, as did range species, skeletal elements and age compositions. The faunal data are summarized in Table 2 that presents overall counts of bone, identified bone and the relative percentage of bone identified within each phase.

Table 2. Bone Assemblage Summary by Phase, Total Number of bone Fragments (TNF) and Minimum Number of bone Units (MNU).

Phase	Time Period	TNF	MNU	Relative % of Identified Bone
1	3800-3700 BC	1185	400	.34
3	3650-3400 BC	1456	715	.49
4	3400-3100 BC	3406	1395	.41
	Total Funnel Beaker	6047	2510	.42

The Phase 1, 3, and 4 bone data come from single component pits. The number of pits containing faunal remains grew three fold from the first to last Funnel Beaker phase corresponding with the increase in settlement size. The size of phase assemblages grew greater over time. During the earliest phase the ratio of identified bone to unidentified bone was higher than in Phases 3 and 4. The Phase 3 bone had a much higher rate of identifiable bone. The jump in the rate of identifiable bone from Phase 1 to Phase 3 may potentially indicate a change in the processing of the bone between phases. While Outram (2005) offers a cautionary note about interpreting high frequency bone breakage without careful examination it should be noted the Bronocice assemblage was recovered from several pit contexts and not middens. A high frequency of bone breaking can indicate extreme processing of bone for marrow and grease. It may be that during the initial settlement of Bronocice Funnel Beaker people may have been stressed for resources and so made greater use of bone grease and marrow. At this time the settlement may not have had well established support lines in which case it would have been far more dependent on itself for survival. When an animal was slaughtered it may have been processed intensively. During Phase 3 the rate of identified bone increased to its greatest point indicating less intensive reduction of the carcass. Between Phases 1 and 2 there was a brief interlude, possibly one generation, by a group of Lublin-Volhynian people. By Phase 3 the settlement was reestablished. Perhaps this was a time of reduced social stress, increased social stability and therefore integrated support so that the need for intensive exploitation of carcasses was not as great. The rate of identifiable bone decreased during Phase 4 though it remained higher than during Phase 1.

Table 3 summarizes the range and relative frequencies of mammal species from Bronocice based on combined sample pit totals by phase while Table 4 presents similar site totals for the other sites in southeastern Poland. The tables separate domesticated species from non-domesticated species. Non-domesticated mammals increased to five percent over time remaining at this level during Phases 3 and 4. In most cases these species were identified only by cranial elements. The tables further divide non-domesticated species into three categories. Possible breed stock species included wild progenitors of cattle and pig. Game animals comprised a range of ungulates that were exploited for several potential reasons including meat, hides, antler and bone for tools. Hamster is listed as an intrusive species, mainly because none of the recovered samples showed signs of having been processed by tools. Grouping species in this way provides a different angle of consideration concerning their role within the assemblages. Several DNA studies have revealed that the genetic composition of modern cattle is the result of cross-breeding with aurochs in the distant past (Götherström et al. 2005, Beja-Pereira et al. 2006). In fact, the modern European pig is descended from the European wild boar and not the domesticated pig first introduced by the earliest Neolithic people (Larson et al 2007, and Larson et al 2005). In an ethnographic study done by Ekvall (1968) he observed the offspring from crossings between wild yak and domesticated yak as well as wild yak and domesticated cattle. The results in either crossing were offspring significantly larger in size than either parent. The problem with current methods of faunal identifications is that aurochs and wild pig are identified solely based on size. Without DNA testing it is impossible to know if the aurochs or wild pigs identified at Bronocice are crossings or the actual species. Even if they are actual aurochs and wild remains they may represent deliberate back-breeding attempts to invigorate the herds.

It is also worth noting that fur bearers commonly present on Funnel Beaker sites are completely absent. Though the other phases and cultures from Bronocice are not discussed here it should be mentioned that fur bearers were almost completely missing from those deposits as well. Wild mammals were virtually absent from Phase 1 but increased in frequency over time. During phase 4 the range of wild species broadened

Table 3. Summary List of Phase 1, 3, and 4 Pits, Minimum Number of bone Units (MNU).

Phase 1 Pits	MNU	Phase 3 Pits	MNU	Phase 4 Pits	MNU
C6	5	1-A1	103	2-B1	36
2-C7	1	1-AD	1	2-B7	263
5-B6	32	3-A2	4	3-B1	16
9-C6	1	6-A1	7	4-A1	2
12-C2	69	6-A4	9	4-A2	31
17-C2	21	7-A3	8	5-A2	7
20-C2	42	8-AD	5	5-A4	20
21-C2	25	9-C7	2	5-B5	160
24-C2	1	15-A1	3	7-A1	22
32-C2	9	20-B1	6	7-B5	4
33-C2	3	21-A1	38	8-A1	2
35-C2	1	26-A1	105	9-A1	4
36-C2	28	28-A1	9	9-A3	1
40-C2	35	33-A1	32	9-B1	19
42-C2	3	37-A1	2	10-A1	13
45-C2	1	38-A1	46	13-A1	2
46-C2	14	42-A1	6	16-A1	18
49-C2	69	44-A1	3	16-A3	2
59-C2	2	49-A1	5	17-A1	23
61-C2	8	51-A1	13	20-A1	2
76-C1	23	64-A1	73	21-B1	11
80-C1	8	66-A1	1	23-A1	7
		67-A1	1	23-B1	187
		75-A1	2	24-B1	56
		76-A1	27	27-A1	24
		78-A1	20	29-A1	10
		89-A1	10	30-A1	42
		98-A1	31	32-A1	13
		100-A1	11	34-A1	1
		101-A1	67	35-A1	7
		102-A1	11	39-A1	17
		110-A1	9	42-B1	16
		111-A1	11	46-A1	5
		117-A1	6	50-A1	2
		120-A1	4	53-A1	5
		124-A1	7	55-A1	2
		126-A1	17	57-B1	13
				58-A1	9
				58-B1	25
				59-A1	3
				63-A1	1
				68-A1	113
				74-A1	3
				80-B1	5
				82-A1	6
				83-A1	1
				85-A1	1
				90-A1	5
				92-A1	9
				94-A1	3
				95-A1	4
				96-A1	8
				98-B1	12
				99-A1	3
				103-A1	45
				105-A1	1
				115-A1	33
				118-A1	19
				119-A1	10
				123-A1	11
TOTAL MNU	400		715		1395

from four species to six and included roe deer and elk. However, in both cases these species were represented only by antler remains suggesting that these two species do not in fact represent live animals but instead material resources for the manufacture of objects. In none of the phases were concentrations of antler remains found within pits. Instead they were occasional elements found along with dietary remains and other refuse types.

During Phase 1 nearly all of the non-domesticated mammal skeletal elements consisted of cranial bone. The only species indicated by other body parts was red deer for which a foreshank was present. During Phase 3 the range of body parts expanded slightly for wild pig, cattle, horse and red deer. The increased range of body parts however generally consisted of lower leg and foot bones except in the case of wild pig for which the lower forearm, neck and rib were present, horse for which the upper arm, butt and thigh were present, and red deer for which the thorax was present. This type of information argues for the presence of skins or hides but not for meat. Perhaps these were obtained through exchange with people living outside of the settlement. By Phase 4 there was a noticeable increase in the range of body parts represented for most species so that in addition to cranial and lower limb elements there were also meat bearing parts. This changed may signal actual consumption of wild mammals on a regular basis and may be indicative of actual hunting. During all phases body parts were found distributed throughout several pits instead of being deposited in a single or even a couple of pits.

Large domesticated mammals form the great majority of all deposits and included cattle, pig, sheep, goat and dog. Dog are rare during Phase 1 but increase during later phases. One of the most notable patterns from Bronocice was the constant rank order of cattle, sheep/goat and pig regardless of phase or associated culture. This pattern is unusual for Funnel Beaker sites where pig is normally second after cattle in relative abundance. An earlier study had already indicated that there was a considerable drop in cattle between Phase 1 and Phase 3 and a subsequent rebound during Phase 4 (Milisauskas et al. in press). Though the percentages are slightly different this pattern is evident when looking at the entire Funnel Beaker faunal assemblage. The drop in cattle frequencies during Phase 3 is of particular interest. It suggests that something happened during this time that impacted cattle in a negative way. During all three phases sheep were the second most abundant species. Table 3 lists goat, sheep and sheep/goat separately because of the difficulty in distinguishing between the two species. However, on the rare occasion when goat was identified it was always present in much lower frequencies than sheep. Therefore it seems likely that the majority of the sheep/goat category represents sheep. During Phase 3 when cattle are less frequent than at any other time sheep and pig increased in frequencies considerably. Whatever impacted the cattle herd during Phase 3 it seems to have been compensated for by more intensive exploitation of pig and sheep/goat.

Age at death profiles provide one of the best sources of information concerning the management of livestock. Large domesticated mammal age at death profiles were generated for each phase as well as for the sites of Zawarża and Niedźwiedź. During Phase 1 over half of the cattle were adults with an almost equal number of juveniles and subadults being represented. Most of the cattle were of medium size, while an equal number of small and large cattle were also present. Phase 3 was marked by a very high percentage of adults, 74 percent and correspondingly low percentages of juveniles and subadults. In addition there was a senile individual.

The predominance of adult cattle at Bronocice is consistent during all three phases. The classic model put forth by Payne and reinforced by many others whereby the primary use of animals used for meat results in high frequency kill-off patterns of younger animals does not work at Bronocice or the other two sites (Payne 1973, Greenfield 2005). Instead the high frequencies of adults must be considered first terms of the need to build the herds and possibly as evidence for dairying. It has been suggested by Bogucki and others that dairying was already being practiced during the Early and Middle Neolithic (Bogucki 1984, 1986, Copley et al. 2003, Miracle 2006, Mulville and Outram 2005, Bartosiewicz 2005). The high numbers of adults in this case would appear to be due to efforts at building up the herd and not to dairying. Medium size cattle were most common though there were large and very large individuals indicated as well. At Zawarża adults also predominated. No senile cattle were observed there. So this outlying settlement was similar in cattle profile to Bronocice but not as extreme. During Phase 4 adults were still well represented at 66 percent however juveniles were now more abundant while subadults remained at the same level. There was one senile individual represented. Medium size cattle were the most frequent in stature but there was an increased in the number of large and very large cattle. This may be due to a rise in the use of oxen, the ard and wheeled vehicles.

At Niedźwiedź cattle were also represented by a high percentage of adults and almost equal numbers of subadults and juveniles, the former being slightly more common. While the numbers were different between the two sites they were not pronounced. It should be noted however that at Niedźwiedź the rank order was

Table 4. Bronocice Range of Mammal Species and Relative Frequencies by Phase and Minimum Number of bone Units (MNU).

Class/Species	Phase 1 3800-3700 BC		Phase 3 3650-3400 BC		Phase 4 3400-3100 BC	
	MNU	Rel%	MNU	Rel%	MNU	Rel%
Domesticated Mammals						
Cattle *(Bos taurus)*	238	.60	284	.40	809	.60
Dog *(Canis familiaris)*	8	.02	56	.08	82	.06
Goat *(Capra hircus)*	1	<.01	2	<.01	4	<.01
Pig, Domesticated *(Sus domesticus)*	46	.115	131	.18	145	.10
Sheep *(Ovis aries)*	7	.02	84	.12	104	.075
Sheep/Goat *(Ovis/Capra)*	88	.22	124	.17	179	.13
Domesticated Mammals Subtotal	388	.97	681	.95	1323	.95
Non-domesticated Mammals						
Possible Breed Stock						
Aurochs *(Bos primigenius)*	1	<.01	3	<.01	25	.02
Pig, Wild *(Sus scrofa)*	3	.01	8	.01	6	<.01
Possible Breed Stock Subtotal	*4*	*.01*	*11*	*.015*	*31*	*.02*
Game, Meat and Hides						
Elk *(Alces alces)*	-	-	-	-	1	<.01
Horse *(Equus caballus)*	1	<.01	7	.01	14	.01
Red Deer *(Cervus elaphus)*	4	.01	14	.02	24	.02
Roe Deer (*Capreolus capreolus)*	-	-	-	-	1	<.01
Game, Meat and Hides Subtotal	*5*	*.01*	*21*	*.03*	*40*	*.03*
Intrusive Species						
Hamster *(Cricetus cricetus)*	3	.01	2	<.01	1	<.01
Intrusive Species Subtotal	*3*	*.01*	*2*	*<.01*	*1*	*<.01*
Non-domesticated mammals Subtotal	12	.03	34	.05	72	.05
Total TNF/MNU	400	1.00	715	1.00	1395	1.00

cattle, pig and sheep/goat. So there was a different economic emphasis in place at that site.

Sheep/goat age at death profiles changed over time. During Phase 1 there was a predominance of adults but there were also a high percentage of juveniles and few subadults. This may be the result of building the herd during a period of time when the area was not as conducive to the rearing of sheep/goat. During Phase 3 there was a drop in juveniles and an increase in adults. This takes on a new significance when considered along with the increase in sheep/goat relative to cattle. During this period it seems there was a shift in economic emphasis on the rearing of sheep specifically. The increase in adults suggests a new role for these animals may have begun. That new role may have been the use of their wool perhaps for small scale purposes such as felting but not necessarily for textiles. During Phase 4 there was a slight increase juveniles and a drop in subadults. This pattern suggests an increased reliance on sheep/goat for meat. If cattle became increasingly tied to dairying and traction it may be that sheep/goat meat was more in demand.

Pig age death profiles change significantly over time. During Phase 1 and 3 there were high frequencies decreasing during Phase 4. However, from the earliest to the latest phase there were increasing numbers of juvenile pigs. During this last phase Payne's model succeeds in pointing to a population reared primarily for meat. There also seems to be an increase in size though without sexing data it may simply be reflection of a greater number of males. During an ethnographic study done by Pipes (Pipes 2006) it was revealed that in England butchers most frequently slaughter female pigs for their customers because their meat has a better flavor. The flesh of male pig has a strong odor. Therefore most males are slaughtered much earlier before

Table 5. Range of Mammal Species and Relative Frequencies from Funnel Beaker Sites in Southeastern Poland, based on Number of Identified Specimens (NISP).

Site	Gródek Nadbużny		Zawichost-Podgórze		Kamień Łukawski		Zawarża		Niedźwiedź		Ćmielów	
Associated Bronocice Phases	Phase 1,3		Phase 3		Phase 3		Phase 3		Phase 4		Phase 4	
Distance from Bronocice	260 km		120 km		120 km		12 km		25 km		100 km	
Class/Species	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Domesticated Mammals												
Cattle (*Bos Taurus*)	1265	.59	1017	.57	1676	.59	1193	.64	777	.58	1578	.58
Sheep/Goat (*Ovis/ Capra*)	252	.12	251	.14	403	.14	406	.22	194	.15	276	.10
Pig (*Sus domesticus*)	453	.21	323	.18	582	.21	194	.10	278	.21	566	.21
Dog (*Canis familiaris*)	41	.02	94	.05	66	.02	13	.05	18	.01	111	.04
Horse (*Equus caballus*)	16	.01	40	.02	8	<.01	13	.05	21	.02	58	.02
Domesticated Mammals Subtotal	*2027*	*.95*	*1725*	*.96*	*2735*	*.96*	*1819*	*.97*	*1288*	*.97*	*2589*	*.95*
Wild Mammals												
Cross Breed Stock												
Aurochs (*Bos primigenius*)	-	-	-	-	12	<.01	-	-	-	-	-	-
Wild Pig (*Sus scrofa*)	59	.03	16	.01	12	<.01	2	<.01	17	.01	43	.02
Cross Breed Stock Subtotal	*59*	*.03*	*16*	*<.01*	*24*	*.01*	*2*	*<.01*	*17*	*.01*	*43*	*.02*
Non-domesticated Mammals												
Game, Meat and Hides												
Elk (*Alces alces*)	6	<01	-	-	2	<.01	2	<.01	-	-	4	<.01
Red Deer (*Cervus elaphus*)	20	.01	32	.02	27	.01	40	.02	11	.01	36	.01
Roe Deer (*Capreolus capreolus*)	11	<.01	10	.01	29	.01	1	<.01	8	.01	45	.02
Hare (*Lepus sp.*)	-	-	1	<.01	2	<.01	2	<.01	-	-	-	-
Brown Bear (*Ursus arctos*)	3	<.01	3	<.01	2	<.01	-	-	-	-	4	<.01
Game, Meat and Hides Subtotal	*40*	*.02*	*36*	*.03*	*62*	*.02*	*45*	*.02*	*19*	*.02*	*89*	*.03*
Game, Fur-bearers												
Wolf (*Canis lupus*)	-	-	-	-	-	-	1	<.01	-	-	2	<.01
Fox (*Vulpes vulpes*)	3	<.01	-	-	-	-	-	-	-	-	3	<.01
Lynx (*Lynx lynx*)	-	-	2	<.01	1	<.01	-	-	-	-	-	-
Badger (*Meles meles*)	1	<.01	3	<.01	3	<.01	-	-	-	-	5	<.01
Beaver (*Castor fiber*)	-	-	4	<.01	24	.01	-	-	-	-	5	<.01
Wild Cat (*Felis silvestris*)	-	-	-	-	-	-	1	<.01	-	-	-	-
Otter (*Lutra lutra*)	1	<.01	-	-	-	-	-	-	-	-	-	-
Game, Fur-bearers Subtotal	*5*	*<.01*	*9*	*.01*	*28*	*.01*	*2*	*.005*	*-*	*.02*	*15*	*<.01*
Other												
Other wild animals	-	-	4	<.01	-	-	-	-	-	-	-	-
Other Subtotal	-	-	4	<.01	-	-	-	-	-	-	-	-
Non-domesticated Mammals Subtotal	*104*	*.05*	*75*	*.04*	*114*	*.04*	*49*	*.03*	*36*	*.03*	*147*	*.05*
Total NISP	2131	1.00	1861		2849	1.00	1333	1.00	1867	1.00	1800	1.00

they become sexually active. While that may not have been a concern among Funnel Beaker people most pigs were of medium size suggesting a predominance of females.

Discussion

The analysis of the Bronocice faunal data serves as a basis for considering some of the social and behavioral aspects of the Funnel Beaker people who lived there. Livestock rearing was one of the foundation stones upon which their economy was built. So controlling factors that potentially affected the health and stability of their livestock was critical. The ability to feed and water animals as well as to protect them were vital concerns. Control over the breeding and the movement of livestock must have been achieved through the erection of barriers and penning.

Comparing Bronocice with six other sites in southeastern Poland reveals that there are some significant differences between them. Though overall ratios of wild mammals are similar, the range of species among these sites was distinct from Bronocice. Only six species overlap between Bronocice and the other sites. Aurochs remains were recovered only from Kamień Łukawski.

Table 6. Bronocice large domesticate mammal age at death profiles by phase based on MNI.

	Age Group		Phase 1		Phase 3		Phase 4	
Species		Stature	MNI	Rel.%	MNI	Rel.%	MNI	Rel.%
Cattle	Juvenile		12	.23	9	.11	24	.17
	Subadult		11	.21	12	.16	22	.16
	Adult	*Unknown*	*8*	*.15*	*11*	*.14*	*18*	.13
		Small	*6*	*.11*	*12*	*.16*	*18*	*.13*
		Medium	*10*	*.19*	*17*	*.22*	*30*	*.22*
		Large	*6*	*.11*	*14*	*.18*	*20*	*.15*
		Very Large	-	-	*1*	*.01*	*4*	*.03*
		Total Adult MNI	30	.56	55	.74	90	.66
	Senile		-	-	1	.01	1	.01
		Total Cattle	53	1.00	77	1.00	137	1.00
Sheep/Goat	Juvenile		8	.30	11	.24	19	.26
	Subadult		6	.22	10	.22	12	.16
	Adult		13	.48	25	.54	43	.58
		Total Sheep/Goat	27	1.00	46	1.00	74	1.00
Pig	Juvenile		4	.17	9	.27	17	.33
	Subadult		5	.20	5	.15	7	.14
	Adult	*Unknown*	*5*	*.20*	*11*	*.32*	*15*	*.29*
		Small	*1*	*.04*	*3*	*.09*	*1*	*.02*
		Medium	*4*	*.17*	*5*	*.15*	*4*	*.08*
		Large	*4*	*.17*	*1*	*.03*	*6*	*.11*
		Total Adult MNI	14	.58	20	.59	26	.50
	Senile		1	.04	-	-	2	.03
		Total Pig	24	1.00	34	1.00	52	1.00
Total MNI by Phase			104		157		263	

Table 7. Large domesticated mammal age at death profiles from Zawarża and Niedźwiedź based on MNI.

	Age Group	Zawarża Phase 3	Niedźwiedź Phase 4
Species		Rel.%	Rel.%
Cattle	Juvenile	.22	.19
	Subadult	.18	.21
	Adult	.60	.59
	Senile	-	.01
		1.00	1.00
Sheep/Goat	Juvenile	.33	.34
	Subadult	.23	.20
	Adult	.44	.45
	Senile	.01	.01
		1.00	1.00
Pig	Juvenile	.18	.22
	Subadult	.29	.24
	Adult	.52	48
	Senile	.01	.06
		1.00	1.00

The rank order pattern of domesticated mammals seen during the Funnel Beaker phases is quite different from other Funnel Beaker sites in the area because of the prominence of sheep/goat and the decline in pigs over time. Sheep/goat are grazers and browsers that do best in open areas while pigs on the other hand can inhabit forested and marshy areas (Bartosiewicz 2005, 2007). The area was initially heavily forested but when the forest canopy was opened up it most likely never closed again but instead grew in size. The increasing numbers of sheep/goat over time suggests the area was increasingly opened up and that the forest was pushed back. The dramatic increase in the size of the settlement of Bronocice is an indication of this process of landscape modification. So while the area may not have been initially well suited to sheep/goat it was altered. The people at Bronocice were clearly intent on raising sheep/goat and this may reflect continued social relations with people on the other side of the Carpathian Mountains. It may also be that the similar rank order seen at the site of Zawarża represents a strong tie to the

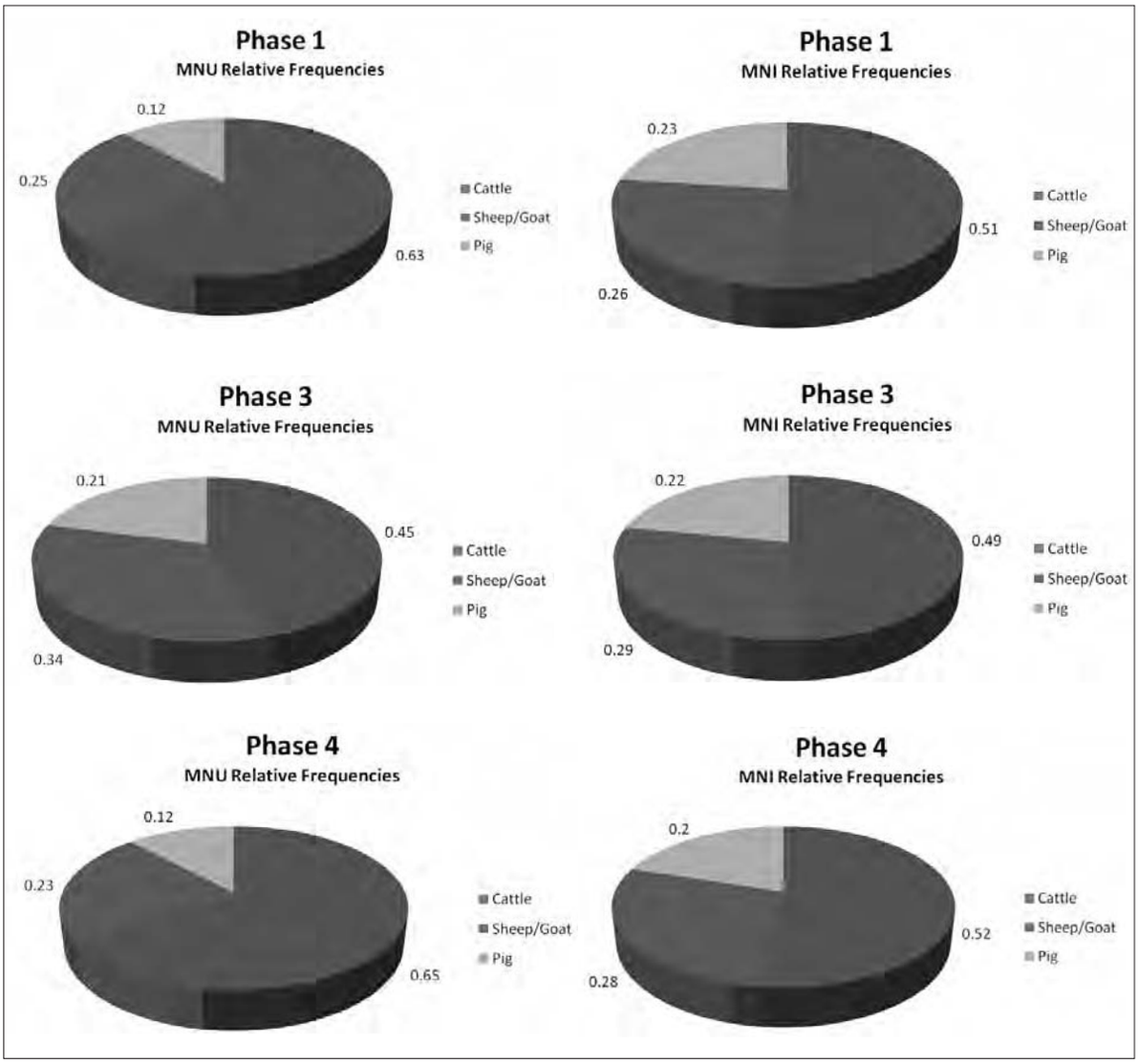

Fig. 3. A Comparison of MNU and MNI Relative Frequencies for Cattle, Sheep/Goat and Pig by Phase.

residents of Bronocice. The two lie in close proximity to each other so allowing for relatively easy movement of livestock. Perhaps they traded livestock for breeding purposes. At any rate both settlements shared the same animal husbandry practices. It should be noted that Kulczycka-Leciejewiczowa (2002) speculated that Zawarża was occupied for a single generation.

The role of sheep/goat shifted and changed economically over time. Relative frequencies of sheep/goat to cattle and shifting ages at death highlight difference in when they were slaughtered and potentially the purposes they served. Initially the large number of adults seems to have been tied to increasing the size of the herd. Then during Phase 3 they increased in number relative to cattle and in age. Much has been written about sheep and the relatively late development of their fleece into wool (Ryder 1983). Perhaps there has been an overemphasis concerning the role of wool as a basic commodity in textile manufacturing. Fibers had long played an important in societies and it seems incredible that people would not have plucked the wool off of animals much earlier and used them to create string, thread long before they wove the fibers into cloth. At Bronocice the increase in herd size and in the age at death profile for Phases 3 and 4 strongly suggest these animals served a secondary purpose in addition to being meat. The increased consumption of juveniles during Phase 4 may correlate with the shift in use of cattle for traction and possibly dairying.

The shifts seen in cattle frequencies from Phase 1 to Phase 3 indicate something impacted the herd in a negative way. The decline in cattle is best seen when considering the frequencies of bones (MNU) as opposed to minimum number of individuals (MNI), and is supported by a pronounced shift in age at death profiles. Figure 3 presents relative frequencies based on MNU and MNI. The drop in cattle is evidence in both MNU and MNI frequencies. There are many factors that in-

fluence the health and reproductive survival of domesticated livestock (Gregg 1988, Bogaard 2004. In this case it might be suggested that social reasons were responsible for the drop in cattle and the subsequent need to rebuild the herd. Healthy reproduction of livestock requires herds to consist of a fairly large number of animals as well as the constant introduction of new genetic material (Siracusano 2002, Fernández et al 2006). Inbreeding leads to poor reproductive health. This introduction by default implies the existence of outside social relationships between social groups and the exchange of livestock for breeding purposes (Fernández et al 2006). For a short of time there was conflict in the region during Phase 2 as seen by occupation of Bronocice by Lublin-Volhynian people and the construction of a fortification at the site. It may be that during that time social relations were disrupted and breeding of livestock impacted in a negative way. We simply do not know what happened. But the fairly large decrease in cattle and the increase in slaughter of adults during the subsequent Phase 3 Funnel Beaker period is strong evidence of the rebuilding of the cattle herd (Greenfield 2005). The high frequency adult cattle continued to a lesser degree during Phase 4 and correlates with greater numbers of larger individuals. The now famous Funnel Beaker pot bearing a decoration probably depicting wheeled vehicles, plowed fields bounded by forest and the river further reveals the presence of oxen or draft animals (Kruk and Milisauskas 1999, Milisauskas and Kruk 1991). Bogucki and others have made persuasive arguments concerning the social and economic impacts oxen, plows and wheeled vehicles had during this period of time and suggest they were responsible for setting into motion increasing social differentiation (Anthony 2007, Bogucki 1993, Johannsen 2002). Further evidence of draft animals may be seen in skeletal pathologies which will be summarized in the future (Fabiś 2002, Johannsen 2002).

Livestock requirements include protection and containment. Control over cattle reproduction was an important element in the survival of cows and their offspring (Siracusano 2002, Ryan 2005). Cattle have no breeding season but ideally they should not deliver in the fall as the chances of dietary stress increase. Pasturage and foddering are necessarily important elements in feeding animals. An inability to control reproduction would potentially result in livestock dying due to malnutrition or starvation, or being slaughtered instead. The Lublin-Volhynian ditch constructed during Phase 2 may well have served as an animal enclosure even before the group had left the area or died out. No other earthwork was created until Phase 5.

The age at death profiles signaled big changes in the management of pigs over time. They became increasingly used for meat. However, pigs are problematic because they are over-represented. There are simply not enough skeletal elements nor a sufficient range of body parts indicated to account for the high number of minimum number of individuals for any phase. Their frequencies drop over time relative to sheep/goat even though the actual estimates of individuals rise. Perhaps the changing environment impacted their survival in the immediate area. The real question is whether or not they were actually raised in the settlement or if they were brought into the settlement as processed carcasses. In a previous study it was found that cranial bone were the most frequent skeletal elements though various meat bearing elements were just as common. This pattern was observed by Marcianiak (2005) from other Funnel Beaker faunal assemblages, which leaves open the possibility that the rank order pattern reported at other sites may be incorrectly tabulated. Pigs differ from cattle and sheep/goat in their behaviors. It has been suggested that pigs may have had symbolic meaning and have been treated ritually by Funnel Beaker people (Midgley 1992).

Conclusion

It is evident that there is a large amount of data on the animal husbandry at Bronocice. The overall characteristics of the faunal assemblage from Bronocice exhibit similarities and differences with those from other Funnel Beaker sites in southeastern Poland. Cattle and sheep were clearly prominent on the Bronocice landscape and their economic importance increased through time. Sheep significance may reflect the importance of the secondary products such as wool production. Furthermore, cattle and sheep played a role in social and symbolic life of people at Bronocice.

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GYVULININKYSTĖ PILTUVĖLINIŲ TAURIŲ KULTŪROS BRONOCICE GYVENVIETĖJE

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Santrauka

Pragyvenimo ekonomikos tyrimai piltuvėlinių taurių kultūros (toliau – PTK) Bronocice gyvenvietėje (Pietryčių Lenkija, Mažoji Lenkija) yra susiję su didelės apimties faunos liekanų tyrimais šios kultūros 1, 3 ir 4 fazių (3800–3100 BC) laikotarpiu. Gauti duomenys atskleidė kelias tyrimų kryptis, kurios atsispindi ilgalaikėse PTK tradicijose. Tyrimų metu aptikta požymių, rodančių, kad laikui bėgant kito naminių gyvulių priežiūra, padidėjo jų kiekis, o tai tikriausiai buvo susiję su žmonių populiacijos augimu, socialiniais pokyčiais bendruomenėje ir ūkio specializacija tiek bendruomenės mastu, tiek už jos ribų. Šiame straipsnyje plačiai apžvelgiamos gyvulininkystės kryptys ir pokyčiai, susiję su socialiniais ir fiziniais veiksniais. Gauti duomenys lyginami su kitose Pietryčių Lenkijos gyvenvietėse aptikta gyvulininkystės medžiaga, pateikiami aiškinimai dėl esamų akivaizdžių skirtumų.

Bronocice gyvenvietė yra didžiausia ir ilgiausiai egzistavusi minėtame regione tarp kitų PTK gyvenviečių. Tuo tarpu PTK išskirtose fazėse yra pastebėta dviejų Liublino-Volynės ir piltuvėlinių taurių-Badeno kultūrų invazija. Faunos pokyčiai išryškėja atskirais PTK periodais ir minėtų kultūrų invazijų metu. PTK faunos tyrimų duomenys rodo, kad naminiai gyvuliai sudarė daugumą, o galvijai tarp jų vyravo (dar iš naminių gyvulių buvo auginamos avys ir kiaulės). Laukinių žinduolių aptikta labai nedaug, tarp jų vyravo kanopiniai, o ne kailiniai gyvūnai.

Naminių gyvulių dominavimas pietinėse PTK gyvenvietėse yra tipiškas reiškinys, nes gyventojai augino daugiausia naminius gyvulius, laukinių gyvūnų medžiojo nedaug, kailinių žvėrių trūkumo nejautė.

Ketvirtosios PTK fazės metu pagausėjo kanopinių žvėrių, kas matyti iš osteologinės medžiagos. Tai buvo susiję su ragų, o ne mėsos poreikiu. Dažniausiai aptinkama stirnų. Bronocice gyvenvietėje tik ketvirtosios PTK fazės metu aptinkama ragų. Tačiau Liublino-Volynės kultūros gyvavimo metu ir dar vėliau, PTK Badeno kultūros pasirodymo metu, stirnų kiekis padidėja. Tai susiję su mėsos ir kailių poreikiu, ir tik viename to meto palaidojime aptinkama šių ragų.

Naminių žinduolių kiekis kiekvienos PTK fazės metu skirtingas. Pirmosios fazės metu tarp naminių žinduolių daugiausia buvo veisiami galvijai. Po trumpo laikotarpio, kai pasirodė Liublino-Volynės kultūrinė grupė, jau PTK trečiosios fazės metu, sumažėja galvijų ir atitinkamai pagausėja avių ir kiaulių. Ketvirtosios fazės metu vėl pagausėja galvijų. Šis galvijų mažėjimo procesas iki galo dar nėra aiškus. Tai galėjo būti susiję su PTK Liublino-Volynės kultūrinės grupės gyventojų pasirodymu, ligomis ar dar dėl iki šiol neištirtų veiksnių.

Naminių gyvulių kiekis, kuris pasiskirstęs tokia tvarka: galvijai, avys, kiaulės, yra netipiškas PTK. Dažniausiai publikacijose apie PTK gyvulininkystės tyrimus nurodoma kita naminių gyvulių kiekio pasiskirstymo tvarka: galvijai, kiaulės, avys. Tik vienoje Pietvakarių Lenkijos teritorijos Zawarža gyvenvietėje aptiktas panašus galvijų kiekio pasiskirstymas. Pastaroji gyvenvietė yra tik 12 km nutolusi nuo Bronocice gyvenvietės. Kitos šio regiono gyvenvietės buvo mažesnės, jose gyveno tik viena ar dvi žmonių kartos. Manoma, kad Bronocice gyvenvietė PTK trečiosios fazės metu dominavo, o panašumas tarp Zawarža ir Bronocice gyvenvietėse egzistavusios gyvulininkystės yra tose gyvenvietėse gyvenusių bendruomenių glaudžių ryšių rezultatas ar net žmonių maišymosi tarp minėtų bendruomenių pasekmė.

Tyrimų duomenys įgalina teigti, kad kiekvienos PTK fazės metu pastebimi skirtumai tarp naminių gyvulių kiekio pasiskirstymo, ypač kiaulių, rodytų, kad jos galėjo būti auginamos ir skerdžiamos ne gyvenvietės teritorijoje, ypač PTK pirmosios ir antrosios fazių metu. Kiaulių skerdimo amžius rodo, kad nebuvo skerdžiami jauni paršiukai. Tik PTK ketvirtosios fazės metu, kai kiaulės buvo pradėtos auginti gyvenvietėje, padidėja ir jauno amžiaus paskerstų kiaulių kiekis.

Kintanti gyvulininkystės kryptis ir struktūra yra susijusi ne tik su socialine žmonių struktūtos kaita, bet ir su fiziniais žmonių ir gyvūnų poreikiais. Šios dvi sąsajos – tai apgalvoti veiksniai, rodantys būtinybę bendrauti tarp atskirų žmonių grupių. Tarp fizinių poreikių buvo ganyklų priežiūra, pašaro ruošimas, gyvulių ganymo kryptis ir jų auginimas, kas skatino bendrauti ir kooperuotis atskiras žmonių grupes. Gyvulių įsigijimas taip pat vertė sąveikauti atskiras žmonių grupes. Tyrimų duomenys rodo, kad medžioklė nebuvo perspektyvi ūkio šaka, nors laukinių gyvulių Bronocice gyvenvietėje ir aptinkama.

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